

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17

years (Review)

Al-Khudairy L, Loveman E, Colquitt JL, Mead E, Johnson RE, Fraser H, Olajide J, Murphy M, Velho RM, O'Malley C, Azevedo LB, Ells LJ, Metzendorf MI, Rees K

Al-Khudairy L, Loveman E, Colquitt JL, Mead E, Johnson RE, Fraser H, Olajide J, Murphy M, Velho RM, O'Malley C, Azevedo LB, Ells LJ, Metzendorf MI, Rees K.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years. *Cochrane Database of Systematic Reviews* 2017, Issue 6. Art. No.: CD012691. DOI: 10.1002/14651858.CD012691.

www.cochranelibrary.com



TABLE OF CONTENTS

HEADER	1
ABSTRACT	1
PLAIN LANGUAGE SUMMARY	2
SUMMARY OF FINDINGS FOR THE MAIN COMPARISON	4
BACKGROUND	7
OBJECTIVES	8
ΜΕΤΗΟDS	8
RESULTS	12
Figure 1	13
Figure 2	17
Figure 3	18
Figure 4	25
DISCUSSION	26
AUTHORS' CONCLUSIONS	28
ACKNOWLEDGEMENTS	28
REFERENCES	29
CHARACTERISTICS OF STUDIES	42
DATA AND ANALYSES	199
Analysis 1.1. Comparison 1 Interventions (all) versus controls, longest follow-up, Outcome 1 BMI change.	204
Analysis 1.2. Comparison 1 Interventions (all) versus controls, longest follow-up, Outcome 2 BMI z score change.	206
Analysis 1.3. Comparison 1 Interventions (all) versus controls, longest follow-up, Outcome 3 BMI percentile change.	207
Analysis 1.4 Comparison 1 Interventions (all) versus controls, longest follow-up, Outcome 4 Weight change	208
Analysis 2.1. Comparison 2 Interventions versus controls, by duration of intervention, less than 6 months, greater than 6	200
months, longest follow-up. Outcome 1 Body mass index (BMI) change.	209
Analysis 2.2. Comparison 2 Interventions versus controls, by duration of intervention, less than 6 months, greater than 6	20)
months, longest follow-up. Outcome 2 BMI z score change.	212
Analysis 3.1 Comparison 3 Interventions (all) versus controls other anthronometrics longest follow-up. Outcome 1.%	212
hady fat	214
Analysis 3.2. Comparison 3 Interventions (all) versus controls, other anthronometrics, longest follow-up, Outcome 2.%	211
trunk fat	215
Analysis 3.3. Comparison 3 Interventions (all) versus controls, other anthropometrics, longest follow-up. Outcome 3 Waist	21)
circumference	216
Analysis 3.4 Comparison 3 Interventions (all) versus controls other anthronometrics longest follow-up. Outcome 4	210
Waist-to-height ratio	217
Analysis 3.5 Comparison 3 Interventions (all) versus controls other anthronometrics longest follow-up. Outcome 5	21/
Waist-to-hin ratio	218
Analysis 3.6. Comparison 3 Interventions (all) versus controls, other anthropometrics, longest follow-up, Outcome 6 Fat	210
mass	219
Analysis 3.7 Comparison 3 Interventions (all) versus controls other anthronometrics longest follow-up. Outcome 7 Trunk	21)
fat mass	220
Analysis 3.8 Comparison 3 Interventions (all) versus controls other anthronometrics longest follow-up. Outcome 8 Lean	220
mays 5.0. Comparison 5 met ventions (an) versus controls, other antinopometries, iongest follow up, Outcome 6 Lear	221
Analysis 3.9 Comparison 3 Interventions (all) versus controls other anthronometrics longest follow-up. Outcome 9.%	221
overweight	222
Analysis 4.1. Comparison 4 Interventions (all) versus controls quality of life longest follow-up. Outcome 1 Health-related	
auality of life	223
Analysis 4.2. Comparison 4 Interventions (all) versus controls quality of life longest follow-up. Outcome 2 Health-related	
auality of life by tool	224
Analysis 4.3. Comparison 4 Interventions (all) versus controls quality of life longest follow-up Outcome 3 Self-esteem	2.25
Analysis 4.4 Comparison 4 Interventions (all) versus controls, quality of life longest follow-up. Outcome 4 Self-esteem by)
outcome	226
	220

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) i Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 4.5. Comparison 4 Interventions (all) versus controls, quality of life, longest follow-up, Outcome 5 Self-esteem by tool.	227
Analysis 5.1. Comparison 5 Interventions (all) versus controls, behavioural change, longest follow-up, Outcome 1 Physical	
activity (mild - vigorous physical activity).	228
Analysis 5.2. Comparison 5 Interventions (all) versus controls, behavioural change, longest follow-up, Outcome 2 Physical	
activity length.	228
Analysis 5.3. Comparison 5 Interventions (all) versus controls, behavioural change, longest follow-up, Outcome 3 Screen	
time	229
Analysis 6.1. Comparison 6 Interventions versus control by duration of follow-up, Outcome 1 Body mass index (BMI)	
change	230
Analysis 6.2. Comparison 6 Interventions versus control by duration of follow-up, Outcome 2 BMI z score change.	233
Analysis 7.1. Comparison 7 Interventions versus controls by duration of postintervention follow-up. Outcome 1 Body mass	
index (BMI) change.	235
Analysis 7.2. Comparison 7 Interventions versus controls by duration of postintervention follow-up. Outcome 2 BMI z	
score change.	237
Analysis 8.1. Comparison 8 Interventions by control type, longest follow-up, Outcome 1 Body mass index (BMI)	-07
change	239
Analysis 8.2 Comparison 8 Interventions by control type longest follow-up. Outcome 2 BMI z score change	241
Analysis 9.1. Comparison 9 Interventions by mode, longest follow-up, Outcome 1 Body mass index (BMI) change.	243
Analysis 9.2. Comparison 9 Interventions by mode, longest follow-up, Outcome 2 BMI z score change.	245
Analysis 10.1. Comparison 10 Interventions by setting, longest follow-up, Outcome 1 Body mass index (BMI) change.	247
Analysis 10.2. Comparison 10 Interventions by setting, longest follow-up, Outcome 2 BMI z score change.	249
Analysis 11.1. Comparison 11 Interventions versus controls by intervention type, longest follow-up. Outcome 1 Body mass	/
index (BMI) change	251
Analysis 11.2. Comparison 11 Interventions versus controls by intervention type, longest follow-up, Outcome 2 BMI z	- / 1
score change	253
Analysis 12.1. Comparison 12 Interventions versus controls by psychological approach, longest follow-up. Outcome 1	
Body mass index (BMI) change	255
Analysis 12.2. Comparison 12 Interventions versus controls by psychological approach, longest follow-up. Outcome 2 BMI	- / /
z score change	257
Analysis 13.1. Comparison 13 Interventions versus controls by parental involvement, longest follow-up, Outcome 1 Body	->1
mass index (BMI) change.	259
Analysis 13.2. Comparison 13 Interventions versus controls by parental involvement, longest follow-up, Outcome 2 BMI z	- / /
score change. \ldots	261
ADDITIONAL TABLES	262
APPENDICES	293
WHAT'S NEW	417
HISTORY	418
CONTRIBUTIONS OF AUTHORS	419
DECLARATIONS OF INTEREST	419
SOURCES OF SUPPORT	420
DIFFERENCES BETWEEN PROTOCOL AND REVIEW	420
NOTES	421

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) ii Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

[Intervention Review]

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Lena Al-Khudairy¹, Emma Loveman², Jill L Colquitt², Emma Mead³, Rebecca E Johnson¹, Hannah Fraser¹, Joan Olajide³, Marie Murphy¹, Rochelle Marian Velho¹, Claire O'Malley⁴, Liane B Azevedo³, Louisa J Ells³, Maria-Inti Metzendorf⁵, Karen Rees¹

¹Division of Health Sciences, Warwick Medical School, University of Warwick, Coventry, UK. ²Effective Evidence LLP, Waterlooville, UK. ³Health and Social Care Institute, Teesside University, Middlesbrough, UK. ⁴School of Medicine, Pharmacy and Health, Durham University Queen's Campus, Durham, UK. ⁵Cochrane Metabolic and Endocrine Disorders Group, Institute of General Practice, Medical Faculty of the Heinrich-Heine-University Düsseldorf, Düsseldorf, Germany

Contact address: Karen Rees, Division of Health Sciences, Warwick Medical School, University of Warwick, Coventry, CV4 7AL, UK. Karen.Rees@warwick.ac.uk, rees_karen@yahoo.co.uk.

Editorial group: Cochrane Metabolic and Endocrine Disorders Group. **Publication status and date:** New, published in Issue 6, 2017.

Citation: Al-Khudairy L, Loveman E, Colquitt JL, Mead E, Johnson RE, Fraser H, Olajide J, Murphy M, Velho RM, O'Malley C, Azevedo LB, Ells LJ, Metzendorf MI, Rees K. Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years. *Cochrane Database of Systematic Reviews* 2017, Issue 6. Art. No.: CD012691. DOI: 10.1002/14651858.CD012691.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

ABSTRACT

Background

Adolescent overweight and obesity has increased globally, and can be associated with short- and long-term health consequences. Modifying known dietary and behavioural risk factors through behaviour changing interventions (BCI) may help to reduce childhood overweight and obesity. This is an update of a review published in 2009.

Objectives

To assess the effects of diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years.

Search methods

We performed a systematic literature search in: CENTRAL, MEDLINE, Embase, PsycINFO, CINAHL, LILACS, and the trial registers ClinicalTrials.gov and ICTRP Search Portal. We checked references of identified studies and systematic reviews. There were no language restrictions. The date of the last search was July 2016 for all databases.

Selection criteria

We selected randomised controlled trials (RCTs) of diet, physical activity and behavioural interventions for treating overweight or obesity in adolescents aged 12 to 17 years.

Data collection and analysis

Two review authors independently assessed risk of bias, evaluated the overall quality of the evidence using the GRADE instrument and extracted data following the guidelines of the *Cochrane Handbook for Systematic Reviews of Interventions*. We contacted trial authors for additional information.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) I Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Main results

We included 44 completed RCTs (4781 participants) and 50 ongoing studies. The number of participants in each trial varied (10 to 521) as did the length of follow-up (6 to 24 months). Participants ages ranged from 12 to 17.5 years in all trials that reported mean age at baseline. Most of the trials used a multidisciplinary intervention with a combination of diet, physical activity and behavioural components. The content and duration of the intervention, its delivery and the comparators varied across trials. The studies contributing most information to outcomes of weight and body mass index (BMI) were from studies at a low risk of bias, but studies with a high risk of bias provided data on adverse events and quality of life.

The mean difference (MD) of the change in BMI at the longest follow-up period in favour of BCI was -1.18 kg/m² (95% confidence interval (CI) -1.67 to -0.69); 2774 participants; 28 trials; low quality evidence. BCI lowered the change in BMI z score by -0.13 units (95% CI -0.21 to -0.05); 2399 participants; 20 trials; low quality evidence. BCI lowered body weight by -3.67 kg (95% CI -5.21 to -2.13); 1993 participants; 20 trials; moderate quality evidence. The effect on weight measures persisted in trials with 18 to 24 months' follow-up for both BMI (MD -1.49 kg/m² (95% CI -2.56 to -0.41); 760 participants; 6 trials and BMI z score MD -0.34 (95% CI - 0.66 to -0.02); 602 participants; 5 trials).

There were subgroup differences showing larger effects for both BMI and BMI z score in studies comparing interventions with no intervention/wait list control or usual care, compared with those testing concomitant interventions delivered to both the intervention and control group. There were no subgroup differences between interventions with and without parental involvement or by intervention type or setting (health care, community, school) or mode of delivery (individual versus group).

The rate of adverse events in intervention and control groups was unclear with only five trials reporting harms, and of these, details were provided in only one (low quality evidence). None of the included studies reported on all-cause mortality, morbidity or socioeconomic effects.

BCIs at the longest follow-up moderately improved adolescent's health-related quality of life (standardised mean difference 0.44 ((95% CI 0.09 to 0.79); P = 0.01; 972 participants; 7 trials; 8 comparisons; low quality of evidence) but not self-esteem.

Trials were inconsistent in how they measured dietary intake, dietary behaviours, physical activity and behaviour.

Authors' conclusions

We found low quality evidence that multidisciplinary interventions involving a combination of diet, physical activity and behavioural components reduce measures of BMI and moderate quality evidence that they reduce weight in overweight or obese adolescents, mainly when compared with no treatment or waiting list controls. Inconsistent results, risk of bias or indirectness of outcome measures used mean that the evidence should be interpreted with caution. We have identified a large number of ongoing trials (50) which we will include in future updates of this review.

PLAIN LANGUAGE SUMMARY

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Review question

How effective are diet, physical activity and behavioural interventions in reducing the weight of overweight or obese adolescents aged 12 to 17 years?

Background

Across the world, more adolescents are becoming overweight and obese. These adolescents are more likely to suffer from health problems in later life. More information is needed about what works best in treating this problem.

Study characteristics

We found 44 randomised controlled trials (clinical studies where people are randomly put into one of two or more treatment groups) comparing diet, physical activity and behavioural (where habits are changed or improved) treatments (interventions) to a variety of control groups delivered to 4781 overweight or obese adolescents aged 12 to 17 years. Our systematic review reports on the effects of multidisciplinary interventions, dietary interventions and physical activity interventions compared with a control group (no

intervention, 'usual care,' enhanced usual care or some other therapy if it was also delivered to the intervention group). The adolescents in the included studies were monitored (called follow-up) for between six months and two years.

Key results

The average age of adolescents ranged from 12 to 17.5 years. Most studies reported the body mass index (BMI). BMI is a measure of body fat and is calculated by dividing weight (in kilograms) by the square of the body height measured in metres (kg/m²). We summarised the results of 28 studies in 2774 adolescents reporting BMI, which on average was 1.18 kg/m² lower in the intervention groups compared with the control groups. We summarised the results of 20 studies in 1993 adolescents reporting weight, which on average was 3.67 kg lower in the intervention groups compared with the control groups. BMI reduction was maintained at 18 to 24 months of follow-up (monitoring participants until the end of the study), which on average was 1.49 kg/m² lower in the intervention groups compared with their life and health) but we did not find firm evidence of an advantage or disadvantage of these interventions for improving self-esteem, physical activity and food intake. No study reported on death from any cause, morbidity (illnesses) or socioeconomic effects (such as days away from school). Three studies reported no side effects, one reported no serious side effects, one did not provide details of side effects and the rest of the studies did not report whether side effects occurred or not.

We identified 50 ongoing studies which we will include in future updates of our review.

Currentness of evidence

This evidence is up to date as of July 2016.

Quality of the evidence

The overall quality of the evidence was rated as low for most of the outcomes (results) measured, mainly because of limited confidence in how studies were performed, inconsistent results between the studies and the way that some outcomes used do not capture obesity outcomes directly. Also, there were just a few studies for some outcomes, with small numbers of included adolescents.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 3 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

SUMMARY OF FINDINGS FOR THE MAIN COMPARISON [Explanation]

Diet, physical activity and behavioural interventions for the treatment of overweight or obesity in adolescents aged 12-17 years

Patient or population: adolescents (aged 12-17 years) being overweight or obese

Settings: school; community; healthcare

Intervention: behaviour changing interventions (behavioural, diet, physical activity (or a combination) components)

Comparison: usual care; concomitant therapy; no intervention/wait list

al inton	Outcomes	Assumed risk	Corresponding risk	Relative effect	No of participants	Quality of the evidence	Comments
ventions for tl		Usual care, concomi- tant therapy, no inter- vention/wait list	Behaviour changing in- tervention	(95%CI)	(triais)	(GRADE)	
ne treatment of overweight or obese adolescents aged 12	 a) Change in BMI Follow-up: 6-24 months b) Change in BMI z score^d Follow-up: 6-24 months c) Change in weight Follow-up: 6-24 months 	 a) The mean BMI change ranged across control groups from -1. 18 kg/m² to 2.1 kg/m² b) The mean BMI z score change ranged across control groups from -0.31 units to 0.13 units c) The mean change in weight ranged across control groups from -1. 8 kg to 8.3 kg 	 a) The mean BMI change in the intervention groups was 1. 18 kg/m² lower (1.67 lower to 0.69 lower) b) The mean BMI z score change in the intervention groups was 0.13 units lower (0.21 lower to 0.05 lower) c) The mean change in weight in the intervention groups was -3.67 kg lower (-5.21 lower to -2.13 lower) 		a) 2774 (28) b) 2399 (20) c) 1993 (20)	a) ⊕⊕○○ Low ^a b) ⊕⊕○○ Low ^b c) ⊕⊕⊕○ Moderate ^c	 a) Lower BMI indicates weight loss b) Lower score indi- cates weight loss c) Lower weight indi- cates weight loss
to I7 vears (Review)	Adverse events	See comment	See comment	See comment	See comment	⊕⊕⊖⊖ Low ^e	Only 5 trials reported adverse events and of these details were pro- vided in only 1 show- ing no substantial dif- ferences between inter-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. adolescents aged 12 to 17 years (Review)

						vention and compara- tor groups
Health-related quality of life Validated self-reported measures Follow-up: 6-24 months	The standardised mean difference for health- related quality of life ranged across control groups from -1.34 to 9. 73	The standardised mean difference for health-re- lated quality of life in the intervention groups was 0.44 standard de- viations higher (0.09 to 0.79 higher)	-	972 (7)	⊕⊕⊖⊖ Low ^f	A standard deviation of 0.44 represents a mod- erate difference be- tween groups. ^g
All-cause mortality	See comment	See comment	See comment	See comment	See comment	Not reported
Morbidity	See comment	See comment	See comment	See comment	See comment	Not reported
Socioeconomic effects	See comment	See comment	See comment	See comment	See comment	Not reported
BMI: body mass index:	CI: confidence interval					
GRADE Working Group g High quality: Further res Moderate quality: Furth Low quality: Further res Very low quality: We are	rades of evidence search is very unlikely to er research is likely to ha earch is very likely to hav e very uncertain about the	change our confidence in ve an important impact o e an important impact on e estimate.	the estimate of effe n our confidence in t our confidence in th	ct. he estimate of effect and e estimate of effect and	l may change the estimat is likely to change the es	e. timate.

rials had less than 80% of participants enrolled included in the analysis); see Appendix 9.

f Downgraded one level due to reporting and detection bias (no blinding of participants and personnel) and inconsistency (I² = 85%); see Appendix 9). g A broadly accurate guide of how to interpret the standard mean difference (SMD) is: less than 0.40 = small, 0.40 to 0.70 = moderate, greater than 0.70 = large (Higgins 2011a).

BACKGROUND

The prevalence of overweight and obese children and adolescents has increased throughout the world, presenting a global public health crisis (Ng 2014; WHO 2015a). Although once considered to be a condition affecting only high-income countries, rates of paediatric overweight and obesity have started to rise dramatically in some low- to middle-income countries (Wang 2012). Using the International Obesity Task Force (IOTF) standard definition, the age-standardised prevalence of overweight and obesity in children and adolescents has increased in both high-income and lowto middle-income countries since the mid-1980s (Cole 2000). In 2013, the prevalence of overweight and obese children and adolescents in high-income countries was estimated at 23.8% (95% confidence interval (CI) 22.9 to 24.7) for boys and 22.6% (95% CI 21.7 to 23.6) for girls. In low- to middle-income countries, the prevalence was estimated as 12.9% (95% CI 12.3 to 13.5) for boys and 13.4% (95% CI 13.0 to 13.9) for girls (Ng 2014). Very young children are also affected. In 2010, de Onis 2010 used the World Health Organization (WHO) growth standards (WHO 2015b) to estimate that over 42 million children under five years of age were overweight or obese, with approximately 35 million of these children living in low- to middle-income countries.

Inequalities in overweight and obesity prevalence have also been documented. Generally, socioeconomically disadvantaged children in high-income countries (Knai 2012; Shrewsbury 2008), and children of higher socioeconomic status in low- to middle-income countries (Lobstein 2004; Wang 2012) are at greater risk of becoming overweight. However, this relationship may vary by population demographics (e.g. age, gender, ethnicity), and environment (e.g. country, urbanisation) (Wang 2012). The prevalence of obesity varies by ethnicity, with large data sets showing substantial ethnic variation in English (HSCIC 2015), US (Freedman 2006; Skinner 2014), and New Zealand (Rajput 2014) child populations.

While there is some evidence that the rate of increase in paediatric obesity may be slowing in some high-income countries, current levels remain too high, and continue to rise in many lowto middle-income countries (Olds 2011; Rokholm 2010). However, an additional concern in some high-income countries such as the USA (Kelly 2013; Skinner 2014), and England (CMO 2015; Ells 2015), is the rise in severe paediatric obesity. While the IOTF published an international definition for severe paediatric (morbid) obesity in 2012 (Cole 2012), often severe obesity prevalence is reported using country-specific cut-off points making international comparisons difficult. However, data from the USA (Skinner 2014), and England (Ells 2015), have shown that the prevalence of severe paediatric obesity varies by socioeconomic status and ethnicity, and may result in a greater risk of adverse cardiometabolic events and severe obesity in adulthood (Kelly 2013).

Description of the condition

Childhood overweight and obesity results from an accumulation of excess body fat, and can increase the risk of both short- and longer-term health consequences. Numerous obesity-related co morbidities can develop during childhood, which include muscular skeletal complaints (Paulis 2014); cardiovascular risk factors such as hypertension, insulin resistance and hyperlipidaemia (Reilly 2003), even in very young children (Bocca 2013); and conditions such as such as sleep apnoea (Narang 2012), asthma (Egan 2013), liver disease, and type 2 diabetes mellitus (Daniels 2009; Lobstein 2004). The condition can also affect psychosocial well-being, with obese young people susceptible to reduced self-esteem and health-related quality of life (Griffiths 2010), and stigmatisation (Puhl 2007; Tang-Peronard 2008). Evidence also shows that childhood obesity can track into adulthood (Parsons 1999; Singh 2008; Whitaker 1997), and is therefore associated with an increased risk of ill health later in life (Reilly 2003).

Description of the intervention

Given the serious implications associated with childhood and adolescent obesity, effective treatment is imperative. While the fundamental principles of weight management in children and adolescents are the same as in adults (i.e. reduced energy intake and increased energy expenditure), the primary aim of treatment (i.e. weight reduction or deceleration of weight gain) and the most suitable intervention approach vary, and are dependent on the child's age and degree of excess weight, among other considerations. Behaviour changing interventions combining dietary, physical activity and behavioural components are effective and are considered the current best practice in the treatment of childhood obesity in adolescents under 18 years of age (WHO 2015c).

Adverse effects of the intervention

It is not anticipated that diet, physical activity and behavioural interventions will lead to adverse outcomes. However, as with all obesity treatment interventions in children and young people, potential adverse effects should be considered, including effects on linear growth, eating disorders and psychological well-being.

How the intervention might work

The cause of childhood obesity is multifactorial, including dietary, activity, behavioural and environmental factors (Orsi 2011). Modifying these factors by behaviour changing interventions is considered the line of treatment of childhood overweight and obesity (Spear 2007). Behaviour changing interventions aim to improve dietary intake, increase activity levels, reduce sedentary behaviour, provide techniques to sustain healthy lifestyle and may have parental or family involvement (Kothandan 2014). Interventions may target one behavioural component (diet only or physical

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 7 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. activity only) while other interventions integrate several components (diet, physical activity and behavioural modification) that seem to show promising results in decreasing overweight and obesity in adolescents (Jelalian 1999). Behavioural modification is often based on theoretical elements such as cognitive behavioural theory to help adolescents sustain changes and minimise relapse (Doak 2006). Theory-based interventions address different elements such as healthy food choices, environmental control, positive thinking and goal-setting that appear to be linked to positive weight outcomes (Dewar 2013; MacDonell 2010; White 2004). Earlier systematic reviews showed that behaviour changing interventions improved weight reduction in children aged 19 and younger (Ho 2012; Wilfley 2007), while one systematic review by Kelly and colleagues showed that interventions addressing nutrition, physical activity and behavioural skills with parental involvement appears to be an effective way to reduce adolescent obesity (Kelly 2008). One systematic review by Ruotsalainen and colleagues showed that supervised physical activity interventions have a favourable effect on adolescent BMI. Ruotsalainen acknowledged the importance of complex interventions that involve behavioural modification and management in the implementation of physical activity in adolescents (Ruotsalainen 2015), while the effect of dietary interventions remains unclear. One systematic review by Collins and colleagues found inconsistent evidence on the role of dietetic interventions in the treatment of childhood obesity (Collins 2006). However, the length, delivery setting and long-term effect of behaviour changing interventions in the treatment of adolescent obesity remains unclear (Ho 2012; McGovern 2008; Wilfley 2007). The importance of behaviour changing interventions in treating childhood obesity has led to questioning their effectiveness in adolescents and whether different types of behavioural modification are more effective than others.

Why it is important to do this review

The first version of this systematic review was published in 2003 and included analysis of childhood obesity treatment trials published up to July 2001 (Summerbell 2003). The second version was published in 2009 providing an update to the 2003 review (Oude Luttikhuis 2009). To reflect the rapid growth in this field, the third update to this review has been split across six reviews focusing on the following treatment approaches: surgery; drugs; parent-only interventions; diet, physical activity and behavioural interventions for young children aged 0 to 6 years; school children aged 5 to 11 years and adolescents aged 12 to 17 years. The current review examines the effectiveness of interventions for adolescents aged 12 to 17 years. Previous systematic reviews identified gaps in research assessing interventions specifically for this age group (Doak 2006). Other systematic reviews did not focus on adolescents specifically (Ho 2012; Peirson 2015; Wilfley 2007) or focused on specific interventions (Ruotsalainen 2015). This review has extended the evidence base by including trials of any form of behaviour changing intervention aimed to treat obesity in adolescents aged 12 to 17 years. It also includes the effect of behaviour changing interventions on other adiposity indicators (e.g. waist circumference, body fat), behavioural change, quality of life, selfesteem and views of the intervention. The results of this current review and other systematic reviews in this series will provide information on which to underpin clinical guidelines and health policy on the treatment of childhood obesity.

OBJECTIVES

To assess the effects of diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years.

METHODS

Criteria for considering studies for this review

Types of studies

We included randomised controlled clinical trials (RCT). For cross-over trials, we only analysed the first phase before cross-over (if this was six months or more) to avoid the potential of carry over effects. Included studies observed participants for a minimum of six months (this time frame refers to the intervention itself or to a combination of the intervention with a follow-up phase).

Types of participants

We included studies of overweight or obese adolescents with a mean study age of 12 to 17 years at the commencement of the intervention. We excluded studies of critically ill people, pregnant or breastfeeding women, or adolescents with a syndromic cause for their obesity (e.g. Prader-Willi syndrome).

Diagnostic criteria

Any method of overweight or obesity classification was acceptable.

Types of interventions

We planned to investigate the following comparisons of intervention versus control/comparator.

Intervention

Any form of behaviour changing intervention with a primary aim to treat overweight or obesity. Behaviour changing interventions included any form of dietary, physical activity, behavioural therapy, or a combination of these delivered as a single or multicomponent intervention, in any setting, using any delivery method

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 8 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. and included studies which examined weight loss or maintenance or both.

Comparator

No treatment/wait list control, usual care or an alternative concomitant therapy providing it is delivered in the intervention arm. Concomitant interventions had to be the same in the intervention and comparator groups to establish fair comparisons.

Types of outcome measures

Primary outcomes

- Changes in measured BMI or body weight.
- Adverse events.

Secondary outcomes

- Health-related quality of life.
- Self-esteem.
- All-cause mortality.
- Morbidity.
- Anthropometric measures other than BMI.
- Behaviour change.
- Participants' views of the intervention.
- Socioeconomic effects.
- Parenting skill and relationships.

Method and timing of outcome measurement

• Changes in BMI (kg/m²) and body weight (kg): measured at baseline and at least at six months.

• Adverse events: defined as an adverse outcome that occurred during or after the intervention but was not necessarily caused by it, and measured at baseline and at least at six months.

• Health-related quality of life: evaluated by a validated instrument such as Paediatric Quality of Life Inventory and measured at baseline and at least at six months.

• Self-esteem: evaluated by a validated instrument such as Rosenberg Self-Esteem Scale and measured at baseline and at least at six months.

• All-cause mortality: defined as any death that occurred during or after the intervention and measured at six months or later. Morbidity: defined as illness or harm associated with the intervention and measured at baseline and six months or later.

• Anthropometric measures other than change in BMI: defined by validated tools such as waist circumference, skin-fold thickness, waist-to-hip ratio, dual x-ray absorptiometry (DXA) or bioelectrical impedance analysis and measured at baseline and at least at six months.

• Behaviour change: defined as validated measures of diet and physical activity and measured at baseline and at least at six months. Participants' views of the intervention: defined as documented accounts from participant feedback and measured at baseline and at least at six months.

• Parent-child relationship or assessment of parenting: evaluated by a validated instrument and measured at baseline and at least at six months.

• Socioeconomic effects defined as a validated measure of socioeconomic status such as parental income or educational status and measured at baseline and at least at six months.

'Summary of findings' table

We presented a 'Summary of findings' table reporting the following outcomes listed according to priority.

- Changes in BMI and body weight.
- Adverse events.
- Health-related quality of life.
- All-cause mortality.
- Morbidity.
- Socioeconomic effects.

Search methods for identification of studies

Electronic searches

We searched the following sources from inception of each database to 14 July 2016 and placed no restrictions on the language of publication.

• Cochrane Central Register of Controlled Trials (CENTRAL) (2016, Issue 6).

• Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) (from 1946).

- Embase Ovid (1974 to 2016 week 28).
- PsycINFO (1806 to July week 1 2016).
- CINAHL.

• LILACS (Latin American and Caribbean Health Science Information database) (last update 8 July 2016).

- ClinicalTrials.gov (www.clinicaltrials.gov).
- WHO International Clinical Trials Registry Platform (ICTRP) (www.who.int/trialsearch/).

We continuously applied a MEDLINE (via OvidSP) e-mail alert service established by the Cochrane Metabolic and Endocrine Disorders Group (CMED) to identify newly published studies using the same search strategy as described for MEDLINE (for details on search strategies and search platforms, see Appendix 1). Should we have identified new studies for inclusion, we planned to evaluate these, incorporated findings in our review and resubmitted another review draft (Beller 2013).

If we detected additional relevant key words during any of the electronic or other searches, we modified the electronic search strategies to incorporate these terms and documented the changes.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 9 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Searching other resources

We tried to identify other potentially eligible trials or ancillary publications by searching the reference lists of retrieved included trials, (systematic) reviews, meta-analyses and health technology assessment reports. We also contacted study authors of included trials to identify any further studies that we may have missed.

Data collection and analysis

Selection of studies

Two review authors (two of LA-K, RJ, EL, JC, KR, CO, LA, EM, LE, HF, JO) independently scanned the abstract, title, or both, of every record retrieved, to determine which studies should be assessed further. We investigated all potentially relevant articles as full text. We resolved any discrepancies through consensus or recourse to a third review author (of KR, EL, LA-K). Where resolution of a disagreement was not possible, we added the article to those 'awaiting assessment' and contacted study authors for clarification. We present an adapted PRISMA flow chart showing the process of study selection (Liberati 2009).

Data extraction and management

For studies that fulfilled the inclusion criteria, two review authors (of LA-K, EL, JC, RJ, CO, LA, EM, KR, HF, RV, MM, JO) independently abstracted key participant and intervention characteristics and reported data on efficacy outcomes and adverse events using standard data extraction templates as supplied by Cochrane Metabolic and Endocrine Disorders Group, with any disagreements to be resolved by discussion, or, if required, by consultation with a third review author (KR or EL) (for details, see Table 1; Appendix 2; Appendix 3; Appendix 4; Appendix 5; Appendix 6; Appendix 7; Appendix 8; Appendix 9; Appendix 10).

We provided information including trial identifier about potentially relevant ongoing studies in the Characteristics of ongoing studies table and in Appendix 5 (Matrix of study endpoints (publications and trial documents)). We tried to find the protocol of each included study and reported primary, secondary and other outcomes in comparison with data in publications in Appendix 5. We e-mailed all authors of included studies to enquire whether they were willing to answer questions regarding their trials. Appendix 10 shows the results of this survey. Thereafter, we sought relevant missing information on the trial from the primary author(s) of the article, if required.

Dealing with duplicate and companion publications

In the event of duplicate publications, companion documents or multiple reports of a primary study, we tried to maximise yield of information by collating all available data and use the most complete data set aggregated across all known publications. In case of doubt, we gave priority to the publication reporting the longest follow-up associated with our primary or secondary outcomes.

Assessment of risk of bias in included studies

We used the Cochrane 'risk of bias' assessment tool (Higgins 2011a; Higgins 2011b), and evaluated the following criteria.

- Random sequence generation (selection bias).
- Allocation concealment (selection bias).
- Imbalances in baseline characteristics.
- Blinding of participants and personnel (performance bias).
- Blinding of outcome assessment (detection bias).
- Incomplete outcome data (attrition bias).
- Selective reporting (reporting bias).
- Other potential sources of bias.

We judged the above 'Risk of bias' criteria as 'low risk', 'high risk' or 'unclear risk' and evaluated individual bias items as described in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011a). We present a 'Risk of bias' graph and a 'Risk of bias summary'. We assessed the impact of individual bias domains on study results at endpoint and study levels. In case of high risk of selection bias, all endpoints investigated in the associated study were marked as 'high risk'.

We evaluated whether imbalances in baseline characteristics existed and how these were addressed (Egbewale 2014).

For performance bias (blinding of participants and personnel) and detection bias (blinding of outcome assessors) we evaluated the risk of bias separately for each outcome type (objective and subjective) (Hróbjartsson 2013). We noted whether endpoints were self-reported, investigator-assessed or adjudicated outcome measures. We considered the implications of missing outcome data from individual participants per outcome such as high dropout rates (e.g. above 15%) or disparate attrition rates (e.g. difference of 10% or more between study arms).

We assessed outcome reporting bias by integrating the results of 'Examination of outcome reporting bias' (Kirkham 2010) (Appendix 6), in the 'Matrix of study endpoints (publications and trial documents)' (Appendix 5), and 'Outcomes (outcomes reported in abstract of publication)' section of the Characteristics of included studies table. This analysis formed the basis for the judgement of selective reporting (reporting bias).

We defined the following endpoints as potentially self-reported outcomes.

- Adverse events.
- Health-related quality of life.
- Participant's views of the intervention.
- Changes in body weight.
- Self-esteem.
- Behaviour change.

We defined the following outcomes as potentially investigatorassessed outcomes.

• Changes in BMI and body weight.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 10 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

- Adverse events.
- All-cause mortality.
- Morbidity.

Measures of treatment effect

We expressed dichotomous data as odds ratios (ORs) or risk ratios (RRs) with 95% confidence intervals (CIs). We expressed continuous data as mean differences (MD) if they used the same instruments or standardised mean differences (SMD) if they used different instruments with 95% CI. We expressed time-to-event data as hazard ratios (HRs) with 95% CIs.

We included studies reporting multiple comparison groups in this review. Where this was the case, we considered whether the aim of the trial was to test for differences between these groups, and whether the study authors found a significant difference. Where there were no demonstrated differences, we merged groups as recommended by the *Cochrane Handbook for Systematic Reviews of Interventions* (Section 7.7.8, Higgins 2011a). In studies that found a difference between groups, we used the data for the control group for each intervention group comparison and reduced the weight assigned to the control group by dividing the number of participants in the control group by the number of intervention groups.

Unit of analysis issues

We used data from the first period of cross-over trials if available. We collected data from the latest available time point in the follow-up reported in the studies to avoid double-counting trials in the same analysis. For cluster RCTs, we used the denominator reported in the trial and considered how the analysis methods used took account of the effect of clustering. Due to the small number of cluster RCTs found, we decided not to adjust the data so we performed sensitivity analyses to ascertain if the results were sensitive to the inclusion of studies with a cluster design.

Dealing with missing data

We obtained relevant missing data from study authors, if feasible, and evaluated important numerical data such as screened, eligible, randomised participants as well as intention-to-treat (ITT), astreated and per-protocol populations. We investigated attrition rates (e.g. dropouts, losses to follow-up and withdrawals), and critically appraised issues of missing data and imputation methods (e.g. last observation carried forward (LOCF)).

Where standard deviations (SD) for outcomes were not reported, and we did not receive information from study authors, we imputed these values by assuming the SD of the missing outcome to be the same as the largest SD from those studies where this information was reported. We investigated the impact of imputation on meta-analyses by means of sensitivity analyses. Where papers did not report results as change from baseline, we calculated this and for the SD differences followed the methods presented in the *Cochrane Handbook for Systematic Reviews of Intervention* for imputing these (Section 16.1.3.2, Higgins 2011a), and assumed a correlation of 0.5 between baseline and follow-up measures as suggested by Follmann 1992.

Assessment of heterogeneity

In the event of substantial clinical or methodological heterogeneity, we did not report study results as meta-analytically pooled effect estimates. We identified heterogeneity by visual inspection of forest plots and by using a standard Chi² test with a significance level of $\alpha = 0.1$, in view of the low power of this test. We examined heterogeneity using the I² statistic, which quantifies inconsistency across studies to assess the impact of heterogeneity on the meta-analysis (Higgins 2002; Higgins 2003), where an I² statistic of 75% or more indicates a considerable level of inconsistency (Higgins 2011a).

When we found heterogeneity, we attempted to determine potential reasons for it by examining individual study and subgroup characteristics.

Assessment of reporting biases

If we included 10 studies or more for a given outcome, we used funnel plots to assess small-study effects. Due to several explanations for funnel plot asymmetry, we interpreted results carefully (Sterne 2011).

Data synthesis

Unless there is good evidence for homogeneous effects across studies we primarily summarised low risk of bias data using a randomeffects model (Wood 2008). We interpreted random-effects metaanalyses with due consideration of the whole distribution of effects, ideally by presenting a prediction interval (Higgins 2009). A prediction interval specifies a predicted range for the true treatment effect in an individual study (Riley 2011). In addition, we performed statistical analyses according to the statistical guidelines presented in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011a).

Quality of evidence

We presented the overall quality of the evidence for each outcome according to the GRADE approach which takes into account issues related to internal validity (risk of bias, inconsistency, imprecision, publication bias)and also to external validity, such as directness of results. Two review authors (LA-K and KR/EL) rated the quality for each outcome. We presented a summary of the evidence in a Summary of findings for the main comparison, which provides key information about the best estimate of the magnitude of the effect, in relative terms and absolute differences for each relevant comparison of alternative management strategies, numbers of participants and studies addressing each important outcome and the rating of the overall confidence in effect estimates for each

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 11 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. outcome. We created the 'Summary of findings' table based on the methods described in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011a). We presented results on the outcomes as described in Types of outcome measures. If metaanalysis was not possible, we presented results in a narrative 'Summary of findings' table.

In addition, we established an appendix 'Checklist to aid consistency and reproducibility of GRADE assessments' (Meader 2014) to help with standardisation of 'Summary of findings' tables (Appendix 9).

Subgroup analysis and investigation of heterogeneity

We expected the following characteristics to introduce clinical heterogeneity, and planned to carry out subgroup analyses with investigation of interactions for our primary outcomes.

- Duration of follow-up.
- Duration of the intervention.
- Duration of postintervention follow-up.
- Type of comparator group.
- Mode of delivery of the intervention.
- Setting.
- Type of intervention.
- Theoretical basis to the intervention.
- Parental involvement.

Sensitivity analysis

We planned to perform sensitivity analyses to explore the influence of the following factors on effect size.

• Restricting the analysis to published studies, and by publication language.

• Restricting the analysis taking into account risk of bias, as specified in the section Assessment of risk of bias in included studies section.

• Restricting the analysis to studies of adolescents without specific health conditions.

• Restricting the analysis to studies with no uncertainties (such as study duration, imputed data).

We also tested the robustness of the results by repeating the analysis using different measures of effect size (RRs, ORs, etc.) and different statistical models (fixed-effect and random-effects models).

RESULTS

Description of studies

For a detailed description of trials, see the Characteristics of included studies, Characteristics of excluded studies, and Characteristics of ongoing studies tables.

Results of the search

This search is up to date as of July 2016 in addition to ongoing email alerts from MEDLINE. The searches generated 16,106 hits after duplicates were removed. Fifty-two additional records were identified through non-database sources. Screening of titles and abstracts identified 736 records to go forward for formal inclusion and exclusion. Forty-four completed RCTs fulfilled the inclusion criteria and were included in the review. For a detailed description of the included trials, see the Characteristics of included studies table. The search identified 50 ongoing trials, which are reported in the Characteristics of ongoing studies table. The flow of trials through the review is presented in Figure 1.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 12 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.



Figure I. Study flow diagram.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 13 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Included studies

A detailed description of the characteristics of included studies is presented elsewhere (see Characteristics of included studies and Appendix 2; Appendix 3; Appendix 4; Appendix 5; Appendix 6; Appendix 7; Appendix 8; Appendix 11). The following is a succinct overview.

Source of data

All data presented in the review were obtained from the published literature. We contacted all study authors for additional information and results are presented in Appendix 10.

Comparisons

To meet the inclusion criteria for the review comparators could be no treatment, usual care or a concomitant therapy providing it was also included in the intervention group. In nine trials the comparator was either no intervention or a wait list control (Brennan 2013; Carraway 2014; Ebbeling 2012; Luna-Pech 2014; Pakpour 2015; Patsopoulou 2017; Schranz 2014; Toulabi 2012; Vos 2011). Twenty-three studies used usual care comparators (Bean 2014; Boodai 2014; Carrel 2005; Christie 2011; Daley 2005; Debar 2012; Ebbeling 2003; Ford 2010; Gourlan 2013; Hofsteenge 2014; Jiang 2005; Kong 2013; Love-Osborne 2014; NCT00132132; NCT00807560; Patrick 2013; Pbert 2013; Pitetti 2007; Saelens 2002; Savoye 2007; Vissers 2008; Visuthranukul 2015; van Egmond-Frohlich 2006). Twelve trials used a concomitant therapy (Brownell 1983; Chandra 1968; Grey 2009; Jelalian 2016; Kong 2014; Nguyen 2012; Norman 2016; Resnicow 2005; Sigal 2014; Walpole 2013; Wengle 2011; Wong 2015).

Overview of trial populations

The 44 trials included 4781 participants. Approximately 2555 were randomised to an intervention and 1850 to a comparator. The proportion of participants finishing the study, where reported, ranged from 34% to 100% in the intervention groups and from 38% to 100% in the comparator groups. Individual sample size ranged from 10 to 521.

Study design

Thirty-nine trials were parallel comparisons with individual randomisation. Four trials were cluster RCTs (Grey 2009; Kong 2013; Pbert 2013; Resnicow 2005), and one was a cross-over trial (Brennan 2013). All 44 trials had a superiority design. Five trials had three arms (Brownell 1983; Daley 2005; Norman 2016; Pakpour 2015; Patsopoulou 2017), and two trials had four arms (Patrick 2013; Sigal 2014). The majority (24) were single centre trials, although the number of centres was unclear or not reported in 10 trials. Two trials had six centres (Grey 2009; Kong 2013), and one study each had two (Brennan 2013), eight (Pbert 2013), 10 (Resnicow 2005), 12 (Toulabi 2012), 15 (Patsopoulou 2017) or 18 (Patrick 2013) centres. Trials were performed from 1968 to 2015. The duration of the intervention ranged from six weeks to two years, and the duration of follow-up ranged from six months to two years. Eight trials had some form of run-in period prior to the start of the study (Brownell 1983; Chandra 1968; Luna-Pech 2014; Norman 2016; Pitetti 2007; Schranz 2014; Sigal 2014; Wengle 2011). None of the trials was terminated early.

Settings

The interventions were carried out in a variety of settings. These included in schools in nine trials (Carrel 2005; Grey 2009; Jiang 2005; Kong 2013; Love-Osborne 2014; Pbert 2013; Pitetti 2007; Toulabi 2012; Vissers 2008), in the community or home in eight trials (Ebbeling 2012; Nguyen 2012; Patrick 2013; Patsopoulou 2017; Resnicow 2005; Saelens 2002; Schranz 2014; Sigal 2014), and various healthcare settings, including outpatients, primary care, research clinics and other hospital sites in 26 trials (based on author locations where the study did not explicitly report this) (Bean 2014; Boodai 2014; Brennan 2013; Brownell 1983; Carraway 2014; Chandra 1968; Christie 2011; Daley 2005; Debar 2012; Ebbeling 2003; Ford 2010; Gourlan 2013; Hofsteenge 2014; Jelalian 2016; Kong 2014; Luna-Pech 2014; NCT00132132; NCT00807560; Norman 2016; Pakpour 2015; Savoye 2007; Visuthranukul 2015; Vos 2011; Walpole 2013; Wengle 2011; Wong 2015).

Participants

The diagnostic criteria for overweight and obesity differed between the trials. Twelve trials included participants with BMI on or above the 85th percentile for age and height (Bean 2014; Carraway 2014; Ebbeling 2012; Grey 2009; Jelalian 2016; Kong 2013; Love-Osborne 2014; NCT00132132; NCT00807560; Pbert 2013; Walpole 2013; Wengle 2011), nine trials used a cutoff of on or above the 95th percentile (Boodai 2014; Carrel 2005; Ebbeling 2003; Ford 2010; Kong 2014; Luna-Pech 2014; Norman 2016; Pakpour 2015; Savoye 2007), three trials used a cut-off of on or above the 90th percentile (Debar 2012; Gourlan 2013; Resnicow 2005), and two trials used a cut-off of on or above the 98th percentile (Christie 2011; Daley 2005). The remaining trials used a range of different criteria to define overweight or obesity for inclusion in the trials (Characteristics of included studies table; Appendix 3).

Thirty-four trials reported the mean BMI at baseline (Brennan 2013; Brownell 1983; Carrel 2005; Christie 2011; Debar 2012; Ebbeling 2003; Ebbeling 2012; Ford 2010; Gourlan 2013; Grey 2009; Hofsteenge 2014; Jelalian 2016; Jiang 2005; Kong 2014; Love-Osborne 2014; Luna-Pech 2014; NCT00807560; Nguyen 2012; Norman 2016; Pakpour 2015; Patsopoulou 2017; Pbert 2013; Pitetti 2007; Resnicow 2005; Saelens 2002; Savoye 2007; Schranz 2014; Sigal 2014; Toulabi 2012; Vissers 2008; Visuthranukul 2015; Vos 2011; Walpole 2013; Wengle 2011) and ranged from 26 kg/m² to 37 kg/m² in all but one study

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 14 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. (Brownell 1983), which was an outlier with BMIs in the three study groups ranging from 42 kg/m² to 45.5 kg/m². Sixteen trials reported BMI z scores (Bean 2014; Boodai 2014; Brennan 2013; Carraway 2014; Daley 2005; Love-Osborne 2014; Luna-Pech 2014; NCT00807560; Nguyen 2012; Norman 2016; Pakpour 2015; Patrick 2013; Pbert 2013; Vos 2011; Walpole 2013; Wengle 2011), and these ranged across all trials between 1.8 and 3.2 with the exception of one study (Vos 2011), which had a mean BMI Standard Deviation Score (SDS) of 4.2. One study reported BMI percentile only at baseline (at 94.5%) (Kong 2013), and two trials did not report BMI measures at baseline (Chandra 1968; Gourlan 2013). Twenty trials reported on change in weight.

Thirty-seven trials reported the gender of the study participants (Bean 2014; Boodai 2014; Brennan 2013; Brownell 1983; Carrel 2005; Chandra 1968; Christie 2011; Daley 2005; Debar 2012; Ebbeling 2003; Ebbeling 2012; Ford 2010; Gourlan 2013; Grey 2009; Hofsteenge 2014; Jelalian 2016; Jiang 2005; Kong 2013; Kong 2014; Love-Osborne 2014; Luna-Pech 2014; NCT00132132; NCT00807560; Nguyen 2012; Norman 2016; Pakpour 2015; Patrick 2013; Pbert 2013; Pitetti 2007; Resnicow 2005; Savoye 2007; Schranz 2014; Sigal 2014; Vissers 2008; Visuthranukul 2015; Vos 2011; Walpole 2013, and the proportion of participants who were female ranged from 33% to 77% in all cases except the trials by Debar 2012 and Resnicow 2005 where all participants were female, and Schranz 2014 where all participants were male. Four trials did not report the gender of participants at baseline (Saelens 2002; Toulabi 2012; Wengle 2011; Wong 2015). Participants ages ranged from 12 to 17.5 years in all trials that reported mean age at baseline, 11 trials did not report mean age at baseline (Brennan 2013; Brownell 1983; Chandra 1968; Christie 2011; Daley 2005; Gourlan 2013; NCT00132132; Resnicow 2005; Saelens 2002; Toulabi 2012; Wong 2015).

Nineteen trials reported ethnicity (Bean 2014; Brownell 1983; Carraway 2014; Daley 2005; Debar 2012; Ebbeling 2012; Ford 2010; Grey 2009; Hofsteenge 2014; Jelalian 2016; Kong 2013; Love-Osborne 2014; Norman 2016; Patrick 2013; Pbert 2013; Resnicow 2005; Savoye 2007; Sigal 2014; Vos 2011). Most trials reported a mixture of ethnic backgrounds for their participants as can be seen in Appendix 3, two trials reported exclusively on African-Americans (Resnicow 2005) and participants described as 'white' (Brownell 1983).

Three trials focused on participants with specific conditions, Jelalian 2016 included people with depression, Luna-Pech 2014 included people with asthma and Pitetti 2007 included people with autism living in a residential school.

Interventions

Thirty-four trials included interventions that were multidisciplinary (Bean 2014; Boodai 2014; Brennan 2013; Brownell 1983; Christie 2011; Daley 2005; Debar 2012; Gourlan 2013; Grey 2009; Hofsteenge 2014; Jelalian 2016; Jiang 2005; Kong 2013; Kong 2014; Love-Osborne 2014; NCT00132132; NCT00807560; Nguyen 2012; Norman 2016; Pakpour 2015; Patrick 2013; Patsopoulou 2017; Pbert 2013; Resnicow 2005; Saelens 2002; Savoye 2007; Sigal 2014; Toulabi 2012; van Egmond-Frohlich 2006; Vissers 2008; Vos 2011; Walpole 2013; Wengle 2011; Wong 2015), where the focus was on at least two components of diet, physical activity and behavioural approaches to weight management. Five trials were focused solely on dietary interventions (Ebbeling 2003; Ebbeling 2012; Ford 2010; Luna-Pech 2014; Visuthranukul 2015), and five focused solely on physical activity interventions (Carraway 2014; Carrel 2005; Chandra 1968; Pitetti 2007; Schranz 2014). Twenty-nine trials had a theoretical basis to their interventions, these included six which had a cognitive behavioural or social cognitive theoretical basis (Hofsteenge 2014; Jelalian 2016; Nguyen 2012; Norman 2016; Pbert 2013; Vos 2011), eight which used motivational interviewing approaches (Bean 2014; Brennan 2013; Christie 2011; Gourlan 2013; Love-Osborne 2014; Pakpour 2015; Resnicow 2005; Walpole 2013), and 15 that used a variety of other psychological approaches (Boodai 2014; Brownell 1983; Daley 2005; Debar 2012; Grey 2009; Jiang 2005; Kong 2013; Kong 2014; NCT00132132; Patrick 2013; Saelens 2002; Savoye 2007; Toulabi 2012; Vissers 2008; Wengle 2011). Thirteen trials did not use a behavioural approach or did not report the theoretical basis to any behavioural component of their intervention (Carrel 2005; Chandra 1968; Ebbeling 2003; Ebbeling 2012; Ford 2010; Luna-Pech 2014; NCT00807560; Patsopoulou 2017; Pitetti 2007; Schranz 2014; Sigal 2014; Visuthranukul 2015; Wong 2015). Twenty-six trials involved parents in the intervention (Bean 2014; Boodai 2014; Brennan 2013; Brownell 1983; Carraway 2014; Christie 2011; Daley 2005; Debar 2012; Ebbeling 2012; Grey 2009; Hofsteenge 2014; Jelalian 2016; Jiang 2005; Kong 2013; Kong 2014; NCT00807560; Nguyen 2012; Norman 2016; Pakpour 2015; Patrick 2013; Resnicow 2005; Savoye 2007; Toulabi 2012; Visuthranukul 2015; Vos 2011; Wengle 2011). In 15 trials, there was no parental involvement (Carrel 2005; Chandra 1968; Ebbeling 2003; Ford 2010; Gourlan 2013; Love-Osborne 2014; Luna-Pech 2014; NCT00132132; Pbert 2013; Pitetti 2007; Saelens 2002; Schranz 2014; Sigal 2014; Vissers 2008; Walpole 2013), and in three trials there were two intervention groups, one which included the parent and one which did not (Brownell 1983; Pakpour 2015; Patsopoulou 2017).

Nineteen trials delivered the intervention in a group format (Boodai 2014; Brownell 1983; Carrel 2005; Christie 2011; Daley 2005; Debar 2012; Grey 2009; Hofsteenge 2014; NCT00132132; Nguyen 2012; Pakpour 2015; Patsopoulou 2017; Pitetti 2007; Resnicow 2005; Savoye 2007; Schranz 2014; Toulabi 2012; Visuthranukul 2015; Vos 2011), for specific details see Characteristics of included studies table. In 14 studies, the intervention was individually based (Bean 2014; Brennan 2013; Ebbeling 2012; Ford 2010; Gourlan 2013; Jiang 2005; Kong 2013; Kong 2014; Luna-Pech 2014; Norman 2016; Pbert 2013; Saelens 2002; Sigal 2014; Walpole 2013), and in 10 studies, there was a mixture of some group and some individual sessions, or

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 15 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. the trial did not report the mode of delivery (Carraway 2014; Chandra 1968; Ebbeling 2003; Jelalian 2016; Love-Osborne 2014; NCT00807560; Patrick 2013; Vissers 2008; Wengle 2011; Wong 2015).

The duration of the intervention was six months or less in 30 trials (Bean 2014; Boodai 2014; Brennan 2013; Brownell 1983; Carraway 2014; Chandra 1968; Christie 2011; Daley 2005; Debar 2012; Ebbeling 2003; Gourlan 2013; Grey 2009; Jelalian 2016; Kong 2013; Kong 2014; NCT00807560; Pakpour 2015; Patsopoulou 2017; Pbert 2013; Resnicow 2005; Saelens 2002; Schranz 2014; Sigal 2014; Toulabi 2012; Vissers 2008; Visuthranukul 2015; Vos 2011; Walpole 2013; Wengle 2011; Wong 2015), and greater than six months in 14 trials (Carrel 2005; Ebbeling 2012; Ford 2010; Hofsteenge 2014; Jiang 2005; Love-Osborne 2014; Luna-Pech 2014; NCT00132132; Nguyen 2012; Norman 2016; Patrick 2013; Pitetti 2007; Savoye 2007; van Egmond-Frohlich 2006).

Outcomes

Twenty-three trials explicitly stated a primary endpoint in the publication (Appendix 5); in 20 of these, this was a measure of body composition such as weight or BMI. In the trial by Schranz 2014, the primary outcomes were exercise self-efficacy, physical selfworth and self-esteem. In the trial by Walpole 2013, the primary outcome was self-efficacy and in Daley 2005 the primary outcome was physical self-perceptions. All except one of the included trials (Chandra 1968) reported a BMI variable as an outcome; this was BMI in 29 trials, BMI z score in 20 trials, BMI percentile in five trials (15 trials reported more than one BMI variable, Brennan 2013; Debar 2012; Hofsteenge 2014; Jiang 2005; NCT00807560; Nguyen 2012; Norman 2016; Pakpour 2015; Patrick 2013; Pbert 2013; Saelens 2002; Savoye 2007; Visuthranukul 2015; Walpole 2013; Wengle 2011). Twenty trials reported weight and five trials reported rates of adverse events as described in the Effects of interventions section. Twenty-nine trials reported other anthropometric measures (Boodai 2014; Brennan 2013; Brownell 1983; Carraway 2014; Carrel 2005; Chandra 1968; Ebbeling 2003; Ebbeling 2012; Ford 2010; Grey 2009; Hofsteenge 2014; Kong 2013; Kong 2014; NCT00132132; Nguyen 2012; Norman 2016; Pakpour 2015; Patrick 2013; Patsopoulou 2017; Pbert 2013; Saelens 2002; Savoye 2007; Schranz 2014; Sigal 2014; Toulabi 2012; Vissers 2008; Vos 2011; Walpole 2013; Wengle 2011); this was percent body fat in 14 trials, trunk fat percentage in two trials, waist circumference in 16 trials, waist-to-height ratio in three trials, waist-to-hip ratio in two trials, fat mass in five trials, trunk fat mass in two trials, lean mass in three trials and percentage of overweight in two trials. Nine trials reported healthrelated quality of life (Debar 2012; Ford 2010; Hofsteenge 2014; Nguyen 2012; Luna-Pech 2014; Pakpour 2015; Patrick 2013; van Egmond-Frohlich 2006; Vos 2011). Nine trials reported self-esteem (Brennan 2013; Carraway 2014; Daley 2005; Debar 2012; Hofsteenge 2014; Nguyen 2012; Pakpour 2015; Patrick 2013; Schranz 2014). Eleven trials reported behavioural change in terms

of dietary intake (Brennan 2013; Ebbeling 2003; Ebbeling 2012; Kong 2013; Kong 2014; Pakpour 2015; Patrick 2013; Pbert 2013; Saelens 2002; Visuthranukul 2015; Wengle 2011), while four trials reported dietary behaviour (Brennan 2013; Ford 2010; Grey 2009; Pakpour 2015). Twelve trials reported behavioural change in terms of physical activity (Debar 2012; Ebbeling 2012; Gourlan 2013; Grey 2009; Jelalian 2016; Kong 2013; Kong 2014; Pakpour 2015; Pbert 2013; Saelens 2002; Sigal 2014; Wengle 2011), while three trials reported physical activity behaviour (Grey 2009; Kong 2013; Pakpour 2015). One trials reported parenting and relationships (Brennan 2013). Eight trials reported views of the intervention (Brennan 2013; Christie 2011; Debar 2012; Jelalian 2016; Nguyen 2012; Pbert 2013; Saelens 2002; Wengle 2011).

Ten trials reported outcomes at more than one time point (Debar 2012; Ebbeling 2012; Hofsteenge 2014; Jiang 2005; Nguyen 2012; Norman 2016; Patrick 2013; Resnicow 2005; Savoye 2007; Schranz 2014).

Excluded studies

We excluded 570 of 736 articles after evaluation of the publication. The main reasons for exclusion were the intervention (aim not focused on treating overweight/obesity and duration of intervention and follow-up less than six months) and study design (not an RCT). Many trials had other reasons for exclusion such as lack of relevant outcomes or the control was not no intervention/usual care or concomitant intervention as long as this was also provided in the intervention arm (for further details see Characteristics of excluded studies table, which lists the 44 studies that closely missed the inclusion criteria for this review).

Studies awaiting classification

Twelve studies are awaiting classification as we await clarification from the study authors. These may be included when this review is updated if they meet the inclusion criteria.

Ongoing studies

Fifty studies are ongoing or have completed but results are not available. These may be included when this review is updated if they meet the inclusion criteria.

Risk of bias in included studies

For details on risk of bias of included studies, see the Characteristics of included studies table. For an overview of review authors' judgements about each risk of bias item for individual studies and across all studies, see Figure 2 and Figure 3. Many trials did not report adequate information to assess the risk of bias and we assessed 30 trials at high risk of bias on at least one domain. We assessed 10 trials at high risk of bias on three or more domains (Daley 2005; Hofsteenge 2014; Kong 2014; Luna-Pech 2014; NCT00807560;

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 16 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. Patsopoulou 2017; Pbert 2013; Schranz 2014; Sigal 2014; van Egmond-Frohlich 2006).

Figure 2. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies (blank cells indicate that the particular outcome was not investigated in some studies).



Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 17 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Figure 3. Risk of bias summary: review authors' judgements about each risk of bias item for each included study (blank cells indicate that the study did not report that particular outcome).



Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 18 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Allocation

The majority of trials provided sufficient information on random sequence generation and were judged at low risk of bias. However, most trials provided inadequate information on concealment of allocation. Twenty-two studies reported adequate random sequence generation, but only 11 of these also described adequate concealment of allocation (Boodai 2014; Christie 2011; Daley 2005; Jelalian 2016; Kong 2014; Nguyen 2012; Schranz 2014; Sigal 2014; Visuthranukul 2015; Vos 2011; Walpole 2013), and therefore have a low risk of selection bias. One trial described allocation concealment and was at high risk of bias (Patsopoulou 2017). One trial was also high risk of bias for allocation concealment (NCT00807560). The risk of selection bias was uncertain in the remaining 31 included studies.

Blinding

Only one study had a low risk of performance bias (subjective and objective outcomes) as participants and personnel were blinded to treatment allocation (Gourlan 2013). Nineteen studies had a high risk of performance bias for subjective and objective outcomes (Christie 2011; Daley 2005; Hofsteenge 2014; Kong 2014; Luna-Pech 2014; NCT00807560; Nguyen 2012; Pakpour 2015; Patsopoulou 2017; Pbert 2013; Schranz 2014; Sigal 2014) or objective outcomes only (subjective outcomes not reported) (Bean 2014; Boodai 2014; Carrel 2005; Debar 2012; Ford 2010; NCT00132132; Savoye 2007). The risk of performance bias was unclear in the remaining 24 studies.

The risk of detection bias was low for objective outcomes (regardless of whether outcome assessors were blinded to treatment allocation) in 44 studies. For subjective outcomes, six studies blinded outcome assessors (Brennan 2013; Gourlan 2013; Jelalian 2016; Nguyen 2012; Norman 2016; Pakpour 2015), and this was unclear in 17 studies (Carraway 2014; Christie 2011; Debar 2012; Ebbeling 2003; Ebbeling 2012; Grey 2009; Kong 2013; NCT00807560; Patrick 2013; Patsopoulou 2017; Saelens 2002; Toulabi 2012; van Egmond-Frohlich 2006; Visuthranukul 2015; Vos 2011; Wengle 2011; Wong 2015). The risk of detection bias was judged to be high in the remaining seven studies reporting subjective ouLena1234tcomes (Daley 2005; Hofsteenge 2014; Kong 2014; Luna-Pech 2014; Pbert 2013; Schranz 2014; Sigal 2014).

Incomplete outcome data

The risk of attrition bias was low in 17 studies (Brennan 2013; Carraway 2014; Ebbeling 2003; Ebbeling 2012; Gourlan 2013; Grey 2009; Hofsteenge 2014; Nguyen 2012; Norman 2016; Patrick 2013; Pbert 2013; Pitetti 2007; Resnicow 2005; Savoye 2007; Sigal 2014; Vos 2011; Walpole 2013). Eleven studies had a high risk of attrition bias on objective and subjective (where reported) outcome measures due to an imbalance in attrition between study groups (Carrel 2005; Jelalian 2016; Kong 2013; Kong 2014; Love-Osborne 2014; NCT00132132; NCT00807560; Saelens 2002; Schranz 2014; van Egmond-Frohlich 2006; Vissers 2008). The remaining 16 studies were at unclear risk of bias due to insufficient reporting of attrition, such as not providing reasons for missing data.

Selective reporting

Fourteen studies were at high risk of reporting bias (Boodai 2014; Brennan 2013; Ebbeling 2003; Ford 2010; Hofsteenge 2014; Love-Osborne 2014; NCT00807560; Norman 2016; Pbert 2013; Pitetti 2007; Schranz 2014; Sigal 2014; van Egmond-Frohlich 2006; Vos 2011). In 17 studies, this was unclear, as the study protocol or trial record were unavailable, or the trial had yet to be fully published. The remaining 13 studies reported all outcomes as stated.

Other potential sources of bias

There was high risk of bias in one study as the run-in programme was conducted to minimise participant attrition, but may have resulted in a more motivated sample of participants and parents compared with non-run-in trial cohorts (Norman 2016). There was an unclear risk of other sources of bias in 10 studies (Bean 2014; Boodai 2014; Brennan 2013; Carraway 2014; Grey 2009; Kong 2013; NCT00132132; NCT00807560; Pbert 2013; Wong 2015). In one of these studies, the participating churches (which were the unit of randomisation) requested that the comparison condition received a meaningful intervention, which may have had an impact on results (Resnicow 2005). The remaining 32 studies were at low risk of other sources of bias.

Effects of interventions

See: **Summary of findings for the main comparison** Diet, physical activity and behavioural interventions for the treatment of overweight or obesity in adolescents aged 12 to 17 years None of the included studies reported all-cause mortality, morbidity and socioeconomic effects.

All diet, physical activity and behavioural interventions versus controls

Primary outcomes

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 19 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. Forty-four trials compared a diet, physical activity, behavioural intervention or a combination of these with usual care, no active intervention or wait list control or a concomitant therapy. Five studies assessed more than one intervention (Brownell 1983; Pakpour 2015; Patrick 2013; Patsopoulou 2017; Sigal 2014). In one three arm trial, Brownell 1983 assessed a multicomponent intervention with three different approaches; mothers attended sessions with the adolescents, mothers attended separate sessions to the adolescent or only the adolescents received the intervention. The study by Pakpour 2015 compared motivational interviewing with a passive control (no details); there were two intervention groups, one with parental involvement and one without. In the study by Patsopoulou 2017, there were two intervention groups compared to no intervention, an activity group and an activity plus diet group with parental involvement. Sigal 2014 allocated participants to four arms comparing different physical activity interventions with a diet-only control group. All groups received the dietary intervention and this was compared to a diet plus aerobic exercise intervention, a diet plus resistance training intervention and a diet plus aerobic plus resistance training intervention. The study by Patrick 2013 compared three different website interventions (website alone, website and group sessions, website and text messages) with a usual care control. There were no substantial differences in the study between the interventions and these were therefore merged into one group as described in the Measures of treatment effect section. One study provided gender stratified analyses (Norman 2016). One study had two control groups, a usual care control and an exercise placebo of body conditioning (an attention control) (Daley 2005). As there was no aim in the study to test the difference between these two control groups, and the attention control was not intended to promote weight control, we merged these two groups into one control arm for the purpose of the review. The other 37 trials each assessed different interventions as described above (Bean 2014; Boodai 2014; Brennan 2013; Carrel 2005; Chandra 1968; Christie 2011; Debar 2012; Ebbeling 2003; Ebbeling 2012; Ford 2010; Gourlan 2013; Grey 2009; Hofsteenge 2014; Jelalian 2016; Jiang 2005; Kong 2013; Kong 2014; NCT00132132; NCT00807560; Nguyen 2012; Love-Osborne 2014; Luna-Pech 2014; Norman 2016; Pbert 2013; Pitetti 2007; Resnicow 2005; Saelens 2002; Savoye 2007; Schranz 2014; Sigal 2014; Toulabi 2012; van Egmond-Frohlich 2006; Vissers 2008; Visuthranukul 2015; Vos 2011; Walpole 2013; Wengle 2011).

Outcomes are considered here at the longest point of follow-up for each study. Sensitivity analyses and subgroup analyses around these outcomes are reported below.

Changes in body mass index or body weight

All but one study (Chandra 1968) reported BMI variables as outcomes. Twenty-nine studies reported BMI and 20 studies reported BMI z score. Twenty-eight trials (33 comparisons) reported BMI change data that were suitable for meta-analysis. Pooling the studies in a random-effects meta-analysis demonstrated a reduction in BMI in the intervention groups compared with control groups at the longest point of follow-up (MD -1.18 kg/m² (95% CI -1.67 to -0.69); P < 0.00001; 2774 participants; 28 studies; 34 comparisons; low quality evidence; Analysis 1.1).

Meta-analysis of BMI z score at the longest point of follow-up showed a reduction in the intervention groups compared with the control groups (MD -0.13 units (95% CI -0.21 to -0.05); P = 0.002; 2399 participants; 20 studies; low quality evidence; Analysis 1.2).

Five studies did not report BMI or BMI z score outcomes in a format that was suitable for meta-analysis (Carraway 2014; Christie 2011; Love-Osborne 2014; Walpole 2013; Wong 2015). The study by Walpole 2013 reported median BMI and BMI z scores and the study reported no substantial differences between groups. In the study by Wong 2015, the mean BMI z score did not substantially differ between groups. Christie 2011 reported the effect estimate for BMI at six months, which was not substantially different between groups. The study by Love-Osborne 2014 reported the proportion of participants with increases or decreases in BMI z scores at different thresholds. The only relevant result was that a higher proportion of participants in the control group decreased their BMI z score by at least 0.1 compared with the intervention group. One study has not currently reported BMI outcomes having only recently published secondary outcomes (Bean 2014). The study by Carraway 2014 did not present BMI data for a mentorled exercise programme compared with wait list control.

Five studies reported BMI percentiles (Bean 2014; Brennan 2013; Debar 2012; Kong 2013; Patrick 2013). Analysis 1.3 shows results from four studies (Brennan 2013; Debar 2012; NCT00807560; Patrick 2013). The results favoured the interventions in two studies. In one study, where three interventions were combined, there was a reduction in the BMI percentile in the control group (Patrick 2013). Kong 2013 reported the median BMI percentile. This reduced in the intervention group and increased in the control group (P = 0.04). Bean 2014 did not report data.

Twenty studies (24 comparisons) reported weight change and were pooled in a random-effects meta-analysis which demonstrated a reduction in weight in the intervention groups compared with controls at the longest point of follow-up (MD -3.67 kg (95% CI -5.21 to -2.13); P < 0.00001; 1993 participants; 20 studies; moderate quality evidence; Analysis 1.4).

Adverse events

Five trials reported rates of adverse events (Ebbeling 2012; Ford 2010; NCT00132132; NCT00807560; Sigal 2014). There were no adverse events reported in either group in the studies by Ford 2010; NCT00132132; and NCT00807560. In the study by Ebbeling 2012, 6.4% of participants experienced an adverse event in the intervention group (no details); it was not reported

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 20 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

whether adverse events occurred in the comparator group. Sigal 2014 reported the proportions of participants experiencing adverse events, the proportion withdrawing owing to adverse events and detailed the specific adverse events in each of their four groups (see Appendix 8 for details). Adverse events were experienced in 25% of participants in the diet plus aerobic exercise group; 19% in the diet plus resistance training group; 21% in the diet plus aerobic plus resistance training group and 24% in the diet-only group.

Secondary outcomes

Anthropometric measures other than body mass index

Twenty-eight trials reported anthropometric measures other than BMI using objective measures (Boodai 2014; Brownell 1983; Brennan 2013; Carrel 2005; Ebbeling 2003; Ebbeling 2012; Ford 2010; Grey 2009; Hofsteenge 2014; Kong 2013; Kong 2014; NCT00132132; NCT00807560; Nguyen 2012; Norman 2016; Pakpour 2015; Patrick 2013; Patsopoulou 2017; Pbert 2013; Saelens 2002; Savoye 2007; Schranz 2014; Sigal 2014; Toulabi 2012; Vissers 2008; Vos 2011; Walpole 2013; Wengle 2011). Fourteen studies reported percentage of body fat change that was suitable for meta-analysis. Meta-analysis demonstrated a reduction in percentage of body fat in the intervention group compared with the control group at the longest follow-up points (MD -1.08% (95% CI -1.69 to -0.46); P = 0.0006; 1886 participants; 14 studies; Analysis 3.1). Three studies reported other measures of body fat that included percentage of fat (Carraway 2014; Pakpour 2015), and percentage of body fat-SDS (Ford 2010). All three studies found a reduction in body fat in the intervention group compared to the control group (see Table 2 for details).

Two trials reported data for percentage of trunk fat that was suitable for meta-analysis. Random-effects meta-analysis showed an MD of -0.84% ((95% CI -3.10 to 1.43); P = 0.47; 123 participants; 2 trials; Analysis 3.2).

Seventeen trials reported data for waist circumference that was suitable for meta-analysis. Random-effects meta-analysis demonstrated a reduction in waist circumference in the intervention group compared with the control group at the longest follow-up points (MD -2.26 cm (95% CI -3.80 to -0.72); P = 0.004; 1997 participants; 17 trials; Analysis 3.3). Two studies reported other measures of abdominal adiposity (Kong 2014; Vos 2011). Percentage of visceral fat did not change in either the intervention or control group (Kong 2013). One study found that both waist circumference minus SDS and waist-to-height ratio significantly decreased in the intervention arm compared to the control arm (Vos 2011) (see Table 2 for details).

Pooling three trials in a random-effects meta-analysis showed no substantial reduction in waist-to-height ratio in the intervention group compared to control group at the longest follow-up points (MD 0 (95% CI -0.02 to 0.02); P = 0.98; 276 participants; 3 trials; Analysis 3.4). Waist-to-hip ratio did not substantially reduce in the intervention group compared to the control group (MD 0.01 (95% CI -0.01 to 0.03); P = 0.22; 211 participants; 2 trials; Analysis 3.5). In one study, hip circumference seemed to decrease in the intervention group compared to the control group (Toulabi 2012; see Table 2).

Five trials reported data for fat mass that was suitable for meta-analysis. Pooling the studies in a random-effects meta-analysis demonstrated a reduction in fat mass in the intervention group compared to the control group at the longest follow-up points (MD -3.13 kg (95% CI -4.70 to -1.56); P < 0.0001; 673 participants; 5 trials; Analysis 3.6). The study by Schranz 2014 found no substantial difference for the reduction in body mass between the intervention and control groups (see Table 2 for details).

Two trials reported data for trunk fat mass that was suitable for meta-analysis. Random-effects meta-analyses showed no substantial reduction in trunk fat mass in the intervention group compared to the control group (MD -0.94 kg (95% CI -2.49 to 0.61); P = 0.24; 184 participants; 2 trials; Analysis 3.7).

Three trials reported data for lean mass that was suitable for metaanalysis. Random-effects meta-analysis showed no substantial increase in body lean mass in the intervention group compared to the control group (MD -0.21 kg (95% CI -0.88 to 0.47); P = 0.55; 417 participants; 3 trials; Analysis 3.8). The Brennan 2013 trial found that participants in the intervention group had lower truncal lean mass compared to the control group, however, statistical significance was not reported (see Table 2 for details).

Two trials reported data for percentage of overweight that was suitable for meta-analysis. Random-effects meta-analysis showed no substantial difference in the percentage of overweight between the intervention group and control group (MD -5.55% (95% CI -13.67 to 2.57); P = 0.18; 73 participants; 2 trials; Analysis 3.9). One study reported percentage of BMI reduction and found that 75% of participants in the intervention group reduced their BMI compared to 23% of participants in the control group (NCT00132132). In one trial, percentage of overweight reduced in both intervention and control at seven months' follow-up (Carraway 2014; see Table 2 for details). In one study, percentage of boys over the median BMI was lower in the intervention group compared to boys in the control group (Norman 2016). In an earlier study, average weight loss was not lower in the intervention group compared to the control (Chandra 1968; see Table 2).

Health-related quality of life and self-esteem

Thirteen trials reported health-related quality of life and self-esteem using validated self-reported tools (Brennan 2013; Carraway 2014; Daley 2005; Debar 2012; Ford 2010; Hofsteenge 2014; Luna-Pech 2014; Nguyen 2012; Patrick 2013; Pakpour 2015; Schranz 2014; van Egmond-Frohlich 2006; Vos 2011). Seven trials reported data for health-related quality of life change that was

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 21 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. suitable for meta-analysis. Random-effects meta-analysis demonstrated an improvement in health-related quality of life in the intervention group compared with the control group at the longest follow-up points ((SMD 0.44 (95% CI 0.09 to 0.79); P = 0.01; 972 participants; 7 studies; low quality evidence Analysis 4.1). An SD of 0.44 represents a moderate difference between groups (Higgins 2011a). The study by Ford 2010 reported narrative findings of health-related quality of life that improved in both the intervention and control arms but did not reach statistical significance (see Table 3 for further details).

Six trials reported data for self-esteem change that was suitable for meta-analysis. Random-effects meta-analysis demonstrated no substantial improvement in self-esteem for either group at the longest follow-up points (SMD 0.09 (95% CI -0.08 to 0.27; P = 0.30, 613 participants; 6 trials; Analysis 4.3). Four trials reported other measures of self-esteem and found no substantial improvement in either group for body appearance, weight satisfaction, body attribution (Hofsteenge 2014), weight efficacy (Pakpour 2015), and physical self-worth (Schranz 2014; van Egmond-Frohlich 2006). One trial reported improvement in global self-esteem post intervention and at seven months' followup for both intervention and control (Carraway 2014) (see Table 3 for further details).

All-cause mortality

None of the studies reported all-cause mortality.

Morbidity

None of the studies reported morbidity.

Behavioural change

Dietary intake

Six trials (454 participants) reported macronutrient and glycaemic consumption assessed by either food record or 24-hour dietary recall (Ebbeling 2003; Ebbeling 2012; Kong 2014; Pbert 2013; Saelens 2002; Visuthranukul 2015). Monitored intakes included fat, protein, carbohydrates, sugar, fibre, glycaemic load and glycaemic index.

Three trials reported fat intake as percentage of total energy intake for 132 participants (Ebbeling 2003; Pbert 2013; Saelens 2002). There was no substantial reduction in fat intake in either group in the studies by Pbert 2013 and Saelens 2002. In the study by Ebbeling 2003, fat intake significantly decreased in the control group but increased in the intervention group at 12 months (see Table 4 for details).

Two trials reported protein intake as percentage of total energy intake for 75 participants (Ebbeling 2003; Kong 2014). At 12

months, there was no substantial increase in protein intake in the either group in the study by Ebbeling 2003. In the study by Kong 2014 the intervention group increased protein consumption compared to the control group at six months (see Table 4 for details). The same trials (Ebbeling 2003; Kong 2014) reported carbohydrate intake. There was no substantial change in carbohydrate consumption in either the intervention or control group at six and 12 months (see Table 4 for details).

Two trials reported total sugar intake for 291 participants (Ebbeling 2012; Pbert 2013). Participants in the intervention group reported lower intakes compared to the control group in both studies (Ebbeling 2012; Pbert 2013). See Table 4 for details. Two trials reported fibre intake for 75 participants (Ebbeling 2003; Kong 2014). At 12 months, fibre intake did not change substantially in either the intervention or control group in one study (Ebbeling 2003). The second study reported an increase in fibre consumption in the intervention group compared to the control group (Kong 2014). See Table 4 for details.

Three trials reported glycaemic load intake for 157 participants (Ebbeling 2003; Kong 2014; Pbert 2013). Glycaemic load decreased in the intervention group in two studies (Ebbeling 2003; Pbert 2013), but there was no substantial difference between the intervention and control groups in one study (Kong 2014). See Table 4 for details.

Three trials reported glycaemic index intake for 127 participants (Ebbeling 2003; Kong 2014; Visuthranukul 2015). Glycaemic index did not change in either group in the studies by Ebbeling 2003 and Kong 2014. At six months, the intervention group (25 participants) reported a higher consumption of low glycaemic index foods compared to the control group (27 participants) in one study (Visuthranukul 2015). See Table 4 for details.

Five trials (650 participants) reported fruit and vegetable intake (Brennan 2013; Kong 2013; Pakpour 2015; Patrick 2013; Wengle 2011), while two trials (408 participants) reported vegetable intake (Brennan 2013; Pakpour 2015). Dietary consumption was assessed using the Fat, Fruit and Vegetable Diet Questionnaire (FFVDQ), diet record or dietary questions from the Center for Disease Control Youth Risk Behavior System (YRBS). In all studies, except for one (Pakpour 2015), fruit and vegetable consumption did not substantially increase. In the study by Pakpour 2015, the motivational interviewing and parental involvement group had a significantly higher intake of fruit servings compared to the control group. See Table 4 for details.

Four trials (668 participants) reported beverage consumption (juice, milk and sugar-sweetened drinks) assessed by either dietary questions YRBS, 24-hour dietary recall or Food Frequency Questionnaire (FFQ) (Brennan 2013; Ebbeling 2012; Kong 2013; Pakpour 2015). Juice and milk consumption did not change substantially in either the intervention and control group in three trials (Brennan 2013; Ebbeling 2012; Pakpour 2015). Reports on sugar-sweetened drinks (606 participants) were significantly lower in the intervention group compared to the control group (Ebbeling

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 22 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. 2012; Kong 2013; Pakpour 2015). See Table 4 for details.

Five trials (742 participants) reported several dietary findings assessed by the FFQ, 24-hour dietary recall or the food record (Brennan 2013; Ebbeling 2012; Pakpour 2015; Pbert 2013; Wengle 2011) (see Table 4 for details). The consumption of fatty food items generally decreased in the intervention group compared to the control group (Pakpour 2015; Wengle 2011). There was no substantial difference between the intervention and control groups in healthier dietary consumption such as increasing salad intake and reducing added sugar (Brennan 2013; Pbert 2013). However, whole-grain intake (Wengle 2011) and unsweetened beverage consumption (Ebbeling 2012) were higher in the intervention group compared to the control group.

Dietary behaviour

Four trials (674 participants) reported changes in dietary behaviours assessed by either objective (e.g. Mandometer) or validated self-reported questionnaires (e.g. FFVDQ) (Brennan 2013; Ford 2010; Grey 2009; Pakpour 2015). Eating behaviours such as eating speed and usual food choices did not change substantially in either group in studies by Grey 2009 and Ford 2010. Dietary self-efficacy improved in the intervention group (118 participants) but not in the control group in one study (Pakpour 2015), while there was no change in either group (198 participants) in another study (Grey 2009). Dietary behaviour in relation to fat intake did not improve in either the intervention or control group (Brennan 2013). See Table 5 for details.

Physical activity

Thirteen trials (1376 participants) reported several measures of physical activity assessed using objective tools (Jelalian 2016; Kong 2013; Pbert 2013; Sigal 2014; Wengle 2011), or validated selfreported tools (Debar 2012; Ebbeling 2012; Grey 2009; Gourlan 2013; Kong 2014; Pakpour 2015; Saelens 2002; Sigal 2014). Three trials reported data for mild-to-vigorous physical activity that was suitable for meta-analysis (Kong 2013; Pbert 2013; Wengle 2011), while the study by Jelalian 2016 could not be metaanalysed (Table 6). Random-effects meta-analysis demonstrated no substantial improvement in mild-to-vigorous physical activity (MD 0.39 (95% CI -15.07 to 15.85); P = 0.96; 129 participants; 3 trials; Analysis 5.1). Two trials reported data for activity length (hours per day) that was suitable for meta-analysis (Gourlan 2013; Pakpour 2015). Random-effects meta-analysis showed no substantial improvement in activity length (MD -0.11 hours/day (95% CI -0.98 to 0.75); P = 0.80; 129 participants; 2 trials; Analysis 5.2). Only two trials reported screen time (hours per day) that was suitable for meta-analysis (Ebbeling 2012; Wengle 2011). Random-effects meta-analysis showed a favourable effect for the intervention group compared with the control group at the longest

follow-up points (MD -0.60 hours/day (95% CI -0.65 to -0.55); P < 0.00001; 241 participants; 2 trials; Analysis 5.3).

Overall, physical activity from validated self-reported measures did not substantially improve in either the intervention or control groups for increasing number of steps per day (Sigal 2014; Wengle 2011), amount per day (Debar 2012; Saelens 2002), intensity (Kong 2013), and metabolic equivalent for self-reported physical activity (Debar 2012; Ebbeling 2012; Grey 2009; Kong 2014). See Table 6 for details.

Physical activity behaviour

Three trials (566 participants) reported behavioural change in relation to physical activity assessed by self-reported measures (Grey 2009; Kong 2013; Pakpour 2015), or objective measures (Jelalian 2016). There was no substantial reduction in the hours spent viewing television for either the intervention or control groups in one trial (Kong 2013), while one trial showed a decrease in hours spent in sedentary behaviour in the intervention arm (Jelalian 2016). Two studies reported improvement in physical activity self-efficacy in the intervention group at 12 months (Grey 2009; Pakpour 2015). See Table 7 for details.

Participants' views of the intervention

Eight trials reported participants' views of the multidisciplinary intervention (Brennan 2013; Christie 2011; Debar 2012; Jelalian 2016; Nguyen 2012; Pbert 2013; Saelens 2002; Wengle 2011). Participants reported high levels of satisfaction for the components (Jelalian 2016; Nguyen 2012; Saelens 2002), services (Debar 2012), and overall quality (Brennan 2013) of multidisciplinary interventions. Similarly, participants were satisfied with the person delivering the intervention whether it was a nurse (Debar 2012), mentor (Pbert 2013; Wengle 2011), or clinician (Brennan 2013). Overall, participants thought that a multidisciplinary weight-related programme met their needs (Debar 2012), and in terms of comfort in discussing their behaviour (Pbert 2013), and ability to focus and deal with their concerns (Brennan 2013), and helped them to make behavioural changes (Christie 2011; Nguyen 2012). See Table 8 for details.

Socioeconomic effects

None of the studies reported socioeconomic effects.

Parenting and relationships

Only one trial reported parent-adolescent communication (Brennan 2013). There was no substantial difference between adolescents in the intervention and control groups for parent-adolescent negative, problematic and supportive communication measures (see Table 9). However, participants in the intervention group reported higher positive communication with parents compared to the control group (Brennan 2013).

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 23 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Subgroup analyses

We performed a number of subgroup analyses to test the effects of different durations of follow-up, duration of the interventions, different types of comparators, mode of delivery of the intervention, setting, type of intervention, psychological basis for the interventions and involvement of parents on the outcomes of BMI and BMI z score.

For duration of follow-up, the studies were divided into three subgroups, six months' follow-up, 12 months' follow-up and 18 months' follow-up or more. Some studies reported follow-up at more than one time point and are included in the analyses. There were no subgroup differences regarding duration of follow-up (Analysis 2.1; Analysis 6.1; Analysis 6.2). For change in BMI score (Analysis 2.2), combining studies with a duration of the intervention of six months or less and studies with a duration of the intervention of greater than six months indicated a statistically significant subgroup difference (P = 0.02).

Studies were furthermore divided by whether they had a period of postintervention follow-up (defined as the period after the active intervention and up to the final measurement) and the duration of that period: no postintervention follow-up, less than six months, six months to less than 12 months and postintervention follow-up lasting 12 months or longer. The duration of no postintervention follow-up was calculated by subtracting the active intervention and all follow-up duration). There were no subgroup differences for BMI (Analysis 7.1). For BMI z score, there was a statistically significant subgroup difference (P = 0.007). The effect size for BMI z score appeared greater in studies with a postintervention follow-up lasting 12 months or longer (Analysis 7.2).

When outcomes from studies with comparators described as no intervention or wait list control, usual care or a concomitant therapy were combined, the effect sizes for BMI change appeared larger for studies with no intervention or wait list control comparators and for studies with usual care controls (P = 0.008; Analysis 8.1). Studies were divided into three groups to test the effect of the mode of delivery of the intervention: group, individual and group plus individual delivery. There were no subgroup differences (Analysis 9.1; Analysis 9.2).

For setting, the studies were divided into three subgroups, school, community and healthcare settings. There were no subgroup differences (Analysis 10.1; Analysis 10.2).

The majority of studies were multidisciplinary interventions; however, some studies focused on diet alone or physical activity interventions alone. There were no subgroup differences (Analysis 11.1; Analysis 11.2).

Studies were categorised into four groups according to any theoretical basis for the intervention. These were those applying cognitive behavioural techniques, those applying motivational interviewing techniques, those reporting any other psychological technique and those not reporting any theoretical basis to the intervention or no psychological component to the intervention (BMI: Analysis 12.1; BMI z score: Analysis 12.2). For BMI change, there was a subgroup difference (P = 0.09).

A number of studies involved parents in their interventions while others did not explicitly provide any intervention to parents. There were no subgroup differences (Analysis 13.1; Analysis 13.2).

We performed subgroups analyses to test the effects of different tools of self-reported measures and different outcomes reported. For health-related quality of life, studies were divided into two subgroups, studies using the Pediatric Quality of Life (PedsQL) tool and studies using other self-reported tools. There were no subgroup differences (Analysis 4.4).

Studies measuring self-esteem were divided into two subgroups, studies measuring total self-esteem and studies measuring global self-worth. There were no subgroup differences (Analysis 4.4; Analysis 4.5).

Results of the subgroup analyses should be interpreted with caution given the large number of variable that we assessed.

Sensitivity analyses

We did not perform sensitivity analysis restricting to published studies as all included studies were published. We did not perform sensitivity analysis restricting studies to type of funding as there was no industrial funding influence. We performed sensitivity analyses for the following factors: longest follow-up with 20% or less attrition; longest follow-up with 30% or less attrition; language of publication; study design; removal of one trial specifically aimed at adolescents with severe autism (Pitetti 2007); removal of one trial specifically aimed at overweight adolescents with asthma (Luna-Pech 2014); removal of one trial specifically aimed at overweight or obese adolescents with depression (Jelalian 2016); removal of one trial where there was some uncertainty over the duration of follow-up and no response was received to a request for clarification from the authors (Toulabi 2012), and removal of one study where SDs were imputed from other studies (Pitetti 2007). These sensitivity analyses were undertaken on both the BMI and BMI z score meta-analyses as appropriate to each study.

For the sensitivity analysis testing the effect of attrition, results did not differ between comparisons for either sensitivity analyses when compared with the main summary effects for studies with 20% or less attrition at the longest follow-up: BMI (MD -1.34 kg/m² (95% CI -2.05 to -0.63); P = 0.0002; 1486 participants; 15 studies; 18 comparisons); BMI z score (MD -0.22 (95% CI -0.39 to -0.05); P = 0.01; 951 participants; 11 studies; 11 comparisons) and for studies with 30% or less attrition at the longest follow-up: BMI (MD -1.07 kg/m² (95% CI -1.62 to -0.51); P = 0.0002; 2135 participants; 20 studies; 25 comparisons); BMI z score (MD -0.18 (95% CI -0.32 to -0.05); P = 0.008; 1066 participants; 13 studies; 13 comparisons). Heterogeneity for these sensitivity analyses did not vary consistently when compared with the heterogeneity seen in the main analyses (20% or less attrition: BMI: I² = 72%; BMI z score: I² = 91%; 30% or less attrition: BMI: I² = 77%; BMI z

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 24 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. score: $I^2 = 90\%$). Therefore, we included all studies regardless of rates of attrition in the analyses and subgroup.

Sensitivity analyses on the primary analyses for BMI and BMI z score removing individual trials did not have a considerable impact on the results and these trials were retained in the analyses. The removal of the study by van Egmond-Frohlich 2006 (published in German) slightly increased the BMI z score (MD -0.14 (95% CI -0.23 to -0.05); P = 0.002; 1878 participants; 19 studies; 21 comparisons), but heterogeneity remained the same ($I^2 = 86\%$). The removal of the study by Pitetti 2007 from the BMI analysis did not change the MD or the CIs (MD -1.18 (95% CI -1.67 to -0.69); P < 0.00001; 2764 participants; 27 studies; 33 comparisons). The removal of the study by Jelalian 2016 changed BMI MD and CIs by one second decimal point only (MD -1.17 kg/m² (95% CI -1.66 to -0.68); P < 0.00001; 2750 participants; 27 studies; 33 studies). The removal of the study by Toulabi 2012 reduced the MD in BMI slightly and narrowed the CIs slightly (MD -1.15 kg/m² (95% CI -1.66 to -0.64); P < 0.0001; 2622 participants; 27 studies; 33 comparisons) but the result remained statistically significant with heterogeneity of $I^2 = 78\%$. Removing the study by Luna-Pech 2014 from the BMI z score meta-analysis reduced the MD slightly and narrowed the CIs slightly (MD -0.11 (95% CI -0.19 to -0.03); P = 0.006; 2348 participants; 19 studies; 21 comparisons) but the result remained statistically significant and only reduced the heterogeneity slightly to I^2 = 83%. One study did not report measures of variance for the BMI z score (Jiang 2005), and we imputed the SDs from another study. Removing this study from the meta-analysis reduced the effect size and reduced the 95% CIs; however, the direction of effect remained the same (MD -0.08 (95% CI -0.14 to -0.02); P = 0.007; 2331 participants; 19 studies; 21 comparisons) and reduced heterogeneity but remained considerable (I^2 = 70%).

The removal of cluster RCTs where it was unclear if the effect of clustering had been taken account of in the analysis (Grey 2009; Pbert 2013) from the BMI analysis increased the MD (MD -1.34 (95% CI -1.80 to -0.89); P < 0.00001; 26 studies; 32 comparisons; 2494 participants) but heterogeneity remained highly significant ($I^2 = 71\%$).

Assessment of reporting bias

We generated a funnel plot for the primary outcome of BMI as this analysis included the highest number of studies on which to assess publication bias. Inspection of the funnel plot suggested the possibility of a small-study bias (Figure 4).

Figure 4. Funnel plot of comparison: I Interventions (all) versus controls, longest follow-up, outcome: I.I BMI change (kg/m2)



Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 25 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Ongoing studies

We found 50 ongoing RCTs (see Characteristics of ongoing studies table). Forty-four of these RCTs are parallel trials, two are cluster trials, two are cross-over trials, one is a factorial trial and in one the design is unclear. Eight trials are three-arm trials and one is a fourarm trial. The ages of the participants in these trials incorporate the range of five to 18 years in 43 trials and are not clearly reported in seven trials. In one trial, the target population is classed as overweight according to Cole international cut-offs for child obesity, in 22 trials the target population are children classed as obese (using different methods), in 23 trials the population is described as overweight or obese and in four trials the classification is unclear. Six trials include a physical activity intervention, four trials include a nutritional intervention, three trials include dietary supplements, 19 trials include a behavioural intervention and 21 trials include a multicomponent intervention.

Thirty-four trials compare the intervention to usual care or no intervention, 12 compare to a concomitant therapy also delivered in the intervention arm, one trial compares to wait list control, two trials compare the intervention to placebo and in one trial the control is not clearly defined.

BMI was the primary outcome (BMI, BMI z score, BMI-SDS, BMI percentile) in 36 trials and secondary outcome in five trials. Weight change ass the primary outcome in four trials and the secondary outcome in one trial. Two trials did not state if weight change was the primary or secondary outcome and body composition (unclear what parameters) are the secondary outcome in one trial and other outcome in one trial. The estimated study completion dates, where reported, range from March 2011 to December 2021.

DISCUSSION

Summary of main results

This systematic review summarised 44 RCTs examining the effect of behaviour changing interventions for treating overweight and obesity in adolescents aged 12 to 17 years. We only included trials with at least a six-month outcome assessment with the aim of assessing the longer-term effects of these types of interventions. Interventions and comparators varied between the included trials. Outcomes assessed also varied between groups; although all trials reported a measure of body weight, the most commonly reported measures were BMI and BMI z score. To allow comparisons across trials, we analysed outcome data at the longest follow-up period. Many trials did not report adequate information to assess the risk of bias and 27 trials were at high risk of bias on at least one domain. Overall, behaviour changing interventions were more successful than the comparators in reducing BMI (low quality evidence), BMI z score (low quality evidence) and weight (moderate quality evidence) in overweight and or obese adolescents. The effects of behaviour changing interventions were maintained at 18 to 24 months' follow-up for both BMI and BMI z score.

There were subgroup differences showing larger effects for both BMI and BMI z score where comparison groups were described as no intervention/wait list control or usual care compared to those testing concomitant interventions delivered to both the intervention and control group (P = 0.008). There were no subgroup differences between interventions with and without parental involvement or by intervention type or setting (health care, community, school) or mode of delivery (individual versus group).

Adverse events were reported in only five trials (low quality evidence). Minor adverse events occurred in one four-arm study, but there were no details in the others.

Secondary outcomes were reported less consistently across trials. Overall, behaviour changing interventions were more successful than the comparators in reducing percentage of body fat, waist circumference and total fat mass. Fewer trials measured quality of life and self-esteem. Behaviour changing interventions improved quality of life at the longest follow-up period (low quality evidence) but not self-esteem.

Overall, trials measuring physical activity showed no improvement for objective and self-reported activity although evidence was limited. However, two trials reported improvement in physical activity self-efficacy at 12 months. Dietary intakes were inconsistently measured and reported across trials, and trials used different tools to assess dietary intake and reported outcomes using different units of measure. The majority of trials reported no substantial effect of behaviour changing interventions on dietary intake although again evidence was limited.

Overall completeness and applicability of evidence

This review identified 44 completed trials and 50 ongoing trials assessing the effect of diet, physical activity and behavioural interventions at six months or longer. The review included studies conducted in the US, Europe, Asia and the Middle East including participants of different ethnicity. Most trials included both genders except for two trials that were restricted to females and one trial was restricted to males. Over half of the trials followed the percentile range to diagnose overweight or obesity. The majority of interventions had a multidisciplinary approach which included

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 26 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. a combination of behavioural, dietary and physical activity components. Most trials reported details of the intervention that were mainly carried out for six months or less. The theoretical approach behind the intervention varied across studies with five studies using only the cognitive behavioural approach and four studies using only motivational interviewing. The majority of studies used either a mixture or other psychological theories (e.g. social cognitive theory, social learning theory, theory of planned behaviour) or did not have a theoretical approach behind the intervention. Only five trials used a mixed delivery approach (both individual and group mode) while the majority used either an individual or group delivery mode of the intervention. Studies were mainly conducted in healthcare settings while fewer trials were conducted in schools. All 44 trials reported measures of body weight but BMI and BMI z score were the commonly assessed outcomes. Adverse events were only reported in five trials and only one trial provided sufficient details of adverse events. Reports on quality of life, self-esteem, diet, physical activity, views of the intervention, and parenting and relationships were less consistent across trials. There was heterogeneity in measurement tools, assessed outcomes and unit of outcome measures. The duration of follow-up varied across trials with most trials reporting outcomes at six to nine months and fewer trials reporting outcomes at two years. Overall, behaviour changing interventions have a favourable effect on measures of body weight including BMI, BMI z score and weight change in adolescents. We found no results for our outcomes of morbidity, mortality or socioeconomic effects of intervention.

Quality of the evidence

We rated the quality of evidence for the outcomes of interest in this review as low with the exception of weight which was moderate (Summary of findings for the main comparison). We judged the risk of bias for many individual studies to be unclear or high for a number of domains, but we found the impact of bias on the results for BMI and weight outcomes to be limited due to the influence of low risk of bias studies in the analysis. For some outcomes where studies had high loss to follow-up, we saw a bigger effect size in sensitivity analyses. Anthropometric measures (BMI, BMI z score, weight) were downgraded for inconsistency (some variation in point estimates, poor overlap of CIs, significant statistical heterogeneity). Both BMI outcomes were downgraded further for indirectness due to the surrogacy of outcome measures (BMI and BMI z score). We maintained our decision to downgrade BMI outcomes for inconsistency even though we had some evidence that variation in effect could be explained by use of active controls in some studies. Within subgroup analysis heterogeneity remained high, indicating that there may be factors in addition to type of control intervention which give a credible explanation for inconsistency of effects across these outcomes.

Adverse events were downgraded due to risk of bias (inconsistency in reporting of data, reporting bias and attrition bias). Health-related quality of life was downgraded for risk of bias (lack of blinding of outcome assessors) and inconsistency (variability in point estimates, overlap in CI and significant statistical heterogeneity). Therefore, results should be interpreted with caution.

Potential biases in the review process

We included four cluster randomised trials in this review but did not adjusted the data to account for the unit of randomisation due to their limited influence on the review findings. While our approach risks introducing a unit of analysis error, the impact of this decision was questionable for the outcomes affected. Most information in our review came from studies which randomised participants rather than clusters. Sensitivity analyses restricted to individually randomised trials provided some indirect evidence that supported our approach. Given that the removal of cluster trials did not change the results, calculating effective sample sizes would reduce their weight in the analysis. Therefore, it is unlikely that the nature of the results would alter with less weight accorded to the cluster trials.

The large number of subgroup analyses in our review carries inherent risks of multiplicity and the statistically significant results for subgroup analyses we have found could simply reflect a chance finding. This should be borne in mind when considering the applicability of the results to decision-making. We conducted several other sensitivity analyses and found no significant differences. Where data of relevance were missing, either to allow assessment of eligibility, or at the data extraction stage and assessment of bias, we contacted the study authors for further information. Twelve trials are awaiting classification as information is currently unavailable to the review.

Agreements and disagreements with other studies or reviews

The UK National Institute for Health and Care Excellence (NICE) guidance emphasises the importance of behaviour changing weight management services in the treatment of overweight and obesity in young people under the age of 18 years (NICE 2013). However, the guidelines show that there is inconsistent evidence on the long-term effect of such interventions. The short-term effect of behaviour changing interventions on weight loss has been reported in a previous review (Wilfley 2007). Our results add to the evidence base and demonstrate that in trials with longer follow-up at 18 to 24 months, weight loss is maintained. Group-based interventions have been recommended by NICE and our review is consistent in that there were no differences between group-based and individually delivered interventions.

Overall the findings of our review are consistent with previous systematic reviews examining the effect of behaviour changing interventions for the treatment of childhood obesity (Kelly 2008;

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 27 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Ruotsalainen 2015; Whitlock 2010). Several reviews have guestioned the optimal length of behaviour changing interventions (Ho 2012; Kelly 2008; Wilfley 2007), we found that both shortterm interventions (less than six months) and long-term interventions (greater than six months) have a favourable effect on BMI, although in subgroup analyses longer interventions seemed to produce a greater effect on BMI. We found inconsistent evidence on the effect of behaviour changing interventions on dietary intake as reported by one previous systematic review (Collins 2006). One previous review reported the beneficial effect of physical activity on quality of life (Penedo 2005), we found similar favourable effect of behaviour changing interventions on quality of life but not selfesteem. The current review synthesises the most up-to-date and highest-quality research available on the effectiveness of different types of behaviour changing interventions for treating overweight or obesity in adolescents aged 12 to 17 years on a large range of outcomes. Future updates will incorporate the large number of ongoing trials which may strengthen this evidence base.

AUTHORS' CONCLUSIONS

Implications for practice

We explored the impact of different types of behaviour changing interventions on adolescents being overweight and obese. Overall, there is low-to-moderate quality evidence that behaviour changing interventions reduce measures of body weight including BMI, BMI z score and weight change in adolescents. Additionally, lifestyle interventions seem to reduce indicators of adiposity such as percentage of body fat, waist circumference and total fat mass. There is low quality evidence that behaviour changing interventions have a moderate effect on health-related quality of life. There is inconclusive evidence on the effects of behaviour changing interventions on self-esteem, dietary intake and physical activity in adolescents. Most of the evidence is from multicomponent interventions which include a combination of behavioural, dietary and physical activity interventions. We found no subgroup differences for type of intervention, behavioural approach, mode of delivery or setting. Similar levels of weight reduction are seen in trials with longer follow-up periods of up to two years suggesting that weight loss is maintained in these studies. However, the results of this review should be interpreted with caution as most of the evidence was rated as low quality due to inconsistency, indirectness or risk of bias for many of the outcomes measured. The risk of adverse events could not be assessed reliably as they were not measured by most of the trials.

Implications for research

This systematic review identified 50 ongoing trials of behaviour changing interventions targeting adolescent overweight and obesity and incorporation of the results of these when they become available may strengthen the evidence base. Further research is required to determine whether the interventions have any adverse effects. Economic data are needed and trials reporting the costs of behaviour changing interventions should be measured and reported. Consistent measures of health-related quality of life, self-esteem, dietary and physical activity outcomes using validated tools should be used in future research and reports should provide adequate and transparent methodological details such as allocation concealment, blinding, attrition, selective reporting and validity of tools. Higher quality trials are required as the current evidence is of low methodological quality.

ACKNOWLEDGEMENTS

We thank Drs Carrel, Christie, DeBar, Ebbeling, Ford, Grey, Ives, Krude, Makkes, Norman, Pbert, Pitetti, Savoye, Wengle and Wiegan, for providing additional information about their trials. We thank Ms Jennifer Cooper for her help with the screening. We thank the Cochrane Editorial Unit (Toby Lasserson) for reviewing this work. We thank the Metabolic and Endocrine Disorders Group editorial team (Bernd Richter) for extracting the German study. We thank Mr Graham Hewitt for translating a Spanish paper to confirm its status as excluded, Dr Karoline Freeman for translating a German publication to confirm its status as excluded, Dr Huayi Huang for translating a Chinese publication to confirm its status as excluded and Dr Soroush Abulfatehi for translating an Iranian publication to confirm its status as excluded. We acknowledge the editorial contributions by Gudrun Paletta and Bernd Richter (Cochrane Metabolic and Endocrine Disorders Group).

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 28 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

REFERENCES

References to studies included in this review

Bean 2014 {published data only}

Bean M, Mazzeo S, Stern M, Bowen D, Ingersoll K. A values-based motivational interviewing (MI) intervention for pediatric obesity: study design and methods for MI values. *Contemporary Clinical Trials* 2011;**32**:667–74. * Bean M, Powell P, Quinoy A, Ingersoll K, Wickham E, Mazzeo S. Motivational interviewing targeting diet and physical activity improves adherence to paediatric obesity treatment: results from the MI Values randomized controlled trial. *Pediatric Obesity* 2015;**10**(2):118–25. NCT00167830. Barriers to treatment in obese adolescents. clinicaltrials.gov/ct2/show/NCT00167830 Date first received: 9 September 2005.

Boodai 2014 {published data only}

* Boodai S, McColl J, Reilly J. National Adolescent Treatment Trial for Obesity in Kuwait (NATTO): project design and results of a randomised controlled trial of a good practice approach to treatment of adolescent obesity in Kuwait. *Trials* 2014;**15**:234.

ISRCTN37457227. National adolescent treatment trial for obesity in Kuwait. www.isrctn.com/ISRCTN37457227 Date first assigned: 1 December 2009.

Brennan 2013 {published data only}

ACTRN12610000111077. The efficacy of a cognitive behavioural lifestyle intervention in improving body composition and cardiovascular fitness in overweight and obese adolescents. A wait-listed randomised controlled trial. www.anzctr.org.au/Trial/Registration/TrialReview.aspx? ACTRN=12610000111077 Date first registered 3 February 2010.

Brennan L, Walkley J, Fraser S, Greenway K, Wilks R. Motivational interviewing and cognitive behaviour therapy in the treatment of adolescent overweight and obesity: study design and methodology. *Contemporary Clinical Trials* 2008;**29**(3):359–75.

* Brennan L, Walkley J, Wilks R, Fraser S, Greenway K. Physiological and behavioural outcomes of a randomised controlled trial of a cognitive behavioural lifestyle intervention for overweight and obese adolescents. *Obesity Research & Clinical Practice* 2013;7(1):e23–e41. Brennan L, Wilks R, Walkley J, Fraser S, Greenway K. Treatment acceptability and psychosocial outcomes of a randomised controlled trial of a cognitive behavioural lifestyle intervention for overweight and obese adolescents. *Behaviour Change* 2012;**29**(01):36–62.

Brownell 1983 {published data only}

Brownell K, Kelman J, Stunkard A. Treatment of obese children with and without their mothers: changes in weight and blood pressure. *Pediatrics* 1983;**71**(4):515–23.

Carraway 2014 {published data only}

Carraway M. Project MENTOR+: Mentor-led Exercise with Cognitive-behavioral Therapy to Improve Perceived Competence, Reduce Social Anxiety, and Increase Physical Activity in Overweight Adolescents [Doctorate of Philosophy in Clinical Psychology Thesis]. Greenville (NC): East Carolina University, 2014.

Carrel 2005 {published data only}

Carrel A, Clark R, Peterson S, Nemeth B, Sullivan J, Allen D. Improvement of fitness, body composition, and insulin sensitivity in overweight children in a school-based exercise program: a randomized, controlled study. *Archives of Pediatrics & Adolescent Medicine* 2005;**159**(10):963–8.

Chandra 1968 {published data only}

Chandra R. Obesity in childhood - a clinical trial of lowcalorie "limical". *Indian Journal of Pediatrics* 1968;**35**(24): 23–6.

Christie 2011 {published data only}

Christie D, Hudson L, Costa S, Mathiot A, Holt R Kinra S, Kessel A, Wong I, et al. Effects of a motivational lifestyle intervention (the Healthy Eating and Lifestyle Programme (HELP)) on metabolic outcomes in obese adolescents: findings from a randomized controlled trial. *Pediatric Diabetes* 2015;**16**:45.

Christie D, Hudson L, Costa S, Mathiot A, Holt R, Kinra S, et al. RCT of a motivational lifestyle intervention (the Healthy Eating and Lifestyle Programme (HELP)) for obese young people. *Archives of Disease in Childhood* 2015;**100**: A2–A2.

Christie D, Hudson L, Kinra S, Nazareth I, Holt R, Kessel A, et al. Does a motivational lifestyle intervention (the Healthy Eating and Lifestyle Programme (HELP) work for obese young people?. *Journal of Adolescent Health* 2015;**2**: S19.

* Christie D, Hudson L, Mathiot A, Cole T, Karlsen S, Kessel A, et al. Assessing the efficacy of the Healthy Eating and Lifestyle Programme (HELP) compared with enhanced standard care of the obese adolescent in the community: study protocol for a randomized controlled trial. *Trials* 2011;**12**:242.

Costa S, Hudson L, Christie D, Kinra S, Mathiot A, Wong I, et al. Fitness may be more important for cardiovascular health than adiposity in adolescent girls. *Obesity Reviews* 2014;**15**:108.

ISRCTN99840111. HELP trial: healthy eating lifestyle programme for adolescents. www.isrctn.com/ ISRCTN99840111 Date first assigned: 21 January 2011.

Daley 2005 {published data only}

Daley A, Copeland R, Wright N, Roalfe A, Wales J. Exercise therapy as a treatment for psychopathologic conditions in obese and morbidly obese adolescents: a randomized, controlled trial. *Pediatrics* 2006;**118**(5):2126–34.

* Daley A, Copeland R, Wright N, Wales J. Protocol for: Sheffield Obesity Trial (SHOT): a randomised controlled trial of exercise therapy and mental health outcomes in

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 2 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

29

obese adolescents [ISRCNT83888112]. *BMC Public Health* 2005;**5**(1):113.

ISRCNT83888112. The psychological effects of exercise therapy in clinically obese children. www.isrctn.com/ ISRCTN83888112 Date first assigned: 17 August 2005.

Debar 2012 {published data only}

* DeBar L, Stevens V, Perrin N, Wu P, Pearson J, Yarborough B, et al. A primary care-based, multicomponent lifestyle intervention for overweight adolescent females. *Pediatrics* 2012;**129**(3):e611–20.

NCT01068236. Primary care treatment for overweight adolescent females (SHINE). clinicaltrials.gov/ct2/show/ NCT01068236 Date first received: 11 February 2010.

Ebbeling 2003 {published data only}

Ebbeling C, Leidig M, Sinclair K, Hangen J, Ludwig D. A reduced-glycemic load diet in the treatment of adolescent obesity. *Archives of Pediatrics & Adolescent Medicine* 2003; **157**(8):773–9.

Ebbeling 2012 {published data only}

* Ebbeling C, Feldman H, Chomitz V, Antonelli T, Gortmaker S, Osganian S, et al. A randomized trial of sugar-sweetened beverages and adolescent body weight. *New England Journal of Medicine* 2012;**367**(15):1407–16. NCT00381160. Reducing sugar-sweetened beverage consumption in overweight adolescents (BASH). clinicaltrials.gov/show/NCT00381160 Date first received: 25 September 2006.

Ford 2010 {published data only}

* Ford A, Bergh C, Södersten P, Sabin M, Hollinghurst S, Hunt L, et al. Treatment of childhood obesity by retraining eating behaviour: randomised controlled trial. *BMJ* 2010; **340**:b5388.

Galhardo J, Hunt L, Lightman S, Sabin M, Bergh C, Sodersten P, et al. Normalizing eating behavior reduces body weight and improves gastrointestinal hormonal secretion in obese adolescents. *Journal of Clinical Endocrinology & Metabolism* 2011;**97**(2):E193–201.

NCT00407420. Can a novel treatment using "Mandometer®" technology improve weight loss in a childhood obesity clinic?. clinicaltrials.gov/ct2/show/ NCT00407420 Date first received: 1 December 2006.

Gourlan 2013 {published data only}

Gourlan M, Sarrazin P, Trouilloud D. Motivational interviewing as a way to promote physical activity in obese adolescents: a randomised-controlled trial using self-determination theory as an explanatory framework. *Psychology & Health* 2013;**28**(11):1265–86.

Grey 2009 {published data only}

Grey M, Berry D, Davidson M, Galasso P, Gustafson E, Melkus G. Preliminary testing of a program to prevent type 2 diabetes among high-risk youth. *Journal of School Health* 2004;74(1):10–5.

* Grey M, Jaser S, Holl M, Jefferson V, Dziura J, Northrup V. A multifaceted school-based intervention to reduce risk for type 2 diabetes in at-risk youth. *Preventive Medicine* 2009;**49**(2):122–8.

Hofsteenge 2014 {published data only}

* Hofsteenge G, Chinapaw M, Delemarre-van de Waal H, Weijs P. Long-term effect of the Go4it group treatment for obese adolescents: a randomised controlled trial. *Clinical Nutrition* 2014;**33**(3):385–91.

Hofsteenge G, Chinapaw M, Weijs P, van Tulder M, Delemarre-van de Waal H. Go4it; study design of a randomised controlled trial and economic evaluation of a multidisciplinary group intervention for obese adolescents for prevention of diabetes mellitus type 2. *BMC Public Health* 2008;**8**:410.

Hofsteenge G, Weijs P, Delemarre-van de Waal H, de Wit M, Chinapaw M. Effect of the Go4it multidisciplinary group treatment for obese adolescents on health related quality of life: a randomised controlled trial. *BMC Public Health* 2013;**13**:939.

NTR691. GO4IT - the effectiveness of a group intervention programme on the lifestyle of adolescents with obesity. www.trialregister.nl/trialreg/admin/rctview.asp?TC=691 Date first registered: 19 July 2006.

Weijs P, Hofsteenge A, Chinapaw M, Delemarre-van de Waal H. Long-term effect of the Go4it group treatment for obese adolescents: a randomised controlled trial. *Clinical Nutrition, Supplement* 2012;7:130.

Jelalian 2016 {published data only}

* Jelalian E, Jandasek B, Wolff J, Seaboyer L, Jones R, Spirito A. Cognitive-behavioral therapy plus healthy lifestyle enhancement for depressed, overweight/obese adolescents: results of a pilot trial. *Journal of Clinical Child & Adolescent Psychology* 2016 Jun 16 [Epub ahead of print]:1–10. NCT01128764. Integrated treatment for comorbid depression and obesity in adolescents. clinicaltrials.gov/ct2/ show/NCT01128764 Date first received: 21 May 2010.

Jiang 2005 {published data only}

Jiang J, Xia X, Greiner T, Lian G, Rosenqvist U. A two year family based behaviour treatment for obese children. *Archives of Disease in Childhood* 2005;**90**(12):1235–8.

Kong 2013 {published data only}

Kong A, Sussman A, Yahne C, Skipper B, Burge M, Davis S. School-based health center intervention improves body mass index in overweight and obese adolescents. *Journal of Obesity* 2013;2013:1–10.

Kong 2014 {published data only}

* Kong A, Choi K, Chan R, Lok K, Ozaki R, Li A, et al. A randomized controlled trial to investigate the impact of a low glycemic index (GI) diet on body mass index in obese adolescents. *BMC Public Health* 2014;**14**:180. NCT01278563. A trial to investigate the impact of a low glycemic index (GI) diet on body mass index and obesity related cardiovascular and hormonal factors in Chinese adolescents. clinicaltrials.gov/ct2/show/NCT01278563 Date first received: 18 January 2011.

Love-Osborne 2014 {published data only}

Love-Osborne K, Fortune R, Sheeder J, Federico S, Haemer M. School-based health center-based treatment for obese

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 30 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. adolescents: feasibility and body mass index effects. *Childhood Obesity* 2014;**10**:424–31.

Luna-Pech 2014 {published data only}

Luna-Pech J, Torres-Mendoza B, Luna-Pech J, Garcia-Cobas C, Navarrete-Navarro S, Elizalde-Lozano A. Normocaloric diet improves asthma-related quality of life in obese pubertal adolescents. *International Archives of Allergy & Immunology* 2014;**163**:252–8.

NCT00132132 {published data only}

NCT00132132. Study of impact of behavioral intervention - exercise, nutrition, education - on body mass index (BMI). clinicaltrials.gov/ct2/show/study/NCT00132132 Date first received: 17 August 2005.

NCT00807560 {published data only}

NCT00807560. Parent-based treatment for pediatric overweight (PO). clinicaltrials.gov/ct2/show/ NCT00807560 Date first received: 11 December 2008.

Nguyen 2012 {published data only}

ACTRN12606000175572. Community-based weight management of overweight and obese adolescents: a randomised controlled trial of extended therapeutic contact vs recommended care with primary outcomes body mass index standard deviation score and waist circumference standard deviation score. www.anzctr.org.au/Trial/ Registration/TrialReview.aspx?ACTRN=12606000175572 Date first registered: 15 May 2006.

Kornman K, Shrewsbury V, Chou A, Nguyen B, Lee A, O'Connor J, et al. Electronic therapeutic contact for adolescent weight management: the Loozit study. *Telemedicine Journal & E-Health* 2010;**16**:678–85. Nguyen B, Shrewsbury V, Lau C, O'Connor J, Steinbeck K, Hill A, et al. Adolescent and parent views of an adolescent weight management program: lessons from the Loozit randomised controlled trial. *Obesity Research and Clinical Practice* 2012;**6**:56.

Nguyen B, Shrewsbury V, O'Connor J, Lau C, Steinbeck K, Hill A, Baur L. A process evaluation of an adolescent weight management intervention: findings and recommendations. *Health Promotion International* 2015;**30**(2):201–12.

Nguyen B, Shrewsbury V, O'Connor J, Steinbeck K, Hill A, Shah S, et al. Two-year outcomes of an adjunctive telephone coaching and electronic contact intervention for adolescent weight-loss maintenance: the Loozit randomized controlled trial. *International Journal of Obesity* 2013;**37**(3):468–72.

* Nguyen B, Shrewsbury V, O'Connor J, Steinbeck K, Lee A, Hill A, et al. Twelve-month outcomes of the Loozit randomized controlled trial: a community-based healthy lifestyle program for overweight and obese adolescents. *Archives of Pediatrics & Adolescent Medicine* 2012;**166**(2): 170–7.

Shrewsbury V, O'Connor J, Steinbeck K, Stevenson K, Lee A, Hill A, et al. A randomised controlled trial of a community-based healthy lifestyle program for overweight and obese adolescents: the Loozit® study protocol. *BMC Public Health* 2009;9(1):1.

Norman 2016 {published data only}

Norman G, Huang J, Davila E, Kolodziejczyk J, Carlson J, Covin J, et al. Outcomes of a 1-year randomized controlled trial to evaluate a behavioral 'stepped-down' weight loss intervention for adolescent patients with obesity. *Pediatric Obesity* 2016;**11**(1):18–25.

Pakpour 2015 {published data only}

NCT02180802. Parental involvement improves the effect of motivational interviewing on weight loss in obese adolescents: a randomized controlled trial study. clinicaltrials.gov/ct2/show/NCT02180802 Date first received: 1 July 2014.

* Pakpour A, Gellert P, Dombrowski S, Fridlund B. Motivational interviewing with parents for obesity: an RCT. *Pediatrics* 2015;**135**(3):e644–52.

Patrick 2013 {published data only}

NCT00412165. PACE-iDP: an intervention for youth at risk for diabetes. clinicaltrials.gov/ct2/show/NCT00412165 Date first received: 13 December 2006.

* Patrick K, Norman G, Davila E, Calfas K, Raab F, Gottschalk M, et al. Outcomes of a 12-month technologybased intervention to promote weight loss in adolescents at risk for type 2 diabetes. *Journal of Diabetes Science and Technology* 2013;7(3):759–70.

Patsopoulou 2017 {published data only}

NCT02653508. Evaluating the efficacy of the Feeding Exercise Trial in Adolescents (FETA Project) in Central Greece (FETA). clinicaltrials.gov/show/NCT02653508 Date first received: 17 December 2015.

* Patsopoulou A, Tsimtsiou Z, Katsioulis A, Malissiova E, Rachiotis G, Hadjichristodoulou C. Evaluating the efficacy of the Feeding Exercise Randomized Trial in overweight and obese adolescents. *Childhood Obesity* 2017;**13**(2):128–37. Patsopoulou A, Tsimtsiou Z, Katsioulis A, Rachiotis G, Malissiova E, Hadjichristodoulou C. Prevalence and risk factors of overweight and obesity among adolescents and their parents in Central Greece (FETA Project). *International Journal of Environmental Research and Public Health* 2015;**13**(1):83.

Pbert 2013 {published data only}

Pbert L, Druker S, Gapinski M, Gellar L, Magner R, Reed G, et al. A school nurse-delivered intervention for overweight and obese adolescents. *Journal of School Health* 2013;**83**(3):182–93.

Pitetti 2007 {published data only}

Pitetti K, Rendoff A, Grover T, Beets M. The efficacy of a 9month treadmill walking program on the exercise capacity and weight reduction for adolescents with severe autism. *Journal of Autism and Developmental Disorders* 2007;**37**(6): 997–1006.

Resnicow 2005 {published data only}

Resnicow K, Taylor R, Baskin M, McCarty F. Results of Go Girls: a weight control program for overweight African-American adolescent females. *Obesity Research* 2005;**13**(10): 1739–48.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 31 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Saelens 2002 {published data only}

Saelens B, Sallis J, Wilfley D, Patrick K, Cella J, Buchta R. Behavioral weight control for overweight adolescents initiated in primary care. *Obesity Research* 2002;**10**(1): 22–32.

Savoye 2007 {published data only}

NCT00409422. Effects of a comprehensive weight management program on obese adolescents and children. www.clinicaltrials.gov/ct2/show/NCT00409422 Date first received: 6 December 2006.

Savoye M, Caprio S, Dziura J, Camp A, Germain G, Summers C, et al. Reversal of early abnormalities in glucose metabolism in obese youth: results of an intensive lifestyle randomized controlled trial. *Diabetes Care* 2014;**37**(2): 317–24.

Savoye M, Nowicka P, Shaw M, Yu S, Dziura J, Chavent G, et al. Long-term results of an obesity program in an ethnically diverse pediatric population. *Pediatrics* 2011;**127** (3):peds–2010.

* Savoye M, Shaw M, Dziura J, Tamborlane W, Rose P, Guandalini C, et al. Effects of a weight management program on body composition and metabolic parameters in overweight children: a randomized controlled trial. *JAMA* 2007;**297**(24):2697–704.

Schranz 2014 {published data only}

ACTRN12609001078246. Can resistance training change the strength, body composition and self-concept of overweight and obese adolescent males? A randomised controlled trial. www.anzctr.org.au/Trial/Registration/ TrialReview.aspx?ACTRN=12609001078246 Date first registered: 16 December 2009.

Schranz N, Olds T, Tomkinson G. Can resistance training change the strength, body composition and self-concept of overweight and obese adolescent males? A randomised controlled trial. *Journal of Science and Medicine in Sport* 2012;**15**:S358.

* Schranz N, Tomkinson G, Parletta N, Petkov J, Olds T. Can resistance training change the strength, body composition and self-concept of overweight and obese adolescent males? A randomised controlled trial. *British Journal of Sports Medicine* 2014;**48**:1482–8.

Sigal 2014 {published data only}

Alberga A, Goldfield G, Kenny G, Hadjiyannakis S, Phillips P, Prud'homme D, et al. Healthy Eating, Aerobic and Resistance Training in Youth (HEARTY): study rationale, design and methods. *Contemporary Clinical Trials* 2012;**33**: 839–47.

Goldfield G, Kenny G, Alberga A, Prud'homme D, Hadjiyannakis S, Gougeon R, et al. Effects of aerobic training, resistance training, or both on psychological health in adolescents with obesity: the HEARTY Rrandomized controlled trial. *Journal of Consulting and Clinical Psychology* 2015;**83**(6):1123.

NCT00195858. Healthy Eating Aerobic and Resistance Training in Youth (HEARTY) trial. clinicaltrials.gov/show/ NCT00195858 Date first received: 12 September 2005. * Sigal R, Alberga A, Goldfield G, Prud'homme D, Hadjiyannakis S, Gougeon R, et al. Effects of aerobic training, resistance training, or both on percentage body fat and cardiometabolic risk markers in obese adolescents: the Healthy Eating Aerobic and Resistance Training in Youth randomized clinical trial. *JAMA Pediatrics* 2014;**168**: 1006–14.

Toulabi 2012 {published data only}

Toulabi T, Nikoo M, Amini F, Nazari H, Mardani M. The influence of a behavior modification interventional program on body mass index in obese adolescents. *Journal of the Formosan Medical Association / Taiwan Yi Zhi* 2012;**111**(3): 153–9.

van Egmond-Frohlich 2006 {published data only}

van Egmond-Frohlich A, Brauer W, Goldschmidt H, Hoff-Emden H, Oepen J, Zimmermann E. Effects of a programme for structured outpatient follow-up care after inpatient rehabilitation of obese children and adolescents - a multicentre, randomized study. *Rehabilitation* 2006;**45**(1): 40–51.

Vissers 2008 {published data only}

Vissers D, De Meulenaere A, Vanroy C, Vanherle K, Van de Sompel A, Truijen S, et al. Effect of a multidisciplinary school-based lifestyle intervention on body weight and metabolic variables in overweight and obese youth. *E-SPEN, the European E-journal of Clinical Nutrition and Metabolism* 2008;**3**(5):e196–202.

Visuthranukul 2015 {published data only}

NCT02049788. Effects of a low glycemic index in obese children. clinicaltrials.gov/show/NCT02049788 Date first received: 28 January 2014.

* Visuthranukul C, Sirimongkol P, Prachansuwan A, Pruksananonda C, Chomtho S. Low-glycemic index diet may improve insulin sensitivity in obese children. *Pediatric Research* 2015;**78**(5):567–73.

Vos 2011 {published data only}

ISRCTN36146436. The effect of lifestyle treatment on childhood obesity. www.isrctn.com/ISRCTN36146436 Date first assigned: 13 July 2010.

Vos R, Huisman S, Houdijk E, Pijl H, Wit J. The effect of family-based multidisciplinary cognitive behavioral treatment on health-related quality of life in childhood obesity. *Quality of Life Research* 2012;**21**(9):1587–94. Vos R, Wit J, Pijl H, Houdijk E. Long-term effect of lifestyle intervention on adiposity, metabolic parameters, inflammation and physical fitness in obese children: a randomized controlled trial. *Nutrition & Diabetes* 2011;**1** (10):e9.

* Vos R, Wit J, Pijl H, Kruyff C, Houdijk, E. The effect of family-based multidisciplinary cognitive behavioral treatment in children with obesity: study protocol for a randomized controlled trial. *Trials* 2011;**12**(1):110.

Walpole 2013 {published data only}

NCT01246349. Motivational interviewing for weight loss. clinicaltrials.gov/ct2/show/study/NCT01246349 Date first received: 11 November 2010.

* Walpole B, Dettmer E, Morrongiello B, McCrindle B, Hamilton J. Motivational interviewing as an intervention to

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 32 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. increase adolescent self-efficacy and promote weight loss: methodology and design. *BMC Public Health* 2011;**11**(1): 459.

Walpole B, Dettmer E, Morrongiello B, McCrindle B, Hamilton J. Motivational interviewing to enhance selfefficacy and promote weight loss in overweight and obese adolescents: a randomized controlled trial. *Journal of Pediatric Psychology* 2013;**39**(9):944–53.

Wengle 2011 {published data only}

Wengle J, Hamilton J, Manlhiot C, Bradley T, Katzman D, Sananes R, et al. The 'Golden Keys' to health - a healthy lifestyle intervention with randomized individual mentorship for overweight and obesity in adolescents. *Paediatrics & Child Health* 2011;**16**(18):473.

Wong 2015 {published data only}

Wong J, Ebbeling C, Robinson L, Feldman H, Ludwig D. Does the recommendation to drink 8 cups of water per day promote weight loss?. *FASEB Journal* 2015;**29**:747–18.

References to studies excluded from this review

Balagopal 2005 {published data only}

Balagopal P, George D, Patton N, Yarandi H, Roberts W, Bayne E, et al. Lifestyle-only intervention attenuates the inflammatory state associated with obesity: a randomized controlled study in adolescents. *Journal of Pediatrics* 2005; **146**(3):342–8.

Belenchia 2013 {published data only}

Belenchia A, Tosh A, Hillman L, Peterson C. Correcting vitamin D insufficiency improves insulin sensitivity in obese adolescents: a randomized controlled trial. *American Journal of Clinical Nutrition* 2013;**97**(4):774–81.

Braet 2004 {published data only}

Braet C, Tanghe A, Decaluwé V, Moens E, Rosseel Y. Inpatient treatment for children with obesity: weight loss, psychological well-being, and eating behavior. *Journal of Pediatric Psychology* 2004;**29**(7):519–29.

Carrel 2007 {published data only}

Carrel A, Clark R, Peterson S, Eickhoff J, Allen D. Schoolbased fitness changes are lost during the summer vacation. *Archives of Pediatrics & Adolescent Medicine* 2007;**161**(6): 561–4.

Crandall 2006 {published data only}

Crandall M. The effectiveness of a program of comprehensive behavior modification therapy and sibutramine for obese adolescents. Thesis 2006; Vol. 69: 3841.

Daly 2013 {published data only}

Daly P. Obese Adolescent Females and Actual Behavioral Responses to a Mindful Eating Intervention [Doctoral dissertation]. Tucson (AZ): University of Arizona, 2013.

Dancy 2006 {published data only}

Dancy B, Crittenden K, Talashek M. Effectiveness of the mother/daughter health promotion intervention in enhancing daughters' healthy eating behavior. APHA 134th Annual Meeting and Exposition; 2006 Nov 4-8; Boston (MA). 2006.

De Jesus 2013 {published data only}

De Jesus S, Prapavessis H. The effects of a peer modeling intervention on cardiorespiratory fitness parameters and self-efficacy in obese adolescents. *Behavioral Medicine* 2013; **39**(4):129–37.

DeVore 2013 {published data only}

DeVore S, Kohli R, Lake K, Nicholas L, Dietrich K, Balistreri W, et al. A multidisciplinary clinical program is effective in stabilizing BMI and reducing transaminase levels in pediatric patients with NAFLD. *Journal of Pediatric Gastroenterology and Nutrition* 2013;**57**(1):119.

Doyle 2008 {published data only}

Doyle A, Goldschmidt A, Huang C, Winzelberg A, Taylor C, Wilfley D. Reduction of overweight and eating disorder symptoms via the internet in adolescents: a randomized controlled trial. *Journal of Adolescent Health* 2008;**43**(2): 172–9.

Dreyer-Gillette 2014 {published data only}

Dreyer-Gillette M, Odar Stough C, Best C, Beck A, Hampl S. Comparison of a condensed 12-week version and a 24-week version of a family-based pediatric weight management program. *Childhood Obesity* 2014;**10**(5):375–82.

Faulkner 2013 {published data only}

Faulkner M, Michaliszyn S, Hepworth J, Wheeler M. Personalized exercise for adolescents with diabetes or obesity. *Biological Research for Nursing* 2013;20: 1099800413500064.

Fonseca 2016 {published data only}

* Fonseca H, Prioste A, Sousa P, Gaspar P, do Céu Machado M. Effectiveness analysis of an internet-based intervention for overweight adolescents: next steps for researchers and clinicians. *BMC Obesity* 2016;**3**(1):1.

NCT01904474. E-therapeutic program for obese adolescents. clinicaltrials.gov/ct2/show/NCT01904474 Date first received: 9 July 2013.

Freire 2013 {published data only}

Freire S, Fisberg M, Cozzolino S. Dietary intervention causes redistribution of zinc in obese adolescents. *Biological Trace Element Research* 2013;**154**(2):168–77.

Garnett 2014 {published data only}

Garnett S, Gow M, Ho M, Baur L, Noakes M, Woodhead H, et al. Improved insulin sensitivity and body composition, irrespective of macronutrient intake, after a 12 month intervention in adolescents with pre-diabetes; RESIST a randomised control trial. *BMC Pediatrics* 2014;14(1):289.

Giel 2013 {published data only}

Giel K, Zipfel S, Schweizer R, Braun R, Ranke M, Binder G, et al. Eating disorder pathology in adolescents participating in a lifestyle intervention for obesity: associations with weight change, general psychopathology and health-related quality of life. *Obesity Facts* 2013;6(4):307–16.

Hay 2016 {published data only}

Hay J, Wittmeier K, MacIntosh A, Wicklow B, Duhamel T, Sellers E, et al. Physical activity intensity and type 2 diabetes risk in overweight youth: a randomized trial. *International Journal of Obesity* 2016;**40**:607–14.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 33 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
Jelalian 1999 {published data only}

Jelalian E, Saelens B. Empirically supported treatments in pediatric psychology: pediatric obesity. *Journal of Pediatric Psychology* 1999;**24**(3):223–48.

Jelalian 2010 {published data only}

Jelalian E, Lloyd-Richardson EE, Mehlenbeck RS, Hart CN, Flynn-O'Brien K, Kaplan J, et al. Behavioral weight control treatment with supervised exercise or peer-enhanced adventure for overweight adolescents. *Journal of Pediatrics* 2010;**157**(6):923–8.

Jones 2008 {published data only}

Jones M, Luce K, Osborne M, Taylor K, Cunning D, Doyle A, et al. Randomized, controlled trial of an internetfacilitated intervention for reducing binge eating and overweight in adolescents. *Pediatrics* 2008;**121**(3):453–62.

Jones 2009 {published data only}

Jones M. *Reducing Binge Eating and Overweight in Adolescents via the Internet [Doctoral thesis]*. Palo Alto (CA): Palo Alto University, 2009.

Lee 2013a {published data only}

Lee S, Kuk J. Changes in fat and skeletal muscle with exercise training in obese adolescents: comparison of wholebody MRI and dual energy X-ray absorptiometry. *Obesity* 2013;**21**(10):2063–71.

Lee 2013b {published data only}

Lee S, Deldin A, White D, Kim Y, Libman I, Rivera-Vega M, et al. Aerobic exercise but not resistance exercise reduces intrahepatic lipid content and visceral fat and improves insulin sensitivity in obese adolescent girls: a randomized controlled trial. *American Journal of Physiology. Endocrinology and Metabolism* 2013;**305**(10):E1222–9.

Lee 2013c {published data only}

Lee S, Burns S, White D, Kuk J, Arslanian S. Effects of acute exercise on postprandial triglyceride response after a high-fat meal in overweight black and white adolescents. *International Journal of Obesity* 2013;**37**(7):966–71.

Lovely 2013 {published data only}

Lovely R, Hossain J, Ramsey J, Komakula V, George D, Farrell D, et al. Obesity-related increased γ ' fibrinogen concentration in children and its reduction by a physical activity-based lifestyle intervention: a randomized controlled study. *Journal of Pediatrics* 2013;**163**(2):333–8.

Lubans 2008 {published data only}

Lubans D, Morgan P. Evaluation of an extra-curricular school sport programme promoting lifestyle and lifetime activity for adolescents. *Journal of Sports Sciences* 2008;**26** (5):519–29.

NCT00863083 {published data only}

NCT00863083. Reducing barriers to behavior change among youth with pediatric overweight and obesity. clinicaltrials.gov/ct2/show/NCT00863083 Date first received: 16 March 2009.

NCT01044134 {published data only}

NCT01044134. Think AHEAD (a healthy eating and drinking) study. clinicaltrials.gov/ct2/show/NCT01044134 Date first received: 5 January 2010.

NCT02011646 {published data only}

NCT02011646. Healthy body study. clinicaltrials.gov/ct2/ show/NCT02011646 Date first received: 10 December 2013.

NCT02295761 {published data only}

NCT02295761. Promoting overweight adolescents physical activity. clinicaltrials.gov/ct2/show/NCT02295761 Date first received: 18 February 2014.

Nunes 2016 {published data only}

Nunes JE, Cunha HS, Freitas ZR, Nogueira AM, Dâmaso AR, Espindola FS, et al. Interdisciplinary therapy changes superoxide dismutase activity and adiponectin in obese adolescents: a randomised controlled trial. *Journal of Sports Sciences* 2016;**34**(10):945–50.

Parks 2014 {published data only}

Parks E, Zemel B, Moore R, Berkowitz R. Change in body composition during a weight loss trial in obese adolescents. *Pediatric Obesity* 2014;**9**(1):26–35.

Racil 2013 {published data only}

Racil G, Ounis O, Hammouda O, Kallel A, Zouhal H, Chamari K, et al. Effects of high vs. moderate exercise intensity during interval training on lipids and adiponectin levels in obese young females. *European Journal of Applied Physiology* 2013;**113**(10):2531–40.

Sabzghabaee 2013 {published data only}

Sabzghabaee AM, Khayam I, Kelishadi R, Ghannadi A, Soltani R, Badri S, et al. Effect of Zizyphus jujuba fruits on dyslipidemia in obese adolescents: a triple-masked randomized controlled clinical trial. *Medical Archives* 2013; **67**(3):156.

Sarvestani 2009 {published data only}

Sarvestani R, Jamalfard M, Kargar M, Kaveh M, Tabatabaee H. Effect of dietary behaviour modification on anthropometric indices and eating behaviour in obese adolescent girls. *Journal of Advanced Nursing* 2009;**65**(8): 1670–5.

Shrewsbury 2011 {published data only}

Shrewsbury V, Nguyen B, O'Connor J, Steinbeck K, Lee A, Hill A, et al. Short-term outcomes of community-based adolescent weight management: the Loozit® Study. *BMC Pediatrics* 2011;**11**(1):13.

Sussman 2013 {published data only}

Sussman A, Montoya C, Werder O, Davis S, Wallerstein N, Kong A. An adaptive CBPR approach to create weight management materials for a school-based health center intervention. *Journal of Obesity* 2013;**2013**(978482):1–9.

Van 2013 {published data only}

Vann L, Stanford F, Durkin M, Hanna A, Knight L, Stallworth J. "Moving and losing": a pilot study incorporating physical activity to decrease obesity in the pediatric population. *Journal of the South Carolina Medical Association (1975)* 2013;**109**(4):116–20.

Ventura 2009 {published data only}

Ventura E, Davis J, Byrd-Williams C, Toledo-Corral C, Spruijt-Metz D, Weigensberg M, et al. The effects of a

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

34

randomized, controlled, modified-carbohydrate nutrition intervention on the metabolic syndrome in overweight Latino adolescents. *Obesity* 2009;**17**:S183–4.

Wadden 1990 {published data only}

Wadden T, Stunkard A, Rich L, Rubin C, Sweidel G, McKinney S. Obesity in black adolescent girls: a controlled clinical trial of treatment by diet, behavior modification, and parental support. *Pediatrics* 1990;**85**(3):345–52.

Wiegand 2014 {published data only}

Wiegand S, Bau A, Ernert A, Krude H. MAINTAIN: an intervention study of weight regain after weight loss in adolescents and children reveals an only minor role of leptin in weight regain. *Hormone Research in Paediatrics* 2014;**82**: 1–507.

Wilson 2012 {published data only}

Wilson A, Jung M, Cramp A, Simatovic J, Prapavessis H, Clarson C. Effects of a group-based exercise and self-regulatory intervention on obese adolescents' physical activity, social cognitions, body composition and strength: a randomized feasibility study. *Journal of Health Psychology* 2012;**17**:1223–37.

Xanthopoulos 2013 {published data only}

Xanthopoulos M, Moore R, Wadden T, Bishop-Gilyard C, Gehrman C, Berkowitz R. The association between weight loss in caregivers and adolescents in a treatment trial of adolescents with obesity. *Journal of Pediatric Psychology* 2013;**38**(7):766–74.

References to studies awaiting assessment

Angerer 2015 {published data only}

Angerer P, Niedermeier H, Graf T, Manthey A, Marten-Mittag B, Schmidt H, et al. Fit4You - a programme for prevention and reduction of overweight in apprentices in the workplace setting. *Gesundheitswesen (Bundesverband der Arzte des Offentlichen Gesundheitsdienstes (Germany)* 2015; 77:S95–6. PUBMED: 23970389]

Barbeau 2003 {published data only}

Barbeau P, Gutin B, Litaker M, Ramsey L, Cannady W, Allison J, et al. Influence of physical training on plasma leptin in obese youths. *Canadian Journal of Applied Physiology* 2003;**28**(3):382–96.

Bohlin 2012 {published data only}

Bohlin A, Klaesson S, Kowalski J. Can telephone consultations substitute visits in treatment of childhood obesity? Results from a randomized trial. *Obesity Facts* 2012;**5**(Suppl 1):237.

Campos 2017 {published data only}

Campos R, Masquio D, Corgosinho F, De Lima S, De Piano A, Carnier J, et al. Homeostasis Model Assessment-Adiponectin: the role of different types of physical exercise in obese adolescents. Journal of Sports Medicine and Physical Fitness 2017; Vol. 57, issue 6:831–8.

Cocca 2016 {published data only}

Cocca A, Lomas R, Enríquez M, Cocca M, Ceballos O. Effects of a school-based intervention program on metabolic syndrome parameters in school-aged youth. *Obesity Reviews* 2016;**17**:131–2.

Garrett 1979 {published data only}

Garrett L. Group behavioral therapy versus family behavioral therapy in treatment of obese adolescent females [Doctor of Philosophy thesis]. University of Pennsylvania, 1979:1364–5.

Gracianette 1982 {published data only}

Gracianette C. The application of behavioral techniques to change eating habits and/or exercise habits to effect weight reduction and maintenance in adolescents: a year-long study [Doctor of Philosophy thesis]. Baton Rouge (LA): Louisiana State University and Agricultural & Mechanical College, 1982.

Li 2006 {published data only}

Li M. Anti-obesity effect of comprehensive diet and sports in girl students with simple obesity or overweight. *Chinese Journal of Clinical Rehabilitation* 2006;**10**(32):44–6.

Makkes 2015 {unpublished data only}

Makkes S. Intensive inpatient treatment for severely obese children and adolescents: costs and effects [Doctoral Thesis]. Amsterdam (Netherlands): VU University Amsterdam, 2015.

Makkes S, Halberstadt J, Renders C, Bosmans J, Van Der Baan-Slootweg O, Seidell C. Health Effects of Lifestyle Interventions in Obese children and adolescents Study (HELIOS) - a randomised controlled trial. *Obesity Reviews* 2011;**12**:58.

Makkes S, Halberstadt J, Renders C, Bosmans J, van der Baan-Slootweg O, Seidell J. Cost-effectiveness of intensive inpatient treatments for severely obese children and adolescents in the Netherlands; a randomized controlled trial (HELIOS). *BMC Public Health* 2011;**11**(1):518. NTR1678. Het HELIOS onderzoek naar behandeling van kinderen en adolescenten met ernstige obesitas. www.trialregister.nl/trialreg/admin/rctview.asp?TC=1678 Date first registered: 20 February 2009.

NCT00462267 {published data only}

NCT00462267. Examining the feasibility of collaborative care treatment for overweight adolescents (SHINE-Garfield). clinicaltrials.gov/ct2/show/NCT00462267 Date first received: 17 April 2007.

NCT00475163 {published data only}

NCT00475163. Mentors in motion: a physical activity intervention for obese adolescents (MIM). clinicaltrials.gov/ show/NCT00475163 Date first received: 17 May 2007.

Shapiro 1976 {published data only}

Shapiro J. A comparison of various reward and monitoring procedures in the behavioral treatment of overweight children. Dissertation 1976; Vol. 36, issue 11–B:5816–7.

References to ongoing studies

ACTRN12607000632493 {published data only}

ACTRN12607000632493. Active video games to improve body composition and physical activity in children. www.anzctr.org.au/Trial/Registration/TrialReview.aspx?

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 35 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. ACTRN=12607000632493 Date first registered: 12 December 2007.

Maddison R, Foley L, Mhurchu CN, Jull A, Jiang Y, Prapavessis H, et al. Feasibility, design and conduct of a pragmatic randomized controlled trial to reduce overweight and obesity in children: the electronic games to aid motivation to exercise (eGAME) study. *BMC Public Health* 2009;**9**:146. [DOI: 10.1186/1471-2458-9-146]

ACTRN12611000139976 {published data only}

ACTRN12611000139976. Staying fit adolescent weight management study. www.anzctr.org.au/Trial/Registration/ TrialReview.aspx?ACTRN=12611000139976 Date first registered: 7 February 2011.

ACTRN12611000862943 {published data only}

ACTRN12611000862943. Whanau Pakari: a multidisciplinary intervention for child and adolescent obesity. anzctr.org.au/Trial/Registration/TrialReview.aspx? id=343300 Date first registered: 15 August 2011.

ACTRN12613001037796 {published data only}

ACTRN12613001037796. Effect of exercise intensity on cardiac and vascular function, and intra-abdominal fat in obese children and adolescents. www.anzctr.org.au/Trial/ Registration/TrialReview.aspx?ACTRN=12613001037796 Date first registered: 18 September 2013.

ACTRN12615000558527 {published data only}

ACTRN12615000558527. The effectiveness of a community weight management program with a behavioural incentive scheme compared to participation in a standard community weight management program in overweight children on relative weight loss and behaviour change. anzctr.org.au/Trial/Registration/TrialReview.aspx? id=368491 Date first registered: 29 May 2015.

Chew 2016 {published data only}

Chew C, Kelly SM, Rajasegaran K, Oh JY, Lim M, Lim SC, et al. Three month outcome of a family based intervention program for adolescent obesity: the Lite randomised controlled trial. *Obesity Reviews* 2016;17:124.

ChiCTR-TRC-13003501 {published data only}

ChiCTR-TRC-13003501. Lifestyle intervention in obese Chinese adolescents with nonalcoholic fatty liver disease: a randomized controlled study. www.chictr.org.cn/ showprojen.aspx?proj=6059 Date first registered: 21 August 2013.

DRKS00004583 {published data only}

DRKS00004583. Feasibility and efficacy of a weight maintenance treatment approach for adolescent obesity via telephone counseling following an obesity treatment program: a randomized controlled trial. drks-neu.uniklinik-freiburg.de/drks[·]web/navigate.do? navigationId=trial.HTML&TRIAL[·]ID=DRKS00004583 Date first registered: 30 November 2012. Marked J, Herget S, Marschke S, Vogel M, Hilbert A, Bluher S. Weight maintenance treatment approach for adolescent obesity via telephone counseling following an inpatient obesity treatment program - study concept. Obesity Facts Vol. 5:30.

Markert J, Herget S, Marschke S, Lehnert T, Falkenberg C, Blüher S. Case management via telephone counseling and SMS for weight maintenance in adolescent obesity: study concept of the TeAM program. BMC Obesity 2014; Vol. 1, issue 1:8.

Markert J, Herget S, Vogel M, Gausche R, Hilbert A, Bluher S. After care treatment approach for adolescent obesity via telephone counseling following an obesity treatment program-study concept. Hormone Research in Paediatrics Vol. 78:279.

DRKS00005299 {published data only}

DRKS00005299. Impact of resistance versus endurance exercise on anthropometric and metabolic parameters within a standardized one year obesity treatment program for obese children and adolescents. drks-neu.uniklinik-freiburg.de/ drks`web/navigate.do?navigationId=trial.HTML& TRIAL'ID=DRKS00005299 Date first registered: 13 September 2013.

DRKS00006781 {published data only}

DRKS00006781. Feasibility of a media-supported highintensity interval training program for overweight and obese adolescents. drks-neu.uniklinik-freiburg.de/drks^{web/} navigate.do?navigationId=trial.HTML&TRIAL[·]ID= DRKS00006781 Date first registered: 17 September 2014.

DRKS00007879 {published data only}

DRKS00007879. Development and evaluation of a computer-based self-regulation training for obese children and adolescents. drks-neu.uniklinik-freiburg.de/drks`web/ navigate.do?navigationId=trial.HTML&TRIAL`ID= DRKS00007879 Date first registered: 13 July 2015.

EUCTR2009-016921-32-ES {published data only}

EUCTR2009-016921-32-ES. A phase II, randomized, double-blind, placebo-controlled, in parallel groups clinical trial to assess the safety and efficacy of dietary supplementation with tryptophan to achieve weight loss, and its neuropsychological effects in adolescents with obesity. www.clinicaltrialsregister.eu/ctr-search/ search?query=eudract`number:2009-016921-32 Date first registered: not available.

IRCT201012235440N1 {published data only}

IRCT201012235440N1. Effectiveness of a theory-based intervention on obesity-related behaviors, laboratory indices, body composition, body mass index and healthrelated quality of life in overweight adolescents. www.irct.ir/ searchresult.php?id=5440&number=1 Date first registered: 18 February 2011.

IRCT2013103115211N1 {published data only}

IRCT2013103115211N1. Study on the effect of nutrition education and physical activity intervention using social cognitive theory for overweight and obese student girls of middle school of Shahinshahr. www.irct.ir/searchresult.php? id=15211&number=1 Date first registered: 27 November 2013.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 36 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

ISRCTN04152711 {published data only}

ISRCTN04152711. Preventing obesity in young people attending primary dental care settings: an exploratory randomised controlled trial. www.isrctn.com/ ISRCTN04152711 Date first assigned: 24 May 2012. Murphy M, Porter J, Yusuf H, Ntouva A, Newton T, Kolliakou A, et al. Considerations and lessons learned from designing a motivational interviewing obesity intervention for young people attending dental practices: a study protocol paper. *Contemporary Clinical Trials* 2013;**36**(1): 126–34.

NCT00562263 {published data only}

NCT00562263. Barriers to effective weight loss in overweight adolescents (TEENS). clinicaltrials.gov/ct2/ show/NCT00562263 Date first received: 20 November 2007.

NCT00850629 {published data only}

NCT00850629. Hormonal regulation of body weight maintenance. clinicaltrials.gov/ct2/show/NCT00850629 Date first received: 17 February 2009.

NCT00881478 {published data only}

NCT00881478. Family intervention for obese children using portion control strategy for weight control (FOCUS). clinicaltrials.gov/ct2/show/NCT00881478 Date first received: 13 April 2009.

NCT00940966 {published data only}

NCT00940966. A pilot study to determine the efficacy of a low carbohydrate diet in treatment of adolescents with metabolic syndrome. clinicaltrials.gov/ct2/show/ NCT00940966 Date first received: 15 July 2009.

NCT00998413 {published data only}

NCT00998413. Weight-reduction intervention in asthmatic children with overweight/obesity. clinicaltrials.gov/ct2/show/NCT00998413 Date first received: 19 October 2009.

Willeboordse M, van de Kant KD, de Laat MN, van Schayck OC, Mulkens S, Dompeling E. Multifactorial intervention for children with asthma and overweight (Mikado): study design of a randomised controlled trial. *BMC Public Health* 2013;**13**:494. [DOI: 10.1186/1471-2458-13-494]

NCT01023139 {published data only}

NCT01023139. Efficacy in adolescents of continued behavior modification following a six month sibutraminebased weight management intervention (AOS). clinicaltrials.gov/ct2/show/NCT01023139 Date first received: 1 December 2009.

NCT01221220 {published data only}

NCT01221220. Environmental strategies & behavior change to reduce overeating in obese children. clinicaltrials.gov/ct2/show/NCT01221220 Date first received: 13 October 2010.

NCT01350531 {published data only}

NCT01350531. Interventionist procedures for adherence to weight loss recommendations in black adolescents. clinicaltrials.gov/ct2/show/NCT01350531 Date first received: 21 April 2011.

NCT01374386 {published data only}

NCT01374386. Impact of Exergaming on adolescent youth. clinicaltrials.gov/ct2/show/NCT01374386 Date first received: 14 June 2011.

NCT01448551 {published data only}

NCT01448551. MPOWERed messages: tailored mobile messages to enhance weight loss for teens. clinicaltrials.gov/ ct2/show/NCT01448551 Date first received: 5 October 2011.

NCT01456221 {published data only}

NCT01456221. Intervention study with omega-3 fatty acids for weight loss and insulin resistance in adolescents (O3WLIRADOL). clinicaltrials.gov/ct2/show/ NCT01456221 Date first received: 12 October 2011.

NCT01514279 {published data only}

NCT01514279. Ideas moving parents and adolescents to change together (IMPACT). clinicaltrials.gov/ct2/show/ NCT01514279 Date first received: 20 December 2011.

NCT01677923 {published data only}

NCT01677923. Obesity in children and adolescents: associated risks and early intervention (OCA). clinicaltrials.gov/ct2/show/NCT01677923 Date first received: 30 July 2012.

NCT01688453 {published data only}

NCT01688453. Overweight management and social inequalities (PRALIMAP-INES). clinicaltrials.gov/ct2/ show/NCT01688453 Date first received: 7 September 2012.

NCT01764113 {published data only}

NCT01764113. Effect of mindful eating on body mass index in obese adolescents. clinicaltrials.gov/ct2/show/ NCT01764113 Date first received: 7 January 2013.

NCT01794546 {published data only}

NCT01794546. Integrated care for pediatric obesity using telehealth. clinicaltrials.gov/ct2/show/NCT01794546 Date first received: 15 February 2013.

NCT01796067 {published data only}

NCT01796067. Families improving together (FIT) for weight loss. clinicaltrials.gov/ct2/show/NCT01796067 Date first received: 22 January 2013. Wilson D, Kitzman-Ulrich H, Resnicow K, Van Horn M,

George S, Siceloff E, et al. An overview of the Families Improving Together (FIT) for weight loss randomized controlled trial in African American families. *Contemporary Clinical Trials* 2015;**31**(42):145–57.

NCT01804855 {published data only}

NCT01804855. Effectiveness of a smartphone app for adolescent obesity management. clinicaltrials.gov/ct2/ show/NCT01804855 Date first received: 4 March 2013. * O'Malley G, Clarke M, Burls A, Murphy S, Murphy N, Perry I. A smartphone intervention for adolescent obesity: study protocol for a randomised controlled non-inferiority trial. *Trials* 2014;**15**(1):43.

NCT01840631 {published data only}

NCT01840631. A trial to study the effects of group versus individual dietary counseling in pediatric obesity.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 37 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. clinicaltrials.gov/ct2/show/NCT01840631 Date first received: 8 March 2013.

NCT02034994 {published data only}

NCT02034994. Combining primary and secondary prevention for reduction of excessive weight gain in school. clinicaltrials.gov/ct2/show/NCT02034994 Date first received: 10 January 2014.

NCT02086851 {published data only}

NCT02086851. Study of a structured parent intervention on adolescent weight loss modification program. clinicaltrials.gov/ct2/show/NCT02086851 Date first received: 7 February 2014.

NCT02228278 {published data only}

NCT02228278. Healthcare text messaging to improve diet, physical activity and weight loss in a pediatric lipid clinic (Text4Fit). clinicaltrials.gov/ct2/show/NCT02228278 Date first received: 25 August 2014.

NCT02280772 {published data only}

NCT02280772. Effect of glucomannan supplementation on body weight in overweight and obese children. clinicaltrials.gov/ct2/show/NCT02280772 Date first received: 29 October 2014.

* Zalewski B, Szajewska H. Effect of glucomannan supplementation on body weight in overweight and obese children: protocol of a randomised controlled trial. *BMJ Open* 2015;**5**(4):e007244.

NCT02353637 {published data only}

NCT02353637. The Peds Obesity study. clinicaltrials.gov/ ct2/show/NCT02353637 Date first received: 21 January 2015.

NCT02444689 {published data only}

NCT02444689. EMPower: electronic media powering positive health changes in youth. clinicaltrials.gov/ct2/ show/NCT02444689 Date first received: 12 May 2015.

NCT02615353 {published data only}

NCT02615353. Preventing diabetes in Latino youth. clinicaltrials.gov/ct2/show/NCT02615353 Date first received: 4 November 2015.

NCT02687516 {published data only}

NCT02687516. Treatment of severely obese children and adolescents employing "Family-based Behavioral Social Facilitation Treatment". clinicaltrials.gov/ct2/show/ NCT02687516 Date first received: 21 February 2014.

NCT02711488 {published data only}

NCT02711488. Managing adolescent obesity at local level by combining primary and secondary intervention (PAAPAS-DC). clinicaltrials.gov/ct2/show/NCT02711488 Date first received: 15 February 2016.

NCT02745795 {published data only}

NCT02745795. Efficacy of motivational interview in the treatment of obesity and overweight in adolescents (IMAGINE). clinicaltrials.gov/ct2/show/NCT02745795 Date first received: 5 April 2016.

NCT02794090 {published data only}

NCT02794090. Childhood obesity treatment - telephone coaching vc usual care. clinicaltrials.gov/ct2/show/ NCT02794090 Date first received: 31 May 2016.

NTR5676 {published data only}

NTR5676. The focus on strength programme: an innovative strength-based physical activity intervention to improve body composition and to stimulate physical activity in adolescents (12-18years) with overweight or obesity. www.trialregister.nl/trialreg/admin/rctview.asp?TC=5676 Date first registered: 8 February 2016.

Ramalho 2016 {published data only}

Ramalho SM, Conceiçao E, Saint Maurice P, Machado P. Taking the route back: new technologies for overweight and obesity treatment in childhood and adolescence - study protocol. *Obesity Facts* 2016;**9**:368–108.

RBR-38p23s {published data only}

RBR-38p23s. Multifocal intervention in obese adolescents: social competence, behavior problems, academic performance and weight reduction. www.ensaiosclinicos.gov.br/rg/RBR-38p23s/ Date first registered: 23 April 2013.

Spieker 2015 {published data only}

Spieker EA, Sbrocco T, Theim KR, Maurer D, Johnson D, Bryant E, et al. Preventing obesity in the military community (POMC): the development of a clinical trials research network. *International Journal of Environmental Research and Public Health* 2015;**12**(2):1174–95.

TCTR20130515001 {published data only}

TCTR20130515001. Effectiveness of weight reduction program on intrinsic motivation and health related outcomes in overweight secondary school students. apps.who.int/ trialsearch/Trial2.aspx?TrialID=TCTR20130515001 Date first registered: 15 May 2013.

Additional references

Bandura 1997

Bandura, A. Self-efficacy: The exercise of control. New York: Freeman & Co, 1997.

Beller 2013

Beller EM, Chen JK, Wang UL, Glasziou PP. Are systematic reviews up-to-date at the time of publication?. *Systematic Reviews* 2013;2:36. [2046–4053: (Electronic)]

Bocca 2013

Bocca G, Ongering EC, Stolk RP, Sauer PJ. Insulin resistance and cardiovascular risk factors in 3- to 5-year old overweight or obese children. *Hormone Research in Paediatrics* 2013;**80**(3):201–6.

CDC 2000

Centers for Disease Control Growth Charts. Centers for Disease Control Growth Charts. www.cdc.gov/ growthcharts 2000.

CMO 2015

Chief Medical Officer. Annual report of the Chief Medical Officer: surveillance volume, 2012: on the state of the

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 38 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. public's health. www.gov.uk/government/publications/ chief-medical-officer-annualreport-surveillance-volume-2012 (accessed 30 March 2015).

Cole 2000

Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ* 2000;**320**(7244): 1240–3.

Cole 2012

Cole TJ, Lobstein T. Extended international (IOTF) body mass index cut-offs for thinness, overweight and obesity. *Pediatric Obesity* 2012;7(4):284–94.

Collins 2006

Collins C, Warren J, Neve M, McCoy P, Stokes B. Measuring effectiveness of dietetic interventions in child obesity: a systematic review of randomized trials. *Archives of Pediatrics & Adolescent Medicine* 2006;**160**(9):906–22.

Daniels 2009

Daniels SR. Complications of obesity in children and adolescents. *International Journal of Obesity* 2009;**33**(Suppl 1):S60–5.

de Onis 2010

de Onis M, Blössner M, Borghi E. Global prevalence and trends of overweight and obesity among preschool children. *American Journal of Clinical Nutrition* 2010;**92**(5):1257–64.

Dewar 2013

Dewar D, Morgan P, Plotnikoff R, Okely A, Collins C, Batterham M, et al. The nutrition and enjoyable activity for teen girls study: a cluster randomized controlled trial. *American Journal of Preventive Medicine* 2013;**45**(3):313–7.

Doak 2006

Doak C, Visscher T, Renders C, Seidell J. The prevention of overweight and obesity in children and adolescents: a review of interventions and programmes. *Obesity Reviews* 2006;7(1):111–36.

Eady 2008

Eady AM, Wilczynski NL, Haynes RB. PsycINFO search strategies identified methodologically sound therapy studies and review articles for use by clinicians and researchers. *Journal of Clinical Epidemiology* 2008;**61**(1):34–40.

Egan 2013

Egan K, Ettinger A, Bracken M. Childhood body mass index and subsequent physician-diagnosed asthma: a systematic review and meta-analysis of prospective cohort studies. *BMC Pediatrics* 2013;**13**(1):121.

Egbewale 2014

Egbewale BE, Lewis M, Sim J. Bias, precision and statistical power of analysis of covariance in the analysis of randomized trials with baseline imbalance: a simulation study. *BMC Medical Research Methodology* 2014;**14:49**:49. [DOI: 10.1186/1471-2288-14-49]

Ells 2015

Ells LJ, Hancock C, Copley VR, Mead E, Dinsdale H, Kinra S, et al. Prevalence of severe childhood obesity in England: 2006-2013. Archives of Disease in Childhood 2015;100(7):631-6.

Follmann 1992

Follmann D, Elliot P, Suh I, Cutler J. Variance imputation for overviews of clinical trials with continuous response. *Journal of Clinical Epidemiology* 1992;**45**(7):769–73.

Freedman 2006

Freedman DS, Khan LK, Serdula MK, Ogden CL, Dietz WH. Racial and ethnic differences in secular trends for childhood BMI, weight, and height. *Obesity (Silver Spring, Md.)* 2006;**14**(2):301–8.

Glenny 1997

Glenny AM, O'Meara S, Melville A, Sheldon TA, Wilson C. The treatment and prevention of obesity: a systematic review of the literature. *International Journal of Obesity and Related Metabolic Disorders* 1997;**21**(9):715–37.

Griffiths 2010

Griffiths LJ, Parsons TJ, Hill AJ. Self-esteem and quality of life in obese children and adolescents: a systematic review. *International Journal of Pediatric Obesity* 2010;**5**(4): 282–304.

Higgins 2002

Higgins JPT, Thompson SG. Quantifying heterogeneity in a meta-analysis. *Statistics in Medicine* 2002;**21**(11):1539–58.

Higgins 2003

Higgins JPT, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. *BMJ* 2003;**327** (7414):557–60.

Higgins 2009

Higgins JPT, Thompson SG, Spiegelhalter DJ. A reevaluation of random-effects meta-analysis. *Journal of the Royal Statistical Society. Series A, (Statistics in Society)* 2009; **172**(1):137–59.

Higgins 2011a

Higgins JPT, Green S, editor(s). Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 (updated March 2011). The Cochrane Collaboration, 2011. Available from handbook.cochrane.org.

Higgins 2011b

Higgins JPT, Altman DG, Gøtzsche PC, Jüni P, Moher D, Oxman AD, et al. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *BMJ* 2011;**343**: d5928.

Ho 2012

Ho M, Garnett S, Baur L, Burrows T, Stewart L, Neve M, et al. Effectiveness of lifestyle interventions in child obesity: systematic review with meta-analysis. *Pediatrics* 2012;**130**: e1647–71.

Hróbjartsson 2013

Hróbjartsson A, Thomsen AS, Emanuelsson F, Tendal B, Hilden J, Boutron I, et al. Observer bias in randomized clinical trials with measurement scale outcomes: a systematic review of trials with both blinded and nonblinded assessors. *Canadian Medical Association Journal* 2013;**185** (4):E201–11.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 39 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

HSCIC 2015

Health and Social Care Information Centre. National Child Measurement Programme - England, 2012-13 school year. http://content.digital.nhs.uk/catalogue/PUB13115 (accessed 30 March 2015).

Kelly 2008

Kelly S, Melnyk B. Systematic review of multicomponent interventions with overweight middle adolescents: implications for clinical practice and research. *Worldviews* on Evidence-Based Nursing 2008;5(2):113–35.

Kelly 2013

Kelly AS, Barlow SE, Rao G, Inge TH, Hayman LL, Steinberger J, et al. Severe obesity in children and adolescents: identification, associated health risks, and treatment approaches: a scientific statement from the American Heart Association. *Circulation* 2013;**128**(15): 1689–712.

Kirkham 2010

Kirkham JJ, Dwan KM, Altman DG, Gamble C, Dodd S, Smyth R, et al. The impact of outcome reporting bias in randomised controlled trials on a cohort of systematic reviews. *BMJ* 2010;**340**:c365. [DOI: 10.1136/bmj.c365]

Knai 2012

Knai C, Lobstein T, Darmon N, Rutter H, McKee M. Socioeconomic patterning of childhood overweight status in Europe. *International Journal of Environmental Research and Public Health* 2012;**9**(4):1472–89.

Kothandan 2014

Kothandan S. School based interventions versus family based interventions in the treatment of childhood obesity - a systematic review. *Archives of Public Health* 2014;**72**:3.

Leclercq 2013

Leclercq E, Leeflang MM, van Dalen EC, Kremer LC. Validation of search filters for identifying pediatric studies in PubMed. *Journal of Pediatrics* 2013;**162**(3):629–34.

Liberati 2009

Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JPA, et al. The PRISMA statement for reporting systematic and meta-analyses of studies that evaluate interventions: explanation and elaboration. *PLoS Medicine* 2009;**6**(7):1–28. [DOI: 10.1371/journal.pmed.1000100]

Lobstein 2004

Lobstein T, Baur L, Uauy R. Obesity in children and young people: a crisis in public health. *Obesity Reviews* 2004;**5** (Suppl 1):4–104.

MacDonell 2010

MacDonell K, Ellis D, Naar-King S, Cunningham P. Predictors of home-based obesity treatment efficacy for African American youth. *Children's Health Care* 2010;**39** (1):1–4.

McGovern 2008

McGovern L, Johnson J, Paulo R, Hettinger A, Singhal V, Kamath C, et al. Treatment of pediatric obesity: a systematic review and meta-analysis of randomized trials.

Journal of Clinical Endocrinology & Metabolism 2008;93 (12):4600–5.

Meader 2014

Meader N, King K, Llewellyn A, Norman G, Brown J, Rodgers M, et al. A checklist designed to aid consistency and reproducibility of GRADE assessments: development and pilot validation. *Systematic Reviews* 2014;**3**:82.

Narang 2012

Narang I, Mathew JL. Childhood obesity and obstructive sleep apnea. *Journal of Nutrition and Metabolism* 2012; **2012**:134202. [DOI: 10.1155/2012/134202; PUBMED: 22957216]

Ng 2014

Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis of the Global Burden of Disease Study 2013. *Lancet* 2014;**384**(9945):766–81.

NICE 2013

National Institute for Health and Care Excellence. Weight management: lifestyle services for overweight or obese children and young people. NICE Guidelines PH47, 2013. www.nice.org.uk/guidance/ph47 (accessed 24 May 2017).

NOO NHS 2011

National Obesity Observatory on behalf of the Public Health Observatories in England. A simple guide to classifying body mass index in children, 2011. www.noo.org.uk/uploads/doc/ vid'11601'A'simple'guide'to 'classifying'BMI'in'children.pdf (accessed 3 November 2015).

Olds 2011

Olds T, Maher C, Zumin S, Péneau S, Lioret S, Castetbon K, et al. Evidence that the prevalence of childhood overweight is plateauing: data from nine countries. *International Journal of Pediatric Obesity* 2011;**6**(5-6): 342–60.

Orsi 2011

Orsi C, Hale D, Lynch, J. Pediatric obesity epidemiology. *Current Opinion in Endocrinology, Diabetes and Obesity* 2011;**18**(1):14–22.

Parsons 1999

Parsons TJ, Power C, Logan S, Summerbell CD. Childhood predictors of adult obesity: a systematic review. *International Journal of Obesity* 1999;23(Suppl 8):S1–S107.

Paulis 2014

Paulis WD, Silva S, Koes BW, van Middelkoop M. Overweight and obesity are associated with musculoskeletal complaints as early as childhood: a systematic review. *Obesity Reviews* 2014;**15**(1):52–67.

Peirson 2015

Peirson L, Fitzpatrick-Lewis D, Morrison K, Warren R, Ali M, Raina P. Treatment of overweight and obesity in children and youth: a systematic review and meta-analysis. *CMAJ Open* 2015;**3**(1):E35.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 40 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Penedo 2005

Penedo F, Dahn J. Exercise and well-being: a review of mental and physical health benefits associated with physical activity. *Current Opinion in Psychiatry* 2005;**18**(2):189–93.

Puhl 2007

Puhl RM, Latner JD. Stigma, obesity, and the health of the nation's children. *Psychology Bulletin* 2007;**133**(4):557–80.

Rajput 2014

Rajput N, Tuohy P, Mishra S, Smith A, Taylor B. Overweight and obesity in 4-5-year-old children in New Zealand: results from the first 4 years (2009-2012) of the B4School Check programme. *Journal of Paediatrics and Child Health* 2014;**51**(3):334–43.

Reilly 2003

Reilly JJ, Methven E, McDowell ZC, Hacking B, Alexander D, Stewart L, et al. Health consequences of obesity. *Archives of Diseases in Childhood* 2003;**88**(9):748–52.

Riley 2011

Riley RD, Higgins JP, Deeks JJ. Interpretation of random effects meta-analyses. *BMJ* 2011;**342**:d549.

Rokholm 2010

Rokholm B, Baker JL, Sørenson TI. The levelling off of the obesity epidemic since the year 1999 - a review of evidence and perspectives. *Obesity Reviews* 2010;**11**(12):835–46.

Ruotsalainen 2015

Ruotsalainen H, Kyngäs H, Tammelin T, Kääriäinen M. Systematic review of physical activity and exercise interventions on body mass indices, subsequent physical activity and psychological symptoms in overweight and obese adolescents. *Journal of Advanced Nursing* 2015;1(11): 2461–77.

Shrewsbury 2008

Shrewsbury V, Wardle J. Socioeconomic status and adiposity in childhood: a systematic review of cross-sectional studies 1990-2005. *Obesity (Silver Spring, Md.)* 2008;**16**(2): 275–84.

Singh 2008

Singh AS, Mulder C, Twisk JW, van Mechelen W, Chinapaw MJ. Tracking of childhood overweight into adulthood: a systematic review of the literature. *Obesity Reviews* 2008;**9** (5):474–88.

Skinner 2014

Skinner AC, Skelton JA. Prevalence and trends in obesity and severe obesity among children in the United States, 1999-2012. *JAMA Pediatrics* 2014;**168**(6):561–6.

Spear 2007

Spear B, Barlow S, Ervin C, Ludwig D, Saelens B, Schetzina K, et al. Recommendations for treatment of child and adolescent overweight and obesity. *Pediatrics* 2007;**120**(4): S254–88.

Sterne 2011

Sterne JA, Sutton AJ, Ioannidis JP, Terrin N, Jones DR, Lau J, et al. Recommendations for examining and interpreting funnel plot asymmetry in meta-analyses of randomised controlled trials. *BMJ* 2011;**343**:d4002.

Stuart and Stevenson 1959

Stuart HC, Stevenson SS, Nelson WE. *Textbook of pediatrics*. Philadelphia: Saunders, 1959.

Tang-Peronard 2008

Tang-Peronard JL, Heitmann BL. Stigmatization of obese children and adolescents, the importance of gender. *Obesity Reviews* 2008;9(6):522–34.

Wang 2012

Wang Y, Lim H. The global childhood obesity epidemic and the association between socio-economic status and childhood obesity. *International Review of Psychiatry* 2012; **24**(3):176–88.

Whitaker 1997

Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. *New England Journal of Medicine* 1997; **337**(13):869–73.

White 2004

White M, Martin P, Newton R, Walden H, York-Crowe E, Gordon S, et al. Mediators of weight loss in a family-based intervention presented over the Internet. *Obesity Research* 2004;**12**(7):1050–9.

Whitlock 2010

Whitlock E, O'Connor E, Williams S, Beil T, Lutz K. Effectiveness of weight management interventions in children: a targeted systematic review for the USPSTF. *Pediatrics* 2010;**125**:396–418.

WHO 2002

World Health Organization. Report of a Joint WHO/FAO Expert Consultation. Diet nutrition and the prevention of chronic diseases. http://www.who.int/dietphysicalactivity/ publications/trs916/en/. Geneva, Switzerland, 2002.

WHO 2009

WHO. WHO AnthroPlus for personal computers manual: software for assessing growth of the world's children and adolescents. http://www.who.int/growthref/tools/ who'anthroplus manual.pdf 2009.

WHO 2015a

World Health Organization. Fact sheet on overweight and obesity. www.who.int/mediacentre/factsheets/fs311/en (accessed 30 March 2015).

WHO 2015b

World Health Organization. The WHO child growth standards. www.who.int/childgrowth/publications/

technical report pub/en/ (accessed 30 March 2015).

WHO 2015c

World Health Organization. http://www.who.int/endchildhood-obesity/interim-report-for-comment/en/. (accessed 5 June 2017).

Wilfley 2007

Wilfley D, Tibbs T, Van Buren D, Reach K, Walker M, Epstein L. Lifestyle interventions in the treatment of childhood overweight: a meta-analytic review of

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 4 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

41

randomized controlled trials. *Health Psychology* 2007;**26**(5): 521.

Wong 2006a

Wong SS, Wilczynski NL, Haynes RB. Developing optimal search strategies for detecting clinically sound treatment studies in EMBASE. *Journal of the Medical Library Association* 2006;**94**(1):41–7.

Wong 2006b

Wong SS, Wilczynski NL, Haynes RB. Optimal CINAHL search strategies for identifying therapy studies and review articles. *Journal of Nursing Scholarship* 2006;**38**(2):194–9.

Wood 2008

Wood L, Egger M, Gluud LL, Schulz KF, Juni P, Altman DG, et al. Empirical evidence of bias in treatment effect estimates in controlled trials with different interventions

and outcomes: meta-epidemiological study. *BMJ* 2008;**336** (7644):601–5.

References to other published versions of this review

Oude Luttikhuis 2009

Oude Luttikhuis H, Baur L, Jansen H, Shrewbury VA, O'Malley C, Stolk RP, et al. Interventions for treating obesity in children. *Cochrane Database of Systematic Reviews* 2009, Issue 1. [DOI: 10.1002/14651858.CD001872.pub2]

Summerbell 2003

Summerbell CD, Ashton V, Campbell KJ, Edmunds L, Kelly S, Waters E. Interventions for treating obesity in children. *Cochrane Database of Systematic Reviews* 2003, Issue 3. [DOI: 10.1002/14651858.CD001872]

* Indicates the major publication for the study

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 42 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Bean 2014

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design	
Participants	Inclusion criteria : aged 11-18 years; BMI \geq 85th percentile for age and gender (CDC 2000); parent willing to participate; an identified primary care physician; no underlying medical condition which would preclude weight loss through behavioural intervention Exclusion criteria : - Diagnostic criteria : as above	
Interventions	Number of study centres: one Treatment before study: all participants had been enrolled in the TEENS RCT. Parents attended biweekly groups. Participants met on alternating weeks with a dietitian and behavioural support specialist for 6 months. Supervised physical activity at least 3 times per week Description of interventions MI Values : 3 main components of TEENS family-based intervention are physical activity, dietary intervention and behaviour support. MI Values targets adolescents alone to enhance autonomy for change. 2 × 30-minute sessions at weeks 1 and 10. Trained interventionists were independent of TEENS. Participants selected target behaviours and included TEENS participation, diet, exercise or a combination. Session 1 included a values clarification exercise, session 2, explored progress in TEENS, re-examined value/ behaviour congruency and elicited participant ideas for change Education control : 30-minute videos focused on healthy eating and exercise for ado- lescents at weeks 1 and 10. Participants complete a knowledge quiz to ensure treatment adherence All participants proceeded with TEENS multidisciplinary obesity treatment programme as usual	
Outcomes	Outcomes reported in abstract of publication : adherence (overall, dietitian visits, behavioural support visits)	
Study details	Run-in period: none Study terminated early: no Trial identifier: NCT00167830	
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal	
Stated aim for study	Quote from publication: "to investigate if brief (two-session) MI can enhance treatment effects among adolescents with obesity enrolled in a multidisciplinary treatment [the T. E.E.N.S. (Teaching Encouragement Exercise Nutrition Support) Program]."	
Notes	Implemented within the TEENS programme. Publication reported no eligible outcomes	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 43 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Bean 2014 (Continued)

Risk of bias

Bias	Authors' judgement	Support for judgement	
Random sequence generation (selection bias)	Low risk	Quote from publication: "participants are randomized to treatment condition using a random number generator" Comment: appropriate	
Allocation concealment (selection bias)	Unclear risk	Comment: no details	
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Quote from publication: "T.E.E.N.S. in- terventionists (dietitian and behavioral support specialists) are blind to participant treatment condition" Comment: suggests that the MI interven- tionists were unblinded	
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment: no details but low risk of bias for objective outcomes	
Incomplete outcome data (attrition bias) Objective outcomes	Unclear risk	Quote from publication: "Ninety-nine par- ticipants were randomized and completed baseline assessments" Comment: no details of numbers ran- domised who did not complete baseline as- sessments	
Selective reporting (reporting bias)	Unclear risk	Comment: limited outcomes published to date, study reports that BMI-percentile to be published	
Other bias	Unclear risk	Comment: trial reported no data and it was unclear if they tested for interaction	

Boodai 2014

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design
Participants	Inclusion criteria : aged 10-14 years, obese (BMI) > 95th percentile, have at least 1 parent who expressed a willingness to attend the intervention, no serious underlying medical condition that might be either a cause or consequence of their obesity Exclusion criteria : non-obese, major disease, underlying pathological cause of obesity, aged < 10 years or > 14 years at study inception, not attending a mainstream school in the public sector, unable or unwilling to attend treatment sessions if randomised to intervention group Diagnostic criteria : as above

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 44 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Boodai 2014 (Continued)

Interventions	Number of study centres: one Treatment before study: none Description of interventions Low-intensity group programme : 6 sessions of 1 hour. Delivered by a physician with specialist training in nutrition and a dietitian. Programme adapted from the Scottish Childhood Obesity Treatment Trial. Treatment materials were provided. Sessions focused on changing behaviours such as reduction in sedentary behaviour (screen-media use); diet (used a modified 'traffic light diet' reference given); promotion of physical activity Theoretically based on behaviour change techniques to all 3 of the targeted behaviours (including self-monitoring of sedentary behaviour; identifying the main barriers to be- haviour change; problem solving; goal setting; relapse prevention). Ideally at least 1 par- ent should have been present The intervention group split into boys (n = 21) and girls (n = 20) in accordance with cultural norms of Kuwait. Sessions were delivered on 2 consecutive days Control : informed that they were obese and advised to attend primary care
Outcomes	Outcomes reported in abstract of publication: BMI z score
Study details	Run-in period: none Study terminated early: no
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal Trial identifier: ISRCTN37457227
Stated aim for study	Quote from publication: "to test the hypothesis that a 'good practice' intervention for the treatment of adolescent obesity in Kuwait would have a greater effect on primary and secondary outcomes than allocation to a control group. The secondary aims were to test the feasibility of conducting such a trial in Kuwait and to test the feasibility of using a good practice intervention and referral to primary care as a control condition."
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication: "computer gener- ated randomisation list that allocated par- ticipants to intervention or control group, with participants balanced for gender in blocks of 10." Comment: appropriate
Allocation concealment (selection bias)	Low risk	Quote from publication: "participants as- signed a unique study code prior to random allocation To ensure concealment of al-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 45 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Boodai 2014 (Continued)

		location, codes were sent electronically to a statistician (JHM) who produced a com- puter generated randomisation list." Comment: appropriate
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Quote from publication: "The statistician informed the researcher responsible for de- livering the intervention (SAB) of the allo- cation, and families were invited to inter- vention or control groups as appropriate." Comment: investigator-assessed
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from publication: "Outcome mea- sures were made by the same trained re- search assistants who were blinded to group allocation and were not involved in deliv- ery of the treatment intervention." Comment: investigator-assessed
Incomplete outcome data (attrition bias) Objective outcomes	Unclear risk	Quote from publication: "The analysis was intention-to-treat, where we used data from all adolescents for whom data were available on the basis of the group to which they were allocated, regardless of their adherence to the protocol (attendance)." Comment: reported and reasons explained ITT is a modified ITT as only those who had data were included
Selective reporting (reporting bias)	High risk	Comment: quality of life, blood lipids, fat- mass and fat-free mass not reported
Other bias	Unclear risk	Comment: no participants in the control arm attended primary care and received the intervention

Brennan 2013

Methods	Cross-over RCT, randomisation ratio: 1:1, superiority design
Participants	Inclusion criteria: aged 11-19 years, overweight or obese according to the international cut-off points for BMI in children, living with a parent or adult carer who was prepared to be involved in treatment Exclusion criteria: had an intellectual or physical disability that prevented them from participating in the programme Diagnostic criteria: as above

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 46 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Interventions	Number of study centres: 2 Treatment before study: none Description of interventions M: individual sessions aimed at improving body composition, cardiovascular fitness, im- prove eating habits, physical activity habits and promote positive psychosocial function- ing by moving participants closer to the Australian recommendations. The programme aimed to instigate small maintainable improvements. Theoretical basis Sessions included a review of the previous session, discussion of homework, goal achieve- ment and monitoring; discussion, questions and practice of strategies; setting of exer- cises for the session and assisted with setting goals; summary of the session material and setting of home practice tasks. Adolescents were then given the choice of attending the remaining sessions alone, or with the support of a parent. 12 sessions over 4-6 months (psycho-education; eating behaviour; physical activity; healthy food choices; exercise; behaviour charts and barriers; recognising thoughts and emotions; helpful thoughts and emotions; assertive communication; problem solving and planning; staying on track; maintenance and closure). Between session 11 and 12 had a telephone call, maintaining change. Weekly sessions for the first 10 weeks Parents and adolescents received a programme workbook. Between sessions, adolescents were encouraged to monitor their behaviour change goals and record their eating and physical activity habits. The physical activity component aimed to promote physical activity habits consistent with guidelines recommending at least 60 minutes of mod- erate-to-vigorous physical activity per day and no more than 2 hours per day in non- educational screen activities. Rather than specifying goals in terms of specific caloric intake or expenditure targets, aimed to move participants closer to recommendations for eating such as consumption of a variety of foods from each of the 5 food groups (cereals, vegetables, fruit, diary, and meat products and alternatives), the selection of low- fat alternatives, and
	Parental support: provided with written session materials for sessions 7 (strengthening parent adolescent relationship), 8 (encouraging appropriate behaviour) and 9 (discour- aging inappropriate behaviour) Maintenance phase: while the control group given the intervention telephone call sessions were completed every second week and a face-to-face session at 3 months which was followed by monthly telephone call session and a final face-to-face session conducted at 6 months Researcher received training in MI Control : wait list control - offered the intervention after 6 months (postintervention)
Outcomes	Outcomes reported in abstract of publication : weight control behaviour, impulse regulation, social support from family and parent-adolescent problem communication, treatment acceptability, body composition (body fat, % body fat, lean mass) and anthropometric measures (weight, BMI, BMI-for-age z score and percentiles), cardiovascular fitness
Study details	Run-in period: none Study terminated early: no Trial identifier: ACTRN12610000111077

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 47 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Brennan 2013 (Continued)

Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal
Stated aim for study	Quote from publication: "evaluate the efficacy of the CHOOSE HEALTH program, a family based cognitive behavioural lifestyle program targeting improved eating and activity habits, in improving body composition, cardiovascular fitness, eating and activity behaviours in overweight and obese adolescents; 2) to explore the impact of The CHOOSE HEALTH Program on psychosocial wellbeing in overweight and obese adolescents."
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote from publication: "After completing all assessments, participants were asked to select a number between 1 and 3 and the selected number was compared to an inves- tigator randomly selected number, which was then used to allocate the participant to the treatment or control condition." Comment: unclear how the investigator number was randomly selected or how the combination of these 2 elements produced an allocation
Allocation concealment (selection bias)	Unclear risk	Comment: no details
Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	Comment: no details. The reliance on self- report data to measure psychosocial factors, and the use of indirect self-report measures of physical activity and energy intake, may result in self-report biases
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment: no details
Blinding of outcome assessment (detection bias) Subjective outcomes	Low risk	Quote from publication: "Assessors and ob- servers were blind to participant's group allocation, treatment adherence, and stage of intervention. The treating clinician was not involved in physical assessment ses- sions. The analysis of all monitoring data was completed by an independent research

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 48 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Brennan 2013 (Continued)

		assistant who was blind to treatment stage and condition." Comment: appropriate
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from publication: "Assessors and ob- servers were blind to participant's group allocation, treatment adherence, and stage of intervention. The treating clinician was not involved in physical assessment ses- sions. The analysis of all monitoring data was completed by an independent research assistant who was blind to treatment stage and condition." Comment: appropriate
Incomplete outcome data (attrition bias) Subjective outcomes	Low risk	Comment: reasons for dropout unclear. Intervention group was larger and had a higher % of dropouts compared to the con- trol group. Complete valid data were not available for all measures or participants. It is possible that the non-completers differed from the completers in important ways and consequently results were not representa- tive of those obtained had the entire sample completed all assessments. ITT was used with first value carried forward method
Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Comment: reasons for dropout unclear. Intervention group was larger and had a higher % of dropouts compared to the con- trol group. Complete valid data were not available for all measures or participants. It is possible that the non-completers differed from the completers in important ways and consequently results were not representa- tive of those obtained had the entire sample completed all assessments. ITT was used with first value carried forward method
Selective reporting (reporting bias)	High risk	Comment: psychosocial outcomes not published
Other bias	Unclear risk	Comment: the lead author was both the clinician and evaluator which may result in an evaluator bias

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 49 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. Brownell 1983

Methods	Parallel RCT, randomisation ratio: 1:1:1, superiority design		
Participants	Inclusion criteria : aged 12-16, \geq 20% mean weight for age, gender and height; free of medical conditions or medications that would influence body weight, not involved in other formal weight loss programmes, able to attend all sessions with their mothers. Mothers could be any weight Exclusion criteria : - Diagnostic criteria : -		
Interventions	Number of study centres: 1 Treatment before study: - Description of interventions Programme of behaviour modification, nutrition education, exercise instruction and social support, described in a treatment manual. 16 weekly sessions 45- to 60-minutes' duration, groups of 5-8. Discussed the week's didactic material and matters such as feelings about being overweight, family difficulties and food preparation Follow-up sessions every 2 months during 1-year maintenance period Each parent deposited USD15: USD10 refunded if all treatment sessions were attended, and USD5 refunded for attendance at follow-up meetings. Mothers also paid USD3 fee before each meeting. As an incentive, each child deposited USD8 at the start of each month during treatment; USD2 was returned to the child each week ≥ 1 lb was lost Trainer was a Masters level psychologist and a Doctoral level psychologist Mother-child separately : mothers and children met concurrently in separate groups Mother-child together : attended all treatment sessions and met together in the same group Child alone : children met in groups, but the mothers did not take part in the formal treatment programme		
Outcomes	Outcomes reported in abstract of publication: weight loss, blood pressure		
Study details	Run-in period: orientation session prior to programme Study terminated early: no Trial identifier: -		
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal		
Stated aim for study	Quote from publication: "to test three methods of parent involvement in the treatment of obese adolescents aged 12 to 16 years. Short-term and long-term changes in weight and blood pressure were assessed."		
Notes			
Risk of bias			
Bias	Authors' judgement	Support for judgement	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 50 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Brownell 1983 (Continued)

Random sequence generation (selection bias)	Unclear risk	Quote from publication: "assigned ran- domly from stratified blocks." Comment: method of randomisation not stated
Allocation concealment (selection bias)	Unclear risk	Comment: not reported
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment: not reported
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment: not reported but low risk of bias from objective outcomes
Incomplete outcome data (attrition bias) Objective outcomes	Unclear risk	Comment: missing data reported but rea- sons not explained
Selective reporting (reporting bias)	Unclear risk	Comment: outcomes reported as in meth- ods, but protocol not available
Other bias	Low risk	Comment: no other bias

Carraway 2014

Methods	Parallel RCT, randomisation ratio: -, superiority design
Participants	Inclusion criteria : male and female adolescents aged 12-17 years, who were at or above the 85th percentile for BMI based on age and gender, willing and able to complete 3 sets of physical and questionnaire assessments (at baseline, postintervention and follow-up), come to the gym 3 times per week to exercise with their assigned mentor for the duration of 3 months Exclusion criteria : - Diagnostic criteria : as above
Interventions	Number of study centres: 1 Treatment before study: none Description of interventions Mentor : mentor-led exercise programme Control : wait list control
Outcomes	Outcomes reported in abstract of publication: perceived athletic competence, physical activity, social anxiety, social support
Study details	Run-in period: none Study terminated early: no

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 51 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Carraway 2014 (Continued)

Publication details	Language of publication: English Unclear funding Publication status: unpublished thesis Trial identifier: -
Stated aim for study	Quote from publication: "the purpose of the current pilot study was to assess whether adding a group-based component to increase problem-solving skills, communication skills, parental social support, and problem-focused coping with teasing as a part of a mentor-led exercise intervention (MENTOR+CBT) would decrease social avoidance, improve social support, and increase perceived competence for physical activity as well as physical activity level in obese adolescents beyond the effects of mentor-led exercise alone (MENTOR only)."
Notes	Relevant for this review is MENTOR only vs wait list control. The second cohort examining MENTOR + CBT are not randomised. Contacted author (17 January 2017) for stratified outcomes and risk of bias

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No details
Allocation concealment (selection bias)	Unclear risk	No details
Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	No details
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	No details
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	No details
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : not specified; however, low risk of bias for objective outcomes
Incomplete outcome data (attrition bias) Subjective outcomes	Low risk	Comment: dropouts described. Attrition low for both groups but different between groups with 9% in the intervention group and 15% in the control group

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 52 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Carraway 2014 (Continued)

Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Comment: dropouts described. Attrition low for both groups but different between groups with 9% in the intervention group and 15% in the control group
Selective reporting (reporting bias)	Unclear risk	Comment : insufficient information to judge
Other bias	Unclear risk	Comment: insufficient information to judge

Carrel 2005

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design
Participants	Inclusion criteria: BMI > 95th percentile for age Exclusion criteria: - Diagnostic criteria: as above
Interventions	 Number of study centres: unclear Treatment before study: none Description of interventions Behaviour changing-focused, fitness-oriented gym classes : class size limited to 14 students to allow for increased instructor attention, increased opportunity for motivation and less time standing in line. The curriculum was personalised to match the student's skill levels and encourage student participation. Competitive games were de-emphasised, and behaviour changing focused activities (walking, cycling and snowshoeing) were encouraged. A consistent warm-up plan brought students into movement participation as quickly as possible soon after they entered the gym. Typical movement time was 42 minutes of a 45-minute class period, as children did not change clothes for this class to increase activity time. Skills were taught with the class broken down into groups of 2 for promoting more movement and less time watching. The ethos of the class encouraged physical fitness, less self-conscious focus on appearance and full group participation. Training for instructors not stated Standard gym classes : movement time averaged 25 minutes of the 45-minute period. Participated in the traditional physical education classes of 35-40 students. The same class topics (e.g. football, mile run/walk, kickball) were taught as in the intervention group, but in a different format, as typical issues in the traditional class were a greater range of skill levels, longer lines during skill development drills and larger numbers of students on teams when games were played. These issues tended to result in less movement and a tendency for students to hold back and not enter into play For both groups: 36-week (9-month) intervention, 90 sessions. The frequency of classes was 5 times every 2 weeks for a 45-minute class period. All received a small nutrition education component. This consisted of educational handouts to participants to develop healthier eating habits. The nutrition portion focuses on t

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 53 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Carrel 2005 (Continued)

Outcomes	Outcomes reported in abstract of publication : BMI, % body fat, VO _{2max} , insulin level	
Study details	Run-in period: - Study terminated early: no Trial identifier: -	
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal	
Stated aim for study	Quote from publication: "To determine whether a school-based fitness program can improve body composition, cardiovascular fitness level, and insulin sensitivity in over- weight children"	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication: "randomly as- signed," "using a random number genera- tor from our statistician." Comment: appropriate
Allocation concealment (selection bias)	Unclear risk	Comment : no details
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Quote from publication : "participants were not blinded to their intervention (they knew if they were in the intervention or control class)." Comment: high risk of performance bias
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : not specified; however, low risk of bias for objective outcomes
Incomplete outcome data (attrition bias) Objective outcomes	High risk	Comment : dropouts only in control arm (differential attrition between groups), rea- sons provided, baseline characteristics only reported on completers
Selective reporting (reporting bias)	Low risk	Comment : no CT record; however, author confirmed "reported all outcomes."
Other bias	Low risk	Comment : no other bias

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 54 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. Chandra 1968

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design	
Participants	Inclusion criteria : not clearly mentioned: 43 children with simple nutritional obesity were enrolled. All had a weight excess of $\geq 20\%$ more than the 50th percentile for American boys and girls (Stuart and Stevenson 1959) Exclusion criteria : - Diagnostic criteria : as above	
Interventions	Number of study centres: 1 Treatment before study: none, observed for 1 month prior to trial Description of interventions Intervention (low-calories formula) : low-calorie formula using Limical (Sarabhai Chemicals) for 1 day (4 servings) contains proteins 70 g, fat 20 g, Carbohydrate 110 g Control : given a low-calorie diet without the aid of Limical All participants received general instructions such as abstention from sweets, chocolates, cakes, ice-cream and potatoes. Advised not to take any snacks in between meals but the number of meals was not reduced	
Outcomes	Outcomes reported in abstract of publica	ation : no abstract
Study details	Run-in period: children were observed for 1 month before being included in trial Study terminated early: no Trial identifier: -	
Publication details	Language of publication: English Other funding: "Limical was supplied in generous quantities through the courtesy of Dr. Barbhaiya, Medical Director, Sarabhai Chemicals, for which the author is grateful." Publication status: peer-reviewed journal	
Stated aim for study	Comment: n o stated aims	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote from publication: "By a random allocation, they were assigned to the two groups." Comment: no further details
Allocation concealment (selection bias)	Unclear risk	Quote from publication: "By a random allocation, they were assigned to the two groups." Comment: no further details
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment: nothing stated

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 55 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Chandra 1968 (Continued)

Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment: nothing stated, objective out- comes unlikely to be affected by lack of blinding
Incomplete outcome data (attrition bias) Objective outcomes	Unclear risk	Comment: unclear why the sample fell from 43 to 35 at 3 and 7 months
Selective reporting (reporting bias)	Unclear risk	Comment: only mean weight loss reported
Other bias	Low risk	Comment : no other bias

Christie 2011

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design
Participants	Inclusion criteria : aged 13-17 years living in Greater London, UK, Obese defined as BMI > 98th centile for BMI using the UK 1990 growth reference Exclusion criteria : significant mental health problems; chronic illness (asthma permitted as long has not more than 1 course of oral steroids in preceding 3 months or on 2nd dose or more of inhaled steroids); known secondary obesity, monogenic obesity syndrome or use of medications known to promote obesity; significant learning disability; insufficient command of English language; previous participation in behavioural weight management programmes in the past 12 months (excluding commercial programmes such as Weight Watchers); BMI $\geq 40 \text{ kg/m}^2$ Diagnostic criteria : as above
Interventions	 Number of study centres: 1 Treatment before study: none Description of interventions HELP : a solution-focused and motivational weight management programme based on national guidelines. Young people and families attended 12 × 40- to 45-minute sessions over 6 months. 4 components: modifying eating behaviours and encouraging regular eating patterns; decreasing sedentary behaviour and increasing behaviour changing and programme activity; reducing intake of energy dense foods, and increasing healthy nutritional choices; addressing emotional eating triggers. Providers (trained Graduate Health Workers) received training in specific MI techniques and use of solution-focused questioning. Used manual to enable delivery in a standardised manner by all the providers Control : enhanced standard care, 1 prewritten standardised educational session delivered to young people within 3 months of recruitment by a practice nurse. The session lasted 40 minutes (although the abstract stated 2 hours) and incorporated standard national guidance and published information on obesity, addressing eating behaviours, healthy activity levels and healthy eating patterns. No training in delivery style offered Recruitment compensation: all participants received a voucher (GBP20) and travel costs

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 56 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Christie 2011 (Continued)

Outcomes	Outcomes reported in abstract of publication : BMI, BMI z score, fat mass, self-esteem, eating behaviours, quality of life, process evaluation, association of pulse wave velocity (proxy for arterial stiffness) and breathlessness score post-step test, self-reported exertion	
Study details	Run-in period: none Study terminated early: no Trial identifier: ISRCTN99840111	
Publication details	Language of publication: English Non-commercial funding Publication status: journal supplement	
Stated aim for study	Quote from publication: "To assess whether a motivational multi-component lifestyle intervention delivered in the community was effective in reducing body mass index (BMI) and improving related health outcomes in obese adolescents."	
Notes	Data reported in 2 abstracts only, therefore limited information available. Main source of information was a published protocol	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication: "Randomisa- tion to the HELP Trial is performed using a secure website." Comment: appropriate
Allocation concealment (selection bias)	Low risk	Quote from publication: "Randomisa- tion will be undertaken independently of the investigators." Comment: third party allocation to groups undertaken
Blinding of participants and personnel (performance bias) Subjective outcomes	High risk	Comment: self-reported outcome mea- surement
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Comment: investigator-assessed
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	Comment: self-reported outcome mea- surement

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 57 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Christie 2011 (Continued)

Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from publication: "assessments will be undertaken blind to allocation sta- tus." Comment: investigator-assessed
Incomplete outcome data (attrition bias) Subjective outcomes	Unclear risk	Comment: missing data not reported for each group separately, stated used ITT principles
Incomplete outcome data (attrition bias) Objective outcomes	Unclear risk	Comment: missing data not reported for each group separately, stated used ITT principles
Selective reporting (reporting bias)	Unclear risk	Comment : data not fully published, avail- able in 2 abstracts only
Other bias	Low risk	Comment: no other bias

Daley 2005

Methods	Parallel RCT, randomisation ratio: 1:1:1, superiority design
Participants	Inclusion criteria : clinically obese and aged 11-16 years (BMI centile > 98th UK stan- dard), no medical condition that would restrict ability to be active 3 times per week for 8 weeks, not diagnosed with insulin-dependent diabetes or receiving oral steroids Exclusion criteria : medical conditions that would restrict the ability to be active 3 times per week for 8 weeks, unwillingness to attend supervised exercise sessions 3 times per week for 8 weeks, major cognitive or psychiatric impairments, and diagnosis of insulin- dependent diabetes mellitus or oral steroid treatment Diagnostic criteria : as above
Interventions	Number of study centres: 1 Treatment before study: none Description of interventions Exercise counselling : knowledge and psychological skills and tools to sustain changes in their exercise behaviour (Transtheoretical Model) to promote positive exercise attitudes and experiences. 8 weeks, hourly sessions (1-4: focus on cognitive-based intervention strategies such as cognitive reappraisal and consciousness raising; 5-8, more behavioural- based interventions were introduced, e.g. goal setting, self-monitoring and finding social support). Participants followed a broad structured curriculum of topics over the course of the intervention (provided in the protocol) Encouraged participants to discuss their thoughts and feelings about exercise, to assist with problem-solving. Weight loss per se was not an intervention goal and no weight loss targets were set, although sensible eating habits were encouraged as part of the exercise therapy intervention Offered a range of aerobic exercise modalities, such as stepping, cycling, seated rowing, dance mat and walking, and asked to exercise intermittently for 30 minutes (4-minute

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 58 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Daley 2005 (Continued)

	warm up, 4 minutes' moderate intensity at 40-59% heart rate reserve, 2 minutes' rest between each bout), 3 times per week for 8 weeks. Mini games also included A GBP25 sports store voucher was given to participants at the end of the intervention phase, and a contribution of GBP2.50 toward travel expenses to attend intervention sessions and assessments was made for each visit to the trial centre. An additional GBP10 sports store voucher was given to participants when they completed their final follow- up assessment Training of interventionists not reported Exercise placebo : 24 sessions over 8 weeks; performed light body-conditioning/stretch- ing exercises, during which heart rate was maintained at 40% of heart rate reserve, and no exercise counselling or behavioural change advice was given. Also, participated in other sedentary activities, such as balance and catching tasks, pool, darts and table football Control : usual care group continued with their lives as usual; were given the opportunity to complete exercise sessions at the centre once they had completed the study
Outcomes	Outcomes reported in abstract of publication : Children's Depression Inventory score, physical self-worth, self-esteem, and physical activity over time, BMI
Study details	Run-in period: none Study terminated early: no Trial identifier: ISRCTN83888112
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal
Stated aim for study	Quote from publication: "The primary aim of SHOT [SHeffield Obesity Trial] is to examine the effects of a supervised exercise therapy intervention in young people who are obese."
Notes	For the purpose of the review, we combined the exercise placebo group and control group as the exercise placebo was not intended to promote weight loss and was therefore considered to be a no treatment comparator

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication: "A researcher from an independent University will per- form the randomisation procedures by al- locating participants to groups according to a computer generated random list." Comment: appropriate
Allocation concealment (selection bias)	Low risk	Quote from publication : "A researcher from an independent University will per- form the randomisation procedures by al- locating participants to groups according

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 59 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Daley 2005 (Continued)

		to a computer generated random list." Comment: appropriate
Blinding of participants and personnel (performance bias) Subjective outcomes	High risk	Comment : not blinded
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Comment : not blinded
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Quote from publication: "The second au- thor provided the intervention and col- lected measures. The trial statistician was blinded to group codes." Comment: no blinding
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from publication: "The second au- thor provided the intervention and col- lected measures. The trial statistician was blinded to group codes." Comment: no blinding but objective out- comes unlikely to be affected by lack of blinding
Incomplete outcome data (attrition bias) Subjective outcomes	Unclear risk	Comment : numbers reported but no reasons provided, used ITT analysis
Incomplete outcome data (attrition bias) Objective outcomes	Unclear risk	Comment : numbers reported but no reasons provided, used ITT analysis
Selective reporting (reporting bias)	Low risk	Comment : all outcomes reported as stated
Other bias	Low risk	Comment : no other bias

Debar 2012

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design
Participants	 Inclusion criteria: aged 12-17 years, female health plan members with an age- and gender-adjusted BMI ≥ 90th percentile Exclusion criteria: significant cognitive impairment or psychosis, severe obesity (BMI > 45), use of medications known to affect body weight and pregnancy Diagnostic criteria: as above
Interventions	Number of study centres: - Treatment before study: none Description of interventions

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 60 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Debar 2012 (Continued)

	Primary care-based multicomponent behaviour changing intervention : 90-minute
	group sessions over 5 months. Addressed issues associated with obesity in adolescent girls (e.g. depression, disordered eating patterns, poor body image). Session included review- ing goals and problem solving to overcome barriers and challenges to increased activity, discussion of topics particularly pertinent to adolescent girls and specific behavioural and cognitive tools for coping, including: self-monitoring of dietary intake, physical activity and screen time; stimulus control and environmental changes, stepwise goal-setting and problem solving; setting goals for increasing pleasant activities; cognitive restructuring techniques to combat negative self-talk. Groups met 16 times, weekly for 3 months and biweekly during months 4 and 5 Increasing physical activity was promoted by using tailored forms of exercise (e.g. ex- ergaming), goals included 30-60 minutes of physical activity at least 5 days per week; 15 minutes of daily yoga (provided with training in safe and basic yoga practices, equipment, an instructional booklet and CD), limiting screen time to 2 hours per day; and increasing "found exercise" opportunities whenever possible. Core activ- ities chosen to overcome obstacles such as embarrassment. Participants provided with exergaming equipment (details provided). Also, strategies for increasing physical activity (e.g. pedometers, resistance bands) promoted Dietary intake and eating patterns followed caloric guidelines (1600- 1800 kcal daily) , and 3 main areas for dietary change emphasised: decreasing portion sizes, limiting consumption of energy dense foods and increasing consumption of lower energy-dense foods. Other dietary strategies also covered Parents had 12 separate weekly group sessions in the first 3 months. Nutritional and physical activity principles the teens would learn discussed, encouraged to increase or maintain the frequency of family meals Paediatric providers received study-sponsored training in motivational enhancement techniques for health behaviour change. Interventionist incl
Outcomes	Outcomes reported in abstract of publication: BMI z score
Study details	Run-in period: none Study terminated early: no Trial identifier: NCT01068236
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal
Stated aim for study	Quote from publication: "This study evaluated a primary care-based, multicomponent lifestyle intervention specifically tailored for overweight adolescent females."

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 61 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Debar 2012 (Continued)

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication: "Eligible ado- lescents were randomized to the inter- vention or control condition by a com- puter program using a well validated pro- cedure to balance age and obesity sever- ity. Project interventionists informed par- ticipants of treatment assignment to keep assessors masked." Comment: appropriate
Allocation concealment (selection bias)	Unclear risk	Comment : no details
Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	Quote from publication: "Project inter- ventionists informed participants of treat- ment assignment to keep assessors masked. " Comment: participants not blinded
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Quote from publication: "Project inter- ventionists informed participants of treat- ment assignment to keep assessors masked. " Comment: participants not blinded
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	Comment: self-reported outcomes collected by staff for some subjective outcomes (diet and physical activity)
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment: measures were collected by staff blinded to participant treatment assign- ment
Incomplete outcome data (attrition bias) Subjective outcomes	Unclear risk	Comment: numbers but not reasons for drop-outs were reported, ITT analysis was used
Incomplete outcome data (attrition bias) Objective outcomes	Unclear risk	Comment : numbers but not reasons for drop-outs were reported, ITT analysis was used
Selective reporting (reporting bias)	Low risk	Comment: all outcomes reported as stated

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 62 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Debar 2012 (Continued)

Other bias	Low risk	Comment : no other bias	
Ebbeling 2003			
Methods	Parallel RCT, randomisation r	Parallel RCT, randomisation ratio: 1:1, superiority design	
Participants	Inclusion criteria: aged 13-2 Exclusion criteria: - Diagnostic criteria: BMI tha	Inclusion criteria: aged 13-21 years Exclusion criteria: - Diagnostic criteria: BMI that exceeded gender- and age-specific 95th percentiles	
Interventions	Number of study centres: 1 Treatment before study: non Description of interventions Both groups received similar conceptual framework for the that was consistent between self-efficacy for dietary change and skill) and self-control. Part (values ascribed to outcomes) a during treatment sessions The topic modules were the setting and problem solving. T the participant and study dieti participants in both groups re 12 sessions over 6 months (12 dietary counselling sessions) Reduced GL diet : written n select-a-meal menu. The topi nutrition intervention messag between the participant and practical application of interv intervention group, lists corre: pyramid The select-a-meal menu conta the food choice lists. Nutritice (Balance Bar; provided by Kra Reduced fat diet, described a modules, food choice lists and mechanism for presenting nutr to promote dialogue between used to enhance practical app modules. For the conventional and were presented as an exch groups (Nature Valley Granola use as snacks The interventionist was a diet	e behavioural therapy: social cognitive theory provided a e educational and behavioural components of treatment intervention groups. Counselling focused on enhancing e using the concepts of behavioural capability (knowledge ticipant expectations (anticipated outcomes), expectancies nd perceptions of environmental influences were discussed primary mechanism for facilitating self-assessment, goal hese modules were designed to promote dialogue between cian. 1 topic module was devoted to physical activity, with ceiving information based on current recommendations dietary counselling sessions) and a 6-month follow-up (2 naterials included topic modules, food choice lists and a ic modules were the primary mechanism for presenting ges. These modules were designed to promote dialogue study dietician. Food choice lists were used to enhance ention messages presented in the topic modules. For the sponded to food groups delineated by a reduced GL food the foods, Inc, Northfield, IL) as a conventional diet : written materials included topic a select-a-meal menu. The topic modules were the primary rition intervention messages. These modules were designed the participant and study dietician. Food choice lists were olication of intervention messages presented in the topic group, the lists corresponded to the diabetes food pyramid ange system. Nutrition bars were offered to conventional . Bar; General Mills, Inc, Minneapolis, MN) for occasional ician trained in the study protocol	
Outcomes	Outcomes reported in abstra	act of publication: GL, BMI, fat mass, insulin resistance	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 63 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Ebbeling 2003 (Continued)

Study details	Run-in period: - Study terminated early: no Trial identifier: -
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal
Stated aim for study	Quote from publication: "(1) to develop a reduced- GL diet for use in an adolescent population; (2) to determine whether adolescents following this diet will successfully achieve long-term reduction of GL; (3) to compare the long-term effects of a reduced-GL diet with those of a conventional reduced-fat diet in a pilot study involving obese adolescents."
Notes	Participants aged 13-21 years, unclear mean age. Control described as conventional diet based on recommendations in 2002

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote from publication : "participants were randomly assigned to experimental (reduced GL) or conventional (reduced fat) dietary treatment." Comment: no other details
Allocation concealment (selection bias)	Unclear risk	Comment: not described
Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	Comment: no mention of blinding
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment: no mention of blinding
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	Comment: no mention of blinding
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment: no mention of blinding, but objective outcome
Incomplete outcome data (attrition bias) Subjective outcomes	Low risk	Comment: numbers and reasons provided

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 64 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Ebbeling 2003 (Continued)

Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Comment: numbers and reasons provided
Selective reporting (reporting bias)	High risk	Comment: body mass was calculated but not reported in follow-up measures
Other bias	Low risk	Comment: no other bias
Ebbeling 2012		
Methods	Parallel RCT, randomisation ratio: 1:1, superiority design	
Participants	Inclusion criteria : grade 9 or 10 and BMI \geq 85th percentile for gender and age, aged 13-18 years, reported consuming \geq 1 serving (i.e. 360 mL or 12 fluid ounces) per day of sugar-sweetened beverages (i.e. soft drinks, juice drinks containing < 100% juice, punches, lemonades, iced teas and sports drinks). Each participant lived predominantly in 1 household (i.e. no more than 1 weekend every 2 weeks in a secondary household) Exclusion criteria : dieting for the purpose of weight loss or taking prescription medications that might affect body weight, reported smoking \geq 1 cigarette in the past week or diagnosed as having a major medical illness or eating disorder, BMI < 25th percentile Diagnostic criteria : as above	
Interventions	Number of study centres: - Treatment before study: none Description of interventions Multicomponent intervention : designed beverages. Emphasis on displacing sugar-swei in the home as a strategy to decrease consul Home delivery of non-caloric beverages (e 2 weeks. Written intervention messages we erages and not to buy or drink sugar-sweet Unsweetened water was recommended over Discussions during telephone calls and che consumption, with no attention to other d 3 check-in visits with participants (20 minute calls with parents (30 minutes per call). H bottled water and 'diet' beverages) every 2 w At 6 months (pilot study), each participant shopping mall at the end of the study. Con of non-caloric beverages for 4 weeks after c year, control group received USD50 super not receive instructions on what to purchas Groups were led by dieticians, Master's lew Staff were trained Control : no details	to reduce consumption of sugar-sweetened eetened beverages with non-caloric beverages mption .g. bottled water and 'diet' beverages) every ith instructions to drink the delivered bev- rened beverages were mailed to participants. r artificially sweetened beverages eck-in visits focused exclusively on beverage ietary behaviours or to physical activity es per visit). Monthly motivational telephone Iome delivery of non-caloric beverages (e.g. weeks received a USD100 gift certificate to a local ntrol group received weekly home deliveries ompletion of follow-up measurements. At 1 market gift cards at 4 and 8 months but did se with the cards wel therapists, psychologists or psychiatrists.
Outcomes	Outcomes reported in abstract of publica erages, BMI, weight, change in body fat as	ation : consumption of sugar-sweetened bev- % body weight

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 65 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Ebbeling 2012 (Continued)

Study details	Run-in period: none Study terminated early: no Trial identifier: NCT00381160
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal
Stated aim for study	Quote from publication: "assess the effect on weight gain of an intervention that included the provision of non-caloric beverages at home for overweight and obese adolescents."

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication: "Eligible partic- ipants were entered sequentially onto a list of random group assignments prepared in advance by the study statistician, stratified by gender and BMI (< 85th percentile for gender and age, \geq 85th percentile). The sequence of random assignments was per- muted within stratum in blocks of 2, 4, and 6."
Allocation concealment (selection bias)	Unclear risk	Quote from publication: "To avoid any bias in the enrolment procedure, personnel conducting recruitment were masked to se- quence." Comment: no details of how allocation was concealed
Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	Comment: no details on blinding
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment : no details on blinding
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	Quote from publication: "All personnel who assessed study outcomes were unaware of the group assignments. The interviewer was masked to group assignment." Comment: self-reported data

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 66 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Ebbeling 2012 (Continued)

Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from publication: "All personnel who assessed study outcomes were unaware of the group assignments. The interviewer was masked to group assignment."
Incomplete outcome data (attrition bias) Subjective outcomes	Low risk	Comment : numbers and reasons provided, used ITT for analysis
Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Comment : numbers and reasons provided, used ITT for analysis
Selective reporting (reporting bias)	Low risk	Comment : all outcomes reported as stated
Other bias	Low risk	Comment : no other bias

Ford 2010

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design	
Participants	Inclusion criteria: aged 9 to < 18 years, BMI > 95th centile, minimal or no learning difficulties, no underlying medical problem, no medication for insulin resistance Exclusion criteria: - Diagnostic criteria: BMI > 95th centile	
Interventions	Number of study centres: 1 Treatment before study: - Titration period: - Description of interventions Mandometer group : computerised device providing real-time feedback during meals to slow down speed of eating and reduce total intake. Saw a research nurse trained in use of Mandometer once per week for 6 weeks, every second week for a further 6 weeks, and once every 6th week thereafter. Research nurse telephoned support and encouragement every second week from week 12 onwards. Participants were trained in the use of Mandometer including test meals, setting of training lines and eating speed. Dietary advice by a paediatric dietitian 4 times over 12 months based on the UK Food Standards Agency 'eatwell plate' educational tool. Clinician met the participants every 4 months, emphasising the need to change eating habits and improve physical activity as advocated in the standard clinic Standard care controls : initial 1-hour discussion about reasons for, and implications of, obesity and behaviour changing measures that may improve BMI Multidisciplinary team composed of a clinician, paediatric dietitian and exercise special- ist. Emphasis placed on implementing changes to increase levels of enjoyable physical activity to national recommended levels (60 minutes of exercise per day) alongside a balanced diet, based on the 'eatwell plate.' Set their own dietary goals and targets, with practical advice and guidance from the dietician, facilitation to exercise rather than pre- scription. MI techniques used to engage participants and families in the decision-making process for changes in behaviour. Appointments at 3-monthly intervals	

Ford 2010 (Continued)

Outcomes	Outcomes reported in abstract of publication : BMI-SDS, body fat SDS, change in portion size, HDL cholesterol
Study details	Run-in period: - Study terminated early: no Trial identifier: NCT00407420
Publication details	Language of publication: English Other funding (a charity funded by a commercial organisation) Publication status: peer-reviewed journal
Stated aim for study	Quote from publication: "To determine whether modifying eating behaviour with use of a feedback device facilitates weight loss in obese adolescents."
Notes	Galhardo 2011 is a linked publication but this is a substudy of 27 participants only with no relevant outcomes. Not extracted

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication: "An indepen- dent statistician unconnected with clini- cal practice used computer generated ran- dom numbers to prepare randomisation lists" Comment: block randomisation. Methods appear appropriate
Allocation concealment (selection bias)	Unclear risk	Quote from publication: "assigned pa- tients sequentially according to the gener- ated lists" Comment: unclear if concealed
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Quote from publication: "we could not blind participants." Comment: no blinding, investigator-as- sessed outcomes
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : not described, investigator-as- sessed, outcomes objective unlikely to be affected by outcome assessor blinding
Incomplete outcome data (attrition bias) Objective outcomes	Unclear risk	Comment : reported and reasons explained for drop-outs but further exclusions from analyses at 18 months were not detailed

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 68 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Ford 2010 (Continued)

Selective reporting (reporting bias)	High risk	Comment : HRQoL, lipids, insulin and blood pressure data not reported, narrative comment only
Other bias	Low risk	Comment : no other bias
Gourlan 2013		
Methods	Parallel RCT, randomisation ratio: 1:1, superiority design	
Participants	Inclusion criteria: aged 11-18 years, BMI > 90th age- and gender-specific percentiles, no unstable or uncontrollable diseases Exclusion criteria: - Diagnostic criteria: as above	
Interventions	Number of study centres: 1 Treatment before study: none Description of interventions MI + standard weight loss : MI-based intervention and self-determination theory to elicit and reinforce the adolescent's change talk to minimise resistance and resolve am- bivalence to change (reference provided). 2 face-to-face, semi-structured interviews for 30 minutes over 3 months where 4 MI principles (making the participant's acquain- tance and building awareness, alternatives and problem solving, goal setting and agenda setting, behaviour modification consequences and perspectives) were used to encourage adolescents to articulate their concerns and goals, and develop their autonomy 6×20 -minute telephone sessions over 6 months. Standard weight loss programme aimed to promote physical activity, provide information and tips to encourage/help with physical activity and the benefits of performing physical activity, promote a balance diet and provide information/tips/self-monitoring on how to achieve healthy behaviour A sport and exercise sciences Doctoral student delivered MI sessions following MI train- ing including 40 hours of reading and 32 hours of training formation Standard weight loss programme (SWLP) : as described above. Delivered by a Doctor of Medicine specialised in paediatric obesity and certified in behavioural and cognitive therapies	
Outcomes	Outcomes reported in abstract of publication : BMI, autonomy support, integrated and identified regulations, motivation	
Study details	Run-in period: none Study terminated early: no	
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal Trial identifier: -	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 69 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
Gourlan 2013 (Continued)

Stated aim for study	Quote from publication: "The primary purpose of this study was to assess the effectiveness of an MI-based intervention in addition to a standard weight loss programme (SWLP) on PA [physical activity] and body mass index (BMI) of obese adolescents. The second purpose was to explore some of the underlying motivational processes accompanying these effects."

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote from publication : "The project manager assigned each adolescent ran- domly and independently to the SWLP [standard weight loss programme] group (n = 34) or the SWLP + MI group (n = 28)." Comment : no further details
Allocation concealment (selection bias)	Unclear risk	Quote from publication : "The project manager assigned each adolescent ran- domly and independently to the SWLP group (n = 34) or the SWLP + MI group (n = 28)." Comment : no further details
Blinding of participants and personnel (performance bias) Subjective outcomes	Low risk	Quote from publication : "Participants, the health care provider and data collectors were blinded to the group (SWLP or SWLP + MI) the adolescents were assigned to." Comment : appropriate
Blinding of participants and personnel (performance bias) Objective outcomes	Low risk	Quote from publication : "Participants, the health care provider and data collectors were blinded to the group (SWLP or SWLP + MI) the adolescents were assigned to." Comment : appropriate
Blinding of outcome assessment (detection bias) Subjective outcomes	Low risk	Quote from publication : "Participants, the health care provider and data collectors were blinded to the group (SWLP or SWLP + MI) the adolescents were assigned to." Comment : appropriate
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from publication: "Participants, the health care provider and data collectors were blinded to the group (SWLP or SWLP + MI) the adolescents were assigned to." Comment: appropriate

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 70 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Gourlan 2013 (Continued)

Incomplete outcome data (attrition bias) Subjective outcomes	Low risk	Comment : numbers and reasons reported
Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Comment: numbers and reasons reported
Selective reporting (reporting bias)	Unclear risk	Comment : not enough information to judge, no protocol or trial registry data available
Other bias	Low risk	Comment : no other bias

Grey 2009

Methods	Cluster RCT, randomisation ratio: 2:1, superiority design	
Participants	Inclusion criteria: in 7th grade, BMI > 85th percentile, family history of type 2 diabetes mellitus, parents who were English or Spanish speaking, no other major health problems Exclusion criteria: - Diagnostic criteria: as above	
Interventions	 Number of study centres: 6 Treatment before study: none Description of interventions CST: nutrition and exercise educational content enhanced by the inclusion of CST, based on Bandura's social learning theory). To increase students' sense of competence and mastery, open discussion and questions and answers about events occurring in the past week with which the youth had difficulty, youth role-playing common situations, practicing new coping skills. Encouragement and reinforcement provided by other students and teacher. Materials developed by a clinical psychologist who was an expert in CST 13 sessions over 16 weeks. No mention of length of sessions: 8 nutrition and activity classes + 5 coping skill training (Getting to know you; Change in actions; Get up and move; Stress identification and reduction; Aim for life skills; Healthy lifestyle tic-tac-toe; Resolving conflict and effective communication; What's on your plate?; Size up your portions; What's in a food label?; Eating in a fast food world; How to "go out" without guilt; Recipe makeover) Physical activity component focused on reducing leisure time sedentary behaviours that may compete with activity, learned creative ways to increase physical activity in a nonstructured exercise programme, including culturally relevant approaches, such as aerobic dancing Materials developed by a registered dietitian. A non-diet, family centred approach used as nutrition education component. Major dietary goal was to provide highest nutritional quality for lowest caloric intake. Emphasis placed on lowering dietary fat intake to < 30%, improving food and drink choices, and decreasing total calories by focusing on appropriate portion sizes, while including culturally specific foods and being sensitive to the costs of foods 	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 71 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Grey 2009 (Continued)

	Health coaching provided only to participants in intervention group, commencing at end of 16-week intervention programme, and lasting until the 12-month data collection - 9 months of weekly 5- to 10-minute telephone health coaching provided by an advanced practice nurse, nutritionist, family therapist or psychologist, on a rotating basis Teachers in schools trained by study staff to deliver intervention. Students compensated for their time with a small token (toy worth USD5-10) following data collection General education : 8 sessions in 16 weeks. Intervention component: Get up and move; Healthy lifestyle tic-tac-toe; What's on your plate?; Size up your portions; What's in a food label?; Eating in a fast food world; How to "go out" without guilt; Recipe makeover. Physical activity and nutritional component as above
Outcomes	Outcomes reported in abstract of publication: anthropometric measures, lipids, de- pressive symptoms, BMI
Study details	Run-in period: none Study terminated early: no Trial identifier: -
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal
Stated aim for study	Quote from publication: "To evaluate the impact of a multifaceted, school-based in- tervention on inner city youth at high risk for type 2 diabetes mellitus (T2DM) and to determine whether the addition of coping skills training (CST) and health coaching improves outcomes."

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote from publication: "Schools were randomized." Comment: no description of randomisa- tion process but there were some baseline differences (not anthropometric measures) likely due to the cluster randomisation - potential bias
Allocation concealment (selection bias)	Unclear risk	Comment: no description of allocation concealment
Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	Comment : no mention of blinding

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 72 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Grey 2009 (Continued)

Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment : no mention of blinding
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	Comment : no mention of blinding
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : no mention of blinding, objec- tive measures
Incomplete outcome data (attrition bias) Subjective outcomes	Low risk	Comment : numbers and reasons stated, ITT analysis used
Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Comment : numbers and reasons stated, ITT analysis used
Selective reporting (reporting bias)	Unclear risk	Comment : outcomes reported as stated but no protocol to confirm
Other bias	Unclear risk	Unclear if they accounted for clustering in analysis. Attendance at sessions/telephone calls received very low. Dropout rate mod- erate

Hofsteenge 2014

Methods	Parallel RCT, randomisation ratio: 3:2, superiority design
Participants	 Inclusion criteria: adolescents with overweight or obesity (defined according to the Cole criteria) aged 11-18 years who were referred to the outpatient paediatric obesity clinic of the VU University Medical Center Exclusion criteria: not Dutch-speaking, obesity as a result of a known syndrome or organic cause (hypothyroidism), mental retardation, physical limitations and diagnosed type 2 diabetes mellitus Diagnostic criteria: Cole criteria
Interventions	Number of study centres: 1 Treatment before study: none Description of interventions Go4it multidisciplinary group treatment : based on evidence and published educa- tional materials (references given). 7 group sessions (90-minute duration) with interval of 2-3 weeks: education on dietary behaviour, physical activity and energy balance. Group size 8-12 adolescents. Also received CBT regarding how to improve lifestyle regarding a healthy weight and how to maintain an adequate energy balance. Dietician, paediatri- cian/endocrinologist and psychologist involved. Booster groups sessions scheduled after

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 73 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Hofsteenge 2014 (Continued)

	6, 14, 26 and 36 weeks. 2 parental sessions consisted of education concerning the health risks of overweight, healthy physical activity and dietary behaviour and how to support their children. Special materials were developed for this programme; an information book, workbook, and dietary and activity diary, and specific worksheets for every session Current regular care : consisting of referral to a dietitian in the home care setting		
Outcomes	Outcomes reported in abstract of publication : BMI-SDS, body composition, metabolic components, effect modifiers, blood pressure, HDL cholesterol, PedsQL, Body Esteem Scale		
Study details	Run-in period: none Study terminated early: no Trial identifier: NTR691, ISRCTN27626398		
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal		
Stated aim for study	Quote from publication: "to investigate the effectiveness and cost-effectiveness of this multidisciplinary group treatment for obese adolescents."		
Notes			
Risk of bias			
Bias	Authors' judgement	Support for judgement	
Random sequence generation (selection bias)	Low risk	Quote from publication: "block randomi- sationusing SPSS for random selection. " Comment: appropriate	
Allocation concealment (selection bias)	Unclear risk	Comment : no details of concealment of al- location	

Blinding of participants and personnel High risk Quote from publication: "The randomisation could not be blinded to the re-(performance bias) searcher and participants." Subjective outcomes Comment: self-reported outcome measurement could be at risk of bias owing to lack of blinding Blinding of participants and personnel High risk Quote from publication: "The randomisation could not be blinded to the re-(performance bias) Objective outcomes searcher and participants." adjudicated/investigator-Comment: assessed outcomes

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 74 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Hofsteenge 2014 (Continued)

Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Quote from publication : "The randomi- sation could not be blinded to the re- searcher and participants." Comment : outcome assessor not blind
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from publication: "The randomi- sation could not be blinded to the re- searcher and participants." Comment: adjudicated/investigator- assessed, outcome assessor not blinded but unlikely to be at risk of bias
Incomplete outcome data (attrition bias) Subjective outcomes	Unclear risk	Quote from publication: "numbers and reasons explained. No ITT analysis for sub- jective outcomes" Comment: unclear
Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Quote from publication: "all participants were analyzed in the group to which they were randomly assigned" Comment: reported and reasons explained
Selective reporting (reporting bias)	High risk	Comment: physical activity and sedentary behaviour not reported
Other bias	Low risk	Comment : no other bias noted

Jelalian 2016

Methods	Parallel RCT, randomisation ratio: 2:1, superiority design
Participants	Inclusion criteria : 12- to 18-years-old, Diagnostic and Statistical Manual of Mental Disorders criteria for current major depressive episode or dysthymia; Clinical Depression Severity Rating Scale (CDRS) score ≥ 65 ; BMI > 25 kg/m ² or BMI percentile ≥ 85 th percentile for gender and age; and parent or carer willing to participate Exclusion criteria : without reliable transportation; taking weight-altering medications within 6 months prior to study initiation; unable to do moderate-to-vigorous physical activity; weighing > 300 lb; in foster care; receiving special needs education; previous participant in study authors' weight loss studies; currently enrolled in a weight loss management or diseases affecting absorption or processing of nutrients Diagnostic criteria : as above
Interventions	Description of interventions CBT for depression and healthy lifestyle + exercise : individual CBT treatment adapted into 1 integrated protocol that addressed depression, exercise component, weight and advice regarding healthy eating. Weekly 60-minute group aerobic exercise sessions were required and facilitated by a physiotherapist. Individual meetings with a nutritionist

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 75 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Jelalian 2016 (Continued)

	individually up to 4 times. Parents involved CBT for depression : standard CBT treatment only. Parents involved		
Outcomes	Primary outcomes: depressed mood, BMI Secondary outcomes: moderate-to-vigorous physical activity, sedentary behaviour Other outcome: -		
Study details	Run-in period: - Study terminated early: no Trial identifier: NCT01128764		
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal		
Stated aim for study	Quote from publication: "Test the feasibility of a novel intervention that integrated healthy lifestyle enhancement and CBT in a clinical sample of depressed, overweight/ obese adolescents."		
Notes			
Risk of bias			
Bias	Authors' judgement	Support for judgement	
Random sequence generation (selection bias)	Low risk	Quote from author : "stratified random- ization was conducted with an urn ran- domization computer program using a 2:1 randomization schedule in favor of CBT- HL [cognitive behavioural therapy-healthy lifestyle]."	
Allocation concealment (selection bias)	Low risk	Quote from publication: "Study staff was masked to allocation sequence until inter- ventions were assigned. The project coordi- nator was responsible for enrolling partic- ipants and notifying families of treatment assignment." Comment: appropriate	
Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	Comment: self-reported outcome mea- surement	
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment : investigator-assessed	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 76 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Jelalian 2016 (Continued)

Blinding of outcome assessment (detection bias) Subjective outcomes	Low risk	Quote from author: "research assistants were blinded to condition." Comment: not reported
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from author: "research assistants were blinded to condition." Comment: not reported
Incomplete outcome data (attrition bias) Subjective outcomes	High risk	Comment: only report number of participants reporting positive views of the intervention
Incomplete outcome data (attrition bias) Objective outcomes	High risk	Comment: numbers reported and reasons explained. Authors mentioned ITT but presented completers outcomes only. High attrition rate; however, this was a pilot study
Selective reporting (reporting bias)	Low risk	Comment: reported all outcomes
Other bias	Low risk	Comment : no other bias noted

Jiang 2005

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design
Participants	Inclusion criteria: grades, defined as weight-for-height ≥ 120% of the Chinese reference Exclusion criteria: - Diagnostic criteria: as above
Interventions	Number of study centres: 1 Treatment before study: none Description of interventions Family-based behavioural treatment : 104 weeks (2 years). Unclear how many sessions. Focused on dietary behaviour modification, 1 or 2 main behaviours which were related to obesity were chosen for each child based on an assessment of relevant dietary and exercise patterns at baseline. Then a new goal behaviour and interval behaviours were defined. Each goal and interval behaviour was discussed with the child and the parents and was agreed to by the child. A diary was kept by the children on their behaviour to monitor adherence to the recommended lifestyle changes. The parents monitored the diary and their child's progress in achieving the new behaviours Paediatricians (researchers) visited the families once per month to observe the family environment, look for where foods were stored, cooking styles and what types of foods were used commonly in the family. The behavioural diary was checked and gaps in the recordings were discussed. Potential methods of reinforcement and penalty were also discussed with the parents and children during home visits. A 'traffic light' food item list was provided to help decrease energy intake and promote a balanced diet: 'red light' foods

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 77 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Jiang 2005 (Continued)

	were those high in fat or calories; 'green light' foods were low in fat and calories; and 'yellow light' foods were intermediate. Children encouraged to eat fewer red light foods and more green light foods and parents encouraged to buy more green light foods instead of red light foods. Daily calorie requirements, based on the Chinese recommended daily allowance, were discussed and Chinese food composition tables given to each family. Dietary behaviours were suggested to the family, including eating slowly, having soup before meals, eating green light foods first, brushing teeth immediately after each meal and having meals without staple foods for supper Exercise for 20-30 minutes per day for 4 days per week (3 weekdays and 1 day on weekends) was advised. Children were asked to choose from running, playing football, climbing stairs and using a skipping rope. Children also urged to decrease sedentary time, e.g. watching television, and to go for a walk after supper instead Control : normal school and family life and did not receive any special intervention, the school had a similar curriculum, including physical education, as most other middle schools in Beijing	
Outcomes	Outcomes reported in abstract of publication: BMI, cholesterol, triglycerides, blood pressure	
Study details	Run-in period: - Study terminated early: no Trial identifier: -	
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal	
Stated aim for study	Quote from publication: "A family based behavioural treatment was developed and tested, to see if its use was feasible in China and to evaluate its impact on obese schoolchildren."	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote from publication: "children were then divided randomly" Comment: no other details
Allocation concealment (selection bias)	Unclear risk	Comment : no details
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment: not specified

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 78 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Jiang 2005 (Continued)

Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : not specified; however, low risk of bias for objective outcomes
Incomplete outcome data (attrition bias) Objective outcomes	Unclear risk	Comment : no discussion of drop-outs
Selective reporting (reporting bias)	Unclear risk	Comment : primary outcomes were all reported, but no clinical trial record of protocol
Other bias	Low risk	Comment : no other bias
Kong 2013		
Methods	Cluster RCT, randomisation ratio: 1:1, sup	periority design
Participants	Inclusion criteria : 9th-11th grade, BMI \geq 85th percentile Exclusion criteria : BMI \geq 40 kg/m ² , previous diagnosis of diabetes, blood pressure in the range of stage 2 hypertension, antipsychotic or corticosteroid medications, not am- bulatory, anorexia nervosa, bulimia nervosa, psychosis, suicidal ideation, hospitalisation, pregnancy Diagnostic criteria : as above	
Interventions	Number of study centres: 6 Treatment before study: none Description of interventions ACTION : based on the Transtheoretical M • clinical encounters with the school-ba for a total of 8 visits over 1 academic year. If personal and family history, physical exami- assessment of dietary and physical activity M • use of MI; • obesity risk reduction strategies from a community advisory group made of overwe parents. The toolkit included a DVD and p options' during clinical encounters - genera 'menu of options' during clinical encounter adolescent motivation for change, strategies guidelines for clinicians, MI for clinicians, adolescent session tools. At the first visit, participants received the DV results, along with American Academy of Per recommendations Feedback was provided to the adolescent. Pa to follow-up in 2-3 weeks with topics they the	Model, 3 primary components: sed health centres clinician every 2-3 weeks First visit dedicated to reviewing pertinent ination and laboratory findings, and behaviour; a toolkit that was co-created with a eight and obese adolescents and their print materials to provide a 'menu of al content of clinician toolkit used as a rs with participants. DVD sections: s targeting energy balance and nutritional n training, print materials: weight loss newsletter for carers, clinic displays, VD, a DVD player and a summary of medical ediatrics (AAP) obesity prevention/treatment articipants were asked to review the DVD and would like to discuss. Subsequent visits were

Kong 2013 (Continued)

	individually tailored to the adolescent's stage of change with the intention of moving towards goal setting for healthier eating and physical activity. Also had a newsletter for carers (obesity risk reduction strategies) and after each visit, telephone updates were given to the carer using MI techniques The intervention provider received a 2-day training workshop in MI Standard care : trained clinician with trial protocol. Received 1 clinic visit similar in content to the first visit of the intervention group given at baseline, except not given the DVD or DVD player. Published recommendations were provided
Outcomes	Outcomes reported in abstract of publication : BMI percentile and waist circumfer- ence, blood pressure, HOMA-IR, triglycerides and HDL cholesterol
Study details	Run-in period: none Study terminated early: no Trial identifier: NCT00841334.
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal
Stated aim for study	Quote from publication: "Was undertaken to determine feasibility of a school-based health center (SBHC) weight management program."
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote from publication: "were ran- domised." Comment: randomisation process was not described but there were no baseline differ- ences
Allocation concealment (selection bias)	Unclear risk	Comment : no details
Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	Comment : no mention of blinding
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment : no mention of blinding
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	Comment : no mention of blinding

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 80 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Kong 2013 (Continued)

Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : no mention of blinding; how- ever, low risk of bias for objective outcomes
Incomplete outcome data (attrition bias) Subjective outcomes	Unclear risk	Comment : numbers and reasons reported
Incomplete outcome data (attrition bias) Objective outcomes	High risk	Comment: numbers and reasons reported, but differential attrition between groups. Missing outcomes for individuals within each cluster
Selective reporting (reporting bias)	Low risk	Comment: all outcomes reported as stated
Other bias	Unclear risk	Comment : unclear if they have accounted for clustering in the analysis

Kong 2014

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design
Participants	Inclusion criteria : aged 15-18, male or female of Chinese ethnicity, obesity $BMI \ge$ 95th percentile of local age- and gender-specific references no major medical illnesses, no chronic medications Exclusion criteria : concurrent participation in any clinical trial, dietary intervention or weight loss programme, concomitant intake of weight-reducing agent, active and uncontrolled endocrine diseases, significant renal impairment or liver impairment, gastrointestinal problems that would prevent them from following the test diets, active malignant disease, pregnant or lactating, any medical illness or condition including known noncompliance, as judged by the investigators Diagnostic criteria : as above
Interventions	Number of study centres: 1 Treatment before study: - Description of interventions Low GI diet : counselled by dietitian at weeks 0, 2, 4, 6 and 8 and at 8-week intervals, total 7 × 30-minute sessions. Parents encouraged to participate. Strategy of increasing energy expenditure and reducing caloric intake using lifestyle behavioural change. Indi- vidualised menu plan with 20% caloric restriction based on his/her current diet. Practical tips were given based on behavioural principles including goal setting, knowledge ac- quisition, problem solving, feedback and reinforcement. Consumption of low GI food, use of healthy fat and avoidance of high GI food based on the low GI pyramid empha- sised. Targeted proportion of energy from carbohydrate and fat: 45-50% and 30-35%, remainder from protein. 2 booklets were provided, 1 with food portion size exchange and tips, the other listing low GI foods and meal plans. Encouraged to perform aerobic exercise \geq 3 days of 30 minutes per week. Ongoing support and encouragement was provided, target goals were redefined based on the participant's feelings and progress,

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 81 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Kong 2014 (Continued)

	efforts and achievements were acknowledged to enhance self-efficacy Motivational telephone calls (10-15 minutes) were made 5 times Control : conventional Chinese diet, based on the standard food pyramid promoted by Hong Kong Department of Health with advice on daily proportion of carbohydrate, fat and protein without information about low GI diet. Emphasis on reducing energy intake by limiting dietary fat intake and high caloric foods. Targeted proportion of energy from carbohydrate and fat: 55-60% and 25-30%, remainder from protein. The conventional Chinese diet was presumed to be a high GI diet (\geq 70). Received counselling from a research nurse The contact times, both individual counselling and telephone reinforcement, and the dietary assessment methods were the same in each group
Outcomes	Outcomes reported in abstract of publication : BMI, body weight and waist circum-ference
Study details	Run-in period: - Study terminated early: no
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal Trial identifier: NCT01278563
Stated aim for study	Quote from publication: "to evaluate the impact of low GI diet versus a conventional Chinese diet on the body mass index (BMI) and other obesity indices of obese adolescents. "
Notes	Interim analysis of 6-month data (18-month trial)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication: "Randomiza- tion were carried out using computer-gen- erated random numbers." Comment: appropriate
Allocation concealment (selection bias)	Low risk	Quote from publication: "sealed in opaque envelopes and in blocks of 6 fur- ther stratified by gender. Treatment assign- ment was done by an independent person- nel who opened the envelopes with consec- utive numbers." Comment: appropriate
Blinding of participants and personnel (performance bias) Subjective outcomes	High risk	Comment: self-reported outcome mea- surement. No details on blinding

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 82 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Kong 2014 (Continued)

Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Comment: investigator-assessed, no details on blinding
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Comment: self-reported outcome mea- surement, no details on outcome assessor blinding
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : investigator-assessed, no details on outcome assessor blinding but objective outcomes unlikely to be affected by lack of blinding
Incomplete outcome data (attrition bias) Subjective outcomes	High risk	Quote from publication: "All the out- come variables were analysed on the basis of the intention-to-treat (ITT) principle" Comment: missing data but reasons not re- ported, imbalance between groups, num- bers suggest no ITT
Incomplete outcome data (attrition bias) Objective outcomes	High risk	Quote from publication: "All the out- come variables were analysed on the basis of the intention-to-treat (ITT) principle" Comment: missing data but reasons not re- ported, imbalance between groups, num- bers suggest no ITT
Selective reporting (reporting bias)	Low risk	Comment : outcomes reported as stated
Other bias	Low risk	Comment : nothing of note

Love-Osborne 2014

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design
Participants	Inclusion criteria: adolescents with BMI ≥ 85% Exclusion criteria: - Diagnostic criteria: as above
Interventions	Number of study centres: 1 (2 schools) Treatment before study: - Description of interventions Health educator involvement : health educator visits in school, participants completed an assessment tool on dietary and exercise habits and the educator used feedback from this tool within a motivational framework to support change and start goal-setting dis- cussions. Goals were reviewed and modified at each visit. Participants encouraged to choose 1 nutrition goal and 1 physical activity goal. Recommended targets for physical

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 83 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Love-Osborne 2014 (Continued)

	activity (1 hour per day) were discussed but participants could choose their own goal. The frequency of visits was participant led, they could choose from 2-week, 1-month, or 2-month return visits. Mean 5 visits (range 1 to 8). Existing resources for physical activity and healthy eating within the school or community were linked to Participants asked to complete a weekly log (self-monitoring of weight weekly and lifestyle behaviours daily) and return this, when 5 were returned a USD10 gift card was received, and a second gift card for an additional 10 log sheets Intervention group randomised to receive 2 weekly text messages (1 individualised to reinforce goals and 1 log sheet reminder) or no text messages for the first semester. All received text messages during second semester. Study staff received training in MI Control : no details Both groups received preventive services, including physical examinations and laboratory screening in the school-based health centre
Outcomes	Outcomes reported in abstract of publication: BMI z score, sports participation
Study details	Run-in period: none Study terminated early: no
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal Trial identifier: -
Stated aim for study	Quote from publication: "to evaluate whether a health educator (HE) providing addi- tional contact time with students and helping them to set personal goals to improve lifestyle would lead to improved BMI outcomes in overweight or obese adolescents."

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote from publication: "students were randomised." Comment: no other details
Allocation concealment (selection bias)	Unclear risk	Comment : no details
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment : no details
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : investigator-assessed. Blinding not reported but low risk of bias from objective outcome

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 84 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Love-Osborne 2014 (Continued)

Incomplete outcome data (attrition bias) Objective outcomes	High risk	Comment : reasons for withdrawals only partially explained. Imbalance in dropouts
Selective reporting (reporting bias)	High risk	Comment : outcomes only reported in cat- egories and subgroups, no overall results by study arm. The intervention group were also randomised into 2 groups, but no re- sults were reported for these 2 groups
Other bias	Low risk	Comment : no other bias

Luna-Pech 2014

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design	
Participants	Inclusion criteria : aged 12-16 years; stable asthma (diagnostic criteria stated); obesity (BMI \geq 95th percentile of the CDC BMI-for-age growth charts); Tanner scale stage 2-3; skin prick test positive for \geq 1 allergen, forced expiratory volume in 1 second (FEV ₁) > 80% predicted value for age and height. Medically treated for asthma for at least 6 months Exclusion criteria : other prescribed dietary programme, undergoing allergen immunotherapy or other chronic diseases or comorbidities Diagnostic criteria : as above	
Interventions	Number of study centres:1 Treatment before study: - Description of interventions Normocaloric diet : programme adjusted at follow-up visits by nutritionist according to individual feeding habits and preferences based on an equivalent exchange system using food lists with a group of measured or weighed foods of approximately the same nutritional value. Individual energy needs calculated according to resting energy expen- diture using standard guidance (references given), applying mild or moderate physical activity criteria and individually adjusted. 10-15% proteins, 50-60% carbohydrates, 25- 30% fat. Daily meal pattern: breakfast 25%, lunch 30%, snack 15-20%, dinner 25-30% Free diet : no details Both groups instructed to fill in a daily 24-hour dietary recall at home, and attend follow- up visits every 2 weeks for 28 weeks All attended the follow-up sessions of 45 minutes to assess aspects of asthma control (i.e. need of rescue and basal medications, review the dietary recall, perform peak expiratory flow and establish an action plan for worsening of asthma symptoms	
Outcomes	Outcomes reported in abstract of publication : ARQoL, BMI z score, acute asthma attacks, night-time awakenings, use of inhaled corticosteroids, pulmonary function	
Study details	Run-in period : 2-weeks (written dietary and respiratory symptoms recall to corroborate stability of asthma and adherence to researcher's instructions Study terminated early : no	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 85 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Luna-Pech 2014 (Continued)

Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal Trial identifier: -
Stated aim for study	Quote from publication: "to evaluate whether a program of supervised ND [normocaloric diet] would improve asthma-related quality of life (AR-QOL), specifically in obese pubertal adolescents with asthma. Secondarily, we assessed the effects of the dietary program on some clinical indicators of asthma control."
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote from publication: "were randomly allocated to." Comment: details not reported
Allocation concealment (selection bias)	Unclear risk	Comment : details not reported
Blinding of participants and personnel (performance bias) Subjective outcomes	High risk	Quote from publication : "Due the nature of the intervention, the study could not be blinded, and this could have induced in- vestigator bias."
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Quote from publication : "Due the nature of the intervention, the study could not be blinded, and this could have induced in- vestigator bias."
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Quote from publication : "Due the nature of the intervention, the study could not be blinded, and this could have induced in- vestigator bias."
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from publication: "Ordinary scheduled medical follow-up was assigned to a single pediatric allergist, who was blinded to group allocation." "Due the na- ture of the intervention, the study could not be blinded, and this could have induced investigator bias." Comment: investigator-assessed, low risk of bias from objective outcomes

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 86 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Luna-Pech 2014 (Continued)

Incomplete outcome data (attrition bias) Subjective outcomes	Unclear risk	Comment: not clearly reported, missing data reported, did not correspond to the numbers used for the final analysis and no discussion of this made
Incomplete outcome data (attrition bias) Objective outcomes	Unclear risk	Comment : not clearly reported, missing data reported, did not correspond to the numbers used for the final analysis and no discussion of this made
Selective reporting (reporting bias)	Unclear risk	Comment: all outcomes reported as stated in methods, but protocol not available
Other bias	Low risk	Comment : nothing of note

NCT00132132

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design	
Participants	Inclusion criteria: 10-20 years; BMI > 85% Exclusion criteria: endocrine disorder; on psychotropic medications Diagnostic criteria: BMI > 85%	
Interventions	Number of study centres: 1 Treatment before study: - Description of interventions Behavioural education programme : monthly meetings for 4 hours; included exercise, education, empowerment and incentives: registration-monitoring of choices of liquid intake, monitoring of sedentary behaviours (hours watching television, computer, video games), monitoring of heart rate, monitoring of metabolic equivalents, MI, monitoring of exercise abilities; 1 hour of exercise (including strength training); educational lectures on nutrition and medical aspects of obesity and Type 2 diabetes; projects/games; empow- erment tools such as leading exercises and presenting food labels for discussion. Referral to a dietitian (minimum 3 visits) Standard of care control : education on physical activity and nutrition in a primary care clinic setting. Referral to a dietitian (minimum 3 visits)	
Outcomes	Outcomes reported in abstract of publication: no abstract	
Study details	Run-in period: - Study terminated early: no Trial identifier: NCT00132132	
Publication details	Language of publication: English Funding not reported Publication status: results published in ClinicalTrials.gov record: NCT00132132	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 87 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT00132132 (Continued)

Stated aim for study	Quote from publication: "evaluate the impact a behavioural intervention can have on BMI."
Notes	Unpublished study, results posted in ClinicalTrials.gov

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Comment : no information on random sequence generation
Allocation concealment (selection bias)	Unclear risk	Comment: no information on conceal- ment of allocation
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Comment : designated as an open-label study. Outcomes investigator-assessed
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from trial record: "open label." Comment: objective outcomes unlikely to be affected by detection bias
Incomplete outcome data (attrition bias) Objective outcomes	High risk	Quote from trial record: "Per protocol analysis: participants who attended at least one intervention session in addition to their final assessment" Comment: missing data with minimal ex- planation, differential loss between groups
Selective reporting (reporting bias)	Low risk	Comment: all outcomes stated reported
Other bias	Unclear risk	Comment: no baseline measurements of key outcomes reported. Limited details re- ported in ClinicalTrials.gov record

NCT00807560

Methods	Parallel, open-label RCT
Participants	Inclusion criteria: aged 13-17 years; living with at least 1 parent or guardian who was willing to participate in treatment; BMI percentile > 85% for gender and age Exclusion criteria: current psychotic illness; current alcohol/drug dependence; active suicidality; eating disorders; history of bariatric surgery; medication associated with significant weight changes (e.g. antipsychotic drugs); serious medical or physical conditions resulting in significant weight changes (e.g. pregnancy, genetic disorders); complications of obesity that contraindicate moderate physical activity (e.g. orthopaedic disorders)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 88 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT00807560 (Continued)

	Diagnostic criteria:-	
Interventions	Number of study centres:- Treatment before study:- Description of interventions Family-based therapy for paediatric overweight : to resolve the eating disorder and return the participant to healthy psychosocial and physiological developmental trajec- tories through active family involvement across 3 treatment phases. No further details provided Nutritional educational control condition : minimal nutrition and physical activity education curriculum across 16 sessions over 24 weeks	
Outcomes	Primary outcomes : height and weight for BMI z score Secondary outcomes : Youth and Parent/Guardian Eating Questionnaire; Child De- pression Inventory; PedsQL; Moderate to Vigorous Physical Activity Measure; Seden- tary Activity Checklist; PACE + Fruit Vegetable Screening Measure; PACE+ Dietary Fat Screening Measure; parent 24-hour dietary recall; parent overweight status, height and weight (converted into BMI z score)	
Study details	Run-in period: - Study terminated early:- Trial identifier: NCT00807560	
Publication details	Language of publication: English Non-commercial funding Publication status: results published in ClinicalTrials.gov record: NCT00807560	
Stated aim for study	Quote: "to determine whether a parent/guardian intervention for adolescent overweight/ obesity more effective than a nutritional counselling education curriculum for reducing body mass index z-score (BMI Z-score) and related outcomes."	
Notes	Unpublished study, results posted in ClinicalTrials.gov	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Comment: nothing stated
Allocation concealment (selection bias)	High risk	Comment : open label
Blinding of participants and personnel (performance bias) Subjective outcomes	High risk	Comment : open label
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Comment : open label

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 89 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT00807560 (Continued)

Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	Comment : nothing stated
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : not specified; however, low risk of bias for objective outcomes
Incomplete outcome data (attrition bias) Subjective outcomes	Unclear risk	Comment : data for subjective outcomes not provided
Incomplete outcome data (attrition bias) Objective outcomes	High risk	Comment: high number of dropouts, 66% for intervention group and 71-77% for control group and no reasons pro- vided. Study flow chart indicated all participants completed but data at follow-up were provided for only approximately one-third of participants
Selective reporting (reporting bias)	High risk	Comment : did not report secondary outcomes
Other bias	Unclear risk	Comment: not enough information to judge

Nguyen 2012

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design
Participants	Inclusion criteria : aged 13-16 years; overweight to moderately obese (i.e. BMI z score range 1.0-2.5); home access to a landline telephone; home access to the Internet to receive e-mails or access to a mobile telephone to receive SMS messages; ability to attend the group programme for 7 weeks in the first instance on the specified days; at least 1 of the adolescent's parents/carers willing to participate in the initial 7 parent group sessions Exclusion criteria : severely obese (i.e. BMI z score > 2.5) or if there was a secondary cause for overweight/obesity; intellectual disability, significant medical illness, psychiatric disturbance; taking medications that affect weight status; inability to take part in physical activity sessions; poor level of spoken English (adolescent or parent/carer) Diagnostic criteria : BMI z score range 1.0-2.5
Interventions	 Number of study centres: unclear Treatment before study: none Description of interventions Loozit intervention : 2 phases Phase 1: adolescent and parent weekly group sessions: simultaneous group sessions. Benefits of a Loozit healthy active lifestyle (increasing physical activity; reducing sedentary behaviour, healthy eating, food labels, measuring fat and sugar in food and drinks, lunch box and snack ideas); positive self-esteem; stress management; review and maintenance; goal setting. Based on social cognitive theory. Parent sessions focussed on practical support of behavioural change in adolescents and parental role

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 90 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Nguyen 2012 (Continued)

	and parents/carers during the sessions
	Phase 2: extended therapeutic contact (adolescents only) Main educational
	• Thase 2. Extended inerapeutic contact (adolescents only). Wain educational
	but key messages from phase 1 were reinforced. Also sessions promoted physical
	activity skills development through approximately 20 minutes/session of indoor
	resistance activities and fun active indeor games. Group facilitators (and outcome
	according activities and run active indoor games. Group facilitators (and butcome
	distributions and could be run by purses or other healthcare professionals. 14 sessions:
	Phase 1: 7 x 75 minute sessions: Phase 2: 5 x 60 minute sessions and 2 outcomes
	assessment sessions
	Intervention 2 : same interventions as above with additional therapeutic contact of $1/4$
	telephone coaching sessions +32 SMS/e-mail messages aimed to enhance adolescents'
	knowledge skills and confidence to initiate and maintain required changes in dietary
	and activity behaviours. If there was a parking fee when attending to the community
	health centres participants were reimbursed
Outcomes	Outcomes reported in abstract of publication: BMI z score; waist-to-height ratio; total
	cholesterol level; triglycerides; global self-worth; dietary, physical activity or sedentary
	behaviour
C. 1 1. 1	
Study details	Run-in period: none
	Study terminated early: no
	Irla Identifier: ACTRIVI20000001/33/2
Publication details	Language of publication: English
	Non-commercial funding
	Publication status: peer-reviewed journal
	· ,
Stated aim for study	Quote from publication: "to determine the effect of additional therapeutic contact to
	usual treatment on body mass index (BMI) z score and waist circumference z-score in
	overweight and obese adolescents aged 13-16 years (at baseline) who participate in a
	community-based weight management program (the Loozit group program)."
Natas	
INOLES	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication: "A computer generated randomisation sequence" Comment: appropriate
Allocation concealment (selection bias)	Low risk	Quote from publication : "a set of consec- utively numbered opaque envelopes con- taining the group allocationthe next numbered envelope is opened by a research assistant revealing the group allocation

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 91 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Nguyen 2012 (Continued)

		and this is recorded along with the individ- uals pre-assigned identification number." Comment: appropriate
Blinding of participants and personnel (performance bias) Subjective outcomes	High risk	Comment: self-reported outcome mea- surement, no blinding of participants or personnel
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Comment : no blinding of participants or personnel
Blinding of outcome assessment (detection bias) Subjective outcomes	Low risk	Comment : outcome assessors blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : outcome assessors blinded
Incomplete outcome data (attrition bias) Subjective outcomes	Low risk	Quote from publication : "An estimation of intervention effect on outcome measures will be obtained at each follow-up observa- tion on an intention to treat basis."
Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Quote from publication : "An estimation of intervention effect on outcome measures will be obtained at each follow-up observa- tion on an intention to treat basis."
Selective reporting (reporting bias)	Low risk	Comment : all outcomes reported as stated
Other bias	Low risk	Comment : no other risks of bias

Norman 2016

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design
Participants	Inclusion criteria : aged 11-13 years, BMI \geq 95th age- and gender-specific percentiles; literate in English; planned to be a San Diego County resident for the next year; willing to return to the physician's clinic for counselling sessions; could attend measurement visits; had a parent or guardian willing to participate who were literate in English or Spanish Exclusion criteria : without reliable transportation; taking weight-altering medications within 6 months prior to study initiation; unable to do moderate-to-vigorous physical activity; weight > 300 lb; in foster care; receiving special needs education; previous participant in study authors' weight loss studies; currently enrolled in a weight loss programme; diagnosed with obesity-related disorders; requiring immediate weight loss

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 92 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Norman 2016 (Continued)

	management or diseases affecting absorption or processing of nutrients Diagnostic criteria : as above
Interventions	 Number of study centres: not clear Treatment before study: none Description of interventions Stepped-down care: based on a combination of Chronic Care Model and social cognitive theory. Chronic Care Model provided a conceptual framework for the healthcare delivery for adolescents with obesity of chronic illness management in a primary care setting. Chronic Care Model emphasises interdisciplinary team input. Within the Chronic Care Model framework, social cognitive theory constructs of behaviour self-management were applied and included: building self-efficacy, goal setting, feedback, identifying barriers and social support. The intervention followed modified recommendations from the American Academy of Pediatrics for treatment of childhood obesity and consisted of 3 × 4-month steps. The goal was for adolescents to lose at least 4 lb every 4 months. If the participant did not meet the goal, then the step was repeated. If a 4-lb weight loss was achieved, the participant was 'stepped-down' to the next level of reduced intensity. The number and frequency of treatment elements varied for each intervention step. At the start, the physician provided brief counselling on healthy behaviours. If progress was not made, then follow-up occurred and focused on weight management strategies. Face-to- face health educator visits occurred monthly in step 1 and bi-monthly in step 2 and were available to the child and parent, but the parent was not required to attend. Biweekly telephone calls were used to review progress and help adolescents set new goals and discuss barriers and solutions, and speak to parent to reinforce parental involvement and emphasise importance of healthy changes in the home environment to encourage goal attainment. Diet and physical activity education materials were distributed to adolescents and their parents at each visit. Pedometers were distributed at the initial health educator visit to monitor physical activity and help participants set appropriate physical activity goals<!--</td-->
Outcomes	Outcomes reported in abstract of publication: BMI, adiposity, biometric outcomes
Study details	Run-in period : 2-week run-in screening programme was conducted. Adolescent-parent dyads were asked to perform some of the activities that would be required of them if they were to be enrolled in the intervention trial. These tasks included attending a measurement visit; scheduling and completing a telephone call with a study staff member; locating a food item at home, reading the food label and describing the nutrition content; tracking basic food intake and physical activity in a written diary over 4 days; and scheduling and attending a follow-up appointment Study terminated early : no Trial identifier: -

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 93 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Norman 2016 (Continued)

Publication details	Language of publication: English Funding not stated Publication status: peer-reviewed journal
Stated aim for study	Quote from publication: "evaluating the stepped-down approach to weight loss, targeting changes in body mass index (BMI), adiposity, blood pressure, fasting blood glucose and lipids among adolescents with obesity."
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication : "Simple ran- domization to study arm was determined by a computer using a permutated block algorithm and was stratified within the pri- mary care provider site." Comment : appropriate
Allocation concealment (selection bias)	Unclear risk	Comment : no details of concealment of allocation
Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	Comment : not mentioned
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment : not mentioned
Blinding of outcome assessment (detection bias) Subjective outcomes	Low risk	Quote from author: "Measurement staff were blinded, self-reported." Comment: outcome assessors blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from author: "Measurement staff were blinded." Comment: outcome assessors blinded
Incomplete outcome data (attrition bias) Subjective outcomes	Unclear risk	Comment : not applicable as data not reported
Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Quote from publication: "Intent-to-treat analyses were conducted using available data and assuming data were missing at ran- dom." Comment: stated ITT and reports all num-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 94 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Norman 2016 (Continued)

		bers randomised
Selective reporting (reporting bias)	High risk	Quote from author: "There were other outcome measures that were not included in the paper. These included the follow- ing: Physical Activity based on self-report, Quality of Life, Calories, food and nutri- ent intake based on self-report, sedentary behavior based on self-report." Comment: reported by the author but rea- sons not explained
Other bias	High risk	Quote from publication: "The run-in programme was conducted to minimize participant attrition, but may have resulted in a more motivated sample of participants and parents compared with non-run in trial cohorts." Comment: study participants may have had higher motivation and much more likely to follow the intervention

Pakpour 2015

Methods	Parallel RCT, randomisation ratio: 1:1:1, superiority design
Participants	 Inclusion criteria: aged 13-18 years, obese (≥ 95th percentile for age and gender), adolescents lived with a parent or adult carer who was prepared to be involved in treatment Exclusion criteria: taking weight-related medication, having a diagnosis of an eating disorder, being pregnant, having clinical mental health conditions or psychosis Diagnostic criteria: BMI > 95th percentile for age and gender
Interventions	 Number of study centres: 1 Treatment before study: none Description of interventions Weekly sessions: participants in both intervention groups received 6 × 40-minute individual counselling sessions on diet and exercise MI : targeted improved eating and physical activity behaviour. All adolescents were encouraged to express their personal motivation to change their physical activity and dietary behaviour. Adolescents assisted with reducing resistance and overcoming ambivalence about behaviour change. MI techniques such as reflective listening, open-ended questions and eliciting self-motivational statements. The intervention was initiated based on the underlying spirit of the MI Session included: in the first phase, the counsellors aimed to foster a confident relationship with the adolescents, address the positive and negative effects of obesity, and increase the adolescents' awareness of their current weight status. In the second phase, alternative courses of action were taken into account, costs and benefits of actions were discussed,

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 95 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Pakpour 2015 (Continued)

	and adolescents' readiness to change was evaluated. In the third phase, adolescents were invited to engage in goal setting and planning for change. Adolescents were encouraged to create an action plan Also encouraged to achieve at least 60 minutes of moderate-to-vigorous intensity physical activity daily as recommended by the World Health Organization. Encouraged to eat a variety of foods from each of the 4 major food groups and low-fat alternatives The facilitators (dietitian or exercise specialist) completed 20 hours of MI training from a certified and experienced MI trainer MI + parental Involvement : identical MI sessions to above. In addition, 1 in-person parent MI session identical in MI style as used for adolescents, focusing on the adolescents' weight, parents' attitudes and behaviours regarding children's physical activity and dietary habits, parent monitoring and supervision; the goal was to promote progress toward the child's intervention goals and attitudes by the parents. The role of parenting in preparing healthy foods for their child and encouraging/monitoring them for being physically active were discussed. Delivered at the end of the 6th session and lasted for > 60 minutes Passive control group : no details	
Outcomes	Outcomes reported in abstract of publication : BMI z score, anthropometric, bio- chemical, psychometric and behavioural outcome variables	
Study details	Run-in period: none Study terminated early: no Trial identifier: NCT02180802	
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal	
Stated aim for study	Quote from publication: "to evaluate and compare the role of parental involvement in MI interventions for obese adolescents."	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication: "To ensure ade- quate concealment of allocation, a research coordinator performed the randomization procedure by using a computer generated randomization schedule/sequence." Comment: appropriate

Allocation concealment (selection bias)

Unclear risk

Comment: no details of how allocation was concealed

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 96 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Pakpour 2015 (Continued)

Blinding of participants and personnel (performance bias) Subjective outcomes	High risk	Quote from publication: "Adolescents could not be blinded to intervention allo- cation." Comment: self-reported outcome mea- surement
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Quote from publication: "Adolescents could not be blinded to intervention allo- cation." Comment: no blinding
Blinding of outcome assessment (detection bias) Subjective outcomes	Low risk	Quote from publication: "All outcomes were assessed by 2 blinded and trained physicians. The blinded assessors passed a series of training courses for testing and in- terviewing according to the standard pro- gram protocol." Comment: investigator assessed
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from publication : "Anthropomet- ric measures at baseline and 12 months af- ter randomization were taken by 2 assessors blinded to group allocation." Comment : investigator assessed
Incomplete outcome data (attrition bias) Subjective outcomes	Unclear risk	Quote from publication : "Due to finan- cial restrictions, only 25 randomly selected adolescents in each group (n = 75) provided accelerometer data." Comment : states ITT but only reported completers in the table
Incomplete outcome data (attrition bias) Objective outcomes	Unclear risk	Quote from publication: "Due to finan- cial restrictions, only 25 randomly selected adolescents in each group (n = 75) provided accelerometer data." Comment: states ITT but only reported completers in the table
Selective reporting (reporting bias)	Low risk	Comment : reported what was initially stated except for BMI percentile which was not reported at 12 months
Other bias	Low risk	Comment : no other bias

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 97 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. Patrick 2013

Methods	Parallel RCT, randomisation ratio: 1:1:1:1, superiority design
Participants	Inclusion criteria: aged 12-16 years, at "high risk" for diabetes, as defined by the Amer- ican Diabetes Association expert consensus panel, overweight BMI > 85th percentile for age and gender, weight and height > 85th percentile, or weight > 120% of ideal for height) + any 2 of the following risk factors: family history of Type 2 diabetes mellitus in a first- or second-degree relative, race/ethnicity (American Indian, African-American, Hispanic, Asian/Pacific Islander), or signs of insulin resistance (acanthosis nigricans, hy- pertension, dyslipidaemia, polycystic ovary syndrome) Exclusion criteria: diagnosis of diabetes, pregnant, not planning to be in the San Diego area over the entire study period, had any medical condition that would prevent them from participating in the intervention Diagnostic criteria: as above
Interventions	 Number of study centres: 18 Treatment before study: none Description of interventions 4 comparator groups, 3 included a website intervention: website only, website and group and website and SMS, and 1 usual care Website only : website and tutorials designed to promote weight loss and healthy behaviours related to obesity such as educational topics and challenges based on skill building exercises, a reward system to encourage success, evaluation for assessment of progress and feedback on progress. Web tutorials on several behaviour change strategies, such as goal setting, seeking social support and positive self-statements. Theoretical based on the behavioural determinants model and the Transtheoretical Model of behaviour change 3 phases, phase 1 (weeks 1-17) entailing education on healthy behaviours, phase 2 (weeks 18-34) interactive games and quizzes for the participant to select challenges and goals, phase 3 (weeks 35-51) interactive and also encouraged working on multiple behaviours at the same time. Also had weekly "check-in" e-mails, monthly mailed tip sheets and, if necessary, a telephone call from a health counsellor Based on the "stoplight approach," participants were encouraged to limit red-light activities (unproductive, low energy), increase green-light activities (high energy) and do yellow-light activities in moderation The website ald group : attendance and participation in group sessions in addition to the website (treatment as 'website only'). Rewarded with mileage incentives and a lottery for prizes such as cookbooks or other materials to assist with healthy behaviour change. Providers underwent a 2-hour counselling training Website and SMS : minimum of 3 text messages per week that related to weekly challenges and intervention. Participants were provided with mobile phones and prepaid text message plans that allowed research staff to monitor SMS use Control : given printed materials produced by the American Diabet

Patrick 2013 (Continued)

Outcomes	Outcomes reported in abstract of publica sedentary behaviour	tion: BMI, adiposity, physical activity, diet,
Study details	Run-in period: none Study terminated early: no	
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal Trial identifier: NCT00412165	
Stated aim for study	Quote from publication: "to evaluate the el population that was offered to participants a delivered through combinations of three mo cents and parents, and short message service usual care, all active treatment conditions w quality-of-life and psychological outcomes."	ffectiveness of an intervention targeting this recruited through clinical sites but primarily odalities: the web, group sessions for adoles- e (SMS). Hypothesized that, compared with ould produce better behavioral, weight, and
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote from publication: "Participants were randomized" Comment: no other details
Allocation concealment (selection bias)	Unclear risk	Comment : no details
Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	Comment : no details
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment : no details
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	Comment : no details
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : no details; however, low risk of bias for objective outcomes
Incomplete outcome data (attrition bias) Subjective outcomes	Low risk	Comment : numbers and reasons provided, used ITT analysis

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 99 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Patrick 2013 (Continued)

Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Comment : numbers and reasons provided, used ITT analysis
Selective reporting (reporting bias)	Low risk	Comment: all outcomes reported as stated
Other bias	Low risk	Comment : no other bias
Patsopoulou 2017		
Methods	Parallel RCT, randomisation ratio: 1:1:1, superiority design	
Participants	Inclusion criteria: overweight or obese students Exclusion criteria: - Diagnostic criteria: Cole criteria	
Interventions	 Number of study centres: 15 Treatment before study: - Description of interventions Activity : training was directed by a professional teacher of physical education. The training programme was designed according to the type and intensity of exercise that school children normally performed. Many activities were delivered as games to encourage enthusiasm and participation. Endurance type activities accounted for most of the time spent in training (about 50% team sports and 50% running games), with attention to co-ordination and flexibility skills Diet + activity : training programme + the same activity trainer information was presented about the reasons behind childhood obesity, dietary and cooking habits, and the motivation for weight loss to involve the whole family in the "battle" against obesity. Discussion with participants on the food pyramid, food choices, food labels, food preparation and cooking, eating habits, regular meals and controlling environments that stimulate overeating. The topics discussed were given to the adolescents in the form of a printed notebook, while parents were also invited to attend these sessions 	
Outcomes	Outcomes reported in abstract of publica sure, Family Eating and Activity Habits Qu	n tion : BMI, waist circumference, blood pres- lestionnaire
Study details	Run-in period: - Study terminated early: no Trial identifier: NCT02653508	
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal	
Stated aim for study	Quote from publication: "test the efficacy of in isolation and combination of physical ac in improving overweight and obesity in ad to a control group."	of two intervention groups, physical activity tivity with provision of dietary information, olescents and also to compare each of them

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 100 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Patsopoulou 2017 (Continued)

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote from publication: "All public mid- dle and high schools (26 in the total) in the city of Larissa in Greece were informed about the purposes of the study. Seventeen secondary and high schools took part in the study"
Allocation concealment (selection bias)	High risk	Quote from publication: "One hundred eighty one adolescents were enrolled and randomized in the three groups of the study, by the same professional teacher of physical education who conducted the pro- gram."
Blinding of participants and personnel (performance bias) Subjective outcomes	High risk	Quote from publication : "randomized in the three groups of the study, by the same professional teacher of physical education who conducted the program." Comment : self-reported outcome mea- surement
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Quote from publication : "randomized in the three groups of the study, by the same professional teacher of physical education who conducted the program." Comment : investigator-assessed
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	Quote from publication: "completed by parents and adolescents. randomized ado- lescents in each group were not aware of the existence of the other two study groups." Comment: self-reported outcome mea- surement
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from publication: "measurement by a single trained nurse, member of the research team." Comment: investigator-assessed, not spec- ified; however, low risk of bias for objective outcomes

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 101 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Patsopoulou 2017 (Continued)

Incomplete outcome data (attrition bias) Subjective outcomes	Unclear risk	Low drop-outs and a modified ITT was car- ried out Comment : reported but not all reasons ex- plained
Incomplete outcome data (attrition bias) Objective outcomes	Unclear risk	Low drop-outs and a modified ITT was car- ried out Comment : reported but not all reasons ex- plained
Selective reporting (reporting bias)	Low risk	Comment : all outcomes reported as men- tioned in the clinical trial record
Other bias	Low risk	Comment: no other bias

Pbert 2013

Methods	Cluster RCT, randomisation ratio: 1:1, superiority design
Participants	Inclusion criteria : participants in grade 9-11, BMI \geq 85th percentile for age and gender. Provided assent and had parental consent. Had at least 1 English-speaking parent Exclusion criteria : planning to move out of the area, had a medical condition that precluded adherence to the intervention, diagnosis of a serious psychiatric illness, genetic or endocrine cause of obesity, taking a medication associated with weight gain or weighing \geq 300 lbs Diagnostic criteria : as above
Interventions	Number of study centres: 8 Treatment before study: none Description of interventions "Lookin' Good Feelin' Good" intervention : incorporated recommendations for the prevention and treatment of child and adolescent overweight and obesity and based on social cognitive theory. 6×1 -to-1 counselling sessions of 18-29 minutes over 2 months, during the school day in non-academic classes in the school nurse's office. Used the 5-3- 2-1-0 approach to support making 5 daily key behaviour changes: \geq 5 servings of fruit and vegetables; 3 structured meals; \leq 2 hours of television, computer, electronic games; \geq 1 hour moderate physical activity, 0 limit soda and sugar-sweetened drinks A participant-centred counselling approach allowed school nurses to tailor the interven- tion to the student's needs. At each visit there was a weigh-in and feedback, review of diet and physical activity logs, assessing progress to behaviour change goals, reviewing successes, problem solving, setting new goals, assessing behaviour and identifying barri- ers Provided and instructed in the use of a pedometer. A USD25 gift certificate was provided at each assessment. School nurses were trained through a daylong group training session Control : 6×1 -to-1 visits with the school nurse for 8.5-9 minutes over 2 months to review behaviour changes, read 6 informational pamphlets on weight management and had questions answered

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 102 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Pbert 2013 (Continued)

Outcomes	Outcomes reported in abstract of publication : ate breakfast, intake of total sugar and added sugar, drink soda ≤ 1 time/day, ate at fast-food restaurants ≤ 1 time/week, BMI, activity, caloric intake
Study details	Run-in period: none Study terminated early: no Trial identifier: -
Publication details	Language of publication: English Funding not stated Publication status: peer-reviewed journal
Stated aim for study	Quote from publication: "The purpose of this study was to test the feasibility and efficacy of a school nurse delivered weight management intervention on BMI, diet, physical activity, and sedentary behavior among overweight and obese adolescents."

Notes

Risk	of	bias
	·	

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote from publication: "Schools were pair matched on total enrolment, gender, race and ethnicity, and percent receiving reduced or free lunch; 1 from each pair was then randomly assigned to either the school nurse counselling intervention group or the control group". "Random assignment was conducted by the study statistician." Comment: majority of baseline character- istics associated with obesity were similar
Allocation concealment (selection bias)	Unclear risk	Comment : no details
Blinding of participants and personnel (performance bias) Subjective outcomes	High risk	Quote from publication: "Participants were not blinded to condition as they re- ceived the intervention allocated to their school." Comment: high risk of performance bias
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Quote from publication: "Participants were not blinded to condition as they re- ceived the intervention allocated to their school." Comment: high risk of performance bias

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 103 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Pbert 2013 (Continued)

Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Quote from publication: "Assessments were completed by a research assistant who was not blinded to school condition at base- line and 2 and 6 months following baseline in the school nurse office." Comment: not blinded
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from publication: "Assessments were completed by a research assistant who was not blinded to school condition at base- line and 2 and 6 months following baseline in the school nurse office." Comment: not blinded; however, objective outcomes unlikely to be affected by lack of blinding
Incomplete outcome data (attrition bias) Subjective outcomes	Low risk	Comment : low drop-outs, reasons given, ITT analysis
Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Comment: low drop-outs, reasons given, ITT analysis
Selective reporting (reporting bias)	High risk	Quote from publication: "We reported on all physiologic and eating and activity be- havioral outcomes. We did not report on psychosocial outcomes that could be con- sidered intermediary variables." Comment: not reported baseline weight controls or intervention or height data
Other bias	Unclear risk	Quote from publication: "Models were also adjusted for baseline level of the out- come and for any baseline characteristics that differed significantly by group at base- line." Comment: unclear if they have accounted for clustering in the analysis

Pitetti 2007

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design
Participants	Inclusion criteria : aged 14-19 years; a physician and a psychologist, both experienced in autism, confirmed that diagnosis met the DSM-IV-Text Revised; manifested moderate-to-profound mental retardation as assessed by standardised tests of intelligence, including the Leiter International Performance Scale, Slosson Intelligence Test, Wechsler Adult Intelligence Scale, or a combination of these; all had histories of lengthy and restrictive placement resulting from their severe maladaptive behaviours; identified by staff as able

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 104 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Pitetti 2007 (Continued)

	to follow instructions to perform treadmill walking Exclusion criteria: had no medical contraindications (i.e. cardiovascular/respiratory anomalies) or significant primary sensory or motor impairments that restricted them from treadmill walking Diagnostic criteria: not stated
Interventions	 Number of study centres: 1 Treatment before study: none Description of interventions Treadmill walking group : weekly activity, regular activity classes (i.e. 15-30 minutes, Monday-Wednesday-Friday) consisted of treadmill walking, when regular activity classes were not planned (i.e. Tuesday and Thursday), taken to the gym and given the opportunity to walk on the treadmill, given the opportunity to walk on the treadmill at their residence in the evenings All 10 participants trained to walk unassisted on the treadmill during their regular class time Initial frequency of twice per week, progression of 1 day every 2 weeks to a peak frequency of 5 times per week. Duration was for 8 minutes per session, with a progression of 1-2 minutes every 2-3 weeks to a peak duration of 20 minutes per session. Initial treadmill speed 2.4-3.5 mph, with a progression of 0.1-0.3 mph every 2-3 weeks to a peak speed of 3.7-4.1 mph. Initial grade of 0%, with progressive increases of 0.5% The activities took place under the guidance of a staff member with a Master's degree in adapted physical activity Control group : leisure activity of choice 3 times per week. Not a strict schedule. Student Support Plan designed and implemented by the residential treatment facility staff members, allowed for 30 minutes of 'leisure activity', 3 times per week, at the campus gym. These activities took place under the guidance of a staff member with a Master's degree in the following activities; basketball (shooting, dribbling, passing), jumping rope, roller skating, scooter-board activities, object control skills (i.e. throwing and catching the ball), striking a ball (i.e. tennis or nerf) with a tennis racket or plastic bat and cycling skills (e.g. adult bicycle or tricycle)
Outcomes	Outcomes reported in abstract of publication: BMI, treadmill walking
Study details	Run-in period: prior to initiating the study, all 10 participants had been trained to walk unassisted (i.e. not holding on to railing) on the treadmill during their regular class time (e.g. 1-3 times per week, duration of 5-10 minutes) and, therefore, were acclimated to the use of the treadmill Study terminated early: no Trial identifier: -
Publication details	Language of publication: English Funding not stated Publication status: peer-reviewed journal
Stated aim for study	Quote from publication: "The purpose of this study was to determine the efficacy of in- corporating a 9-month treadmill walking program into the weekly academic curriculum of youth with severe developmental disabilities including autism."

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 105 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
Pitetti 2007 (Continued)

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Comment: randomisation was unclear from the manuscript. After contact with the authors to check on method of ran- domisation information was provided: "it was a randomized allocation using ran- dom assignment or random placement. We flipped a coin and "heads" assigned the par- ticipant to the treadmill group and "tails" assigned the participants to the control group." Comment: appropriate
Allocation concealment (selection bias)	Unclear risk	Comment : randomisation by coin toss
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment: authors stated, "Participants were severely developmentally disabled, so they had limited to no ability to be cognizant of whether they were in the supplemental treadmill walking or control group."
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment: no details blinding outcomes assessors. No member of the research team or outcome assessors participated during or was present in the exercise portion, respec- tively. Objective outcomes unlikely to be affected by lack of blinding
Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Comment : no attrition
Selective reporting (reporting bias)	High risk	Comment: exercise capacity (treadmill walking frequency, speed, elevation) not reported. Authors stated that all measured outcomes were reported
Other bias	Low risk	Comment: no other bias

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 106 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. Resnicow 2005

Methods	Cluster RCT, randomisation ratio: 1:1, superiority design
Participants	 Inclusion criteria: African-American girls aged 12-16 years and BMI > 90th percentile for age and gender, churches where the majority of members' household income was above USD40,000 Exclusion criteria: unclear Diagnostic criteria: used the 90th percentile as inclusion cut-off point rather than the 85th percentile based on formative research and pilot studies. Girls on the lower end of the obesity continuum, i.e. 85th to 90th percentile, were different behaviourally and psychologically, and combining girls from the low and high ends of the obesity continuum would adversely affect group cohesion
Interventions	Number of study centres: 10 Treatment before study: none Description of interventions High intensity (24-26 sessions) : girls attended weekly group behavioural sessions. Parents were encouraged to attend sessions (around 12 sessions). Each group session included an experiential, interactive behavioural activity, at least 30 minutes of mod- erate-to-vigorous physical exercise, and preparation or consumption (or both) of low- fat, portion-controlled meals or snacks. Target behaviours included: increased fruit and vegetable intake, decreased fat intake, decreased fast-food intake, decreased sedentary behaviour and increased physical activity. Girls were taught to reshape their target be- haviours using the principles of substitution, moderation and abstinence. Girls focused their behaviour change on target foods or priority behaviours identified or selected by the girls. At the beginning of each intervention cycle, girls only attended a 1-day retreat where participants completed a low ropes course and team building activities, ate healthy portion-controlled meals and attended a group session on hunger and satiety. All girls received a 2-way paging device. Messages, developed by the girls based on their target foods and activity patterns, were sent to them throughout the day and in key times when they needed reminders about their eating or physical activity. Received 4-6 MI calls by telephone over the 6 months of intervention to support and help in behavioural change Moderate intensity (6 sessions) control : sessions were selected from the larger pool of sessions delivered to the high-intensity group. Parents were encouraged to attend sessions (3 sessions). Topics included fat facts, barriers to physical activity, fad diets, neophobia (i.e. fear of new foods) and benefits of physical activity. Girls did not receive the 2-way pagers, MI telephone calls or kick-off retreat
Outcomes	Outcomes reported in abstract of publication: BMI units and % body fat
Study details	Run-in period: churches were contacted either by telephone or in-person and adminis- tered a brief screening instrument that queried their membership numbers and socioe- conomic status Study terminated early: no Trial identifier: -
Publication details	Language of publication: English Other funding: "given that the sponsoring agency was unable to provide any additional funding, we were able to complete the study in only 10 of the projected 12 churches." Publication status: peer-reviewed journal

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 107 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Resnicow 2005 (Continued)

Stated aim for study	Quote from publication: "The primary aim of the project, called Go Girls, was to develop and test a culturally tailored intervention program for overweight 12- to 16-year-old AA [African-American] adolescents and their parents."

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote from publication: "Before ran- domization, a pool of middle and upper income churches was identified by project staff based on prior projects as well as telephone directory and internet searches, Churches were then contacted either by telephone or in person. Only churches that reported that the majority of mem- bers' household income was above \$40, 000 [USD40,000] were included." "A to- tal of 10 churches (including the aggregate church) were randomized to condition, five treatment (high intensity) and five compar- ison (moderate intensity)." Comment: there was no difference in base- line parameters between groups
Allocation concealment (selection bias)	Unclear risk	Quote from publication: "A total of 10 churches (including the aggregate church) were randomized to condition, five treatment (high intensity) and five comparison (moderate intensity)." Comment: no further details
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment : no mention of blinding
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : no mention of blinding, objective outcomes unlikely to be affected by lack of blinding
Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Quote from publication: "no evidence of differential attrition, because girls in the moderate-intensity group who dropped out did not significantly differ from drop- outs in the high-intensity group." "In in- tention-to-treat analysis, there was no sig-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 108 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Resnicow 2005 (Continued)

		nificant group difference for BMI, the trial's main outcome, nor were there significant group effects for any of the secondary out- come." Comment: reported numbers lost to fol- low-up but reasons not provided
Selective reporting (reporting bias)	Unclear risk	Comment : protocol unavailable
Other bias	Low risk	Comment : before randomisation, a pool of middle- and upper-income churches was identified by project staff based on prior projects as well as telephone directory and Internet searches. Churches were then con- tacted either by telephone or in-person and administered a brief screening instrument that queried their membership numbers and socioeconomic status. Only churches that reported that the majority of members household income was above USD40,000 were included. Churches requested that the comparison condition receive a meaning- ful intervention. It was agreed on by the church representatives and study staff that 6 sessions represented a meaningful inter- vention of sufficient benefit that would not jeopardise between-group differences. However, using different timings in the comparator (once per month instead of once per week) and this may have had an impact For cluster analysis - quote: "Outcomes were analyzed with a mixed model repeated measures ANOVA program, SAS PROC MIXED (SAS Institute, Cary, NC), that allows for adjustment of subject non-inde- pendence within churches."

Saelens 2002

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design
Participants	Inclusion criteria: aged 12-16 years, 20-100% above the median (50th percentile) for BMI for age and gender. Interested in weight control, not currently engaged in another weight control programme, and otherwise healthy as determined by a paediatrician Exclusion criteria: - Diagnostic criteria: as above.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 109 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Interventions	Number of study centres: unclear
	Treatment before study: none
	Description of interventions
	Healthy Habits : computer and telephone intervention. Adolescents engaged in a com-
	puter program after baseline assessment, the program was adapted from PACE+ soft-
	ware designed for adolescents and modified for overweight adolescents. It assessed eat-
	ing, physical activity and sedentary behaviour and guided adolescents through individ-
	ualised plans generated to increase physical activity or decrease sedentary behaviour and
	decrease dietary fat or increase fruits/vegetables or decrease overeating/snacking. Plan
	generation included identifying benefits, barriers and specific strategies to achieve goals.
	Action plan summaries were generated, and a provider summary was produced for the
	(tailored physician counselling) and approximately 1 week after the clinic visit met the
	study author to discuss upcoming mail and telephone contacts and to learn food self-
	monitoring
	Calls from a telephone counsellor 1 week later detailed telephone scripts to address
	adolescents' weight change since the last call, the link between weight change and eating
	and physical activity behaviours, instruction and feedback on self-monitoring, goals and
	behavioural skills
	Provided with a manual and information sheets. Self-monitoring of food and beverage
	intake and calories consumed
	Foods were categorised into green, red or no colour foods. Green defined as ≤ 1 g of fat
	per serving, 150 calories per serving and providing a good source of ≥ 1 valuable dietary
	components (e.g. calcium, fibre or protein), red foods were defined as having ≥ 5 g of
	fat per serving or were diet versions of high-fat foods. The eventual green food goal was
	40 green food servings (based on standard serving sizes) or more per week, and the red
	Fince and to self monitor physical activity doily with a goal of a minimum of 60
	minutes of at least moderate-intensity physical activity on 5 days per week with gradual
	increases from baseline
	Overall duration 16 weeks with 13 sessions.
	Paediatricians trained with the study protocol and telephone counsellors (with at least a
	Bachelor's degree in psychology or nutrition) received weekly supervision
	Standard care control : non-tailored physician-counselling session. 1 session in the 16-
	week treatment period by the same paediatrician as the intervention group. Assessed/
	encouraged the adolescent's motivation for weight-related behaviour change, provided
	information about short- and long-term health consequences of high weight status and
	benefits of better weight control, made recommendations for healthful eating consistent
	with the Food Guide Pyramid, reviewed physical activity recommendations for adoles-
	cents (60 minutes per day of at least moderate-intensity physical activity), and encour-
	aged consistency and persistence with health behaviour changes. Used a worksheet to fa-
	clittate the discussions. Adolescents encouraged to implement recommended behaviour $\frac{1}{2}$
	Addescents received USD25 for post treatment and USD25 for follow up accomment
	In the intervention group, a lottery occurred after all adolescents had completed post-
	treatment assessment for USD50. Adolescents were awarded 1 point each for meeting
	self-monitoring, physical activity, calorie, green food goals and red food goals each week

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 10 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Saelens 2002 (Continued)

	based on the counsellor's review of self-monitoring booklets. Points were accumulated for tickets for a study-based lottery (1 point = 1 ticket)
Outcomes	Outcomes reported in abstract of publication : BMI z scores, behavioural skills use, energy intake, % calories from fat, physical activity, sedentary behaviour and problematic weight-related or eating behaviours/beliefs, feasibility and participant satisfaction
Study details	Run-in period: - Study terminated early: no Trial identifier: -
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal
Stated aim for study	Quote from publication: "This study evaluates the post-treatment and short-term follow- up efficacy of, as well as participant satisfaction for, a 4-month behavioral weight control program for overweight adolescents initiated in a primary care setting and extended through telephone and mail contact."
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote from publication: "Randomiza- tion occurred by selection among opaque envelopes labelled with levels of percent overweight, each envelope containing an HH [Healthy Habits] or TC [typical care] card." Comment: unclear how envelopes were se- lected or how the labelling affected selec- tion
Allocation concealment (selection bias)	Unclear risk	Quote from publication: "Randomiza- tion occurred by selection among opaque envelopes labelled with levels of percent overweight, each envelope containing an HH or TC card." Comment: unclear if assignment envelopes were used with appropriate safeguards (e. g. if envelopes were sealed or sequentially numbered)
Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	Comment : no blinding of carers, unclear if participants blinded

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 111 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Saelens 2002 (Continued)

Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment: no blinding of carers, unclear if participants blinded
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	Comment: not specified
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment: not specified, outcomes un- likely to be affected by blinding
Incomplete outcome data (attrition bias) Subjective outcomes	High risk	Comment : reasons not provided, imbal- ance in dropouts, ITT used
Incomplete outcome data (attrition bias) Objective outcomes	High risk	Comment : reasons not provided, imbal- ance in dropouts, ITT used
Selective reporting (reporting bias)	Unclear risk	Comment : not enough information to judge
Other bias	Low risk	Comment : no other bias

Savoye 2007

Methods	Parallel RCT, randomisation ratio: 2:1, superiority design
Participants	Inclusion criteria: BMI > 95th percentile based on the CDC growth chart, aged 8-16 years, English-speaking ability, shown an interest in the weight management programme, have a carer (e.g. father, mother or grandparent) who was willing to participate in the educational component of the programme Exclusion criteria: had diabetes, psychiatric disorder (e.g. schizophrenia, severe autism or mental retardation, or psychosis) or other serious medical condition that would preclude participation in the programme, taking medications that potentially cause significant weight gain (e.g. risperidone, olanzapine, clozapine) as well as using medications for weight loss or involved in a coexisting weight management programme Diagnostic criteria: as above
Interventions	Number of study centres: 1 Treatment before study: none Description of interventions Bright Bodies weight management : nutrition/behaviour modification once (40 min- utes each) per week: behaviour modification classes for participants and carers were held separately. Topics were provided from the Smart Moves Workbook, a curriculum devel- oped for overweight children and used in the authors' pilot study. Sample topics included Ready, Set, Goal!, Risky Business: Identifying High-risk Situations, Environmental En- gineering, Mirror, Mirror on the Wall, Bullies, Teasers, and Other Annoying People and

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 112 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Savoye 2007 (Continued)

Oops I Slipped - Understanding a Relapse. Attended the programme twice per week for 6 months and then every other week for an additional 6 months Techniques included self-awareness, goal setting, stimulus control, CST, cognitive behaviour strategies and contingency management. Behaviour modification classes for carers included topics that reflected the challenges that parents verbalised. Classes emphasised the importance of the parents' roles in modelling healthy behaviour change. Motivational tools were used to encourage regular attendance Each class of high-intensity exercise to sustain 65-80% of the age-adjusted maximal heart rate held twice (50 minutes each) and nutrition/behaviour modification once (40 minutes each) per week. Participants were also encouraged to exercise 3 additional days at home per week and to decrease sedentary behaviours. The minimum activity that each participant completed was 100 minutes per week (2 × 50-minute sessions) for the first 6 months and 100 minutes twice per month for the last 6 months The nutrition education component of the weight management programme used a nondiet approach that emphasised low-fat, nutrient-dense foods of moderate portion sizes No details of trainer provided, registered dietitians supervised nutritional component Control : received diet and exercise counselling by registered dietitians and physicians along with brief psychosocial counselling by a social worker. The participant and carer were both involved in setting the nutrition and activity goals to ensure that the clinic plan was realistic and accepted by both. Exercise counselling included decreasing sedentary activities (computer and video games) and finding an activity the participant enjoyed enough to engage in on a regular basis. Nutrition counselling included decreasing intake of juice, switching to diet beverages, switching from whole-fat to low-fat milk and bringing lunch to school vs choosing hot lunch. 30-minute session every 6 months Outcomes Outcomes reported in abstract of publication: BMI z score, BMI, % body fat, total body fat mass, total cholesterol, HDL and LDL cholesterol, insulin resistance Study details Run-in period: none Study terminated early: no Trial identifier: NCT00409422 Publication details Language of publication: English Non-commercial funding Publication status: peer-reviewed journal Stated aim for study Quote from publication: "to compare changes in BMI, body composition, insulin sensitivity, blood pressure, and lipid profiles, a secondary aim was to compare nutrition components by randomizing families in the weight management group to either the better food choices or structured meal plan approaches." Notes The study initially re-randomised those in the weight management group to either a meal plan group or a better food choices group. After high levels of attrition in the meal plan group (at 6 months, 83%) this arm was discontinued. No results for this group were reported Risk of bias Bias Authors' judgement Support for judgement

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 113 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Savoye 2007 (Continued)

Random sequence generation (selection bias)	Low risk	Quote from publication: "Participants were randomly assigned 2:1 by using a per- muted block design to the weight manage- ment or clinic control group by the same co-investigators who recruited the partic- ipants. Random assignments were gener- ated by computer and concealed by the study statistician (Dr Dziura)." Comment: appropriate
Allocation concealment (selection bias)	Unclear risk	Comment : stated allocation was main- tained by the study statistician and was con- cealed but no details reported
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Quote from publication: "Participants were not blinded to treatment group. They knew if they were returning back to clinic only (control) or Program (experimental) at the school. Personnel were not blinded during treatment phase either because they knew if subject was going to the Program." Comment: high risk of performance bias
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : no details on blinding; how- ever, low risk of bias from objective out- comes
Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Comment : numbers and reasons provided, used ITT analysis
Selective reporting (reporting bias)	Unclear risk	Quote from publication: "We have reported all the outcomes measured except for psychosocial outcomes which we are writing a manuscript for as we speak. We assessed self-concept of children and family dynamics of family using Piers-Harris Self Concept Scale and Family Assessment Device, respectively. We plan to submit this manuscript by January 1." Comment: the results at 6 and 12 months were different in each publication
Other bias	Low risk	Comment : no other bias

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 114 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. Schranz 2014

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design
Participants	Inclusion criteria : males aged 13-17 years; considered to be very overweight or obese (very overweight defined as being above the mid-point between the age- and gender-specific BMI cut-offs for overweight and obese, e.g. if the age- and gender-specific BMI cut-offs for overweight and obesity were 23 kg/m ² and 25 kg/m ² , respectively, then the BMI cut-off for very overweight was calculated to be 24.0 kg/m ² ; Cole criteria); Tanner stage ≥ 2 ; categorised as a low or moderate risk by the Sports Medicine Australia screening questionnaire or, if categorised as high risk, obtained a medical clearance from their general practitioner and had no history of injuries or musculoskeletal conditions Exclusion criteria : < Tanner stage 2; categorised as a high risk by the Sports Medicine Australia pre-exercise screening questionnaire and did not obtain a medical clearance; current or previous injuries which would prevent them from participating in resistance training; exhibit musculoskeletal conditions which would place them 'at risk' as a result resistance training Diagnostic criteria : as above
Interventions	Number of study centres: 1 or 2 gymnasia Treatment before study: - Description of interventions 6-month resistance training programme : 3 × 75-minute sessions per week on non- consecutive days. Each session included a 10-minute warm-up, 60 minutes of resistance training, and a 5-minute static stretching cool down. A total of 10 separate multijoint exercises and single-joint exercises for major muscle groups were trained during each session. Weight-stacked machines and free-weight exercises were used Control : no intervention: instructed to continue with normal everyday activities. After completion of the 12-month assessment, offered a complimentary 3-month gym mem- bership
Outcomes	Outcomes reported in abstract of publication: exercise self-efficacy, resistance training confidence, self-esteem, body composition
Study details	Run-in period: orientation to the resistance training equipment run by 1 of the trainers to familiarise with machines, estimate 1-repetition maxima to guide strength testing, to determine a starting load Study terminated early: no Trial identifier: ACTRN12609001078246
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal
Stated aim for study	Quote from publication: "to determine the effect of a 6-month resistance training in- tervention on the self-concept strength and body composition of overweight and obese adolescent males."
Notes	
Risk of bias	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 115 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Schranz 2014 (Continued)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication: "random num- ber generator." Comment: appropriate
Allocation concealment (selection bias)	Low risk	Quote from publication: "Before recruit- ment began an impartial individual, using a random number generator, produced a random list of group allocation for a pos- sible 70 participants Each group alloca- tion was written on a piece of paper and concealed inside a non-transparent enve- lope which was sealed and the correspond- ing participant number written on the out- side." Comment: appropriate
Blinding of participants and personnel (performance bias) Subjective outcomes	High risk	Quote from publication: "group alloca- tion which was revealed to the participant (and the Principal investigator) after base- line testing was complete." Comment: self-reported outcome mea- surement
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Quote from publication : "group alloca- tion which was revealed to the participant (and the Principal investigator) after base- line testing was complete." Comment : investigator-assessed
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Quote from publication: "All outcome variables (with the exception of DEXA [dual-energy X-ray absorptiometry] which the lead author conducted) were conducted by trained research assistants who were blinded to group allocation." Comment: self-reported outcome mea- surement
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from publication: "All outcome variables (with the exception of DEXA which the lead author conducted) were conducted by trained research assistants who were blinded to group allocation." Comment: investigator-assessed

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 116 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Schranz 2014 (Continued)

Incomplete outcome data (attrition bias) Subjective outcomes	High risk	Quote from publication: "they were in- cluded in the analysis at all subsequent as- sessment sessions." Comment: no missing data reported and reasons explained, but handling of missing data not reported, differential dropout be- tween groups; however, states all were in- cluded in the analysis at all assessment ses- sions which suggests an ITT analysis (al- though no details) and baseline BMI is dif- ferently reported which may suggest a dif- ferent number was used
Incomplete outcome data (attrition bias) Objective outcomes	High risk	Quote from publication: "they were in- cluded in the analysis at all subsequent as- sessment sessions." Comment: no missing data reported and reasons explained, but handling of missing data not reported, differential dropout be- tween groups, however, states all were in- cluded in the analysis at all assessment ses- sions which suggests an ITT analysis (al- though no details) and baseline BMI is dif- ferently reported which may suggest a dif- ferent number was used
Selective reporting (reporting bias)	High risk	Comment: bone mineral density not reported
Other bias	Low risk	Comment : no other bias

Sigal 2014

Methods	Parallel RCT, randomisation ratio: 1:1:1:1, superiority design
Participants	Inclusion criteria : BMI \geq 95th percentile for age and gender or \geq 85th percentile for age/gender with an additional diabetes risk factor (criteria stated), or both; waist circumference \geq 75th percentile for age and gender; aged 14-18 years; post-pubertal (Tanner stage IV or V); sedentary for \geq 4 months prior to enrolment. Had to attend \geq 13 out of 16 prescribed sessions (> 80% adherence) during run-in Exclusion criteria : participation in previous 4 months in a regular programme of exercise or aerobic sports \geq 2 times per week for at least 20 minutes per session; diabetes; body weight > 159 kg or BMI > 45 kg/m ² , or both; use of any performance-enhancing medication; use of medication/herbal supplement likely to affect body composition, lipids or glucose metabolism (metformin permitted); significant weight change; uncontrolled hypertension; activity restrictions due to disease; other illness; unwillingness/lack of availability to attend exercise and/or nutrition sessions; significant cognitive deficit; pregnancy or intention; inability to communicate in English or French

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 117 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Sigal 2014 (Continued)

	Diagnostic criteria: as above
Interventions	Number of study centres: 1 Treatment before study: - Description of interventions All groups had 3 counselling sessions (baseline, 3 months and 6 months) by a registered dietitian to promote healthy eating, with a daily energy deficit of 250 kcal (see details of run-in session). Also had telephone support at 6 weeks and 4 months The 3 exercising groups attended gyms 4 times weekly. Duration 22 weeks. Exercise was supervised by personal trainers weekly to 3 months, and biweekly from 3-6 months. Personal trainers monitored attendance and exercise progression by reviewing sign-in sheets and exercise logs. To encourage adherence and retention, participants completing all measurement assessments received a USD50 gift certificate. In addition, participants who maintained good compliance (\geq 70% of sessions attended) obtained a free gym membership renewal for a subsequent 6-month period (postintervention) Diet + aerobic exercise : followed diet plan + exercised on treadmills, elliptical machines or bicycle ergometers. Heart rate monitors used to adjust workloads to achieve target heart rates. Gradual progressed in exercise duration (20-45 minutes per aerobic exercise session) and intensity (65-85% of maximum heart rate) Diet + resistance exercise : followed diet plan + performed 7 exercises using weight machines or free weights, progressing from 2 sets of 15 repetitions at moderate intensity to 3 sets of 8 repetitions at the maximum resistance that could be moved 8 times (8- RM), duration progressed to a maximum of 45 minutes Diet + resistance training programme during each session Diet-only control : followed the same eating plan as those in the exercise groups, wait list control as offered the option to begin an exercise programme (with a free gym membership) for the subsequent 6 months
Outcomes	Outcomes reported in abstract of publication: % body fat, waist circumference
Study details	Run-in period : 4-week run-in period to assess compliance with low-intensity aerobic and resistance exercise for 4 sessions per week. Individually supervised by a personal trainer 2 sessions per week. Also small group sessions (n = 12) covering various topics: barriers in achieving healthful eating, solutions to overcome them, taste panels. The recommended macronutrient energy distribution was 15-20% protein, 50-55% carbohydrates and 30% fat. To qualify for randomisation, participants had to attend at least 13 out of 16 prescribed sessions (> 80% adherence) during run-in Study terminated early : no Trial identifier : NCT00195858
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal
Stated aim for study	Quote from publication: "to determine the effects of aerobic training, resistance train- ing, or their combination on percentage body fat and cardiometabolic risk markers in previously inactive postpubertal overweight and obese adolescents."

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 118 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Sigal 2014 (Continued)

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication: "Randomiza- tion was stratified by degree of overweight (85th-95th BMI percentile or ≥95th BMI percentile) and sex and done in blocks ran- domly varying between 4 or 8 participants. Randomization sequences were prepared by an independent statistician and entered into a telephone based central randomiza- tion program." Comment: appropriate
Allocation concealment (selection bias)	Low risk	Comment : as above
Blinding of participants and personnel (performance bias) Subjective outcomes	High risk	Quote from publication: "The exercise specialist informed participants of their group assignments allowing the research coordinator to remain blinded." Comment: no blinding of participants or personnel
Blinding of participants and personnel (performance bias) Objective outcomes	High risk	Quote from publication: "The exercise specialist informed participants of their group assignments allowing the research coordinator to remain blinded." Comment: no blinding of participants or personnel
Blinding of outcome assessment (detection bias) Subjective outcomes	High risk	Comment: self-reported outcome mea- surement, high risk of bias for self-reported outcomes
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from publication: "Outcome as- sessorswere blinded to the study group of participants" Comment: investigator- assessed outcomes. Unlikely that blinding was maintained, but low risk of bias from objective outcomes
Incomplete outcome data (attrition bias) Subjective outcomes	Low risk	Comment : missing numbers reported and reasons explained

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 119 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Sigal 2014 (Continued)

Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Comment : missing numbers reported and reasons explained
Selective reporting (reporting bias)	High risk	Comment: self-esteem, HRQoL and Past Day Physical Activity Recall not reported
Other bias	Low risk	Comment: no other bias
Toulabi 2012		
Methods	Parallel RCT, randomisation ratio: 1:1, superiority design	
Participants	Inclusion criteria : absence of morbid obesity (hormonal disorders such as hypothyroidism, Cushing's syndrome, etc.), absence of weight-reducing diets or drugs affecting body weight, participation of 1 parent (with a minimum educational level of 9th grade) in the study, tendency of the students and parents to lose weight, BMI > 28 kg/m ² in the 1st grade students (15 years old), and BMI ≥ 29 kg/m ² in the 2nd grade and 3rd grade students (16 and 17 years old) Exclusion criteria : consuming special diets, taking drugs affecting body weight, or not complying with the intended conditions or criteria (due to the holidays or examination periods) Diagnostic criteria : as above	
Interventions	 Number of study centres: 12 schools Treatment before study: none Description of interventions Behaviour modification programme : implemented by a nursing expert and a physical education expert for the participants (based on the compiled training booklets). 24-hour diet record for participants and parents; face-to-face nutritional instructions for the parents supported by an educational booklet (during 4 × 1-hour weekly sessions) ; face-to-face nutritional instructions for the participants on dietary modification and techniques for increasing physical activity, supported by an educational booklet (during 8 × 45-minute sessions, held twice per week); exercises demonstrated by the physical education expert at school in a group, 1 hour per day, 3 days per week, for 6 weeks The exercise programme consisted of warming up for 10 minutes, performing aerobic exercises for 40-45 minutes and cooling down for 5-10 minutes, and included rapid and vigorous walking, running, rope jumping, zigzag movements, high-knees, butterfly movements, stepping exercises and exercises for strengthening important muscles (e.g. rectus abdominal, quadriceps, trapezius and latissimus dorsi) Control : provided with educational booklets after data collection 	
Outcomes	Outcomes reported in abstract of public cumferences; students' and parents' nutritie	cation: weight, BMI, and waist and hip cir- on knowledge; symptoms of depression
Study details	Run-in period: none Study terminated early: no Trial identifier: trial was registered at Met of Medical Sciences, Tehran under the num	abolism Research Center, Tehran University nber 578

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 120 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Toulabi 2012 (Continued)

Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal	
Stated aim for study	Quote from publication: "to determine the gram on body mass index (BMI) in obese p	influence of a "behavior modification" pro- ublic high school students in Iran."
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote from publication: "Participants were randomly assigned to either interven- tion or control." Comment: no other details
Allocation concealment (selection bias)	Unclear risk	Comment : no details
Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	Comment: no details
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment: no details
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	Comment: the same nurse who provided the intervention measured outcomes
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : the same nurse who provided the intervention measured outcomes; how- ever, low risk of bias from objective out- comes
Incomplete outcome data (attrition bias) Subjective outcomes	Unclear risk	Comment : no discussion of attrition
Incomplete outcome data (attrition bias) Objective outcomes	Unclear risk	Comment : no discussion of attrition
Selective reporting (reporting bias)	Unclear risk	Comment: no clinical trial record or pro- tocol identified
Other bias	Low risk	Comment : no other bias

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 121 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. van Egmond-Frohlich 2006

Methods	Parallel RCT, randomisation ratio: 1:1, sup	eriority design
Participants	Inclusion criteria : participating in an inpat as the primary indication (BMI > 97th perc Exclusion criteria : secondary obesity, langu days, type 1 diabetes, psychiatric disease Diagnostic criteria : BMI > 97th percentile	tient rehabilitation programme with obesity tentile), aged 9-16 years, informed consent nage barriers, duration of rehabilitation < 28 c.
Interventions	Number of study centres: 320 physicians Treatment before study: rehabilitation programme Description of interventions Behavioural education programme : after the rehabilitation programme, participating physicians of the intervention group received a practice guideline. Telephone consul- tation was offered. Key items of the guideline were: addressing the guilt or fate prob- lem; treatment aims (health promotion activities); guidance on fat-limiting mixed diet; promotion of a physical active lifestyle; local support resources; promotion of flexible control of eating; patient guidance according to the public health counselling and self- management model; the outpatient programme was intended to have health check-ups every 4 weeks during the first 12 months (10-12 appointments); the intervention was financed by the health insurer AOK Sachsen-Anhalt in the context of research funding Standard of care control : -	
Outcomes	Outcomes reported in abstract of publication: BMI-SDS, HRQoL, behaviour, self-efficacy	
Study details	Run-in period: rehabilitation programme (unknown duration) Study terminated early: no Trial identifier: none	
Publication details	Language of publication: German Non-commercial funding: BMBR, AOK Sachsen-Anhalt, LVA Sachsen-Anhalt Publication status: peer-reviewed journal	
Stated aim for study	"To study the effects of structured outpatient care on the long-term rehab success in children and adolescents" [translation]	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement

Random sequence generation (selection bias)	Unclear risk	Quote from publication (translation): " according to randomisation criteria allocation according to sex and age" Comment: no further details
Allocation concealment (selection bias)	Unclear risk	Quote from publication (translation): " external methods centre of the Martin-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 122 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

van Egmond-Frohlich 2006 (Continued)

		Luther-University Halls"
Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	Comment : nothing stated
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment : nothing stated
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	Comment : nothing stated
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : not specified; however, low risk of bias for objective outcomes
Incomplete outcome data (attrition bias) Subjective outcomes	High risk	Comment : intervention was used by < 50% of participants
Incomplete outcome data (attrition bias) Objective outcomes	High risk	Comment : intervention was used by < 50% of participants
Selective reporting (reporting bias)	High risk	Comment : data only partially reported with usually no differentiation between in- tervention and control group
Other bias	Low risk	Comment : no other bias
Vissers 2008		
Methods	Parallel RCT, randomisation ratio: 1:1, superiority design	
Participants	Inclusion criteria: overweight volunteers in 3rd grade secondary vocational education schools who donated a blood sample. Were in 3rd grade secondary vocational education schools in the Flemish province of Antwerp, Belgium Exclusion criteria: - Diagnostic criteria: no details	
Interventions	Number of study centres: - Treatment before study: none	

A monthly counselling session with a physiotherapist to coach them to increase their daily physical activity. They also received a free subscription to a nearby fitness club and

School-based behaviour changing intervention : intervention was based on concepts from health behaviour change models such as the Social Cognitive Theory, Theory of

Planned Behavior and Transtheoretical Model and Stages of Change

Description of interventions

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 12 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Vissers 2008 (Continued)

	were instructed to work out at least 3 times per week. These workout sessions consisted of a mix of aerobic and strength exercises. In general, a session this would typically include:
	short warming up and stretching; 30 minutes of aerobic exercises such as treadmill
	running, cycling, rowing, stepping; strength exercises focused on large muscle groups
	such as pectoral, upper arm, abdominal and leg muscles; and a cooling down period.
	I he practical implementation of these general guidelines was left to the respective fitness centres
	Participants in the intervention group were offered nutritional counselling by a dictitian. Topic of these counselling sessions was healthy food choices and maintaining a proper energy balance. Every session there was a specific theme, e.g. breakfast, snacks, drinks, dairy products, fast food, portion sizes, nutritional labelling, motivation and coping strategies, based on the Flemish model of 'the active food pyramid', as proposed by the Flemish institute of Health Promotion, an inventory of specific food product and popular brands in adolescents, categorised by health effect, was developed as an attractive hang- up model. Main goals were improving food knowledge, attitude and behaviour
	Total sessions: 6 nutrition sessions: individual or group (maximum of 2 group sessions) once per month. Took place in school after or between school hours. 6 counselling
	sessions once per month. No mention of total length of session but they included 30-
	minute aerobic exercises
	Control : continued to participate in standard gym classes
Outcomes	Outcomes reported in abstract of publication : weight, BMI, waist circumference, fasting glucose
Study details	Run-in period: none Study terminated early: no Trial identifier: -
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal
Stated aim for study	Quote from publication: "To study the effect of a multidisciplinary school-based lifestyle intervention for overweight and obese students attending vocational secondary school (VSE). VSE provides practice-oriented education in which young people learn a specific occupation."
Notes	
Risk of bias	

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote from publication: "were ran- domised" Comment: no details
Allocation concealment (selection bias)	Unclear risk	Comment : no details

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 124 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Vissers 2008 (Continued)

Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment : no details
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from publication: "The researchers were not blinded for the randomization when assessing parameters such as weight and waist circumference due to limited means." Comment: outcomes unlikely to be af- fected by lack of blinding
Incomplete outcome data (attrition bias) Objective outcomes	High risk	Comment : numbers and reasons reported, differential dropouts between study groups
Selective reporting (reporting bias)	Unclear risk	Comment: no clinical trial record or pro- tocol
Other bias	Low risk	Comment : no other bias

Visuthranukul 2015

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design
Participants	 Inclusion criteria: aged 9-16 years; BMI > International Obesity Task Force cut-off corresponding to BMI of 30 kg/m² in adulthood. Exclusion criteria: behavioural and intellectual problems that might be an obstacle to follow the diet instruction, underlying diseases that might affect a weight management programme used drugs associated with weight increment or reduction attended other weight management programmes Diagnostic criteria: as above.
Interventions	Number of study centres: 1 Treatment before study: - Description of interventions Low-GI diet : individual goals for weight management were set. Emphasis on low-GI foods was provided. A dietitian emphasised the selection of low-GI carbohydrates that fit Thai culture and their routine lives. The energy distribution was carbohydrate 50- 55%, protein 15-20% and fat 30-35%. Each visit consisted of a 2-hour, small class teaching session with parental participation (4-5 families/class). The contents varied from the 1st to 6th visit, starting from portion size and food exchange, modest energy restriction, principle of GI, sources of low-GI diet, cooking demonstration of low-GI dishes, guidance about food labelling and some games about GI of common food and beverages Control group : received conventional instructions at the nutrition clinic about low energy (approximately 1200-1300 kcal/day), low-fat (25% of total energy from fat) and high-fibre diet by another dietitian who gave the dietary advices with special emphasis on the energy restriction such as energy count and how to avoid high-fat Thai dishes as

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 125 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Visuthranukul 2015 (Continued)

	well as sources of high-fibre diet Both groups received the same instruction about physical activity, by increasing non- weight bearing exercise 30 minutes per day at least 3 times per week, increasing physical activity in their routine lives and decreasing sedentary activity	
Outcomes	Outcomes reported in abstract of publication: BMI z score, fat, fat-free mass, fasting plasma insulin, HOMA-IR	
Study details	Run-in period: - Study terminated early: no Trial identifier: NCT02049788	
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal	
Stated aim for study	Quote from publication: "The objective of this study was to compare the effectiveness of a low-GI diet program and a standard counselling program in the treatment of obese Thai children."	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication : "Participants were randomly allocated (by computer gen- erated randomization blocks of 10) to re- ceive either conventional obesity clinic ad- vice or an intervention of a low-GI diet." Comment : appropriate
Allocation concealment (selection bias)	Low risk	Quote from publication: "The researcher who did not relate to data collection and data analysis used computer to generate the random allocation sequence. Other re- searchers enrolled participants and assigned them to interventions." Comment: appropriate
Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	Comment: not mentioned
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment: not mentioned

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 126 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Visuthranukul 2015 (Continued)

Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	Comment : not mentioned
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : not reported, but low risk of bias from objective outcomes. Investigator-assessed
Incomplete outcome data (attrition bias) Subjective outcomes	Unclear risk	Quote from publication: "8 out of 35 par- ticipants (22.9%) lost to follow-up 8 out of 35 participants (22.9%) lost to follow- up and 2 participants out of 35 participants (5.7%) withdrew their consents because of the travelling problems." Comment: only reported baselines and re- sults data for participants completing the study. Reasons for dropouts not provided. States ITT but completers only are reported
Incomplete outcome data (attrition bias) Objective outcomes	Unclear risk	Quote from publication: "8 out of 35 par- ticipants (22.9%) lost to follow-up 8 out of 35 participants (22.9%) lost to follow- up and 2 participants out of 35 participants (5.7%) withdrew their consents because of the travelling problems." Comment: only reported baselines and re- sults data for participants completing the study. Reasons for dropouts not provided. States ITT but completers only are reported
Selective reporting (reporting bias)	Low risk	Comment: report all outcomes intended to measure in trial documents and main publication
Other bias	Low risk	Comment : no other bias

Vos 2011

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design
Participants	 Inclusion criteria: obesity, aged 8-17 years, living in the Hague and in the area around the Hague and referred to a paediatrician for overweight or obesity, and increased risk of comorbidity (e.g. hypertension, family history of diabetes mellitus, hypercholesterolaemia, cardiovascular disease (or a combination of these) before the age of 55 years, Hindustani ethnicity) Exclusion criteria: knowledge of the Dutch language, intelligence or social skills insufficient to participate in the group, use of medication that might have an effect on weight loss, medical comorbidities that could affect participation, or previous enrolment in an-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 127 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

other cognitive behavioural treatment programme with the focus on reducing obesity Diagnostic criteria : not stated.
 Number of study centres: 1. Treatment before study: none. Description of interventions Family-based intervention : an individual consultation with the child psychologist, group intervention with 8-10 participants in each group. Received a treatment manual with the objectives and goals of the treatment and, per session, information about the topics discussed. The focus was on the effort to change habits more than weight reduction goals. Adolescents were made aware of their own actions and their way of living that has led to their obesity Several cognitive behavioural techniques were learned (knowledge, skills and attitude) during the intensive phase of the treatment during 6 bi-weekly sessions of 2.5 hours per session. Each session contained: determination of body weight, homework discussion and evaluation, education, physical activity, role playing, discussing homework for next meeting and set goals linked to educational topics of the session. The educational topics included group bond to encourage peer support, individual motivation for participating, nutritional information and the balance between energy intake and energy expenditure, healthy nutrition, self-control techniques, coping with teasing and being teased, self-image, cognitive strategies and relapse techniques Current physical activity level and sedentary behaviour of the child also reviewed, energy intake versus energy expenditure was evaluated and visualised for the adolescent by a computer program. Options to change or optimise physical and sedentary activities were debated and the participants were advised how to find suitable exercise programmes Taught how to read product labels and obtain information on misleading advertisement and discuss how to deal with meals (breakfast, lunch, diner, 2 healthy snacks), and how to make healthy choices and develop healthy eating habits (small bits, slow eating, eating at the family table, no other activities during eating) Parents had se
Outcomes reported in abstract of publication : BMI-SDS, HRQoL, waist circum- ference SDS, physical fitness, insulin resistance, lipid profile, high-sensitive C-reactive protein or for adiponectin
Run-in period: none. Study terminated early: no. Trial identifier: ISRCTN36146436.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 128 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Vos 2011 (Continued)

Publication details	Language of publication: English. Non-commercial funding Publication status: peer-reviewed journal.
Stated aim for study	Quote from publication: "the effect evaluation of a family-based cognitive behavioral multidisciplinary lifestyle treatment. The intervention aims to establish long-term weight reduction and stabilization, reduction of obesity related health consequences and improvement of self-image by change of lifestyle and learning cognitive behavioral techniques."
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication: "Following in- formed consent of all participating chil- dren and parents the children are strati- fied by gender and ethnicity ('North Euro- pean' and 'Other') and randomized to the intervention or control group according to coin-tossing. In order to obtain a similar size of the intervention and control groups, blocked randomization is applied with an allocation ratio of 1:1. Randomization is carried out by a member of the team who does not take part in the treatment" Comment: randomisation by coin tossing
Allocation concealment (selection bias)	Low risk	Quote from publication : "Participants are allocated randomisation codes known by the researcher and research coordinator." Comment : randomisation by coin toss
Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	Comment : no details
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment : no details
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	Comment : no details

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 129 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Vos 2011 (Continued)

Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from publication: "An experienced assistant blinded for the study design mea- sures weight and height." Comment: appropriate
Incomplete outcome data (attrition bias) Subjective outcomes	Low risk	Comment : numbers and reasons provided, ITT analysis used
Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Comment : numbers and reasons provided, ITT analysis used
Selective reporting (reporting bias)	High risk	Comment: some collected data not reported e.g. free fatty acid, gut hormones (all time points) lipids and inflammatory markers (postintervention)
Other bias	Low risk	Comment : no other bias

Walpole 2013

Methods	Parallel RCT, randomisation ratio: 1:1, superiority design
Participants	Inclusion criteria : overweight and obese, $BMI \ge 85$ th percentile for age and gender (WHO 2002), 10-18 years, attending a local paediatric outpatient clinic Exclusion criteria : current use of medication with possible adverse effects of weight gain/loss, non-English speaking, developmental delay, pregnant or diagnosed with an active eating disorder, or both Diagnostic criteria : as above
Interventions	Number of study centres: 1 Treatment before study: - Description of interventions Motivational interviewing intervention : counselling sessions were approximately 30 minutes long, 6 sessions held at the time of regularly scheduled healthy lifestyles ap- pointments. Interventionist was a clinical psychology doctoral student trained in MI. Guided toward increasing awareness of unhealthy behaviours, consideration of whether current behaviour was consistent with personal values and envision how change may be helpful. Where ambivalence or resistance to change, agenda setting, decisional balances and scale questions with empathy and supporting autonomy were used The interviewer was trained in MI and received professional supervision Social skills training: counselling sessions were approximately 30 minutes long, 6 ses- sions held at the time of regularly scheduled healthy lifestyles appointments. Offered advice rather than attempting to elicit ideas, prescribed goals to work on without specific regard for the client's readiness to change. Used a standardised treatment manual, de- veloped and validated for children and adolescents. Sessions were based around finding appropriate ways to navigate typical social situations Different interventionist to the MI group who was provided with feedback at monthly intervals

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 130 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Walpole 2013 (Continued)

Outcomes	Outcomes reported in abstract of publication : self-efficacy, BMI z scores, number of sessions attended
Study details	Run-in period: - Study terminated early: no Trial identifier: NCT01246349
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal
Stated aim for study	Quote from publication: "to determine whether MI, in addition to a standard care program, would significantly increase self-efficacy (a parameter thought to be integral in making and sustaining behavior changes) and promote BMI reduction in children aged 10-18 years compared to a control intervention (social skills training)."

Notes

Risk	of	bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication: "allocation to one of the four strata was made subse- quent to computer-generated block per- mutations, which determined the interven- tion assignment." Comment: block randomisation to ensure balanced groups
Allocation concealment (selection bias)	Low risk	Quote from publication: "study interven- tionists were blind to the randomization process, which was carried out by a research coordinator" Comment: adequate
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Quote from publication: "participants were unaware of the specific intervention group to which they were assigned." Comment: investigator-assessed. Unlikely participants could be blinded to allocation
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Quote from publication: "measurements were assessed at the clinic site by staff who were blinded to the intervention assign- ment" Comment: investigator-assessed

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 131 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Walpole 2013 (Continued)

Incomplete outcome data (attrition bias) Objective outcomes	Low risk	Comment : missing data reported and reasons explained
Selective reporting (reporting bias)	Unclear risk	Comment : HRQoL and self-esteem not yet published
Other bias	Low risk	Comment : no other bias
Wengle 2011		
Methods	Parallel RCT, randomisation ratio: 1:1, sup	eriority design
Participants	Inclusion criteria: aged 12-16 years, BMI morbidities that might have impaired or co- study Exclusion criteria: physical/intellectual lin atric illness, significant non-obesity-related recent surgery performed or planned), treat with weight or growth control (e.g. cortico logical illness (e.g. major depression or an e Diagnostic criteria: as above	> 85th percentile for age and gender, free of ontraindicated their safe participation in the nitations (e.g. developmental delay, psychi- medical conditions, orthopaedic problems, ment with medications that might interfere osteroids or thyroid hormone), and psycho- rating disorder)
Interventions	Number of study centres: - Treatment before study: none Description of interventions Mentored behaviour changinginterventio a 1-day group educational workshop at the l tions and written materials regarding how to successively implement small changes by set outcomes. Learned about the study recomm Visits at baseline, 1, 2, 3 and 6 months incl Met with a mentor in person for 1-2 hou participate in physical activity, and discuss agreed to communicate (either through tele Mentoring was provided by mentor volum Toronto (Ontario). Unclear who delivered tions. The mentor had regular contact with ings and were trained to standardise the int Control : as above without the additional r	n : adolescents and family members attended beginning of the study, given specific instruc- o self-assess behaviour and environment, and tring goals toward measurable and attainable endations for physical activity and nutrition. uded nutrition and activity counselling trs once per week to achieve activity goals, and set nutritional goals. Additionally, they phone or e-mail) twice per week for support teers were recruited from the University of the remaining behaviour changing interven- study personnel, and monthly group meet- ervention nentor support
Outcomes	Outcomes reported in abstract of public HDL, LDL:HDL ratio, consumption high- visits, screen time, feasibility of intervention	cation : BMI z score, waist circumference, calorie foods and snacks, fast food restaurant
Study details	Run-in period: all attended 1-day worksho Study terminated early: no Trial identifier: -	pp prerandomisation

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 132 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Wengle 2011 (Continued)

Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal	
Stated aim for study	Quote from publication: "To conduct a pil a healthy lifestyle intervention with or with metabolic profile, nutrition and physical ac	ot study designed to measure the impact of out individualized mentorship on adiposity, tivity in overweight teens."
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote from publication: "blocked ran- domization with random number gen- erator, 1:1 treatment allocation, mentor- mentee pair matched according to sex." Comment: appropriate
Allocation concealment (selection bias)	Unclear risk	Comment: no details
Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	Comment : unclear if blinding was carried out
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	Comment : unclear if blinding was carried out
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	Comment : unclear if blinding was carried out
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : unclear if blinding was carried out but low risk of bias from objective out- comes
Incomplete outcome data (attrition bias) Subjective outcomes	Unclear risk	Comment : 6 adolescents withdrew shortly after the behaviour changing intervention started (reasons given) but the study did not provide any baseline measures for them
Incomplete outcome data (attrition bias) Objective outcomes	Unclear risk	Comment : 6 adolescents withdrew shortly after the behaviour changing intervention started (reasons given) but the study did not provide any baseline measures for them

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 133 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Wengle 2011 (Continued)

Selective reporting (reporting bias)	Unclear risk	Comment: outcomes reported as stated but no protocol to confirm
Other bias	Low risk	Comment : no other bias
Wong 2015		
Methods	Parallel RCT, randomisation ratio: -, super	iority design
Participants	Inclusion criteria: - Exclusion criteria: - Diagnostic criteria: -	
Interventions	Number of study centres: - Treatment before study: - Description of interventions Standard weight loss + advice + behavioural support : standard weight loss diet + advice + behavioural support (counselling, cookbook of recipes and health guides) to increase habitual water intake to 8 cups/day Control : standard weight loss diet + advice and behavioural support (counselling, cook- book of recipes and health guides)	
Outcomes	Outcomes reported in abstract of publication : water intake, urine specific gravity, BMI z score, cardiometabolic risk factors	
Study details	Run-in period: - Study terminated before regular end (for benefit/because of adverse events): - Trial identifier: -	
Publication details	Language of publication: English Non-commercial funding Publication status: peer-reviewed journal	
Stated aim for study	Quote from publication: "to conduct a pilot study comparing two standard weight loss diets, either with (Experimental) or without (Control) additional advice and behavioral support to increase habitual water intake to 8 cups per day."	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No details
Allocation concealment (selection bias)	Unclear risk	No details

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 134 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Wong 2015 (Continued)

Blinding of participants and personnel (performance bias) Subjective outcomes	Unclear risk	No details
Blinding of participants and personnel (performance bias) Objective outcomes	Unclear risk	No details
Blinding of outcome assessment (detection bias) Subjective outcomes	Unclear risk	No details
Blinding of outcome assessment (detection bias) Objective outcomes	Low risk	Comment : not specified; however, low risk of bias for objective outcomes
Incomplete outcome data (attrition bias) Subjective outcomes	Unclear risk	No details
Incomplete outcome data (attrition bias) Objective outcomes	Unclear risk	No details
Selective reporting (reporting bias)	Unclear risk	No details
Other bias	Unclear risk	No details

ARQoL: asthma-related quality of life; BMI: body mass index; CBT: cognitive behavioural therapy; CDC: Centers for Disease Control and Prevention; CST: coping skills training; CT: computer tomography; DSM-IV-Text Revised: Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition - Text Revised; GI: glycaemic index; GL: glycaemic load; HDL: high-density lipoprotein; HELP: Healthy Eating and Lifestyle Programme; HOMA-IR: homeostatic model assessment, insulin resistance; HRQoL: health-related quality of life; ITT: intention to treat; LDL: low-density lipoprotein; MI: motivational interviewing; mph: miles per hour; n: number of participants; PACE+: Patient-Centered Assessment and Counseling for Exercise plus Nutrition; PedsQL: Pediatric Quality of Life; RCT: randomised controlled trial; SDS: standard deviation score; TEENS: Teaching Encouragement Exercise Nutrition Support - denotes not reported

Note: where the judgement is 'Unclear' and the description is blank, the trial did not report that particular outcome

Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
Balagopal 2005	Study < 6 months.
Belenchia 2013	Primary and secondary outcomes not reported (measures glucose control). Did not meet the aim of the review

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 135 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

(Continued)

Braet 2004	Intervention study, not an RCT.
Carrel 2007	Secondary analysis, not an RCT.
Crandall 2006	Drug intervention.
Daly 2013	Study < 6 months.
Dancy 2006	Intervention study, not an RCT.
De Jesus 2013	Study < 6 months.
DeVore 2013	Prospective follow-up, not an RCT.
Doyle 2008	Study < 6 months.
Dreyer-Gillette 2014	Compared 2 different interventions.
Faulkner 2013	Intervention study, not an RCT.
Fonseca 2016	Study < 6 months.
Freire 2013	Intervention study, not an RCT.
Garnett 2014	Compared 2 different interventions.
Giel 2013	Not an RCT, compared to an aged-matched control.
Hay 2016	Comparing 2 different interventions.
Jelalian 1999	Systematic review.
Jelalian 2010	Non-relevant comparator (comparing 2 different interventions)
Jones 2009	Intervention not aiming to treat overweight or obesity.
Jones 2008	Non-relevant intervention (intervention not aiming to treat obesity)
Lee 2013a	Study < 6 months.
Lee 2013b	Study < 6 months.
Lee 2013c	Study < 6 months.
Lovely 2013	Study < 6 months.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 136 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

(Continued)

Lubans 2008	Quasi-experimental design.
NCT00863083	Study terminated due to poor enrolment.
NCT01044134	Study terminated (achieved n = 38, due to slow recruitment, which was $2/3$ of target
NCT02011646	Study terminated (the principal investigator changed institutions)
NCT02295761	Study < 6 months.
Nunes 2016	Not relevant intervention (the effect of interdisciplinary therapy in the parameters of the oxidative stress and the anti-inflammatory responses)
Parks 2014	Drug intervention.
Racil 2013	Study < 6 months.
Sabzghabaee 2013	Study < 6 months.
Sarvestani 2009	Experimental quasi design.
Shrewsbury 2011	Study < 6 months.
Sussman 2013	Qualitative study.
Van 2013	Not relevant age (< 12 years).
Ventura 2009	Study < 6 months.
Wadden 1990	Study < 6 months.
Wiegand 2014	Participants not overweight or obese.
Wilson 2012	2 different interventions.
Xanthopoulos 2013	Only % weight change in association with carers' weight loss reported

n: number of participants; RCT: randomised controlled trial.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 137 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Characteristics of studies awaiting assessment [ordered by study ID]

Angerer 2015

Methods	Type of study: controlled clinical trial Allocation: - Intervention model: - Masking: - Primary purpose: -
Participants	Condition: Enrollment: Inclusion criteria: Exclusion criteria:
Interventions	Interventions: nutrition counselling, sport and life-skill training Comparator: -
Outcomes	Primary outcome: - Secondary outcome: - Other outcome: medical and psychological outcomes
Study identifier	-
Official title	Fit4You - a programme for prevention and reduction of overweight in apprentices in the workplace setting
Stated purpose of study	"Examined the effect of a multimodal programme including nutrition counselling, sport, and life-skill training on medical and psychological outcomes."
Notes	Unclear if it is an RCT
Barbeau 2003	
Methods	Type of study: - Allocation: randomised Intervention model: Masking: - Primary purpose: -
Participants	Condition: obesity

Enrollment: 55 Inclusion criteria: triceps skinfold > 85th percentile for gender, race and age; not involved in any other weight control or exercise programme; could not have limitations to physical activity Exclusion criteria: -

Interventions	Intervention: high-intensity physical training and lifestyle education
	Interventions: moderate-intensity physical training and lifestyle education
	Comparators: lifestyle education

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 138 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Barbeau 2003 (Continued)

Outcomes	Primary outcome: fasting leptin Secondary outcome: Other outcomes: body composition, visceral adipose tissue, subcutaneous abdominal adipose tissue, car- diovascular fitness, heart rate, daily physical activity, time spent sleeping, dietary intake
Study identifier	-
Official title	Influence of physical training on plasma leptin in obese youths
Stated purpose of study	Effect of 2 intensities of physical training on leptin in obese teenagers
Notes	Anthropometric outcomes not reported

Bohlin 2012

Methods	Type of study: non-inferiority study Allocation: randomised Intervention model: - Masking: open Primary purpose: treatment
Participants	Condition: obesity Enrollment: 35 Inclusion criteria: children aged 5-16 years Exclusion criteria: -
Interventions	Intervention: multidisciplinary treatment provided by the obesity treatment clinic followed by frequent telephone consultations with parents Comparator: the usual multidisciplinary treatment visits delivered provided by the obesity treatment clinic
Outcomes	Primary outcome: BMI-SDS Secondary outcome: - Other outcome: -
Study identifier	-
Official title	Can telephone consultations substitute visits in treatment of childhood obesity? Results from a randomized trial
Stated purpose of study	"To explore the possibility to substitute nurse-visits at the clinic with more frequent telephone-consultations without degrading treatment outcome measured in BMI-SDS."
Notes	Unclear if the mean age of participants was 12-16 years old. Contacted author (19 October 2015) requesting mean age and risk of bias

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 139 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Campos 2017

Methods	Type of study: - Allocation: - Intervention model: - Masking: - Primary purpose: -
Participants	Condition: - Enrollment: 148 Inclusion criteria: - Exclusion criteria: -
Interventions	Interventions: aerobic training + resistance training Comparator: aerobic training
Outcomes	Primary outcome: Secondary outcome: Other outcomes: body mass, BMI, fat mass, visceral and subcutaneous fat, insulin resistance
Study identifier	-
Official title	HOMA-AD: the role of different types of physical exercise in obese adolescents
Stated purpose of study	"The purpose of this study was to investigate the effects of different kinds of exercise in the sensitive index predictor of insulin resistance."
Notes	Library cannot provide reference

Cocca 2016

Methods	Type of study: - Allocation: randomised. Intervention model: - Masking: - Primary purpose: -
Participants	Condition: - Enrollment: 41. Inclusion criteria: - Exclusion criteria: -
Interventions	Intervention : school physical activity based on tactical ball games (4 × 60-minute sessions/week), and attended meetings of nutritional counselling with their families (1 hour/week) Comparator : regular school physical education
Outcomes	Outcomes: cholesterol, HDL cholesterol, triglycerides, waist circumference, blood pressure and glycaemia values Primary outcome: Secondary outcome:

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 140 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Cocca 2016 (Continued)

	Other outcome:
Study identifier	-
Official title	Effects of a school-based intervention program on metabolic syndrome parameters in school-aged youth
Stated purpose of study	"The aim of this study was to assess the impact of a school intervention program on the parameters of MetS [metabolic syndrome] in Mexican secondary school students."
Notes	Unclear whether all participants were overweight or obese at baseline and focus of study is on metabolic syndrome rather than weight loss. No data, only P values and most of the outcomes are cardiovascular disease risk factors rather than weight. Contacted author (12 January 2017) to clarify inclusion criteria of participants, aim of the study and weight outcomes
Garrett 1979	

Methods	Type of study: - Allocation: - Intervention model: - Masking: - Primary purpose: -
Participants	Condition: obesity Enrollment: - Inclusion criteria: aged 11-16 years, females. Exclusion criteria: -
Interventions	Intervention: - Comparator: -
Outcomes	Primary outcome: - Secondary outcome: - Other outcome: -
Study identifier	-
Official title	Group behavioural therapy versus family behavioural therapy in treatment of obese adolescent females
Stated purpose of study	-
Notes	Library cannot locate full-text

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 141 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
Gracianette 1982

Methods	Type of study: - Allocation: - Intervention model: - Masking: - Primary purpose: -
Participants	Condition: obesity Enrollment: - Inclusion criteria: obese adolescents Exclusion criteria: -
Interventions	Intervention: - Comparator: -
Outcomes	Primary outcome: - Secondary outcome: - Other outcome: -
Study identifier	-
Official title	The application of behavioural techniques to change eating habits and/or exercise habits to effect weight reduction and maintenance in adolescents: a year-long study
Stated purpose of study	
Notes	Library cannot locate full-text

Li 2006

Methods	Type of study: efficacy Allocation: randomised Intervention model: - Masking: - Primary purpose: -
Participants	Condition: overweight or obesity Enrollment: 120 Inclusion criteria: girl students with simple obesity and overweight aged (mean ± SD) 15.5 ± 3.7 years Exclusion criteria:
Interventions	Interventions : reducing weight therapy composed of aerobic exercise (body exercise, power, jump and flexible sports, body and mental health sports, relax sports), reasonable diet (protein:carbohydrate:fat = 5: 4:1) and mental modification Comparator : -
Outcomes	Primary outcome: Secondary outcome: Other outcomes: BMI, body mass, chest circumference, waistline, hip circumference, power of gripping, 800 m running, standing long jump, sit-up, quiet heart rate, blood glucose, blood fat, cholesterol, insulin

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 142 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Li 2006 (Continued)

	and leptin
Study identifier	-
Official title	Anti-obesity effect of comprehensive diet and sports in girl students with simple obesity or overweight
Stated purpose of study	To investigate the effective antiobesity therapy with comprehensive diet prescription and sports for girl students with simple obesity and overweight
Notes	Article in Chinese, lack of resources to translate. Contacted author (11 August 2015) for an English version

Makkes 2015

Methods	HELIOS study Type of study: efficacy Allocation: randomised Intervention model: parallel assignment Masking: none Primary purpose: treatment
Participants	Condition : obesity Enrollment : 80 Inclusion criteria : children and adolescents aged 8-18 years referred to Heideheuvel by their own paedia- trician. They must have BMI-SDS ≥ 2.3 according to the growth curves based on the 4th Dutch National Growth Study of 1997 (this corresponds to the 99th percentile) and comorbidity related to obesity (e.g. obstructive sleep apnoea syndrome, raised insulin, diabetes type 2, liver function disorders, dyslipidaemia, worn out joints) or a BMI-SDS ≥ 3.0 (this corresponds to the 99.9th percentile) Exclusion criteria : having syndromal or chromosomal determined obesity, obesity caused by endocrine disorders (hypothyroidism, Cushing's syndrome, primary hyperinsulinaemia, pseudohypoparathyroidism, acquired (structural) hypothalamic damage) or medicine use (e.g. oral steroids, antiepileptic drugs, antide- pressants), severe psychiatric problems, an IQ < 75 or similar school level or if their parents are not willing to participate in the treatment
Interventions	Intervention A: intensive combined behaviour changing inpatient treatment for 6 months during week- days, followed by biweekly hospital admissions of 2 days for 4 months Intervention B: intensive combined behaviour changing inpatient treatment for 2 months during week- days, followed by biweekly return visits of 2 days during the next 4 months, then followed by 6 monthly return visits of 2 days Comparator : usual care: will receive usual care for 1 year, after which the participants will be randomly allocated to the groups A and B
Outcomes	Primary outcome: BMI-SDS (costs of treatment per change in relative BMI) Secondary outcomes: psychological and psychosocial data on issues such as motivation, competence, self- esteem, anxiety and mental stress; cardiovascular risk factors (blood pressure, serum lipids, liver function tests, glucose and insulin); waist circumference; dietary behaviour; eating behaviour, physical activity (sedentary behaviour); quality of life (generic, weigh-specific and health-related quality of life) Other outcome: -

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 143 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Makkes 2015 (Continued)

Study identifier	NTR1678.
Official title	Health effects of behaviour changing interventions in obese children and adolescents study (Helios) - a randomised controlled trial
Stated purpose of study	Quote: "to compare the cost-effectiveness of these two intensive one-year inpatient treatments to each other and to usual care for severely obese children and adolescents."
Notes	Study only intended to compare the 2 active interventions. The thesis states that for 'logistical reasons' they randomised to a wait list control group, review authors assumed as they were only able to take a small number of participants through the interventions at any 1 time. They also randomise to the groups in 2 batches so that every 6 months for 2 years they start a new intervention 1 and 2 with 10 participants each. The flow chart and number of participants do not show the wait list control group but include them when they are included in intervention A and B. There is 1 analysis for the 3 groups (6 and 12 months only as appropriate) which was described as an "additional analysis." For the purpose of the review, the comparison with the wait list control would be relevant; however, there are no numbers included in the analysis, no baseline characteristics and the only data for BMI-SDS is from a figure. Awaiting further clarification from author or publication of the data to know if this group will be analysable
NCT00462267	
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel assignment Masking: single blind (outcomes assessor) Primary purpose: treatment
Participants	Condition : obesity/overweight Enrollment : 215 Inclusion criteria : aged 13-15 years, BMI \geq 90%, 1 or both parent(s) willing to participate in study assessments and parent sessions Exclusion criteria : BMI \geq 99%, significant cognitive impairment, pregnant, congenital heart disease that limits activity, serious asthma requiring oral prednisone, taking medications that increase appetite
Interventions	Intervention : enriched behaviour changing intervention, multicomponent group teen and parent sessions, individual telephone-based coaching contact and a distinct collaborative care component with follow-up visits to the youth's primary care provider Comparator : usual care
Outcomes	Primary outcome: BMI z score Secondary outcomes: quality of life, self-esteem, depression, unhealthy eating practices, weight and shape concerns, sociocultural attitudes toward appearance, satisfaction, dietary intake, personal and family eating patterns, physical activity, sedentary behaviours, personal and family physical activity patterns Other outcome: -
Study identifier	NCT00462267
Official title	Examining the feasibility of collaborative care treatment for overweight adolescents

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 144 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT00462267 (Continued)

Stated purpose of study	"Examine the effectiveness of a primary care based intervention to help overweight teen girls adopt healthy lifestyle practices."
Notes	Contacted author (6 August 2015), author reply: "The study you identified was a small pilot that supported the larger trial published in <i>Pediatrics</i> (included in this review). Unfortunately, we don't have analytic resources to provide more detail than what is available in the paper itself."

NCT00475163		
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel assignment Masking: open label Primary purpose: prevention	
Participants	Condition : obesity Enrollment : 34 Inclusion criteria : aged 13-17 years, able to participate in physical activity Exclusion criteria : on medications that could affect weight	
Interventions	Intervention : weekly contacts with mentors to improve physical activity pattern, self-esteem and weight loss in obese teenagers over a 6-month period Comparator : -	
Outcomes	Primary outcomes: weight gain, fitness, self-esteem Secondary outcome: Other outcome:	
Study identifier	NCT00475163.	
Official title	Mentors in motion: a physical activity intervention for obese adolescents	
Stated purpose of study	Assessing the impact of mentoring on the behaviour changing choices of adolescents who are overweight	
Notes	Study listed as completed on ClinicalTrials.gov, but no study results available (last checked 16 August 2016). Contacted authors (7 August 2015) for published/unpublished data, author response (15 September 2015) : data had not been published and the work is still pending (no results available, checked 21 November 2016)	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 145 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Shapiro 1976

Methods	Type of study: - Allocation: - Intervention model: - Masking: - Primary purpose: -
Participants	Condition: - Enrollment: - Inclusion criteria: - Exclusion criteria: -
Interventions	Intervention: - Comparator: -
Outcomes	Primary outcome: Secondary outcome: Other outcome:
Study identifier	-
Official title	A comparison of various reward and monitoring procedures in the behavioral treatment of overweight children
Stated purpose of study	-
Notes	Library cannot locate full-text

BMI: body mass index; HDL: high-density lipoprotein; HOMA-AD: homeostatic model assessment - adiponectin; IQ: intelligence quotient; RCT: randomised controlled trial; SD: standard deviation; SDS: standard deviation score.

Characteristics of ongoing studies [ordered by study ID]

ACTRN12607000632493

Trial name or title	Acronym: eGAME (Electronic Games to Aid Motivation to Exercise)
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: open label Primary purpose: treatment
Participants	Condition : overweight Enrollment : estimated 330 Inclusion criteria : aged 10-14 years, living in the greater metropolitan Auckland area, overweight (accord- ing to the Cole international cut-offs for child obesity); play ≥ 2 hours of video games per week; have no

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 146 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

ACTRN12607000632493 (Continued)

	contraindications to perform physical activity; required to own a PlayStation® 2 or 3 gaming console but not the EyeToy TM or Dance Mat technology
	Exclusion criteria : if they already own active video games or have a medical condition that would prohibit exercise
Interventions	Intervention : eGAME: a USB motion-capture camera to place a picture of the gamer onscreen. The gamer then interacts with the images on screen. The upgrade consisted of an EyeToy [™] camera, dance mat and a selection of active video games. Children encouraged to meet physical activity recommendations to perform 60 minutes of moderate-to-vigorous physical activity on most days of the week by supplementing periods of inactive with active video game play and substituting periods of inactive video game play with the active version Comparator : control group: continue normal video game playing and physical activity behaviour. At the end of the study, received the active video games upgrade package
Outcomes	 Primary outcomes: change in BMI z score and centile Secondary outcomes: % body fat, waist circumference, physical fitness, PAQ-C score, mean daily time spent in light-to-vigorous activities (minutes), mean daily time spent in active video games (minutes) and mean daily time spent in non-active video games (minutes) Other outcomes: mean daily time spent in light activities (minutes), moderate activities (minutes) and vigorous activities (minutes); psychological variables intention, self-efficacy, barrier efficacy, perceived competence, perceived enjoyment; and mean daily total energy consumed from snacks (kJ)
Starting date	Study start date: 2008 Study completion date: unclear
Contact information	Responsible party/principal investigator: University of Auckland/Ralph Maddison
Study identifier	ACTRN12607000632493
Official title	Active video games to improve body composition and physical activity in children
Stated purpose of study	Quote: "to determine the effects of an active video game intervention over 6 months on: body mass index (BMI), percent body fat, waist circumference, cardio-respiratory fitness, and physical activity levels in overweight children."
Notes	Contacted author (22 October 2015) for anticipated study completion data

ACTRN12611000139976

Trial name or title	Acronym: -
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: blinded, masking used.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 147 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

ACTRN12611000139976 (Continued)

Participants	Condition : overweight and obesity (\geq 85th centile) Enrollment : 570 Inclusion criteria : aged 12-17 years; overweight or obese (\geq 85th centile) according to the age- and gender- specific BMI data from the International Obesity Task Force; Internet access at home or at a location where regular use is possible (i.e. school, library). Recruitment will be restricted to those living in the Melbourne metropolitan area (to facilitate complete follow-up assessments by maximising opportunities to collect height and weight data, and to contain study costs) Exclusion criteria : young people with a known endocrine or chromosomal cause for their obesity; taking prescription medication resulting in weight changes (e.g. prednisolone); complications of overweight that contraindicate moderate physical activity (e.g. orthopaedic disorders); past or current medical diagnosis of a clinical eating disorder (i.e. anorexia or bulimia nervosa, binge eating disorder) or significant health disability or condition which prevents participation
Interventions	Intervention: Internet-based programme for 12 weeks, 1 session per week for self-directed 30-60 minutes. Goals will be set by the participant from a framework recommended within the programme (e.g. to increase moderate activity from 0 to 30 minutes on most days) and reviewed every week, activities will be specific to intervention group but not to each individual. Participants will receive a pedometer and a walking programme to help achieve goal of 60 minutes of moderate-to-vigorous activity per day. Cognitive behaviour aspect of the programme will address self-monitoring, goal setting, stimulus control, social eating, etc Participants will receive feedback at least weekly. Parents of participants will be sent monthly newsletters for the 3 months of the intervention programme with tips on creating a supportive environment. After the 12-week programme is finished, participants will receive monthly follow-up via text or e-mail asking them to review their eating and physical activity habits, and provide feedback. They can also review the materials from the programme (e.g. to review the programme to review a pack with flyers about the physical activity requirements, healthy eating and planning healthy meals and a sheet with links to websites about the age appropriate healthy eating, physical activity and mental health). No cognitive behaviour element
Outcomes	Primary outcome: reduction in BMI z score Secondary outcomes: waist circumference, % body fat, blood pressure, psychological distress, quality of life, eating disorder, programme content satisfaction questionnaire Other outcome: adherence
Starting date	Study start date: July 2011 Study completion date: actual date last participant enrolled: 1 October 2013
Contact information	Responsible party/principal investigator: Joanne Williams, The Royal Children's Hospital, Victoria, Australia
Study identifier	ACTRN12611000139976
Official title	Staying fit adolescent weight management study
Stated purpose of study	Quote: "Staying Fit has been designed as an Internet-based adolescent weight management program for overweight or mildly obese Australian young people. Goals of the program include: targeting weight loss, promoting weight maintenance, decreasing weight and shape concerns, healthy eating and increasing

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 148 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

ACTRN12611000139976 (Continued)

	physical activity."
Notes	Trial website (www.rch.org.au/cah/research.cfm?doc ⁻ id=14887) states that they are currently preparing publications (accessed 16 August 2016)

ACTRN12611000862943		
Trial name or title	Acronym: -	
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: open (masking not used) Primary purpose: treatment	
Participants	Condition: obesity Enrollment: 107 Inclusion criteria: males and females aged 5-16 years; BMI ≥ 98th centile, or > 91st centile with weight- related comorbidities. Ready for change as assessed by questionnaire and overall assessment of level of motivation by Healthy Lifestyles Co-ordinator on interview. Committed family member Exclusion criteria: significant comorbidities (i.e. any medical condition serious enough to make it impos- sible for a child/adolescent to embark on a programme of increasing physical activity)	
Interventions	Intervention : physical activity - fitness assessments and knowledge of importance of physical fitness at 0, 6, 12, 18 and 24 months. Initial home visits by Active Families co-ordinator (1 hour), then weekly activity sessions for 40 weeks during the year (1.5 hours per session). Dietary education - dietitian input and initial home visits (1 hour). Psychology input - input as group at commencement of intervention (2 × 1-hour sessions), and then at family/individual level as indicated Comparator : brief dietary education by means of pamphlet	
Outcomes	Primary outcomes : BMI-SDS; quality of life; physical activity Secondary outcomes : dietary behaviour; sedentary activity; glycaemic control Other outcome : -	
Starting date	Study start date: 9 January 2012 Study completion date: -	
Contact information	Responsible party/principal investigator : Yvonne Anderson; Child and Adolescent Centre, Taranaki Base Hospital	
Study identifier	ACTRN12611000862943.	
Official title	The effect of a multi-disciplinary obesity intervention compared to usual practice in those ready to make lifestyle changes: design and rationale of Whanau Pakari	
Stated purpose of study	Quote: "to improve local obesity services for 5-16 year olds in the Taranaki region, and assess whether the devised intervention programme shows benefits in those participants that are assessed as ready to make healthy lifestyle changes."	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 149 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

ACTRN12611000862943 (Continued)

Notes

Recruitment status: active, not recruiting. Contacted author (17 January 2017) for trial status

Trial name or title	Acronym: -
Methods	Type of study: efficacy study Allocation: randomised block design will be used. Obese participants will be randomised to 1 of 3 groups and will be stratified according to age and gender Intervention model: single blind (outcome assessors) Primary purpose: effect on myocardial function
Participants	Condition: obesity Enrollment: 100 Inclusion criteria: BMI > 95th percentile (age and gender specific), children and adolescents aged 7-16 years Exclusion criteria: hypertension (defined as blood pressure > 95th centile for systolic or diastolic values), any history or evidence of heart disease or an abnormal resting or stress echocardiography which indicates it would be unsafe to participate (or both), any chronic disease (e.g. chronic asthma, kidney disease, diabetes, current smoking habits or an orthopaedic/neurological disorder that may limit ability to exercise) , diagnosed attention deficit hypersensitivity disorder and use of steroid medications
Interventions	 Intervention 1: high-intensity interval training. Walk, run or cycle at 85-95% of their maximal heart rate at intervals of 4 × 4 minutes, with 3-minute active breaks (~ 60% of maximal heart rate) between intervals. Total exercise time 40 minutes Intervention 2: moderate-intensity exercise. Walk, run or cycle continuously at 70% maximal heart rate for approximately 44 minutes to equalise the energy expenditure performed by high-intensity interval training group. Total exercise time 50 minutes Common across interventions: dietary education sessions that will parallel sessions provided to those assigned to the control group. 30-minute session every second week for 3 months, followed by 1 session every 2 months for the next 9 months. Exercise training 3 times per week for 12 months. Months 1-3, 2 supervised sessions in the gym and 1 session at home. Months 4-12, all training at home. Consists of walking or running on a treadmill, or on a bike for the older children Comparator: control: dietary education sessions, 8-10 × 20-minute individual diet intervention sessions over 12 months. A session every second week for 3 months, followed by 1 session every 2 months for the next 9 months.
Outcomes	Primary outcome: myocardial function (peak systolic tissue velocity) Secondary outcomes: vascular function (flow-mediated dilation assessment), quantity of visceral and sub- cutaneous adipose tissue, myocardial structure and function, body composition, cardiorespiratory fitness, autonomic function, blood biochemistry, physical activity and nutrition Other outcome: -
Starting date	Study start date : October 2013 Study completion date : January 2015 (last participant enrolled)
Contact information	Responsible party/principal investigator : The University of Queensland/Norwegian University of Science and Technology

ACTRN12613001037796

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 150 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

ACTRN12613001037796 (Continued)

Study identifier	ACTRN12613001037796 and NCT01991106
Official title	Effects of exercise intensity and nutrition advice on myocardial function in obese children and adolescents: a multicentre randomised controlled trial study protocol
Stated purpose of study	Quote: "The primary aim of this randomised controlled trial is to compare the effectiveness of three 12-month interventions: HIIT [high-intensity interval training] and nutrition advice, MICT [moderate-intensity exercise] and nutrition advice or nutrition advice alone on myocardial function in obese children and adolescents."
Notes	Study is ongoing, but not recruiting participants (last updated: 4 January 2017)

ACTRN12615000558527

Trial name or title	Acronym: -
Methods	Type of study: efficacy Allocation: randomised Intervention model: cluster randomised controlled trial Masking: blinded (masking used) outcome assessors Primary purpose: prevention
Participants	Condition: overweight, obese Enrollment: 570 Inclusion criteria: sites: participating in standard Go4Fun programme in 2015; 2014 attendance mean of at least 20 children per programme per term. Participants: males and females aged 7-13 years with no comorbidities; BMI > 85th percentile for their age and gender (according to Australian Institute of Health and Welfare classification of overweight/obesity in children); be enrolled in and meet the general criteria to participate in the Go4Fun programme at 1 of the sites participating in this study which includes having a parent or adult carer able to accompany them to each session Exclusion criteria: sites: not willing to participate in a trial and adhere to standardised procedures for duration of the trial. Participants: parent/guardian not willing to provide written and informed consent
Interventions	 Intervention: Go4Fun programme is a community-based, multidisciplinary family-focused programme and will also be eligible to receive incentives for reaching certain levels of attendance and for goal attainment. Children will receive a skipping rope for attending 80% of programme sessions (8 sessions) and a frisbee for 100% attendance (10 sessions) Once the goals are achieved children are eligible to receive agreed incentives as follows; a vegetable slicer once 2 goals are achieved, a USD10 Rebel voucher once 4 goals are achieved and a height adjustable tennis set (Totem Tennis) once 6 goals are achieved Comparator: standard community weight management programme (namely Go4Fun) without the structured behaviour incentives
Outcomes	Primary outcome : BMI z score Secondary outcomes : waist circumference z score; BMI; difference in rate of attendance at programme sessions between intervention and control sites; difference in mean rate of nutrition goal attainment between intervention and control groups; difference in mean rate of physical activity goal attainment between intervention and control groups

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 151 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

ACTRN12615000558527 (Continued)

	Other outcome: -
Starting date	Study start date: 2 February 2015 Study completion date: -
Contact information	Responsible party/principal investigator : Julie Redfern; Cardiovascular Division, The George Institute for Global Health, Level 10, King George V Building, Missenden Road, Camperdown NSW 2050
Study identifier	ACTRN12615000558527
Official title	The effectiveness of a community weight management program with a behavioural incentive scheme compared to participation in a standard community weight management program in overweight children on relative weight loss and behaviour change
Stated purpose of study	Quote: "to determine the effectiveness of enhanced goal setting linked to a structured incentive scheme designed to improve the sustained health and wellbeing of overweight/obese children within the context of an existing community-based program."
Notes	As of 1 July 2015, recruitment has commenced and follow-up assessments are ongoing. No data cleaning or analysis of results had begun at the time of this submission (protocol publication 2016)

Chew 2016

Trial name or title	Acronym: LITE
Methods	Type of study: efficacy study Allocation: randomised Intervention model: parallel assignment Masking: - Primary purpose: treatment
Participants	Condition: obesity Enrollment: 60 Inclusion criteria: adolescents 10-16 years referred to the Weight Management Clinic Exclusion criteria: -
Interventions	Intervention : the LITE (Lifestyle Intervention for obese teenagers) group programme is a 6-month, family- based behavioural lifestyle intervention, specifically designed to treat obesity in adolescents 10-16 years Comparator : usual care
Outcomes	Outcomes: outcome measurement are assessed at 3 and 6 months postbaseline and include anthropomet- ric measurements, physical activity, dietary intake, metabolic profile, improvement in positive parenting behaviour and measurement of family support Primary outcome: not clearly stated Secondary outcome: not clearly stated Other outcome: -

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 152 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Chew 2016 (Continued)

Starting date	Study start date: - Study completion date: -
Contact information	Responsible party/principal investigator: -
Study identifier	-
Official title	The LITE randomised controlled trial
Stated purpose of study	Quote: "This study was designed to address the gap in service provision of a family based weight manage- ment program for overweight and obese adolescents. The LITE (Lifestyle Intervention for obese teenagers) group program is a 6-month, family-based behavioural lifestyle intervention, specifically designed to treat obesity in adolescents 10-16 years referred to the Weight Management Clinic."
Notes	Journal abstract. Data presented for BMI z score at 3 months but not 6 months. High attrition from both groups. Contacted author (12 January 2016) for 6 months' data

ChiCTR-TRC-13003501

Trial name or title	Acronym: -
Methods	Type of study: efficacy study Allocation: randomised Intervention model: parallel Masking: - Primary purpose: treatment
Participants	 Condition: obesity with non-alcoholic fatty liver disease Enrollment: 56 Inclusion criteria: postpubertal Chinese adolescents aged 14-18 years with primary obesity attending the Obesity and Lipid Disorder Clinic in Prince of Wales Hospital Exclusion criteria: hepatic viral infection, daily usage of alcohol, from parental or self-report BMI < 95th centile of local reference, using steatogenic or anti-diabetic drugs (or both), concurrent participation in any clinical trial, dietary intervention or weight loss programme, concomitant intake of a weight-reducing agent, any chronic medical illness, unwillingness to attend regular follow-up appointments
Interventions	Intervention : behaviour changing intervention with modification of diet, physical activity and behaviour patterns, consisting of counselling sessions weekly and then bi-monthly for 1 year. Sessions 15-20 minutes long, taken by dietitians/nutritionists. Also motivational interviewing, such as discussing barriers to lifestyle change and child's and parents' feelings about the progress. Provided with a booklet for portion size exchange and tips for eating out Comparator : conventional care with follow-up in the Obesity and Lipid Disorder Clinic every 16 weeks
Outcomes	Primary outcomes : not stated as primary/secondary: the degree of change of intrahepatic triglyceride con- tent of non-alcoholic fatty liver disease after intervention; anthropometric measurements: height, weight, body fat and waist circumference; blood tests: plasma fasting glucose, lipid profile, plasma alanine amino- transferase, aspirate aminotransferase and serum insulin Secondary outcome : -

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 153 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

ChiCTR-TRC-13003501 (Continued)

	Other outcome: -
Starting date	Study start date: August 2013 Study completion date: unclear
Contact information	Responsible party/principal investigator: Dorothy Chan, The Chinese University of Hong Kong
Study identifier	ChiCTR-TRC-13003501
Official title	Behaviour changing intervention in obese Chinese adolescents with nonalcoholic fatty liver disease: a randomized controlled study
Stated purpose of study	Quote: "A lifestyle modification programme (LMP) developed by the Centre for Nutritional Studies of The Chinese University of Hong Kong for the treatment of obesity and obesity-related diseases. It is clinically proven and developed based on motivational interviewing and behavioural modification, to accompany improving knowledge regarding diet and exercise. Lifestyle intervention with modification of diet, physical activity and behaviour patterns that have been shown to be effective among adults could reduce the severity and prevalence of nonalcoholic fatty liver disease (NAFLD) in obese children and adolescents."
Notes	

DRKS00004583

Trial name or title	Acronym: TeAM (Telephone counselling as Adiposity Management)
Methods	Type of study: efficacy Allocation: randomised Intervention model: parallel assignment Masking: - Primary purpose: treatment (maintenance)
Participants	Condition: obesity Enrollment: 150 Inclusion criteria: aged 14-18 years, completion of a structured inpatient obesity therapy programme (4- 6 weeks of inpatient treatment) Exclusion criteria: current involvement in weight loss treatment, psychiatric conditions interfering with participation (e.g. eating disorder, psychosis), medication interfering with participation or weight mainte- nance, underlying chronic disease interfering with weight maintenance
Interventions	Intervention 1: telephone counselling and tailored SMS messages Intervention 2: telephone counselling, tailored SMS messages and in addition access to a password- protected web-forum for interaction with other participants Comparator: no intervention, medical care as usual
Outcomes	Primary outcome: BMI-SDS Secondary outcomes: sociodemographics, psychosocial status (KIDSCREEN, self-image scale), daily physical activity, leisure time habits (MoMo Questionnaire) and eating behaviour (DEBQ-C, FFQ) usage of health services (EQ-5D)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 154 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

DRKS00004583 (Continued)

	Other outcome: -
Starting date	Study start date: 2012 Study completion date: April 2015
Contact information	Responsible party/principal investigator: Jana Markert, Universität Leipzig
Study identifier	DRKS00004583
Official title	Feasibility and efficacy of a weight maintenance treatment approach for adolescent obesity via telephone counselling following an obesity treatment program: a randomized controlled trial
Stated purpose of study	Quote: "to evaluate a) the feasibility and b) the efficacy of a six month aftercare weight maintenance treat- ment (maintaining BMI-SDS, i.e. standard deviation score of body mass index) following reconvalescent care for adolescent obesity based on telephone counselling, with a follow up period of two years."
Notes	Undertook a feasibility study which is the main publication. Baseline characteristics but no results presented. Contact with author suggests submission to journal publication due late September 2015. No publications available yet (last checked trial record on 21 November 2016)

DRKS00005299

Trial name or title	Acronym: KLAKS-Study
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: open label Primary purpose: treatment
Participants	Condition: obesity, other disorders of pancreatic internal secretion Enrollment: actual 60 Inclusion criteria: aged 8-18 years, BMI > 97th percentile Exclusion criteria: syndromal obesity, pregnancy
Interventions	Intervention : endurance exercise for 60 minute/week on top of a standardised obesity therapy programme; resistance exercise for 60 minute/week on top of a standardised obesity therapy programme Comparator : unsupervised physical activity for 60 minute/week on top of a standardised obesity therapy programme
Outcomes	Primary outcome: change in BMI-SDS Secondary outcomes: change in waist circumference, body fat distribution and body fat content (skin- folds: triceps, biceps, subscapular, suprailiacal); change in metabolic profile; assessment of motor skills; psychological parameters: eating disorder symptoms (Child Eating Disorder Examination, ChEDE-Q); depressive symptoms (Depressions-Inventar für Kinder und Jugendliche, DIKJ); weight bias internalisation (Weight Bias Internalization Scale, WBIS) Other outcome: -

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 155 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

DRKS00005299 (Continued)

Starting date	Study start date: September 2013 Study completion date: -
Contact information	Responsible party/principal investigator: Susann Blüher, Universität Leipzig
Study identifier	DRKS00005299
Official title	Impact of resistance versus endurance exercise on anthropometric and metabolic parameters within a standardized one year obesity treatment program for obese children and adolescents
Stated purpose of study	Quote: "evaluate which exercise modality is more favourable in influencing weight status, body composition and associated metabolic and cardiovascular risk factors."
Notes	Recruiting ongoing (according to trial record, accessed 16 August 2016)

DRKS00006781

Trial name or title	Acronym: moveHIT
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: blinded (participant, investigator/therapist) Primary purpose: prevention
Participants	Condition: obesity, metabolic syndrome Enrollment: actual 70 Inclusion criteria: male or female, 13-18 years, overweight and obesity (BMI-SDS > 90th percentile) Exclusion criteria: pregnancy, severe orthopaedic disabilities
Interventions	Intervention : high-intensity interval training (twice per week for 60 minutes) and reception of weekly text message reminders and e-mails for 6 months. Website use based on principles of the social cognitive theory (social support and self-efficacy training regarding initiation and maintenance of physical activity) through posts and individualised feedback Comparator : high-intensity interval training (twice per week for 60 minutes) without media support for 6 months
Outcomes	Primary outcome: participation rate (number of days training) Secondary outcomes: anthropometric parameters, including body weight, BMI, BMI-SDS; waist, hip, neck circumferences, waist-to-hip ratio, waist-to-height ratio; blood pressure; daily physical exercise and daily sedentary behaviour; health-related quality of life; self-efficacy, social support and outcome expectation over physical activity; internalisation of stigmatisation Other outcome: -
Starting date	Study start date: April 2014 Study completion date: -

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 156 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

DRKS00006781 (Continued)

Contact information	Responsible party/principal investigator : IFB Adipositas Erkrankungen, Universität Leipzig/Sabine Herget
Study identifier	DRKS00006781.
Official title	Feasibility of a media-supported high-intensity interval training program for overweight and obese adoles- cents
Stated purpose of study	Quote: "The present study aims to evaluate a) The feasibility of a six months high intensity interval-training program for overweight or obese adolescents and b) Whether motivation to participate in and to adhere to a six months high-intensity interval-training program can be increased by regular, tailored text messages and the support of a password-protected webpage with participant profile for individualized feedback."
Notes	Follow-up ongoing (according to trial record, accessed 16 August 2016)
DRKS00007879	
Trial name or title	Acronym: SRT-Joy
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel assignment Masking: blinded (participants, study personnel, outcome assessors) Primary purpose: treatment
Participants	Condition: obesity Enrollment: 226 Inclusion criteria: males and females, aged 8-16; BMI > 97th percentile; informed consent by parents Exclusion criteria: secondary obesity, hyperkinetic disorder with medication, mental retardation
Interventions	Intervention : self-regulation training with the developed computer program (Approach-Avoidance-Train- ing). The training will be an add-on to the treatment as usual (inpatient rehabilitation treatment). The training will take place on 6 sessions for 10-15 minutes each, spread over 2 consecutive weeks Comparator : will receive a placebo training. This is a similar computer program as the intervention programme but with the difference that no learning effect will occur. The training will be an add-on to the treatment as usual (inpatient rehabilitation treatment). The training will be held on 6 sessions for 10- 15 minutes each, spread over 2 consecutive weeks
Outcomes	Primary outcome: BMI-SDS Secondary outcomes: self-regulation skills of the children, weight-specific self-efficacy, dietary intake Other outcome:

Starting date	Study start date : treatment allocation 7 April 2015 to 30 September 2015 Study completion date : 12-month analysis estimated to be complete 31 December 2016
Contact information	Responsible party/principal investigator: Universität Potsdam Lehrstuhl für Beratungspsychologie, Ger-

many

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 157 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

DRKS00007879 (Continued)

Study identifier	DRKS00007879
Official title	Development and evaluation of a computer-based self-regulation training for obese children and adolescents
Stated purpose of study	Quote: "The PC [personal computer]-based self-regulation training "SRT-Joy" will be implemented in a randomized-controlled multi-center clinical study with obese children and adolescents aged from 8 to 16 years. It is expected that the experimental group will show an increase in self-regulating capacity and a better course of BMI-SDS, compared to the control group."
Notes	www.psych.uni-potsdam.de/counseling/research/adipositas-training-d.html

EUCTR2009-016921-32-ES

Trial name or title	Acronym: -
Methods	Type of study: efficacy Allocation: randomised Intervention model: parallel Masking: double blind Primary purpose: treatment
Participants	Condition : obesity Enrollment : 60 Inclusion criteria : attending the Pediatric Endocrinology Service on an out-patient basis; 12-17 years; BMI ≥ 2 SD and ≤ 4 SD for age and gender; educational level that permits adequate communication and agree to co-operate in all the tests and examinations; use of an effective contraceptive method, negative pregnancy test where appropriate; informed consent of the parents Exclusion criteria : obesity secondary to an endocrine disease or the use of medications such as cortisol; concomitant administration of other psychotropic medication; taking any vitamins or nutritional supple- ments or any antiobesity preparations; known psychiatric disorder; treated with any type of structured psychotherapy regimen; type 2 diabetes mellitus, arterial hypertension (blood pressure > 95th percentile for gender and height) or steatotic liver; any severe food intolerance, or with a known allergy to substances used in the study; treatment with oral hypoglycaemic agents; pregnant or breastfeeding
Interventions	Intervention : dietary supplementation with an oral capsule of tryptophan 140 mg for 6 months Comparator : oral placebo for 6 months.
Outcomes	Primary outcomes: weight, height, BMI, weight/height z scores, BMI z score, and height/blood pressure and waist/hip circumference Z scores Secondary outcomes: dietary intake, anxiety, depression and other symptoms associated with eating disorders; plasma tryptophan levels; tryptophan/large neutral amino acids ratio, and plasma serotonin Other outcome: -
Starting date	Study start date: unclear Study completion date: unclear
Contact information	Responsible party/principal investigator: Fundació Sant Joan de Déu Spain/Morales R

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 158 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

EUCTR2009-016921-32-ES (Continued)

Study identifier	EUCTR2009-016921-32-ES
Official title	A phase II, randomized, double-blind, placebo-controlled, in parallel groups clinical trial to assess the safety and efficacy of dietary supplementation with tryptophan to achieve weight loss, and its neuropsychological effects in adolescents with obesity
Stated purpose of study	Quote: "To assess the efficacy of a treatment of dietary supplementation with tryptophan to achieve weight loss, and the improvement of clinical parameters such as reduced body mass index and waist/hip ratio."
Notes	Trial status completed (according to trial record, accessed 16 August 2016). Contacted author (6 August 2015) for study completion date and there is an e-mail error (cannot reach author). Recontacted author (6 October 2016) for results/published work

IRCT201012235440N1

Trial name or title	Acronym: -
Methods	Type of study: - Allocation: randomised Intervention model: parallel Masking: open label Primary purpose: treatment
Participants	Condition: overweight and obesity Enrollment: target 115 Inclusion criteria: aged 12-17 years; overweight or obese according to WHO cut-off; living with a parent or adult carer prepared to participate in the study Exclusion criteria: physical disability that prevents participation
Interventions	Intervention: intensive phase: 17 focus group discussions, twice per week and a 45-minute face-to-face session of nutritional counselling at the end of programme Maintenance programme: 7 focus group discussions for 6 months Intervention involved improvement in diet, increase in the level of physical activity and improvement of stress management which was implemented through motivational interviews, group discussions and educational publications Comparator: conventional diet counselling
Outcomes	Primary outcomes: obesity-related behaviours, laboratory indices, BMI, body composition Secondary outcome: health-related quality of life Other outcome: -
Starting date	Study start date: May 2011 Study completion date: September 2012
Contact information	Responsible party/principal investigator: Research Institute for Endocrine Sciences, Tehran/Parisa Amiri
Study identifier	IRCT201012235440N1

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 159 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

IRCT201012235440N1 (Continued)

Official title	Effectiveness of a theory-based intervention on obesity-related behaviours, laboratory indices, body com- position, body mass index and health-related quality of life in overweight adolescents
Stated purpose of study	Quote: "aims at evaluating the effectiveness of a TORBA [theory of obesity-related behaviors in adoles- cents]-based intervention on obese adolescents' weight reduction and its related factors."
Notes	Trial status completed (according to trial record, accessed 17 August 2016). Contacted author (21 October 2015) for study completion date. Re-contacted (6 October 2016) for results/publication

IRCT2013103115211N1

Trial name or title	Acronym: SCT: social cognitive theory
Methods	Type of study: - Allocation: randomised Intervention model: parallel Masking: open label Primary purpose: supportive care
Participants	Condition: obesityEnrollment: target 150Inclusion criteria: second- and third-grade female students in middle schools who according to the WHO2007 Tables have BMI \geq 85th percentile; aged 12-16 yearsExclusion criteria: using drugs associated with overweight and obesity; received and followed any diet bystudents for losing weight before the study; any metabolic disease
Interventions	Intervention : students and parents taught about nutrition and physical activity with participating in theory and practical seminars, conferences and workshops (12 sessions and each session 60 minutes). In addition, 6 sessions held for individual counselling about nutrition and physical activity (each session 60 minutes). Sent 48 messages, given an educational CD, attended practical exercise classes (40 sessions and each session 90 minutes). Interventions duration: 6 months Comparator : no intervention, after which 4 education sessions for students and their parents (each session 90 minutes)
Outcomes	Primary outcomes: weight, height, BMI, waist circumference, nutritional behaviour, physical activity behaviour, nutrition self-efficacy, physical activity self-efficacy, perceived social support in nutrition, perceived social support in physical activity, outcome expectation in nutrition, outcome expectation in physical activity Secondary outcome: - Other outcome: -
Starting date	Study start date: December 2013 Study completion date: May 2014
Contact information	Responsible party/principal investigator: Tehran University of Medical Sciences/Mohamad Bagherniya
Study identifier	IRCT2013103115211N1.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 160 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

IRCT2013103115211N1 (Continued)

Official title	Study on the effect of nutrition education and physical activity intervention using social cognitive theory for overweight and obese student girls of middle school of Shahinshahr
Stated purpose of study	Quote: "to correct two important criteria of lifestyle, nutrition and physical activity, and ultimately reduce the prevalence of overweight and obesity and promoting level of health among adolescents."
Notes	

ISRCTN04152711

Trial name or title	Acronym: SWITCH (SmartWeight in Teenagers Choosing Health)
Methods	Type of study: efficacy study Allocation: randomised Intervention model: cluster Masking: open label Primary purpose: treatment
Participants	Condition: overweight or obese Enrollment: 140 Inclusion criteria: aged 11-16 years, attending participating dental practices, overweight or obese (BMI ≥ 85th centile) and consuming ≥ 1 can (or equivalent) of soft drink per day Exclusion criteria: serious underlying medical condition or eating disorder, being unable to communicate effectively in English or being on a special prescribed diet
Interventions	Intervention: 3-4 motivational interviewing sessions, to reduce consumption of soft drinks, in addition to usual dental healthcare advice from the dentist. Sessions were followed up with a maintenance phase which included text, e-mail and telephone follow-up Comparator : no intervention: usual dental healthcare advice from their dentist and received a healthy eating leaflet at the 6-month follow-up
Outcomes	Primary outcomes: BMI; waist circumference Secondary outcome: mean daily consumption of soft drinks Other outcomes: physical activity levels, sedentary behaviour, social support, process evaluation
Starting date	Study start date: July 2011 Study completion date: March 2013
Contact information	Responsible party/principal investigator: University College London/Richard G Watt, Marie Murphy
Study identifier	ISRCTN04152711.
Official title	Preventing obesity in young people attending primary dental care settings: an exploratory randomised controlled trial
Stated purpose of study	Quote: "to test the feasibility of a MI intervention aimed at reducing soft drink consumption in adolescents attending dental surgeries."

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 161 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

ISRCTN04152711 (Continued)

Notes	Trial status completed (according to trial record, accessed 17 August 2016). Contacted author (22 October 2015) for publication
NCT00562263	
Trial name or title	Acronym: TEENS
Methods	Type of study: efficacy study Allocation: randomised Intervention model: parallel assignment Masking: open label Primary purpose: treatment
Participants	 Condition: overweight Enrollment: 257 Inclusion criteria: aged 11-18 years, BMI ≥ 85th percentile for age and gender, ≥ 1 adult in household committed to programme meetings Exclusion criteria: previous enrolment; underlying genetic, neurological, endocrine or metabolic conditions that preclude weight loss; weight > 400 lb, pregnancy; inability to understand programme instructions due to language or mental disability; primary residence > 30-mile radius; primary participating parent pregnant during parent's intervention
Interventions	Intervention: behaviour changing modification with parents attending 12 educational sessions covering strategies to manage children's health behaviours Comparator: behaviour changing modification (parent does not attend parent education sessions)
Outcomes	Primary outcome: changes in BMI z score Secondary outcomes: changes in body composition, metabolic and anthropometric measures, fitness measures, dietary intake and quality of life scores Other outcome: -
Starting date	Study start date: October 2007 Study completion date: November 2013
Contact information	Responsible party/principal investigator: Gary L. Francis, Virginia Commonwealth University
Study identifier	NCT00562263
Official title	Barriers to effective weight loss in overweight adolescents enrolled in an intensive, team-based, family- centered lifestyle modification program
Stated purpose of study	Quote: "to investigate the impact of a comprehensive, team-based, family-centered, lifestyle modification program on body weight, metabolic abnormalities, fitness measures, and self-esteem in overweight adoles- cents beginning the study at ages 11-18 years."
Notes	The reference provided in the clinical trial record ("automatically linked") is not the same study, and has already been excluded as it is not a randomised controlled trial: Ning Y, Yang S, Evans RK, Stern M, Sun

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 162 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT00562263 (Continued)

S, Francis GL, Wickham EP 3rd. Changes in body anthropometry and composition in obese adolescents in a behaviour changing intervention program. European Journal of Nutrition 2014;53(4):1093-102. doi: 10.1007/s00394-013-0612-9. Contacted author on 1 September 2016 for published data

NCT00850629	
Trial name or title	Acronym: MAINTAIN
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel assignment Masking: open label Primary purpose: treatment
Participants	Condition: weight regain Enrollment: 77 Inclusion criteria: aged 10-17 years; primary adiposity at recruitment with a BMI > 97th percentile; willingness of candidates and their families to actively participate in the 3 parts of the study: residential weight reduction programme (participants who stay about 24 days, on average, at least 4-week treatment programme focusing in behaviour changing change, physical activity and healthful eating) Exclusion criteria: participation in another clinical trial or intake of experimental medication within 30 days before the inclusion date, personal relationships or dependencies between participants and study team, severe chronic diseases that were incompatible with the planned intervention (i.e. severe damage of liver or kidney, clotting disorder, psychological or psychiatric disorders, systemic infections, endocrine diseases as well as malabsorption, food allergies or special diets, pregnancy)
Interventions	 Intervention: initial weight loss at a residential weight reduction programme. 1-year group multiprofessional behaviour changing intervention with monthly meetings at the paediatric outpatient obesity clinic following BABELUGA (Berlin Adiposity Therapy Program for children and adolescents and their families) behaviour changing monitoring map (behaviour changing counselling) Comparator: initial weight loss at a residential weight reduction programme. Received usual medical care, but no particular programme (as the intervention group throughout the whole year)
Outcomes	Primary outcome : change in age- and gender-adjusted BMI z score Secondary outcomes : change in age- and gender-adjusted waist circumference percentile, change in age- and gender-adjusted blood pressure percentile, change in fasting lipid profile, change in fasting insulin and fasting glucose, change in plasma visfatin level, change in plasma adiponectin level, proportion of children achieving a BMI < 85th percentile for age and gender Other outcome : -
Starting date	Study start date: October 2009 Study completion date: August 2012
Contact information	Responsible party/principal investigator: Joachim Spranger, Professor, Charite University, Berlin, Germany
Study identifier	NCT00850629

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 163 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT00850629 (Continued)

Official title	Hormonal regulation of body weight maintenance
Stated purpose of study	Quote: "It is the aim of the therapy to lose weight and maintenance; improvement of physical fitness and endurance capacity; implementation of active lifestyle in daily living; building social networks, making new friend; changing eating patterns at home (with support of the family); strengthening and activating the family as social resource; treatment of co-morbidities."
Notes	Study still ongoing; the investigators are still analysing data. Therefore, they did not wish to share their data publicly (2016, study protocol)

NCT00881478

Trial name or title	Acronym: FOCUS
Methods	Type of study: efficacy study Allocation: randomised Intervention model: parallel assignment Masking: single blind, outcomes assessor Primary purpose: treatment
Participants	Condition: obesityEnrollment: 102Inclusion criteria: aged 8-16 years, $BMI \geq 85$ th percentile for age and genderExclusion criteria: currently taking a weight loss medication, gastrointestinal disorder, psychiatric illnessunder the care of a psychiatrist, Cushing's syndrome, hypothalamic or genetic aetiology of obesity, un- controlled or untreated thyroid disease, current diagnosis of cancer, history of an eating disorder such as bulimia or anorexia nervosa, surgery in the past 3 months, surgery planned in the ensuing 6 months, any chronic illness that could affect weight status
Interventions	Intervention : nutrition counselling + portion control. Nutrition counselling with registered dietitian in addition to teaching about use of a portion control tool Comparator : nutrition counselling alone with registered dietitian
Outcomes	Primary outcome: change in age- and gender-adjusted BMI z score Secondary outcomes: change in age- and gender-adjusted waist circumference percentile, change in age- and gender-adjusted blood pressure percentile, change in fasting lipid profile, change in fasting insulin and fasting glucose, change in plasma visfatin level, change in plasma adiponectin level, proportion of children achieving a BMI < 85th percentile for age and gender Other outcome: -
Starting date	Study start date: August 2009 Study completion date: August 2014
Contact information	Responsible party/principal investigator: Josephine Ho, Alberta Children's Hospital, Calgary
Study identifier	NCT00881478

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 164 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT00881478 (Continued)

Official title	Family intervention for obese children using portion control strategy (F.O.C.U.S.) for weight control - a randomized controlled trial
Stated purpose of study	Quote: "The purpose of this study is to assess the efficacy of a family intervention using a portion control tool to help control weight in obese children. The investigators hypothesize that the use of portion control tools by the parents and child will result in a greater decrease in the child's BMI over a 6 month period compared with the control group."
Notes	Last update: 29 August 2014

NCT00940966

Trial name or title	Acronym: -
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: open label Primary purpose: treatment
Participants	 Condition: elevated triglycerides, systolic hypertension, insulin resistance, abdominal obesity Enrollment: 40 Inclusion criteria: aged 13-18 years, BMI > 95% for age or > 30 kg/m² for young adults, with pre-existing metabolic syndrome Exclusion criteria: on any chronic medication other than antihistamines, asthma medications, oral contraceptives or diabetes medications; smoke > 5 cigarettes/day; alcoholism or drug abuse; significant abnormality not associated with metabolic syndrome; currently taking Byetta; familial hypercholesteremia if the investigator considers the history to be severe; pregnant or desiring pregnancy
Interventions	Intervention: non-energy restricted controlled carbohydrate programmes: energy-restricted very-low car- bohydrate diet; low glycaemic index diet; restricted ketogenic diet Comparator: standard American Diabetes Association diet
Outcomes	Primary outcome: weight loss Secondary outcome: - Other outcome: -
Starting date	Study start date: July 2006 Study completion date: May 2012
Contact information	Responsible party/principal investigator: WVU department of paediatrics/Steven Sondike MD
Study identifier	NCT00940966.
Official title	A pilot study to determine the efficacy of a low carbohydrate diet in treatment of adolescents with metabolic syndrome

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 165 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT00940966 (Continued)

Stated purpose of study	Quote: "to determine the effectiveness of two different non-energy restricted controlled carbohydrate programs with the American Diabetes Associations' diet on glycosylated hemoglobin and other diabetes risk factors in obese adolescents with metabolic syndrome, a constellation of symptoms associated with the development of type 2 diabetes and cardiovascular disease."
Notes	Trial status completed (according to trial record, accessed 17 August 2016). Contacted author (5 August 2015) for study completion date. Recontacted (6 October 2016) for results/publication

NCT00998413

Trial name or title	Acronym: Mikado (Multifactorial intervention for children with asthma and overweight)
Methods	Type of study:interventional Allocation: randomised Intervention model: parallel Masking: open label Primary purpose: prevention
Participants	Condition: asthma, overweight, obesity Enrollment: actual 104 Inclusion criteria: asthma and overweight (BMI-SDS > 1), aged 6-16 years, living in Southern Limburg Exclusion criteria: congenital malformations of the airways or other chronic lung diseases like cystic fibrosis, mental retardation or syndromes, heart disease
Interventions	Intervention : multifaceted family-based, physical exercise, nutrition, cognitive behavioural therapy, parental sessions and individualised counselling for 18 months. Small groups of 8-12 children. Based on health counselling model. Group exercises (twice per week during initial phase, 3 times per month during the follow-up phase), with a duration of 60 minutes per session guided by an experienced paediatric physiotherapist or a paediatric sport instructor. A dietitian and psychologist guide 18 behaviour changing sessions with a duration of 75-90 minutes. Use a workbook with additional information for each behaviour changing session, homework and space for individualised goal setting. Small presents as incentives for participation and achievements. 3 basic dietary guidelines: healthy food choice, regular eating pattern, and normalised portion sizes. Children receive individualised counselling sessions. Parents follow 10 parental sessions of 60 minutes guided by the dietitian and psychologist General Practitioners and the Paediatric Pulmonology section of the Dutch Society of Paediatrics
Outcomes	Primary outcomes : forced expiratory volume in 1 second (FEV ₁ %) predicted value, BMI-SDS Secondary outcomes : lung function parameters, inflammatory parameters, asthma control, medication use, asthma symptoms, health-related quality of life, asthma-related quality of life, sleep-related breathing disorders, gastro-oesophageal reflux disease, psychosocial problems, eating behaviour, weight, height, BMI) , waist and hip circumference, 4-fold skinfold measurement, food record, accelerometer output Other outcome : -
Starting date	Study start date: January 2010 Study completion date: September 2013
Contact information	Responsible party/principal investigator: Maastricht University Medical Center/Edward Dompeling

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 166 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT00998413 (Continued)

Study identifier	NCT00998413.
Official title	Secondary prevention of asthma in overweight/obese children by a combined dietary-behavioural-physical activity intervention
Stated purpose of study	Quote: "to determine the efficacy of a multifactorial intervention with weight reduction, behavioural therapy, and physical exercise on the severity and control of asthma in obese children."
Notes	Trial status completed (according to trial record, accessed 17 August 2016). Contacted author (22 October 2015) for study completion date but e-mail error. Recontacted (6 October 2016) and e-mail error

NCT01023139

Trial name or title	Acronym: AOS
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel assignment Masking: open label Primary purpose: treatment
Participants	Condition : overweight Enrollment : estimated 100 Inclusion criteria : BMI \geq U. weighted mean of the 95th percentile based on age and gender; willing to lose weight to meet and continue study medication for the 12-month treatment period and meet personal weight loss goal; willing to not start any new weight loss products; males or non-pregnant females (pregnancy determined by self-report); females of childbearing potential if practicing acceptable method of contraception Exclusion criteria : weight loss \geq 10 lb in previous 3 months; active gastrointestinal disorders (except gastro-oesophageal reflux disease); at least 2 out of 3 blood pressure readings either systolic or diastolic \geq 95 percentile for height and age or pulse \geq 95 beats per minute at initial visit; drug-treated diabetes mellitus or hypertension; drugs or supplements (or both) administered for the first time or withdrawn during the past 6 months which have a significant impact on body weight or digestion; inability or unwillingness to comply with protocol requirements; unwilling to avoid consumption of alcoholic beverages; smoking or has started a smoking cessation programme within the past 6 months; previous treatment with prescription sibutramine; history of recurrent nephrolithiasis; major psychiatric or eating disorders; kidney, liver or thyroid disorder; drugs that are contraindicated; cardiovascular disease; history of bleeding problems, migraine headaches or seizures; stroke; history of pulmonary hypertension, osteopenia or osteoporosis; current recreational drug use or overused prescription medications; history of glaucoma; pregnancy
Interventions	Intervention : continuing behavioural therapy. Study uses a multidisciplinary approach along with phar- macotherapy (use of Meridia) to motivate and establish behaviour changes in adolescents (aged 12-18 years) during the first phase of the study. The group will continue on monthly behaviour modifications and be evaluated at 3 and 6 months. This arm follows the end of the phase 1 which incorporates behavioural therapy, nutrition counselling and pharmacotherapy with sibutramine while medically supervised. Partic- ipants randomised to this arm no longer receive medication and will receive behavioural therapy once per month and then evaluated at 3 and 6 months for weight loss maintenance Comparator : no intervention: standard of care. No intervention following phase 1 of the study done

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 167 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT01023139 (Continued)

	during this 2nd phase. Participants have their height and weights examined at 3 and 6 months following end of phase 1. During these 2 visits, they receive counselling from the physician regarding food choices and exercise maintenance
Outcomes	Primary outcome: % change in BMI z score Secondary outcomes: absolute weight change, waist circumference change Other outcome: -
Starting date	Study start date: April 2009 Study completion date: March 2011
Contact information	Responsible party/principal investigator: Brooke Army Medical Center/Jorge L Cabrera
Study identifier	NCT01023139.
Official title	Efficacy in adolescents of continued behavior modification following a six month sibutramine-based weight management intervention
Stated purpose of study	Quote: "This study uses a multidisciplinary approach along with pharmacotherapy (use of Meridia) to motivate and establish behavior changes in adolescents (12-18yo) during the first phase of the study."
Notes	Trial record stated, "The recruitment status of this study is unknown because the information has not been verified recently."

NCT01221220

Trial name or title	Acronym: -
Methods	Type of study: efficacy Allocation: randomised Intervention model: parallel Masking: single blind (outcome assessor) Primary purpose: treatment
Participants	Condition: obesity Enrollment: 160 Inclusion criteria: aged 8-15 years, obese (BMI > 95th percentile on the 2000 CDC BMI reference) on the date of randomisation. Standard Stanford Pediatric Weight Control Program eligibility criteria apply: both child and parent/guardian must want to join, both child and at least 1 parent/guardian must agree to attend sessions and must agree to not miss > 2 consecutive sessions Exclusion criteria: diagnosed with a medical condition affecting growth (a genetic or metabolic disease/ syndrome associated obesity, type 1 diabetes, type 2 diabetes taking medication, chronic gastrointestinal diseases, chronic renal diseases, uncorrected structural heart disease, heart failure, heart transplant, anorexia nervosa or bulimia nervosa or binge eating disorder (present or past), AIDS or HIV infection, pregnancy) ; taking medications affecting growth (systemic corticosteroids > 2 weeks in the past year, insulin, oral hypoglycaemic drugs, thyroid hormone, growth hormone); have a condition limiting their participation in the interventions (e.g. unable to participate in routine physical education classes at school, requiring oxygen supplementation for exertion, developmental or physical disability preventing participation in

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 168 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT01221220 (Continued)

	interventions, children or parents/guardians who cannot medically participate in mild dietary restrictions, increased physical activity for any reason, or a combination of these); have a condition limiting participation in the assessments (child or primary carer unable to read surveys in English or Spanish, child ≥ 2 grade levels delayed in school for reading and writing in his/her native language); unable to read, understand or complete informed consent in English or Spanish; plan to move from the San Francisco Bay Area within the next 18 months
Interventions	Intervention : behavioural treatment + environmental strategies. 6-month, family-based, group, be- havioural weight control programme + home-based environmental intervention Comparator : active comparator: behavioural treatment only. 6-month, family-based, group, behavioural weight control programme
Outcomes	Primary outcome: BMI Secondary outcomes: waist circumference, triceps skinfold, resting heart rate, dietary intake/meals eaten with television, weight concerns, depressive symptoms, daily energy intake, physical activity, systolic and diastolic blood pressure, fasting blood lipids, insulin/glucose metabolism Other outcome: -
Starting date	Study start date: September 2010 Study completion date: February 2015 (estimated)
Contact information	Responsible party/principal investigator: Thomas Robinson Stanford University
Study identifier	NCT01221220.
Official title	Environmental strategies & behavior change to reduce overeating in obese children
Stated purpose of study	Quote: "There is a need for effective weight control methods for obese children. Environmental strategies such as reducing the size of dishware and serving utensils, storing food out of view and reducing food consumption while watching television may reduce food intake without requiring conscious, cognitive self-control. The investigators propose to test these methods when added to a current state-of-the-art behavioral program."
Notes	Trial record stated, "The recruitment status of this study is unknown because the information has not been verified recently" (accessed 17 August 2016)

NCT01350531

Trial name or title	Acronym: -
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: single blind (outcomes assessor) Primary purpose: treatment

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 169 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT01350531 (Continued)

Participants	 Condition: obesity Enrollment: estimated 200 Inclusion criteria: African-American adolescents, aged 12-16 years and 11 months; obesity (BMI ≥ 95th percentile or BMI > 30 kg/m²); may have primary obesity or obesity in combination with other medical comorbidities; youth with mild mental retardation may be included if they are capable of reading and understanding the study measures Exclusion criteria: obesity secondary to medication use for another disorder; obesity in a youth with medical condition that prevents their participation in normal exercise; thought disorders; serious cognitive impairments; pregnant or have a medical condition where weight loss is contraindicated; do not live with their primary carer
Interventions	Intervention: skills training: includes skills most proximal to adhering to the eating and weight loss plan (e. g. calorie counting, making healthy food choices, measuring food portions, scheduling snacks and meals, meal planning, completing food logs daily, following an exercise plan) Comparator: contingency management: behavioural principles to counteract the reinforcing mechanisms of food and inactivity
Outcomes	Primary outcomes : change in weight-related outcomes (height, weight and % body fat) Secondary outcomes : change in adherence to weight loss recommendations (objective measures of car- diovascular fitness, BLOCK Kids FFQ, and the Frequency of Fast Food Use Questionnaire); change in physiological functioning (plasma glucose, insulin, total cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol and triglyceride levels); change in motivation (Importance Ruler) Other outcome : -
Starting date	Study start date: September 2009 Study completion date: June 2014
Contact information	Responsible party/principal investigator : Wayne State University/Sylvie Naar-King, PhD and K-L Cathy Jen, PhD
Contact information Study identifier	Responsible party/principal investigator: Wayne State University/Sylvie Naar-King, PhD and K-L Cathy Jen, PhD NCT01350531.
Contact information Study identifier Official title	Responsible party/principal investigator: Wayne State University/Sylvie Naar-King, PhD and K-L Cathy Jen, PhD NCT01350531. Interventionist procedures for adherence to weight loss recommendations in black adolescents, phase two
Contact information Study identifier Official title Stated purpose of study	Responsible party/principal investigator: Wayne State University/Sylvie Naar-King, PhD and K-L Cathy Jen, PhD NCT01350531. Interventionist procedures for adherence to weight loss recommendations in black adolescents, phase two Quote: "To refine intervention protocols from our preliminary studies that maximize adolescent and parent skills, informed by learning theory, through the use of home and community-based interventions in which in-vivo opportunities are used to promote practice in making changes in dietary, exercise and sedentary behaviors in AAAO [African-American adolescents with obesity] and their families (PHASE I); To develop intervention protocols that utilize findings from basic science regarding intrinsic and extrinsic motivation to maximize adolescent and family adherence to recommendations for obesity-related behavior change in AAAO and their families (PHASE I); To develop an adaptive intervention using a sequential multiple randomized assignment trial (SMART design) (PHASE II); To refine the intervention including qualitative analysis of interviews from participant families and to develop further community participation in preparation for a confirmatory randomized clinical trial (PHASE III)."

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 170 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Trial name or title	Acronym: -
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: open label Primary purpose: treatment
Participants	Condition: childhood obesity Enrollment: estimated 100 Inclusion criteria: aged 12-14 years; BMI > 25 kg/m ² ; gender- and age-specific 85th percentile cut-off points from the CDC growth chart; parental consent and subject assent Exclusion criteria: physician-determined musculoskeletal, cardiopulmonary, metabolic, psychological, neurodevelopmental or behavioural conditions that make mild-to-moderate physical activity potentially hazardous
Interventions	Intervention: Exergaming: access to usual physical activity at the gym as well as access to Exergaming equipment (video games that require physical activity). Exergaming equipment will be available for use at the YMCA (Young Men's Christian Association) daily. Exergames include a mixture of aerobic and resistance exercise activities Comparator: usual physical activity at the gym, no access to Exergames
Outcomes	Primary outcome: change in mean daily physical activity Secondary outcomes: change in caloric expenditure, body composition (total body estimates of fat mass, fat-free mass, and lean body mass) and BMI (BMI z score) Other outcome: -
Starting date	Study start date: October 2010 Study completion date: October 2012
Contact information	Responsible party/principal investigator : Charles Drew University of Medicine and Science/David Mar- tins
Study identifier	NCT01374386
Official title	RCMI clinical research infrastructure initiative: exergaming
Stated purpose of study	Quote: "to gather information on how much exercising with video games (ExerGaming) can increase the physical activity among overweight and youth. This study will try to see if participating in physical activity and exercising with video games at the same time can make overweight children move around more to better their own health."
Notes	Trial record stated, "The recruitment status of this study is unknown because the information has not been verified recently" (accessed 17 August 2016)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 171 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Trial name or title	Acronym: MPOWERed
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: single blind (outcome assessor) Primary purpose: treatment
Participants	Condition: obesityEnrollment: 60Inclusion criteria: $BMI \ge 95$ th percentile for gender and age according to CDC growth charts; enrolmentin the MPOWER programme; at least 1 parent willing and able to participate in the MPOWER programmewith the adolescent; absence of any major medical illness, disability or moderate/severe mental disorder (e.g. liver disease, renal failure, cancer, bipolar disorder)Exclusion criteria: presence of any major medical illness, disability or moderate/severe mental disorder;physical, mental or cognitive handicaps that prevent participation; chronic use of medications that mayaffect study outcomes; pregnancy or planning pregnancy in the next 6 months; lactating; within 6 monthspostpartum
Interventions	Intervention : tailored mobile messages to enhance weight loss for teens. Participants receive daily messages over 20 weeks. The content of the messages is tailored on participants' responses to the MPOWER enrolment survey and the initial tailoring questionnaire. The tailored messages utilise various degrees of personalisation, adaptation and feedback - including momentary assessments with feedback requiring a text reply from the adolescents Comparator : participation in the MPOWER programme without receiving tailored text messages
Outcomes	Primary outcomes: session attendance; adherence to MPOWER programme homework assignments; satisfaction with the MPOWER programme; drop-out Secondary outcomes: change in BMI; objective measurement of daily participation in moderate-to-vigorous activity; self-efficacy for achieving MPOWER recommendations for the 6 target behaviours; intrinsic motivation to increase intake of fruits and vegetables and to increase physical activity; change in self-report of the 6 behaviours targeted in the intervention Other outcome: -
Starting date	Study start date: October 2011 Study completion date: February 2015
Contact information	Responsible party/principal investigator: University of Michigan/Susan J Woolford, MD, MPH
Study identifier	NCT01448551
Official title	Novel individually tailored mobile messages to enhance weight loss for teens
Stated purpose of study	Quote: "The investigators hypothesize that program participants who receive the tailored text messages will experience lower attrition rates, increased treatment adherence, and greater weight loss compared to those program participants who do not receive the messages."
Notes	Last updated: 30 November 2015

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 172 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Trial name or title	Acronym: O3WLIRADOL (Omega-3 Fatty Acids for Weight Loss and Insulin Resistance in Adolescents)
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: double blind (participant, investigator) Primary purpose: supportive care
Participants	Condition: obesity, insulin resistance Enrollment: estimated 300 Inclusion criteria: aged 12-18 years; male and female; BMI > 95th percentile of the National Center for Health Statistics reference; informed consent Exclusion criteria: diagnosed with type 2 diabetes mellitus, cardiovascular disease or kidney disease; allergic to fish
Interventions	Intervention : omega 3 supplement (1.1 g of docosahexaenoic acid and eicosapentaenoic acid) containing omega 3: docosahexaenoic acid and eicosapentaenoic acid fatty acids and a hypocaloric diet. 30 capsules provided every month for 3 months. Personalised diet including: reduction of 700 kcal from the usual diet considering lipids and carbohydrates, increasing fruits and vegetables intake up to 6 portions daily each and incrementing the intake of fibre to 30 g per day through the inclusion of whole grains Comparator : sunflower oil supplement and a hypocaloric diet. Personalised diet including: reduction of 700 kcal from the usual diet considering lipids and carbohydrates, increasing fruits and vegetables intake up to 6 portions daily each and incrementing the intake of fibre to 30 g per day through the inclusion of whole grains up to 6 portions daily each and incrementing the intake of fibre to 30 g per day through the inclusion of whole grains and vegetables intake up to 6 portions daily each and incrementing the intake of fibre to 30 g per day through the inclusion of whole grains and vegetables intake up to 6 portions daily each and incrementing the intake of fibre to 30 g per day through the inclusion of whole grains
Outcomes	Primary outcome: change in insulin resistance Secondary outcome: nutritional status (measured by weight, stature, BMI, waist) Other outcome: -
Starting date	Study start date: July 2012 Study completion date: December 2015
Contact information	Responsible party/principal investigator : Pediatric Hospital CMN "Siglo XXI/Mardia Lopez-Alarcon, PhD
Study identifier	NCT01456221
Official title	The impact of using omega3 long-chain polyunsaturated fatty acids in weight loss and insulin resistance in obese adolescents
Stated purpose of study	Quote: "to evaluate if a supplement containing omega-3 long chain polyunsaturated fatty acids for three months reduce obesity and insulin resistance to obese adolescents if administered together with a hypocaloric diet."
Notes	Last updated: 3 February 2016

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 173 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Trial name or title	Acronym: IMPACT (Ideas Moving Parents and Adolescents to Change Together)
Methods	Type of study: interventional Allocation: randomised Intervention model: single blind Masking: parallel Primary purpose: treatment
Participants	Condition: overweight, obese Enrollment: estimated 360 Inclusion criteria: aged 11-15 years, found at standard school screenings to be overweight (BMI 85-94th percentile for age/gender) or obese (> 95th percentile for age/gender) Exclusion criteria: medications that alter appetite or weight; inability to understand English; stage 2 hypertension or stage 1 hypertension with end-organ damage (left ventricular hypertrophy, microalbu- minuria); severe behavioural problems that preclude group participation (as reported by parent/guardian) ; involvement in another weight management programme; family expectation to move from the region within 1 year; presence of a known medical condition that itself causes obesity (e.g. Prader-Willi syndrome) or interfere with glycated haemoglobin (sickle cell disease)
Interventions	Intervention 1; HealthyCHANGE: cognitive behavioural strategies to address diet, physical activity, seden- tary behaviour and sleep for children. Intensive series of group sessions, followed by rotating monthly face- to-face meetings or telephone calls Intervention 2: SystemCHANGE: system improvement and choice architecture theories seek to teach a set of skills using family self-designed experiments to redesign daily routines regarding eating, activity and sleep. Intensive series of group sessions, followed by rotating monthly face-to-face meetings or telephone calls Comparator: Tools4CHANGE: 1 × 60-minute face-to-face meeting at initiation of the study with a dietitian who is also trained in recommendations for exercise and sedentary behaviour (representing usual care)
Outcomes	Primary outcome: slope of BMI Secondary outcomes: dietary intake, blood pressure, physical activity, sleep, cardiovascular risk factors, body composition, fitness, quality of life, DNA Other outcome: -
Starting date	Study start date: February 2011 Study completion date: December 2017
Contact information	Responsible party/principal investigator: Elaine Borawski, Case Western Reserve University/Leona Cut- tler, MD
Study identifier	NCT01514279
Official title	Targeting obesity and blood pressure in urban youth (consortium title: Childhood Obesity Prevention and Treatment Research [COPTR] and site project name IMPACT (Ideas Moving Parents and Adolescents to Change Together)
Stated purpose of study	Quote: "The project assesses the effects of three interventions on Body Mass Index(BMI) in overweight and obese urban 5th-8th grade youth: a cognitive-behavioral intervention (HealthyChange), a systems

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 174 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT01514279 (Continued)

	improvement intervention (SystemsChange), and an education-only intervention (Tools4Change). In ad- dition the study assesses the potential additional impact of a school-community based intervention on outcomes."
Notes	Last updated: 26 January 2016

NCT01677923

Trial name or title	Acronym: -
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: open label Primary purpose: treatment
Participants	Condition: obesity Enrollment: estimated 400 Inclusion criteria: aged 10-17 years; weight > 85th percentile for age and gender (by International Obesity Task Force); living in Kaunas and its region; no obvious chronic diseases; not on steroid or other long-term treatment; informed consent of the participant and parents Exclusion criteria: diagnosis of type 1 diabetes mellitus; chronic illness that may affect physical activity and metabolic profile; insulin treatment; steroid treatment; planning to move from Kaunas or its region in the period of 1 year
Interventions	 Intervention: intervention duration: 12 months Intervention 1: intensive diet + physical activity group: seen by a dietitian once per month for diet re-evaluation; physical therapist, who will give physical activity course twice per week (1 hour each); paediatric endocrinologist every 3 months Intervention 2: intensive diet + physical activity group + insulin sensitisation: metformin 1000 mg/day. Children seen by a dietitian once per month for diet re-evaluation; physiotherapist, who will give physical activity course twice per week (1 hour each); paediatric endocrinologist every 3 month Comparator 1: insulin sensitisation without intensive diet and physical activity. Metformin 1000 mg/day after standardised information on healthy lifestyle, diet and exercise during the first visit only. Seen by paediatric endocrinologist every 3 months Comparator 2: during the first visit participants get standardised information on healthy lifestyle, diet and exercise. Followed-up at 12 months
Outcomes	Primary outcome: BMI changes Secondary outcomes: glucose homeostasis; lipid profile; metabolic syndrome; hepatosteatosis; polycystic ovary syndrome and hyperandrogenism in females Other outcome: safety
Starting date	Study start date: May 2013 Study completion date: December 2015
Contact information	Responsible party/principal investigator: Lithuanian University of Health Sciences/Rasa Verkauskiene

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 175 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT01677923 (Continued)

Study identifier	NCT01677923
Official title	Phase 3: effect of diet, physical activity and insulin sensitizer metformin on obesity and associated risks in children and adolescents
Stated purpose of study	Quote: "to get better effect of weight decrease and metabolic processes repair in the intensive treatment group with intervention of physical activity, diet correction and Metformin use."
Notes	Trial status completed (according to trial record, accessed 17 August 2016). Contacted author (2 September 2016) for results/publication

NCT01688453

Trial name or title	Acronym: PRALIMAP-INES
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: open label Primary purpose: prevention
Participants	Condition : overweight Enrollment : 1250 Inclusion criteria : attending grade 10 in participating schools; aged \leq 18 years; able to complete a questionnaire; overweight or obese according to the International Obesity Task Force criteria (for BMI) and the McCarthy criteria (for waist circumference), have a high eating disorder score, express the need for management of excess weight, or a combination of these; confirmed as corresponding to the inclusion criteria by the physician; agree to an overweight and obesity care management programme Exclusion criteria : -
Interventions	Intervention : strengthened care management: 5 collective sessions with the same standard operating procedure as the standard-care management with supplementary interventions between each session: strength- ened solicitation with the adolescent and the family, peer-led educational sessions, motivational interviews, financial support for physical activity practice, cooking classes and multidisciplinary consultation meetings Comparator : standard-care management: 5 collective sessions of 2 hour each about nutritional practices (food and physical activity) and on changes of nutritional behaviours. The sessions are organised in high schools by the healthcare team in collaboration with paediatricians, dietitians and the Sickness Insurance Primary Fund
Outcomes	Primary outcomes : change in BMI; change in overweight and obesity status; change in BMI Z score Secondary outcomes : change in waist circumference; change in eating attitude score; change in anxiety and depression scores Other outcome : change in nutritional behaviour
Starting date	Study start date: September 2012 Study completion date: September 2015

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 176 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT01688453 (Continued)

Contact information	Responsible party/principal investigator : Institut National de la Santé Et de la Recherche Médicale, France/Serge Briançon, Pr
Study identifier	NCT01688453
Official title	Reduction of inequalities in overweight and obesity management care access among high school adolescents
Stated purpose of study	Quote: "to investigate whether a strengthened care management (CM) for socially less advantaged adoles- cents in school in the short and long term has an equivalent effect as a standard-CM on decreasing the prevalence of overweight and obesity among socially advantaged adolescents."

NCT01764113

Trial name or title	Acronym: -
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: open label Primary purpose: treatment
Participants	Condition: adolescent obesity Enrollment: 21 Inclusion criteria: aged ≥ 14 years; BMI ≥ 95th percentile for age and gender Exclusion criteria: -
Interventions	Intervention: mindful eating: adolescents and parents receive mindful eating-based behavioural modifi- cation programme over multiple sessions. At least 1 parent would be expected to attend the counselling sessions. Duration: 6 months Comparator: standard nutritional counselling provided by a registered dietitian. At least 1 parent would be expected to attend the counselling sessions. Duration: 6 months
Outcomes	Primary outcome: BMI Secondary outcome: quality of life Other outcome: fasting glucose
Starting date	Study start date: December 2012 Study completion date: December 2013
Contact information	Responsible party/principal investigator: Mayo Clinic/Seema Kumar
Study identifier	NCT01764113

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 177 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
NCT01764113 (Continued)

Official title	Effect of mindful eating on body mass index and cardiovascular risk markers in obese adolescents: a pilot randomized clinical trial
Stated purpose of study	Quote: "to study the effect of a family based mindfulness training program with special focus on diet and nutrition on weight and cardiovascular risk markers in obese adolescents."
Notes	Trial status completed (according to trial record, accessed 17 August 2016). Contacted author (5 August 2015) for expected publication date, author response: data ongoing and will notify once accepted

NCT01794546

Trial name or title	Acronym: -
Methods	Type of study: interventional Allocation: randomised Intervention model: cross-over Masking: single blind (outcomes assessor) Primary purpose: treatment
Participants	Condition : paediatric obesity Enrollment : 40 Inclusion criteria : aged 10-17 years; BMI \geq 95th percentile for age and gender; no known significant obesity comorbidity or cause requiring urgent medical evaluation or treatment in a subspecialty programme other than an obesity programme; no known physical limitations to changes in diet or activity level (i.e. concern for cardiac disease, primary gastrointestinal disease or orthopaedic concerns); patient at Wareham Pediatrics practice Exclusion criteria : unstable home environment; inability to actively participate in treatment; physician diagnosis of a major medical illness or eating disorder; chronic use of any medication or supplement that may affect study outcomes; another member of the family participating in the study; planning to relocate from current area of residence during the proposed time frame for study participation
Interventions	Intervention : telehealth, alternate visits between a dietitian and behavioural medicine provider for either 30 minutes or 1 hour. 12 sessions over 6 months. The dietitian provides dietary and physical activity recommendations, and the behavioural medicine provider counsels on strategies for achieving specific goals. Applying a Chronic Care Model, self-management support will be augmented by linkages to community resources Comparator : wait list control group
Outcomes	Primary outcome: BMI Secondary outcomes: satisfaction, compliance Other outcome: -
Starting date	Study start date: February 2013 Study completion date: January 2015
Contact information	Responsible party/principal investigator: Children's Hospital Boston/Cara B Ebbeling, PhD

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 178 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT01794546 (Continued)

Study identifier	NCT01794546
Official title	Integrated care for pediatric obesity using telehealth
Stated purpose of study	Quote: "to evaluate telehealth for treating pediatric obesity in collaboration with a community practice (Wareham Pediatrics)."
Notes	Trial status completed (according to trial record, accessed 17 August 2016). Contacted author (23 November 2015) for expected publication date, author response: data are ongoing and cannot share unless published

NCT01796067

Trial name or title	Acronym: FIT: Families Improving Together
Methods	Type of study: interventional Allocation: randomised Intervention model: factorial Masking: open label Primary purpose: treatment
Participants	Condition : overweight, obese Enrollment : estimated 520 Inclusion criteria : parent or primary carer who lives in the same house; live within 60 miles of the programme's office; \geq 3 grandparents who are African-American; access to the Internet; aged 11-16 years; BMI \geq 85th to < 99th percentile; no medical condition that would limit participation in moderate-intensity exercise including life-threatening illness (e.g. immobile, severely disabled or bed ridden); available and able to participate in measures and intervention activities over the next year Exclusion criteria : chronic illness; require a specialised diet (may not be eligible); developmental delay; partaking currently in another weight loss programme
Interventions	 Intervention: 8-week face-to-face group programme comparing motivational plus family weight loss to a comprehensive health education programme. Then participants undertake either an 8-week online tailored intervention or online control and then participants have online intervention or control booster sessions for 6 months. 4 groups: Group 1: motivational and family weight loss + online intervention Group 2: motivation and family weight loss + online control Group 3: basic health education and online intervention Group 4: basic health education and online control Comparator: see above
Outcomes	Primary outcome: change in BMI (BMI z score) Secondary outcomes: change in moderate-to-vigorous physical activity in parents and adolescents; change of 24-hour dietary recall in parents and adolescents; change in psychosocial variables (autonomy-support, monitoring, communication); change in moderate-to-vigorous physical activity; change of 24-hour dietary recall; change in BMI z score in parents Other outcome: -

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 179 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT01796067 (Continued)

Starting date	Study start date: July 2012 Study completion date: June 2017
Contact information	Responsible party/principal investigator: University of South Carolina/Dawn K Wilson, PhD
Study identifier	NCT01796067.
Official title	Families Improving Together (FIT) for weight loss
Stated purpose of study	Quote: "to test the effects of an integrated intervention curriculum and the added effects of a tailored web- based intervention on reducing z-BMI in overweight African American adolescents."
Notes	Last updated: 19 July 2016

NCT01804855

Trial name or title	Acronym: -
Methods	Type of study: non-inferiority study Allocation: randomised Intervention model: parallel assignment Masking: single blind (outcome assessor) Primary purpose: treatment
Participants	Condition: obesity Enrollment: 134 (126 in trial record) Inclusion criteria: aged 12-17 years, BMI > 98th percentile, fluent in English, parent(s) willing to partic- ipate in the programme, written informed consent and assent prior to any study-specific procedures Exclusion criteria: severe intellectual difficulties which would limit the child's ability to engage in group activity, obesity secondary to genetic condition, limitations to engaging in physical activity or use of medication known to effect body weight, limitations to using a smart phone device and known family issues that would affect general compliance and attendance at follow-up visits
Interventions	Intervention : W82GO (underpinned by behavioural change theory (Transtheoretical Model and social cognitive theory) uses strategies including stimulus control, self-monitoring, positive reinforcement, goal setting and problem solving to facilitate lifestyle change), 6×2 -hour weekly sessions for adolescents and parents followed by randomisation to a maintenance phase, of 3×3 -month booster maintenance sessions over 46 weeks and using a smart phone application: incorporates evidence-based behavioural change tools such as self-monitoring, goal setting and peer support. Evidence-based tips as a text tip, a video tip or an image tip. Aim to increase knowledge with regard to healthy eating, physical activity, physical fitness and sleep. Encouraged to engage in daily goal setting and monitor progress. Monthly telephone calls Comparator : W82GO followed by randomisation to usual care maintenance phase: 3 booster sessions at 3, 6 and 9 months and no smart phone intervention
Outcomes	Primary outcome: BMI z score Secondary outcomes: weight, height, waist circumference, fat mass, physical activity, lipids, glucose, insulin, glycated haemoglobin, psychosocial health, adverse events, health-related quality of life

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 180 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT01804855 (Continued)

	Other outcome: -
Starting date	Study start date: 2013 Study completion date: 2014
Contact information	Responsible party/principal investigator : Grace O'Malley, Temple Street Children's University Hospital. Dublin, Ireland
Study identifier	NCT01804855
Official title	Effectiveness of a smartphone app for adolescent obesity management
Stated purpose of study	Quote: "This study will test whether treatment can be delivered via an Android app and whether such treatment reduces obesity."
Notes	Some conflicting information between the protocol and clinical trials record, e.g. sample size and outcomes. Trial record stated, "The recruitment status of this study is unknown because the information has not been verified recently" (accessed 18 August 2016)

NCT01840631

Trial name or title	Acronym: -
Methods	Type of study: intervention Allocation: randomised Intervention model: parallel Masking: open label Primary purpose: treatment
Participants	 Condition: obesity Enrollment: 80 Inclusion criteria: aged 9-17 years, BMI percentile for age of ≥ 95, able to attend monthly sessions with a parent or guardian (or both) Exclusion criteria: diabetes at baseline, mental or psychological disease that would interfere with understanding, disease or medication causing obesity or weight loss, and participants in an alternative weight management programme, impaired glucose tolerance
Interventions	Intervention : group nutritional counselling for a total of 6 classes. Classes meet 1 time per month for 60 minutes (30 minutes for dietetic session and 30 minutes for discussion/questions). Classes cover topics including nutrition, exercise and behaviour to promote healthy eating. All content developed prior to starting the intervention. Each group session have a maximum of 7 children with 1 parent/carer per child and a minimum of 5 children with a carer. All groups receive standard of care for physical fitness counselling which includes recommending 1 hour of physical activity per day and limiting screen time to < 2 hours per day. All groups evaluated for depression and appropriately referred if found to be depressed. Behavioural strategies, such as mindful eating, included in the nutrition education (participants receive the same information in both interventions) Comparator : individual nutritional counselling (usual care): nutritionist conducts the nutritional counselling with 1 family at a time. Individual sessions once per month for 30 minutes for a total of 6 sessions.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 181 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT01840631 (Continued)

	All groups receive standard of care for physical fitness counselling which includes recommending 1 hour of physical activity per day and limiting screen time to < 2 hours per day. All groups evaluated for depression and appropriately referred if found to be depressed. Behavioural strategies, such as mindful included in the nutrition (participants receive the same information in both interventions)
Outcomes	Primary outcome: mean BMI change Secondary outcomes: correlation between change in BMI and dietary composition change, correlation between change in BMI and increased physical activity, effect of change in BMI on metabolic profile Other outcome: -
Starting date	Study start date: April 2013 Study completion date: December 2015
Contact information	Responsible party/principal investigator: Rubina Heptulla, Albert Einstein College of Medicine of Yeshiva University, New York
Study identifier	NCT01840631.
Official title	A randomized controlled trial to Study the effects of group versus individual dietary counseling in pediatric obesity
Stated purpose of study	Quote: "The primary aim of our study is to assess whether group counselling is a non-inferior intervention compared to the usual care of individual counselling in the management of childhood obesity. In order to achieve this aim, the investigators will compare the mean change in BMI after 6 months of intervention in the two study arms."
Notes	Last updated: 24 June 2015

NCT02034994

Trial name or title	Acronym: -
Methods	Type of study: efficacy Allocation: randomised Intervention model: parallel assignment Masking: single blind (outcomes assessor) Primary purpose: prevention
Participants	Condition: obesity but only in second part of the study Enrollment: 1200 Inclusion criteria: secondary prevention programme (relevant to our review): overweight and obese chil- dren, 6th and 7th grades students, consent form signed by parents/tutors Exclusion criteria: pregnant girls
Interventions	Intervention : behavioural: eating behaviour and physical activity change: a combination of 2 prevention school-based programmes addressed to schoolchildren over 1 year. Primary prevention developed monthly to reduce cookies and sugar-sweetened beverage consumption, reduction of sedentary activities, increase meal consumption frequency and quality, etc, in all children from 6th and 7th grades. Overweight and

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 182 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT02034994 (Continued)

	obese children invited to participate on a secondary prevention programme in which daily physical activity classes performed by physical education teachers in school facilities Comparator : no intervention
Outcomes	Primary outcome: BMI Secondary outcomes: mean lean and fatty body mass proportions Other outcomes: sedentary activities, sugar-sweetened beverages intake, cookies intake, fruits intake, physical activity
Starting date	Study start date: February 2014 Study completion date: December 2014
Contact information	Responsible party/principal investigator: Rosely Sichieri, Rio de Janeiro State University
Study identifier	NCT02034994
Official title	Combining primary and secondary prevention for reduction of excessive weight gain in school
Stated purpose of study	Quote: "The main objective is to evaluate the effects of a multicomponent, school-based intervention combining change in nutritional behaviors with after school physical activity activities in reducing the excessive weight gain in schoolchildren."
Notes	Only part 2 of the study is relevant. Trial record stated, "The recruitment status of this study is unknown because the information has not been verified recently" (accessed 18 August 2016)

NCT02086851

Trial name or title	Acronym: -
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: open label Primary purpose: treatment
Participants	Condition: paediatric obesity Enrollment: 110 Inclusion criteria: aged 11-16 years; BMI > 85th percentile; 1 parent or guardian committed to participate in protocol Exclusion criteria: previous enrolment in IRB3354, IRB3008 or HM11113; underlying genetic, neuro- logical, endocrine or metabolic condition that precludes weight loss with conventional diet and exercise programmes; weight > 400 lb, pregnancy; inability to understand study instructions due to language barrier or mental disability; primary residence outside a 30-mile radius of study location
Interventions	Intervention : behaviour changing intervention + parent motivational interviewing: 6-month intensive behaviour changing modification, includes a structured exercise programme, nutrition education and dietary modification and behavioural support. Followed by a 6-month maintenance phase with monthly booster sessions. Parents participate in 4 dedicated "pre-treatment" parent psychoeducational sessions

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 183 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT02086851 (Continued)

	Comparator : behaviour changing intervention alone (no parent psychoeducational sessions)
Outcomes	Primary outcome: change in BMI z scores Secondary outcomes: changes in body composition, BMI, insulin sensitivity, blood pressure, serum lipids, fitness measures, electrocardiographic parameters, dietary intake, quality of life scores, BMI of participating parents or body composition of participating parents Other outcome: -
Starting date	Study start date: September 2011 Study completion date: August 2015
Contact information	Responsible party/principal investigator: Virginia Commonwealth University/Edmond P Wickham, MD, MPH
Study identifier	NCT02086851
Official title	Impact of a structured parent intervention on weight loss and behavioral change in overweight adolescents enrolled in a lifestyle modification program
Stated purpose of study	Quote: "The study will enroll 110 overweight and obese adolescents ages 11-16 in a lifestyle modification program focusing on dietary modification and exercise. Parents will be randomized into control and motivational interviewing-based intervention groups. The primary hypothesis is that adolescents whose parents are in the intervention group will have improved compliance, weight loss and health outcomes compared with adolescents whose parents do not receive the intervention."
Notes	Trial status completed (according to trial record, accessed 18 August 2016). Contacted author (21 October 2015) for expected publication date

NCT02228278

Trial name or title	Acronym: Text4Fit
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: open label Primary purpose: treatment
Participants	Condition: paediatric obesity Enrollment: 25 Inclusion criteria: aged 13-17 years; overweight or obese (BMI > 85th percentile); attend or will start attending UF Pediatric Lipid Clinic during the study period; own a mobile telephone that can receive text messages Exclusion criteria: current diagnosis of a psychiatric eating disorder; pregnancy; medical disease that would contraindicate moderate physical activity, as determined by clinician from the Lipid Clinic

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 184 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT02228278 (Continued)

Interventions	Intervention : typical clinic visits plus text messages: daily texts for 12 weeks, with fitness and nutrition messages to support their health goals Comparator : current standard care: clinic visits every 3 months with anthropometric assessments and counselling on physical activity and nutrition goals by a healthcare provider, typically with no patient-provider communication between visits
Outcomes	Primary outcomes: feasibility and acceptability of text message intervention Secondary outcomes: changes from baseline proportion of healthy food choices versus unhealthy choices; changes from baseline time spent doing physical activity; changes from baseline BMI z score Other outcome: -
Starting date	Study start date: April 2015 Study completion date: February 2016
Contact information	Responsible party/principal investigator: University of Florida/Lindsay Thompson, MD
Study identifier	NCT02228278
Official title	Text 4 Fit Project: healthcare text messaging as an adjunct to routine care for overweight and obese adolescents enrolled in a pediatric lipid clinic
Stated purpose of study	Quote: "to determine if health-related text messages sent from healthcare providers to overweight and obese adolescents enrolled at a paediatric lipid clinic will result in increased adherence to their nutrition and physical activity goals and improve their weight loss. The study will also assess if the volume of texts per week impacts outcomes."
Notes	Trial status completed (according to trial record, accessed 18 August 2016). Contacted author (2 September 2016) for expected publication date, author response: currently drafting a manuscript

NCT02280772

Trial name or title	Acronym: -
Methods	Type of study: efficacy study Allocation: randomised Intervention model: parallel Masking: double blind (participant, carer, investigator, outcomes assessor) Primary purpose: treatment
Participants	Condition: overweight and obesity Enrollment: 96 Inclusion criteria: aged 6-17 years; overweight (> +1 SD) or obesity (> +2 SD) based on the WHO growth charts/references Exclusion criteria: drug therapy for a chronic disease (including drugs that influence appetite or body weight); type 1 or 2 diabetes mellitus; history of surgical treatment of obesity; participation in another programme for treating obesity during the project or 3 months prior to recruitment, or both; secondary causes of obesity; pregnancy

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 185 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT02280772 (Continued)

Interventions	Intervention : glucomannan orally, 3 g/day (in 3 divided doses) for 12 weeks, 3 months' follow-up. Prior to the intervention, all children will receive dietetic advice and be encouraged to engage in physical activity Comparator : placebo. Maltodextrin orally, 3 g/day (in 3 divided doses) for 12 weeks, 3 months' follow-up. Prior to the intervention, all children will receive dietetic advice and they will be encouraged to engage in physical activity
Outcomes	Primary outcome: BMI-for-age z score difference Secondary outcomes: body composition; BMI-for-age z score difference; proportion of participants with dyslipidaemia; proportion of participants with impaired fasting plasma glucose; physical activity; adverse events; blood pressure (systolic and diastolic) Other outcome: -
Starting date	Study start date: April 2015 Study completion date: February 2017
Contact information	Responsible party/principal investigator: Bartlomiej M Zalewski
Study identifier	NCT02280772
Official title	Effect of glucomannan supplementation on body weight in overweight and obese children: protocol of a randomised controlled trial
Stated purpose of study	Quote: "We aim to systematically evaluate the efficacy of GNN consumption for the management of overweight and obesity in children."
Notes	Last updated: 7 April 2015

NCT02353637

Trial name or title	Acronym: Peds
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: open label Primary purpose: basic science
Participants	Condition: paediatric obesity Enrollment: estimated 45 Inclusion criteria: severely obese adolescents; 13-17-year-old males, 21-17-year-old postmenarcheal fe- males; primary obesity; BMI ≥ 99th percentile for age Exclusion criteria: current diagnosis of type 2 diabetes mellitus; gall bladder, renal or liver disorders; known eating disorders; known endocrine disorders (e.g. hyperthyroidism or polycystic ovary syndrome) ; pregnancy; genetic disorder (e.g. Prader-Willi Syndrome); mental retardation; severe depression; use of any chronic medicine which could impact appetite

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 186 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT02353637 (Continued)

Interventions	 Intervention: high protein, restricted carbohydrates utilising partial meal replacements diet, behavioural counselling (combination of immediate, short-term and long-term individual and family psychotherapy sessions to increase motivation to change diet and physical activity level), dietitian meetings weekly for the first 2 months, then every other week for additional 4 months, followed by monthly meeting for additional 6 months for each patient/family Comparator: ad lib, low glycaemic load diet, behavioural counselling (combination of immediate, short-term and long-term individual and family psychotherapy sessions to increase motivation to change diet and physical activity level), dietitian meetings weekly for the first 2 months, then every other week for additional 4 months, followed by monthly meeting for additional 4 months, followed by monthly meeting for additional 4 months, then every other week for additional 4 months, followed by monthly meeting for additional 6 months for each patient/family
Outcomes	Primary outcome: improvement in BMI z scores; weight loss; metabolic abnormalities Secondary outcome: - Other outcome: -
Starting date	Study start date: November 2014 Study completion date: June 2016
Contact information	Responsible party/principal investigator: University of Florida/Madeline Joseph, MD
Study identifier	NCT02353637
Official title	Partial meal replacements providing high protein, restricted carbohydrates in the treatment of adolescents with severe obesity: a randomized controlled trial
Stated purpose of study	Quote: "to investigate, in severely obese adolescents, the effects of a high protein, restricted carbohydrates utilizing partial meal replacements diet (HPRC-PMR) and compare it to an ad lib, low-glycemic load (LGL) diet on weight loss, body composition, and bio-chemical markers of lipid metabolism, insulin resistance, and inflammation over a 12 months period."
Notes	Last updated: 24 June 2015

NCT02444689

Trial name or title	Acronym: EMPower
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel assignment Masking: open label Primary purpose: treatment
Participants	 Condition: obesity, hypertension Enrollment: 90 Inclusion criteria: elevated blood pressure defined as ≥ 90th percentile or 120/80 mmHg, whichever is lower; overweight or obese; speaks English Exclusion criteria: no smart phone or smart phone data plan; unwilling to send/receive SMS messages or download and use the study applications; neurological impairment/developmental delay; taking anti-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 187 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT02444689 (Continued)

	hypertensive medication or medication known to affect blood pressure; prior diagnosis of congenital heart disease or cancer; pregnancy; taking medication with weight gain as adverse effect; taking medications for weight loss/participation in another weight loss programme
Interventions	Intervention : electronic media application: motivation, education and coaching regarding therapeutic lifestyle changes via a smart phone electronic media application Comparator : standard care
Outcomes	Primary outcome: BMI z score Secondary outcomes: daytime ambulatory systolic blood pressure; left ventricular mass index Other outcome: -
Starting date	Study start date: July 2015 Study completion date: July 2018
Contact information	Responsible party/principal investigator : Tammy M Brady, Assistant Professor Pediatric Nephrology, Johns Hopkins University
Study identifier	NCT02444689
Official title	EMPower: electronic media powering positive health changes in youth
Stated purpose of study	Quote: "The purpose of this study is to evaluate the effectiveness of a technology-based behavioral Healthy Lifestyle intervention on adiposity (body mass index z-score), blood pressure (mean daytime ambulatory systolic BP [blood pressure]), and heart size (LVM [left ventricular mass]) in comparison to standard care. "
Notes	

NCT02615353

Trial name or title	Acronym: Preventing Diabetes in Latino Youth
Methods	Type of study: efficacy study Allocation: randomised Intervention model: parallel assignment Masking: open label Primary purpose: prevention of type 2 diabetes mellitus
Participants	Condition : obesity Enrollment : estimated 120 Inclusion criteria : Latino (self-report); aged 12-16 years; obese (BMI percentile \geq 95th percentile for age and gender or BMI \geq 30 kg/m ²); prediabetic (fasting glucose \geq 100 mg/dL or 2-hour post-oral glucose tolerance test glucose \geq 120 mg/dL, or both) Exclusion criteria : taking medication(s) or diagnosed with a condition that influences carbohydrate metabolism, physical activity, cognition, or a combination; type 2 diabetes (fasting glucose \geq 126 mg/ dL or 2-hour glucose \geq 200 mg/dL; recent hospitalisation (previous 2 months); currently enrolled in (or within previous 6 months) a formal weight loss programme; diagnosed depression or other condition that

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 188 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT02615353 (Continued)

	may impact quality of life
Interventions	Intervention: culturally grounded intensive behaviour changing intervention guided by social cognitive theory over 6 months Comparator: usual care control
Outcomes	Primary outcome: Secondary outcomes: improvements in glucose tolerance; reductions in 2-hour glucose following an oral glucose tolerance test Other outcomes: quality of life; body composition; decrease in fat mass and increase in lean tissue mass by dual-energy X-ray absorptiometry
Starting date	Study start date: January 2016 Study completion date: December 2021
Contact information	Responsible party/principal investigator: Arizona State University
Contact information Study identifier	Responsible party/principal investigator: Arizona State University NCT02615353
Contact information Study identifier Official title	Responsible party/principal investigator: Arizona State University NCT02615353 Preventing diabetes in Latino youth
Contact information Study identifier Official title Stated purpose of study	Responsible party/principal investigator: Arizona State University NCT02615353 Preventing diabetes in Latino youth Quote: "To date, no diabetes prevention studies have been conducted in obese Latino youth with prediabetes, a highly vulnerable and underserved group. Therefore, investigators propose a randomized-controlled trial to test the short-term (6-month) and long-term (12-month) efficacy of a culturally-grounded, lifestyle intervention, as compared to usual care, for improving glucose tolerance and reducing diabetes risk in 120 obese Latino adolescents with prediabetes."

NCT02687516

Trial name or title	Acronym: FABO
Methods	Type of study: interventional Allocation: randomised Intervention model: cross-over assignment Masking: open label Primary purpose: treatment
Participants	Condition: -Enrollment: 120Inclusion criteria: families of children aged 8-16 years attending an outpatient's obesity clinic; BMI \geq 35 kg/m ² or BMI \geq 30 kg/m ² with obesity-related comorbidity; both the child and at least 1 of the parents agrees to actively participate in the treatmentExclusion criteria: severe somatic or psychiatric illness that makes adherence to the treatment programme impossible; somatic conditions, syndromes or medications that lead to pathological weight gain; participation in other obesity treatment programmes

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 189 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT02687516 (Continued)

Interventions	Intervention : 17 weekly manualised sessions with subsequent follow-up every 3 month for 2 years Comparator : treatment as usual, default treatment at the obesity clinic
Outcomes	Primary outcomes: BMI; waist circumference; body composition Secondary outcomes: blood samples; blood pressure; activity level/inactivity; sleep pattern; psychological measures; food records Other outcomes: parenting scale; barriers to treatment participation scale; treatment acceptability
Starting date	Study start date: February 2014 Study completion date: December 2018
Contact information	Responsible party/principal investigator: Petur B Juliusson, MD/PhD, University of Bergen
Study identifier	NCT02687516
Official title	Treatment of severely obese children and adolescents in common health care settings: an effectiveness study employing "Family-based Behavioral Social Facilitation Treatment."
Stated purpose of study	Quote: "The purpose of the FABO study is to evaluate the effect of family-based behavioral weight loss treatment (FBBT) compared with the effect of today's standard treatment given to children and adolescents suffering from obesity at the Obesity Outpatient Clinic (OOC), Haukeland University Hospital."
Notes	Last updated: 19 February 2016

NCT02711488

Trial name or title	Acronym: PAAPAS-DC
Methods	Type of study: efficacy study Allocation: randomised Intervention model: parallel assignment Masking: single blind (outcome assessor) Primary purpose: primary and secondary prevention (secondary prevention programme relevant here)
Participants	Condition: obesity Enrollment: 3000 Inclusion criteria: both prevention programmes: 5th and 6th grades students; consent form signed by parents/tutors; secondary prevention programme: overweight and obese children Exclusion criteria: pregnancy
Interventions	Intervention : encouraging students to change their eating habits and food consumption over 9 months (from March to November). Monthly 1-hour sessions in the classroom will be given by the class teacher, and includes playing games, staging theatre sketches, watching movies and puppet shows, and writing and drawing contests. Activities designed to discourage students from consuming sugar-sweetened beverages as well as getting them to replace snacks, particularly processed foods (especially cookies) with fresh fruit or healthy homemade food. To reinforce the messages of the in-class nutritional sessions, a set of messages will be sent to the families in the form of illustrated booklets and recipes. The secondary prevention strategy at

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 190 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT02711488 (Continued)

	households will be developed for those with excessive weight. The family will receive additional motivation to change these behaviours, using the community health agents as the encourager Comparator : no intervention
Outcomes	Primary outcome: BMI Secondary outcome: body composition Other outcomes: adherence to the protocol at household level; physical activity; food intake
Starting date	Study start date: March 2016 Study completion date: December 2016
Contact information	Responsible party/principal investigator : Rosely Sichieri, MD, PhD. Full Professor of Epidemiology, Rio de Janeiro State University
Study identifier	NCT02711488
Official title	Managing adolescent obesity at local level by combining primary and secondary intervention
Stated purpose of study	Quote: "to develop, implement and evaluate a prevention program for obesity among adolescents in Brazil combining the primary care health system implemented in the country in recent decades with primary prevention at schools."
Notes	Only the secondary prevention programme relevant for this review. Study is not yet open for participant recruitment (last updated: 11 March 2016)

NCT02745795

Trial name or title	Acronym: IMAGINE
Methods	Type of study: efficacy study Allocation: randomised Intervention model: parallel assignment Masking: double blind (subject, outcome assessor) Primary purpose: treatment
Participants	Condition: obesityEnrollment: 83Inclusion criteria: aged 14-19 years; BMI \geq 85th percentile according to WHO charts (de Onis 2010).Exclusion criteria: recent weight loss \geq 10% of body weight; pregnancy; breastfeeding; endocrine disease; present therapy with antidepressant or hypoglycaemic drugs; present treatment for food behaviour disease or depression; cognitive impairment of the student or his/her legal tutor
Interventions	Intervention : motivational interview, group submitted to 3 face-to-face interviews using motivational interview techniques to elicit motivation for adhesion to a diet and physical activity plan intended to lose weight. The interviews will be done at schools with 3-month intervals Comparator : conventional interview, group submitted to 3 face-to-face interviews without using motivational interview techniques to elicit motivation for adhesion to a diet and physical activity plan intended to lose weight. The interviews will be done at schools with 3-month intervals

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 191 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT02745795 (Continued)

Outcomes	 Primary outcomes: motivation scores to adhere to a diet and physical activity plan; motivation scores assessed by 2 self-report confidential paper questionnaires (self-regulation and perceived competence questionnaire to begin or maintain a healthy diet and self-regulation and perceived competence questionnaire to begin or maintain regular physical exercise) Secondary outcomes: self-concept score; quality of life score; depressive symptoms score; anxiety symptoms; abdominal circumference; blood pressure; weight; height Other outcome:
Starting date	Study start date: October 2015 Study completion date: May 2016
Contact information	Responsible party/principal investigator : Maria do Céu Machad, Director of the Department of Pediatry of Centro Hospitalar Lisboa Norte, Chair of Pediatry at Medicine School of the University of Lisbon, Centro Hospitalar Lisboa Norte
Study identifier	NCT02745795
Official title	Efficacy of motivational interview in the treatment of obesity and overweight in adolescents (IMAGINE)
Stated purpose of study	Quote: "The objective of the study is to investigate the efficacy of motivational interview intervention with adolescent students at a school environment on the adhesion to a therapeutic plan to lose weight."
Notes	Contacted author (12 January 2017) for data/anticipated study completion data

NCT02794090

Trial name or title	Acronym: -
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel assignment Masking: open label Primary purpose: treatment
Participants	Condition: obesity Enrollment: 37 Inclusion criteria: aged 5-14 years; patients at outpatient paediatric centre; parents attended at least 4 of 7 meetings in a parental/education group Exclusion criteria: obesity-related syndromes; non-Swedish speaking families
Interventions	Intervention : telephone consultation each month except for summer holidays for 18 months. The treating nurse communicated with 1 of the parents Comparator : usual care according to regular treatment routines at the clinic for 18 months. The child and parent(s) at regular visits to the nurse at the clinic
Outcomes	Primary outcome: BMI-SDS Secondary outcomes: working time required for the healthcare personnel; families experience of the

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 192 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT02794090 (Continued)

	treatment Other outcome: -
Starting date	Study start date: May 2007 Study completion date: January 2013
Contact information	Responsible party/principal investigator: Pernilla Danielsson, PhD paediatric nurse, Karolinska Insti- tutet
Study identifier	NCT02794090
Official title	Exclusive telephone coaching in maintaining weight loss - an randomized controlled trial of childhood obesity treatment
Stated purpose of study	Quote: "This study evaluates if usual physical care visits to an outpatient pediatric clinic can be replaced with more frequent and shorter Telephone coaching Contacts during 18 months."
Notes	Last updated: 8 June 2016. Contacted author (13 January 2017) for further data

NTR5676

Trial name or title	Acronym: -
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel Masking: none Primary purpose: -
Participants	Condition: overweight, obesity Enrollment: 1000 Inclusion criteria: aged 11-13 years (1st grade high school students) in Dutch high schools Exclusion criteria: unable to engage in physical activity
Interventions	Intervention : 30% increase in absolute strength exercises in physical education classes, once per month a motivational lesson given by a mentor and for the first 5 months an additional online motivational lesson (once per month) Comparator : -
Outcomes	Primary outcome: body composition Secondary outcomes: daily physical activity, social cognitive determinants; BMI z score, strength Other outcome: -
Starting date	Study start date: January 2015 Study completion date: January 2017
Contact information	Responsible party/principal investigator: Gill Ten Hoor, Maastricht University Medical Centre (MUMC+)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 193 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NTR5676 (Continued)

Study identifier	NTR5676
Official title	The focus on strength programme: an innovative strength-based physical activity intervention to improve body composition and to stimulate physical activity in adolescents (12-18 years) with overweight or obesity
Stated purpose of study	Quote: "a one year combined strength- and motivational program for high schools improve body compo- sition and motivation in overweight and obese youngsters."
Notes	Status open patient inclusion (data registered & February 2016)

Ramalho 2016

Trial name or title	Acronym: -
Methods	Type of study: effectiveness and cost-effectiveness trial Allocation: randomised Intervention model: parallel assignment Masking: - Primary purpose: treatment
Participants	Condition: obesity Enrollment: 120 Inclusion criteria: aged 13-18 years; $BMI \ge 25 \text{ kg/m}^2$ Exclusion criteria: -
Interventions	Intervention: Internet-based programme intervention + treatment as usual. Programme based on cognitive behavioural therapy. 9-month, 2-phase programme for weight loss and maintenance. Phase 1: weight loss through weight control, healthy eating and life-style strategies. Phase 2: weight maintenance through weight maintenance skills Comparator: treatment as usual
Outcomes	Outcomes: weight; eating related variables; physical activity; costs Primary outcome: unclear Secondary outcome: unclear Other outcomes: disorder eating behaviour; intuitive eating; physical activity; body image; impulsivity
Starting date	Study start date: Study completion date:
Contact information	Responsible party/principal investigator:
Study identifier	-
Official title	Taking the route back: new technologies for overweight and obesity treatment in childhood and adolescence - study protocol

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 194 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Ramalho 2016 (Continued)

Stated purpose of study	Quote: "a randomized controlled trial to examine the effectiveness and cost-effectiveness of an internet- based program intervention as supplementary tool for weight loss treatment in overweight and obese adolescents."
Notes	Contacted author (16 January 2017) for results/anticipated publication date

RBR-38p23s

Trial name or title	Acronym: -
Methods	Type of study: interventional Allocation: randomised Intervention model: parallel (3 arms) Masking: open label Primary purpose: treatment
Participants	Condition: obesity Enrollment: target 39 Inclusion criteria: aged 10-19 years; willingness to participate in all programme activities BMI for age and gender > 95th percentile (CDC 2000) Exclusion criteria: psychological disorders; use of medications that could interfere in the variables; physical difficulties that impeded the development of all activities
Interventions	 Interventions: Complex intervention: 20 meetings with the adolescents (16 psychological intervention twice per week, 4 monthly nutritional orientations). 36 sessions of physical exercises 3 times per week. 9 meetings with parents that include nutritional meetings and physical education Simple intervention: 4 monthly meetings with adolescents for nutritional orientation and 36 sessions of physical exercises. 9 meetings with the parents with a psychologist, nutritionist and a physical educator Comparator: meetings with a nutritionist and a physical educator for the adolescents and parents and physical exercises sessions for adolescents
Outcomes	Primary outcomes : BMI, social competence, behavioural change, academic performance Secondary outcomes : intrinsic motivation and health-related outcomes. Other outcome :
Starting date	Study start date: March 2010 Study completion date: March 2011
Contact information	Responsible party/principal investigator: University Federal de São Paulo, Brazil/Graziela Sapienza
Study identifier	RBR-38p23s
Official title	Multifocal intervention in obese adolescents: social competence, behavior problems, academic performance and weight reduction
Stated purpose of study	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 195 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

RBR-38p23s (Continued)

Notes	
Spieker 2015	
Trial name or title	Acronym: POMC
Methods	Type of study: efficacy Allocation: randomised Intervention model: parallel assignment Masking: single blind (assessors at baseline) Primary purpose: prevention
Participants	Condition : obesity and overweight Enrollment : 48 Inclusion criteria : female military dependents; aged 12-17 years; at high risk for excess weight gain (BMI \geq 85th percentile) who report lifetime loss of control eating or \geq 2 current indicators of loss of control eating (e.g. eating in response to negative affect, feelings of guilt or shame around eating) Exclusion criteria : presence of a chronic major medical illness (e.g. renal, hepatic, gastrointestinal, en- docrinological); documented, obesity-related medical complication requiring a more intensive intervention approach; psychiatric conditions (e.g. psychosis, suicidality) that would impede programme participation; current weight loss treatment; current weight-affecting medication usage; pregnancy (current or recent); current breastfeeding
Interventions	 Intervention:interpersonal psychotherapy-based intervention: 1 initial 1.5-hour individual session, and 12 weekly 90-minute group sessions that take place after school hours. The interpersonal inventory interview to identify the strengths, problems and goals of the adolescent. Information used to link problems to loss of control eating and other disturbed eating attitudes or behaviours. Sessions delivered over different phases. A psychoeducation phase (sessions 1-3), such as education about the predictors of excess weight gain, outlining problem areas and discussing the link between feelings and interpersonal interactions. Intermediate phase (sessions 4-9) where group members practice skills such as hypothetical scenarios and role-plays. Training on how interpersonal strategies can be applied to different, specific relationships in the adolescents' lives, particularly relationships that are linked to loss of control and emotionally induced eating. A termination phase (sessions 10-12) the group reviews improvements in loss of control eating and related symptoms, with a focus on identifying possible warning signs of a return or increase in problematic eating and knowing when to seek help. Finally, group members are encouraged to continue the interpersonal work on their own Comparator:health education control: receives a workbook on how to live a healthier life, discussing topics unrelated to eating. Participants complete 4 monthly 90-minute group meetings during after school hours to discuss the information presented in the workbook. The workbook will serve as a guide for teens to improve their self-image, build friendships, resist peer pressure and engage in goal-setting
Outcomes	 Primary outcomes: % participants who do not gain weight during follow-up; total weight change as markers of outcomes Secondary outcome: not clearly stated Other outcomes: eating disorder examination; Schedule for Affective Disorders and Schizophrenia for School-Age Children; Social Adjustment Scale - Self-Report; Family Adaptation and Cohesion, Evaluation Scales Inventory; Beck Depression Inventory State-Trait Anxiety Inventory for Children - a trait scale; Life

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 196 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Events and Coping Inventory; Eating Disorder Diagnostic Scale; Treatment Acceptability Questionnaire;

Spieker 2015 (Continued)

	Inventory of Parent and Peer Attachment; Family Resilience Assessment Scale; Perceived Stress Scale; The Emotional Eating Scale adapted for Children Physical assessments: height and weight; blood pressure; waist circumference; blood pressure; high-density lipoprotein cholesterol; triglycerides; glucose; insulin; glycated haemoglobin Parent questionnaires: Parent Stress Index - Short Form; Child Behavior Checklist
Starting date	Study start date: - Study completion date: -
Contact information	Responsible party/principal investigator : research support provided by a grant from the Uniformed Services University (USUHS72NC-01) to Tracy Sbrocco and intramural support from NICHD (Z1aHD00641) to Jack A Yanovski, a Commissioned Officer in the United States Public Health Service
Study identifier	-
Official title	Preventing Obesity in the Military Community (POMC): the development of a clinical trials research network
Stated purpose of study	Quote: "IPT will decrease loss of control eating and reduce these adverse outcomes. A secondary hypothesis of this study is that girls in the IPT group who maintain their weight or experience weight loss will demonstrate an improvement in components of the metabolic syndrome at follow-up visits."
Notes	Quote: "We use percentage of participants who do not gain weight during follow-up and total weight change as markers of our study outcomes We hypothesize that POMC [Preventing Obesity in Military Communities] intervention programs will reduce weight gain beyond the control comparison programs in the period following study participation."

TCTR20130515001

Trial name or title	Acronym: -
Methods	Type of study: - Allocation: randomised Intervention model: parallel Masking: single blind (participants) Primary purpose: prevention
Participants	Condition: overweight Enrollment: target 320 Inclusion criteria: aged 13-18 years; secondary school students; BMI for age and gender 85th percentile (WHO 2007) Exclusion criteria: musculoskeletal disorder; cardiovascular disease
Interventions	Intervention: behavioural weight reduction programme (no details) Comparator: no intervention

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 197 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

TCTR20130515001 (Continued)

Outcomes	Primary outcome: BMI Secondary outcomes: intrinsic motivation; health-related outcomes Other outcome: -
Starting date	Study start date: July 2013 Study completion date: December 2013
Contact information	Responsible party/principal investigator : Preventive Medicine and Social Department Faculty of medicine Chulalongkorn Thailand/Kanlayanee No-in
Study identifier	TCTR20130515001
Official title	Effectiveness of weight reduction program on intrinsic motivation and health related outcomes in over- weight secondary school students
Stated purpose of study	
Notes	Trial status completed (according to trial record, accessed 18 August 2016). Contacted author (2 September 2016) for expected publication date, author response: manuscript amendments and still not published

BMI: body mass index; CDC: Centers for Disease Control and Prevention; DEBQ-C: Dutch Eating Behaviour Questionnaire for Children; FFQ: Food Frequency Questionnaire; PAQ-C: Physical Activity Questionnaire for Older Children; SD: standard deviation; SDS: standard deviation score; WHO: World Health Organization.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 198 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

DATA AND ANALYSES

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 BMI change	28	2774	Mean Difference (IV, Random, 95% CI)	-1.18 [-1.67, -0.69]
2 BMI z score change	20	2399	Mean Difference (IV, Random, 95% CI)	-0.13 [-0.21, -0.05]
3 BMI percentile change	4		Mean Difference (IV, Random, 95% CI)	Subtotals only
4 Weight change	20	1993	Mean Difference (IV, Random, 95% CI)	-3.67 [-5.21, -2.13]

Comparison 1. Interventions (all) versus controls, longest follow-up

Comparison 2. Interventions versus controls, by duration of intervention, less than 6 months, greater than 6 months, longest follow-up

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Body mass index (BMI) change	28	2774	Mean Difference (IV, Random, 95% CI)	-1.18 [-1.67, -0.69]
1.1 BMI interventions ≤ 6 months	19	1863	Mean Difference (IV, Random, 95% CI)	-1.17 [-1.79, -0.55]
1.2 BMI interventions > 6 months	9	911	Mean Difference (IV, Random, 95% CI)	-1.23 [-2.04, -0.41]
2 BMI z score change	20	2399	Mean Difference (IV, Random, 95% CI)	-0.13 [-0.21, -0.05]
2.1 BMI-z interventions ≤ 6 months	12	1539	Mean Difference (IV, Random, 95% CI)	-0.02 [-0.06, 0.02]
2.2 BMI-z interventions > 6 months	8	860	Mean Difference (IV, Random, 95% CI)	-0.26 [-0.46, -0.07]

Comparison 3. Interventions (all) versus controls, other anthropometrics, longest follow-up

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 % body fat	14	1886	Mean Difference (IV, Random, 95% CI)	-1.08 [-1.69, -0.46]
2 % trunk fat	2	123	Mean Difference (IV, Random, 95% CI)	-0.84 [-3.10, 1.43]
3 Waist circumference	17	1997	Mean Difference (IV, Random, 95% CI)	-2.26 [-3.80, -0.72]
4 Waist-to-height ratio	3	276	Mean Difference (IV, Random, 95% CI)	-0.00 [-0.02, 0.02]
5 Waist-to-hip ratio	2	211	Mean Difference (IV, Random, 95% CI)	0.01 [-0.01, 0.03]
6 Fat mass	5	673	Mean Difference (IV, Random, 95% CI)	-3.13 [-4.70, -1.56]
7 Trunk fat mass	2	184	Mean Difference (IV, Random, 95% CI)	-0.94 [-2.49, 0.61]
8 Lean mass	3	417	Mean Difference (IV, Random, 95% CI)	-0.21 [-0.88, 0.47]
9 % overweight	2	73	Mean Difference (IV, Random, 95% CI)	-5.55 [-13.67, 2.57]

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 199 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Health-related quality of life	7	972	Std. Mean Difference (IV, Random, 95% CI)	0.44 [0.09, 0.79]
2 Health-related quality of life by tool	7	972	Std. Mean Difference (IV, Random, 95% CI)	0.44 [0.09, 0.79]
2.1 Pediatric Quality of Life Inventory	4	703	Std. Mean Difference (IV, Random, 95% CI)	0.23 [0.07, 0.39]
2.2 Other self-reported tools	3	269	Std. Mean Difference (IV, Random, 95% CI)	0.98 [-0.35, 2.31]
3 Self-esteem	6	613	Std. Mean Difference (IV, Random, 95% CI)	0.09 [-0.08, 0.27]
4 Self-esteem by outcome	6	613	Std. Mean Difference (IV, Random, 95% CI)	0.09 [-0.08, 0.27]
4.1 Self-esteem	3	325	Std. Mean Difference (IV, Random, 95% CI)	-0.03 [-0.39, 0.34]
4.2 Global self-worth	3	288	Std. Mean Difference (IV, Random, 95% CI)	0.17 [-0.07, 0.40]
5 Self-esteem by tool	6	613	Std. Mean Difference (IV, Random, 95% CI)	0.09 [-0.08, 0.27]
5.1 Rosenberg Self-Esteem Scale	3	325	Std. Mean Difference (IV, Random, 95% CI)	-0.03 [-0.39, 0.34]
5.2 Self-Perception Profile for Adolescents	3	288	Std. Mean Difference (IV, Random, 95% CI)	0.17 [-0.07, 0.40]

Comparison 4. Interventions (all) versus controls, quality of life, longest follow-up

Comparison 5. Interventions (all) versus controls, behavioural change, longest follow-up

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Physical activity (mild - vigorous physical activity)	3	129	Mean Difference (IV, Random, 95% CI)	0.39 [-15.07, 15.85]
2 Physical activity length	2	129	Mean Difference (IV, Random, 95% CI)	-0.11 [-0.98, 0.75]
3 Screen time	2	241	Mean Difference (IV, Random, 95% CI)	-0.60 [-0.65, -0.55]

Comparison 6. Interventions versus control by duration of follow-up

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Body mass index (BMI) change	28	2774	Mean Difference (IV, Random, 95% CI)	-1.18 [-1.67, -0.69]
1.1 BMI 6-9 months	13	1116	Mean Difference (IV, Random, 95% CI)	-1.25 [-1.91, -0.59]
1.2 BMI 12 months	9	898	Mean Difference (IV, Random, 95% CI)	-0.79 [-1.70, 0.12]
1.3 BMI 18-24 months	6	760	Mean Difference (IV, Random, 95% CI)	-1.49 [-2.56, -0.41]
2 BMI z score change	20	2399	Mean Difference (IV, Random, 95% CI)	-0.13 [-0.21, -0.05]
2.1 BMI z score 6-9 months	8	461	Mean Difference (IV, Random, 95% CI)	-0.07 [-0.20, 0.05]
2.2 BMI z score 12 months	7	1336	Mean Difference (IV, Random, 95% CI)	-0.06 [-0.11, 0.00]
2.3 BMI z score 18-24 months	5	602	Mean Difference (IV, Random, 95% CI)	-0.34 [-0.66, -0.02]

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 200 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Comparison 7. Interventions versus controls by duration of postintervention fol	llow-up
---	---------

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Body mass index (BMI) change	24	2594	Mean Difference (IV, Random, 95% CI)	-1.12 [-1.69, -0.54]
1.1 No postintervention	12	1004	Mean Difference (IV, Random, 95% CI)	-0.87 [-1.49, -0.26]
follow-up				
1.2 < 6 months	7	683	Mean Difference (IV, Random, 95% CI)	-1.53 [-2.76, -0.30]
1.3 6 to < 12 months	3	524	Mean Difference (IV, Random, 95% CI)	-0.99 [-2.17, 0.19]
$1.4 \ge 12$ months	2	383	Mean Difference (IV, Random, 95% CI)	-1.49 [-3.95, 0.96]
2 BMI z score change	17	2253	Mean Difference (IV, Random, 95% CI)	-0.13 [-0.22, -0.04]
2.1 No postintervention	9	687	Mean Difference (IV, Random, 95% CI)	-0.19 [-0.39, 0.01]
follow-up				
2.2 < 6 months	2	163	Mean Difference (IV, Random, 95% CI)	0.01 [-0.07, 0.08]
2.3 6 to < 12 months	4	1162	Mean Difference (IV, Random, 95% CI)	-0.06 [-0.14, 0.02]
$2.4 \ge 12$ months	2	241	Mean Difference (IV, Random, 95% CI)	-0.15 [-0.21, -0.09]

Comparison 8. Interventions by control type, longest follow-up

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Body mass index (BMI) change	28	2774	Mean Difference (IV, Random, 95% CI)	-1.18 [-1.67, -0.69]
1.1 Interventions vs no intervention/wait list control	6	992	Mean Difference (IV, Random, 95% CI)	-1.79 [-2.73, -0.85]
1.2 Interventions vs usual care controls	13	763	Mean Difference (IV, Random, 95% CI)	-1.41 [0.00, -0.83]
1.3 Interventions vs concomitant therapy controls	9	1019	Mean Difference (IV, Random, 95% CI)	-0.39 [-0.93, 0.14]
2 BMI z score change	20	2399	Mean Difference (IV, Random, 95% CI)	-0.14 [-0.22, -0.05]
2.1 Interventions vs no intervention/wait list control	4	527	Mean Difference (IV, Random, 95% CI)	-0.23 [-0.42, -0.05]
2.2 Interventions vs usual care controls	13	1583	Mean Difference (IV, Random, 95% CI)	-0.14 [-0.24, -0.04]
2.3 Interventions vs concomitant therapy controls	3	289	Mean Difference (IV, Random, 95% CI)	0.05 [-0.05, 0.16]

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 201 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Comparison 9. Interventions by mode, longest follow-up

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Body mass index (BMI) change	26	2726	Mean Difference (IV, Random, 95% CI)	-1.15 [-1.65, -0.66]
1.1 Group interventions	14	1641	Mean Difference (IV, Random, 95% CI)	-1.33 [-2.10, -0.55]
1.2 Individual interventions	9	984	Mean Difference (IV, Random, 95% CI)	-0.90 [-1.52, -0.27]
1.3 Mixed interventions	3	101	Mean Difference (IV, Random, 95% CI)	-1.29 [-1.89, -0.69]
2 BMI z score change	19	2377	Mean Difference (IV, Random, 95% CI)	-0.13 [-0.22, -0.05]
2.1 Group interventions	9	1229	Mean Difference (IV, Random, 95% CI)	-0.05 [-0.13, 0.02]
2.2 Individual interventions	8	1015	Mean Difference (IV, Random, 95% CI)	-0.26 [-0.45, -0.06]
2.3 Mixed interventions	2	133	Mean Difference (IV, Random, 95% CI)	-0.06 [-0.25, 0.14]

Comparison 10. Interventions by setting, longest follow-up

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Body mass index (BMI) change	27	2750	Mean Difference (IV, Random, 95% CI)	-1.17 [-1.66, -0.68]
1.1 School based	7	613	Mean Difference (IV, Random, 95% CI)	-0.91 [-1.97, 0.15]
1.2 Community based	7	1030	Mean Difference (IV, Random, 95% CI)	-1.20 [-2.11, -0.29]
1.3 Healthcare based	13	1107	Mean Difference (IV, Random, 95% CI)	-1.32 [-1.81, -0.82]
2 BMI z score change	20	2399	Mean Difference (IV, Random, 95% CI)	-0.13 [-0.21, -0.05]
2.1 School based	2	150	Mean Difference (IV, Random, 95% CI)	-0.70 [-2.06, 0.66]
2.2 Community based	3	289	Mean Difference (IV, Random, 95% CI)	-0.03 [-0.20, 0.15]
2.3 Healthcare based	15	1960	Mean Difference (IV, Random, 95% CI)	-0.10 [-0.17, -0.03]

Comparison 11. Interventions versus controls by intervention type, longest follow-up

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Body mass index (BMI) change	28	2774	Mean Difference (IV, Random, 95% CI)	-1.18 [-1.67, -0.69]
1.1 Multidisciplinary interventions	22	2298	Mean Difference (IV, Random, 95% CI)	-1.18 [-1.75, -0.62]
1.2 Physical activity only	4	199	Mean Difference (IV, Random, 95% CI)	-1.80 [-3.21, -0.40]
1.3 Diet only	3	277	Mean Difference (IV, Random, 95% CI)	-0.62 [-1.29, 0.06]
2 BMI z score change	20	2399	Mean Difference (IV, Random, 95% CI)	-0.13 [-0.21, -0.05]
2.1 Multidisciplinary interventions	17	2209	Mean Difference (IV, Random, 95% CI)	-0.11 [-0.19, -0.03]
2.2 Physical activity only	0	0	Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2.3 Diet only	3	190	Mean Difference (IV, Random, 95% CI)	-0.25 [-0.55, 0.04]

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 202 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Comparison 12.	Interventions versus control	ols by psychologica	l approach, longest follow-up

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size	
1 Body mass index (BMI) change	27	2652	Mean Difference (IV, Random, 95% CI)	-0.94 [-1.33, -0.55]	
1.1 Cognitive behavioural	6	553	Mean Difference (IV, Random, 95% CI)	-0.35 [-0.69, -0.00]	
1.2 Motivational interviewing	4	570	Mean Difference (IV, Random, 95% CI)	-1.04 [-2.21, 0.13]	
1.3 Other psychological	9	680	Mean Difference (IV, Random, 95% CI)	-1.34 [-2.25, -0.42]	
theory					
1.4 No theoretical basis/no psychological component	8	849	Mean Difference (IV, Random, 95% CI)	-0.83 [-1.21, -0.45]	
2 BMI z score change	18	1856	Mean Difference (IV, Random, 95% CI)	-0.14 [-0.24, -0.05]	
2.1 Cognitive behavioural	5	528	Mean Difference (IV, Random, 95% CI)	-0.01 [-0.09, 0.07]	
2.2 Motivational interviewing	2	409	Mean Difference (IV, Random, 95% CI)	-0.13 [-0.26, -0.01]	
2.3 Other psychological	8	729	Mean Difference (IV, Random, 95% CI)	-0.19 [-0.36, -0.02]	
theory					
2.4 No theoretic basis/no psychological component	3	190	Mean Difference (IV, Random, 95% CI)	-0.25 [-0.55, 0.04]	

Comparison 13.	Interventions versus	controls by parental	involvement,	longest follow-up
			,	

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Body mass index (BMI) change	28	2774	Mean Difference (IV, Random, 95% CI)	-1.18 [-1.67, -0.69]
1.1 Parent involvement	18	1820	Mean Difference (IV, Random, 95% CI)	-1.13 [-1.90, -0.35]
1.2 No parental involvement	13	954	Mean Difference (IV, Random, 95% CI)	-1.22 [-1.76, -0.67]
2 BMI z score change	20	2399	Mean Difference (IV, Random, 95% CI)	-0.13 [-0.21, -0.05]
2.1 Parental involvement	14	1370	Mean Difference (IV, Random, 95% CI)	-0.15 [-0.26, -0.03]
2.2 No parental involvement	7	1029	Mean Difference (IV, Random, 95% CI)	-0.11 [-0.25, 0.03]

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 203 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis I.I. Comparison | Interventions (all) versus controls, longest follow-up, Outcome | BMI change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: I Interventions (all) versus controls, longest follow-up

Outcome: I BMI change

Study or subgroup	Intervention N	Mean(SD)[kg/m2]	Control N	Mean(SD)[kg/m2]	Mean Difference IV,Random,95% Cl	Weight	Mean Difference IV,Random,95% Cl
Pitetti 2007	5	-3 (7.18)	5	-0.9 (7.99)	• • •	0.3 %	-2.10 [-11.52, 7.32]
NCT00807560	13	-0.8 (5.3)	11	2.1 (8)		0.7 %	-2.90 [-8.44, 2.64]
Jelalian 2016	17	- (7.)	7	1.7 (5.2)		0.8 %	-2.70 [-7.82, 2.42]
Brownell 1983 (1)	12	-4.66 (6.6)	6	-0.1 (3.5)		0.9 %	-4.56 [-9.23, 0.11]
Wengle 2011	16	0.1 (5.86)	16	-0.5 (5.07)		1.2 %	0.60 [-3.20, 4.40]
Carrel 2005	27	I (8.72)	23	0 (4.58)		1.3 %	1.00 [-2.78, 4.78]
Brownell 1983 (2)	12	-0. (3.)	6	-0.1 (3.5)		1.5 %	0.0 [-3.30, 3.30]
Gourlan 2013	26	-1.61 (4.64)	28	0.12 (5.94)	·	1.9 %	-1.73 [-4.56, 1.10]
Schranz 2014	30	0.1 (4.16)	26	1.2 (5.77)	·	2.0 %	-1.10 [-3.77, 1.57]
Pakpour 2015 (3)	113	-0.63 (8.25)	57	0.03 (8.33)		2.0 %	-0.66 [-3.30, 1.98]
Resnicow 2005	45	1.3 (5.9)	62	0.5 (7.9)	_ 	2.1 %	0.80 [-1.82, 3.42]
Brennan 2013	42	-0.69 (4.59)	21	0.76 (5.18)		2.1 %	-1.45 [-4.06, 1.16]
Saelens 2002	18	0.1 (4.09)	19	1.4 (3.5)		2.2 %	-1.30 [-3.76, 1.16]
Pakpour 2015 (4)	118	-2.05 (6.18)	58	0.03 (8.33)		2.3 %	-2.08 [-4.50, 0.34]
Norman 2016 (5)	29	0.9 (4.29)	25	0.2 (4.18)	_ 	2.4 %	0.70 [-1.56, 2.96]
Norman 2016 (6)	24	-0.6 (4.06)	28	0.6 (4.12)		2.5 %	-1.20 [-3.43, 1.03]
Hofsteenge 2014	71	0.9 (5.51)	51	I.3 (5.37)		2.8 %	-0.40 [-2.35, 1.55]
Kong 2014	34	-1.2 (4.1)	27	-0.2 (3.24)		3.0 %	-1.00 [-2.84, 0.84]
Ebbeling 2003	8	-1.2 (2)	8	0.6 (1.4)		3.2 %	-1.80 [-3.49, -0.11]
Nguyen 2012	73	0 (4.41)	78	I (4.09)		3.7 %	-1.00 [-2.36, 0.36]
Savoye 2007	105	-0.9 (4.1)	69	1.9 (4.2)		3.8 %	-2.80 [-4.06, -1.54]
Sigal 2014 (7)	75	-0.6 (2.4)	25	0 (2.4)	-+	4.1 %	-0.60 [-1.69, 0.49]
Sigal 2014 (8)	78	-0.5 (2.4)	25	0 (2.4)	-+	4.1 %	-0.50 [-1.58, 0.58]
Sigal 2014 (9)	75	-0.9 (2.2)	26	0 (2.4)		4.1 %	-0.90 [-1.95, 0.15]
Visuthranukul 2015	25	-0.2 (1.6)	27	0.4 (2)		4.2 %	-0.60 [-1.58, 0.38]
				-	0 -5 0 5	10	

Favours intervention Favours control

(Continued ...)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 204 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

								(Continued)
	Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
		Ν	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% C	1	IV,Random,95% CI
	Pbert 2013	42	0.01 (2.2)	40	0.23 (2.1)	-	4.3 %	-0.22 [-1.15, 0.71]
	NCT00132132 (10)	8	-0.37 (1)	13	1.28 (1.1)		4.3 %	-1.65 [-2.57, -0.73]
	Grey 2009	112	0.9 (3.2)	86	0.1 (3)		4.4 %	0.80 [-0.07, 1.67]
	Toulabi 2012	76	-2.92 (2.87)	76	-1.18 (2.44)		4.4 %	-1.74 [-2.59, -0.89]
	Ebbeling 2012	105	0.71 (2.9)	104	I (2.9)	-	4.5 %	-0.29 [-1.08, 0.50]
	Jiang 2005	33	-2.6 (1.6)	35	-0.1 (1.1)	+	4.7 %	-2.50 [-3.16, -1.84]
	Vissers 2008	22	-0.78 (1.42)	31	0.49 (0.74)	+	4.7 %	-1.27 [-1.92, -0.62]
	Patsopoulou 2017 (11)	55	-2.3 (1.13)	28	0.2 (1.14)	+	4.8 %	-2.50 [-3.02, -1.98]
	Patsopoulou 2017 (12)	55	-3.1 (0.94)	28	0.2 (1.14)	+	4.9 %	-3.30 [-3.79, -2.81]
T	otal (95% CI)	1599		1175	o/	•	100.0 % -	1.18 [-1.67, -0.69]
H Te	eterogeneity: $Iau^2 = I.2$ est for overall effect: Z =	4.74 (P < 0.00)	s/, at = 33 (P<0.0000 001)); i~ =/8	%			

Test for subgroup differences: Not applicable

10

-10 -5 0 5

Favours intervention Favours control

(1) Mother and child separate

(2) Mother and child together

(3) Motivational interviewing no parents

(4) Motivational interviewing with parents

(5) Girls

-

(6) Boys

(7) Diet + aerobic

(8) Diet + resistance

(9) Diet, exercise + resistance

(10) Outcomes adjusted for covariates

(II) Activity

(12) Activity+Diet

Analysis I.2. Comparison I Interventions (all) versus controls, longest follow-up, Outcome 2 BMI z score change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: I Interventions (all) versus controls, longest follow-up

Outcome: 2 BMI z score change

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
Poodsi 2014	21	Mean(SD)	N 22	Mean(SD)	IV,Random,95% CI	E 0 %	IV,Kandom,95% CI
Boodal 2014	12	0 (0.1)	32	0 (0.2)		5.0 %	0.0 [-0.08, 0.08]
Brennan 2013	42	-0.09 (0.42)	21	0.01 (0.4)		4.3 %	-0.10 [-0.31, 0.11]
Daley 2005	28	-0.01 (0.29)	53	-0.08 (0.44)		5.0 %	0.07 [-0.09, 0.23]
Debar 2012	90	-0.15 (0.41)	83	-0.08 (0.36)	-=-	5.4 %	-0.07 [-0.18, 0.04]
Ford 2010	44	-0.41 (0.66)	43	-0.14 (0.5)		4.0 %	-0.27 [-0.52, -0.02]
Hofsteenge 2014	71	-0.07 (0.61)	51	0.03 (0.56)		4.4 %	-0.10 [-0.31, 0.11]
Jiang 2005 (1)	33	-1.7 (0.66)	35	-0.3 (0.56)	•	3.5 %	-1.40 [-1.69, -1.11]
Luna-Pech 2014	26	-0.52 (0.26)	25	-0.05 (0.26)		5.1 %	-0.47 [-0.61, -0.33]
NCT00807560	13	-0.1 (0.4)	9	0 (0.21)		3.8 %	-0.10 [-0.36, 0.16]
Nguyen 2012	73	-0.09 (0.35)	78	-0.2 (0.46)		5.3 %	0.11 [-0.02, 0.24]
Norman 2016 (2)	24	-0.1 (0.37)	28	0 (0.4)		4.4 %	-0.10 [-0.31, 0.11]
Norman 2016 (3)	29	-0.1 (0.36)	25	-0.1 (0.46)		4.2 %	0.0 [-0.22, 0.22]
Pakpour 2015 (4)	118	-0.24 (0.62)	58	0.01 (0.69)		4.4 %	-0.25 [-0.46, -0.04]
Pakpour 2015 (5)	113	-0.02 (0.78)	57	0.01 (0.69)		4.1 %	-0.03 [-0.26, 0.20]
Patrick 2013	76	-0.13 (0.41)	25	0 (0.46)		4.5 %	-0.13 [-0.33, 0.07]
Pbert 2013	42	0 (0.2)	40	0.01 (0.2)	+	5.7 %	-0.01 [-0.10, 0.08]
Saelens 2002	18	-0.05 (0.4)	19	0.07 (0.3)		4.2 %	-0.12 [-0.35, 0.11]
Savoye 2007	105	-0.2 (0.2)	69	-0.05 (0.2)	+	5.9 %	-0.15 [-0.21, -0.09]
van Egmond-Frohlich 2006	250	-0.12 (0.44)	271	-0.13 (0.42)	+	5.8 %	0.01 [-0.06, 0.08]
Visuthranukul 2015	25	-0.3 (0.2)	27	-0.3 (0.5)		4.4 %	0.0 [-0.20, 0.20]
Vos 2011	32	-0.4 (0.96)	35	-0.1 (0.7)		2.5 %	-0.30 [-0.71, 0.11]
Wengle 2011	16	-0.03 (0.42)	16	-0.11 (0.45)		3.4 %	0.08 [-0.22, 0.38]
Total (95% CI)	1299		1100		•	100.0 %	-0.13 [-0.21, -0.05]
Heterogeneity: Tau ² = 0.03; Ch Test for overall effect: Z = 3.11 Test for subgroup differences: N	ni ² = 145.05, df (P = 0.0019) Not applicable	= 21 (P<0.0000	01); I ² =869	6			
				Favour	-I -0.5 0 0.5	I	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 206 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. (1) SDs imputed from other studies

(2) Boys

(3) Girls

(4) Motivational interviewing with parent

(5) Motivational interviewing no parent

Analysis 1.3. Comparison I Interventions (all) versus controls, longest follow-up, Outcome 3 BMI percentile change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: I Interventions (all) versus controls, longest follow-up

Outcome: 3 BMI percentile change

Study or subgroup	Intervention		Control		Dit	Mean fference	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Ran	dom,95% Cl		IV,Random,95% CI
Brennan 2013 (1)	42	-1.17 (4.5)	21	0.06 (2.95)		+		-1.23 [-3.09, 0.63]
Debar 2012 (2)	100	-1.9 (5.99)	83	-0.82 (2.94)		+		-1.08 [-2.41, 0.25]
NCT00807560	13	0.3 (2.3)	9	0.2 (0.98)				0.10 [-1.30, 1.50]
Patrick 2013 (3)	76	-0.66 (0.05)	25	-0.9 (0.05)		•		0.24 [0.22, 0.26]
Test for subgroup differ	rences: Not applica	ble						
					<u> i i </u>		i .	
					-4 -2	0 2	4	
				Fav	ours intervention	Favours c	ontrol	

(I) 6 months

(2) 12 months

(3) 12 months

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 207 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis I.4. Comparison I Interventions (all) versus controls, longest follow-up, Outcome 4 Weight change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: I Interventions (all) versus controls, longest follow-up

Outcome: 4 Weight change

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)[kg]	Ν	Mean(SD)[kg]	IV,Random,95% CI		IV,Random,95% CI
Brennan 2013	42	-1.39 (18.74)	21	2.78 (18.77)		1.8 %	-4.17 [-14.00, 5.66]
Brownell 1983 (1)	12	-7.7 (14.2)	6	3.2 (5.9)	•	2.0 %	-10.90 [-20.22, -1.58]
Brownell 1983 (2)	12	2.9 (7.3)	6	3.2 (5.9)		3.3 %	-0.30 [-6.57, 5.97]
Debar 2012	90	2.21 (16.36)	83	3.21 (16.31)		4.2 %	-1.00 [-5.87, 3.87]
Ebbeling 2012	105	4.3 (10.24)	104	5.1 (10.19)	-	5.8 %	-0.80 [-3.57, 1.97]
Hofsteenge 2014	71	7.8 (18.92)	51	7.1 (18.65)		3.0 %	0.70 [-6.05, 7.45]
Jiang 2005	33	-0.3 (4.3)	35	5.5 (3.5)	-	6.5 %	-5.80 [-7.67, -3.93]
Kong 2013	28	1.7 (3.9)	23	2.5 (4)	+	6.2 %	-0.80 [-2.98, 1.38]
Kong 2014	34	-3.3 (13.75)	27	0.1 (14.09)		2.9 %	-3.40 [-10.44, 3.64]
Luna-Pech 2014	26	-2.5 (1.3)	25	1.6 (1.3)	-	7.0 %	-4.10 [-4.81, -3.39]
NCT00807560	13	0.1 (14.7)	11	2.3 (28.9)	•	0.6 %	-2.20 [-21.06, 16.66]
Nguyen 2012	73	4.4 (16.15)	78	8.3 (14.27)		4.2 %	-3.90 [-8.77, 0.97]
Patsopoulou 2017 (3)	55	-4 (1.89)	28	3.7 (1.9)	-	7.0 %	-7.70 [-8.56, -6.84]
Patsopoulou 2017 (4)	55	-5.9 (1.89)	28	3.7 (1.9)	-	7.0 %	-9.60 [-10.46, -8.74]
Pitetti 2007	5	-5.1 (17.07)	5	-1.8 (31.62)	• • •	→ 0.2 %	-3.30 [-34.80, 28.20]
Saelens 2002	18	2 (15.06)	19	5.3 (14.08)		2.0 %	-3.30 [-12.71, 6.11]
Savoye 2007	105	5.9 (10.1)	69	12 (10.6)	-•-	5.5 %	-6.10 [-9.26, -2.94]
Schranz 2014	30	3.3 (16.26)	26	7.7 (24.78)		1.5 %	-4.40 [-15.56, 6.76]
Sigal 2014 (5)	75	-0.1 (7)	25	1.3 (7.2)		5.4 %	-1.40 [-4.64, 1.84]
Sigal 2014 (6)	75	-0.8 (6.7)	26	1.3 (7.2)		5.5 %	-2.10 [-5.26, 1.06]
Sigal 2014 (7)	78	0.3 (7.1)	25	1.3 (7.2)		5.4 %	-1.00 [-4.23, 2.23]
Toulabi 2012	76	-4.17 (11.77)	76	-0.92 (11.32)		5.1 %	-3.25 [-6.92, 0.42]
Vissers 2008	22	-2.23 (4)	31	1.39 (2.12)	-	6.5 %	-3.62 [-5.45, -1.79]
Wengle 2011	16	1.6 (18.56)	16	0.5 (15.12)		1.4 %	1.10 [-10.63, 12.83]
Total (95% CI) Heterogeneity: Tau ² = 8. Test for overall effect: Z Test for subgroup differen	1149 70; Chi ² = 190.1 = 4.66 (P < 0.000 nces: Not applica	3, df = 23 (P<0.00 001) ble	844 0001); I ² =8	8%	•	100.0 %	-3.67 [-5.21, -2.13]
				-2	20 -10 0 10	20	
				Favours	intervention Favours co	ntrol	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 208 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

- (1) Mother + child separate
- (2) Mother + child together
- (3) Activity
- (4) Activity+Diet
- (5) Diet and aerobics
- (6) Diet, aerobics and resistance
- (7) Diet and resistance training

Analysis 2.1. Comparison 2 Interventions versus controls, by duration of intervention, less than 6 months, greater than 6 months, longest follow-up, Outcome I Body mass index (BMI) change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years Comparison: 2 Interventions versus controls, by duration of intervention, less than 6 months, greater than 6 months, longest follow-up

Outcome: I Body mass index (BMI) change

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% Cl		IV,Random,95% CI
I BMI interventions \leq 6	months						
Brennan 2013	42	-0.69 (4.59)	21	0.76 (5.18)		2.1 %	-1.45 [-4.06, 1.16]
Brownell 1983 (1)	12	-4.66 (6.6)	6	-0.1 (3.5)		0.9 %	-4.56 [-9.23, 0.11]
Brownell 1983 (2)	12	-0.1 (3.1)	6	-0.1 (3.5)		1.5 %	0.0 [-3.30, 3.30]
Ebbeling 2003	8	-1.2 (2)	8	0.6 (1.4)		3.2 %	-1.80 [-3.49, -0.11]
Gourlan 2013	26	-1.61 (4.64)	28	0.12 (5.94)		1.9 %	-1.73 [-4.56, 1.10]
Grey 2009	112	0.9 (3.2)	86	0.1 (3)		4.4 %	0.80 [-0.07, 1.67]
Jelalian 2016	17	- (7.)	7	1.7 (5.2)		0.8 %	-2.70 [-7.82, 2.42]
Kong 2014	34	-1.2 (4.1)	27	-0.2 (3.24)		3.0 %	-1.00 [-2.84, 0.84]
NCT00807560	13	-0.8 (5.3)	11	2.1 (8)		0.7 %	-2.90 [-8.44, 2.64]
Pakpour 2015 (3)	113	-0.63 (8.25)	57	0.03 (8.33)		2.0 %	-0.66 [-3.30, 1.98]
Pakpour 2015 (4)	118	-2.05 (6.18)	58	0.03 (8.33)		2.3 %	-2.08 [-4.50, 0.34]
Patsopoulou 2017 (5)	55	-2.3 (1.13)	28	0.2 (1.14)	+	4.8 %	-2.50 [-3.02, -1.98]
				-	0 -5 0 5 1	0	

Favours intervention Favours control

(Continued ...)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 209 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	N	Mean(SD)[kg/m2]	N	Mean(SD)[kg/m2]	IV,Random,95% Cl		IV,Random,95% CI
Patsopoulou 2017 (6)	55	-3.1 (0.94)	28	0.2 (1.14)	-	4.9 %	-3.30 [-3.79, -2.81]
Pbert 2013	42	0.01 (2.2)	40	0.23 (2.1)	-	4.3 %	-0.22 [-1.15, 0.71]
Resnicow 2005	45	1.3 (5.9)	62	0.5 (7.9)		2.1 %	0.80 [-1.82, 3.42]
Saelens 2002	18	0.1 (4.09)	19	1.4 (3.5)		2.2 %	-1.30 [-3.76, 1.16]
Schranz 2014	30	0.1 (4.16)	26	1.2 (5.77)		2.0 %	-1.10 [-3.77, 1.57]
Sigal 2014 (7)	75	-0.9 (2.2)	26	0 (2.4)		4.1 %	-0.90 [-1.95, 0.15]
Sigal 2014 (8)	78	-0.5 (2.4)	25	0 (2.4)	-+	4.1 %	-0.50 [-1.58, 0.58]
Sigal 2014 (9)	75	-0.6 (2.4)	25	0 (2.4)		4.1 %	-0.60 [-1.69, 0.49]
Toulabi 2012	76	-2.92 (2.87)	76	-1.18 (2.44)		4.4 %	-1.74 [-2.59, -0.89]
Vissers 2008	22	-0.78 (1.42)	31	0.49 (0.74)	+	4.7 %	-1.27 [-1.92, -0.62]
Visuthranukul 2015	25	-0.2 (1.6)	27	0.4 (2)		4.2 %	-0.60 [-1.58, 0.38]
Wengle 2011	16	0.1 (5.86)	16	-0.5 (5.07)		1.2 %	0.60 [-3.20, 4.40]
Subtotal (95% CI)	1119		744		•	69.8 % -1	.17 [-1.79, -0.55]
Test for overall effect: Z = 2 BMI interventions > 6 r Carrel 2005	= 3.71 (P = 0.00 months 27	0021) I (8.72)	23	0 (4.58)		1.3 %	1.00 [-2.78, 4.78]
Ebbeling 2012 (10)	105	0.71 (2.9)	104	(2.9)		4.5 %	-0.29 [-1.08, 0.50]
Hofsteenge 2014	71	0.9 (5.51)	51	1.3 (5.37)		2.8 %	-0.40 [-2.35, 1.55]
liang 2005	33	-2.6 (1.6)	35	-0.1 (1.1)	+	4.7 %	-2.50 [-3.161.84]
NCT00132132 (11)	8	-0.37 (1)		28 ()		43%	-1.65 [-2.57 -0.73]
Nguyen 2012	- 73	0 (441)	78	L (409)	_+_	37%	-100[-236.036]
Norman 2016 (12)	24	-0.6 (4.06)	28	0.6 (4.12)		2.5 %	-1.20 [-3.43, 1.03]
Norman 2016 (13)	29	0.9 (4.29)	25	0.2 (4.18)		2.4 %	0.70 [-1.56, 2.96]
Pitetti 2007	5	-3 (7.18)	5	-0.9 (7.99) +		0.3 %	-2.10 [-11.52. 7.32]
Savoye 2007	105	-0.9 (4.1)	69	1.9 (4.2)	<u> </u>	3.8 %	-2.80 [-4.06, -1.54]
Subtotal (95% CI)	480		431		•	30.2 % -1	.23 [-2.040.41]
Heterogeneity: $Tau^2 = 0.9$	95; Chi ² = 29.3	0, df = 9 (P = 0.0005	8); I ² =69	%		0012 /0 1	
Test for overall effect: Z =	= 2.95 (P = 0.0	032)	1175		•	100 0 0/ 1	19[1(7 0(0]
Iotal (95% C1) Heterogeneity: Tau ² = 1. Test for overall effect: Z = Test for subgroup different	1399 21; Chi ² = 147. = 4.74 (P < 0.00 nces: Chi ² = 0.0	87, df = 33 (P<0.000 0001) 01, df = 1 (P = 0.91), l	2 =0.0%	8%		100.0 % -1	.18 [-1.0/, -0.09]
						1	
				-10 Favours in) -5 0 5 ntervention Favours co	10 ontrol	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 210 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. (1) Mother + child separate

- (2) Mother + child together
- (3) Motivational interviewing no parents
- (4) Motivational interviewing with parents
- (5) Activity
- (6) Activity+Diet
- (7) Diet, aerobic + resistance
- (8) Diet and resistance
- (9) Diet and aerobic
- (10) adjusted for covariates
- (11) Outcomes adjusted for covariates

(12) Boys

(13) Girls

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 211 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 2.2. Comparison 2 Interventions versus controls, by duration of intervention, less than 6 months, greater than 6 months, longest follow-up, Outcome 2 BMI z score change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 2 Interventions versus controls, by duration of intervention, less than 6 months, greater than 6 months, longest follow-up

Outcome: 2 BMI z score change

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference	
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,95% CI		IV,Random,95% CI	
I BMI-z interventions ≤ 6 months								
Boodai 2014	31	0 (0.1)	32	0 (0.2)	+	5.8 %	0.0 [-0.08, 0.08]	
Brennan 2013	42	-0.09 (0.42)	21	0.01 (0.4)		4.3 %	-0.10 [-0.31, 0.11]	
Daley 2005	28	-0.01 (0.29)	53	-0.08 (0.44)	_ 	5.0 %	0.07 [-0.09, 0.23]	
Debar 2012	90	-0.15 (0.41)	83	-0.08 (0.36)		5.4 %	-0.07 [-0.18, 0.04]	
NCT00807560	13	-0.1 (0.4)	9	0 (0.21)		3.8 %	-0.10 [-0.36, 0.16]	
Pakpour 2015 (1)	118	-0.24 (0.62)	58	0.01 (0.69)		4.4 %	-0.25 [-0.46, -0.04]	
Pakpour 2015 (2)	113	-0.02 (0.78)	57	0.01 (0.69)	<u> </u>	4.1 %	-0.03 [-0.26, 0.20]	
Pbert 2013	42	0 (0.2)	40	0.01 (0.2)	+	5.7 %	-0.01 [-0.10, 0.08]	
Saelens 2002	18	-0.05 (0.4)	19	0.07 (0.3)		4.2 %	-0.12 [-0.35, 0.11]	
van Egmond-Frohlich 2006	250	-0.12 (0.44)	271	-0.13 (0.42)	+	5.8 %	0.01 [-0.06, 0.08]	
Visuthranukul 2015	25	-0.3 (0.2)	27	-0.3 (0.5)		4.4 %	0.0 [-0.20, 0.20]	
Vos 2011	32	-0.4 (0.96)	35	-0.1 (0.7)		2.5 %	-0.30 [-0.71, 0.11]	
Wengle 2011	16	-0.03 (0.42)	16	-0.11 (0.45)		3.4 %	0.08 [-0.22, 0.38]	
Subtotal (95% CI)	818		721		•	58.8 %	-0.02 [-0.06, 0.02]	
Heterogeneity: $Tau^2 = 0.0$; Chi^2	= .44, df =	12 (P = 0.49); I ²	2 =0.0%					
lest for overall effect: $\angle = 1.10$	(P = 0.27)							
Ford 2010	44	-0.41 (0.66)	43	-0.14 (0.5)		4.0 %	-0.27 [-0.52, -0.02]	
Hofsteenge 2014	71	-0.07 (0.61)	51	0.03 (0.56)		4.4 %	-0.10 [-0.31, 0.11]	
Jiang 2005 (3)	33	-1.7 (0.66)	35	-0.3 (0.56)	•	3.5 %	-1.40 [-1.69, -1.11]	
Luna-Pech 2014	26	-0.52 (0.26)	25	-0.05 (0.26)		5.1 %	-0.47 [-0.61, -0.33]	
Nguyen 2012	73	-0.09 (0.35)	78	-0.2 (0.46)		5.3 %	0.11 [-0.02, 0.24]	
Norman 2016 (4)	29	-0.1 (0.36)	25	-0.1 (0.46)		4.2 %	0.0 [-0.22, 0.22]	
Norman 2016 (5)	24	-0.1 (0.37)	28	0 (0.4)	- _	4.4 %	-0.10 [-0.31, 0.11]	
Patrick 2013	76	-0.13 (0.41)	25	0 (0.46)		4.5 %	-0.13 [-0.33, 0.07]	
					-1 -0.5 0 0.5	I		

Favours intervention Favours control

(Continued ...)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 212 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

(.		Continued)
× .		

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference	
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,95% CI		IV,Random,95% CI	
Savoye 2007	105	-0.2 (0.2)	69	-0.05 (0.2)	*	5.9 %	-0.15 [-0.21, -0.09]	
Subtotal (95% CI)	481		379		•	41.2 %	-0.26 [-0.46, -0.07]	
Heterogeneity: $Tau^2 = 0.08$;	Chi ² = 107.38, df =	= 8 (P<0.00001);	l ² =93%					
Test for overall effect: $Z = 2$.	.65 (P = 0.0079)							
Total (95% CI)	1299		1100		•	100.0 %	-0.13 [-0.21, -0.05]	
Heterogeneity: Tau ² = 0.03; Chi ² = 145.05, df = 21 (P<0.00001); l ² =86%								
Test for overall effect: $Z = 3$.	II (P = 0.0019)							
Test for subgroup differences	s: Chi ² = 5.77, df =	I (P = 0.02), I ²	=83%					
				I				

-I -0.5 0 0.5 I

Favours intervention Favours control

(1) Motivational interviewing with parent

(2) Motivational interviewing no parent

(3) SDs imputed from other studies

(4) Girls

(5) Boys

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 213 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
Analysis 3.1. Comparison 3 Interventions (all) versus controls, other anthropometrics, longest follow-up, Outcome 1 % body fat.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 3 Interventions (all) versus controls, other anthropometrics, longest follow-up

Outcome: I % body fat

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,95% Cl		IV,Random,95% CI
Brennan 2013	42	-1.17 (7.27)	20	0.21 (5.57)	←	2.9 %	-1.38 [-4.67, 1.91]
Carrel 2005	27	-3.9 (5.74)	23	-1.9 (5.3)	←	3.3 %	-2.00 [-5.06, 1.06]
Ebbeling 2012	105	1.3 (4.1)	104	1.8 (4.08)		10.9 %	-0.50 [-1.61, 0.61]
Ford 2010	43	-4.6 (8.17)	46	-1.4 (6.8)	~	3.1 %	-3.20 [-6.33, -0.07]
Grey 2009	112	-1 (7.83)	86	-2.7 (13.01)		→ 3.2 %	1.70 [-1.41, 4.81]
Kong 2014	34	-1.3 (8.22)	27	-0.9 (7.89)	• •	2.0 %	-0.40 [-4.46, 3.66]
Norman 2016 (1)	29	-0.9 (6.34)	25	-2.4 (5.81)		→ 3.0 %	1.50 [-1.74, 4.74]
Norman 2016 (2)	24	-5.9 (8.29)	28	-4.2 (8.33)	· · · · · · · · · · · · · · · · · · ·	1.7 %	-1.70 [-6.23, 2.83]
Pakpour 2015 (3)	113	-1.74 (6.35)	57	0.03 (7.92)	•	4.8 %	-1.77 [-4.14, 0.60]
Pakpour 2015 (4)	118	-1.12 (7.68)	58	0.03 (7.92)		4.6 %	-1.15 [-3.61, 1.31]
Patrick 2013	76	-1.76 (7.4)	25	-0.5 (6.71)	· · · · ·	3.2 %	-1.26 [-4.37, 1.85]
Pbert 2013	42	-0.14 (5.06)	40	-1.17 (5.07)		5.4 %	1.03 [-1.16, 3.22]
Savoye 2007	105	-3.6 (6.8)	69	0.6 (7.42)	←	5.4 %	-4.20 [-6.38, -2.02]
Schranz 2014	30	-2.5 (5.75)	26	-5 (8.05)		→ 2.4 %	2.50 [-1.22, 6.22]
Sigal 2014 (5)	74	-1.4 (2.6)	26	-0.3 (2.6)		10.6 %	-1.10 [-2.26, 0.06]
Sigal 2014 (6)	75	-1.6 (2.6)	25	-0.3 (2.6)		10.5 %	-1.30 [-2.48, -0.12]
Sigal 2014 (7)	74	-1.1 (2.6)	25	-0.3 (2.6)		10.5 %	-0.80 [-1.98, 0.38]
Vissers 2008	22	-1.46 (1.84)	31	0.54 (1.21)	_ - -	12.6 %	-2.00 [-2.88, -1.12]
Total (95% CI)	1145		741		•	100.0 %	-1.08 [-1.69, -0.46]
Heterogeneity: Tau ² =	0.58; Chi ² = 28.	52, df = 17 (P =	0.04); l ² =40	%			
Test for overall effect: Z	Z = 3.43 (P = 0.0)	00061)					
Test for subgroup differ	rences: Not appli	cable					
				Eastern 1	-4 -2 0 2	4	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 214 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. (I) Girls

(2) Boys

(3) Motivational interviewing no parents

- (4) Motivational interviewing with parents
- (5) Diet, exercise + resistance
- (6) Diet + resistance
- (7) Diet + aerobic

Analysis 3.2. Comparison 3 Interventions (all) versus controls, other anthropometrics, longest follow-up, Outcome 2 % trunk fat.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 3 Interventions (all) versus controls, other anthropometrics, longest follow-up

Outcome: 2 % trunk fat

Study or subgroup	Intervention		Control		Diffe	Mean rence	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Rando	om,95% Cl		IV,Random,95% CI
Brennan 2013	42	-2.04 (7.08)	20	-0.44 (4.74)	-8	_	57.6 %	-1.60 [-4.58, 1.38]
Kong 2014	34	-1.3 (6.54)	27	-1.5 (7.15)		-	42.4 %	0.20 [-3.28, 3.68]
Total (95% CI)	76		47		-	•	100.0 %	-0.84 [-3.10, 1.43]
Heterogeneity: Tau ² =	$0.0; Chi^2 = 0.59,$	df = 1 (P = 0.44)	l ² =0.0%					
Test for overall effect:	Z = 0.72 (P = 0.4)	17)						
Test for subgroup diffe	erences: Not appli	cable						
					-10 -5 C) 5 I	0	
				Favo	urs intervention	Eavours cont	rol	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 215 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 3.3. Comparison 3 Interventions (all) versus controls, other anthropometrics, longest follow-up, Outcome 3 Waist circumference.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 3 Interventions (all) versus controls, other anthropometrics, longest follow-up

Outcome: 3 Waist circumference

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	N	Mean(SD)[cm]	N 22	Mean(SD)[cm]	IV,Random,95% CI	F 1 0/	IV,Random,95% CI
Boodai 2014	١٤	4.9 (5.8)	32	3.5 (5.7)		5.1 %	1.40 [-1.44, 4.24]
Brennan 2013	38	-1.35 (11.29)	21	-0.6 (10.34)		3.3 %	-0.75 [-6.45, 4.95]
Grey 2009	112	-3.3 (12.15)	86	-3.6 (11.36)		4.8 %	0.30 [-2.99, 3.59]
Hofsteenge 2014	71	4.5 (14.47)	51	6.6 (12.14)		3.9 %	-2.10 [-6.84, 2.64]
Kong 2013	28	0 (3.78)	23	1.7 (3.06)		5.6 %	-1.70 [-3.58, 0.18]
Kong 2014	34	-5.3 (10.71)	27	1.8 (10.01)	-	3.6 %	-7.10 [-12.32, -1.88]
NCT00807560	8	-0.78 (9)	9	2 (10.8)		1.9 %	-2.78 [-12.20, 6.64]
Nguyen 2012	73	0.8 (10.75)	78	-1.5 (12.36)		4.5 %	2.30 [-1.39, 5.99]
Norman 2016 (1)	24	-0.4 (11.03)	28	0.9 (11.06)		3.2 %	-1.30 [-7.32, 4.72]
Norman 2016 (2)	29	0.3 (11.95)	25	-1.1 (11.57)		3.0 %	1.40 [-4.88, 7.68]
Pakpour 2015 (3)	118	-1.78 (8.74)	58	4.39 (8.52)		5.2 %	-6.17 [-8.87, -3.47]
Pakpour 2015 (4)	113	-0.62 (9.19)	57	4.39 (8.52)		5.1 %	-5.01 [-7.80, -2.22]
Patsopoulou 2017 (5)	55	-3.7 (1.32)	28	3.2 (1.9)	-	6.1 %	-6.90 [-7.69, -6.11]
Patsopoulou 2017 (6)	55	-4 (1.89)	28	3.2 (1.9)	-	6.0 %	-7.20 [-8.06, -6.34]
Pbert 2013	42	-0.22 (7.04)	40	0.88 (7.03)		5.0 %	-1.10 [-4.15, 1.95]
Sigal 2014 (7)	75	-1.6 (2.6)	25	-0.3 (2.6)	-	5.9 %	-1.30 [-2.48, -0.12]
Sigal 2014 (8)	74	-1.4 (2.6)	26	-0.3 (2.6)	-	5.9 %	-1.10 [-2.26, 0.06]
Sigal 2014 (9)	74	-1.1 (2.6)	25	-0.3 (2.6)	-	5.9 %	-0.80 [-1.98, 0.38]
Toulabi 2012	76	-3.02 (8.75)	76	0.21 (8.67)		5.1 %	-3.23 [-6.00, -0.46]
Vissers 2008	22	-3.4 (5.85)	31	1.05 (4.67)		5.0 %	-4.45 [-7.40, -1.50]
Walpole 2013	20	1.55 (7.09)	20	-2. (. 5)		3.3 %	3.65 [-2.14, 9.44]
Wengle 2011	16	-2 (11.53)	15	-2 (9.54)		2.5 %	0.0 [-7.43, 7.43]
Total (95% CI)	1188		809		•	100.0 %	-2.26 [-3.80, -0.72]
Heterogeneity: Tau ² = 9. Test for overall effect: Z Test for subgroup differe	99; Chi ² = 236.6 = 2.88 (P = 0.00 nces: Not applica	b2, df = 21 (P<0.00 40) ble	001); l ² =9	1%		1	
				-20 Favours	0 -10 0 10 intervention Favours co	20 ntrol	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 216 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. (I) Boys

(2) Girls

(3) Motivational interviewing with parents

(4) Motivational interviewing no parents

(5) Activity

- (6) Activity+Diet
- (7) Diet + resistance

(8) Diet, exercise + resistance

(9) Diet + aerobic

Analysis 3.4. Comparison 3 Interventions (all) versus controls, other anthropometrics, longest follow-up, Outcome 4 Waist-to-height ratio.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 3 Interventions (all) versus controls, other anthropometrics, longest follow-up

Outcome: 4 Waist-to-height ratio

-

-

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,95% Cl		IV,Random,95% CI
Brennan 2013	38	-0.01 (0.07)	21	-0.01 (0.06)	•	27.2 %	0.0 [-0.03, 0.03]
Nguyen 2012	73	-0.02 (0.06)	78	-0.02 (0.07)	•	72.8 %	0.0 [-0.02, 0.02]
Vos 2011	32	-0.6 (1.73)	34	-0.2 (1.78)	•	0.0 %	-0.40 [-1.25, 0.45]
Total (95% CI)	143		133		•	100.0 %	0.00 [-0.02, 0.02]
Heterogeneity: Tau 2 =	$0.0; Chi^2 = 0.86,$	df = 2 (P = 0.65)	; I ² =0.0%				
Test for overall effect:	Z = 0.02 (P = 0.9)	98)					
Test for subgroup diffe	rences: Not appli	cable					
					-1 -0.5 0 0.5	I	

Favours intervention Favours control

Analysis 3.5. Comparison 3 Interventions (all) versus controls, other anthropometrics, longest follow-up, Outcome 5 Waist-to-hip ratio.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 3 Interventions (all) versus controls, other anthropometrics, longest follow-up

Outcome: 5 Waist-to-hip ratio

Study or subgroup	Intervention		Control		Diff	Mean erence	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Rand	om,95% Cl		IV,Random,95% CI
Brennan 2013	38	0 (0.67)	21	0 (0.08)			0.5 %	0.0 [-0.22, 0.22]
Toulabi 2012	76	0.01 (0.05)	76	0 (0.05)	I	•	99.5 %	0.01 [-0.01, 0.03]
Total (95% CI)	114		97			•	100.0 %	0.01 [-0.01, 0.03]
Heterogeneity: Tau ² =	0.0; Chi ² = 0.01,	df = I (P = 0.93);	$ ^2 = 0.0\%$					
Test for overall effect:	Z = 1.23 (P = 0.2)	2)						
Test for subgroup diffe	rences: Not appli	able						
					- I -0.5	0 0.5 I		
				Favour	s intervention	Favours cont	rol	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 218 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 3.6. Comparison 3 Interventions (all) versus controls, other anthropometrics, longest follow-up, Outcome 6 Fat mass.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 3 Interventions (all) versus controls, other anthropometrics, longest follow-up

Outcome: 6 Fat mass

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)[kg]	Ν	Mean(SD)[kg]	IV,Random,95% CI		IV,Random,95% CI
Brennan 2013	42	-1.48 (12.09)	20	1.77 (12.44)		5.7 %	-3.25 [-9.81, 3.31]
Ebbeling 2003	8	-2.6 (4.24)	8	1.6 (2.26)		22.3 %	-4.20 [-7.53, -0.87]
Hofsteenge 2014	71	-1.5 (9.3)	51	-0.6 (9.32)		22.0 %	-0.90 [-4.25, 2.45]
Savoye 2007	105	-0.6 (10.46)	69	5.2 (11.02)		23.0 %	-5.80 [-9.08, -2.52]
Sigal 2014 (1)	74	-1.2 (11.62)	25	0.4 (11.62)		8.9 %	-1.60 [-6.87, 3.67]
Sigal 2014 (2)	75	-1.3 (11.72)	25	0.4 (11.62)		8.9 %	-1.70 [-6.97, 3.57]
Sigal 2014 (3)	74	-1.6 (11.62)	26	0.4 (11.62)		9.2 %	-2.00 [-7.19, 3.19]
Total (95% CI)	449		224		•	100.0 %	-3.13 [-4.70, -1.56]
Heterogeneity: Tau ² =	= 0.0; Chi ² = 5.4	3, df = 6 (P = 0.49)	; I ² =0.0%				
Test for overall effect:	Z = 3.90 (P = 0)	0.000095)					
Test for subgroup diffe	erences: Not app	olicable					

-10 -5 0 5 10

Favours intervention Favours control

(1) Diet + aerobic

(2) Diet + resistance

(3) Diet, exercise + resistance

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 219 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 3.7. Comparison 3 Interventions (all) versus controls, other anthropometrics, longest follow-up, Outcome 7 Trunk fat mass.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 3 Interventions (all) versus controls, other anthropometrics, longest follow-up

Outcome: 7 Trunk fat mass

Study or subgroup	Intervention		Control			Me Differer	ean Iice	Weight	Mean Difference
	Ν	Mean(SD)[kg]	Ν	Mean(SD)[kg]		IV,Random,	95% CI		IV,Random,95% CI
Brennan 2013	42	-0.63 (6.03)	20	0.67 (5.24)				28.0 %	-1.30 [-4.23, 1.63]
Hofsteenge 2014	71	-0.9 (5)	51	-0.1 (5.14)				72.0 %	-0.80 [-2.63, 1.03]
Total (95% CI)	113		71			-		100.0 %	-0.94 [-2.49, 0.61]
Heterogeneity: Tau ² =	= 0.0; Chi ² = 0.08	B, df = 1 (P = 0.78);	$ ^2 = 0.0\%$						
Test for overall effect:	Z = 1.19 (P = 0.1)	.24)							
Test for subgroup diffe	erences: Not app	licable							
						1			
					-10	-5 0	5	10	

Favours intervention Favours control

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 20 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 3.8. Comparison 3 Interventions (all) versus controls, other anthropometrics, longest follow-up, Outcome 8 Lean mass.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 3 Interventions (all) versus controls, other anthropometrics, longest follow-up

Outcome: 8 Lean mass

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)[kg]	Ν	Mean(SD)[kg]	IV,Random,95% CI		IV,Random,95% CI
Brennan 2013	42	0.01 (9.53)	20	1.37 (7.83)		2.3 %	-1.36 [-5.84, 3.12]
Schranz 2014	30	2.3 (7.69)	26	4.7 (10.58)		1.9 %	-2.40 [-7.31, 2.51]
Sigal 2014 (1)	75	1.4 (2.8)	25	1.1 (2.6)	-	31.7 %	0.30 [-0.90, 1.50]
Sigal 2014 (2)	74	0.8 (2.8)	26	1.1 (2.6)	-	32.5 %	-0.30 [-1.49, 0.89]
Sigal 2014 (3)	74	0.7 (2.8)	25	1.1 (2.6)	-	31.6 %	-0.40 [-1.60, 0.80]
Total (95% CI)	295		122		•	100.0 %	-0.21 [-0.88, 0.47]
Heterogeneity: Tau ² =	$= 0.0; Chi^2 = 1.83$	B, df = 4 (P = 0.77);	$ ^2 = 0.0\%$				
Test for overall effect:	Z = 0.59 (P = 0.59)	.55)					
Test for subgroup diffe	erences: Not app	licable					
						_	

-10 -5 0 5 10

Favours control Favours intervention

(1) Diet + resistance

(2) Diet, exercise + resistance

(3) Diet + aerobic

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 221 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 3.9. Comparison 3 Interventions (all) versus controls, other anthropometrics, longest follow-up, Outcome 9 % overweight.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 3 Interventions (all) versus controls, other anthropometrics, longest follow-up

Outcome: 9 % overweight

Study or subgroup	Intervention		Control		M Differe	ean nce	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random	n,95% CI		IV,Random,95% CI
Brownell 1983 (1)	12	-5.5 (12.1)	6	-6 (13.2)	+	_	40.8 %	0.50 [-12.09, 13.09]
Brownell 1983 (2)	12	-20.5 (22.5)	6	-6 (13.2)			23.8 %	-14.50 [-31.04, 2.04]
Saelens 2002	18	-2.4 (22.83)	19	4.1 (18.9)			35.3 %	-6.50 [-20.04, 7.04]
Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: 2 Test for subgroup differ	42 0.80; Chi ² = 2.02 Z = 1.34 (P = 0.1 rences: Not appli	8, df = 2 (P = 0.34 8) cable	31 5); I ² =2%		•		100.0 %	-5.55 [-13.67, 2.57]
				Favou	-50 -25 0	25 50 Favours contro	sl	

(1) Mother and child together

(2) Mother and child separate

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 222 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 4.1. Comparison 4 Interventions (all) versus controls, quality of life, longest follow-up, Outcome I Health-related quality of life.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 4 Interventions (all) versus controls, quality of life, longest follow-up

Outcome: I Health-related quality of life

Study or subgroup	Intervention		Control		Std. Mean Difference	Weight	Std. Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,95% CI		IV,Random,95% CI
Debar 2012	85	6.68 (15.15)	76	2.86 (16.47)	-#-	13.7 %	0.24 [-0.07, 0.55]
Hofsteenge 2014	57	6.6 (12.1)	38	1.5 (10.6)	-	12.6 %	0.44 [0.02, 0.85]
Luna-Pech 2014	26	0.85 (0.25)	25	0.2 (0.2)		8.6 %	2.82 [2.03, 3.61]
Nguyen 2012	73	-1.34 (4.13)	78	-1.21 (4.44)	+	13.6 %	-0.03 [-0.35, 0.29]
Pakpour 2015 (1)	113	1.15 (20.85)	57	-1.01 (18.69)	-	13.6 %	0.11 [-0.21, 0.43]
Pakpour 2015 (2)	118	2.68 (19.56)	58	-1.01 (18.69)	-	13.7 %	0.19 [-0.12, 0.51]
Patrick 2013	76	9.73 (12.15)	25	6.1 (12.25)		12.2 %	0.30 [-0.16, 0.75]
Vos 2011	32	6.6 (11.04)	35	2.8 (13.6)		11.9 %	0.30 [-0.18, 0.78]
Total (95% CI) Heterogeneity: Tau ² = Test for overall effect; 2	580 0.21; Chi ² = 45.2 Z = 2.47 (P = 0.0	26, df = 7 (P<0.00	392 001); I ² =85	%	*	100.0 %	0.44 [0.09, 0.79]
Test for subgroup differ	rences: Not appli	cable					
					-4 -2 0 2 4		

Favours control Favours intervention

(1) Motivational interviewing no parents

(2) Motivational interviewing with parents

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 223 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 4.2. Comparison 4 Interventions (all) versus controls, quality of life, longest follow-up, Outcome 2 Health-related quality of life by tool.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 4 Interventions (all) versus controls, quality of life, longest follow-up

Outcome: 2 Health-related quality of life by tool

Study or subgroup	Intervention		Control		Std. Mean Difference	\\/cight	Std. Mean Difference
Study of subgroup	N	Mean(SD)	N	Mean(SD)	IV,Random,95% CI	vveigni	IV,Random,95% CI
L Padiatric Quality of Life	Inventory						
Debar 2012	85	6.68 (15.15)	76	2.86 (16.47)	-	13.7 %	0.24 [-0.07, 0.55]
Hofsteenge 2014	57	6.6 (12.1)	38	1.5 (10.6)		12.6 %	0.44 [0.02, 0.85]
Pakpour 2015 (1)	113	1.15 (20.85)	57	-1.01 (18.69)	+	13.6 %	0.11 [-0.21, 0.43]
Pakpour 2015 (2)	118	2.68 (19.56)	58	-1.01 (18.69)	-	13.7 %	0.19 [-0.12, 0.51]
Patrick 2013	76	9.73 (12.15)	25	6.1 (12.25)		12.2 %	0.30 [-0.16, 0.75]
Subtotal (95% CI)	449		254		*	65.9 %	0.23 [0.07, 0.39]
Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 1.69$, df	= 4 (P = 0.79); I	2 =0.0%				
Test for overall effect: Z =	2.89 (P = 0.003	8)					
2 Other self-reported too	ols						
Luna-Pech 2014	26	0.85 (0.25)	25	0.2 (0.2)		8.6 %	2.82 [2.03, 3.61]
Nguyen 2012	73	-1.34 (4.13)	78	-1.21 (4.44)	+	13.6 %	-0.03 [-0.35, 0.29]
Vos 2011	32	6.6 (11.04)	35	2.8 (13.6)		11.9 %	0.30 [-0.18, 0.78]
Subtotal (95% CI)	131		138			34.1 %	0.98 [-0.35, 2.31]
Heterogeneity: $Tau^2 = 1.2$	29; Chi ² = 42.94,	df = 2 (P<0.000	01); I ² =95%				
Test for overall effect: Z =	: I.45 (P = 0.15)						
Total (95% CI)	580		392		•	100.0 %	0.44 [0.09, 0.79]
Heterogeneity: $Tau^2 = 0.2$	21; Chi ² = 45.26,	df = 7 (P<0.000	01); I ² =85%				
Test for overall effect: Z =	2.47 (P = 0.014))					
Test for subgroup differen	ces: Chi ² = 1.21,	df = 1 (P = 0.27), $ ^2 = 7\%$				
					-4 -2 0 2 4		

Favours control

Favours intervention

(1) Motivational interviewing no parents

(2) Motivational interviewing with parents

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 224 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 4.3. Comparison 4 Interventions (all) versus controls, quality of life, longest follow-up, Outcome 3 Self-esteem.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 4 Interventions (all) versus controls, quality of life, longest follow-up

Outcome: 3 Self-esteem

Study or subgroup	Intervention		Control		Std. Mean Difference	Weight	Std. Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,95% CI		IV,Random,95% CI
Brennan 2013	42	-0.9 (5.9)	21	0.4 (4.7)		10.5 %	-0.23 [-0.76, 0.29]
Daley 2005	51	0.22 (2.68)	30	0.17 (2.51)		13.9 %	0.02 [-0.43, 0.47]
Debar 2012	85	0.06 (0.26)	76	-0.01 (0.26)		26.3 %	0.27 [-0.04, 0.58]
Nguyen 2012	73	0.34 (0.6)	78	0.19 (0.7)		25.1 %	0.23 [-0.09, 0.55]
Patrick 2013	76	I (5.39)	25	2.3 (5.33)		13.8 %	-0.24 [-0.69, 0.21]
Schranz 2014	30	0.16 (0.57)	26	0.05 (0.55)		10.5 %	0.19 [-0.33, 0.72]
Total (95% CI)	357		256		•	100.0 %	0.09 [-0.08, 0.27]
Heterogeneity: Tau ² =	= 0.01; Chi ² = 5.68	B, df = 5 (P = 0.34	$ +); ^2 = 2\% $				
Test for overall effect:	Z = 1.03 (P = 0.3)	80)					
Test for subgroup diffe	erences: Not appli	cable					

-2 -1 0 1 2

Favours control Favours intervention

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 225 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 4.4. Comparison 4 Interventions (all) versus controls, quality of life, longest follow-up, Outcome 4 Self-esteem by outcome.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 4 Interventions (all) versus controls, quality of life, longest follow-up

Outcome: 4 Self-esteem by outcome

Study or subgroup	Intervention		Control		Std. Mean Difference	Weight	Std. Mean Difference
, , ,	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,95% CI	5	IV,Random,95% CI
I Self-esteem							
Brennan 2013	42	-0.9 (5.9)	21	0.4 (4.7)		10.5 %	-0.23 [-0.76, 0.29]
Debar 2012	85	0.06 (0.26)	76	-0.01 (0.26)		26.3 %	0.27 [-0.04, 0.58]
Patrick 2013	76	I (5.39)	25	2.3 (5.33)		13.8 %	-0.24 [-0.69, 0.21]
Subtotal (95% CI)	203		122		+	50.6 %	-0.03 [-0.39, 0.34]
Heterogeneity: $Tau^2 = 0.0$	06; Chi ² = 4.56, d	f = 2 (P = 0.10);	$ ^2 = 56\%$				
Test for overall effect: Z =	= 0.14 (P = 0.89)						
2 Global self-worth							
Daley 2005	51	0.22 (2.68)	30	0.17 (2.51)		13.9 %	0.02 [-0.43, 0.47]
Nguyen 2012	73	0.34 (0.6)	78	0.19 (0.7)		25.1 %	0.23 [-0.09, 0.55]
Schranz 2014	30	0.16 (0.57)	26	0.05 (0.55)		10.5 %	0.19 [-0.33, 0.72]
Subtotal (95% CI)	154		134		•	49.4 %	0.17 [-0.07, 0.40]
Heterogeneity: $Tau^2 = 0.0$); Chi ² = 0.56, df	= 2 (P = 0.75); I	2 =0.0%				
Test for overall effect: Z =	= 1.38 (P = 0.17)						
Total (95% CI)	357		256		•	100.0 %	0.09 [-0.08, 0.27]
Heterogeneity: $Tau^2 = 0.0$	01; Chi ² = 5.68, d	f = 5 (P = 0.34);	$ ^2 = 2\%$				
Test for overall effect: Z =	= 1.03 (P = 0.30)						
Test for subgroup differen	ces: $Chi^2 = 0.73$,	df = 1 (P = 0.39), l ² =0.0%				
						i	
					-2 -1 0 1	2	

-2 -1 0 I 2 Favours control Favours intervention

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 226 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 4.5. Comparison 4 Interventions (all) versus controls, quality of life, longest follow-up, Outcome 5 Self-esteem by tool.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 4 Interventions (all) versus controls, quality of life, longest follow-up

Outcome: 5 Self-esteem by tool

Study or subgroup	Intervention		Control		Std. Mean Difference	Weight	Std. Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,95% CI	-	IV,Random,95% CI
I Rosenberg Self-Esteem	Scale						
Brennan 2013	42	-0.9 (5.9)	21	0.4 (4.7)		10.5 %	-0.23 [-0.76, 0.29]
Debar 2012	85	0.06 (0.26)	76	-0.01 (0.26)		26.3 %	0.27 [-0.04, 0.58]
Patrick 2013	76	I (5.39)	25	2.3 (5.33)		13.8 %	-0.24 [-0.69, 0.21]
Subtotal (95% CI)	203		122		•	50.6 %	-0.03 [-0.39, 0.34]
Heterogeneity: $Tau^2 = 0.0$	06; Chi ² = 4.56, dt	r = 2 (P = 0.10);	$ ^2 = 56\%$				
Test for overall effect: Z =	= 0.14 (P = 0.89)						
2 Self-Perception Profile f	for Adolescents						
Daley 2005	51	0.22 (2.68)	30	0.17 (2.51)		13.9 %	0.02 [-0.43, 0.47]
Nguyen 2012	73	0.34 (0.6)	78	0.19 (0.7)		25.1 %	0.23 [-0.09, 0.55]
Schranz 2014	30	0.16 (0.57)	26	0.05 (0.55)		10.5 %	0.19 [-0.33, 0.72]
Subtotal (95% CI)	154		134		*	49.4 %	0.17 [-0.07, 0.40]
Heterogeneity: $Tau^2 = 0.0$); $Chi^2 = 0.56$, df	= 2 (P = 0.75); I ²	2 =0.0%				
Test for overall effect: Z =	= 1.38 (P = 0.17)						
Total (95% CI)	357		256		•	100.0 %	0.09 [-0.08, 0.27]
Heterogeneity: $Tau^2 = 0.0$	01; Chi ² = 5.68, dt	= 5 (P = 0.34);	$ ^2 = 2\%$				
Test for overall effect: Z =	= 1.03 (P = 0.30)						
Test for subgroup differen	nces: $Chi^2 = 0.73$,	df = I (P = 0.39), l ² =0.0%				

-2 -1 0 I 2 Favours control Favours intervention

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 227 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 5.1. Comparison 5 Interventions (all) versus controls, behavioural change, longest follow-up, Outcome 1 Physical activity (mild - vigorous physical activity).

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 5 Interventions (all) versus controls, behavioural change, longest follow-up

Outcome: I Physical activity (mild - vigorous physical activity)

Study or subgroup	Intervention		Control		Me Differer	ean nce	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,	95% CI		IV,Random,95% CI
Kong 2013	14	16.5 (36.84)	8	-7.1 (22.8)		-	22.5 %	23.60 [-1.34, 48.54]
Pbert 2013	40	-2.28 (13.7)	42	3.69 (13.97)			50.0 %	-5.97 [-11.96, 0.02]
Wengle 2011	11	-5 (23.9)	14	2 (28.8)		-	27.5 %	-7.00 [-27.67, 3.67]
Total (95% CI)	65		64		-	-	100.0 %	0.39 [-15.07, 15.85]
Heterogeneity: Tau ² =	$115.11; Chi^2 = 1$	5.16, df = 2 (P =	0.08); I ² =6	1%				
Test for overall effect:	Z = 0.05 (P = 0.9)	96)						
Test for subgroup diffe	erences: Not appl	icable						
					-50 -25 0	25 50		

Favours control Favours intervention

Analysis 5.2. Comparison 5 Interventions (all) versus controls, behavioural change, longest follow-up, Outcome 2 Physical activity length.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 5 Interventions (all) versus controls, behavioural change, longest follow-up

Outcome: 2 Physical activity length

Study or subgroup	Intervention		Control		۱ Differ	1ean ence	Weight	Mean Difference
	Ν	Mean(SD)[hour	rs/day] N	Mean(SD)[hours/	day] IV,Randor	n,95% Cl		IV,Random,95% CI
Gourlan 2013	26	1.35 (0.76)	28	0.5 (0.61)		-	32.7 %	0.85 [0.48, 1.22]
Pakpour 2015 (1)	25	-0.09 (0.36)	13	0.69 (0.41)	-		33.7 %	-0.78 [-1.04, -0.52]
Pakpour 2015 (2)	25	0.31 (0.38)	12	0.69 (0.41)	-		33.6 %	-0.38 [-0.66, -0.10]
Total (95% CI)	76		53		-	•	100.0 %	-0.11 [-0.98, 0.75]
Heterogeneity: Tau ² =	0.56; Chi ² = 50.2	27, df = 2 (P<0.00	0001); l ² =9	6%				
Test for overall effect: 2	Z = 0.25 (P = 0.8)	80)						
Test for subgroup differ	rences: Not appli	cable						
				-4	-2 0	2	4	
				Favo	ours control	Favours in	tervention	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 228 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. (1) Motivational interviewing with parents

(2) Motivational interviewing no parents

Analysis 5.3. Comparison 5 Interventions (all) versus controls, behavioural change, longest follow-up, Outcome 3 Screen time.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 5 Interventions (all) versus controls, behavioural change, longest follow-up

Outcome: 3 Screen time

Study or subgroup	Intervention		Control		0	Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)[hour	s/day] N	Mean(SD)[ho	urs/day] IV,Ra	ndom,95% Cl		IV,Random,95% CI
Ebbeling 2012	105	-0.7 (0.2)	104	-0.1 (0.2)	+		100.0 %	-0.60 [-0.65, -0.55]
Wengle 2011	16	-1.5 (3.8)	16	-1.4 (3.6)	•		→ 0.0 %	-0.10 [-2.66, 2.46]
Total (95% CI)	121		120		•		100.0 %	-0.60 [-0.65, -0.55]
Heterogeneity: Tau ² =	0.0; Chi ² = 0.15	, $df = 1$ (P = 0.70)	; l ² =0.0%					
Test for overall effect:	Z = 21.68 (P < 0	0.00001)						
Test for subgroup diffe	rences: Not appl	icable						
					-2 -1	0 I	2	
				Favo	urs intervention	Favours c	ontrol	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 229 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 6.1. Comparison 6 Interventions versus control by duration of follow-up, Outcome I Body mass index (BMI) change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 6 Interventions versus control by duration of follow-up

Outcome: I Body mass index (BMI) change

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	N	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% CI		IV,Random,95% CI
I BMI 6-9 months	10	0.40.44.50	21	074 (5 10)		2 1 0/	
Brennan 2013	42	-0.69 (4.59)	21	0.76 (5.18)		2.1 %	-1.45 [-4.06, 1.16]
Carrel 2005	27	I (8.72)	23	0 (4.58)		1.3 %	1.00 [-2.78, 4.78]
Gourlan 2013	26	-1.61 (4.64)	28	0.12 (5.94)		1.9 %	-1.73 [-4.56, 1.10]
Kong 2014	34	-1.2 (4.1)	27	-0.2 (3.24)	-+-	3.0 %	-1.00 [-2.84, 0.84]
Patsopoulou 2017 (1)	55	-2.3 (1.13)	28	0.2 (1.14)	+	4.8 %	-2.50 [-3.02, -1.98]
Patsopoulou 2017 (2)	55	-3.1 (0.94)	28	0.2 (1.14)	+	4.9 %	-3.30 [-3.79, -2.81]
Pbert 2013	42	0.01 (2.2)	40	0.23 (2.1)	+	4.3 %	-0.22 [-1.15, 0.71]
Pitetti 2007	5	-3 (7.18)	5	-0.9 (7.99)	·	0.3 %	-2.10 [-11.52, 7.32]
Saelens 2002	18	0.1 (4.09)	19	1.4 (3.5)		2.2 %	-1.30 [-3.76, 1.16]
Sigal 2014 (3)	78	-0.5 (2.4)	25	0 (2.4)	-+	4.1 %	-0.50 [-1.58, 0.58]
Sigal 2014 (4)	75	-0.9 (2.2)	26	0 (2.4)		4.1 %	-0.90 [-1.95, 0.15]
Sigal 2014 (5)	75	-0.6 (2.4)	25	0 (2.4)		4.1 %	-0.60 [-1.69, 0.49]
Toulabi 2012	76	-2.92 (2.87)	76	-1.18 (2.44)		4.4 %	-1.74 [-2.59, -0.89]
Vissers 2008	22	-0.78 (1.42)	31	0.49 (0.74)	+	4.7 %	-1.27 [-1.92, -0.62]
Visuthranukul 2015	25	-0.2 (1.6)	27	0.4 (2)	-+	4.2 %	-0.60 [-1.58, 0.38]
Wengle 2011	16	0.1 (5.86)	16	-0.5 (5.07)		1.2 %	0.60 [-3.20, 4.40]
Subtotal (95% CI) Heterogeneity: Tau ² = 1. Test for overall effect: Z =	671 14; Chi ² = 80.0 = 3.69 (P = 0.0	00, df = 15 (P<0.0000 0023)	445 1); ² =8 5	%	•	51.5 % -1	.25 [-1.91, -0.59]
2 BMI 12 months							
Ebbeling 2003	8	-1.2 (2)	8	0.6 (1.4)		3.2 %	-1.80 [-3.49, -0.11]
Grey 2009	112	0.9 (3.2)	86	0.1 (3)	-	4.4 %	0.80 [-0.07, 1.67]
Jelalian 2016	17	- (7.)	7	1.7 (5.2)		0.8 %	-2.70 [-7.82, 2.42]
NCT00132132 (6)	8	-0.37 (1)	13	1.28 (1.1)		4.3 %	-1.65 [-2.57, -0.73]
NCT00807560	13	-0.8 (5.3)	11	2.1 (8)		0.7 %	-2.90 [-8.44, 2.64]
				- II Favours	0 -5 0 5 intervention Favours co	10 ntrol	

(Continued ...)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 230 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
,	Ν	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% CI	-	IV,Random,95% CI
Norman 2016 (7)	24	-0.6 (4.06)	28	0.6 (4.12)		2.5 %	-1.20 [-3.43, 1.03]
Norman 2016 (8)	29	0.9 (4.29)	25	0.2 (4.18)		2.4 %	0.70 [-1.56, 2.96]
Pakpour 2015 (9)	118	-2.05 (6.18)	58	0.03 (8.33)		2.3 %	-2.08 [-4.50, 0.34]
Pakpour 2015 (10)	113	-0.63 (8.25)	57	0.03 (8.33)		2.0 %	-0.66 [-3.30, 1.98]
Resnicow 2005	45	1.3 (5.9)	62	0.5 (7.9)	_ 	2.1 %	0.80 [-1.82, 3.42]
Schranz 2014	30	0.1 (4.16)	26	1.2 (5.77)		2.0 %	-1.10 [-3.77, 1.57]
Subtotal (95% CI)	517		381		•	26.6 %	-0.79 [-1.70, 0.12]
Heterogeneity: $Tau^2 = 1$.07; Chi ² = 22.5	2, df = 10 (P = 0.01);	l ² =56%				
Test for overall effect: Z	= 1.70 (P = 0.09	90)					
3 BMI 18-24 months							
Brownell 1983 (11)	12	-4.66 (6.6)	6	-0.1 (3.5)		0.9 %	-4.56 [-9.23, 0.11]
Brownell 1983 (12)	12	-0.1 (3.1)	6	-0.1 (3.5)		1.5 %	0.0 [-3.30, 3.30]
Ebbeling 2012 (13)	105	0.71 (2.9)	104	I (2.9)	+	4.5 %	-0.29 [-1.08, 0.50]
Hofsteenge 2014	71	0.9 (5.51)	51	1.3 (5.37)		2.8 %	-0.40 [-2.35, 1.55]
Jiang 2005	33	-2.6 (1.6)	35	-0.1 (1.1)	+	4.7 %	-2.50 [-3.16, -1.84]
Nguyen 2012	73	0 (4.41)	78	I (4.09)		3.7 %	-1.00 [-2.36, 0.36]
Savoye 2007	105	-0.9 (4.1)	69	1.9 (4.2)		3.8 %	-2.80 [-4.06, -1.54]
Subtotal (95% CI)	411		349		•	21.9 %	-1.49 [-2.56, -0.41]
Heterogeneity: $Tau^2 = 1$.33; Chi ² = 25.9	9, df = 6 (P = 0.00022	2); $ ^2 = 775$	%			
Test for overall effect: Z	= 2.70 (P = 0.00	069)					
Total (95% CI)	1599		1175		•	100.0 %	-1.18 [-1.67, -0.69]
Heterogeneity: $Tau^2 = 1$.21; Chi ² = 147.	87, df = 33 (P<0.0000	$); ^2 = 78$	3%			
Test for overall effect: Z	= 4.74 (P < 0.00	. (1000					
Test for subgroup differe	nces: $Chi^2 = 1.0$	96, df = 2 (P = 0.59), l	2 =0.0%				
				-10	0 -5 0 5	10	
				Favours	intervention Favours co	ntrol	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 231 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. (I) Acitivity

(2) Activity+Diet

(3) Diet and resistance

(4) Diet, aerobic + resistance

(5) Diet and aerobic

(6) Outcomes adjusted for covariates

(7) Boys

(8) Girls

(9) Motivational interviewing with parents

(10) Motivational interviewing no parents

(II) Mother + child separate

(12) Mother + child together

(13) Adjusted for covariates

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 232 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 6.2. Comparison 6 Interventions versus control by duration of follow-up, Outcome 2 BMI z score change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 6 Interventions versus control by duration of follow-up

Outcome: 2 BMI z score change

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,95% CI		IV,Random,95% CI
I BMI z score 6-9 months							
Boodai 2014	31	0 (0.1)	32	0 (0.2)	+	5.8 %	0.0 [-0.08, 0.08]
Brennan 2013	42	-0.09 (0.42)	21	0.01 (0.4)	-+	4.3 %	-0.10 [-0.31, 0.11]
Daley 2005	28	-0.01 (0.29)	53	-0.08 (0.44)	+	5.0 %	0.07 [-0.09, 0.23]
Luna-Pech 2014	26	-0.52 (0.26)	25	-0.05 (0.26)	+	5.1 %	-0.47 [-0.61, -0.33]
Pbert 2013	42	0 (0.2)	40	0.01 (0.2)	-	5.7 %	-0.01 [-0.10, 0.08]
Saelens 2002	18	-0.05 (0.4)	19	0.07 (0.3)		4.2 %	-0.12 [-0.35, 0.11]
Visuthranukul 2015	25	-0.3 (0.2)	27	-0.3 (0.5)	+	4.4 %	0.0 [-0.20, 0.20]
Wengle 2011	16	-0.03 (0.42)	16	-0.11 (0.45)		3.4 %	0.08 [-0.22, 0.38]
Subtotal (95% CI)	228		233		•	37.9 %	-0.07 [-0.20, 0.05]
Heterogeneity: $Tau^2 = 0.02$; C	:hi ² = 39.31, df =	7 (P<0.00001)	; I ² =82%				
Test for overall effect: $Z = 1.1^{\circ}$	7 (P = 0.24)						
Debar 2012	90	-0.15 (0.41)	83	-0.08 (0.36)	-	5.4 %	-0.07 [-0.18. 0.04]
NCT00807560	13	-0.1 (0.4)	9	0 (0.21)		3.8 %	-0.10 [-0.36, 0.16]
Norman 2016 (1)	29	-0.1 (0.36)	25	-0.1 (0.46)	+	4.2 %	0.0 [-0.22, 0.22]
Norman 2016 (2)	24	-0.1 (0.37)	28	0 (0.4)		4.4 %	-0.10 [-0.31, 0.11]
Pakpour 2015 (3)	113	-0.02 (0.78)	57	0.01 (0.69)	+	4.1 %	-0.03 [-0.26, 0.20]
Pakpour 2015 (4)	118	-0.24 (0.62)	58	0.01 (0.69)		4.4 %	-0.25 [-0.46, -0.04]
Patrick 2013	76	-0.13 (0.41)	25	0 (0.46)		4.5 %	-0.13 [-0.33, 0.07]
van Egmond-Frohlich 2006	250	-0.12 (0.44)	271	-0.13 (0.42)	+	5.8 %	0.01 [-0.06, 0.08]
Vos 2011	32	-0.4 (0.96)	35	-0.1 (0.7)		2.5 %	-0.30 [-0.71, 0.11]
Subtotal (95% CI)	745		591		•	39.1 %	-0.06 [-0.11, 0.00]
Heterogeneity: $Tau^2 = 0.00$; C	$hi^2 = 8.77$, df =	8 (P = 0.36); l ²	=9%				
Test for overall effect: $Z = 1.9$	5 (P = 0.052)						
3 BMI z score 18-24 months			10			10.01	
Ford 2010	44	-0.41 (0.66)	43	-0.14 (0.5)		4.0 %	-0.27 [-0.52, -0.02]
					-2 -1 0 1	2	

Favours intervention Favours control

(Continued ...)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 23 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

							(Continued)
Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,95% CI		IV,Random,95% CI
Hofsteenge 2014	71	-0.07 (0.61)	51	0.03 (0.56)	-+	4.4 %	-0.10 [-0.31, 0.11]
Jiang 2005 (5)	33	-1.7 (0.66)	35	-0.3 (0.56)		3.5 %	-1.40 [-1.69, -1.11]
Nguyen 2012	73	-0.09 (0.35)	78	-0.2 (0.46)	-	5.3 %	0. [-0.02, 0.24]
Savoye 2007	105	-0.2 (0.2)	69	-0.05 (0.2)	-	5.9 %	-0.15 [-0.21, -0.09]
Subtotal (95% CI)	326		276		•	23.0 %	-0.34 [-0.66, -0.02]
Heterogeneity: $Tau^2 = 0.12$;	Chi ² = 87.04, df =	= 4 (P<0.00001)	; I ² =95%				
Test for overall effect: $Z = 2.0$	08 (P = 0.038)						
Total (95% CI)	1299		1100		•	100.0 %	-0.13 [-0.21, -0.05]
Heterogeneity: $Tau^2 = 0.03$;	Chi ² = 145.05, df	= 21 (P<0.0000)); ² =86%	Ś			
Test for overall effect: $Z = 3$.	II (P = 0.0019)						
Test for subgroup differences	:: Chi ² = 2.92, df =	= 2 (P = 0.23), I	² =32%				

-2 -1 0 1 2

Favours intervention Favours control

(I) Girls

(2) Boys

(3) Motivational interviewing no parent

(4) Motivational interviewing with parent

(5) SDs imputed from other studies

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 234 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 7.1. Comparison 7 Interventions versus controls by duration of postintervention follow-up, Outcome I Body mass index (BMI) change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 7 Interventions versus controls by duration of postintervention follow-up

Outcome: I Body mass index (BMI) change

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% Cl		IV,Random,95% CI
I No postintervention fo	ollow-up						
Brennan 2013	42	-0.69 (4.59)	21	0.76 (5.18)		2.5 %	-1.45 [-4.06, 1.16]
Carrel 2005	27	I (8.72)	23	0 (4.58)		1.6 %	1.00 [-2.78, 4.78]
Gourlan 2013	26	-1.61 (4.64)	28	0.12 (5.94)		2.3 %	-1.73 [-4.56, 1.10]
Jiang 2005	33	-2.6 (1.6)	35	-0.1 (1.1)	+	4.8 %	-2.50 [-3.16, -1.84]
Kong 2014	34	-1.2 (4.1)	27	-0.2 (3.24)	_+_	3.4 %	-1.00 [-2.84, 0.84]
Nguyen 2012	73	0 (4.41)	78	l (4.09)		4.0 %	-1.00 [-2.36, 0.36]
Norman 2016 (1)	24	-0.6 (4.06)	28	0.6 (4.12)		2.9 %	-1.20 [-3.43, 1.03]
Norman 2016 (2)	29	0.9 (4.29)	25	0.2 (4.18)		2.9 %	0.70 [-1.56, 2.96]
Pitetti 2007	5	-3 (7.18)	5	-0.9 (7.99)	••	0.3 %	-2.10 [-11.52, 7.32]
Sigal 2014 (3)	75	-0.9 (2.2)	26	0 (2.4)		4.4 %	-0.90 [-1.95, 0.15]
Sigal 2014 (4)	75	-0.6 (2.4)	25	0 (2.4)	-+	4.3 %	-0.60 [-1.69, 0.49]
Sigal 2014 (5)	78	-0.5 (2.4)	25	0 (2.4)	-+	4.4 %	-0.50 [-1.58, 0.58]
Vissers 2008	22	-0.78 (1.42)	31	0.49 (0.74)	+	4.8 %	-1.27 [-1.92, -0.62]
Visuthranukul 2015	25	-0.2 (1.6)	27	0.4 (2)	-+	4.5 %	-0.60 [-1.58, 0.38]
Wengle 2011	16	-0.03 (0.42)	16	-0.11 (0.45)	-	5.1 %	0.08 [-0.22, 0.38]
Subtotal (95% CI)	584		420		•	52.1 %	-0.87 [-1.49, -0.26]
Heterogeneity: Tau ² = 0. Test for overall effect: Z = 2 < 6 months	83; Chi ² = 59. = 2.78 (P = 0.0	88, df = 14 (P<0.0000 0054)	I); I ² =775	%			
Grey 2009	112	0.9 (3.2)	86	0.1 (3)		4.6 %	0.80 [-0.07, 1.67]
Jelalian 2016	17	- (7.)	7	1.7 (5.2)		1.0 %	-2.70 [-7.82, 2.42]
NCT00807560	13	-0.8 (5.3)	11	2.1 (8)		0.9 %	-2.90 [-8.44, 2.64]
Patsopoulou 2017 (6)	55	-2.3 (1.13)	28	0.2 (1.14)	+	4.9 %	-2.50 [-3.02, -1.98]
Patsopoulou 2017 (7)	55	-3.1 (0.94)	28	0.2 (1.14)	+	5.0 %	-3.30 [-3.79, -2.81]
Pbert 2013	42	0.01 (2.2)	40	0.23 (2.1)	+	4.5 %	-0.22 [-1.15, 0.71]
				-	0 -5 0 5	10	

Favours intervention Favours control

(Continued ...)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 235 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	N	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% CI		IV,Random,95% CI
Saelens 2002	18	0.1 (4.09)	19	1.4 (3.5)		2.6 %	-1.30 [-3.76, 1.16]
Toulabi 2012	76	-2.92 (2.87)	76	-1.18 (2.44)		4.6 %	-1.74 [-2.59, -0.89]
Subtotal (95% CI)	388		295		•	28.2 %	-1.53 [-2.76, -0.30]
Heterogeneity: Tau ² = 2	.26; Chi ² = 85.1	4, df = 7 (P<0.00001)); l ² =92%				
Test for overall effect: Z	= 2.43 (P = 0.0	15)					
3 6 to < 12 months							
Hofsteenge 2014	71	0.9 (5.51)	51	1.3 (5.37)		3.2 %	-0.40 [-2.35, 1.55]
Pakpour 2015 (8)	113	-0.63 (8.25)	57	0.03 (8.33)		2.5 %	-0.66 [-3.30, 1.98]
Pakpour 2015 (9)	118	-2.05 (6.18)	58	0.03 (8.33)		2.7 %	-2.08 [-4.50, 0.34]
Schranz 2014	30	0.1 (4.16)	26	1.2 (5.77)		2.4 %	-1.10 [-3.77, 1.57]
Subtotal (95% CI)	332		192		•	10.8 %	-0.99 [-2.17, 0.19]
Heterogeneity: $Tau^2 = 0$.0; Chi ² = 1.20,	df = 3 (P = 0.75); I ² =	=0.0%				
Test for overall effect: Z	= 1.64 (P = 0.1	0)					
$4 \ge 12$ months							
Ebbeling 2012	105	0.71 (2.9)	104	I (2.9)	+	4.7 %	-0.29 [-1.08, 0.50]
Savoye 2007	105	-0.9 (4.1)	69	1.9 (4.2)	<u> </u>	4.1 %	-2.80 [-4.06, -1.54]
Subtotal (95% CI)	210		173		-	8.8 %	-1.49 [-3.95, 0.96]
Heterogeneity: $Tau^2 = 2$.86; Chi ² = 10.9	92, df = 1 (P = 0.0009	5); ² =9	%			
Test for overall effect: Z	= 1.19 (P = 0.2	3)					
Total (95% CI)	1514		1080		•	100.0 %	-1.12 [-1.69, -0.54]
Heterogeneity: $Tau^2 = 1$.66; Chi ² = 226	.34, df = 28 (P<0.000	01); l ² =88	3%			
Test for overall effect: Z	= 3.82 (P = 0.0	0014)					
Test for subgroup differe	nces: $Chi^2 = 1.0$	02, df = 3 (P = 0.80),	2 =0.0%				
						L	
				-10) -5 0 5	10	

Favours intervention Favours control

(I) Boys

(2) Girls

(3) Diet, exercise + resistance

- (4) Diet + aerobic
- (5) Diet + resistance
- (6) Activity
- (7) Activity+Diet

(8) Motivational interviewing no parents

(9) Motivational interviewing with parents

Analysis 7.2. Comparison 7 Interventions versus controls by duration of postintervention follow-up, Outcome 2 BMI z score change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 7 Interventions versus controls by duration of postintervention follow-up

Outcome: 2 BMI z score change

Study or subgroup	Intervention	M (CD)	Control		Mean Difference	Weight	Mean Difference
	IN	I™lean(SD)	IN	Mean(SD)	IV,Kandom,95% CI		IV,Kandom,95% CI
I No postintervention follow Boodai 2014	-up 31	0 (0.1)	32	0 (0.2)	+	6.5 %	0.0 [-0.08, 0.08]
Brannan 2013	42	0.09 (0.42)	21	0.01 (0.4)		49%	
	12	-0.07 (0.42)	21	0.01 (0.1)	4	4.0.9/	
Jiang 2005 (1)	33	-1.7 (0.66)	30	-0.3 (0.56)	_	4.0 %	-1.40 [-1.69, -1.11]
Luna-Pech 2014	26	-0.52 (0.26)	25	-0.05 (0.26)		5.8 %	-0.47 [-0.61, -0.33]
Nguyen 2012	73	-0.09 (0.35)	78	-0.2 (0.46)		6.0 %	0.11 [-0.02, 0.24]
Norman 2016 (2)	24	-0.1 (0.37)	28	0 (0.4)		5.0 %	-0.10 [-0.31, 0.11]
Norman 2016 (3)	29	-0.1 (0.36)	25	-0.1 (0.46)		4.8 %	0.0 [-0.22, 0.22]
Patrick 2013	76	-0.13 (0.41)	25	0 (0.46)		5.1 %	-0.13 [-0.33, 0.07]
Visuthranukul 2015	25	-0.3 (0.2)	27	-0.3 (0.5)		5.1 %	0.0 [-0.20, 0.20]
Wengle 2011	16	-0.03 (0.42)	16	-0.11 (0.45)		3.9 %	0.08 [-0.22, 0.38]
Subtotal (95% CI)	375		312		•	51.1 %	-0.19 [-0.39, 0.01]
Heterogeneity: $Tau^2 = 0.09$; (Chi ² = 121.61, df	= 9 (P<0.00001)); I ² =93%				
Test for overall effect: $Z = 1.8$	38 (P = 0.060)						
2 < 6 months Daley 2005	28	-0.01 (0.29)	53	-0.08 (0.44)		5.6 %	0.07 [-0.09, 0.23]
Pbert 2013	42	0 (0.2)	40	0.01 (0.2)	+	6.4 %	-0.01 [-0.10, 0.08]
Subtotal (95% CI)	70		93		•	120%	0.01 [-0.07 0.08]
Heterogeneity: $Tau^2 = 0.0$; Cl	$hi^2 = 0.74, df = 1$	(P = 0.39); I ² =).0%			12.0 /0	0.01 [0.07, 0.00]
Test for overall effect: $Z = 0.2$	21 (P = 0.83)						
3 6 to < 12 months	00		0.2	0.00 (0.00)		() (
Debar 2012	90	-0.15 (0.41)	83	-0.08 (0.36)	-	6.1 %	-0.07 [-0.18, 0.04]
Hofsteenge 2014	71	-0.07 (0.61)	51	0.03 (0.56)		5.0 %	-0.10 [-0.31, 0.11]
Pakpour 2015 (4)	3	-0.02 (0.78)	57	0.01 (0.69)		4.7 %	-0.03 [-0.26, 0.20]
Pakpour 2015 (5)	118	-0.24 (0.62)	58	0.01 (0.69)		5.0 %	-0.25 [-0.46, -0.04]
van Egmond-Frohlich 2006	6 250	-0.12 (0.44)	271	-0.13 (0.42)	+	6.5 %	0.01 [-0.06, 0.08]
Subtotal (95% CI)	642		520		•	27.4 %	-0.06 [-0.14, 0.02]
					-1 -05 0 05 1		

Favours intervention Favours control

(Continued ...)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 237 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Study or subgroup	Intervention		Control		Diffe	Mean rence	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Rando	m,95% Cl		IV,Random,95% CI
Heterogeneity: Tau ² = 0.00;	Chi ² = 6.18, df = 4	P = 0.19; $P = 100$	=35%					
Test for overall effect: $Z = 1$.	44 (P = 0.15)							
$4 \ge 12$ months								
Savoye 2007	105	-0.2 (0.2)	69	-0.05 (0.2)	-		6.6 %	-0.15 [-0.21, -0.09]
Vos 2011	32	-0.4 (0.96)	35	-0.1 (0.7)		_	2.9 %	-0.30 [-0.71, 0.11]
Subtotal (95% CI)	137		104		•		9.5 %	-0.15 [-0.21, -0.09]
Heterogeneity: $Tau^2 = 0.0$; C	$2hi^2 = 0.5 I, df = I$	$(P = 0.47); I^2 = 0$).0%					
Test for overall effect: $Z = 5$.	00 (P < 0.00001)							
Total (95% CI)	1224		1029		•		100.0 %	-0.13 [-0.22, -0.04]
Heterogeneity: $Tau^2 = 0.03$;	$Chi^2 = 142.63, df =$	= 18 (P<0.0000	I); I ² =87%					
Test for overall effect: $Z = 2$.	77 (P = 0.0056)							
Test for subgroup differences	$: Chi^2 = 12.17, df$	= 3 (P = 0.01), I	² =75%					
				-	-0.5 C	0.5	I	
				Favours	ntervention	Favours cont	trol	

(1) SDs imputed from other studies

(2) Boys

(3) Girls

(4) Motivational interviewing no parent

(5) Motivational interviewing with parent

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 238 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 8.1. Comparison 8 Interventions by control type, longest follow-up, Outcome 1 Body mass index (BMI) change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 8 Interventions by control type, longest follow-up

Outcome: I Body mass index (BMI) change

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% Cl		IV,Random,95% CI
I Interventions vs no int	ervention/wait l	ist control					
Brennan 2013	42	-0.69 (4.59)	21	0.76 (5.18)		2.1 %	-1.45 [-4.06, 1.16]
Ebbeling 2012	105	0.71 (2.9)	104	I (2.9)	-	4.5 %	-0.29 [-1.08, 0.50]
Pakpour 2015 (1)	118	-2.05 (6.18)	58	0.03 (8.33)		2.3 %	-2.08 [-4.50, 0.34]
Pakpour 2015 (2)	113	-0.63 (8.25)	57	0.03 (8.33)		2.0 %	-0.66 [-3.30, 1.98]
Patsopoulou 2017 (3)	55	-2.3 (1.13)	28	0.2 (1.14)	+	4.8 %	-2.50 [-3.02, -1.98]
Patsopoulou 2017 (4)	55	-3.1 (0.94)	28	0.2 (1.14)	+	4.9 %	-3.30 [-3.79, -2.81]
Schranz 2014	30	0.1 (4.16)	26	1.2 (5.77)		2.0 %	-1.10 [-3.77, 1.57]
Toulabi 2012	76	-2.92 (2.87)	76	-1.18 (2.44)		4.4 %	-1.74 [-2.59, -0.89]
Subtotal (95% CI)	594		398		•	27.0 %	-1.79 [-2.73, -0.85]
Heterogeneity: $Tau^2 = I$.21; Chi ² = 46.0	02, df = 7 (P<0.00001)); I ² =85%				
Test for overall effect: Z	= 3.74 (P = 0.0	0018)					
Carrel 2005	27	l (8.72)	23	0 (4.58)	-	1.3 %	1.00 [-2.78, 4.78]
Ebbeling 2003	8	-1.2 (2)	8	0.6 (1.4)		3.2 %	-1.80 [-3.49, -0.11]
Gourlan 2013	26	-1.61 (4.64)	28	0.12 (5.94)	.	1.9 %	-1.73 [-4.56, 1.10]
Hofsteenge 2014	71	0.9 (5.51)	51	1.3 (5.37)	-	2.8 %	-0.40 [-2.35, 1.55]
Jiang 2005	33	-2.6 (1.6)	35	-0. (.)	+	4.7 %	-2.50 [-3.16, -1.84]
NCT00132132 (5)	8	-0.37 (1)	13	1.28 (1.1)		4.3 %	-1.65 [-2.57, -0.73]
NCT00807560	13	-0.8 (5.3)	11	2.1 (8)		0.7 %	-2.90 [-8.44, 2.64]
Pbert 2013	42	0.01 (2.2)	40	0.23 (2.1)	-	4.3 %	-0.22 [-1.15, 0.71]
Pitetti 2007	5	-3 (7.18)	5	-0.9 (7.99)	·	0.3 %	-2.10 [-11.52, 7.32]
Saelens 2002	18	0.1 (4.09)	19	1.4 (3.5)		2.2 %	-1.30 [-3.76, 1.16]
Savoye 2007	105	-0.9 (4.1)	69	1.9 (4.2)		3.8 %	-2.80 [-4.06, -1.54]
Vissers 2008	22	-0.78 (1.42)	31	0.49 (0.74)	+	4.7 %	-1.27 [-1.92, -0.62]
Visuthranukul 2015	25	-0.2 (1.6)	27	0.4 (2)	-	4.2 %	-0.60 [-1.58, 0.38]
						•	

-10 -5 0 5 10

Favours intervention Favours control

(Continued ...)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 239 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% CI		IV,Random,95% CI
Subtotal (95% CI)	403		360		•	38.3 %	-1.41 [-2.00, -0.83]
Heterogeneity: $Tau^2 = 0$.	.49; Chi ² = 27.3	9, df = $12 (P = 0.01)$;	l ² =56%				
Test for overall effect: Z	= 4.75 (P < 0.00	(1000					
3 Interventions vs conco Brownell 1983 (6)	mitant therapy o	controls	6	01(35)		09%	456 [923 011]
	12	-1.00 (0.0)	0	-0.1 (5.5)		0.7 78	-1.50 [-7.25, 0.11]
Brownell 1983 (7)	12	-0.1 (3.1)	6	-0.1 (3.5)		1.5 %	0.0 [-3.30, 3.30]
Grey 2009	112	0.9 (3.2)	86	0.1 (3)		4.4 %	0.80 [-0.07, 1.67]
Jelalian 2016	17	- (7.)	7	1.7 (5.2)		0.8 %	-2.70 [-7.82, 2.42]
Kong 2014	34	-1.2 (4.1)	27	-0.2 (3.24)		3.0 %	-1.00 [-2.84, 0.84]
Nguyen 2012	73	0 (4.41)	78	I (4.09)		3.7 %	-1.00 [-2.36, 0.36]
Norman 2016 (8)	29	0.9 (4.29)	25	0.2 (4.18)	 •	2.4 %	0.70 [-1.56, 2.96]
Norman 2016 (9)	24	-0.6 (4.06)	28	0.6 (4.12)		2.5 %	-1.20 [-3.43, 1.03]
Resnicow 2005	45	1.3 (5.9)	62	0.5 (7.9)	 +	2.1 %	0.80 [-1.82, 3.42]
Sigal 2014 (10)	75	-0.9 (2.2)	26	0 (2.4)		4.1 %	-0.90 [-1.95, 0.15]
Sigal 2014 (11)	78	-0.5 (2.4)	25	0 (2.4)		4.1 %	-0.50 [-1.58, 0.58]
Sigal 2014 (12)	75	-0.6 (2.4)	25	0 (2.4)		4.1 %	-0.60 [-1.69, 0.49]
Wengle 2011	16	0.1 (5.86)	16	-0.5 (5.07)		1.2 %	0.60 [-3.20, 4.40]
Subtotal (95% CI)	602		417		•	34.7 %	-0.39 [-0.93, 0.14]
Heterogeneity: $Tau^2 = 0$.	.21; Chi ² = 15.7	6, df = 12 (P = 0.20);	l ² =24%				
Test for overall effect: Z	= 1.45 (P = 0.15	5)					
Total (95% CI)	1599		1175		•	100.0 %	-1.18 [-1.67, -0.69]
Heterogeneity: $Tau^2 = 1$.	21; Chi ² = 147.	87, df = 33 (P<0.000	$0); ^2 = 78$	8%			
Test for overall effect: Z	= 4.74 (P < 0.00	0001)	2 700/				
lest for subgroup differen	nces: Chi² = 9.6	4, dt = 2 (P = 0.01),	- =/9%				
						10	
				-10 Favours ir	-JUJ	ntrol	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 240 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. (1) Motivational interviewing with parents

- (2) Motivational interviewing no parents
- (3) Activity
- (4) Activity+Diet
- (5) Outcomes adjusted for covariates
- (6) Mother and child separate
- (7) Mother and child together
- (8) Girls
- (9) Boys
- (10) Diet, exercise + resistance
- (II) Diet + resistance
- (12) Diet + aerobic

Analysis 8.2. Comparison 8 Interventions by control type, longest follow-up, Outcome 2 BMI z score change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 8 Interventions by control type, longest follow-up

Outcome: 2 BMI z score change

Study or subgroup	Intervention		Control		l Differ	Mean rence	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Rando	m,95% Cl		IV,Random,95% CI
I Interventions vs no interve	ention/wait list con	trol						
Brennan 2013	42	-0.09 (0.42)	21	0.01 (0.4)	-+		4.5 %	-0.10 [-0.31, 0.11]
Luna-Pech 2014	26	-0.52 (0.26)	25	-0.05 (0.26)	+		5.3 %	-0.47 [-0.61, -0.33]
Pakpour 2015 (1)	113	-0.02 (0.78)	57	0.01 (0.69)	-	-	4.3 %	-0.03 [-0.26, 0.20]
Pakpour 2015 (2)	118	-0.24 (0.62)	58	0.01 (0.69)			4.6 %	-0.25 [-0.46, -0.04]
Vos 2011	32	-0.4 (0.96)	35	-0.1 (0.7)			2.6 %	-0.30 [-0.71, 0.11]
Subtotal (95% CI)	331		196		•		21.3 %	-0.23 [-0.42, -0.05]
Heterogeneity: $Tau^2 = 0.03$;	Chi ² = 14.19, df =	4 (P = 0.01); I ²	=72%					
Test for overall effect: $Z = 2$.48 (P = 0.013)							
2 Interventions vs usual care	controls							
					-2 -1 0	I 2		
				Favour	rs intervention	Favours contr	ol	
								(Continued)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 241 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV.Random.95% Cl	Weight	Mean Difference IV.Random.95% CI
Boodai 2014	31	0 (0.1)	32	0 (0.2)	+	6.0 %	0.0 [-0.08, 0.08]
Daley 2005	28	-0.01 (0.29)	53	-0.08 (0.44)	+	5.1 %	0.07 [-0.09, 0.23]
Debar 2012	90	-0.15 (0.41)	83	-0.08 (0.36)	-	5.6 %	-0.07 [-0.18, 0.04]
Ford 2010	44	-0.41 (0.66)	43	-0.14 (0.5)		4.1 %	-0.27 [-0.52, -0.02]
Hofsteenge 2014	71	-0.07 (0.61)	51	0.03 (0.56)	-+	4.6 %	-0.10 [-0.31, 0.11]
Jiang 2005 (3)	33	-1.7 (0.66)	35	-0.3 (0.56)	_ 	3.6 %	-1.40 [-1.69, -1.11]
NCT00807560	13	-0.1 (0.4)	9	0 (0.21)	-+-	4.0 %	-0.10 [-0.36, 0.16]
Patrick 2013	76	-0.13 (0.41)	25	0 (0.46)	-+	4.6 %	-0.13 [-0.33, 0.07]
Pbert 2013	42	0 (0.2)	40	0.01 (0.2)	+	5.9 %	-0.01 [-0.10, 0.08]
Saelens 2002	18	-0.05 (0.4)	19	0.07 (0.3)	-+-	4.3 %	-0.12 [-0.35, 0.11]
Savoye 2007	105	-0.2 (0.2)	69	-0.05 (0.2)	-	6.1 %	-0.15 [-0.21, -0.09]
van Egmond-Frohlich 2006	250	-0.12 (0.44)	271	-0.13 (0.42)	÷	6.0 %	0.01 [-0.06, 0.08]
Visuthranukul 2015	25	-0.3 (0.2)	27	-0.3 (0.5)	+	4.6 %	0.0 [-0.20, 0.20]
Subtotal (95% CI)	826		757		•	64. 7 %	-0.14 [-0.24, -0.04]
Heterogeneity: $Tau^2 = 0.03$; C	$hi^2 = 102.50$, df	= 12 (P<0.0000); ² =889	6			
3 Interventions vs concomitan	t therapy contro	bls					
Nguyen 2012	73	-0.09 (0.35)	78	-0.2 (0.46)	-	5.5 %	0.11 [-0.02, 0.24]
Norman 2016 (4)	29	-0.1 (3.36)	25	-0.1 (0.46)		0.4 %	0.0 [-1.24, 1.24]
Norman 2016 (5)	24	-0.1 (0.37)	28	0 (0.4)	-+-	4.6 %	-0.10 [-0.31, 0.11]
Wengle 2011	16	-0.03 (0.42)	16	-0.11 (0.45)	_ 	3.5 %	0.08 [-0.22, 0.38]
Subtotal (95% CI)	142		147		•	14.0 %	0.05 [-0.05, 0.16]
Heterogeneity: $Tau^2 = 0.0$; Ch	$i^2 = 2.83, df = 3$	P = 0.42; $P = 0.42$; $P =$	0.0%				
Total (95% CI)	1299		1100		•	100.0 %	-0.14 [-0.22, -0.05]
Heterogeneity: $Tau^2 = 0.03$; C	$ihi^2 = 144.54$, df	= 21 (P<0.0000)); ² =859	6			
Test for overall effect: $Z = 3.1$	5 (P = 0.0016)	2 (5 0 0 1)	12 010/				
lest for subgroup differences:	Chi² = 10.36, di	r = 2 (P = 0.01),	1- =81%				
					-2 -1 0 1	2	
				Favou	rs intervention Favours co	ntrol	
(1) Motivational interviewing	no parent						
(2) Mativational interviewing	with parent						

 $\left(2\right)$ Motivational interviewing with parent

(3) SDs imputed from other studies

(4) Girls

(5) Boys

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 242 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 9.1. Comparison 9 Interventions by mode, longest follow-up, Outcome I Body mass index (BMI) change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 9 Interventions by mode, longest follow-up

Outcome: I Body mass index (BMI) change

Intervention		Control		Mean Difference	Weight	Mean Difference
Ν	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% CI		IV,Random,95% CI
12	-4.66 (6.6)	6	-0.1 (3.5)		0.9 %	-4.56 [-9.23, 0.11]
12	-0.1 (3.1)	6	-0.1 (3.5)		1.6 %	0.0 [-3.30, 3.30]
27	I (8.72)	23	0 (4.58)		1.3 %	1.00 [-2.78, 4.78]
112	0.9 (3.2)	86	0.1 (3)		4.5 %	0.80 [-0.07, 1.67]
71	0.9 (5.51)	51	1.3 (5.37)		2.9 %	-0.40 [-2.35, 1.55]
8	-0.37 (1)	13	1.28 (1.1)		4.4 %	-1.65 [-2.57, -0.73]
73	0 (4.41)	78	I (4.09)		3.7 %	-1.00 [-2.36, 0.36]
113	-0.63 (8.25)	57	0.03 (8.33)		2.1 %	-0.66 [-3.30, 1.98]
118	-2.05 (6.18)	58	0.03 (8.33)	<u> </u>	2.3 %	-2.08 [-4.50, 0.34]
55	-3.1 (0.94)	28	0.2 (1.14)	+	4.9 %	-3.30 [-3.79, -2.81]
55	-2.3 (1.13)	28	0.2 (1.14)	+	4.9 %	-2.50 [-3.02, -1.98]
5	-3 (7.18)	5	-0.9 (7.99)		0.3 %	-2.10 [-11.52, 7.32]
45	1.3 (5.9)	62	0.5 (7.9)	-	2.1 %	0.80 [-1.82, 3.42]
105	-0.9 (4.1)	69	1.9 (4.2)		3.9 %	-2.80 [-4.06, -1.54]
30	0.1 (4.16)	26	1.2 (5.77)		2.1 %	-1.10 [-3.77, 1.57]
76	-2.92 (2.87)	76	-1.18 (2.44)		4.5 %	-1.74 [-2.59, -0.89]
25	-0.2 (1.6)	27	0.4 (2)		4.3 %	-0.60 [-1.58, 0.38]
942		699		•	50.4 % -1	.33 [-2.10, -0.55]
.66; Chi ² = 96.3	7, df = 16 (P<0.0000	I); I ² =839	%			
= 3.35 (P = 0.0	0080)					
42	-0.69 (4.59)	21	0.76 (5.18)		2.1 %	-1.45 [-4.06, 1.16]
105	0.71 (2.9)	104	I (2.9)	+	4.6 %	-0.29 [-1.08, 0.50]
					1	
			- E	D -5 0 5	10	
	Intervention N 12 12 27 112 71 8 73 113 118 55 55 5 45 105 30 76 25 942 66; $Chi^2 = 96.3$ = 3.35 (P = 0.0) 5 42 105	N Mean(SD)[kg/m2] 12 -4.66 (6.6) 12 -0.1 (3.1) 27 1 (8.72) 112 0.9 (3.2) 71 0.9 (5.51) 8 -0.37 (1) 73 0 (4.41) 113 -0.63 (8.25) 118 -2.05 (6.18) 5 -3.1 (0.94) 55 -3.1 (0.94) 55 -2.3 (1.13) 5 -3.1 (0.94) 55 -3.1 (0.94) 55 -2.3 (1.13) 5 -3.1 (0.94) 55 -2.3 (1.13) 5 -3.1 (0.94) 55 -2.3 (1.13) 5 -3.2 (1.6) 76 -2.92 (2.87) 25 -0.2 (1.6) 942 -0.69 (4.59) 66; Chi ² = 96.37, df = 16 (P<0.0000	Intervention Control N Mean(SD)[kg/m2] N 12 -4.66 (6.6) 6 12 -0.1 (3.1) 6 27 I (8.72) 23 112 0.9 (3.2) 86 71 0.9 (5.51) 51 8 -0.37 (1) 13 73 0 (4.41) 78 113 -0.63 (8.25) 57 118 -2.05 (6.18) 58 55 -3.1 (0.94) 28 55 -3.1 (0.94) 28 55 -3.1 (0.94) 28 55 -3.1 (0.94) 28 55 -3.1 (0.94) 28 55 -3.0 (1.13) 28 5 -3.0 (1.4) 59 30 0.1 (4.16) 26 76 -2.92 (2.87) 76 25 -0.2 (1.6) 27 942 -0.69 (4.59) 21 105 0.71 (2.9) 104	Intervention Control Mean(SD)[kg/m2] N Mean(SD)[kg/m2] 12 -4.66 (6.6) 6 -0.1 (3.5) 12 -0.1 (3.1) 6 -0.1 (3.5) 12 -0.1 (3.1) 6 -0.1 (3.5) 12 0.9 (3.2) 86 0.1 (3.5) 112 0.9 (5.5) 51 1.3 (5.37) 8 -0.37 (1) 13 1.28 (1.1) 73 0 (4.41) 78 1 (4.09) 113 -0.63 (8.25) 57 0.03 (8.33) 118 -2.05 (6.18) 58 0.03 (8.33) 155 -3.1 (0.94) 28 0.2 (1.14) 55 -2.3 (1.13) 28 0.2 (1.14) 55 -3.3 (7.18) 58 0.2 (5.7) 105 -0.9 (4.1) 69 1.9 (4.2) 30 0.1 (4.16) 26 1.2 (5.7) 76 -2.92 (2.87) 76 -1.18 (2.44) 25 -0.2 (1.6) 27 0.4 (2) 942 -0	Intervention Control Difference N Mean(SD)[kg/m2] N Mean(SD)[kg/m2] V/Random,95% CI 12 -4.66 (6.6) 6 -0.1 (3.5)	Intervention Control Difference Weight N Mean(SD)[kg/m2] N Mean(SD)[kg/m2] IVRandom,95% CI 12 -4.66 (6.6) 6 -0.1 (3.5) 0.9 % 12 -0.1 (3.1) 6 -0.1 (3.5) 1.6 % 27 1 (8.72) 23 0 (4.58) 1.3 % 112 0.9 (3.2) 86 0.1 (3) 4.5 % 71 0.9 (5.51) 5.1 1.3 (5.37) 2.9 % 8 -0.37 (1) 13 1.28 (1.1) - 4.4 % 73 0 (4.41) 78 1 (4.09) 3.7 % 2.3 % 113 -0.63 (8.25) 57 0.03 (8.33) 2.1 % 4.9 % 55 -3.1 (0.94) 28 0.2 (1.14) + 4.9 % 55 -3.2 (1.13) 28 0.2 (1.14) + 4.9 % 55 -3.2 (1.13) 28 0.2 (1.14) + 4.9 % 50 -0.9 (4.1) 69 1.9 (4.2) -

(Continued ...)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 243 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
,,	Ν	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% Cl	0	IV,Random,95% CI
Gourlan 2013	26	-1.61 (4.64)	28	0.12 (5.94)		1.9 %	-1.73 [-4.56, 1.10]
Jiang 2005	33	-2.6 (1.6)	35	-0. (.)	+	4.7 %	-2.50 [-3.16, -1.84]
Kong 2014	34	-1.2 (4.1)	27	-0.2 (3.24)		3.0 %	-1.00 [-2.84, 0.84]
Norman 2016 (8)	24	-0.6 (4.06)	28	0.6 (4.12)		2.5 %	-1.20 [-3.43, 1.03]
Norman 2016 (9)	29	0.9 (4.29)	25	0.2 (4.18)	·	2.5 %	0.70 [-1.56, 2.96]
Pbert 2013	42	0.01 (2.2)	40	0.23 (2.1)	-	4.4 %	-0.22 [-1.15, 0.71]
Saelens 2002	18	0.1 (4.09)	19	1.4 (3.5)		2.3 %	-1.30 [-3.76, 1.16]
Sigal 2014 (10)	75	-0.6 (2.4)	25	0 (2.4)		4.1 %	-0.60 [-1.69, 0.49]
Sigal 2014 (11)	75	-0.9 (2.2)	26	0 (2.4)	_+_	4.2 %	-0.90 [-1.95, 0.15]
Sigal 2014 (12)	78	-0.5 (2.4)	25	0 (2.4)		4.1 %	-0.50 [-1.58, 0.58]
Subtotal (95% CI)	581		403		•	40.4 % -	0.90 [-1.52, -0.27]
Heterogeneity: $Tau^2 = 0$.65; Chi ² = 29.7	'9, df = 11 (P = 0.002)); I ² =63%	,)			
Test for overall effect: Z	= 2.79 (P = 0.0	052)					
3 Mixed interventions							
Ebbeling 2003	8	-1.2 (2)	8	0.6 (1.4)		3.2 %	-1.80 [-3.49, -0.11]
Vissers 2008	22	-0.78 (1.42)	31	0.49 (0.74)		4.7 %	-1.27 [-1.92, -0.62]
Wengle 2011	16	0.1 (5.86)	16	-0.5 (5.07)		1.3 %	0.60 [-3.20, 4.40]
Subtotal (95% CI)	46		55		•	9.2 % -	1.29 [-1.89, -0.69]
Heterogeneity: $Tau^2 = 0$.0; Chi ² = 1.30,	df = 2 (P = 0.52); I^2 =	=0.0%				
Test for overall effect: Z	= 4.23 (P = 0.0	00023)					
Total (95% CI)	1569	,	1157		•	100.0 % -	1.15 [-1.65, -0.66]
Heterogeneity: $Tau^2 = 1$.23; Chi ² = 147	.49, df = 31 (P<0.000	$(21); ^2 = 79$	9%			
Test for overall effect: Z	= 4.58 (P < 0.0	0001)	,				
Test for subgroup differe	nces: Chi ² = 1.0)4, df = 2 (P = 0.59), I	² =0.0%				
0				_			
				-10	, -, , , , , , , , , , , , , , , , , ,		
				Favours i	ntervention Favours co	ntroi	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 244 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. Mother and child separate
Mother and child together
Outcomes adjusted for covariates
Motivational interviewing no parents
Motivational interviewing with parents
Activity+Diet
Activity
Boys
Girls
Diet + aerobic
Diet, exercise + resistance
Diet + resistance

Analysis 9.2. Comparison 9 Interventions by mode, longest follow-up, Outcome 2 BMI z score change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 9 Interventions by mode, longest follow-up

Outcome: 2 BMI z score change

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% Cl	Weight	Mean Difference IV,Random,95% CI
I Group interventions							
Boodai 2014	31	0 (0.1)	32	0 (0.2)	+	6.0 %	0.0 [-0.08, 0.08]
Daley 2005	28	-0.01 (0.29)	53	-0.08 (0.44)		5.2 %	0.07 [-0.09, 0.23]
Debar 2012	90	-0.15 (0.41)	83	-0.08 (0.36)		5.6 %	-0.07 [-0.18, 0.04]
Hofsteenge 2014	71	-0.07 (0.61)	51	0.03 (0.56)		4.6 %	-0.10 [-0.31, 0.11]
Nguyen 2012	73	-0.09 (0.35)	78	-0.2 (0.46)		5.5 %	0.11 [-0.02, 0.24]
Pakpour 2015 (1)	3	-0.02 (0.78)	57	0.01 (0.69)	_	4.3 %	-0.03 [-0.26, 0.20]
Pakpour 2015 (2)	118	-0.24 (0.62)	58	0.01 (0.69)		4.6 %	-0.25 [-0.46, -0.04]
Savoye 2007	105	-0.2 (0.2)	69	-0.05 (0.2)	-	6.1 %	-0.15 [-0.21, -0.09]
				Favour	-I -0.5 0 0.5 I rs intervention Favours contr	ol	

(Continued . . .)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 245 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% Cl	Weight	Mean Difference IV,Random,95% CI
Visuthranukul 2015	25	-0.3 (0.2)	27	-0.3 (0.5)	<u> </u>	4.6 %	0.0 [-0.20, 0.20]
Vos 2011	32	-0.4 (0.96)	35	-0.1 (0.7)		2.6 %	-0.30 [-0.71, 0.11]
Subtotal (95% CI)	686		543		•	49.0 %	-0.05 [-0.13, 0.02]
Heterogeneity: $Tau^2 = 0.01$; Chi ²	= 24.78, df =	9 (P = 0.003); I	2 =64%				
2 Individual interventions	0.16)						
Brennan 2013	42	-0.09 (0.42)	21	0.01 (0.4)	_+	4.5 %	-0.10 [-0.31, 0.11]
Ford 2010	44	-0.41 (0.66)	43	-0.14 (0.5)		4.1 %	-0.27 [-0.52, -0.02]
Jiang 2005 (3)	33	-1.7 (0.66)	35	-0.3 (0.56)		3.6 %	-1.40 [-1.69, -1.11]
Luna-Pech 2014	26	-0.52 (0.26)	25	-0.05 (0.26)	-	5.3 %	-0.47 [-0.61, -0.33]
Norman 2016 (4)	29	-0.1 (0.36)	25	-0.1 (0.46)		4.4 %	0.0 [-0.22, 0.22]
Norman 2016 (5)	24	-0.1 (0.37)	28	0 (0.4)		4.6 %	-0.10 [-0.31, 0.11]
Pbert 2013	42	0 (0.2)	40	0.01 (0.2)	+	5.9 %	-0.01 [-0.10, 0.08]
Saelens 2002	18	-0.05 (0.4)	19	0.07 (0.3)		4.3 %	-0.12 [-0.35, 0.11]
van Egmond-Frohlich 2006	250	-0.12 (0.44)	271	-0.13 (0.42)	ŧ	6.0 %	0.01 [-0.06, 0.08]
Subtotal (95% CI)	508		507		•	42.8 %	-0.26 [-0.45, -0.06]
Heterogeneity: $Tau^2 = 0.08$; Chi ² Test for overall effect: $Z = 2.57$ (3 Mixed interventions	= 117.30, df P = 0.010)	= 8 (P<0.00001)); I ² =93%				
Patrick 2013	76	-0.13 (0.41)	25	0 (0.46)		4.6 %	-0.13 [-0.33, 0.07]
Wengle 2011	16	-0.03 (0.42)	16	-0.11 (0.45)	<u> </u>	3.5 %	0.08 [-0.22, 0.38]
Subtotal (95% CI) Heterogeneity: Tau ² = 0.00; Chi ²	92 = 1.28, df =	I (P = 0.26); I ² =	41 =22%		•	8.2 %	-0.06 [-0.25, 0.14]
Test for overall effect: $Z = 0.56$ (P = 0.58)						
Total (95% CI) Heterogeneity: Tau ² = 0.03; Chi ² Test for overall effect: $Z = 3.05$ (1286 = 145.04, df P = 0.0023)	= 20 (P<0.0000	1091); ² =86%	6	*	100.0 %	-0.13 [-0.22, -0.05]
Test for subgroup differences: Ch	i ² = 3.73, df =	= 2 (P = 0.16), I ²	=46%				
						1	

Favours intervention Favours control

(1) Motivational interviewing no parent

(2) Motivational interviewing with parent

(3) SDs imputed from other studies

(4) Girls

(5) Boys

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 246 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 10.1. Comparison 10 Interventions by setting, longest follow-up, Outcome 1 Body mass index (BMI) change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 10 Interventions by setting, longest follow-up

Outcome: I Body mass index (BMI) change

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% CI		IV,Random,95% CI
I School based							
Carrel 2005	27	I (8.72)	23	0 (4.58)		• 1.3 %	1.00 [-2.78, 4.78]
Grey 2009	112	0.9 (3.2)	86	0.1 (3)		4.4 %	0.80 [-0.07, 1.67]
Jiang 2005	33	-2.6 (1.6)	35	-0.1 (1.1)		4.7 %	-2.50 [-3.16, -1.84]
Pbert 2013	42	0.01 (2.2)	40	0.23 (2.1)		4.3 %	-0.22 [-1.15, 0.71]
Pitetti 2007	5	-3 (7.18)	5	-0.9 (7.99)	• • •	• 0.3 %	-2.10 [-11.52, 7.32]
Toulabi 2012	76	-2.92 (2.87)	76	-1.18 (2.44)	<u> </u>	4.5 %	-1.74 [-2.59, -0.89]
Vissers 2008	22	-0.78 (1.42)	31	0.49 (0.74)		4.7 %	-1.27 [-1.92, -0.62]
Subtotal (95% CI) 317		296			24.2 %	-0.91 [-1.97, 0.15]
Heterogeneity: $Tau^2 = 1$.40; Chi ² = 42.6	7, df = 6 (P<0.0000 I)	; I ² =86%				
Test for overall effect: Z	= 1.68 (P = 0.0	93)					
2 Community based	LOE	071 (20)	104	1 (2 0)		1 E 0/	
Ebbeling 2012	105	0.71 (2.7)	104	1 (2.7)		4.5 %	-0.27 [-1.06, 0.50]
Nguyen 2012	73	0 (4.41)	78	1 (4.09)		3.7 %	-1.00 [-2.36, 0.36]
Patsopoulou 2017	55	-3.1 (0.94)	28	0.2 (1.14)		4.9 %	-3.30 [-3.79, -2.81]
Patsopoulou 2017	55	-2.3 (1.13)	28	0.2 (1.14)	_ —	4.9 %	-2.50 [-3.02, -1.98]
Resnicow 2005	45	1.3 (5.9)	62	0.5 (7.9)		2.1 %	0.80 [-1.82, 3.42]
Saelens 2002	18	0.1 (4.09)	19	1.4 (3.5)		2.2 %	-1.30 [-3.76, 1.16]
Schranz 2014	30	0.1 (4.16)	26	1.2 (5.77)		2.0 %	-1.10 [-3.77, 1.57]
Sigal 2014 (1)	78	-0.5 (2.4)	25	0 (2.4)		4.1 %	-0.50 [-1.58, 0.58]
Sigal 2014 (2)	75	-0.6 (2.4)	25	0 (2.4)		4.1 %	-0.60 [-1.69, 0.49]
Sigal 2014 (3)	75	-0.9 (2.2)	26	0 (2.4)		4.2 %	-0.90 [-1.95, 0.15]
Subtotal (95% CI) 609		421		•	36.7 %	-1.20 [-2.11, -0.29]
Heterogeneity: $Tau^2 = I$.64; Chi ² = 74.0	04, df = 9 (P<0.00001)); l ² =88%				
Test for overall effect: Z	= 2.58 (P = 0.0	099)					
3 Healthcare based	10	0.40.44.50	21			210/	
Brennan 2013	42	-0.69 (4.59)	21	0.76 (5.18)		2.1 %	-1.45 [-4.06, 1.16]
				-	4 -2 0 2	4	
				Favours	s intervention Favours con	trol	

(Continued ...)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 247 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
,	Ν	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% CI	0	IV,Random,95% CI
Brownell 1983 (4)	12	-4.66 (6.6)	6	-0.1 (3.5)	·	0.9 %	-4.56 [-9.23, 0.11]
Brownell 1983 (5)	12	-0. (3.)	6	-0.1 (3.5)		1.5 %	0.0 [-3.30, 3.30]
Ebbeling 2003	8	-1.2 (2)	8	0.6 (1.4)		3.2 %	-1.80 [-3.49, -0.11]
Gourlan 2013	26	-1.61 (4.64)	28	0.12 (5.94)	·	1.9 %	-1.73 [-4.56, 1.10]
Hofsteenge 2014	71	0.9 (5.51)	51	1.3 (5.37)		2.8 %	-0.40 [-2.35, 1.55]
Kong 2014	34	-1.2 (4.1)	27	-0.2 (3.24)		3.0 %	-1.00 [-2.84, 0.84]
NCT00132132 (6)	8	-0.37 (1)	13	1.28 (1.1)	<u> </u>	4.4 %	-1.65 [-2.57, -0.73]
NCT00807560	13	-0.8 (5.3)	11	2.1 (8)	• • • · · · · · · · · · · · · · · · · ·	0.7 %	-2.90 [-8.44, 2.64]
Norman 2016 (7)	29	0.9 (4.29)	25	0.2 (4.18)		2.5 %	0.70 [-1.56, 2.96]
Norman 2016 (8)	24	-0.6 (4.06)	28	0.6 (4.12)		2.5 %	-1.20 [-3.43, 1.03]
Pakpour 2015 (9)	118	-2.05 (6.18)	58	0.03 (8.33)	·	2.3 %	-2.08 [-4.50, 0.34]
Pakpour 2015 (10)	113	-0.63 (8.25)	57	0.03 (8.33)		2.1 %	-0.66 [-3.30, 1.98]
Savoye 2007	105	-0.9 (4.1)	69	1.9 (4.2)	←	3.8 %	-2.80 [-4.06, -1.54]
Visuthranukul 2015	25	-0.2 (1.6)	27	0.4 (2)		4.3 %	-0.60 [-1.58, 0.38]
Wengle 2011	16	0.1 (5.86)	16	-0.5 (5.07)		→ I.3 %	0.60 [-3.20, 4.40]
Subtotal (95% CI)) 656		451		•	39.1 %	-1.32 [-1.81, -0.82]
Heterogeneity: $Tau^2 = 0$	0.10; Chi ² = 16.6	55, df = 15 (P = 0.34);	$ ^2 = 0\%$				
Test for overall effect: Z	= 5.18 (P < 0.0)	0001)			_		
Total (95% CI)	1582		1168		•	100.0 %	-1.17 [-1.66, -0.68]
Heterogeneity: $Iau^2 = I$.22; $Chi^2 = 14/$.70, df = 32 (P<0.000	01); 14 = /8	3%			
Test for subgroup differe	-7.00 (1 < 0.0)	48 df = 2 (P = 0.79)	$^{2} = 0.0\%$				
lest for subgroup differe	.nees. en - 0.	10, 01 - 2(1 - 0.77),	-0.070			_	
					4 -2 0 2	4	
				Favours	s intervention Favours co	ntrol	

- (1) Diet + resistance
- (2) Diet + aerobic
- (3) Diet, exercise + resistance
- (4) Mother and child separate
- (5) Mother and child together
- (6) Outcomes adjusted for covariates
- (7) Girls
- (8) Boys
- (9) Motivational interviewing with parents
- (10) Motivational interviewing no parents

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 248 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 10.2. Comparison 10 Interventions by setting, longest follow-up, Outcome 2 BMI z score change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 10 Interventions by setting, longest follow-up

Outcome: 2 BMI z score change

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% Cl	Weight	Mean Difference IV,Random,95% Cl
I School based		~ /		. ,			
Jiang 2005 (1)	33	-1.7 (0.66)	35	-0.3 (0.56)		3.5 %	-1.40 [-1.69, -1.11]
Pbert 2013	42	0 (0.2)	40	0.01 (0.2)	+	5.7 %	-0.01 [-0.10, 0.08]
Subtotal (95% CI)	75		75			9.2 %	-0.70 [-2.06, 0.66]
Heterogeneity: $Tau^2 = 0.95$;	Chi ² = 80.13, df =	I (P<0.0000)); l ² =99%				
Test for overall effect: $Z = 1$.	00 (P = 0.32)						
2 Community based							
Nguyen 2012	73	-0.09 (0.35)	78	-0.2 (0.46)	-	5.3 %	0.11 [-0.02, 0.24]
Patrick 2013	76	-0.13 (0.41)	25	0 (0.46)	-+	4.5 %	-0.13 [-0.33, 0.07]
Saelens 2002	18	-0.05 (0.4)	19	0.07 (0.3)	-+-	4.2 %	-0.12 [-0.35, 0.11]
Subtotal (95% CI)	167		122		+	13.9 %	-0.03 [-0.20, 0.15]
Heterogeneity: $Tau^2 = 0.01$;	Chi ² = 5.35, df =	2 (P = 0.07); I ²	=63%				
Test for overall effect: $Z = 0$.	32 (P = 0.75)						
3 Healthcare based							
Boodai 2014	31	0 (0.1)	32	0 (0.2)	ŧ	5.8 %	0.0 [-0.08, 0.08]
Brennan 2013	42	-0.09 (0.42)	21	0.01 (0.4)	-+-	4.3 %	-0.10 [-0.31, 0.11]
Daley 2005	28	-0.01 (0.29)	53	-0.08 (0.44)	+	5.0 %	0.07 [-0.09, 0.23]
Debar 2012	90	-0.15 (0.41)	83	-0.08 (0.36)	-	5.4 %	-0.07 [-0.18, 0.04]
Ford 2010	44	-0.41 (0.66)	43	-0.14 (0.5)		4.0 %	-0.27 [-0.52, -0.02]
Hofsteenge 2014	71	-0.07 (0.61)	51	0.03 (0.56)	-+-	4.4 %	-0.10 [-0.31, 0.11]
Luna-Pech 2014	26	-0.52 (0.26)	25	-0.05 (0.26)	-	5.1 %	-0.47 [-0.61, -0.33]
NCT00807560	13	-0.1 (0.4)	9	0 (0.21)	_+_	3.8 %	-0.10 [-0.36, 0.16]
Norman 2016 (2)	29	-0.1 (0.36)	25	-0.1 (0.46)	+	4.2 %	0.0 [-0.22, 0.22]
Norman 2016 (3)	24	-0.1 (0.37)	28	0 (0.4)	-+-	4.4 %	-0.10 [-0.31, 0.11]
Pakpour 2015 (4)	118	-0.24 (0.62)	58	0.01 (0.69)		4.4 %	-0.25 [-0.46, -0.04]
Pakpour 2015 (5)	113	-0.02 (0.78)	57	0.01 (0.69)	+	4.1 %	-0.03 [-0.26, 0.20]
					-2 -1 0 1 2	2	

Favours intervention Favours control

(Continued . . .)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 249 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
(Continued)
-------------	---

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,95% CI		IV,Random,95% CI
Savoye 2007	105	-0.2 (0.2)	69	-0.05 (0.2)		5.9 %	-0.15 [-0.21, -0.09]
van Egmond-Frohlich 2006	250	-0.12 (0.44)	271	-0.13 (0.42)	÷	5.8 %	0.01 [-0.06, 0.08]
Visuthranukul 2015	25	-0.3 (0.2)	27	-0.3 (0.5)	+	4.4 %	0.0 [-0.20, 0.20]
Vos 2011	32	-0.4 (0.96)	35	-0.1 (0.7)		2.5 %	-0.30 [-0.71, 0.11]
Wengle 2011	16	-0.03 (0.42)	16	-0.11 (0.45)	_ 	3.4 %	0.08 [-0.22, 0.38]
Subtotal (95% CI)	1057		903		•	7 6.9 %	-0.10 [-0.17, -0.03]
Heterogeneity: $Tau^2 = 0.01$; C	hi ² = 55.24, df =	= 16 (P<0.0000	I); I ² =71%				
Test for overall effect: $Z = 2.78$	B (P = 0.0054)						
Total (95% CI)	1299		1100		•	100.0 %	-0.13 [-0.21, -0.05]
Heterogeneity: Tau ² = 0.03; C	$hi^2 = 145.05$, df	= 21 (P<0.000	01); I ² =869	6			
Test for overall effect: $Z = 3.1$	I (P = 0.0019)						
Test for subgroup differences:	$Chi^2 = 1.30, df =$	= 2 (P = 0.52), I	2 =0.0%				

-2 -1 0 1

2

Favours intervention Favours control

(1) SDs imputed from other studies

(2) Girls

(3) Boys

(4) Motivational interviewing with parent

(5) Motivational interviewing no parent

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 250 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 11.1. Comparison 11 Interventions versus controls by intervention type, longest follow-up, Outcome 1 Body mass index (BMI) change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: II Interventions versus controls by intervention type, longest follow-up

Outcome: I Body mass index (BMI) change

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% CI		IV,Random,95% CI
I Multidisciplinary interve	entions						
Brennan 2013	42	-0.69 (4.59)	21	0.76 (5.18)		2.1 %	-1.45 [-4.06, 1.16]
Brownell 1983 (1)	12	-0.1 (3.1)	6	-0.1 (3.5)		1.5 %	0.0 [-3.30, 3.30]
Brownell 1983 (2)	12	-4.66 (6.6)	6	-0.1 (3.5)		0.9 %	-4.56 [-9.23, 0.11]
Gourlan 2013	26	-1.61 (4.64)	28	0.12 (5.94)		1.9 %	-1.73 [-4.56, 1.10]
Grey 2009	112	0.9 (3.2)	86	0.1 (3)		4.4 %	0.80 [-0.07, 1.67]
Hofsteenge 2014	71	0.9 (5.51)	51	1.3 (5.37)		2.8 %	-0.40 [-2.35, 1.55]
Jelalian 2016	17	- (7.)	7	1.7 (5.2)		0.8 %	-2.70 [-7.82, 2.42]
Jiang 2005	33	-2.6 (1.6)	35	-0.1 (1.1)	+	4.7 %	-2.50 [-3.16, -1.84]
Kong 2014	34	-1.2 (4.1)	27	-0.2 (3.24)		3.0 %	-1.00 [-2.84, 0.84]
NCT00132132 (3)	8	-0.37 (1)	13	1.28 (1.1)		4.3 %	-1.65 [-2.57, -0.73]
NCT00807560	13	-0.8 (5.3)	11	2.1 (8)		0.7 %	-2.90 [-8.44, 2.64]
Nguyen 2012	73	0 (4.41)	78	I (4.09)		3.7 %	-1.00 [-2.36, 0.36]
Norman 2016 (4)	24	-0.6 (4.06)	28	0.6 (4.12)		2.5 %	-1.20 [-3.43, 1.03]
Norman 2016 (5)	29	0.9 (4.29)	25	0.2 (4.18)		2.4 %	0.70 [-1.56, 2.96]
Pakpour 2015 (6)	113	-0.63 (8.25)	57	0.03 (8.33)		2.0 %	-0.66 [-3.30, 1.98]
Pakpour 2015 (7)	118	-2.05 (6.18)	58	0.03 (8.33)	_	2.3 %	-2.08 [-4.50, 0.34]
Patsopoulou 2017 (8)	55	-3.1 (0.94)	28	0.2 (1.14)	+	4.9 %	-3.30 [-3.79, -2.81]
Pbert 2013	42	0.01 (2.2)	40	0.23 (2.1)		4.3 %	-0.22 [-1.15, 0.71]
Resnicow 2005	45	1.3 (5.9)	62	0.5 (7.9)		2.1 %	0.80 [-1.82, 3.42]
Saelens 2002	18	0.1 (4.09)	19	1.4 (3.5)		2.2 %	-1.30 [-3.76, 1.16]
Savoye 2007	105	-0.9 (4.1)	69	1.9 (4.2)	<u> </u>	3.8 %	-2.80 [-4.06, -1.54]
Sigal 2014 (9)	78	-0.5 (2.4)	25	0 (2.4)	-+	4.1 %	-0.50 [-1.58, 0.58]
Sigal 2014 (10)	75	-0.9 (2.2)	26	0 (2.4)		4.1 %	-0.90 [-1.95, 0.15]
						1	

-10 -5 0 5 10 Favours intervention Favours control

(Continued . . .)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 251 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% CI		IV,Random,95% CI
Sigal 2014 (11)	75	-0.6 (2.4)	25	0 (2.4)		4.1 %	-0.60 [-1.69, 0.49]
Toulabi 2012	76	-2.92 (2.87)	76	-1.18 (2.44)		4.4 %	-1.74 [-2.59, -0.89]
Vissers 2008	22	-0.78 (1.42)	31	0.49 (0.74)	+	4.7 %	-1.27 [-1.92, -0.62]
Wengle 2011	16	0.1 (5.86)	16	-0.5 (5.07)		1.2 %	0.60 [-3.20, 4.40]
Subtotal (95% CI)	1344		954		•	79.7 %	-1.18 [-1.75, -0.62]
Heterogeneity: $Tau^2 = 1.2$	36; Chi ² = 119.5	57, df = 26 (P<0.0000	I); I ² =78	%			
Test for overall effect: Z =	= 4.08 (P = 0.00	0045)					
2 Physical activity only							
Carrel 2005	27	I (8.72)	23	0 (4.58)		1.3 %	1.00 [-2.78, 4.78]
Patsopoulou 2017 (12	2) 55	-2.3 (1.13)	28	0.2 (1.14)	+	4.8 %	-2.50 [-3.02, -1.98]
Pitetti 2007	5	-3 (7.18)	5	-0.9 (7.99) *	· · ·	0.3 %	-2.10 [-11.52, 7.32]
Schranz 2014	30	0.1 (4.16)	26	1.2 (5.77)		2.0 %	-1.10 [-3.77, 1.57]
Subtotal (95% CI)	117		82		•	8.4 %	-1.80 [-3.21, -0.40]
Heterogeneity: $Tau^2 = 0.7$	71; Chi ² = 4.16,	df = 3 (P = 0.25); I ² =	=28%				
Test for overall effect: Z =	= 2.51 (P = 0.01	2)					
3 Diet only							
Ebbeling 2003	8	-1.2 (2)	8	0.6 (1.4)		3.2 %	-1.80 [-3.49, -0.11]
Ebbeling 2012	105	0.71 (2.9)	104	I (2.9)	+	4.5 %	-0.29 [-1.08, 0.50]
Visuthranukul 2015	25	-0.2 (1.6)	27	0.4 (2)		4.2 %	-0.60 [-1.58, 0.38]
Subtotal (95% CI)	138		139		•	11.9 %	-0.62 [-1.29, 0.06]
Heterogeneity: $Tau^2 = 0.0$	08; Chi ² = 2.52,	df = 2 (P = 0.28); I ² =	=21%				
Test for overall effect: Z =	= 1.80 (P = 0.07	2)					
Total (95% CI)	1599		1175		•	100.0 %	-1.18 [-1.67, -0.69]
Heterogeneity: $Tau^2 = 1.2$	21; Chi ² = 147.8	37, df = 33 (P<0.0000	I); I ² =78	%			
Test for overall effect: Z =	= 4.74 (P < 0.00	001)					
Test for subgroup differer	hces: $Chi^2 = 2.87$	7, df = 2 (P = 0.24), I ²	=30%				
				-10	0 -5 0 5	10	
				Favours i	intervention Favours	control	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 252 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. Mother and child together
 Mother and child separate
 Outcomes adjusted for covariates
 Boys
 Girls
 Motivational interviewing no parents
 Motivational interviewing with parents
 Activity+Diet
 Diet + resistance
 Diet + aerobic
 Activity

Analysis 11.2. Comparison 11 Interventions versus controls by intervention type, longest follow-up, Outcome 2 BMI z score change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 11 Interventions versus controls by intervention type, longest follow-up

Outcome: 2 BMI z score change

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,95% CI		IV,Random,95% CI
I Multidisciplinary interventic	ons						
Boodai 2014	31	0 (0.1)	32	0 (0.2)	+	5.8 %	0.0 [-0.08, 0.08]
Brennan 2013	42	-0.09 (0.42)	21	0.01 (0.4)		4.3 %	-0.10 [-0.31, 0.11]
Daley 2005	28	-0.01 (0.29)	53	-0.08 (0.44)		5.0 %	0.07 [-0.09, 0.23]
Debar 2012	90	-0.15 (0.41)	83	-0.08 (0.36)		5.4 %	-0.07 [-0.18, 0.04]
Hofsteenge 2014	71	-0.07 (0.61)	51	0.03 (0.56)		4.4 %	-0.10 [-0.31, 0.11]
Jiang 2005 (1)	33	-1.7 (0.66)	35	-0.3 (0.56)	•	3.5 %	-1.40 [-1.69, -1.11]
NCT00807560	13	-0.1 (0.4)	9	0 (0.21)		3.8 %	-0.10 [-0.36, 0.16]
				Favou	-I -0.5 0 0.5 rs intervention Favours c	l ontrol	(

(Continued . . .)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 253 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

(... Continued)

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV.Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Nguyen 2012	73	-0.09 (0.35)	78	-0.2 (0.46)		5.3 %	0.11 [-0.02, 0.24]
Norman 2016 (2)	24	-0.1 (0.37)	28	0 (0.4)		4.4 %	-0.10 [-0.31, 0.11]
Norman 2016 (3)	29	-0.1 (0.36)	25	-0.1 (0.46)		4.2 %	0.0 [-0.22, 0.22]
Pakpour 2015 (4)	113	-0.02 (0.78)	57	0.01 (0.69)		4.1 %	-0.03 [-0.26, 0.20]
Pakpour 2015 (5)	118	-0.24 (0.62)	58	0.01 (0.69)		4.4 %	-0.25 [-0.46, -0.04]
Patrick 2013	76	-0.13 (0.41)	25	0 (0.46)		4.5 %	-0.13 [-0.33, 0.07]
Pbert 2013	42	0 (0.2)	40	0.01 (0.2)	+	5.7 %	-0.01 [-0.10, 0.08]
Saelens 2002	18	-0.05 (0.4)	19	0.07 (0.3)	+ _	4.2 %	-0.12 [-0.35, 0.11]
Savoye 2007	105	-0.2 (0.2)	69	-0.05 (0.2)	-	5.9 %	-0.15 [-0.21, -0.09]
van Egmond-Frohlich 2006	250	-0.12 (0.44)	271	-0.13 (0.42)	-	5.8 %	0.01 [-0.06, 0.08]
Vos 2011	32	-0.4 (0.96)	35	-0.1 (0.7)		2.5 %	-0.30 [-0.71, 0.11]
Wengle 2011	16	-0.03 (0.42)	16	-0.11 (0.45)	-	3.4 %	0.08 [-0.22, 0.38]
Subtotal (95% CI)	1204		1005		•	86.4 %	-0.11 [-0.19, -0.03]
Test for overall effect: $Z = 2.5$ 2 Physical activity only Subtotal (95% CI)	6 (P = 0.010)	- 18 (P<0.0000	n); I842 0	6			Not estimable
Heterogeneity: not applicable	U		U				Not estimable
Test for overall effect: not app	licable						
3 Diet only Ford 2010	44	-0.41 (0.66)	43	-0.14 (0.5)		4.0 %	-0.27 [-0.52, -0.02]
Luna-Pech 2014	26	-0.52 (0.26)	25	-0.05 (0.26)		5.1 %	-0.47 [-0.61, -0.33]
Visuthranukul 2015	25	-0.3 (0.2)	27	-0.3 (0.5)		4.4 %	0.0 [-0.20, 0.20]
Subtotal (95% CI)	95	()	95	()	-	13.6 %	-0.25 [-0.55, 0.04]
Heterogeneity: $Tau^2 = 0.06$; C	Chi ² = 13.78, df =	= 2 (P = 0.001);	l ² =85%			-0.0 /	
Test for overall effect: $Z = 1.6$	8 (P = 0.093)						
Total (95% CI)	1299	21 (D -0.000)	1100		•	100.0 %	-0.13 [-0.21, -0.05]
Heterogeneity: $Iau^2 = 0.03$; C Test for overall effect: $7 = 3$ [$_{\rm hl^2} = 145.05$, dt 1 (P = 0.0019)	= 21 (P<0.0000	01); 1 ² =869	6			
Test for subgroup differences:	$Chi^2 = 0.85, df =$	= I (P = 0.36), I ²	2 =0.0%				
						1	
					-1 -0.5 0 0.5	I	
				Favou	rs intervention Favours co	ntrol	
(1) SDs imputed from other	studies						

(2) Boys

(3) Girls

(4) Motivational interviewing no parent

(5) Motivational interviewing with parent

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 254 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 12.1. Comparison 12 Interventions versus controls by psychological approach, longest follow-up, Outcome I Body mass index (BMI) change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 12 Interventions versus controls by psychological approach, longest follow-up

Outcome: I Body mass index (BMI) change

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% Cl		IV,Random,95% CI
I Cognitive behavioural							
Hofsteenge 2014	71	0.9 (5.51)	51	1.3 (5.37)	· · · · · · · · · · · · · · · · · · ·	2.5 %	-0.40 [-2.35, 1.55]
Jelalian 2016	17	- (7.)	7	1.7 (5.2)		0.5 %	-2.70 [-7.82, 2.42]
Nguyen 2012	73	0 (4.41)	78	I (4.09)	· · · · · · · · · · · · · · · · · · ·	3.8 %	-1.00 [-2.36, 0.36]
Norman 2016 (1)	25	-0.6 (4.06)	28	0.6 (4.12)	· · · · · · · · · · · · · · · · · · ·	2.2 %	-1.20 [-3.40, 1.00]
Norman 2016 (2)	29	0.9 (4.29)	25	0.2 (4.18)		2.1 %	0.70 [-1.56, 2.96]
Pbert 2013	42	0.01 (2.2)	40	0.23 (2.1)		5.0 %	-0.22 [-1.15, 0.71]
Vos 2011	32	-0.4 (0.96)	35	-0.1 (0.7)		6.6 %	-0.30 [-0.71, 0.11]
Subtotal (95% CI) 289		264		-	22.8 %	-0.35 [-0.69, 0.00]
Heterogeneity: $Tau^2 = 0$	0.0; Chi ² = 3.22,	df = 6 (P = 0.78); $I^2 =$	=0.0%				
Test for overall effect: Z	= 1.98 (P = 0.0	48)					
2 Motivational interview	ring						
Brennan 2013	42	-0.69 (4.59)	21	0.76 (5.18)	← ↓	1.7 %	-1.45 [-4.06, 1.16]
Gourlan 2013 (3)	26	-1.61 (4.64)	28	0.12 (5.94)	••	1.5 %	-1.73 [-4.56, 1.10]
Pakpour 2015 (4)	113	-0.63 (8.25)	57	0.03 (8.33)	• • • • • • • • • • • • • • • • • • •	1.7 %	-0.66 [-3.30, 1.98]
Pakpour 2015 (5)	118	-2.05 (6.18)	58	0.03 (8.33)	·	1.9 %	-2.08 [-4.50, 0.34]
Resnicow 2005	45	1.3 (5.9)	62	0.5 (7.9)		1.7 %	0.80 [-1.82, 3.42]
Subtotal (95% CI) 344		226			8.4 %	-1.04 [-2.21, 0.13]
Heterogeneity: $Tau^2 = 0$	0.0; $Chi^2 = 3.02$,	df = 4 (P = 0.56); $I^2 =$	=0.0%				
Test for overall effect: Z	= 1.74 (P = 0.0	81)					
3 Other psychological th	neory						
Brownell 1983 (6)	12	-0.1 (3.1)	6	-0.1 (3.5)	• • • • •	1.2 %	0.0 [-3.30, 3.30]
Brownell 1983 (7)	12	-4.66 (6.6)	6	-0.1 (3.5)	·	0.6 %	-4.56 [-9.23, 0.11]
Grey 2009	112	0.9 (3.2)	86	0.1 (3)		5.2 %	0.80 [-0.07, 1.67]
				Favour	-z -I U I .	∠ rol	

(Continued ...)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 255 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

(... Continued)

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% CI		IV,Random,95% CI
Jiang 2005	33	-2.6 (1.6)	35	-0. (.)	4	5.9 %	-2.50 [-3.16, -1.84]
Kong 2014	34	-1.2 (4.1)	27	-0.2 (3.24)	·	2.7 %	-1.00 [-2.84, 0.84]
NCT00132132 (8)	8	-0.37 (1)	13	1.28 (1.1)	← ■	5.1 %	-1.65 [-2.57, -0.73]
Saelens 2002	18	0.1 (4.09)	19	1.4 (3.5)	· · · · · · · · · · · · · · · · · · ·	1.9 %	-1.30 [-3.76, 1.16]
Savoye 2007	105	-0.9 (4.1)	69	1.9 (4.2)	←	4.1 %	-2.80 [-4.06, -1.54]
Vissers 2008	22	-0.78 (1.42)	31	0.49 (0.74)	_ 	5.9 %	-1.27 [-1.92, -0.62]
Wengle 2011	16	0.1 (5.86)	16	-0.5 (5.07)	• • • • • • • • • • • • • • • • • • • •	→ 0.9 %	0.60 [-3.20, 4.40]
Subtotal (95% CI) 372		308			33.5 %	-1.34 [-2.25, -0.42]
Heterogeneity: Tau ² = 1	.35; Chi ² = 44.3	I, df = 9 (P<0.00001)	; l ² =80%				
Test for overall effect: Z	= 2.86 (P = 0.0	043)					
4 No theoretical basis/n	o psychological o	component					
Carrel 2005	27	I (8.72)	23	0 (4.58)	•	→ 0.9 %	1.00 [-2.78, 4.78]
Ebbeling 2003	8	-1.2 (2)	8	0.6 (1.4)	* · · · · · · · · · · · · · · · · · · ·	3.0 %	-1.80 [-3.49, -0.11]
Ebbeling 2012	105	0.71 (2.9)	104	I (2.9)		5.5 %	-0.29 [-1.08, 0.50]
Pitetti 2007	5	-3 (7.18)	5	-0.9 (7.99)	•	→ 0.2 %	-2.10 [-11.52, 7.32]
Schranz 2014	30	0.1 (4.16)	26	1.2 (5.77)	• • · · · · · · · · · · · · · · · · · ·	1.6 %	-1.10 [-3.77, 1.57]
Sigal 2014 (9)	75	-0.6 (2.4)	25	0 (2.4)		4.6 %	-0.60 [-1.69, 0.49]
Sigal 2014 (10)	75	-0.9 (2.2)	26	0 (2.4)		4.7 %	-0.90 [-1.95, 0.15]
Sigal 2014 (11)	78	-0.5 (2.4)	25	0 (2.4)		4.6 %	-0.50 [-1.58, 0.58]
Toulabi 2012	76	-2.92 (2.87)	76	-1.18 (2.44)	*=	5.3 %	-1.74 [-2.59, -0.89]
Visuthranukul 2015	25	-0.2 (1.6)	27	0.4 (2)		4.9 %	-0.60 [-1.58, 0.38]
Subtotal (95% CI) 504		345		•	35.3 %	-0.83 [-1.21, -0.45]
Heterogeneity: $Tau^2 = 0$	0.01; Chi ² = 9.28	$h, df = 9 (P = 0.41); 1^2$	=3%				
Test for overall effect: Z	= 4.28 (P = 0.0	00019)					
Total (95% CI)	1509		1143		•	100.0 %	-0.94 [-1.33, -0.55]
Heterogeneity: $Tau^2 = 0$	0.56; Chi ² = 79.0	07, df = 31 (P<0.0000	$); ^2 = 6 ^{\circ}$	%			
Test for overall effect: Z	= 4.75 (P < 0.0	0001)					
Test for subgroup differe	ences: Chi ² = 6.4	14, df = 3 (P = 0.09), I	² =53%				
						1	
					-2 -1 0 1	2	
				Favour	s intervention Favours o	ontrol	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 256 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. (I) Boys

(2) Girls

(3) Outcomes adjusted for covariates

- (4) Motivational interviewing no parents
- (5) Motivational interviewing with parents
- (6) Mother and child together
- (7) Mother and child separate

(8) Outcomes adjusted for covariates

(9) Diet + aerobic

(10) Diet, exercise + resistance

(II) Diet + resistance

Analysis 12.2. Comparison 12 Interventions versus controls by psychological approach, longest follow-up, Outcome 2 BMI z score change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 12 Interventions versus controls by psychological approach, longest follow-up

Outcome: 2 BMI z score change

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,95% Cl		IV,Random,95% CI
l Cognitive behavioural							
Hofsteenge 2014	71	-0.07 (0.61)	51	0.03 (0.56)		4.9 %	-0.10 [-0.31, 0.11]
Nguyen 2012	73	-0.09 (0.35)	78	-0.2 (0.46)		5.8 %	0.11 [-0.02, 0.24]
Norman 2016 (1)	24	-0.1 (0.37)	28	0 (0.4)		4.9 %	-0.10 [-0.31, 0.11]
Norman 2016 (2)	29	-0.1 (0.36)	25	-0.1 (0.46)	—	4.7 %	0.0 [-0.22, 0.22]
Pbert 2013	42	0 (0.2)	40	0.01 (0.2)	+	6.2 %	-0.01 [-0.10, 0.08]
Vos 2011	32	-0.4 (0.96)	35	-0.1 (0.7)		2.9 %	-0.30 [-0.71, 0.11]
Subtotal (95% CI)	271		257		+	29.3 %	-0.01 [-0.09, 0.07]
Heterogeneity: $Tau^2 = 0.0$	00; Chi ² = 6.64, c	f = 5 (P = 0.25)	l ² =25%				
Test for overall effect: Z =	= 0.29 (P = 0.77)						
					-I -0.5 0 0.5 I		
				Favou	rs intervention Favours contr	ol	

(Continued ...)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 257 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

(... Continued)

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,95% CI		IV,Random,95% CI
2 Motivational interviewin	ng						
Brennan 2013	42	-0.09 (0.42)	21	0.01 (0.4)		4.8 %	-0.10 [-0.31, 0.11]
Pakpour 2015 (3)	118	-0.24 (0.62)	58	0.01 (0.69)		4.9 %	-0.25 [-0.46, -0.04]
Pakpour 2015 (4)	113	-0.02 (0.78)	57	0.01 (0.69)		4.6 %	-0.03 [-0.26, 0.20]
Subtotal (95% CI)	273		136		•	14.4 %	-0.13 [-0.26, -0.01]
Heterogeneity: $Tau^2 = 0.0$	00; Chi ² = 2.06, d	f = 2 (P = 0.36);	$ ^2 = 3\%$				
Test for overall effect: Z =	= 2.04 (P = 0.041))					
3 Other psychological the	eory						
Boodai 2014	31	0 (0.1)	32	0 (0.2)	+	6.2 %	0.0 [-0.08, 0.08]
Daley 2005	28	-0.01 (0.29)	53	-0.08 (0.44)		5.4 %	0.07 [-0.09, 0.23]
Debar 2012	90	-0.15 (0.41)	83	-0.08 (0.36)		5.9 %	-0.07 [-0.18, 0.04]
Jiang 2005 (5)	33	-1.7 (0.66)	35	-0.3 (0.56)	•	4.0 %	-1.40 [-1.69, -1.11]
Patrick 2013	76	-0.13 (0.41)	25	0 (0.46)		5.0 %	-0.13 [-0.33, 0.07]
Saelens 2002	18	-0.05 (0.4)	19	0.07 (0.3)		4.7 %	-0.12 [-0.35, 0.11]
Savoye 2007	105	-0.2 (0.2)	69	-0.05 (0.2)	•	6.3 %	-0.15 [-0.21, -0.09]
Wengle 2011	16	-0.03 (0.42)	16	-0.11 (0.45)		3.8 %	0.08 [-0.22, 0.38]
Subtotal (95% CI)	397		332		•	41.3 %	-0.19 [-0.36, -0.02]
Heterogeneity: $Tau^2 = 0.0$	05; Chi ² = 91.27,	df = 7 (P<0.000	01); I ² =929	6			
Test for overall effect: Z =	= 2.19 (P = 0.029))					
4 No theoretic basis/no p	osychological com	ponent					
Ford 2010	44	-0.41 (0.66)	43	-0.14 (0.5)		4.5 %	-0.27 [-0.52, -0.02]
Luna-Pech 2014	26	-0.52 (0.26)	25	-0.05 (0.26)		5.6 %	-0.47 [-0.61, -0.33]
Visuthranukul 2015	25	-0.3 (0.2)	27	-0.3 (0.5)		4.9 %	0.0 [-0.20, 0.20]
Subtotal (95% CI)	95		95		-	15.0 %	-0.25 [-0.55, 0.04]
Heterogeneity: $Tau^2 = 0.0$	06; Chi ² = 13.78,	df = 2 (P = 0.00	I); I ² =85%				
Test for overall effect: Z =	= 1.68 (P = 0.093))					
Total (95% CI)	1036		820		•	100.0 %	-0.14 [-0.24, -0.05]
Heterogeneity: $Tau^2 = 0.0$	03; Chi ² = 138.08	, df = 19 (P<0.0	0001 ; $ ^2 = 8$	36%			
Test for overall effect: Z =	= 3.04 (P = 0.002	3)					
Test for subgroup differen	tces: $Chi^2 = 6.33$,	df = 3 (P = 0.10))), I ² =53%				
						I	
					-1 -0.5 0 0.5	I	

Favours intervention Favours control

(I) Boys

(2) Girls

(3) Motivational interviewing with parent

(4) Motivational interviewing no parent

(5) SDs imputed from other studies

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 258 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 13.1. Comparison 13 Interventions versus controls by parental involvement, longest follow-up, Outcome I Body mass index (BMI) change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 13 Interventions versus controls by parental involvement, longest follow-up

Outcome: I Body mass index (BMI) change

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% CI		IV,Random,95% CI
I Parent involvement							
Brennan 2013	42	-0.69 (4.59)	21	0.76 (5.18)	· · · · · · · · · · · · · · · · · · ·	2.1 %	-1.45 [-4.06, 1.16]
Brownell 1983 (1)	12	-0.1 (3.1)	6	-0.1 (3.5)		1.5 %	0.0 [-3.30, 3.30]
Ebbeling 2012	105	0.71 (2.9)	104	I (2.9)		4.5 %	-0.29 [-1.08, 0.50]
Grey 2009	112	0.9 (3.2)	86	0.1 (3)		4.4 %	0.80 [-0.07, 1.67]
Hofsteenge 2014	71	0.9 (5.51)	51	1.3 (5.37)		2.8 %	-0.40 [-2.35, 1.55]
Jelalian 2016	17	-1 (7.1)	7	1.7 (5.2)	• • • • • • • • • • • • • • • • • • •	0.8 %	-2.70 [-7.82, 2.42]
Jiang 2005	33	-2.6 (1.6)	35	-0. (.)	<u> </u>	4.7 %	-2.50 [-3.16, -1.84]
Kong 2014	34	-1.2 (4.1)	27	-0.2 (3.24)		3.0 %	-1.00 [-2.84, 0.84]
NCT00807560	13	-0.8 (5.3)	11	2.1 (8)	• • • • • • • • • • • • • • • • • • •	0.7 %	-2.90 [-8.44, 2.64]
Nguyen 2012	73	0 (4.41)	78	I (4.09)		3.7 %	-1.00 [-2.36, 0.36]
Norman 2016 (2)	24	-0.6 (4.06)	28	0.6 (4.12)		2.5 %	-1.20 [-3.43, 1.03]
Norman 2016 (3)	29	0.9 (4.29)	25	0.2 (4.18)		2.4 %	0.70 [-1.56, 2.96]
Pakpour 2015 (4)	118	-2.05 (6.18)	58	0.03 (8.33)	•	2.3 %	-2.08 [-4.50, 0.34]
Patsopoulou 2017 (5)	55	-3.1 (0.94)	28	0.2 (1.14)	<u> </u>	4.9 %	-3.30 [-3.79, -2.81]
Resnicow 2005	45	1.3 (5.9)	62	0.5 (7.9)		2.1 %	0.80 [-1.82, 3.42]
Savoye 2007	105	-0.9 (4.1)	69	1.9 (4.2)	← →──	3.8 %	-2.80 [-4.06, -1.54]
Toulabi 2012	76	-2.92 (2.87)	76	-1.18 (2.44)		4.4 %	-1.74 [-2.59, -0.89]
Visuthranukul 2015	25	-0.2 (1.6)	27	0.4 (2)		4.2 %	-0.60 [-1.58, 0.38]
Wengle 2011	16	0.1 (5.86)	16	-0.5 (5.07)		• 1.2 %	0.60 [-3.20, 4.40]
Subtotal (95% CI)	1005		815		•	55.8 %	-1.13 [-1.90, -0.35]
Heterogeneity: $Tau^2 = 1$.	96; Chi ² = 112	.78, df = 18 (P<0.0000	01); l ² =84	1%			
					4 -2 0 2	4	
				Favours	intervention Favours con	trol	

(Continued ...)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 259 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

(... Continued)

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)[kg/m2]	Ν	Mean(SD)[kg/m2]	IV,Random,95% CI		IV,Random,95% CI
Test for overall effect: Z	= 2.84 (P = 0.0	045)					
2 No parental involveme	nt						
Brownell 1983 (6)	12	-4.66 (6.6)	6	-0.1 (3.5)		0.9 %	-4.56 [-9.23, 0.11]
Carrel 2005	27	I (8.72)	23	0 (4.58)		→ I.3 %	1.00 [-2.78, 4.78]
Ebbeling 2003	8	-1.2 (2)	8	0.6 (1.4)		3.2 %	-1.80 [-3.49, -0.11]
Gourlan 2013	26	-1.61 (4.64)	28	0.12 (5.94)		1.9 %	-1.73 [-4.56, 1.10]
NCT00132132	8	-0.37 (1)	13	1.28 (1.1)		4.3 %	-1.65 [-2.57, -0.73]
Pakpour 2015 (7)	113	-0.63 (8.25)	57	0.03 (8.33)		2.0 %	-0.66 [-3.30, 1.98]
Patsopoulou 2017 (8)	55	-2.3 (1.13)	28	0.2 (1.14)		4.8 %	-2.50 [-3.02, -1.98]
Pbert 2013	42	0.01 (2.2)	40	0.23 (2.1)	<u> </u>	4.3 %	-0.22 [-1.15, 0.71]
Pitetti 2007	5	-3 (7.18)	5	-0.9 (7.99)		→ 0.3 %	-2.10 [-11.52, 7.32]
Saelens 2002	18	0.1 (4.09)	19	1.4 (3.5)		2.2 %	-1.30 [-3.76, 1.16]
Schranz 2014	30	0.1 (4.16)	26	1.2 (5.77)		2.0 %	-1.10 [-3.77, 1.57]
Sigal 2014 (9)	78	-0.5 (2.4)	25	0 (2.4)		4.1 %	-0.50 [-1.58, 0.58]
Sigal 2014 (10)	75	-0.9 (2.2)	26	0 (2.4)		4.1 %	-0.90 [-1.95, 0.15]
Sigal 2014 (11)	75	-0.6 (2.4)	25	0 (2.4)		4.1 %	-0.60 [-1.69, 0.49]
Vissers 2008	22	-0.78 (1.42)	31	0.49 (0.74)	<u> </u>	4.7 %	-1.27 [-1.92, -0.62]
Subtotal (95% CI)	594		360		•	44.2 % -1	.22 [-1.76, -0.67]
Heterogeneity: $Tau^2 = 0$.50; Chi ² = 33.3	84, df = 14 (P = 0.003)); I ² =58%				
Test for overall effect: Z	= 4.37 (P = 0.0	00013)					
Total (95% CI)	1599		1175		•	100.0 % -1	.18 [-1.67, -0.69]
Heterogeneity: $Tau^2 = 1$	21; Chi ² = 147	.87, df = 33 (P<0.0000	$); ^2 = 78$	3%			
Test for overall effect: Z	= 4.74 (P < 0.0	0001)					
Test for subgroup differe	nces: Chi ² = 0.0)3, df = 1 (P = 0.85), 1	2 =0.0%				
				u		4	
				-4 Failours	U Z	T optrol	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 260 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. Mother and child together
 Boys
 Girls
 Motivational interviewing with parents
 Activity+Diet
 Mother and child separate
 Motivational interviewing no parents
 Activity
 Diet + resistance
 Diet, exercise + resistance
 Diet, eacobic

Analysis 13.2. Comparison 13 Interventions versus controls by parental involvement, longest follow-up, Outcome 2 BMI z score change.

Review: Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years

Comparison: 13 Interventions versus controls by parental involvement, longest follow-up

Outcome: 2 BMI z score change

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,95% Cl		IV,Random,95% CI
I Parental involvement							
Boodai 2014	31	0 (0.1)	32	0 (0.2)	+	5.8 %	0.0 [-0.08, 0.08]
Brennan 2013	42	-0.09 (0.42)	21	0.01 (0.4)		4.3 %	-0.10 [-0.31, 0.11]
Debar 2012	90	-0.15 (0.41)	83	-0.08 (0.36)	-=-	5.4 %	-0.07 [-0.18, 0.04]
Hofsteenge 2014	71	-0.07 (0.61)	51	0.03 (0.56)		4.4 %	-0.10 [-0.31, 0.11]
Jiang 2005 (1)	33	-1.7 (0.66)	35	-0.3 (0.56)	•	3.5 %	-1.40 [-1.69, -1.11]
NCT00807560	13	-0.1 (0.4)	9	0 (0.21)		3.8 %	-0.10 [-0.36, 0.16]
Nguyen 2012	73	-0.09 (0.35)	78	-0.2 (0.46)		5.3 %	0.11 [-0.02, 0.24]
Norman 2016 (2)	24	-0.1 (0.37)	28	0 (0.4)		4.4 %	-0.10 [-0.31, 0.11]
				Favou	-1 -0.5 0 0.5 1 rs intervention Favours cont	rol	

(Continued ...)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 261 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

(Continued)
---	--	------------

Study or subgroup	Intervention		Control		Mean Difference	Weight	Mean Difference
	Ν	Mean(SD)	Ν	Mean(SD)	IV,Random,95% CI		IV,Random,95% CI
Norman 2016 (3)	29	-0.1 (0.36)	25	-0.1 (0.46)		4.2 %	0.0 [-0.22, 0.22]
Pakpour 2015 (4)	118	-0.24 (0.62)	58	0.01 (0.69)	_ _	4.4 %	-0.25 [-0.46, -0.04]
Patrick 2013	76	-0.13 (0.41)	25	0 (0.46)		4.5 %	-0.13 [-0.33, 0.07]
Savoye 2007	105	-0.2 (0.2)	69	-0.05 (0.2)	-	5.9 %	-0.15 [-0.21, -0.09]
Visuthranukul 2015	25	-0.3 (0.2)	27	-0.3 (0.5)		4.4 %	0.0 [-0.20, 0.20]
Vos 2011	32	-0.4 (0.96)	35	-0.1 (0.7)		2.5 %	-0.30 [-0.71, 0.11]
Wengle 2011	16	-0.03 (0.42)	16	-0.11 (0.45)		3.4 %	0.08 [-0.22, 0.38]
Subtotal (95% CI)	778		592		•	66.1 %	-0.15 [-0.26, -0.03]
Heterogeneity: $Tau^2 = 0.04$; ($Chi^2 = 101.51, df$	= 14 (P<0.0000); ² =86%	6			
Test for overall effect: $Z = 2.5$	57 (P = 0.010)						
2 No parental involvement							
Daley 2005	28	-0.01 (0.29)	53	-0.08 (0.44)		5.0 %	0.07 [-0.09, 0.23]
Ford 2010	44	-0.41 (0.66)	43	-0.14 (0.5)		4.0 %	-0.27 [-0.52, -0.02]
Luna-Pech 2014	26	-0.52 (0.26)	25	-0.05 (0.26)	-	5.1 %	-0.47 [-0.61, -0.33]
Pakpour 2015 (5)	113	-0.02 (0.78)	57	0.01 (0.69)		4.1 %	-0.03 [-0.26, 0.20]
Pbert 2013	42	0 (0.2)	40	0.01 (0.2)	+	5.7 %	-0.01 [-0.10, 0.08]
Saelens 2002	18	-0.05 (0.4)	19	0.07 (0.3)		4.2 %	-0.12 [-0.35, 0.11]
van Egmond-Frohlich 2006	6 250	-0.12 (0.44)	271	-0.13 (0.42)	-	5.8 %	0.01 [-0.06, 0.08]
Subtotal (95% CI)	521		508		•	33.9 %	-0.11 [-0.25, 0.03]
Heterogeneity: $Tau^2 = 0.03$; (Chi ² = 42.09, df =	= 6 (P<0.00001)	; I ² =86%				
Test for overall effect: $Z = 1.5$	66 (P = 0.12)						
Total (95% CI)	1299		1100		•	100.0 %	-0.13 [-0.21, -0.05]
Heterogeneity: Tau ² = 0.03; (Chi ² = 145.05, df	= 21 (P<0.0000)); l ² =86%	6			
Test for overall effect: $Z = 3.1$	I (P = 0.0019)						
lest for subgroup differences:	$Chi^2 = 0.14, df =$	= I (P = 0.71), ŀ	- =0.0%				
					<u> </u>		
					-1 -0.5 0 0.5	I	

Favours intervention Favours control

(1) SDs imputed from other studies

(2) Boys

(3) Girls

(4) Motivational interviewing with parent

(5) Motivational interviewing no parent

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 262 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

ADDITIONAL TABLES

Table 1. Overview of study populations

Trial ID (trial de- sign)	Interven- tion and com- parator	Sample size ^a	Screened/ eligible (n)	Ran- domised (n)	ITT (n)	Analysed (n)	Finishing study (n)	Ran- domised finishing study (%)	Follow-up time ^b
Pat-	I1: activity	-	2618/-	60	55	55	50	83	6
sopoulou 2017 (parallel	I2: activity + diet			60	55	55	50	83	months (af- ter 12-week interven-
RCT)	C1: no in- tervention			61	56	56	50	82	tion)
	total:			181	166	166	150	82.8	
Jelalian 2016 (parallel RCT)	I1: CBT- healthy lifestyle	-	127	24	-	17	11	46.0	48 weeks (after 24- week inter- vention)
	C1: CBT	-		9	-	7	8	88.0	
	total:			33		24	19	-	
Norman 2016	I1: stepped down	53	460/106	53	53	53	35	66.0	12 months (imme- diately after interven- tion)
(parallel RCT)	C1: enhanced usual care	53		53	53	53	38	71.6	
	total:			106	106	106	73	68.8	
Wong 2015 (parallel RCT)	I1: standard weight loss diet + in- crease wa- ter intake	-	-	-	-	-	-	-	6 months (imme- diately after interven- tion)
	C1: stan- dard weight loss diet	-	-	-	-	-	-	-	
total	total:			38	-	-	-	-	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 263 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Hofs- teenge 2014	I1: group education	54	219/189	71	71	71	36	50.7	18 months (after 36-
2014 (parallel RCT)	C1: dieti- tian only	54		51	51	51	32	62.7	vention)
	total:			122	122	122	68	55.7	
Schranz 2014 (parallel	I1: resistance training	17	61/56	30	30	30	21	70.0	12 months (6-month postinter-
RC1)	C1: no in- tervention	no in- 17 ention			26	26	22	84.6	vention)
	total:			56	56	56	43	76.8	
Vi- suthranuku	I1: low GI diet	26	-	35	-	25	25	71	6 months (imme-
2015 (parallel RCT)	C1: con- ventional diet	26		35	-	27	27	77	interven- tion)
	total:			70	-	52	52	74.3	
Pakpour 2015 (parallel	I1: motiva- tional in- terviewing	-	409/369	119	-	-	113	95.0	12 months (42 weeks after
RC1)	I2: motiva- tional in- terviewing + parental involve- ment			119	-	-	118	99.2	6-week in- tervention)
	C1: passive control			119	-	-	115	96.6	_
	total:			357			346	96.9	
Bean 2014 (parallel RCT)	I1: motiva- tional in- terviewing values	80	123/-	58	-	-	52	89.7	6 months (3 months fol- lowing end of interven- tion)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 264 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

									_
	C1: educa- tion control	80		41	-	-	35	85.4	
	total:			99			87	87.9	
Carraway 2014 (parallel	I1: men- tor-led ex- ercise	11	-	11	-	-	10	91	7 months (12- week inter-
RCT)	C1: wait list control	13	-	13	-	-	11	85	vention)
	total:			24	-	-	22	91.6	
Sigal 2014 (parallel RCT)	I1: diet + aer- obic train- ing	62	840/358	75	75	75	57	76	6 months (af- ter 22-week interven-
	I2: diet + resistance training	62		78	78	78	57	73	tion + 4- week run- in)
	I3: diet + aerobic + resistance training	62		75	75	75	58	77	
	C1: diet only	62		76	76	76	57	75	
	total:			304	304	304	229	75.3	
Love- Osborne 2014	I1: motiva- tional in- terviewing	80	-	82		77	77	94	6-8 months (imme- diately after
(parallel RCT)	C1: control	80		83		72	72	87	interven- tion)
	total:			165		149	149	90.3	
Kong 2014 (parallel RCT)	I1: low GI diet	-	-	52	-	34	34	65.4	6 months (imme- diately fol- lowing in- tervention)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 265 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

		_							-
	C1: usual Chi- nese diet			52	-	27	27	51.9	
	total:			104	-	61	61	58. 7	
Luna- Pech 2014 (parallel RCT)	I1: nor- mocaloric diet + physical activity	-	-	29	-	26	26 ^c	89.7	28 weeks (imme- diately fol- lowing in- tervention)
	C1: no in- tervention			29	-	25	25 ^{<i>d</i>}	86.2	
	total:			58	-	51	51	87.9	
Boodai 2014 (parallel RCT)	I1: multi- compo- nent group sessions	45	224/82	41	31	31	31	75.6	6 months (imme- diately fol- lowing in-
	C1: no in- tervention	45		41	32	32	32	78.0	tervention)
	total:			82	63	63	63	76.8	
Gourlan 2013 (parallel RCT)	I1: motiva- tional in- terviewing + standard weight loss	30	-/64	28	-	26	26	92.9	6 months (after 3- month in- tervention for stan- dard weight loss group, 6-month
	C1: stan- dard weight loss	30		34	-	28	28	82.4	vention for moti- vational in-
	total:			62	-	62	54	87.1	group)
Patrick 2013 (parallel RCT)	I1: website in- tervention	26	387/101	26	26	26	17	65.4	12 months (imme- diately after interven- tion)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 266 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Table 1.	Overview	of study	populations	(Continued)
----------	----------	----------	-------------	-------------

	I2: website + group	26		26	26	26	14	53.8	
	I3: website + SMS	26	_	24	24	24	17	70.8	_
	C1: usual care	26		25	25	25	16	64.0	_
	total:			101	-	101	64	63.4	
Kong 2013	I1: ACTION	21	101/60	31	-	28	28	90.3	6 months (inter-
(cluster RCT)	C1: stan- dard care	21		29	-	23	23	79.3	vention for 1 academic year)
	total:			60	-	51	51	85.0	
Pbert 2013 (cluster RCT)	I1: "Lookin' Good Feelin' Good"	-	6/6 schools 176/ 82 partici- pants	42	-	42	42	100	6 months (16- week inter- vention)
	C1: control			40	-	40	40	100	_
	total:			82	-	82	82	100	
Brennan 2013 (cross-	I1: motiva- tional in- terviewing	-	120/-	42	-	17	17	40.5	12 months (26- week inter-
over RC1)	C1: wait list control			21	-	14	14	66.7	vention)
	total:			63	-	31	31	49.2	
Walpole 2013 (parallel	I1: motiva- tional in- terviewing	16	73/52	20	-	20	20	100	6 months (imme- diately after
KUI)	C1: social skills train- ing	16		20	-	18	18	90	interven- tion)
	total:			40	-	38	38	95	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 267 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Toulabi 2012 (parallel RCT)	I1: be- havioural modifica- tion	-	192/152	76	-	-	-	-	6 months (6-week in- tervention)
	C1: control			76	-	-	-	-	
	total:			152	-	-	-	-	
Debar 2012 (parallel RCT)	I1: multi- compo- nent inter- vention	100	2647/ 2350	105	-	90	90	85.7	12 months (5- month in- tervention)
	C1: usual care	100		103	-	83	83	80.6	_
	total:			208	-	173	173	83.2	
Ebbeling 2012 (parallel RCT)	I1: multi- compo- nent inter- vention	-	762/374	110	-	105	105	95.5	24 months (52- week inter- vention)
	C1: control			114	-	104	104	91.2	_
	total:			224	-	209	209	93.3	
Vos 2011 (parallel RCT)	I1: family- based CBT + nutrition	35	108/81	41	-	32	32	78.0	24 months (3- month in-
	C1: wait list control	35		40	-	35	35	87.5	tervention)
	total:			81	-		66	81.5	
Christie 2011 (parallel RCT)	I1: HELP weight manage- ment	100	-	-	-	-	-	-	12 months (6- month in- tervention)
	C1: enhanced standard care	100		-	-	-	-	-	
	total:			174	-	-	145	83.3	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 268 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Wengle 2011 (parallel RCT)	I1: mentored behaviour chang- ing inter- vention	-	-/38	20	-	16	16	80.0	6 months (imme- diately after interven- tion)
	C1: un- mentored behaviour chang- ing inter- vention			18	-	16	16	88.9	
	total:			38	-	32	32	84.2	
Ford 2010 (parallel	I1: Man- dometer	40	115/-	54		44	44	81.5	18 months (12-
RCT)	C1: stan- dard care	40		52		43	43	82.7	month in- tervention)
	total:			106		87	87	82.1	
Nguyen 2012 (parallel RCT)	I1: Loozit + addi- tional ther- apeutic contact	-	474/249	73	73	73	58	79.4	24 months (interven- tion con- tinued for 24 months)
	C1: Loozit	_		78	78	78	56	71.8	-
	total:			151	151	151	114	78.5	
Grey 2009 (cluster	I1: coping skills	-	426/324	112	112	112	87	77.7	36 weeks (16-
RCT)	C1: general ed- ucation			86	86	86	64	74.4	week inter- vention)
	total:			198	198	198	151	76.3	
Vissers 2008 (parallel RCT)	I1: school- based in- tervention	-	506/-	37	-	22	22	59.5	6 months (imme- diately fol- lowing in- tervention)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 269 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	C1: control			39	-	31	31	79.5	
	total:			76	-	53	53	69. 7	
NCT00132 (parallel RCT)	I1: be- havioural education	-	-	15	-	8	8	53.3	12- 15 months (12-
	C1: stan- dard care			15	-	13	13	86.7	month in- tervention)
	total:			30	-	21	21	70.0	
Pitetti 2007	I1: tread- mill	-	42/-	5	-	5	5	100	36 weeks (imme-
(parallel RCT)) C1: control			5	-	5	5	100	diately fol- lowing in- tervention)
	total:			10	-	10	10	100	
Savoye 2007 (parallel RCT)	I1: Bright Bod- ies weight manage- ment	174 (58 per group (originally 3 groups)	284/271	105	105	105	45	42.9	24 months (52- week inter- vention)
	C1: control			69	69	69	31	44.9	
	total:			174	174	174	76	43.7	
van Egmond- Frohlich 2006	I1: multi- compo- nent inter- vention	-	821	250	250	-	-	-	12 months (12-month intervention) d
(parallel RCT)	C1: stan- dard care	-		271	271	-	-	-	-
	total:			521	521	-	423	81.2	
Daley 2005 (parallel BCT)	I1: exercise coun- selling	30	141/132	28	28	28	24	85.7	28 weeks (8-week in- tervention)
KCI)									

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 270 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

			-						_
	C2: control	30		30	30	30	25	83.3	
	total:			81	81	81	71	87.7	
Resnicow 2005 (cluster RCT)	I1: GoGirls high-in- tensity be- havioural interven- tion	75-120	-	-	-	53	45	-	12 months (6- month in- tervention)
	C1: mod- erate-in- tensity be- havioural interven- tion	75-120	-	-	-	70	62	-	
	total:			-	-	123	107	-	
Jiang 2005 (parallel	I1: family- based in- tervention	-	106/75	36	-	33	33	91.7	24 months (imme- diately fol-
RCT)	C1: control			39	-	35	35	89.7	lowing in- tervention)
	total:			75	-	68	68	90.7	
Carrel 2005 (parallel RCT)	I1: behaviour changing- focused gym classes	-	-155	27	-	27	27	100	9 months (imme- diately fol- lowing in- tervention)
	C1: stan- dard gym classes			26	-	23	23	88.5	
	total:			53	-	50	50	94.3	
Ebbeling 2003 (parallel RCT)	I1: low GL diet	-	30/21	8	8	8	7	87.5	12 months (26- week inter- vention)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 271 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	C1: con-	-		8	8	8	7	87.5	_
	ventional diet			C	Ŭ	Ū	,	0,19	
	total:			16	16	16	14	87.5	
Saelens 2002 (parallel	I1: Healthy Habits	21	-/59	23	23	-	18	78.3	28 weeks (12- week inter-
RCT)	C1: stan- dard care	21		21	21	-	19	90.5	vention)
	total:			44	44	-	37	84.1	
Brownell 1983 (parallel	I1: mother + child sep- arate	-	-	14	-	12	12	85.7	12 months (16- week inter-
RCT)	I2: mother + child to- gether			15	-	12	12	80	vention)
	C1: child only			13	-	12	12	92.3	
	total:			42	-	36	36	85.7	
<mark>Chandra</mark> 1968 (parallel RCT)	I1: low- calorie for- mula Limi- cal	-	43	-	-	18	18	-	7 months (3- month in- tervention)
	C1: low- calorie diet	-		-	-	17	17	-	_
	total:			43	-	35	35	81.4	
NCT00807 (parallel RCT)	I1: family- based ther- apy for paedi- atric over- weight	-	-	39	-	13	13	34.2	44 weeks (24- week inter- vention)
	C1: nutri- tion educa- tion control	-	-	38	-	9	11	38.2	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 272 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	total:	77		22	24	31.1	
Grand to- tal ^e	All inter ventions	2555	-		1801	-	
	All c om- parators	1850			1255		
	All inter- ventions and c om- parators	4781			3735		

- denotes not reported

^aAccording to power calculation in study publication or report.

^bDuration of follow-up/(duration of intervention).

 c For number of participants finishing the study the publication stated that 26 participants in the normocaloric diet + physical activity group and 25 participants in the no intervention groups finished the study but also reported that there were four dropouts/withdrawals in the normocaloric diet + physical activity group and eight dropouts/withdrawals in the no intervention group.

^{*d*}At 6 months, only 115 (46%) children in the multicomponent intervention group and 135 (54%) children in the standard care group participated in a follow-up examination.

^eNumbers did not add up accurately because of missing data per intervention/comparator groups in some trials.

C: comparator; CBT: cognitive behavioural therapy; FBT-PO: family-based therapy for paediatric overweight; GI: glycaemic index; GL: glycaemic load; I; intervention; ITT: intention to treat; n: number of participants; N/A: not applicable; RCT: randomised controlled trial; SMS: short message service.

Study	Tool	Outcome	Findings
Norman 2016	Child's BMI - median BMI for age and gender)/median BMI for age and gender × 100	% over median BMI	At 12 months, a significant treat- ment effect was observed in boys in the stepped care group compared to the enhanced usual care group ($P = 0.002$)
Schranz 2014	Scales	Body mass (kg), mean ± SD	At 12 months, there was no significant difference (P= 0.69) between the intervention (99.3 \pm 16.6; 30 participants) and control group (104 \pm 27.1; 26 participants)
	Calliper	Sum of skinfolds (mm), mean ± SD	At 12 months, there was no sig- nificant difference (P= 0.86) be- tween the intervention (249.4 ± 72. 9; 30 participants) and control group (248.1 ± 96.9; 26 participants)

Table 2. Anthropometric data

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 273 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Carraway 2014	By comparing actual BMI to BMI at the 50th percentile	% overweight)	Participants in both groups were able to reduce % overweight from base- line to post-test by 1.98% and from baseline to follow-up by 1.48%
	DXA	% fat	Reduction from baseline to postin- tervention tended towards signifi- cance. However, this reduction was reversed across follow-up
Pakpour 2015	Bioelectrical impedance analysis	% fat, mean ± SD	At 12 months, the motivational interview + parental involvement group had significantly (P = 0.001) lower body fat ($42.32 \pm 3.56\%$; 118 participants) compared to the control ($45.33 \pm 4.86\%$; 115 participants) but was not superior (P= 0. 38) to the motivational interviewing group ($45.62 \pm 4.32\%$; 113 participants)
Kong 2014	Bioimpedence	% visceral fat, median (interquartile range)	At 6 months, no significant reduc- tion of visceral fat in either the low GI group (from 14.2 (10.8 to 19.8) to 12.0 (10.0 to 19.0); 27 partici- pants) or the control group (from 12. 5 (9.0 to 19.0) to 13.5 (7.5 to 20.5) ; 34 participants)
Brennan 2013	Body scan	Trunk lean mass (kg), mean ± SD	At 6 months, the intervention group had lower truncal lean mass (21.67 \pm 4.72; 42 participants) compared to the control group (21.99 \pm 3.96; 20 participants)
Toulabi 2012	Anthropometric tape	Hip circumference (cm), mean ± SD	At 6 months, the intervention group had a significantly lower (P = 0.001) circumference (105.18 \pm 7.38; 76 participants) compared to the con- trol (109.80 \pm 6; 76 participants)
Vos 2011	Anthropometric tape	Waist circumference-SDS, MD, 95% CI	At 12 months, the mean change in the intervention group (-0.6, -1.2 to -0.00; 32 participants) was signifi- cantly lower (P = 0.03) compared to the control group (-0.2, -0.7 to 0.5; 34 participants)

Table 2. Anthropometric data (Continued)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 274 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	Stadiometer and anthropometric tape	Waist circumference/height, MD, 95% CI	At 12 months, the mean change in the intervention group (-0.03 , -0.06 to 0.00; 32 participants) was significantly lower (P = 0.03) compared to the control group (-0.01 , -0.03 to 0. 00; 34 participant)
Ford 2010	Bioimpedence	% body fat-SDS, MD, 95% CI	At 12 months, the Mandometer group had a greater fall in body fat (- 0.32, 0.22 to 0.41; 43 participants) compared to the control group (-0. 07, -0.04 to 0.18; 45 participants)
Chandra 1968	Beam balance	Average weight loss (% of expected)	At 17 months, the difference be- tween the intervention group (Lim- ical) and the control tended to level off (112% in the intervention in comparison to 114% in the control)

BMI: body mass index; CI: confidence interval; DXA: dual-energy X-ray absorptiometry; GI: glycaemic index; kg: kilogram; MD: mean difference; mm; millimetre; SD: standard deviation; SDS: standard deviation score.

	Table 3.	Behavioural	change -	health-related	quality	y of life and	l self-esteem
--	----------	-------------	----------	----------------	---------	---------------	---------------

Study	Tool	Outcome	Findings
Hofsteenge 2014	Body Esteem Scale	Body appearance, mean ± SD	At 18 months, body appearance scores did not significantly im- prove in either the intervention (from 1.8 ± 0.7 to 2.2 ± 0.7 ; 57 participants) or the control group (from 1.9 ± 0.8 to $0.3 \pm$ 0.75; 38 participants)
		Weight satisfaction, mean ± SD	At 18 months, weight satisfac- tion scores did not significantly improve in either the interven- tion (from 1.6 \pm 0.7 to 1.7 \pm 0. 7; 57 participants) or the con- trol group (from 1.7 \pm 0.6 to 1. 8 \pm 0.7; 38 participants)
		Body attribution, mean ± SD	At 18 months, body attribution scores did not significantly im- prove in either the intervention (from 1.8 ± 0.8 to 2.3 ± 0.8 ; 57 participants) or the control

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 275 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Table 3.	Behavioural change -	- health-related	quality of life and	d self-esteem	(Continued)
----------	----------------------	------------------	---------------------	---------------	-------------

			group (from 1.9 ± 1.0 to 2.0 ± 0.6; 38 participants)
Schranz 2014	Physical self-worth scale	Global physical self-worth, mean ± SD	At 12 months, there was no sig- nificant difference (P= 0.52) for physical self-worth between the intervention (2.40 \pm 0.54; 30 participant) and control group (2.44 \pm 0.57; 26 participants)
Carraway 2014	40-item Children and Youth Physical Self-Perception Profile measure	Global self-esteem	At 7 months, significant change in global self-esteem by time for both groups
Pakpour 2015	20-item weight efficacy lifestyle questionnaire	Weight efficacy, mean ± SD	At 12 months, the motivational interview + parental involve- ment had significantly higher confidence scores for their abil- ity to lose weight (108.05 ± 24.28; 118 participants) com- pared to the control (93.21 ± 29. 60; 115 participants; P = 0.002) and the motivational interview group (101.27 ± 27.23; 113 par- ticipants; P = 0.04)
Ford 2010	Paediatric quality of life inven- tory	Health-related quality of life	Measures of quality of life im- proved in both the Mandometer and control group with no sig- nificant change at 12 months
van Egmond-Frohlich 2006	KINDL-K (self- report) and KINDL-E (parents) , 24 items with subscales fam- ily, friends, school, self-worth, mental and physical well-being (4 items per domain)	Health-related quality of life	At 12 months, (total group) statistically significant improve- ments in obesity-related qual- ity of life and subdomains fam- ily, friends, school, physical and mental well-being

KINDL: Fragebogen für KINDer und Jugendliche zur Erfassung der gesundheitsbezogenen Lebensqualität (questionnaire for children and adolescents to record health-related quality of life); SD: standard deviation.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 276 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Table 4. Behavioural change - dietary intake

Study	Tool	Outcome	Findings
Pbert 2013	24-hour dietary recall	Fat (% of energy), MD, 95% CI	At 6 months, no significant change in the intervention arm (1.21, -1. 99 to 4.41;2 participants) and the control arm (MD 1.19, 95% CI -1.92 to 4.30; 40 participants) for fat intake
Ebbeling 2003	7-day food record	Fat (% of energy), mean ± SD	At 12 months, a significant decrease (P= 0.03) in the conventional reduced fat arm (from 33 ± 1 to 29 ± 3 ; 7 participants) but tended to increase in the glycaemic load arm (27 ± 2 to 29 ± 3; 7 participants)
Saelens 2002	2-day dietary recall	Fat (% of energy), mean ± SD	At 7 months, no significant change in the Healthy Habits intervention arm (from 33.9 ± 8.8 to 32.9 ± 9 . 4; 18 participants) and the typical care arm (from 34.3 ± 4.9 to 35.6 ± 6.4 ; 18 participants)
Kong 2014	3-day dietary record	Protein (% of energy), mean ± SD	At 6 months, the low GI group had a significantly (P = 0.002) higher protein intake (17.9 \pm 3.8; 34 par- ticipants) compared to the control (15.9 \pm 2.7; 27 participants)
Ebbeling 2003	7-day food record	Protein (% of energy), mean ± SD	At 12 months, there was no significant change in protein intake in the glycaemic load arm (from 17 \pm 2 to 20 \pm 1; 7 participants) or the conventional reduced fat group (from 16 \pm 1 to 18 \pm 2; 7 partici- pants)
Kong 2014	3-day diet record	Carbohydrate (% of energy), mean ± SD	At 6 months, there was no significant difference for carbohydrate mean intake between the low GI group (50.8 ± 8.1 ; 34 participants) and the control group (49.5 ± 6.6 ; 27 participants)
Ebbeling 2003	7-day food record	Carbohydrate (% of energy), mean ± SD	At 12 months, there was a non-sig- nificant decrease (P = 0.07) in the reduced glycaemic load arm (from

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 277 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

			58 ± 3 , to 52 ± 4 ; 7 participants) and no significant change in the conventional reduced fat arm
Kong 2014	3-day diet record	Glycaemic load (per 100 kcal), mean ± SD	At 6 months, there was no signifi- cant (P = 0.175) difference for gly- caemic load mean intake between the low GI group (117.7 \pm 42.5; 34 participants) and the control group (106.3 \pm 42.7; 27 participants)
Pbert 2013	24-hour dietary recall	Glycaemic load, MD, 95% CI	At 6 months, the was a reduction in the intervention arm (-22.93, -39. 68 to -6.18) but not in the control arm (-11.08, -27.36 to 5.20)
Ebbeling 2003	7-day food record	Glycaemic load (g/100 kcal), mean ± SD	At 12 months, there was a signif- icant (P = 0.007) decrease in the reduced glycaemic load arm (from 86 ± 5 to 69 ± 6 ; 7 participants) but not in the conventional reduced fat arm (from 79 ± 2 to 79 ± 7; 7 par- ticipants)
Visuthranukul 2015	3-day dietary record	Low glycaemic index diet (items/ day), MD ± SD	At 6 months, the consumption of low glycaemic food items increased in the intervention group $(3.6 \pm 1.$ 6; 25 participants) while the con- trol group consumed fewer items $(-0.4 \pm 1.5; 27 \text{ participants})$
Kong 2014	3-day dietary record	Glycaemic index, mean ± SD	At 6 months, there was no signifi- cant (P = 0.175) difference for gly- caemic index mean intake between the low GI group (74.4 \pm 8.7; 34 participants) and the control group (76.8 \pm 10.2; 27 participants)
Ebbeling 2003	7-day food record	Glycaemic index, mean ± SD	At 12 months, there was no significant reduction in the reduced gly- caemic load arm (from 58 ± 2 to 53 ± 3 ; 7 participants) or the conven- tional reduced fat arm (from 59 ± 1 to 56 ± 2 ; 7 participants)
Pbert 2013	24-hour dietary recall	Total sugar (g/day), MD, 95% CI	At 6 months, total sugar intake re- duced in the intervention arm (- 29.15, -49.08 to -9.22) but not in the control arm (-11.37, -30.71 to

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 278 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

			7.96)
Ebbeling 2012	24-hour dietary recall (3 recalls)	Sugar (g/day), MD ± SD	At 2 years, the intervention group consumed less sugar compared to the control (-19 \pm 7, P = 0.005; 209 participants)
Kong 2014	3-day dietary record	Fibre (g/1000 kcal), mean ± SD	At 6 months, the low GI group had a higher (P = 0.041) fibre intake (6. 5 ± 3.3 ; 34 participants) compared to the control arm (5.3 ± 2.5; 27 participants)
Ebbeling 2003	7-day food record	Fibre (g/1000 kcal), mean ± SD	At 12 months, fibre intake did not increase significantly in the re- duced glycaemic load arm (from 8 \pm 1 to 10 \pm 1; 7 participants) or the conventional reduced fat arm (from 8 \pm 1 to 10 \pm 2; 7 partici- pants)
Pakpour 2015	FFQ	Fruits and juice (servings/day), mean ± SD	At 12 months, the motivational interview + parental involvement group had a higher (P = 0.030) intake of fruit servings (1.33 \pm 0. 93; 118 participants) compared to the control group (1.23 \pm 0.97; 115 participants), but did not sig- nificantly (P = 0.17) differ com- pared to the motivational inter- view group (1.31 \pm 0.96; 113 par- ticipants)
Patrick 2013	FFQ	Fruit and vegetable (servings per 1000 calories), mean ± SE	At 12 months, fruit and vegetable consumption did not change the web-only group (from 1.9 ± 0.01 to 2.9 ± 0.01 ; P= 0.685; 26 partici- pants), web + sessions group (from 2.3 ± 0.01 to 2.9 ± 0.01 ; P = 0.398; 26 participants) and web + SMS group (from 2.0 ± 0.01 to $2.6 \pm$ 0.01; P = 0.369; 24 participants) compared to the usual care group (from 1.9 ± 0.01 to 2.0 ± 0.01 ; 25 participants)
Kong 2013	FFQ	Fruits and vegetables (servings/ day), median, 95% CI	At 6 months, there was no change in the intervention arm (-0.22, - 0.72 to 0.41; 28 participants) or

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 279 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

			the control arm (-1.16, -0.56 to 0. 02; 23 participants) for fruit and vegetables intake
Wengle 2011	4-day record	Fruits and vegetables (serving/day) , mean ± SD	At 6 months, fruits and vegeta- bles consumption did not signifi- cantly increase in either the non- mentored group (from 1.9 ± 1.5 to 1.8 ± 1.7 ; P = 0.79; 14 participants) or the mentored group (from 2.9 ± 2.7 to 2 ± 2 ; P = 0.63; 14 partic- ipants)
Pakpour 2015	FFQ	Vegetables (servings/day) mean ± SD	At 12 months, there was no sig- nificant difference for vegetable consumption across the motiva- tional interview + parental involve- ment group (1.77 ± 0.76 ; 118 par- ticipants), motivational interview group (1.71 ± 0.80 ; 113 partici- pants), and the control group ($1.$ 64 ± 0.80 ; 115 participants)
Brennan 2013	Dietary questions from the YBRS	Vegetables (serving/day), mean ± SD	At 6 months, there was no differ- ence (P = 0.901) for vegetables in- take between the intervention (2. 98 ± 1.13 ; 41 participants) and the control group (3.00 ± 0.71; 21 par- ticipants)
Brennan 2013	Dietary questions from the YBRS	Juice (serving/day), mean ± SD	At 6 months, there was no dif- ference (P = 0.056) for juice con- sumption between the interven- tion (2.07 \pm 1.18; 40 participants) and control group (2.71 \pm 1.31; 21 participants)
Ebbeling 2012	24-hour dietary recall (3 recalls)	Fruit juices beverages (serving/day) , MD ± SD	At 2 years, there was no difference in the reduction of fruit juice con- sumption between the interven- tion and control group (-3 \pm 17; P = 0.44; 209 participants)
Pakpour 2015	FFQ	Milk (servings/day), mean ± SD	At 12 months, there was no sig- nificant difference for milk intake across the motivational interview + parental involvement group (0.96 \pm 0.43; 118 participants), motiva- tional group (0.95 \pm 0.29; 113 par-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 280 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

			ticipants) and the control group (0. 97 ± 0.37; 115 participants)
Brennan 2013	Dietary questions from the YBRS	Milk (serving/day), mean ± SD	At 6 months, there was no differ- ence (P = 0.99) for milk consump- tion between the intervention (3. 63 ± 1.61 ; 41 participants) and the control group (3.59 \pm 1.56; 21 par- ticipants)
Pakpour 2015	FFQ	Non-diet soda (servings/day), mean ± SD	At 12 months, the motivational interview + parental involvement group consumed fewer sugary drinks (0.48 \pm 0.35; 118 partic- ipants) compared to the control group (0.95 \pm 0.33; P = 0.001; 115 participants) and the motivational interview group (0.77 \pm 0.38; P = 0.01; 113 participants)
Kong 2013	FFQ	Sweetened drinks (glasses/day), median, 95% CI	At 6 months, there was a signifi- cant reduction in sweetened drinks consumption in the intervention arm (-0.12, -0.47 to -0.08; 28 par- ticipants) compared to the control arm (-0.16, -0.57 to 0.22; 23 par- ticipants)
Ebbeling 2012	24-hour dietary recall (3 recalls)	Sugar-sweetened beverages (serv- ing/day), MD ± SD	At 2 years, the intervention group consumed fewer sugar-sweetened beverages compared to the control group (-58 ± 21; P = 0.007; 209 participants)
Pakpour 2015	FFQ	Snacks/desserts (servings/day), mean ± SD	At 12 months, the motivational interview + parental involvement group consumed fewer snacks (3. 89 ± 1.65 ; 118 participants) com- pared to the control group (4.55 \pm 1.71; P < 0.001; 115 partici- pants) and the motivational inter- view group (4.12 \pm 1.43; P = 0.04; 113 participants)
Wengle 2011	4-day dietary record	Total snack food (servings/week), mean ± SD	At 6 months, the non-mentored group had a non-significant de- crease (P = 0.06) in snacks con- sumption (from 10.3 ± 6.9 to $6.3 \pm$ 4.2; 14 participants). Similarly, the

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 281 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

			mentored group had a non-signifi- cant (P = 0.07) reduction in snacks consumption (from 8.9 ± 3.3 to 7. 4 ± 3.8 ; 14 participants)
Pakpour 2015	FFQ	Total dietary fat (g), mean ± SD	At 12 months, the motivational interview + parental involvement group had a lower (P = 0.012) fat consumption (74.40 ± 42.39; 118 participants) compared to the con- trol group (95.73 ± 40.10; 115 par- ticipants). There was a reduction (P = 0.041) when comparing the motivational interview + parental involvement group to the motiva- tional interview group (98.42 ± 49. 83; 113 participants)
		Saturated fat (g), mean ± SD	At 12 months, the control group had a lower (P < 0.001) con- sumption of saturated fat (30.03 \pm 20.84; 115 participants) com- pared to the motivational inter- view + parental involvement group (35.52 \pm 21.48; 118 participants) . Similarly, the motivational inter- view group had a lower consump- tion (32.54 \pm 22.86; P = 0.029; 113 participants) compared to the motivational interview + parental involvement group
		Fried foods (servings/day), mean ± SD	At 12 months, the motivational interview + parental involvement group consumed fewer (P= 0.01) servings of fried foods (0.63 ± 0.33 ; 118 participants) compared to the control group (0.90 ± 0.44 ; 115 participants). Similarly, the moti- vational interview + parental in- volvement group consumed fewer fried foods compared to the moti- vational group (0.82 ± 0.30 , P = 0. 042; 113 participants)
Pbert 2013	24-hour dietary recall	% calories saturated fat, MD, 95% CI	At 6 months, there was no change % calories of saturated fat in the intervention arm (1.21, -1.99 to 4. 41) or the control arm (1.19, 95%

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 282 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

			CI -1.92 to 4.30)
		Added sugar (g/day), MD, 95% CI	At 6 months, sugar intake reduced in the intervention arm (-18.87, - 40.17 to 2.43) but not in the con- trol arm (-7.20, -27.59 to 13.19)
Brennan 2013	Dietary questions from the YBRS	Fruit (serving/day), mean ± SD	At 6 months, there was no differ- ence (P = 0.518) between the in- tervention (3.49 \pm 0.32; 39 partic- ipants) and the control group (3. 48 \pm 1.17; 21 participants) for fruit consumption
		Potatoes (serving/day), mean ± SD	At 6 months, there was no dif- ference (P = 0.141) for potatoes intake between the intervention group (2.25 \pm 0.78; 40 partici- pants) and the control group (2.67 \pm 0.86; 21 participants)
	Carrots (serving/day), mean ± SD	At 6 months, there was no signifi- cant difference (P = 0.948) for car- rots intake between the interven- tion group (2.15 \pm 0.52; 41 partic- ipants) and the control group (2. 38 \pm 0.92; 21 participants)	
		Salad (serving/day), mean ± SD	At 6 months, there was no differ- ence (P = 0.515) for salad con- sumption between the interven- tion group (2.38 \pm 1.21; 40 partic- ipants) and the control group (2. 57 \pm 1.50; 21 participants)
Ebbeling 2012	24-hour dietary recall (3 recalls)	Artificially sweetened beverages (servings/day), MD ± SD	At 2 years, there was no difference in the consumption of artificially sweetened beverages between the intervention and control group (0. 1 ± 0.1 , P = 0.32; 209 participants)
		Unsweetened beverages (servings/ day), MD ± SD	At 2 years, the consumption of unsweetened beverages remained higher in the intervention group compared to the control group (0.6 \pm 0.2, P < 0.001; 224 participants)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 283 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Wengle 2011 4-day dietary record	High fat/sugar (servings/week), mean ± SD	At 6 months, the non-mentored group demonstrated a significant decrease (P = 0.02) in high fat/ sugar consumption (from 3.6 ± 0.8 to 2.2 ± 0.9 ; 14 participants) while the mentored group had no significant (P = 0.19) nutritional changes (from 4.2 ± 2.7 to 3.7 ± 1.5 ; 14 participants)	
		Fast food (servings/week), mean ± SD	At 6 months, the non-mentored group demonstrated significant decrease (P = 0.02) in fast food consumption (from 1.6 ± 1.5 to 0.8 ± 1.0; 14 participants) while the mentored group had no significant (P = 0.36) nutritional changes (from 1.1 ± 1.1 to 0.7 ± 0.8; 14 participants)
		Whole-grain foods (servings/day), mean ± SD	At 6 months, the non-mentored group demonstrated significant increase (P = 0.02) in whole-grains consumption (from 0.8 ± 0.9 to 2.0 ± 1.4 ; 14 participants) while the mentored group had no significant (P = 0.73) nutritional changes (from 1.2 ± 0.8 to 1.0 ± 1.0 ; 14 participants)

CI: confidence interval; FFQ: Food Frequency Questionnaire; MD: mean difference; SD: standard deviation; SE: standard error; YBRS: Youth Behavioural Risk Survey.

Table 5. Behavioural change - dietary behaviour

Study	Tool	Outcome	Findings
Pakpour 2015	15- item Child Dietary Self-Efficacy Scale	Dietary self-efficacy, mean ± SD	At 12 months, the motivational interview + parental involvement group scored significantly higher (7. 11 \pm 2.62; 118 participants) compared to the control group (5.71 \pm 2. 82; 115 participants; P < 0.001) and the motivational interview group (6. 88 \pm 2.72; 113 participants; P = 0. 01)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 284 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Brennan 2013 FFVDQ	FFVDQ	Fat substitution	At 6 months, there was no differ- ence (P= 0.093) in fat substitution between the intervention group (2. 42 ± 0.93 ; 42 participants) and the control group (2.51 \pm 0.82; 21 par- ticipants)
		Modify meat	At 6 months, there was no differ- ence (P = 0.063) for the removal of fat from meat and choosing low fat cuts of meat between the interven- tion group (1.93 \pm 0.81; 40 partici- pants) and control group (2.43 \pm 0. 99; 19 participants)
		Avoid frying	At 6 months, there was no differ- ence (P = 0.289) in terms of avoiding fried food such as fried chicken, fish and chips between the intervention group (1.44 \pm 0.46; 40 participants) and the control group (1.64 \pm 0.57; 19 participants)
		Fat replacement	At 6 months, there was no differ- ence (P = 0.289) for the use of fruit and vegetables as an alternative to high-fat ingredients such as meat and desserts in the intervention group (2. 97 \pm 0.65; 40 participants) and the control group (2.71 \pm 0.73; 19 par- ticipants)
		Avoid fat	At 6 months, there was no differ- ence (P = 0.142) in avoiding fat as flavouring in terms of adding high- fat condiments such as butter, cream and cheese sauces to meals in the in- tervention group (2.50 \pm 0.54; 40 participants) and the control group (2.40 \pm 0.56; 19 participant)
		Fruit and vegetable	At 6 months, there was no difference (P = 0.992) between the intervention (2.98 \pm 0.67; 40 participants) and the control group (2.92 \pm 0.71; 19 par- ticipants) for fruit and vegetable con- sumption

Table 5. Behavioural change - dietary behaviour (Continued)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 285 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
Ford 2010	Mandometer	Eating speed, mean ratio, 95% CI	At 12 months, eating speed did not change for either the Mandometer group (mean ratio 0.89, 95% CI 0. 77 to 1.02; 44 participants) or the standard care group (1.04, 0.86 to 1. 25; 23 participants)
		Satiety at end of meal (arbitrary units 0-100), MD, 95% CI	At 18 months, satiety at the end of a meal did not change for either the Mandometer group (MD 3.7, 95% -11.2 to 3.8; 44 participants) or the standard care group (-4.1, -18.6 to 9. 5; 23 participants)
		Portion size (g), mean decrease, 95% CI	At 18 months, portion size did not change for either the Mandometer group (-31, 95% CI -2 to 64; 43 par- ticipants) or the standard care group (-3, -54 to 60; 21 participants)
Grey 2009	Health behaviour questionnaire (14 items student's usual food selections)	Usual food choices, MD, 95% CI	At 12 months, health behaviour in terms of food choices did not im- prove in either the coping skill train- ing group (1.2, -0.4 to 2.7; 112 par- ticipants) or the general education group (1.0, -0.7 to 2.6; 86 partici- pants)
	Health behaviour questionnaire (15 items Dietary Self-Efficacy)	Dietary self-efficacy, MD, 95% CI	At 12 months, health behaviour in terms of dietary self-efficacy did not change in either the coping skills training group (1.0, -0.7 to 2.6, 112 participants) or the general educa- tion group (-0.5, -2.2 to 1.3, in 86 participants)

Table 5. Behavioural change - dietary behaviour (Continued)

CI: confidence interval; FFVDQ: Fat, Fruit and Vegetables Diet Questionnaire; MD: mean difference; SD: standard deviation.

Table 6. Behavioural change - physical activity

Study	Tool	Outcome	Findings
Jelalian 2016	Sense Wear Mini monitor	MVPA (% time spent), mean ± SD	There was no significant increase in % time spent in MVPA in either the intervention group $(7.5 \pm 4.0 \text{ at base-line to } 8.5 \pm 3.9 \text{ at } 48 \text{ weeks})$ and control group $(7.9 \pm 2.2 \text{ at baseline})$

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 286 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Table 6.	Behavioural	change -	physical	activity	(Continued)
----------	-------------	----------	----------	----------	-------------

			to 8.9 ± 4.4)
Pakpour 2015	7-day physical activity recall inter- view	Self-reported physical activity dura- tion (hours/day), mean ± SD	At 12 months, the motivational in- terview + parental involvement re- ported a significantly higher dura- tion of physical activity (1.30 \pm 0. 66; 118 participants) compared to the control group (0.66 \pm 0.32; 115 participants; P= 0.004) and the mo- tivational interview group (1.12 \pm 0. 61; 113 participants; P = 0.01)
Sigal 2014	Pedometer	Steps (counts/day), MD, 95% CI	At 6 months, the number of steps did not significantly increase in the aerobic training group (303, -2039 to 2644; 38 participants), resis- tance training group (1821, -1097 to 4739; 53 participants), combined group (959, 9-1975 to 3893; 38 participants) and the control group (2224, -1122 to 5569; 36 partici- pants)
Gourlan 2013	7-day physical activity recall	Physical activity length (hours/day), mean ± SD	At 6 months, the standard weight loss programme + motivational in- terviewing significantly (P < 0.01) increased self-reported physical ac- tivity (1.30 \pm 0.82; 26 participants) compared to the standard weight loss programme group (0.99 \pm 0.62; 28 participants)
Kong 2013	3-day physical activity recall	MVPA (30-minute blocks/day), me- dian, 95% CI	At 6 months, there was no change in the intervention arm (0.0, -2.0 to 0.7; 27 participants) or the control group (-0.9, -1.3 to 0.4; 20 partici- pants)
Debar 2012	24- hour physical activity recall (adapted from the 7-day validated recall)	Physical activity (minutes/day), mean ± SD	At 6 months, physical activity did not significantly improve for either the intervention group (from 55.35 \pm 51.81 to 64.77 \pm 67.60; 104 par- ticipants) or the control group (from 49.68 \pm 39.47 to 56.39 \pm 53.12; 102 participants)
Wengle 2011	Accelerometer	Steps (1000/day), mean ± SD	At 6 months, there was no difference (P = 0.27) in the number of steps be- tween the intervention group (9.1 \pm

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 287 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Table 6. Behavioural change - physical activity (Continued)

			3.5; 14 participants) and the control group (7.6 ± 2.9; 11 participants)
Saelens 2002	7-day physical activity recall inter- view	Physical activity (kcal/kg/day), mean ± SD	At 7 months, no significant change in the Healthy Habits intervention $arm (6.7 \pm 5.6 \text{ to } 6.3 \pm 3.5; 18 \text{ partic-ipants})$ and the typical care $arm (34.$ $3 \pm 4.9 \text{ to } 35.6 \pm 6.4; 18 \text{ participants})$
Kong 2014	International Physical Activity Questionnaire (IPAQ), 7-day recall	Physical activity level (MET- min- utes/week), median (interquartile range)	At 6 months, there was no signifi- cant (P = 0.235) difference for activ- ity levels between the low GI group (1453, 740 - 2780; 28 participants) and the control group (2266, 960 to 4318; 18 participants)
Debar 2012	24- hour physical activity recall (adapted from the 7-day validated recall)	Physical activity level (MET/day), mean ± SD	At 6 months, the MET for self-reported physical activity did not significantly improve for either the intervention group (from 4.28 ± 3.97 to 4.84 ± 5.11 ; 104 participants) or the control group (from 3.80 ± 3.13 to $4.47 \pm .82$; 102 participants)
Ebbeling 2012	24-hour physical activity recall (3 re- calls)	Daily physical activity level (MET/ day), MD ± SD	At 2 years, there was no difference in activity levels between the interven- tion group and control group (0.01 ± 0.04; P = 0.86; 224 participants)
Grey 2009	Goldin Shephard activity survey	Physical activity (METs/week), MD, 95% CI	At 12 months, the MET for self- reported physical activity did not change in either the coping skill training group (2.6, -4.1 to 9.4; 112 participants) and the general educa- tion group (6.5, -0.7 to 13.7; 86 par- ticipants)

CI: confidence interval; GI: glycaemic index; MD: mean difference; MET: metabolic equivalent of task; MVPA: moderate to vigorous physical activity; SD: standard deviation.

Table 7. Behavioural change - physical activity behaviour

Study	Tool	Outcome	Findings
Jelalian 2016	Sense Wear Mini monitor	Sedentary behaviour (percentage of time spent), mean ± SD	The CBT-healthy lifestyle decreased percentage of time spent in seden- tary behaviour (from 71.2 ± 11.5 at

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 288 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

			baseline to 65.0 ± 12.0 at 48 weeks) . There was no change in the control group (from 69.1 ± 9.0 at baseline to 69.0 ± 9.04 at 48 weeks)
Pakpour 2015	5-item Physical Exercise Self-efficacy Scale	Physical exercise self-efficacy	At 12 months, the motivational interview + parental involvement group had significantly (P = 0.003) higher confidence scores (6.68 ± 1 . 97; 118 participants) compared to the control group (5.39 ± 2.18 ; 115 participants). However, the motiva- tional interview group scored signif- icantly higher (6.75 ± 1.15 ; P = 0. 01 113 participants) compared to the motivational interview + parental in- volvement group
Kong 2013	11-item Planet Health Study Ques- tionnaire	Television weekday viewing (hours/ day), median, 95% CI	At 6 months, there was no change in the intervention arm (-0.4, -1.0 to 0.2; 14 participants) or the con- trol group (0.2, -0.3 to 0.6; 8 partic- ipants)
		Television weekend viewing (hours/ day)	At 6 months, there was no change in the intervention arm (-0.1, -0.8 to 0. 0; 14 participants) or the control (0. 5, -2.0 to 1.5, 8 participants)
Grey 2009	Health Behaviour Questionnaire (5- item Physical Activity Self-Efficacy Scale)	Physical activity self-efficacy	At 12 months, health behaviour in terms of physical activity self-efficacy did not change in either the coping skills training group (0.6, 0.0 to 1.3; 112 participants) or the general ed- ucation group (0.3, -0.3 to 1.0; 86 participants)

Table 7. Behavioural change - physical activity behaviour (Continued)

CBT: cognitive behavioural therapy; CI: confidence intervals; MD: mean difference; SD: standard deviation

Table 8. Views of the intervention

Study	Tool	Outcome	Findings
Jelalian 2016	Session Evaluation Form - 4-point Likert scale from 1 = strongly agree to 4 = strongly disagree	Application (I will be able to apply what I learned from this session in my life), %	CBT-healthy lifestyle 75% (18 par- ticipants) agreed or strongly agreed Control 77.8% (7 participants) agreed or strongly agreed

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 289 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Table 8. Views of the intervention (Continued)

	Relevant (topic of this session was rel- evant to my life), %	CBT-healthy lifestyle 83.3% (20 participants) agreed or strongly agreed Control 100% (9 participants) agreed or strongly agreed	
		Comfortable (I felt comfortable par- ticipating in this session), %	CBT-healthy lifestyle 62.5% (15 participants) agreed or strongly agreed Control 88.9% (8 participants) agreed or strongly agreed
		Helpful (session was helpful to me), %	CBT-healthy lifestyle 70.8% (17 participants) agreed or strongly agreed Control 88.9% (8 participants) agreed or strongly agreed
Pbert 2013	bert 2013 Patient Exit Interview Survey and nurse checklist	% of visits in which the students thought that the school nurse was very helpful in their learning how to eat healthy and be physically active, (%)	At 6 months, a higher proportion of participants in the intervention group (98%) thought the school nurse was very helpful compared to the control group (71%) (P= 0.003)
		% of visits in which the students thought that they feel very comfort- able in discussing their weight-re- lated behaviours with the nurse, (%)	At 6 months, a higher proportion of participants in the intervention group (88%) felt more comfortable with the nurse compared to the con- trol group (62%) (P = 0.01)
Brennan 2013	CHOOSE HEALTH Consumer sat- isfaction survey - 5-point Likert scale	Satisfaction with Quality of Service (mean ± SD)	4.71 ± 0.47 for 70% of adolescents in the intervention arm
	ranging from 1 = strongly disagree to 5 = strongly agree, with a higher score indicating higher treatment accept- ability	Programme met needs (mean ± SD)	4.06 ± 0.75 for 70% of adolescents in the intervention arm
		Recommend to others (mean ± SD)	4.35 ± 0.79 for 70% of adolescents in the intervention arm
		Return to the programme if needed (mean ± SD)	3.81 ± 1.05 for 70% of adolescents in the intervention arm
		Now able to deal more effectively with concerns (mean ± SD)	4.06 ± 0.56 for 70% of adolescents in the intervention arm
		Able to focus on my concerns (mean ± SD)	4.00 ± 0.35 for 70% of adolescents in the intervention arm

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 290 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Table 8. Views of the intervention (Continued)

		Clinician listened to me (mean ± SD)	4.24 ± 0.56 for 70% of adolescents in the intervention arm
		Involved in treatment planning/de- cision making (mean ± SD)	4.29 ± 0.47 for 70% of adolescents in the intervention arm
		Clinician provided adequate expla- nations (mean ± SD)	4.41 ± 0.62 for 70% of adolescents in the intervention arm
		Clinician was not negative towards us (mean ± SD)	4.59 ± 1.00 for 70% of adolescents in the intervention arm
		Clinician knew what she was talking about (mean ± SD)	4.71 ± 0.47 for 70% of adolescents in the intervention arm
		Clinician was friendly and warm (mean ± SD)	4.64 ± 0.49 for 70% of adolescents in the intervention arm
		Felt free to express myself (mean ± SD)	4.41 ± 0.80 for 70% of adolescents in the intervention arm
		Clinician understood my thoughts and feelings (mean ± SD)	4.25 ± 0.86 for 70% of adolescents in the intervention arm
Debar 2012	1 to 5 Likert scale, 5 = excellent)	Rating of intervention services (mean ± SD)	4.4 ± 0.8
	1 to 5 Likert scale, 5 = defiantly met their needs)	Programme met their needs (mean ± SD)	4.0 ± 1.0
Nguyen 2012	7-point Likert scales, 1 = poor; 3 = fair; 5 = good; 7 = excellent	Programme quality rating (median, IQR)	At 24 months, 5, 5 to 6; 93 participants
	7-point Likert scales, 1 = not at all; 4 = moderately; 7 = extremely	Satisfaction with the amount of help received during the programme (me- dian, IQR)	At 24 months, 6, 5 to 6; 93 participants
	Yes or no (%)	Did the Loozit programme help you make changes to your eating habits? (% yes)	At 24 months, yes: 88%; 90 participants
	Yes or no (%)	Did the Loozit programme help you make changes to your physical activ- ity? (% yes)	At 24 months, yes: 82%; 92 participants
	Yes or no (%)	Did the Loozit programme help you make changes to other areas of your life? (% yes)	At 24 months, yes: 47%; 92 participants

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 291 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Table 8. Views of the intervention (Continued)

	A 7-point Likert scales, 1 = not at all; 4 = moderately; 7 = extremely	Additional therapeutic contact: SMS text messages (median, IQR)	At 24 months, 4, 4 to 5; 18 participants
	A 7-point Likert scales, 1 = not at all; 4 = moderately; 7 = extremely	Additional therapeutic contact: e- mails (median, IQR)	At 24 months, 5, 5 to 6; 11 partici- pants
	A 7-point Likert scales, 1 = not at all; 4 = moderately; 7 = extremely	Additional therapeutic contact: tele- phone coaching sessions (median, IQR)	At 24 months, 6, 4 to 6; 24 participants
	Yes or no (%)	Did the telephone coaching sessions help you: achieve your goals? (% yes)	Yes: 91%; 33 participants
	Yes or no (%)	Did the telephone coaching sessions help you: set goals for healthy living? (% yes)	Yes: 94%; 33 participants
	Yes or no (%)	Did the telephone coaching sessions help you: set goals for physical activ- ity? (% yes)	Yes: 85%; 33 participants
	Yes or no (%)	Did the telephone coaching sessions help you: in other ways? (% yes)	Yes: 39%; 33 participants
Christie 2011	Structured and semi-structured in- terviews	Ease of delivery, participation and influence on weight, quality of life, self-management, emotional, behavioural and family functioning	Participants and their families found the intervention highly engaging, re- spectful and helpful in making be- havioural changes
Wengle 2011	Helpfulness of having a mentor on a scale of 1-10	Helpfulness of having a mentor	13 participants reported $\geq 7/10$
	Getting along with the mentor on a scale of 1-10	How well they got along with their mentor	15 participants reported $\geq 8/10$
Saelens 2002	5-point Likert scale, 1 = not at all; 5 = very much	Satisfaction for intervention compo- nents (mean ± SD)	Reported significantly (P < 0.01) greater satisfaction for mailed mate- rials/manual than the computer in- teraction. Reported similar levels of satisfaction between the mailed ma- terials/manual (3.57 ± 1.13) and the physician counselling (3.39 ± 0.92) , and between physician counselling and the computer interaction (2.98 \pm 1.06)

CBT: cognitive behavioural therapy; IQR: interquartile range; SD: standard deviation

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 292 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Table 9. Parenting and relationships

Study	Tool	Outcome	Findings
Brennan 2013	Parent Adolescent Communication Scale designed to assess communica- tion between parent and adolescents. Open communication provides an indication of the freedom of expres- sion, understanding and satisfaction during family communications with high scores indicating positive com- munication	Open communication	At 6 months, intervention group had signif- icantly increased scores compared to control group
	Parent Adolescent Communication Scale designed to assess communica- tion between parent and adolescents. Problem communication focuses on negative interaction styles and con- straints in communication with high scores indicating negative communi- cation	Problems in communication	At 6 months, there was no difference be- tween the intervention group and the con- trol group
	The Family Problem Solving Com- munication Index to measure prob- lem solving and coping during fam- ily interactions. Incendiary indicates high levels of problematic commu- nication that inflame a difficult in- teraction with high scores indicating high levels of problematic communi- cation	Incendiary communication	At 6 months, there was no difference be- tween the intervention group and control group
	The Family Problem Solving Com- munication Index to measure prob- lem solving and coping during fam- ily interactions. Affirming commu- nication indicates high levels of sup- portive communication styles that calm a difficult interaction with high scores indicating supportive commu- nication	Affirming communication	At 6 months, there was no difference be- tween the intervention group and control group

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 293 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

APPENDICES

Appendix I. Search strategies

Cochrane Central Register of Controlled Trials (Cochrane Register of Studies Online)

Part I: Obesity 1. [mh Ôbesity] 2. [mh ^"Obesity, Morbid"] 3. [mh ^"Obesity, Abdominal"] 4. [mh ^"Pediatric Obesity"] 5. [mh Ôverweight] 6. [mh ^"Weight Loss"] 7. (adipos* or obes*):ti,ab 8. (overweight* or ("over" next weight*)):ti,ab 9. ("weight" near/1 (reduc* or los* or control* or manage*)):ti,ab 10. {or #1-#9} Part II: Intervention 11. [mh "Behavior Therapy"] 12. [mh "Counseling"] 13. [mh ^"Family Therapy"] 14. [mh ^"Social Support"] 15. [mh ^"Program Evaluation"] 16. [mh "Exercise"] 17. [mh "Exercise Therapy"] 18. [mh "Physical Education and Training"] 19. [mh "Exercise Movement Techniques"] 20. [mh ^"Motor Activity"] 21. [mh Diet] 22. [mh "Diet Therapy"] 23. [mh ^"Patient Education as Topic"] 24. [mh ^"Health Education"] 25. [mh "Health Behavior"] 26. [mh "Health Promotion"] 27. [mh ^"School Health Services"] 28. [mh ^"School Nursing"] 29. [mh ^"Life style"] 30. (("obesity" near/4 "intervention") or "program" or "programme" or "camp" or "camps"):ti,ab 31. ("lifestyle" or "life style"):ti,ab 32. exercis*:ti,ab 33. (physic* next (activ* or fit*)):ti,ab 34. (walk* or jog* or swim* or ("weight" next lift*) or danc* or "aerobics"):ti,ab 35. ((physic* or strength* or resist* or "circuit" or "weight" or aerob* or "cross" or "endurance" or structur*) near/4 train*):ti,ab 36. ("behavioral" or "behavioural" or (("behavior" or "behaviour") next "modification") or psychoth* or "psychosocial"):ti,ab 37. (("group" or "family" or cognit* or behav*) next therap*):ti,ab 38. (counseling or counselling):ti,ab

39. educat*:ti,ab

40. (("parent" or "parents" or "family") next ("based" or "focused" or "directed" or "centered" or "only" or "led")):ti,ab

41. (diet* or "healthy nutrition" or (nutrition* next ("knowledge" or educat* or therap* or program* or intervention*))):ti,ab

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 294 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

42. {or #11-#41} Part III: Part I + Part II and additional MeSH/subheading combination 43. #10 and #42 44. [mh Ôbesity] or [mh ^"Obesity, Morbid"] or [mh Ôverweight] 45. [mh /DH,PC,RH,TH,PX]/diet therapy or prevention & control or rehabilitation or therapy or psychology] 46. #44 and #45 47. #43 or #46 Part IV: Population (adapted from Leclercq 2013) 48. [mh Âdolescent] 49. [mh Child] 50. [mh Înfant] 51. [mh ^Pediatrics] 52. "minors":ti,ab 53. ("boy" or "boys" or "boyhood"):ti,ab 54. girl*:ti,ab 55. ("kid" or "kids"):ti,ab 56. infant*:ti,ab 57. ("baby" or "babies"):ti,ab 58. ("toddler" or "toddlers"):ti,ab 59. ("child" or "childs" or children* or childhood* or childcare* or schoolchild*):ti,ab 60. adolescen*:ti,ab 61. juvenil*:ti,ab 62. youth*:ti,ab 63. (teen* or preteen*):ti,ab 64. (underage* or ("under" next age*)):ti,ab 65. pubescen*:ti,ab 66. (paediatric* or pediatric*):ti,ab 67. {or #48-#66} Part V: Part III AND IV and additional MeSH/subheading combination 68. #47 and #67 69. [mh ^"Pediatric Obesity"] 70. [mh /DH,PC,RH,TH,PX] 71. #69 and #70 72. #68 or #71

MEDLINE (OvidSP)

Part I: Obesity
1. Obesity/
2. Obesity, Morbid/
3. Obesity, Abdominal/
4. Pediatric Obesity/
5. Overweight/
6. Weight Loss/
7. (adipos* or obes*).tw.
8. (overweight* or over weight*).tw.
9. (weight adj1 (reduc* or los* or control* or manage*)).tw.
10. or/1-9
Part II: Intervention
11. exp Behavior Therapy/

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 295 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

12. exp Counseling/ 13. Family Therapy/ 14. Social Support/ 15. Program Evaluation/ 16. exp Exercise/ 17. exp Exercise Therapy/ 18. exp "Physical Education and Training"/ 19. exp Exercise Movement Techniques/ 20. Motor Activity/ 21. exp Diet/ 22. exp Diet Therapy/ 23. Patient Education as Topic/ 24. Health Education/ 25. exp Health Behavior/ 26. exp Health Promotion/ 27. School Health Services/ 28. School Nursing/ 29. Life style/ 30. ((obesity adj3 intervention) or program or programme or camp?).tw 31. (lifestyle or life style).tw. 32. exercis*.tw. 33. (physic* adj (activ* or fit*)).tw. 34. (walk* or jog* or swim* or weight lift* or danc* or aerobics).tw 35. ((physic* or strength* or resist* or circuit or weight or aerob* or cross or endurance or structur*) adj3 train*).tw 36. (behavio?ral or behavio?r modification or psychoth* or psychosocial).tw 37. ((group or family or cognit* or behav*) adj therap*).tw. 38. counsel?ing.tw. 39. educat*.tw. 40. ((parent? or family) adj (based or focused or directed or centered or only or led)).tw 41. (diet* or healthy nutrition or (nutrition* adj (knowledge or educat* or therap* or program* or intervention*))).tw 42. or/11-41 Part III: Part I + Part II and additional MeSH/subheading combination 43. 10 and 42 44. Obesity/ or Obesity, Morbid/ or Overweight/ or Weight Loss/ 45. diet therapy.fs. or prevention & control.fs. or rehabilitation.fs. or therapy.fs. or psychology.fs 46. 44 and 45 47. 43 or 46 Part IV: Population (adapted from Leclercq 2013) 48. Adolescent/ 49. exp Child/ 50. Infant/ 51. Pediatrics/ 52. minors.tw. 53. (boy or boys or boyhood).tw. 54. girl*.tw. 55. infant*.tw. 56. (baby or babies).tw. 57. toddler?.tw. 58. (kid or kids).tw.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 296 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

59. (child or childs or children* or childhood* or childcare* or schoolchild*).tw 60. adolescen*.tw. 61. juvenil*.tw. 62. youth*.tw. 63. (teen* or preteen*).tw. 64. (underage* or under age*).tw. 65. pubescen*.tw. 66. p?ediatric*.tw. 67. or/48-66 Part V: Part III AND IV and additional MeSH/subheading combination 68. 47 and 67 69. Pediatric Obesity/ 70. diet therapy.fs. or prevention & control.fs. or rehabilitation.fs. or therapy.fs. or psychology.fs 71. 69 and 70 72. 68 or 71 Part VI: Study filter (Cochrane Handbook 2008 RCT filter - sensitivity and precision maximizing version) 73. randomized controlled trial.pt. 74. controlled clinical trial.pt. 75. randomi?ed.ab. 76. placebo.ab. 77. clinical trials as topic/ 78. randomly.ab. 79. trial.ti. 80. or/73-79 81. exp animals/ not humans/ 82. 80 not 81 Part VII: Part V + Part VI 83. 72 and 82

Embase (OvidSP)

Part I: Obesity 1. obesity/ 2. morbid obesity/ 3. abdominal obesity/ 4. childhood obesity/ 5. weight reduction/ 6. weight control/ 7. (adipos* or obes*).tw. 8. (overweight* or over weight*).tw. 9. (weight adj1 (reduc* or los* or control* or manage*)).tw. 10. or/1-9 Part II: Intervention 11. behavior therapy/ 12. cognitive therapy/ 13. exp counseling/ 14. family therapy/ 15. social support/ 16. exp program evaluation/

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 297 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

17. exp exercise/

18. exp physical education/
 19. exp physical activity/

20. exp motor activity/ 21. training/ 22. exp diet/ 23. exp diet therapy/ 24. nutritional health/ 25. child nutrition/ 26. feeding behavior/ 27. patient education/ 28. health promotion/ 29. health literacy/ 30. nutrition education/ 31. health education/ 32. school health education/ 33. school health service/ 34. lifestyle/ 35. lifestyle modification/ 36. ((obesity adj3 intervention) or program or programme or camp?).tw 37. (lifestyle or life style).tw. 38. exercis*.tw. 39. (physic* adj (activ* or fit*)).tw. 40. (walk* or jog* or swim* or weight lift* or danc* or aerobics).tw 41. ((physic* or strength* or resist* or circuit or weight or aerob* or cross or endurance or structur*) adj3 train*).tw 42. (behavio?ral or behavio?r modification or psychoth* or psychosocial).tw 43. ((group or family or cognit* or behav*) adj therap*).tw. 44. counsel?ing.tw. 45. educat*.tw. 46. ((parent? or family) adj (based or focused or directed or centered or only or led)).tw 47. (diet* or healthy nutrition or (nutrition* adj (knowledge or educat* or therap* or program* or intervention*))).tw 48. or/11-47 Part III: Part I + Part II and additional MeSH/subheading combination 49. 10 and 48 50. obesity/ or morbid obesity/ 51. pc.fs or rh.fs or th.fs. [prevention.fs. or rehabilitation.fs. or therapy.fs.] 52. 50 and 51 53. 49 or 52 Part IV: Population (adapted from Leclercq 2013) 54. juvenile/ 55. adolescent/ 56. child/ 57. infant/ 58. baby/ 59. toddler/ 60. preschool child/ 61. school child/ 62. pediatrics/ 63. minors.tw.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 298 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

64. (boy or boys or boyhood).tw. 65. girl*.tw. 66. infant*.tw. 67. (baby or babies).tw. 68. toddler?.tw. 69. (kid or kids).tw. 70. (child or childs or children* or childhood* or childcare* or schoolchild*).tw 71. adolescen*.tw. 72. juvenil*.tw. 73. youth*.tw. 74. (teen* or preteen*).tw. 75. (underage* or under age*).tw. 76. pubescen*.tw. 77. p?ediatric*.tw. 78. or/54-77 Part V: Part III AND IV and additional MeSH/subheading combination 79. 53 and 78 80. childhood obesity/ 81. pc.fs or rh.fs or th.fs. [prevention.fs. or rehabilitation.fs. or therapy.fs.] 82. 80 and 81 83. 79 or 82 Part VI: Study filter (Wong 2006afilter - SDSSGS version) 84. random*.tw. or clinical trial*.mp. or exp treatment outcome/ Part VII: Part V + Part VI 85. 83 and 84

PsycINFO (OvidSP)

Part I: Obesity 1. exp Overweight 2. (adipos* or obes*).tw. 3. (overweight* or over weight*).tw. 4. or/1-3 Part II: Intervention 5. Weight Control/ 6. Weight Loss/ 7. Aerobic Exercise/ 8. Diets/ 9. exp Exercise/ 10. Movement Therapy/ 11. Dance Therapy/ 12. exp Physical Activity/ 13. Physical Fitness/ 14. Health Behavior/ 15. Health Promotion/ 16. Health Knowledge/ 17. Health Literacy/ 18. Health Education/ 19. Client Education/

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 299 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

20. Lifestyle/ 21. Physical Education/ 22. exp Program Evaluation/ 23. Educational Programs/ 24. Educational Therapy/ 25. exp Program Development/ 26. School Based Intervention/ 27. School Counseling/ 28. Counseling/ 29. Group Counseling/ 30. Family Therapy/ 31. Support Groups/ 32. Social Support/ 33. School Counselors/ 34. exp Behavior Modification/ 35. Cognitive Behavior Therapy/ 36. Cognitive Therapy/ 37. ((obesity adj3 intervention) or program or programme or camp?).tw 38. (lifestyle or life style).tw. 39. exercis*.tw. 40. (physic* adj (activ* or fit*)).tw. 41. (walk* or jog* or swim* or weight lift* or danc* or aerobics).tw 42. ((physic* or strength* or resist* or circuit or weight or aerob* or cross or endurance or structur*) adj3 train*).tw 43. (behavio?ral or behavio?r modification or psychoth* or psychosocial).tw 44. ((group or family or cognit* or behav*) adj therap*).tw. 45. counsel?ing.tw. 46. educat*.tw. 47. ((parent? or family) adj (based or focused or directed or centered or only or led)).tw 48. (diet* or healthy nutrition or (nutrition* adj (knowledge or educat* or therap* or program* or intervention*))).tw 49. or/5-48 Part III: Part I + Part II 50. 4 and 49 Part IV: Population (adapted from Leclercq 2013) 51. minors.tw. 52. (boy or boys or boyhood).tw. 53. girl*.tw. 54. infant*.tw. 55. (baby or babies).tw. 56. toddler?.tw. 57. (kid or kids).tw. 58. (child or childs or children* or childhood* or childcare* or schoolchild*).tw 59. adolescen*.tw. 60. juvenil*.tw. 61. youth*.tw. 62. (teen* or preteen*).tw. 63. (underage* or under age*).tw. 64. pubescen*.tw. 65. p?ediatric*.tw. 66. or/51-65

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 300 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Part V: Part III AND IV and additional MeSH/subheading combination
67. 50 and 66
Part VI: Study filter (Eady 2008 filter - BS version)
68. control*.tw. OR random*.tw. OR exp Treatment/
Part VII: Part V + Part VI
69. 67 and 68

CINAHL (EBSCOhost)

Part I: Obesity S1. MH "Obesity+" S2. TX (adipos* or obes*) S3. TX (overweight* or "over weight*") S4. S1 OR S2 OR S3 Part II: Intervention S5. MH "Weight Loss" S6. MH "Behavior Modification+" S7. MH "Counseling" S8. MH "Family Therapy" S9. MH "Support, Psychosocial" S10.MH "Support Groups" S11.MH "Program Evaluation" S12.MH "Program Implementation" S13.MH "Exercise+" S14.MH "Sports+" S15.MH "Therapeutic Exercise+" S16.MH "Physical Fitness" S17.MH "Physical Education and Training+" S18.MH "Health Education+" S19.MH "Diet+" S20.MH "Diet Therapy+" S21.MH "Health Behavior" S22.MH "Eating Behavior" S23.MH "Health Promotion" S24.MH "School Health Services+" S25.MH "Life style changes" S26.MH "Life style" S27.TX (weight N1 (reduc* or los* or control* or manage*)) S28.TX ((obesity N3 intervention) OR program OR programme OR camp#) S29.TX (lifestyle or "life style") S30.TX exercis* S31.TX (physic* N1 (activ* or fit*)) S32.TX (walk* or jog* or swim* or weight lift* or danc* or aerobics) \$33.TX ((physic* or strength* or resist* or circuit or weight or aerob* or cross or endurance or structur*) N3 train*) S34.TX (behavio#ral or behavio#r modification or psychoth* or psychosocial) S35.TX ((group or family or cognit* or behav*) N1 therap*) S36.TX counsel#ing S37.TX educat* S38.TX ((parent# or family) N1 (based or focused or directed or centered or only or led))

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 301 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

S39.TX (diet* or "healthy nutrition" or (nutrition* N1 (knowledge or educat* or therap* or program* or intervention*))) S40.S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 Part III: Part I + Part II and additional MeSH/subheading combination S41.S4 AND S40 S42.(MH "Obesity+/DH/ED/PC/PF/RH/TH") [diet therapy or education or prevention & control or psychosocial factors or rehabilitation or therapy] S43.S41 OR S42 Part IV: Population (based on Leclercq 2013I S44.MH "Adolescence" S45.MH "Child+" S46.MH "Infant" S47.MH "Pediatrics" S48.TX minors S49.TX (boy OR boys OR boyhood) S50.TX girl* S51.TX infant* S52.TX (baby OR babies) S53.TX toddler# S54.TX (kid OR kids) S55.TX (child OR childs OR children* OR childhood* OR childcare* OR schoolchild*) S56.TX adolescen* S57.TX juvenil* S58.TX youth* S59.TX (teen* or preteen*) S60.TX (underage* or under age*) S61.TX pubescen* S62.TX (paediatric* OR pediatric*) S63.S44 OR S45 OR S46 OR S47 OR S48 OR S49 OR S50 OR S51 OR S52 OR S53 OR S54 OR S55 OR S56 OR S57 OR S58 OR S59 OR S60 OR S62 Part V: Part III AND IV and additional MeSH/subheading combination S64.S43 AND S63 S65.(MH "Pediatric Obesity/DH/ED/PC/PF/RH/TH") [diet therapy or education or prevention & control or psychosocial factors or rehabilitation or therapy] S66.S64 OR S65 Part VI: Study filter (Wong 2006b filter - SDSSGS version) S67.MH "treatment outcomes+" OR MH "experimental studies+" or random* Part VII: Part V + Part VI S68.S66 AND S67

LILACS (IAHx)

((((MH: "Obesity" OR MH: "Obesity, Morbid" OR MH: "Obesity, Abdominal" OR MH: "Pediatric Obesity" OR MH: "Overweight" OR adipos\$ OR obes\$ OR overweight\$ OR "over weight" OR sobrepes\$ OR "excess de peso" OR "excess de peso") AND (MH: "Weight Loss" OR MH: "Exercise" OR MH: "Exercise Therapy" OR MH: "Physical Education and Training" OR MH: "Exercise Movement Techniques" OR MH: "Weight Reduction Programs" OR MH: "Motor Activity" OR MH: "Behavior Therapy" OR MH: "Counseling" OR MH: "Family Therapy" OR MH: "Social Support" OR MH: "Program Evaluation" OR MH: "Diet" OR MH: "Diet Therapy" OR MH: "Patient Education as Topic" OR MH: "Health Education" OR MH: "Health Behavior" OR MH: "Health Promotion" OR MH: "Weight Reduction Programs" OR MH: "School Health Services" OR MH: "Life style" OR exerci\$ OR ejerci\$

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 302 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

OR ((physic\$ OR fisic\$) AND (activ\$ OR ativid\$ OR fit\$ OR educac\$ OR entrenam\$ OR treinam\$)) OR ((physic\$ OR fisic\$ OR strength\$ OR forca OR fuerza OR resist\$ OR circuit\$ OR weight OR aerob\$ OR endurance OR structur\$ OR estructur\$) AND train\$ OR treina\$ OR entrena\$) OR program\$ OR "estilo de vida" OR padres OR pais OR familia OR familias OR familiar OR terapia OR orienta\$ OR educa\$ OR diet\$ OR nutric\$ OR "weight reduction" OR "weight loss" OR "weight control" OR "control de peso")) OR (MH: "Obesity/diet therapy" OR MH: "Obesity, Morbid/diet therapy" OR MH: "Overweight/diet therapy" OR MH: "Obesity/prevention & control" OR MH: "Obesity, Morbid/prevention & control " OR MH: "Overweight/prevention & control" OR MH:"Obesity/rehabilitation" OR MH:"Obesity, Morbid/rehabilitation" OR MH:"Overweight/rehabilitation" OR MH:"Obesity/ therapy" OR MH: "Obesity, Morbid/therapy" OR MH: "Overweight/therapy" OR MH: "Obesity/psychology" OR MH: "Obesity, Morbid/psychology" OR MH: "Overweight/psychology")) AND (MH: "Adolescent" OR MH: "Child" OR MH: "Pediatrics" OR MH: "Infant" OR minors OR boy OR boys OR girl\$ OR kid OR kids OR child OR childs OR children\$ OR childhood\$ OR childcare\$ OR schoolchild\$ OR escolar\$ OR adolescen\$ OR preadolescen\$ OR juvenil\$ OR juventud\$ OR youth\$ OR teen\$ OR preteen\$ OR underage\$ OR pubescen\$ OR paediatri\$ OR pediatri\$ OR joven\$ OR jovem\$ OR niños OR niñas OR crianca\$ OR menin\$ OR "menor de edad" OR "menores de edad" OR "menor de idade" OR "menores de idade")) OR MH: "Pediatric Obesity/diet therapy" OR MH: "Pediatric Obesity/prevention & control" OR MH: "Pediatric Obesity/rehabilitation" OR MH: "Pediatric Obesity/therapy" OR MH:"Pediatric Obesity/psychology" [activated filter "Controlled Clinical Trial"]

ICTRP Search Portal (Advanced search)

[activated "Search for clinical trials in children"]: in Title: obes* OR overweight* OR in Condition: obes* OR overweight* Recruitment Status: ALL

ClinicalTrials.gov (Advanced search)

Conditions: obese OR overweight OR obesity Study type: Interventional Studies Age Group: Child (birth-17)

Appendix 2. Description of interventions

Trial ID	Interventions	Comparators
Patsopoulou 2017	I1: activity programme 3-day per week training programme (45 minutes per training session) for 12 weeks. Instructed to add an extra 30-45 min- utes of walking or other sport activity of their preference at least once per week and to reduce inactivity	No intervention
	I2: as for activity group + nutritional education introductory meeting (45-60 minutes). Parents were invited to attend sessions	I2: as for activity group + nutritional education introductory meeting (45-60 minutes). Parents were invited to attend sessions

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 303 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Jelalian 2016	CBT for depression and healthy lifestyle plus ex- ercise: CBT treatment adapted into 1 integrated protocol that addresses depression, an exercise component, weight and advice regarding healthy eating. Weekly 60-minute group aerobic exercise sessions were required and facilitated by a phys- iotherapist	CBT for depression treatment only
Norman 2016	Stepped down care based on cognitive be- havioural modification, individual sessions of counselling health education and telephone calls. Consisted of 3×4 -month steps but the number and frequency of each intervention step varied. Aimed for adolescents to lose 4 lb every 4 months and if the 4-lb weight loss was achieved, the par- ticipant was 'stepped-down' to the next level of reduced intensity	Enhanced usual care. 1 counselling visit, 1 health education visit, materials and monthly mailings of weight-related materials
Hofsteenge 2014	Group education on dietary behaviour, physical activity and energy balance	Referral to a dietitian
Schranz 2014	Resistance training	No intervention
Visuthranukul 2015	Low GI diet. Monthly visits for 6 months. Each visit consisted of a 2-hour, small class teaching session with parental participation (4-5 families per class)	Conventional diet. Monthly visits for 6 months (1 per month for 6 months)
Wong 2015	Monthly dietary counselling with a registered di- etitian and daily text messaging	Monthly dietary counselling with a registered di- etitian and daily text messaging
Pakpour 2015	I1: MI. Physical activity and dietary intervention,40-minute session weekly for 6 weeks	Passive control: no details
	I2: MI + parental involvement. As for MI group with 1-hour parental session after 6 weeks	I2: MI + parental involvement. As for MI group with 1-hour parental session after 6 weeks
Bean 2014	I1: MI values. 2 sessions, values clarification, re- examined value/behaviour congruency and ideas for change + TEENS family-based intervention	Education control. Watched 2 educational videos, week 1 and week 10 + TEENS family-based intervention
Carraway 2014	12-week mentor-led exercise programme. Each adolescent paired with a college student mentor who was majoring in exercise physiology or re- lated field. Mentor/mentee pairs met for 3 exer- cise sessions per week, each lasting 1 hour. Activ- ity type varied by session and was decided collab- oratively and included exercise machines (tread-	Wait list control

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 304 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	mill, stationary bike, elliptical), racquetball, ten- nis, group outdoor activities (flag football, tag) . Mentees wore heart rate monitors to monitor exercise intensity. In addition to exercise, the 12- week programme included individual weekly cog- nitive behavioural-based challenges, or lessons. Mentors received 12 hours of training in MI and behavioural strategies to increase physical activity and modify eating. Mentors also received weekly supervision on goal setting and related topics. Parents of adolescents attended monthly parent meetings to discuss progress and build support through education	
Sigal 2014	I1: diet + aerobic training, reduced calorie diet and 4 weekly visits to gym for aerobic training over 22 weeks	Diet only: reduced calorie diet and usual activity
	I2: diet + resistance training: reduced calorie diet and 4 weekly visits to gym for resistance training over 22 weeks	I2: diet + resistance training: reduced calorie diet and 4 weekly visits to gym for resistance training over 22 weeks
	I3: diet + aerobic + resistance training: reduced calorie diet and 4 weekly visits to gym for aerobic and resistance training over 22 weeks	I3: diet + aerobic + resistance training: reduced calorie diet and 4 weekly visits to gym for aerobic and resistance training over 22 weeks
Love-Osborne 2014	MI: diet and exercise goal setting, additional text messages for half the group	Control group, no details
Kong 2014	Low GI diet individual counselling diet, physical activity and behavioural components. 7 sessions over 6 months	Usual Chinese diet: individual counselling diet, physical activity and behavioural components. 7 sessions over 6 months
Luna-Pech 2014	Normocaloric diet and physical activity, seen ev- ery 2 weeks for 28 weeks	No intervention, free diet, seen every 2 weeks for 28 weeks
Boodai 2014	Group sessions focusing on reduction in seden- tary behaviour, diet, promotional of physical ac- tivity	No intervention, advice to attend primary care
Gourlan 2013	MI + standard weight loss. Behaviour modifica- tion as well as standard weight loss intervention. No details of number sessions	Standard weight loss: balanced diet, a healthy lifestyle and physical activity
Patrick 2013	I1: website intervention. To promote weight loss and healthy behaviours. 51-week intervention, website for adolescents and for parents	Usual care. Given printed materials

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 305 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	I2: website + group. To promote weight loss and healthy behaviours. 51-week intervention, web- site for adolescents and for parents. Also group support sessions (number not stated)	I2: website + group. To promote weight loss and healthy behaviours. 51-week intervention, web- site for adolescents and for parents. Also group support sessions (number not stated)
	I3: website + SMS. To promote weight loss and healthy behaviours. 51-week intervention, web- site for adolescents and for parents. Text messages sent weekly	I3: website + SMS. To promote weight loss and healthy behaviours. 51-week intervention, web- site for adolescents and for parents. Text messages sent weekly
Kong 2013	ACTION. MI, visit to clinician every 2-3 weeks for a total of 8 visits over 1 academic year, DVD toolkit	Standard care. 1 clinician visit and printed infor- mation
Pbert 2013	"Lookin' Good Feelin' Good." 6 × 1-on-1 coun- selling sessions conducted over 2 months focused on behavioural change, diet and physical activity goals	6 × 1-on-1 visits with the school nurse, informa- tion pamphlets
Brennan 2013	MI. 13 sessions over 4-6 months with or without parent. Then maintenance phase of 2×1 -hour clinic sessions and 7×15 -minute maintenance telephone call session and a final face-to-face session 6 months after the last treatment session	Wait list control
Walpole 2013	MI: focus on unhealthy behaviours, 6 sessions, 30-minutes long	Social skills training: finding ways to navigate so- cial situations, 6 sessions, 30-minutes long
Toulabi 2012	Behavioural modification. Dietary modification and techniques for increasing physical activity. 8 × 45-minute sessions, held twice per week and group physical activity 1 hour per day, 3 days per week, for 6 weeks	Educational booklets
Debar 2012	Multicomponent intervention. Group meetings, 16 times (90 minutes each) over 5 months for adolescents and 12 sessions for parents	Usual care. Clinic visit, information and resources
Ebbeling 2012	Multicomponent intervention. Emphasis on the consumption of sugar-sweetened beverages, provided with written information, telephone calls and 3 check-in visits (20 minutes per visit). Monthly motivational telephone calls with parents (30 minutes per call)	Control: no details
Vos 2011	Family-based CBT + nutrition. Educational ses- sions, computer package, 7 children group meet- ings - 2.5 hours' duration biweekly. 5 parent meet- ings, 1 parent and child meeting	Wait list control

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 306 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Christie 2011	Multicomponent motivational and solution-fo- cused family-based weight management pro- gramme. 12 HELP sessions (45 minutes each) across 6 months	Enhanced standard care, 1 educational session of 40 minutes addressing eating behaviours, healthy activity, uses standard national guidance		
Wengle 2011	I1: mentored lifestyle intervention. Nutrition and activity counselling at baseline, 1, 2, 3 and 6 months. 1-2 hour once per week mentoring sessions to achieve activity goals, participate in physical activity, and discuss and set nutritional goals	Unmentored lifestyle intervention. Nutrition and activity counselling at baseline, 1, 2, 3 and 6 months		
Ford 2010	Mandometer. Real-time feedback during meals to slow down speed of eating and reduce total intake. Weekly visits for 6 weeks, then every 2 weeks for 6 weeks then monthly. Telephone support	Standard care. 3 monthly visits, emphasis on diet and physical activity goal setting		
Nguyen 2012	I1: Loozit + ATC. Healthy lifestyle intervention based on cognitive behavioural approach with an intensive treatment phase followed by a longer maintenance phase. 7×75 -minute weekly group sessions then 7×60 -minute sessions over 24 months. Telephone coaching, e-mails, text mes- sages (32 electronic and 14 telephone coaching sessions). Adolescent and parent	Loozit as for intervention except no ATC		
Grey 2009	Coping skills. 13 sessions over 16 weeks: 8 nutri- tion and activity classes + 5 coping skill training. Telephone counselling for 9 months	General education. 8 nutrition and activity classes over 16 weeks		
Vissers 2008	School-based intervention. Physical activity and nutrition sessions and gym membership. 6 nutri- tion sessions: individual or group (maximum of 2 group sessions) once per month	Standard gym classes		
NCT00132132	Behavioural education programme. Monthly 4- hour session which incorporated: exercise, em- powerment, education and incentives	Standard of care control: education on physical activity and nutrition		
Pitetti 2007	Treadmill. Use of treadmill in usual school activity sessions (3 per week) and also taken to the gym to use the treadmill on days and evenings when not participating in usual school activity sessions	Usual school activity sessions and Leisure activity of choice		
Savoye 2007	Bright Bodies weight management. Nutrition/ behaviour modification once (40 minutes each) per week. Parental involvement in the nutrition related topics. Behaviour modification sessions	Diet and exercise counselling and brief psy- chosocial counselling. 30 minute session every 6 months		

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 307 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	were held separately for parents and children. At- tended twice per week for 6 months and then ev- ery other week for an additional 6 months	
van Egmond-Frohlich 2006	Multicomponent intervention: after a rehabilita- tion programme participating physicians of the intervention group received a practice guideline: this addressed the guilt or fate problem, treatment aims (health promotion activities), guidance on fat-limiting mixed diet, promotion of a physical active lifestyle, local support resources, promo- tion of flexible control of eating and patient guid- ance according to the public health counselling and self-management model The outpatient programme was intended to have health check-ups every 4 weeks during the first 12 months (10-12 appointments)	Standard care
Daley 2005	Exercise counselling. 8 weekly behavioural ses- sions focused on attitudes to exercise. Offered aer- obic exercise modalities, asked to exercise inter-	C1: exercise placebo. 24 sessions over 8 weeks; performed light body-conditioning/stretching exercises
	weeks	C2: usual care
Resnicow 2005	Go Girls. High intensity. Weekly (20-26) be- havioural sessions. 1 meeting/week for 6 months (parents attending 10-13 times), 1 day retreat, 6 MI telephone calls. 2-way paging messages to sup- port behavioural change. Retreats (unclear how many)	Moderate intensity 6 sessions over 6 months (1 per month), parents attending 3. Sessions were selected from the larger pool of sessions delivered to the intervention group
Jiang 2005	Family-based intervention. 104 weeks (2 years). Unclear number of sessions	Usual care
Carrel 2005	Lifestyle-focused gym classes. Fitness-oriented group gym classes, movement time was 42 min- utes of a 45-minute class period. 36- week (9 month) intervention, 90 sessions	Standard gym classes. 36-week (9-month) inter- vention, 90 sessions (5 times every 2 weeks for a 45-minute class period), Movement time 25 min- utes of the 45-minute period
Ebbeling 2003	Low GL diet. 12 sessions over 6 months (12 di- etary counselling sessions) and a 6-month follow- up (2 dietary counselling sessions)	Conventional low-fat diet. 12 sessions over 6- months (12 dietary counselling sessions) and a 6- month follow-up (2 dietary counselling sessions)
Saelens 2002	Healthy Habits. Computer- and telephone-deliv- ered intervention, focus on diet and physical ac- tivity goals, 1 tailored physician-counselling ses- sion. 12 telephone call sessions with counsellor (10-20 minutes). Overall duration was 16 weeks with 13 sessions	Standard care. Non-tailored physician-coun- selling session

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 308 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Brownell 1983	I1: mother-child separate sessions of behaviour modification, social support, nutrition and exer- cise	Child-only sessions of behaviour modification, social support, nutrition and exercise		
	I2: mother-child together sessions of behaviour modification, social support, nutrition and exer- cise	I2: mother-child together sessions of behaviour modification, social support, nutrition and exer- cise		
Chandra 1968	Low-calorie formula using Limical (Sarabhai Chemicals) for 1 day (4 servings) containing pro- teins 70 g, fat 20 g, carbohydrates 110 g	Low-calorie diet without the aid of Limical		
NCT00807560	Family-based therapy for paediatric overweight to resolve the eating disorder and return the patient to healthy psychosocial and physiological devel- opmental trajectories through active family in- volvement across 3 treatment phases	Nutritional educational control condition will re- ceive a minimal nutrition and physical activity education curriculum across 16 sessions over 24 weeks		

^{*a*} The term 'adequate' refers to sufficient use of the intervention/comparator with regard to dose, dose escalation, dosing scheme, provision for contraindications and other features necessary to establish a fair contrast between intervention and comparator ATC: additional therapeutic contact; C: comparator; CBT: cognitive behavioural therapy; DVD: digital versatile disc; GI: glycaemic index; GL: glycaemic load; HELP: Healthy Eating and Lifestyle Programme; I: intervention; MI: motivational interviewing; SMS: short message service

Appendix 3. Baseline characteristics (I)

Trial ID	Interven- tion and comparator	Duration of interven- tion (dura- tion of fol- low-up)	Descrip- tion of par- ticipants	Study period (year to year)	Country	Setting	Ethnic groups (%)	Socioeco- nomic sta- tus
Pat- sopoulou 2017	11: activity	12 weeks (at 6 months)	Overweight and obese adolescents, aged 13-15 years, no or- ganic cause for their obesity and on no medications	2011-2014	Greece	Public train- ing centre	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 309 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	I2: activity + diet						-	-
	C1: no in- tervention						-	-
Jelalian 2016	I1: CBT + healthy lifestyle	6 months (at 12 months)	Aged 12- 18 years, de- pressed, overweight or obese (BMI > 25 kg/m ² or BMI per- centile > 85th for gender and age)	-	USA	University (based on author loca- tion)	Child Latino: 33.3 Child mi- nority race: 58.3	Parent edu- cation: < high school: 17.4% high school: 47.8% > high school: 34.8% House- hold income (USD): < 5000: 4. 2% 5000-9999: 16.7% 10,000-14, 999: 4.2% 15,000-25, 999: 16.7% 26,000-49, 999: 20.8% 50,000-74, 999: 20.8% 75,000-99, 999: 8.3% 100,000- 149,000: 4. 2%
	C1: CBT						Child Latino: 33.3 Child mi- nority race: 44.4	Parent edu- cation: < high school 0%; high school 22.2% > high school 77.8% House- hold income

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 310 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

							(USD): < 5000: 11. 1% 5000-9999: 11.1% 10,000-14, 999: 0% 15,000-25, 999: 22.2% 26,000-49, 999: 11.1% 50,000-74, 999: 33.3% 75,000-99, 999: 0% 100,000- 149,000: 11.1%
Norman 2016	I1: stepped down care	12 months + 2 weeks run-in (at 12 months)	Aged 11-13 years, obese (≥ 95th per- centile for age and gen- der)	USA	Primary care	Girls African- American: 7 Asian/ Pacific Islander: 0 Hispanic: 83 White non- Hispanic: 7 Multiethnic or other: 3 Boys African- American: 4 Asian/ Pacific Islander: 4 Hispanic: 71 White non- Hispanic: 17 Multiethnic or other: 4	Parent highest edu- cation (%): Girls: \leq high school degree 44 some college/asso- ciates degree 28 \geq Bachelor's degree 28 Boys: \leq high school degree 29 some college/ associates degree 42 \geq Bachelor's degree 29 Parent an- nual income (USD) :

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 311 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

				Girls: < 35,000: 39% 35,000-49, 900: 30% 50,000-74, 900: 8% \geq 75,000: 23% Boys: < 35,000: 31% 35,000-49, 900: 23% 50,000-74, 900: 19% \geq 75,000: 27%
C1: enhanced usual care			Girls African - American: 0 Asian/ Pacific Islander: 0 Hispanic: 92 White non- Hispanic: 0 Multiethnic or other: 8 Boys African- American: 4 Asian/ Pacific Islander: 4 Hispanic: 81 White non- Hispanic: 7 Multiethnic or other: 4	Parent highest edu- cation (%): Girls: \leq high school degree: 28 some college/ associates degree: 56 \geq Bachelor's degree: 16 Boys: \leq high school degree: 37 some college/as- sociates de- gree: 26 \geq Bachelor's degree: 37 Parent an- nual income (USD):

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 312 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

								Girls: < 35,000 36% 35,000 49,900; $32%50,00074,900$; $24%\geq 75,000;8%Boys:< 35,00043%35,00043%35,00043%35,00043%35,00043%35,00043%35,00043%35,00043%35,00043%35,00043%35,00043%35,00043%35,00043%35,00043%35,00043%35,00043%35,00043%35,00043%35,00050,00050,00050,00050,00050,00035,00043%35,00043%35,00050,00018%$
Hofsteenge 2014	I1: group education	36 weeks (at 18 months)	Aged 12-18 years with overweight or obesity according to	2006-2009	The Nether- lands	Outpatient	Western: 50. 7 Non- Western: 49. 3	-
	C1: dietitian only		Cole criteria				Western: 35. 3 Non- Western: 64. 7	-
Schranz 2014	I1: resis- tance train- ing	6 months (at 12 months)	Aged 13-17 years, very over-	2010-2011	Australia	Community (gym)	-	-
	C1: no in- tervention		obese (Cole criteria)				-	-
Vi- suthranukul	I1: low GI diet	6 months (at 6 months)	Obese Thai chil-	2010-2013	Thailand	Hospital	-	-
2015	C1: conven- tional diet		dren aged 9- 16 years				-	-
Wong 2015	I1: standard weight loss diet + in- crease water intake	6 months (immedi- ately follow- ing inter- vention)	Over- weight and obese ado- lescents who consumed 4 cups of wa-	-	USA	Hospi- tal (based on authors lo- cation)	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 313 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

		_	ter per day at screening					
	C1: stan- dard weight loss diet						-	-
Pakpour 2015	I1: motiva- tional inter- viewing	6 weeks (at 12 months)	13-18 years, obese (≥ 95th per- centile for age and gen- der)	-	Iran	Outpatient	-	Mother edu- cation, years 6.26 (3.42) father edu- cation, years 7.43 (3.86) house- hold income (1000 ri- als) 7434.63 (1891.39)
	I2: moti- vational in- terviewing + parental in- volvement						-	Mother edu- cation, years 6.19 (3.54) father edu- cation, years 7.28 (3.91) house- hold income (1000 trials) 7304.10 (2136.48)
	C1: passive control						-	Mother edu- cation, years 5.92 (3.89) father edu- cation, years 8.26 (4.21) house- hold income (1000 rials)
Bean 2014	I1: motiva- tional inter- viewing val- ues	3 months (at 6 months)	Over- weight aged 11-18 years, BMI ≥ 85th percentile for age and gender	2009-2011	USA	Healthcare (based on author loca- tion)	Black: 75.4 White: 19.3 Other: 5.3	Family income (USD): < 40,000: 56% ≥ 40,000: 44%

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 314 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

								Parent edu- cation: ≤ high school grad- uate: 19.6 some college: 43.1 college degree or be- yond: 37.3
	C1: educa- tion control						Black: 68.3 White: 19.5 Other: 12.2	Family income (USD): < 40,000 (48.6%) \ge 40,000 (51.4%) Parent edu- cation: \le high school grad- uate: 34.3 some college: 20.0 college degree or be- yond: 45.7
Carraway 2014	I1: mentor- led exercise	12 weeks (at 7 months)	Over- weight aged 12-17 years, BMI \ge 85th percentile	-	USA	Healthcare (based on author loca- tion)	African- American: 27.3 White: 63.6 Other: 9.1	-
	C1: wait list control		tor age and gender				African- American: 61.5 White: 30.8 Other: 7.7	-
Sigal 2014	I1: diet + aero- bic training	22 weeks + 4-week run- in (at 6 months)	Overweight or obese adoles- cents, aged 14-18 years, BMI ≥ 95th percentile or	2005-2011	Canada	Community	White: 72.0 Black: 8.0 Mixed: 6.7 Arabic: 5.3 Asian: 1.3 Hispanic: 5. 3	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 315 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

			≥ 85th per- centile + dia- betes or car- diovascular risk factor				Other: 1.3 Native Canadian: 0	
	I2: diet + re- sistance training						White: 70.5 Black: 14.1 Mixed: 2.6 Arabic: 1.3 Asian: 6.4 Hispanic: 2. 6 Other: 2.6 Native Canadian: 0	-
	I3: diet + aero- bic + resis- tance train- ing						White: 62.7 Black: 16.0 Mixed: 4.0 Arabic: 5.3 Asian: 2.7 Hispanic: 4. 0 Other: 2.7 Native Canadian: 2.7	-
	C1: diet only						White: 82.9 Black: 2.6 Mixed: 5.3 Arabic: 2.6 Asian: 2.6 Hispanic: 0 Other: 1.3 Native Canadian: 2.6	-
Love- Osborne 2014	I1: motiva- tional inter- viewing	6- 8 months (at 6-8 months)	BMI ≥ 85%	2010-	USA	School- based health centres	Hispanic: 88	-
	C1: control						Hispanic: 89	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 316 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Kong 2014	I1: low GI diet C1: usual Chinese diet	6 months (in- terim data from a 12- month in- tervention)	Adolescents, BMI ≥ 95th percentile	2010-2012	Hong Kong	University	-	-
Luna-Pech 2014	I1: nor- mocaloric diet + physi- cal activity	28 weeks (at 28 weeks)	Aged 12-16 years, asthma, BMI \geq 95th percentile of the CDC	-	Mexico	Tertiary care	-	-
	C1: no in- tervention		BMI-for- age growth charts				-	-
Boodai 2014	I1: multi- compo- nent group sessions	6 months (at 6 months)	Aged 10-14 years, BMI > 95th per- centile	2009	Kuwait	Primary care	-	-
	C1: no in- tervention						-	-
Gourlan 2013	I1: motiva- 3 mon tional inter- stan- view- dard wei ing + stan- loss grou dard weight 6 mon loss motiva-	3 months' stan- dard weight loss group + 6 months' motiva-	5 months' Aged 11-18 tan- years, BMI lard weight > 90th age- oss group + and gender- 5 months' specific per- notiva- centiles		France	Hospital	-	-
	C1: stan- dard weight loss	tional inter- view group (at 6 months)					-	-
Patrick 2013	I1: website intervention	12 months (at 12 months)	Aged 12-16 years, 'high risk' for di- abetes, over- weight BMI > 85th per- centile for age and gen- der, weight and height > 85th percentile or weight >	-	USA	Home	White: 26.9 African- American: 15.4 Native American: 0 Asian or Pacific Is- lander: 3.8 Multiethnic or other: 3.8 Pre-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 317 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

I2: website + group	White: 23.1 African- American: 7.7 Native American: 0 Asian or Pacific Is- lander: 7.7 Multiethnic or other: 3.8 Pre- ferred not to state: 15.4 Did not state: 42.3	-
I3: website + SMS	White: 8.3 African- American: 12.5	-
	Na- tive Ameri- can: 4.2 Asian	
	or Pacific Is- lander: 0 Multiethnic	
	Pre- ferred not to state: 16.7	
	state: 58.3	
C1: usual care	White: 12.0 African- American: 28.0 Native American: 0 Asian or Pacific Is- lander: 4 Multiethnic or other: 4 Pre-	-
	110	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 318 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

							ferred not to state: 16 Did not state: 36.0	
Kong 2013	I1: ACTION	1 academic year (at 6 months)	9th-11th grade, BMI ≥ 85th per- centile	2009-2010	USA	School- based health centres	Asian: 14 Hispanic: 75 Native American: 0 Multiple: 11	Carer years of edu- cation: 0-6: 11% 7-11: 29% 12 (high school grad- uate): 21% 13-15: 25% ≥ 16: 14%
	C1: stan- dard care						Asian: 4 Hispanic: 61 Na- tive Ameri- can: 13 Multiple: 22	Carer years of edu- cation: 0-6: 9% 7-11: 35% 12 (high school grad- uate): 22% 13-15: 26% ≥ 16: 9%
Pbert 2013	I1: "Lookin' Good Feelin' Good"	16 weeks (at 6 months)	Grade 9-11, BMI \geq 85th percentile for age and gender	2008-2009	USA	School	White: 73.8 Black: 14.3 Hispanic: 14.3	-
	C1: control						White: 80.0 Black: 5.0 Hispanic: 15.0	-
Brennan 2013	I1: motiva- tional inter- viewing	26 weeks (at 12 months)	Aged 11-19 years, over- weight or obese ac- cording to the inter-	2003-	Australia	University clinic	-	-
	C1: wait list control		off points for BMI				-	-
Walpole 2013	I1: motiva- tional inter- viewing	6 months (immedi- ately follow-	Over- weight and obese (BMI	2010-2012	Canada	Outpatient clinic	-	House- hold income

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 319 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	I2: social skills train- ing	ing inter- vention)	≥ 85th per- centile) aσed 10-18				-	(CAD) (n = 18): 0-20 000: House- hold income (CAD) (n = 14): 0-20,000: 6% 20,000-40, 000: 11% 40,000-50, 000: 6% 50,000-60, 00: 11% 60,000-80, 000: 17% 80,000: 49%
Toulabi 2012	I1: behavioural modifica- tion	6 weeks (at 6 months)	$\begin{array}{l} \text{BMI} > \\ 28 \text{ kg/m}^2 \text{ in} \\ 15 \text{ year olds,} \\ \text{BMI} \ge 29 \\ \text{kg/m}^2 \text{ in 16} \end{array}$	2004-2006	Iran	School	-	-
	C1: control		and 17 year olds				-	-
Debar 2012	I1: multi- component intervention	5 months (at 12 months)	Aged 2-17 years, female, age- and gender- adjusted BMI ≥ 90th percentile	-	USA	Primary care	White: 75	Family income: > USD75, 000: 40.0% Grade in school: 6th-8th: 52. 8% 9th-12th: 47.1%
	C1: usual care						White: 75	Family income: > USD75, 000: 36.5% Grade in school: 6th-8th: 52. 4% 9th-12th: 47.6%

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 320 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Ebbeling 2012	I1: multi- component intervention	52 weeks (at 24 months)	BMI ≥ 85th percentile for gen- der and age, aged 13-18 years	2007-2011	USA	Home	White: 55 Black: 24 Asian: 4 Multiple or other: 18 Ethnic group: Hispanic: 25 Non-His- panic: 75	An- nual house- hold income (USD) (%): < $30,000.27$ 30,000.59, 999: 35 ≥ $$60,000:$ 38 Parental ed- ucational level (%): Some high school: 2 High-school diploma or General Ed- ucation De- velop- ment certifi- cate: 21 Some col- lege or voca- tional school: 25 Associate's degree: 6 Bachelor's degree: 30 Some gradu- ate school or graduate de- gree: 15
	C1: control						White: 56 Black: 24 Asian: 4 Multiple or other: 17 Ethnic group: Hispanic: 17 Non-His- panic: 83	An- nual house- hold income (USD) (%): < 30,000:27 30,000-59, 999: 30 $\geq 60,000:$ 43 Parental ed- ucational level (%):

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 321 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
Some high school: 4 High-school diploma or General Education Development certificate: 18 Some college or vocational school: 21 Associate's degree: 12 Bachelor's degree: 29 Some graduate school or graduate degree: 16

Vos 2011	11: family- based CBT + nutrition C1: wait list control	3 months (at 24 months)	Aged 8-17 years, over- weight or obesity, in- creased risk of comorbidity	-	Netherlands	Healthcare (based on author loca- tion)	North Euro- pean: 35 Other: 65 North Euro- pean: 28 Other: 72	-
Christie 2011	I1: HELP weight man- agement C1: en- hanced stan- dard care	6 months (at 12 months)	Aged 13-17 years, obese defined as BMI > 98th centile	2011-2013	UK	Primary care	-	-
Wengle 2011	I1: mentored lifestyle in- tervention I2: unmen- tored lifestyle in- tervention	24 weeks (at 24 weeks)	Aged 12-16 years, BMI > 85th per- centile	2006-2007	Canada	Outpatient	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 322 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Ford 2010	I1: Man- 12 dometer months (at 18 months)	Obese ado- lescents,	2004-2007	UK	Hospital- based obe-	Non-white: 9	-	
	C1: stan- dard care	18 months)	BMI > 95th centile			sity clinic	Non-white: 15	-
Nguyen 2012	I1: Loozit + ATC I2: Loozit	24 months (at 24 months)	Aged 13-16 years, over- weight to mod- erately obese (BMI z score range 1.0-2. 5)	2006-2009	Australia	Community health cen- tres	-	-
Grey 2009	I1: coping skills	16 weeks (at 36 weeks)	In 7th grade, BMI > 85th per- centile, fam- ily history of type 2 dia- betes melli- tus		USA	School	White: 0.9 White His- panic: 42.0 African- American: 55.4 Bi/Other: 1. 8	Carer educa- tion, %: < high school 24.1 high school 39.3 Trade school or college 36.6 Carer income (USD), %: < 5000 15.2 5000-9999 17.0 10,000-14, 999 15.2 15,000-19, 999 9.8 20,000-29, 000 14.3 30,000-39, 000 6.3 \geq 40,000 10.7 Missing 11. 6
	C1: general education						White: 4.7 White His- panic: 48.8 African- American: 40.7	Carer educa- tion, %: < high school 16.3 high school 33.7

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 323 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

							Bi/Other: 5. 8	trade school or college 50.0 Carer (USD), %: < 5000 12.8 5000-9999 15.1 10,000-14, 999 16.3 15,000-19, 999 10.5 20,000-29, 000 7.0 30,000-39, 000 15.1 ≥ 40,000 11.6 Missing 11. 6
Vissers 2008	I1: school- based inter- vention	24 weeks (at 24 weeks)	Overweight	-	Belgium	School	-	-
	C1: control						-	-
NCT001321	I1: behavioural education	12 months (12- 15 months)	Over- weight, BMI > 85%, aged	-	USA	Healthcare (based on author loca-	-	-
	C1: stan- dard care		10-20 years			tion)	-	-
Pitetti 2007	I1: treadmill	36 weeks (at 36 weeks)	Aged 14-19 years, autism BMI	-	USA	Residential school	-	-
	C1: control		$> 30 \text{ kg/m}^2$				-	-
Savoye 2007	I1: Bright Bodies weight man- agement	12 months (at 24 months)	Aged 8-16 years, BMI > 95th per- centile	-	USA	Obesity clinic	Non-His- panic white: 38.1 Non-His- panic black: 38.1 Hispanic: 23.8	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 324 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	C1: control						Non-His- panic white: 34.8 Non-His- panic black: 39.1 Hispanic: 26.1	-
van Egmond- Frohlich	I1: multi- component intervention	12 months (12 months)	Obese chil- dren and adoles-	2002/2003?	Germany	Outpatient	-	High school: 15%
2006	C1: stan- dard care		cents, aged 9-16 years				-	High school: 12%
Daley 2005	I1: exercise counselling C1: exercise placebo	8 weeks (at 28 weeks)	Clinically obese, 11-16 years	2002-2006	UK	Outpatient	White: 82.7 Black: 9.9 South Asian: 7.4	In- dex of mul- tiple depri- vation rank scores: quartile 1 (least de- prived): 16% quartile 2: 14.8% quartile 3: C1: exercise placebo
Resnicow 2005	C2: control I1: Go Girls. high- intensity be- havioural in- tervention C1: moder-	6 months (at 12 months)	Aged 12-16 years, girls, BMI > 90th percentile for age and gender	-	USA	Community - churches	African- American: 100	C2: control Household income > USD40,000 C1: moder-
	ate- intensity be- havioural in- tervention							ate- intensity be- havioural in- tervention
Jiang 2005	I1: fam- ily-based in- tervention	24 months (at 24 months)	Grade 7-9, obese	-	China	School	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 325 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	C1: control	-					-	-
Carrel 2005	I1: lifestyle- focused gym classes	9 months (at 9 months)	BMI > 95th percentile for age	-	USA	School and outpatients	-	-
	C1: standard gym classes						-	-
Ebbeling 2003	I1: low GL diet	26 weeks (at 12 months)	Aged 13-21 years, BMI	-	USA	Research clinic	-	-
	C1: conven- tional diet		> 95th per- centiles				-	-
Saelens 2002	I1: Healthy Habits	12 weeks (at 28 weeks)	Aged 12- 16 years, 20- 100% above the median	-	USA	Clinic/ home	-	-
	C1: stan- dard care		(50th per- centile) for BMI				-	-
Brownell 1983	I1: mother + child sepa- rate	16 weeks (1 year later)	Aged 12-16, \geq 20% mean weight for age, gen- der and	-	USA	Healthcare (based on author loca- tion)	White: 100	Predomi- nately lower- middle class families
	I2: mother + child to- gether		height				White: 100	Predomi- nately lower- middle class families
	C1: child only						White: 100	Predomi- nately lower- middle class families
Chandra 1968	I1: low-calo- rie formula Limical	3 months (at 7 months - for this re- port but the author stated that the fol- low-up pe-	Mod- erately obese boys and girls, aged 9- 17 years.	-	-	Outpatient	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 326 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

		riod ex- tended to 2 years)						
	C1: low- calorie diet						-	-
NCT008075	I1: family- based ther- apy for pae- diatric over- weight	24 weeks (at 12 months)	Aged 13-17 years, BMI percentile > 85% for gender and	-	USA	Outpa- tient eating and weight disorders clinic	-	-
	C1: nu- tritional- ed- ucational control con- dition		age	-			-	-

- denotes not reported

ATC: additional therapeutic contact; BMI: body mass index; C: comparator; CAD: Canadian dollars; CBT: cognitive behavioural therapy; CDC: Centers for Disease Control and Prevention; GI: glycaemic index; GL: glycaemic load; HELP: Healthy Eating and Lifestyle Programme; I: intervention; SD: standard deviation; SDS: standard deviation score; USD: US dollars

Appendix 4. Baseline characteristics (II)

Trial ID	Inter- vention and comparator	Sex (female %)	Age (mean (SD))	BMI/BMI percentile/ BMI z score (mean kg/ m ² (SD))	Body weight (mean kg (SD))	Parental weight/ BMI	Comedica- tions/ cointerven- tions	Comor- bidities/ conditions
Pat-	I1: activity	48.3	14.04 (0.8)	32.6 (3.50)	81.0 (8.9)	-	-	-
sopoulou 2017	12: activity + diet	53.3	14.01 (0.8)	32.3 (3.0)	80.7 (7.8)	-	-	-
	C1: no in- tervention	52.5	14.04 (0.8)	33.4 (4.0)	85.0 (8.0)	-	-	-
Jelalian 2016	I1: CBT + healthy lifestyle	70.8	15.25 (1.51)	36.8 (7.9)	101.43 (24. 82)	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 327 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	C1: CBT	77.8	14.44 (1.67)	37.6 (4.3)	100.08 (12. 79)	-	-	-
Norman 2016	I1: stepped down care	27	Girls 12 (0.9) Boys 12 (0.8)	BMI percentile: Girls 97.3 (2.5) Boys 98.1 (1.3)	-	-	-	-
	C1: enhanced usual care	24	Girls 11.8 (1.0) Boys 11.7 (0.9)	BMI percentile: Girls 97.3 (2.4) Boys 97.8 (1.8)	-	-	-	-
Hofsteenge 2014	I1: group education	53.5	14.5 (1.7)	33.3 (4.6)	94.7 (18.4)	-	-	Impaired fasting glu- cose: 8.5% Im- paired glu- cose intoler- ance: 5.6%
	C1: dietitian only	58.8	14.4 (1.8)	33.6 (5.1)	92.2 (18.5)	-	-	Impaired fasting glu- cose: 5.9% Im- paired glu- cose intoler- ance: 3.9%
Schranz 2014	I1: resis- tance train- ing	0	14.9 (1.4)	32.2 (4.3)	97.7 (18.3)	-	-	-
	C1: no in- tervention	0	15.1 (1.6)	32.6 (5.0)	99.1 (23.7)	-	-	-
Vi- suthranukul	I1: low GI diet	36	11.9 (1.9)	34.2 (5.8)	83.8 (16.0)	-	-	-
2015	C1: conven- tional diet	29.7	12.0 (2.1)	33.1 (6.6)	84.5 (23.2)	-	-	-
Wong 2015	I1: standard weight loss diet + in-	-	-	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 328 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	crease water intake							
	C1: stan- dard weight loss diet	-	-	-	-	-	-	-
Pakpour 2015	I1: motiva- tional inter- viewing	53.8	15.59 (1.31)	33.07 (8.87) BMI z score: 2.83 (0.79) BMI per- centile: 95. 19 (4.72)	-	Mother BMI: 39.46 (9.81) Father BMI: 36.22 (9.89)	-	-
	I2: moti- vational in- terviewing + parental in- volvement	35.9	15.57 (1.38)	33.09 (5. 86) BMI z score: 2.82 (0.62) BMI per- centile: 94. 63 (5.01)	-	Mother BMI: 39.48 (8.87) Father BMI: 36.32 (9.83)	-	-
	C1: passive control	45.4	15.78 (1.19)	32.92 (7.79) BMI z score: 2.75 (0.67) BMI per- centile: 95. 56 (4.63)	-	Mother BMI: 39.31 (8.64) Father BMI: 36.02 (8.78)	-	-
Bean 2014	I1: motiva- tional inter- viewing val- ues	75.9	13.6 (1.8)	BMI per- centile: 98.9 (1.0) BMI z score: 2.4 (0.3)	-	-	-	-
	C1: educa- tion control	70.7	14.1 (1.7)	BMI per- centile: 98.9 (1.3) BMI z score: 2.4 (0.3)	-	-	-	-
Carraway 2014	I1: mentor- led exercise	54.5	13.64 (1.75)	BMI z score: 2.01 (0.44)	-	-	-	-
	C1: wait list control	61.5	13.69 (1.6)	BMI z score: 2.2 (0.42)	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 329 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

10		1
(Co)	ntinu	ea)

Sigal 2014	I1: diet + aero- bic training	70.7	15.5 (1.4)	34.7 (4.3)	97.1 (1.8) ^a	-	Metformin: 2 (2.7) Oral contra- ceptives: 12 (16) Stimulants: 1 (1.3)	Normal glu- cose toler- ance (%): 62 (82.7)
	I2: diet + re- sistance training	70.5	15.9 (1.5)	35.1 (4.4)	100.1 (1.7) ^a	-	Metformin 1 (1.3) Oral contra- ceptives: 13 (17) Stimulants: 1 (1.3)	Normal glu- cose toler- ance (%): 66 (84.6)
	I3: diet + aero- bic + resis- tance train- ing	70.7	15.5 (1.3)	34.7 (4.3)	97.8 (1.8) ^a	-	Metformin 1 (1.3) Oral contra- ceptives: 5 (6.7) Stimulants: 3 (4)	Normal glu- cose toler- ance (%): 67 (89.3)
	C1: diet only	68.4	15.6 (1.3)	34.2 (4.4)	97.9 (1.8) ^a	-	Metformin 1 (1.3) Oral contra- ceptives: 16 (21.1) Stimulants: 3 (4)	Normal glu- cose toler- ance (%): 68 (89.5)
Love- Osborne 2014	I1: motiva- tional inter- viewing	58	15.7 (1.5)	31.9 (6.2) BMI z score: 1.92 (0.46)	-	-	-	Se- vere dyslipi- daemia: 1
	C1: control	46	16.0 (1.5)	31.6 (6.5) BMI z score: 1.89 (0.52)	-	-	-	Type 2 dia- betes: 2 Se- vere dyslipi- daemia: 1
Kong 2014	I1: low GI diet	59.6	16.8 (1.0)	31.6 (4.2)	87.6 (13.0)	-	-	Impaired glucose tol- erance: 11. 5%

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 330 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	C1: usual Chinese diet	53.8	16.7 (1.0)	30.2 (3.5)	82.9 (14.9)	-	-	Impaired glucose tol- erance: 15. 4%
Luna-Pech 2014	I1: nor- mocaloric diet + physi- cal activity	53.8	14 (0.7)	28.3 (0.9) BMI z score: 2.18 (0.3)	57.9 (8.0)	-	-	Asthma: 100%
	C1: no in- tervention	44	14 (0.3)	27.1 (0.9) BMI z score: 2.17 (0.2)	53.8 (7.1)	-	-	Asthma: 100%
Boodai 2014	I1: multi- compo- nent group sessions	48.8	12.4 (1.2)	BMI z score 2.2 (0.3)	-	-	-	-
	C1: no in- tervention	48.8	12.4 (1.2)	BMI z score 2.2 (0.3)	-	-	-	-
Gourlan 2013	I1: motiva- tional Inter- view- ing + stan- dard weight loss	41	-	29.56 (4.75)	-	-	-	-
	C1: stan- dard weight loss		-	29.59 (5.92)	-	-	-	-
Patrick 2013	I1: website intervention	61.5	14.1 (1.4)	BMI z score: 2.2 (0.4) BMI per- centile: 98.1 (0.1)	-	-	-	-
	I2: website + group	69.2	14.3 (1.5)	BMI z score: 2.2 (0.4) BMI percentile: 97.8 (0.1)	-	-	-	-
	I3: website + SMS	50.0	14.3 (1.8)	BMI z score: 2.2 (0.3) BMI percentile:	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 331 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

				97.9 (0.1)				
	C1: usual care	72.0	14.5 (1.5)	BMI z score: 2.2 (0.4). BMI per- centile: 98.1 (0.1)	-	-	-	-
Kong 2013	I1: ACTION	61.0	15.0 (1.0)	BMI per- centile 94.5 (4.1)	78.5 (12.5)	-	-	-
	C1: stan- dard care	57.0	14.6 (0.7)	BMI per- centile 94.4 (4.6)	78.1 (18.1)	-	-	-
Pbert 2013	I1: "Lookin' Good Feelin' Good"	64.3	15.9 (1.03)	32.78 (5.91) BMI z score 1.95 (0.44)	-	-	-	-
	C1: Control	75.0	15.7 (1.01)	31.24 (5.33) BMI z score: 1.81 (0.41)	-	-	-	-
Brennan 2013	I1: motiva- tional inter- viewing	54.0	-	31.84 (4.52) BMI z score: 2.08 (0.37) BMI per- centile: 97. 40 (2.72)	88.91 (18. 57)	-	-	-
	C1: wait list control		-	31.67 (4.76) BMI z score: 2.08 (0.40) BMI per- centile: 97. 29 (2.94)	87.65 (17. 98)	-	-	-
Walpole 2013	I1: motiva- tional Inter- viewing	70	14.1 (1.8)	30.2 (2.8) BMI z score: 2.51 (0.47)	-	Mother: 30. 8 (7.6) Father: 26.8 (4.5)	-	-
	C1: social skills train- ing	45	13.7 (1.7)	30.4 (5.0) BMI z score: 2.64 (0.73)	-	Mother: 29. 1 (6.1) Father: 28.6 (5.1)	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 332 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Toulabi 2012	I1: behavioural modifica- tion	-	-	30.43 (2.39)	81.67 (10. 94)	-	-	-
	C1: control	-	-	30.33 (1.93)	84.43 (10. 79)	-	-	-
Debar 2012	I1: multi- component intervention	100	14.1 (1.5)	32.03 (4.79) BMI per- centile: 97. 09 (2.27)	86.0 (15.2)	-	-	-
	C1: usual care	100	14.3 (1.5)	31.84 (4.63) BMI per- centile: 97. 10 (2.29)	84.6 (15.6)	-	-	-
Ebbeling 2012	I1: multi- component intervention	47	15.3 (0.7)	30.4 (5.2)	85.2 (16.8)	-	-	-
	C1: control	42	15.2 (0.7)	30.1 (4.7)	86.1 (17)	-	-	-
Vos 2011	I1: family- based CBT + nutrition	55	13.3 (2.0)	32.4 (4.7) BMI-SDS 4.2 (0.7)	85.7 (18.4)	-	-	-
	C1: wait list control	51.3	13.1 (1.9)	32.5 (3.9) BMI-SDS 4.3 (0.6)	85.7 (17.98)	-	-	-
Christie 2011	I1: HELP weight man- agement	62.6	-	32.3 (4.4)	-	-	-	-
	C1: en- hanced stan- dard care		-		-	-	-	-
Wengle 2011	I1: mentored lifestyle in- tervention	-	14.4 (1.5)	31.8 (5.7) BMI z: 2.00 (0.41)	-	-	-	-
	C1: unmen- tored lifestyle in- tervention	-	14.5 (1.4)	32.8 (4.5) BMI z score: 2.16 (0.35)	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 333 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Ford 2010	I1: Man- dometer	56	12.7 (2.2)	34.4	-	-	-	-
	C1: stan- dard care	56	12.5 (2.3)	33.1	-	-	-	-
Nguyen 2012	I1: Loozit + ATC	53.8	14.2 (1)	30.8 (3.5) BMI z score: 2.02 (0.29)	82.4 (12.4)	-	-	-
	C1: Loozit	49.3	14 (0.9)	30.8 (4.2) BMI z score: 2.03 (0.37)	82.4 (12.4)	-	-	-
Grey 2009	I1: coping skills	62.5	12.8 (0.7)	30.5 (7.2)	-	-	-	-
	C1: general education	41.6	12.6 (0.7)	30.3 (6.0)	-	-	-	-
Vissers 2008	I1: school- based inter- vention	67.6	17.5 (1.3)	Girls: 29.3 (2.9) Boys: 28.9 (2.0)	Girls: 79.9 (10.7) Boys: 89.8 (9.6)	-	-	-
	C1: control	69.2	17.5 (1.3)	Girls: 29.3 (4.1) Boys: 28.7 (3.6)	Girls 81.1 (13.8) Boys 92.3 (19.1)	-	-	-
NCT001321	I1: behavioural education	46.7	-	-	-	-	-	-
	C1: stan- dard care	73.3	-	-	-	-	-	-
Pitetti 2007	I1: treadmill	40	16.6 (1.9)	33.2 (7.8)	98 (18.3)	-	Autism- related med- ications re- ported	Autism: 100%
	C1: control	40	17.4 (1.1)	30.9 (8.5)	93 (32.)	-	Autism- related med- ications re- ported	Autism: 100%
Savoye 2007	I1: Bright Bodies weight man-	55.2	11.9 (2.5)	35.8 (7.6)	87 (25.1)	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 334 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	agement							
	C1: control	68.1	12.4 (2.3)	36.2 (6.2)	91.2 (23.3)	-	-	-
van Egmond- Frohlich	I1: multi- component intervention	58	13.2 (1.8)	BMI-SDS 2. 3 (0.4)	-	-	-	-
2006	C1: stan- dard care	55	13.5 (1.7)	BMI-SDS 2. 3 (0.5)	-	-	-	-
Daley 2005	I1: exercise counselling	55.6	-	BMI-SDS 3. 17 (0.33)	-	-	-	-
	C1: exercise placebo		-	BMI-SDS 3. 22 (0.61)	-	-	-	-
	C2: control		-	BMI-SDS 3. 32 (0.37)	-	-	-	-
Resnicow 2005	I1: GoGirls high- intensity be- havioural in- tervention	100	-	32 (5.8)	87.9 (17.73)	-	-	-
	C1: moder- ate- intensity be- havioural in- tervention	100	-	33.2 (7.3)	84.1 (20.84)	-	-	-
Jiang 2005	I1: fam- ily-based in- tervention	39.4	13.3 (0.6)	26.6 (1.7)	70.1 (5.7)	-	-	-
	C1: control	40.0	13.2 (0.7)	26.1 (1.5)	71.2 (6.4)	-	-	-
Carrel 2005	I1: lifestyle- focused gym classes	52	12.5 (0.5)	32 (6)	-	-	-	-
	C1: standard gym classes	43	12.5 (0.7)	30 (4)	-	-	-	-
Ebbeling 2003	I1: low GL diet	68.8	16.9 (1.3)	34.9 (1.0)	103.5 (6.0)	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 335 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	C1: conven- tional diet		15.3 (0.9)	34.9 (1.0)	104.7 (4.8)	-	-	-
Saelens 2002	I1: Healthy Habits	-	-	31.0 (3.5)	85.5 (13.9)	-	-	-
	C1: stan- dard care	-	-	30.7 (3.1)	80.5 (13.5)	-	-	-
Brownell 1983	I1: mother + child sepa- rate	78.6	-	45.5, (7.1)	83.6 (16.8)	43.4% 'overweight'	-	-
	I2: mother + child to- gether		-	42.4 (12.0)	80.5 (28.3)		-	-
	C1: child only		-	42.0 (6.5)	81.1 (18.7)		-	-
Chandra 1968	I1: low-calo- rie formula Limical	70	-	-	-	-	-	-
	C1: low- calorie diet		-	-	-	-	-	-
NCT008075	I1: family- based ther- apy for pae- diatric over- weight	65	15.0 (1.52)	35.3 (5.5)	96.6 (14.4)	-	-	-
	C1: nutritional- educational control con- dition	69	15.2 (1.6)	36.6 (6.6)	103.3 (28.9)	-	-	-

- denotes not reported

ATC: additional therapeutic contact; BMI: body mass index; CBT: cognitive behavioural therapy; C: comparator; GI: glycaemic index; GL: glycaemic load; HELP: Healthy Eating and Lifestyle Programme; I: intervention; SD: standard deviation; SDS: standard deviation score; SMS: short message service

 $^{\it a}$ inconsistencies between tables in the publication

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 336 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Trial ID	Endpoints quoted in trial document (ClinicalTrials. gov, FDA/EMA doc- ument, manufacturer's website, published de- sign paper) ^a	Study results posted in trial register	Endpoints quoted in publication(s) ^{b,c}	Endpoints quoted in abstract of publication (s) ^{b,c}
Patsopoulou 2017	Source: NCT02653508 Primary outcome measures: BMI; weight; height; heart rate; blood pressure; waist circum- ference; 50-m sprint run test; family eating and activity habits	No Last verified: January 2016 History of changes: 0 documented changes	Primary outcome mea- sure: -	Primary outcome mea- sure: -
	Secondary outcome measures: BMI; weight; height; heart rate; blood pressure; waist circum- ference; 50-m sprint run test; family eating and activity habits		Secondary outcome measure: -	Secondary outcome measure: -
	Other outcome mea- sure: -		Other outcome measures: an- thropometric measure- ments (BMI, weight, height, waist circumfer- ence) fitness assessment (50-m sprint run test), Family Eating and Ac- tivity Habits Question- naire, blood pressure	Other outcome measure: an- thropometric measure- ments (BMI, weight, height, waist circumfer- ence), Fitness assessment (50-m sprint run test), Family Eating and Ac- tivity Habits Question- naire, blood pressure
Jelalian 2016	Source: NCT01128764 Primary outcome mea- sure: depressed mood	No Last verified: July 2014	Primary outcome mea- sures : depressed mood and BMI	Primary outcome mea- sure: -
	Secondary outcome measure: weight	History of changes: 3 documented changes	Secondary outcome measures: % time spent in MVPA and sedentary behaviour	Secondary outcome measure: -
	Other outcome mea- sure: -		Other outcome mea- sure: treatment feasibil- ity/acceptability	Other outcome mea- sure: depressed mood, BMI, MVPA, accept-

Appendix 5. Matrix of study endpoints (publications and trial documents)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 337 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

				ability of intervention
Norman 2016	Source: N/T		Other outcome mea- sures: BMI, waist cir- cumference, body fat, fasting blood lipids, blood pressure	Other outcome mea- sures: BMI, adiposity and biometric measures
Hofsteenge 2014	Source: NTR691, IS- RCTN27626398 Primary outcome mea- sures: BMI, body com- position, glucose-intol- erance, insulin resistance	No Last verified: August 2015	Primary outcome mea- sure: BMI-SDS	Primary outcome mea- sure: -
	Sec- ondary outcome mea- sures: dietary behaviour, physical activity, seden- tary behaviour, quality of life, self-esteem, cost-ef- fectiveness		Secondary outcome measures: glucose toler- ance, dietary behaviour, physical activity, seden- tary behaviour and self- esteem	Secondary outcome measure: -
	Other outcome mea- sure: -		Other outcome mea- sure: -	Other out- come measures: BMI- SDS, body composition, metabolic components, effect modifiers, blood pressure, HDL choles- terol, PedsQL, Body Es- teem Scale
Schranz 2014	Source: ACTRN1260900107824 Primary outcome mea- sure: self-concept (self- esteem)	No Last verified: August 2015	Primary outcome mea- sures: exercise self-effi- cacy, physical self-worth and self-esteem	Primary outcome mea- sure: -
	Secondary outcome measures: body compo- sition, strength		Secondary outcome measures: body compo- sition, strength	Secondary outcome measure: -
	Other outcome mea- sure: -		Other outcome mea- sure: -	Other outcome mea- sures: exercise self-effi- cacy, resistance training confidence, self-esteem, body composition

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 338 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Visuthranukul 2015	Source: NCT02049788 Primary outcome mea- sures: change in body compo- sition measured by BIA and DXA	No Last verified: January 2014	Primary outcome mea- sure : body composition changes (refers to fat mass and fat-free mass)	Primary outcome mea- sure: -
	Secondary out- come measure: change in metabolic syndrome risks		Secondary outcome measures: metabolic syndrome risk changes which were blood pres- sure, fasting plasma glu- cose, plasma insulin and serum lipid profiles	Secondary outcome measure: -
	Other outcome mea- sure: -		Other outcome mea- sure: -	Other outcome mea- sures: BMI z score, fat and fat-free mass, fasting plasma insulin, HOMA- IR
Wong 2015	Source: N/T		Primary outcome mea- sure: -	Primary outcome mea- sure: -
			Secondary outcome measure: -	Secondary outcome measure: -
			Other outcome mea- sure: -	Other outcome measures: wa- ter intake, urine specific gravity, BMI z score, car- diometabolic risk factors
Pakpour 2015	Source: NCT02180802 Primary outcome mea- sures: BMI, dietary self- efficacy, weight self-ef- ficacy, physical exercise self-efficacy, physical ac- tivity	No Last verified: August 2014 History of changes: 1 documented changes	Primary outcome mea- sures: changes in BMI, the Child Di- etary Self-Efficacy Scale (CDSS), the Weight Ef- ficacy Lifestyle question- naire (WEL), the Physi- cal Exercise Self-Efficacy Scale (PES) and self-re- ported physical activity and diet	Primary outcome mea- sures: BMI z score, anthropometric, biochemical, psychome- tric and behavioural out- come variables
	Secondary out- come measures: choles- terol, triglycerides, % body fat		Secondary outcome measures: changes in an- thropometric measures, cholesterol, triglycerides	Secondary outcome measure: -

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 339 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

			and body fat	
	Other outcome mea- sure: -		Other outcome mea- sure: -	Other outcome mea- sure: -
Bean 2014	Source: published pro- tocol and trial record: NCT00167830 Primary outcome mea- sure - source protocol: BMI percentile Primary outcome mea- sures - source trial record: BMI, metabolic indicators, fitness mea- sures	No Last verified: January 2014 History of changes: 8 documented changes	Primary outcome mea- sures: BMI percentile in methods publication, re- tention and adherence in results publication	Primary outcome mea- sure: -
	Secondary out- come measures - source protocol: dietary intake, physical activity, attri- tion, and compliance Secondary outcome measures - source trial record: participant's compliance with exer- cise and diet, parental compliance and support, knowledge of nutritional principles, attitude to- ward healthy behaviours, self-esteem, motivation, negativity and family co- hesiveness		Secondary outcome measure: -	Secondary outcome measure: -
	Other outcome mea- sure - source protocol: - Other out- come measure - source trial record: -		Other outcome mea- sure: -	Other outcome mea- sures: adherence (over- all, dietitian visits, be- havioural support visits)
Carraway 2014	Source: N/T		Primary outcome mea- sure: -	Other outcome mea- sures: perceived athletic competence, physical ac- tivity, social anxiety, so- cial support
			Secondary outcome measure: -	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 340 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

			Other outcome mea- sures: height, weight, body composition, BMI, % overweight, VO _{2max} , phys- ical appearance, Chil- dren and Youth Physi- cal Self-Perception Pro- file, accelerometry, per- ceived social support, so- cial anxiety	-
Sigal 2014	Source: NCT00195858 Primary outcome mea- sure: change in % body fat (MRI scan)	No Last verified: April 2015 History of changes: 8 documented changes	Primary outcome mea- sure: % body fat by MRI	Primary outcome mea- sure: % body fat
	Secondary out- come measures: resting energy expenditure (in- direct calorimetry); lean body mass; abdominal vis- ceral and subcutaneous fat; waist and hip cir- cumference; apolipopro- tein A1; plasma insulin; HOMA-IR; apoprotein B; CRP; HDL choles- terol; LDL cholesterol; triglycerides; total:HDL cholesterol ratio; fast- ing and 2-hour postload glucose; HbA1c; blood pressure; health-related quality of life		Secondary out- come measures: body weight, BMI, waist cir- cumference, systolic and diastolic blood pressure, energy intake, steps per day, muscle strength, glucose levels, lipid lev- els, hip circumference, resting energy expen- diture, cardiorespiratory fitness, musculoskeletal fitness, insulin, HbA1c, apoliproteins, high-sen- sitivity CRP, non-ester- ified fatty acids, qual- ity of life, body image, mood, self-esteem, ad- verse events	Secondary outcome measure: waist circumference
Love-Osborne 2014	Source: N/T		Primary outcome mea- sure: BMI z score (ba- sis of sample size calcula- tion)	Primary outcome mea- sure: -
			Secondary outcome measure: fitness testing	Secondary outcome measure: -
			Other outcome mea- sure: -	Other outcome mea- sures: BMI z score, sports participation

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 341 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Kong 2014	Source: NCT01278563 Primary outcome mea- sure: BMI	78563 No I e mea-Last verified: January s 2011 History of changes: 0	Primary outcome mea- sure: BMI	Primary outcome mea- sure: -
	Secondary outcome measures: waist circum- ference, % body fat	History of changes: 0 documented changes	Secondary outcome measure: obesity indices	Secondary outcome measure: -
	Other outcome mea- sure: -		Other : cardiometabolic risk factors	Other outcome mea- sures : BMI, body weight and waist circumference
Luna-Pech 2014	Source: N/T		Other outcome mea- sures: asthma-related quality of life, BMI z score, weight, macronu- trient intake, acute asthma attacks, night- time awakenings, use of inhaled corticosteroids, pulmonary function	Other outcome mea- sures: asthma-related quality of life, BMI z score, acute asthma attacks, night- time awakenings, use of inhaled corticosteroids, pulmonary function
Boodai 2014	Source: ISRCTN37457227 Primary outcome mea- sure: change in BMI z score	No Last verified: August 2015	Primary outcome mea- sure: change in BMI z score	Primary outcome mea- sure: BMI z score
	Secondary out- come measures: change in quality of life, change in blood pressure and blood-based car- diometabolic risk factors (fasting lipids, triglyc- erides, insulin, glucose), changes in estimated fat and fat-free mass (using BIA)		Secondary out- come measures: blood pressure, waist circum- ference	Secondary outcome measure: -
Gourlan 2013	Source: N/T		Other outcome measures: mo- tivation for physical ac- tivity, perceived compe- tence, perceived auton- omy support, physical activity, BMI	Other out- come measures: BMI, autonomy support, inte- grated and identified reg- ulations, amotivation

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 342 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Patrick 2013	Source: NCT00412165 Primary outcome mea- sure: BMI	5 No F Last verified: August 2012 History of changes: 5 documented changes c b c t, t, f y	Primary outcome mea- sure: BMI z score	Primary outcome mea- sure: BMI
	Secondary outcome measures: metabolic and physiological mani- festations of insulin re- sistance, BMI, waist-to- hip ratio, % body fat, behavioural measures of diet and physical activity		Secondary outcome measures: % body fat, health-related quality of life, behaviour change physical activity, diet	Secondary out- come measures: adipos- ity, physical activity, diet, sedentary behaviour
	Other outcome mea- sure: -		Other outcome mea- sure: -	Other outcome mea- sure: -
Kong 2013	Source: NCT00841334 Primary outcome mea- sure: BMI percentile	No Last verified: January 2013 History of changes: 2 documented changes	Primary outcome mea- sure: -	Primary outcome mea- sure: -
	Secondary out- come measures: insulin resistance, lipids, dietary intake, blood pressure, physical activity		Secondary outcome measure: -	Secondary outcome measure: -
	Other outcome mea- sure: -		Other outcome mea- sures: height, weight, BMI percentile, waist circumference, blood pressure, dietary intake, physical activity, tele- vision viewing, partici- pant satisfaction, HDL cholesterol, triglycerides, fasting plasma glucose, fasting insulin, insulin resistance	Other outcome mea- sures: BMI percentile and waist circumference, blood pressure, HOMA- IR, triglycerides and HDL cholesterol
Pbert 2013	Source: N/T		Other outcome mea- sures: height, weight, BMI, BMI z score, blood pressure, waist circum- ference, dietary intake, physical activity, seden- tary behaviour, accept- ability	Other outcome mea- sures: ate breakfast, in- take of total sugar and added sugar, drink soda \leq once per day, eat at fast food restaurants \leq once per week, BMI, activity, caloric intake

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 343 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Brennan 2013	Source: ACTRN1261000011107 Primary outcome mea- sures: body composi- tion, BMI, cardiovascu- lar fitness	No Last verified: February 2010 History of changes: no documented changes	Primary outcome mea- sure: body composition	Primary outcome mea- sure: -
	Secondary out- come measures: energy intake and diet quality, energy expenditure and physical activity, self- reported eating habits, self-reported daily phys- ical activity and seden- tary behaviour, resting metabolic rate, cardiovascular fit- ness, eating and weight- related psychopathology, psychopathology, self-es- teem, social support, family in- teraction, parenting ap- proach, social skills, neg- ative cognitions, knowl- edge of factors related to overweight and obe- sity, involvement of fam- ily and friends in adoless- cents' adoption of health behaviour, hip and waist		Secondary out- come measures: height, weight, BMI, BMI z score, waist and hip cir- cumference, cardio- vascular fitness, resting metabolic rate, pubertal status, eating and phys- ical activity behaviours, energy intake and nutri- tional intake, energy ex- penditure and physical activity, psychosocial as- sessments (psychosocial functioning, psychopathology, family functioning, motivation for change), satisfaction	Secondary outcome measure: -
	Other outcome mea- sure: -		Other outcome mea- sure: -	Other outcome mea- sures: weight control be- haviour, impulse regula- tion, social support from family and parent-ado- lescent problem commu- nication, treatment ac- ceptability, body compo- sition (body fat, % body fat, lean mass) and an- thropometric measures (weight, BMI, BMI-for- age z score and per- centiles), cardiovascular fitness

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 344 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Walpole 2013	Source: NCT01246349 Primary outcome mea- sures: weight Efficacy Life-style Questionnaire, Child Dietary Self-Effi- cacy Scale Sec- ondary outcome mea- sures: BML waist cir-	Yes (study results) , first received: 17 Jan- uary 2014 Last verified: March 2014 History of changes: 26 documented changes	Primary outcome mea- sure: self-efficacy Secondary outcome measures: BMI z score, waist circumference	Primary outcome mea- sure: - Secondary outcome measure: -
	cumference, psycholog- ical well-being, self-es- teem, quality of life, de- pression, coping		wast encumerence	
	Other outcome mea- sure: -		Other outcome mea- sure: -	Other outcome mea- sure : self-efficacy, BMI z scores, number of ses- sions attended
Toulabi 2012	Source: N/T		Other outcome mea- sures: BMI, body weight, height, waist cir- cumference, hip circum- ference, and waist-to-hip ratio, depression scores, students' and parents' nutrition knowledge	Other outcome mea- sures: weight, BMI, and waist and hip circumfer- ences, students' and par- ents' nutrition knowl- edge, symptoms of de- pression
Debar 2012	Source: NCT01068236 Primary outcome mea- sure: BMI z score	No Last verified: March 2010	Primary outcome mea- sure: BMI z score	Primary outcome mea- sure: -
	Secondary outcome measures: blood pres- sure, fasting lipid profile, fasting glucose	History of changes: 1 documented change	Secondary outcome measures: di- etary intake, physical ac- tivity, health behaviours, eating and mood disor- der symptoms, body sat- isfaction, internalisation of sociocultural attitudes toward appearance, self- esteem, quality of life	Secondary outcome measure: -
	Other outcome mea- sure: -		Other outcome mea- sure: -	Other outcome mea- sure: BMI z score

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 345 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Ebbeling 2012	Source: NCT00381160 Primary outcome mea- sure: BMI	No Last verified: August 2012	Primary outcome mea- sure: BMI	Primary outcome mea- sure: BMI
	Secondary outcome measure: -	History of changes: 12 documented changes	Sec- ondary outcome mea- sures: body fat as % total body weight, dietary in- take, physical activity	Secondary outcome measures: consumption of sugar-sweetened bev- erages, weight, change in body fat as a % body weight
Vos 2011	Source: ISRCTN36146436 Primary outcome mea- sure: BMI	No Last verified: September 2011	Primary outcome mea- sure: BMI-SDS	Primary outcome mea- sure: -
	Secondary outcome measures: waist circum- ference, insulin sensitiv- ity, secretion of gastroin- testinal hormones, car- diovascular fitness, qual- ity of life		Secondary outcome measures: weight, waist circumference, waist-to- height ratio, blood pres- sure, glucose, insulin, C-peptide, total choles- terol, HDL cholesterol, LDL cholesterol, triglyc- erides, free fatty acids, free T4, TSH, inflam- mation param- eters (CRP, adiponectin) , mixed meal tolerance, insulin sensitivity, physi- cal fitness, health-related quality of life	Secondary outcome measure: -
	Other outcome mea- sure: -		Other outcome mea- sure: -	Other outcome mea- sures: BMI-SDS, health-related quality of life, waist circumference SDS, physical fitness, in- sulin resistance, lipid profile, high-sensitive CRP or for adiponectin
Christie 2011	Source: ISRCTN99840111 Primary outcome mea- sure: BMI	No Last verified: August 2015	Primary outcome mea- sure: BMI at 6 months (end of intervention)	Primary outcome mea- sure: -

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 346 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	Secondary out- come measures: quality of life, waist circumfer- ence, cardiovascular risk factors, psycholog- ical function, lifestyle; cardiometabolic risk fac- tors; health economic data	Sec- ondary outcome mea- sures: HRQoL, BMI at 12 months, waist cir- cumference, fat mass/fat percentage, Eating Atti- tudes Test, self-esteem, psychological health, lifestyle, fasting insulin and glucose, fast- ing lipids (total choles- terol, HDL cholesterol, LDL cholesterol, triglyc- erides, total cholesterol: HDL cholesterol ratio, peripheral blood pres- sure, cost-effectiveness	Secondary outcome measure: -
	Other outcome mea- sure: -	Other outcome mea- sure: -	Other outcome mea- sures: BMI, BMI z score, fat mass, self-esteem, eat- ing be- haviours, quality of life, process evaluation, asso- ciation of pulse wave ve- locity (proxy for arterial stiffness) and breathless- ness score poststep test, self-reported exertion
Wengle 2011	Source: N/T	Primary outcome mea- sures: BMI and BMI z score	Primary outcome mea- sure: -
		Secondary out- come measures: changes in metabolic profile, nu- trition, physical activity	Secondary outcome measure: -
		Other outcome mea- sure: -	Other outcome mea- sures: BMI z score, waist circumference, HDL cholesterol, LDL: HDL ratio, consump- tion high-calorie foods and snacks, fast food restaurant visits, screen time, feasibility of inter- vention

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 347 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Ford 2010	Source: NCT00407420 Primary outcome mea- sure: change in BMI- SDS Sec- ondary outcome mea- sures: biochemical pa- rameters including in- sulin sensitivity using glucose and insulin mea- sures, physical activity measured by CSA, state of well-being, rate of eat- ing and grams of food consumed in mandome- ter arm, fat-free mass (bioimpedance)	No Last verified: December 2006 History of changes: 0 documented changes	Primary outcome mea- sure: change in BMI- SDS Secondary out- come measures: % body fat/body fat SDS, grams of food consumed, speed of eating, development of satiety (Mandometer and subgroup of con- trol arm only), fasting glucose and insulin con- centrations, lipid profile, high-sensitivity CRP, in- sulin resistance, paedi- atric quality of life, blood pressure	Primary outcome mea- sure: BMI-SDS Secondary outcome measures: body fat SDS, change in portion size, HDL cholesterol
Nguyen 2012	Source: ACTRN1260600017557 Primary outcome mea- sures: BMI z score, waist circumference z score	No Last verified: May 2006	Primary outcome mea- sures: BMI z score and waist- to-height ratio (protocol paper states primary out- comes are BMI z score and waist circumference z score)	Primary outcome mea- sure: -
	Sec- ondary outcome mea- sures: fasting insulin, glucose total cholesterol, HDL cholesterol, LDL cholesterol, blood pres- sure, physical activity, food intake and eat- ing patterns; psychoso- cial assessment		Sec- ondary outcome mea- sures: parallel changes in metabolic and self-re- ported psychosocial and behavioural variables, physical activity, adverse events	Secondary outcome measure: -
	Other outcome mea- sure: -		Other outcome mea- sure: -	Other outcome mea- sures: BMI z score, waist-to- height ratio, total choles- terol level, triglycerides level, global self-worth, dietary, physical activity, sedentary behaviour

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 348 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Grey 2009	Source: N/T		Other outcome mea- sures: weight, % body fat, height, BMI, waist circumference, insulin, insulin resistance, im- paired glucose tolerance, lipids, child depressive symptoms, health be- haviours and attitudes, physical activity	Other outcome measures: an- thropometric measures, lipids, depressive symp- toms, BMI
Vissers 2008	Source: N/T		Primary outcome mea- sure: weight	Primary outcome mea- sure: -
			Sec- ondary outcome mea- sures: BMI, body fat, skinfold thickness, hip and waist circumference, waist-to-hip ratio, fast- ing glucose, cholesterol and triglycerides	Secondary outcome measure: -
			Other outcome mea- sure: -	Other out- come measures: weight, BMI, waist circumfer- ence, fasting glucose
NCT00132132	Source: NCT00132132 Primary outcome mea- sures: change in BMI, % participants with BMI reduction	Yes (study results) Last verified: May 2015 History of changes: 9 documented changes	Primary outcome mea- sure: -	Primary outcome mea- sure: -
Pitetti 2007	Source: N/T		Primary outcome mea- sures: body weight, BMI	Primary outcome mea- sure: -
			Secondary out- come measures: energy expenditure, exercise ca- pacity (treadmill walking frequency, speed, eleva- tion)	Secondary outcome measure: -
			Other outcome mea- sure: -	Other outcome mea- sures: BMI, treadmill walking

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 349 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Savoye 2007	7 Source: NCT00409422 No Primary outcome mea- sures: weight, BMI, per- centage body fat, lipids, blood pressure, glu- cose, insulin, insulin re- sistance		Primary outcome mea- sure: change in BMI	Primary outcome mea- sure: -
	Secondary outcome measure: -		Sec- ondary outcome mea- sures: weight, % body fat, total body fat, blood pressure, plasma glucose, insulin, total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides, insulin resistance	Secondary outcome measure: -
	Other outcome mea- sure: -		Other outcome mea- sure: -	Other outcome mea- sures: BMI z score, BMI, % body fat, total body fat mass, total choles- terol, density lipoprotein cholesterol, insulin resis- tance
van Egmond-Frohlich 2006	Source: N/T		Primary outcome mea- sure: -	Primary outcome mea- sure: -
			Secondary outcome measure: -	Secondary outcome measure: -
			Other outcome mea- sures : BMI-SDS, phys- ical activity, eating be- haviour, quality of life	Other outcome measures: an- thropometric measures, questionnaires on eating behaviour, physical ac- tivity, quality of life, self- efficacy, subjective rating of the intervention
Daley 2005	Source: ISRCTN83888112 Primary outcome mea- sures: physical self-per- ceptions, depression, fit- ness, BMI	No Last verified: September 2009 History of changes: no documented changes	Primary outcome mea- sure: physical self-per- ceptions	Primary outcome mea- sure: -

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 350 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	Secondary outcome measure: -	Sec- ondary outcome mea- sures: depression, self- perceptions, affect, aero- bic fitness, physical ac- tivity, height, weight, BMI	Secondary outcome measure: -
	Other outcome mea- sure: -	Other outcome mea- sure: -	Other outcome mea- sures: children's Depres- sion Inventory score, physical self-worth, self- esteem, physical activity over time, BMI
Resnicow 2005	Source: N/T	Primary outcome mea- sure: BMI	Primary outcome mea- sure: -
		Secondary outcome measures: % body fat; waist and hip circum- ferences; blood pressure; serum measures of lipids, insulin, glucose; cardio- vascular fitness	Secondary outcome measure: -
		Other outcome mea- sure: -	Other outcome mea- sures: BMI, % body
Jiang 2005	Source: N/T -	Other outcome mea- sures: weight, height, BMI, cholesterol, triglycerides, blood pressure	Other outcome mea- sures: BMI, cholesterol, triglycerides, blood pres- sure
Carrel 2005	Source: N/T	Other outcome mea- sures: BMI, % body fat, cardiovascular fit- ness, insulin sensitivity	Other outcome mea- sures : BMI, % body fat, VO _{2max} , insulin level
Ebbeling 2003	Source: N/T	Other out- come measures: dietary outcomes including gly- caemic load, BMI, body mass, fat mass, weight, insulin resistance	Other outcome mea- sures: glycaemic load, BMI, fat mass, insulin resistance
Saelens 2002	Source: N/T	Primary outcome mea- sure: BMI z score	Primary outcome mea- sure(s): -

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 351 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

			Secondary out- come measures: weight, height, dietary intake, physical activity, seden- tary behaviour, problem- atic eating and weight- related behaviours and beliefs, physician coun- seling, behavioural skills use, participant satisfac- tion	Secondary outcome measure: -
			Other outcome mea- sure: -	Other outcome mea- sures: BMI z scores, be- havioural skills use, en- ergy intake, % calories from fat, physical activ- ity, sedentary behaviour, problematic weight-related or eating behaviours/beliefs, feasi- bility, participant satis- faction
Brownell 1983	Source: N/T		Other outcome mea- sures : weight, % above mean weight, BMI, De- velopmental Index	Other outcome mea- sures: weight loss, blood pressure
Chandra 1968	Source: N/T		Other outcome mea- sure: weight (% ex- pected)	Other outcome mea- sure: -
NCT00807560	Source: NCT00807560 Primary outcome mea- sure: BMI z score	Yes (study results) Last verified: December 2015	Primary outcome mea- sure: -	Primary outcome mea- sure: -
	Secondary outcome measures: % completion, waist mea- surement, hip measure- ment, height, weight, BMI, BMI percentile	History of changes: 9 documented changes	Secondary outcome measure: -	Secondary outcome measure: -
	Other outcome mea- sure: -		Other outcome mea- sure: -	Other outcome mea- sure: -

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 352 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

BIA: bioelectrical impedence analysis; BMI: body mass index; CRP: C-reactive protein; CSA: computer science applications; DXA: dual-energy x-ray absorptiometry; EMA: European Medicines Agency; FDA: Food and Drug Administration; HbA1c: glycosylated haemoglobin A1c; HDL: high-density lipoprotein; HOMA-IR: homeostatic model assessment, insulin resistance; HRQoL: health-related quality of life; LDL: low-density lipoprotein; MRI: magnetic resonance imaging; MVPA: moderate-to-vigorous physical activity; N/T: no trial document available; PedsQL: Pediatric Quality of Life; SDS: standard deviation score; TSH: thyroid stimulating hormone; VO_{2max}: maximum volume of oxygen.

Appendix 6. Examination of outcome reporting bias according to ORBIT classification

Trial ID	Outcome	High risk of bias (category A) ^a	High risk of bias (category D) ^b	High risk of bias (category E) ^c	High risk of bias (category G) ^d
Patsopoulou 2017	N/A	-	-	-	-
Jelalian 2016	N/A	-	-	-	-
Norman 2016	N/A	-	-	-	-
Hofsteenge 2014	N/A	-	-	-	-
Schranz 2014	N/A	-	-	-	-
Visuthranukul 2015	N/A	-	-	-	-
Wong 2015	N/A	-	-	-	-
Pakpour 2015	N/A	-	-	-	-
Bean 2014	N/A	-	-	-	-
Carraway 2014	N/A	-	-	-	-
Sigal 2014	N/A	-	-	-	-
Love-Osborne 2014	N/A	-	-	-	-
Kong 2014	N/A	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 353 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

[&]quot;-" denotes not reported.

^{*a*}Trial document(s) refers to all available information from published design papers and sources other than regular publications (e.g. FDA/EMA documents, manufacturer's websites, trial registers)

^bPublication(s) refers to trial information published in scientific journals (primary reference, duplicate publications, companion documents or multiple reports of a primary study)

Luna-Pech 2014	N/A	-	-	-	-
Boodai 2014	N/A	-	-	-	-
Gourlan 2013	N/A	-	-	-	-
Patrick 2013	N/A	-	-	-	-
Kong 2013	N/A	-	-	-	-
Pbert 2013	N/A	-	-	-	-
Brennan 2013	N/A	-	-	-	-
Walpole 2013	N/A	-	-	-	-
Toulabi 2012	N/A	-	-	-	-
Debar 2012	N/A	-	-	-	-
Ebbeling 2012	N/A	-	-	-	-
Vos 2011	N/A	-	-	-	-
Christie 2011	N/A	-	-	-	-
Wengle 2011	N/A	-	-	-	-
Ford 2010	N/A	-	-	-	-
Nguyen 2012	N/A	-	-	-	-
Grey 2009	N/A	-	-	-	-
Vissers 2008	N/A	-	-	-	-
NCT00132132	N/A	-	-	-	-
Pitetti 2007	N/A	-	-	-	-
Savoye 2007	N/A	-	-	-	-
van Egmond- Frohlich 2006	N/A	-	-	-	-
Daley 2005	N/A	-	-	-	-
Resnicow 2005	N/A	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 354 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Jiang 2005	N/A	-	-	-	-
Carrel 2005	N/A	-	-	-	-
Ebbeling 2003	N/A	-	-	-	-
Saelens 2002	N/A	-	-	-	-
Brownell 1983	N/A	-	-	-	-
Chandra 1968	N/A	-	-	-	-
NCT00807560	N/A	-	-	-	-

^aClear that outcome was measured and analysed; trial report states that outcome was analysed but reports only that result was not significant

(Classification 'A', table 2, Kirkham 2010)

^bClear that outcome was measured and analysed; trial report states that outcome was analysed but report no results

(Classification 'D', table 2, Kirkham 2010)

^cClear that outcome was measured but was not necessarily analysed; judgement says likely to have been analysed but not reported because of non-significant results

(Classification 'E', table 2, Kirkham 2010)

^d Unclear whether outcome was measured; not mentioned, but clinical judgement says likely to have been measured and analysed but not reported on the basis of non-significant results

(Classification 'G', table 2, Kirkham 2010)

N/A: not applicable; ORBIT: Outcome Reporting Bias In Trials

Appendix 7. Definition of endpoint measurement

Trial ID	Behaviour change	Changes in BMI and body weight	Height	Health- related quality of life or self- esteem	All-cause mortality/ morbidity	Socioeco- nomic ef- fects	Parent- child rela- tionship or assess- ment of parenting	Partici- pants' views of the in- tervention	Severe/ serious adverse events
Pat- sopoulou 2017	-	Weight mea- sured using Tanita HD646 scales (ref- erence pro- vided) to 0.	Height mea- sured to 0. 1 cm us- ing stretch stature method and PE87	-	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 355 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

		 kg. Par- ticipants removed shoes and jackets. BMI deter- mined ac- cording to: BMI weight/ height² 	portable stadiome- ters (refer- ence pro- vided). Partic- ipants re- moved shoes and jackets						
Jelalian 2016	Physical activity as- sessed us- ing Sense Wear Mini monitor	Weight measured on digital scale with partici- pants wearing light cloth- ing and no shoes. BMI was calcu- lated as kg/ m ²	Measured on wall mounted stadiome- ter	-	-	-	-	Ses- sion Evalu- ation Form given to adoles- cents at end of each ther- apy session with ques- tions about useful- ness of ses- sion rated on a 4- point Lik- ert scale (1 = strongly disagree	-
Norman 2016	-	Weight measured using cali- brated dig- ital scale while participant was wearing light cloth- ing. BMI cal- culated as kg/m ² .	Height (without shoes) measured using sta- diometer	-	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 356 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

BMI z scores calculated using CDC Vital and Health Statistics. BMI percentile calculated using ageand gender-specific median, SD and power of the Box-Cox transformation (reference provided). % over median BMI calculated as adolescent's percentage over median BMI for age and gender (formulae provided). % body fat determined from DXA (model details provided). Waist circumference based on the mean of

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 357 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
		2 measure- ments fol- lowing standard- ised proce- dures							
Hofs- teenge 2014	Dutch Eat- ing Behaviour Question- naire	Body weight measured within 0.1 kg with calibrated electronic flat scale. For cal- culation of BMI- SDS or z scores, us- ing Dutch reference database. Waist cir- cumfer- ence mea- sured and recorded with flex- ible band to an accu- racy of 0.1 cm. Body com- position assessed with DXA	Height measured with an ac- cu- racy of 0.1 cm with an elec- tronic sta- diometer	PedsQL CHQ BES - vali- dated question- naire on general feelings about ap- pearance, weight sat- is- faction and evalua- tions of at- tributions to others about one's body and appear- ance Mean scores range from 0 (worst pos- sible score) to 4 (best pos- sible score) to 4 (best pos- sible score) to scores rep- resenting a better body esteem					
Schranz 2014	-	Body mass using dig- ital scales (model details	Height mea- sured with stadiome- ter (model	Physical Self-Worth Scale - 4- choice	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 358 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

		provided) . Skinfolds measured (biceps, triceps,	details pro- vided)	struc- tured alter- native for- mat Self-					
		subscapu- lar, iliac crest, supraspinale abdomi- nal, front thigh, medial calf) to calculate a sum of		Percep- tion Profile for Adoles- cents - 4- choice struc- tured alter- native for- mat For all measures a					
		skinfolds measure, using Harp- enden callipers. Stature, mass and skinfold measure- ments		higher score (or positive effect size change) in- dicated higher self- efficacy/ confidence or beliefs/ self-					
		taken us- ing ISAK protocols. Body composi- tion (% body fat, lean mass and bone mineral density) assessed using		perception					
		whole body DXA scanning (details provided)							
Vi- suthranuku 2015	Dietary: 3- day dietary records,	Weight mea- sured with-	Mea- sured with- out shoes	-	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. 359

tracted as and with gen review light clobs ter to near- protocol ing using a set 0.1 cm set- ret to near- catal activity ter to near- catal activity ter to near- catal activity at 2 score cal- idated cu- lated based on (WHO Anthro- Plus pro- gramme. Waist cir- cumfer- ence mea- sured at umbili- cus level af- ter normal exchalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circum- ference at sured the circumfer- ence mea- sured the circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circum- ference at middle point be-	not ex-	out shoes	using a sta-			
per review light cloth- protocol ing using a stadiome- stadiome- ical activity ter to near- est 0.1 cm est 0.1 cm est 0.1 kg naire: un- BMI clear if val- z score cal- idated on (WHO 2009) growth ref- erence us- ing WHO Anthro- Plus pro- gramme. Waist cir- cumfer- ence mea- sured at umbili- cuslevel af- ter normal exhaltion standing position. Hip pitip frence of hips. Mid- upper arm circumfer- ence mea- sured at maximum circumfer- ence mea- sured at maximum ence mea- sured at maximum ence mea- sured at maximum ence mea- ence mea- enc	tracted as	and with	diome-			
protocol ing using a est 0.1 cm Phys- ical activity ter to near- question- naire: un- clear if val- cu- lated based on (WHO 2009) growth ref- erence us- ing WHO Anthro- Plus pro- gramme. Waist cir- cumfer- ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circum- ference at middle point be-	per review	light cloth-	ter to near-			
Phys-statione- ical activity ter to near- question- est 0.1 kg, naire: un- bMI clear if val- z score cal- idated cu- lated based on (WHO 2009) growth ref- erence us- ing WHO Anthro- Plus pro- gramme. Waist cir- cumfer- ence mea- sured at umbili- cus level af- ter normal exbalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circum- ference at middle point be-	protocol	ing using a	est 0.1 cm			
ical activity ter to near- question- ter to 1. kg, naire: un- BMI clear if val- idated actu- lated based on (WHO 2009) growth ref- erence us- ing WHO Anthro- Plus pro- gramme. Waist cir- cumfer- ence mea- sured ar umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circum- ference at middle point be-	Phys-	stadiome-				
question- est 0.1 kg, maire: un- bMI clear if val- z score cal- idated cu- lated based on (WHO 2009) growth ref- erence us- ing WHO Anthro- Plus pro- gramme. Waist cir- cumfer- ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-	ical activity	ter to near-				
naire: un- BMI clear if val- z score cal- idared cu- lated based on (WHO 2009) growh ref- crence us- ing WHO Anthro- Plus pro- gramme. Waist cir- cumfer- ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-	question-	est 0.1 kg.				
clear if val- idared z score cal- idared cu- lared based on (WHO 2009) growth ref- erence us- ing WHO Anthro- Plus pro- gramme. Waist cir- cumfer- ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circum- ference at middle point be-	naire: un-	BMI				
idated cu- lated based on (WHO 2009) growth ref- erence us- ing WHO Anthro- Plus pro- gramme. Waist cir- cumfer- ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-	clear if val-	z score cal-				
lated based on (WHO 2009) growth ref- erence us- ing WHO Anthro- Plus pro- gramme. Waist cir- cumfer- ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circumfer- ence mea- sured the circumfer- ence mea- sured the circumfer- ence mea- sured the circumfer- ence mea- sured the circumfer- ence mea- sured the circumfer- ence mea- sured the circum- ference at middle point be-	idated	cu-				
on (WHO 2009) growth ref- erence us- ing WHO Anthro- Plus pro- gramme. Waist cir- cumfer- ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		lated based				
2009) growth ref- erence us- ing WHO Anthro- Plus pro- gramme. Waist cir- cumfer- ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circum- ference at middle point be-		on (WHO				
growth ref- erence us- ing WHO Anthro- Plus pro- gramme. Waist cir- cumfer- ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips, Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		2009)				
erence us- ing WHO Anthro- Plus pro- gramme. Waist cir- cumfer- ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		growth ref-				
ing WHO Anthro- Plus pro- gramme. Waist cir- cumfer- ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		erence us-				
Andhro- Plus pro- gramme. Waist cir- cumfer- ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		ing WHO				
Plus pro- gramme. Waist cir- cumfer- ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		Anthro-				
gramme. Waist cir- cumfer- ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		Plus pro-				
Waist cit- cumfer- ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circumfer- ence mea- sured the circumfer- ence mea- sured the circum- ference at middle point be-		gramme				
cumfer- ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circumfer- ence mea- sured the circumfer- ence mea- sured the circumfer- ence mea- sured the circumfer- ence mea- sured the circum- ference at middle point be-		Waist cir-				
ence mea- sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circumfer- ence mea- sured the circum- ference at middle point be-		cumfer-				
sured at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circumfer- ence mea- sured at maximum circum- ference at middle point be-		ence mea-				
at umbili- cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circumfer- ence mea- sured at maximum circum- ference at middle point be-		sured				
cus level af- ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		at umbili-				
ter normal exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		cus level af-				
exhalation with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circumfer- ence at middle point be-		ter normal				
with par- ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		exhalation				
ticipants in standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		with par-				
standing position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		ticipants in				
position. Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		standing				
Hip circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		position.				
circumfer- ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		Hip				
ence mea- sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		circumfer-				
sured at maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		ence mea-				
maximum circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		sured at				
circum- ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		maximum				
ference of hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		circum-				
hips. Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		ference of				
Mid- upper arm circumfer- ence mea- sured the circum- ference at middle point be-		hips.				
upper arm circumfer- ence mea- sured the circum- ference at middle point be-		Mid-				
circumfer- ence mea- sured the circum- ference at middle point be-		upper arm				
ence mea- sured the circum- ference at middle point be-		circumfer-				
sured the circum- ference at middle point be-		ence mea-				
circum- ference at middle point be-		sured the				
ference at middle point be-		circum-				
middle point be-		ference at				
point be-		middle				
		point be-				

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 360 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

		tween ole- cranon process of ulna and acromion process of scapula							
Wong 2015	-	-	-	-	-	-	-	-	-
Pakpour 2015	Youth Adolescent Food Frequency Ques- tionnaire: valid and reliable against the 24-hour dietary recall adolescent popula- tions. The Persian version of the ques- tionnaire was found to be valid and reliable for use in Iranian adoles- cents Objec- tive Physi- cal Activity us- ing a GT3 X monitor. Child Di- etary Self- Efficacy Scale 15- item tool	Weight for adoles- cents and par- ents mea- sured to nearest 0.1 kg on cali- brated dig- ital scales BMI calcu- lated in kg/ m ² . BMI z score or SDS recom- mended by WHO. BMI per- centile cal- culated ac- cording to the CDC's age- and gender- specific reference norms. Waist cir- cumfer- ence mea- sured mid- way be- tween low- est rib and su-	Height for adoles- cents and parents measured to nearest 0.1 cm af- ter remov- ing shoes. Height measured using a sta- diome- ter (model details pro- vided)	PedsQL					

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 361 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

assessing perior border of iliac dietary self-efficrest with cacy gathinelasered tic measuron a 3-point ing tape at Likert end of norscale (from mal expira-"not sure" tion to "very nearest 0.1 to sure"). cm % body fat Responses measured ranged by DXA, a from -15 to 15, with valid meahigher sure that scores provided a indicating more accuhigher dirate assessetary selfment of efficacy body com-Weight Efposition than body ficacy Lifestyle weight Questionalone. BIA naire, a 20conducted item tool assessing adolescents' confidence in their ability to lose weight. Items scored on a 10-point Likert scale (from 0 =not confident to 9 = very confident) , and items scores were averaged Physical Exercise

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 362 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	Self-Effi- cacy Scale, adoles- cents' con- fidence in their abil- ity to per- form phys- ical activ- ity a 5-item tool with responses scored on a 4-point Likert scale (0 = uncer- tain to 9 = very cer- tain)								
Bean 2014	-	Weight measured in light cloth- ing with- out shoes to nearest 0.1 kg us- ing an elec- tric scale. (ref- erence pro- vided) BMI z scores and age- and gender- specific BMI per- centiles de- termined using Epi Info soft- ware	Height measured to nearest 0.1 cm us- ing a sta- diome- ter (refer- ence pro- vided)	-	-	-	-	-	-
Carraway 2014	Physical ac- tivity levels assessed by accelerom-	BMI calculated using mea- sured height and	Height measured to nearest 0.1 inches	-	-	-	Multidi- mensional Scale of Perceived	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 363 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	e- ter (model details pro- vided) Children and Youth Physical Self- Perception Profile, self- admin- istered, 40- item mea- sure assess- ing self- per- ception in 6 domains (validated)	weight. Weight measured to nearest 0.1 lb us- ing a Dig- ital Cardi- nal Scale (ref- erence pro- vided) % over- weight cal- culated by comparing actual BMI to BMI at the 50th percentile for partici- pant's age and gender. Body com- position assessed by DXA	using a sta- diome- ter (details provided)				Social Sup- port a 12- item mea- sure that as- sessed per- ceptions of social sup- port in sev- eral do- mains, in- clud- ing family (validated)		
Sigal 2014	Pedome- ters (model details pro- vided) to as- sess physi- cal activity, asked to main- tain step- count logs for 7 days at base- line and 6 months	Body com- position assessed by MRI with a 1.5-T system (de- tails of sys- tem provided) Weight in kg mea- sured using a Health O Me- ter manual scale (details provided) Waist cir- cumfer- ence mea-	Height in cm mea- sured using a Health O Me- ter manual scale (details provided)	PedsQL- Adolescent version) Harter Physical Self-Per- ceptions Profile for Children adapted physical self-per- ception profile question- naire, 36- item self- reporting scale de- veloped to	-	-	-	-	Recorded all directly observed adverse events and those sponta- neously reported by par- ticipants. Partici- pants also questioned about adverse events at each study visit.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 364 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

sured at	determine	Serious
middle dis-	domain-	adverse
tance be-	specific	events
tween last	judge-	and hos-
floating rib	ments of	pitalisa-
and il-	compe-	tions, not
iac crest us-	tence, and	defined
ing a re-	a global	further
tractable	perception	
ergonomic	of their	
mea-	worth or	
suring tape	esteem as	
(details	a person.	
provided)	It contains	
Hip	6 separate	
circumfer-	subscales	
ence mea-	consist-	
sured at	ing of 5	
widest	specific	
point over	domains	
buttocks	sport com-	
buttoeks	petence	
	(athletic	
	ability	
	ability	
	to	
	coorte).	
	sports),	
	of physical	
	condition	
	and fitness	
	of	
	fidence in	
	personal	
	appear-	
	ance);	
	of physical	
	or physical strongth.	
	strength;	
	and phys-	
	Ical self-	
	worth, as	
	well as a	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 365 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

				general domain of global self- worth					
Love- Osborne 2014	-	Weight mea- sured with- out shoes with same calibrated scale. BMI recorded as various cat- egories of BMI and subgroups	Height mea- sured with- out shoes with same stadiome- ter	-	-	-	-	-	-
Luna- Pech 2014	-	Digital scale (model de- tails provided) , BMI z score	Stadiome- ter	Standard- ized Pedi- atric Asthma Quality of Life Ques- tion- naire Span- ish Version	-	-	-	-	-
Kong 2014	Phys- ical activity levels: self- adminis- tered, vali- dated, Chinese version of Interna- tional Phys- ical Activ- ity Ques- tionnaires	BMI ≥ 95th per- centile of local age- and gen- der-spe- cific refer- ences % body fat by bioim- pedence (Tanita physi- cian digital scale)	-	-	-	-	-	-	-
Boodai 2014	-	Weight measured to 0.1 kg	Height mea- sured to 0.	-	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 366 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

		in light in- door cloth- ing, not wear- ing shoes BMI z scores cal- cu- lated based on (CDC 2000) ref- erence data. Waist cir- cumfer- ence: de- tails not re- ported	1 cm with a portable stadiome- ter (model details pro- vided), not wearing shoes						
Gourlan 2013	Perceived com- petence as- sessed by 14-item question- naire - a scale based on recom- dations by Bandura 1997 (not validated). Mo- tivation for phys- ical activ- ity assessed via French version of the Behav- ioral Regu- la- tion Exer- cise Ques- tionnaire (validated) Phys- ical activity	Weight recorded in light clothes and without shoes (dig- ital balance scale; model details pro- vided) to nearest 1 kg	Measured to nearest 0.5 mm us- ing a wall- mounted stadiome- ter (model details pro- vided)	-	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 367 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	measures as- sessed us- ing the 7- day Physi- cal Activity Re- call Inter- view (vali- dated) Total energy ex- penditure assessed by accelerom- e- ter by mul- tiplying each inten- sity level by an in- tensity fac- tor (1.5 for light inten- sity, 4 for moderate intensity, 6 for hard in- tensity, 10 for very hard inten- sity (vali- dated))								
Patrick 2013	Per- sonal views and ques- tionnaires (unclear if question- naires were completed by partici- pants/ member of team) - not validated Dietary in- take as-	Weight measured using a cal- i- brated dig- ital scale. % body fat assessed by DXA	Height (with- out shoes) mea- sured using stadiome- ter with participant standing erect against a wall with heels close to wall	Health-re- lated qual- ity of life. Rosenberg Self-Es- teem Scale used to as- sess self-es- teem, a 10- item sur- vey where each item had a 4- point ordi- nal	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 368 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

sessed us-		response			
ing		scale and a			
the Youth/		score range			
Adolescent		of 10-40,			
Question-		with			
naire, a val-		higher			
idated self-		scores indi-			
adminis-		cat-			
tered food		ing greater			
frequency		self-esteem			
question-					
naire					
for adoles-					
cents (not					
relevant to					
review pro-					
tocol)					
Phys-					
ical activ-					
ity assessed					
using 7-					
day Physi-					
cal Activity					
Re-					
call Inter-					
view, de-					
veloped for					
the Stan-					
ford Five-					
City					
Project					
Sedentary					
benaviour					
assessed					
using Sitem					
o-nem					
based on					
survey that					
measured					
hours					
spent do-					
ing various					
sedentary					
behaviours					
during					
school					
and non-					

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 369 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	school days								
Kong 2013	Dietary in- take as- sessed us- ing the YAQ. Not relevant to review pro- tocol Phys- ical activ- ity assessed using 3- Day Phys- ical Activ- ity Recall and an ac- celerome- ter (model details pro- vided) (validated)	Weight measured twice with- out shoes and mean for analy- sis, measured to near- est 0.1 kg on a strain- gauge digi- tal scale (model de- tails provided) Waist cir- cumfer- ence mea- sured twice to nearest 1 mm with a steel tape and averaged	Height measured twice with- out shoes and av- eraged for analysis Height measured to nearest 1 mm using a Schorr verti- cal measur- ing board	-	-	-	-	Pro- cess evalu- ation con- ducted to monitor how well study was imple- mented. In addition to monitor- ing fidelity of motiva- tional in- terviewing used by in- terven- tion clini- cian, par- ticipant at- tendance, length of clinic visit, partic- ipant satis- faction	-
Pbert 2013	Phys- ical activity assessed by accelerom- e- ter (model details pro- vided) for 7-day pe- riod Mean daily minutes of light, mod- erate and vigor- ous activity calculated using pub- lished cut-	Weight in kg, mea- sured in light cloth- ing by a research as- sistant Waist cir- cumfer- ence mea- sured as mean of 2 measure- ments midway between rib cage and su- perior bor-	Height measured using stan- dard methodol- ogy, wear- ing light cloth- ing, and no shoes	-	-	-	-	Perceived helpful- ness of nurse in- tervention and level of comfort in discussing weight with school nurse % visits in which the students thought that school	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 370 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

off points	der of iliac			nurse was	
(validated)	crest			verv help-	
Sedentary	Body-			ful in their	
behaviour.	weight and			learning	
TV watch-	body fat			how to	
ing and	measured			eat healthy	
nlaving	using leg-			and be	
computer	to-leg BIA			physically	
or video	system (de-			active	
games on a	tails			% visits in	
school day	provided)			which stu-	
measured	provided)			dents	
using 2				thought	
items from				thought	
the Vouth				feel	
Rick Be				Verv com	
havior Sur				fortable in	
Havior Sur-				discussing	
Vey. Dietary in				their	
take as				weight	
sessed with				related	
24-hour				behaviours	
Dietary				with the	
Recall In-				nurse	
terview				nuise	
(pot ev-					
tracted as					
per review					
protocol)					
8-item					
instru-					
ment used					
to assess					
healthful					
and un-					
healthful					
dietary					
behaviours					
targeted					
by inter-					
vention.					
Instru-					
ment was					
designed					
to be					
completed					
indepen-					
dently					
,					

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 371 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	by ado- lescents and was based on literature review, expert feedback, and fea- sibility testing, which found it to be feasible in public health and pri- mary care settings, similar to the perfor- mance of the longer Food Habits Question- naire and Rate Your Plate (not								
Brennan 2013	Resting metabolic rate deter- mined through indirect calorime- try at the laboratory Diet assessed by 7-day weighed food diary (not validated). Energy expendi-	body weight measured to nearest 10 g on a calibrated set of digi- tal scales by trained in- dependent assessors in presence of a trained assistant Body com- position deter- mined	Stand- ing height measured with a cal- ibrated sta- diome- ter to near- est 0.5 cm	Rosen- berg Self- Esteem Scale used as measure of self-es- teem for adoles- cents and parents	-	-	Par- ent Adoles- cent Com- munica- tion Scale and the Family Problem Solv- ing Com- munica- tion Index used to as- sess family function- ing	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 372 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

and through ture whole physical activity body DXA measured (model using details acceleromprovided) eters for . A total 7-day a body scan monitorwas coning period. ducted to Particproviding ipants estimates wore the of fat actigraph mass and on their lean tissue right hip mass for attached the entire using body and 4 firmsubregions а fitting Body cirelastic belt cumferstrapped ence meaaround surements their hips taken from as per the operator's right side instrucof body at tions. Data hip, waist, included upper arm if particiand forepants had arm using worn the a steel tape actigraph measure to for ≥ 10 nearest 1 hours each mm day on \geq 5 days including 1 weekend day. Physical activity and sedentary behaviour using Self-Administered Phys-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 373 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	ical Activ- ity Check- list (validated)								
Walpole 2013	-	BMI z score and waist circumfer- ence	-	-	-	-	-	-	-
Toulabi 2012	Students and par- ents' nu- tritional knowl- edge. 12 questions (with 1. 5 points given to each correct answer) before and after imple- menting interven- tional pro- gramme (not ex- tracted as per review protocol)	Weight (without wearing shoes or excess clothes) measured by same nurse using a digital scale (model details provided) to nearest 0.1 kg Waist and hip circumfer- ences mea- sured to nearest 0.1 cm us- ing a plas- tic measur- ing tape	Nurse who provided interven- tion - measured to nearest 0.1 cm using a plastic measuring tape (while standing against wall, without wearing shoes, and their occiputs and heels touching the wall) ; a level was placed on top of head, parallel with floor, to indicate height on measuring tape	-		-	-	-	
Debar 2012	Certified dietary in- terviewers conducted 3 unan-	Weight measured with par- ticipants lightly	Height measured with par- ticipants lightly	-	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 374 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

nounced	clothed	clothed			
24-	and with-	and with-			
hour tele-	out shoes	out shoes			
phone di-	and taken	and taken			
etarv	3 times for	3 times			
recalls (not	quality as-	for quality			
reported as	surance	assurance,			
per review		measured			
protocol)		to nearest			
Adapted		0.5 cm			
24-hour		by using			
telephone		a Harp-			
physical		enden			
ac-		portable			
tivity recall		stadiome-			
from the 7-		ter (model			
day physi-		details			
cal activity		provided)			
recall (not		monthly			
validated)					
Validated					
ques-					
tionnaire					
measures					
included:					
hours per					
week of					
screen					
time and					
mean days					
per week					
of break-					
fast eaten					
(both					
adapted					
from the					
Youth Risk					
Behavior					
Survey)					
Mean					
times per					
week a					
"family"					
meal eaten					
together,					
and mean					
times per					
week fast					

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 375 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	food and sweetened beverages/ sodas consumed (adapted from the Project EAT Student Survey)						
Ebbeling 2012	2 × 24-hour dietary and physical activity re- call inter- views con- ducted by telephone at baseline and an- other 2 at the end of interven- tion period (not validated) Dietary intake (not validated). Energy in- take from sugar- sweet- ened bev- erages (not validated) Volumet- ric con- sumption of all non- caloric bev- erages (not validated) Recall of physical	Trained personnel measured weight using cali- brated scales. BIA used to calculate body fat as a % total body weight (reference for calcu- lation pro- vided)	Trained personnel measured height using cali- brated sta- diometers			Adherence to Instruc- tions, bev- erage delivery lo- gistics and overall en- joyment of participa- tion 1) How well did you follow the study in- structions to drink the BASH bev- erages de- livered to your home? Range: 0 = not at all (0) to 10 = very well. mean 8.4 (SD 1.7) 2) How well did you follow the	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 376 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

activity and inactivity, including sleep, using а protocol modelled after validated methodology. Participant asked to recall activity performed most during respective 15-minute time blocks throughout the preceding day (12: 00 AM to 11:59 PM) and then to rate the relative intensity of each reported activity light, as moderate, hard or very hard MET level assigned to each activity to calculate a physical activity factor

study instructions to not buy or drink sugarsweetened beverages? Range: 0 = not at all (0) to 10 = very well, mean -8.1 (SD 2.1) 3) How was the number of beverages that you received each week? Range: 0 = too few to 10 = too many, mean -6.4 (SD 1.9) 4) How was the frequency (once per week) of beverage deliveries? Range: 0 = not often enough to 10 = too often, mean -5.4 (SD 1. 5) 5) Did you en-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 377 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	(kcal/kg/ hour). As points of reference, resting = 1.0, and brisk walking = 5.0. Asked partici- pants to estimate usual number of hours per day spent watching television, using a computer (for pur- poses other than doing home- work), and playing video games							joy partic- ipating in the BASH study? Range: 0 = not at all (0) to 10 = very much, mean -8.6 (SD 1.9)	
Vos 2011	-	Assistant measured weight to nearest 0.1 kg using elec- tronic scale (model details pro- vided) in underwear and bare- foot BMI calcu- lated as kg/ m ² . Partic- ipants clas- sified as obese	Height to nearest of 0.1 cm with a sta- diometer (model de- tails provided)	Disease- generic measure for chil- dren with chronic dis- eases (DIS- ABKIDS) and KID- SCREEN	-	-	-	-	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 378 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

		using BMI gender- and age- specific in- ternational cut-off lev- els de- veloped by Cole et al. BMI expressed as SDS for Dutch ref- erences. Waist mea- sured with an anthro- po- metric tape midway between lower rib mar- gin and il- iac crest at end of gen- tle expi- ration and ex- pressed as SDS (waist circumfer- ence-SDS)							
Christie 2011	Questions on smok- ing activi- ties, meal skipping, sociable eating and frequency of 5 fruit per day intake (did not appear to use vali- dated tools)	BMI (kg/m ²) at end of in- tervention. Waist cir- cumfer- ence using standard- ised proto- col. Non- invasive measure- ment of fat mass/	-	PedsQL, Impact of Weight on Quality of Life-Kids, see below. Rosenberg Self-Es- teem Scale: global self- es- teem scale valid and reliable for adoles-	-	-	-	Structured and semi- structured interviews adminis- tered to providers, young people and their parents to assess how acceptable the pro-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 379 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Actigraph acceleron- bioimpedan eter 7-day scales in each participan- tro allbrate activity di- ary% fat by bioimpedan eter 7-day scales provided)centsgramme was, teac of delivery, participan- tion and influence on weight, quality of life, schman- agement, enot total tools aryTrained trained total tools study staff, and total tools activity: dofting diffuence total tools aryTrained trained total tools study staff, total total tools activity: dofting delivery diffuence total tools activity: dofting with shoes total tools actionation delivery total study staff, acceleron- neasured to nal tools acceleron- neasured tor measured to neasured to neasured <b< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></b<>									
Wiengle 2011 Nutri- tional tools Trained study staff. Trained study staff. - - Views - 2011 not validated. Lightweight clothing Lightweight clothing Lightweight clothing Lightweight clothing Lightweight clothing aking par- ticipants. aking par- ticipants. all partici- validated. with shoes removed. removed. Help- fulness of hav- ing a men- tor nearest hav- ing a men- tor score c- ter (model 0.1 kg 1 cm using and get along with along with vided) combined standing standing their men- tor score along with vided) combined standing ter and get all rest (model (model details pro- vided) and vided) and measuring and water cumfer- activ- except dur- vided reli- vided reli- crest above iliac vided) and measuring able and valid mea- surements above iliac staff staff staff staff vided reli- vided reli- vided reli- vided reli- vided reli- vided reli- vided reli- staff staff staff staff valid mea- surements <th></th> <th>Actigraph accelerom- eter 7-day measure- ment once in each participant to calibrate activity di- ary</th> <th>% fat by bioimpedan scales (model details provided)</th> <th></th> <th>cents</th> <th></th> <th></th> <th>gramme was, ease of delivery, participa- tion and influence on weight, quality of life, self-man- agement, emo- tional, be- havioural and family function- ing</th> <th></th>		Actigraph accelerom- eter 7-day measure- ment once in each participant to calibrate activity di- ary	% fat by bioimpedan scales (model details provided)		cents			gramme was, ease of delivery, participa- tion and influence on weight, quality of life, self-man- agement, emo- tional, be- havioural and family function- ing	
	Wengle 2011	Nutri- tional tools not validated. Activity: all partici- pants wore uniaxial accelerom- e- ter (model details pro- vided) at mid-ax- illary line using an elastic waist strap, except dur- ing sleep and water activ- ities, for 7 days. Pro- vided reli- able and valid mea- surements of physical activity levels	Trained study staff. Lightweight clothing with shoes removed. Weight measured to nearest 0.1 kg using combined standing stadiome- ter scale (model details provided) Waist cir- cumfer- ence mea- sured just above iliac crest	Trained study staff. Lightweight clothing with shoes removed. Height measured to nearest 1 cm using combined standing stadiome- ter and scale (model details pro- vided) and measuring tape	-	-	-	Views measured by asking par- ticipants. Help- fulness of hav- ing a men- tor score and get along with their men- tor score	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 380 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	during walking, running and free- living activities. Data from accelerom- eter down- loaded to a com- puter, and software provided with ac- celerome- ter used to calculate number of steps and time spent in mod- erate-to- vigorous physical activity based on age- dependent validated criteria Activ- ity (activ- ity log) not validated								
Ford 2010	-	Body weight in kg mea- sured with SECA scales to 1 decimal point Waist cir- cumfer- ence mea- sured in cm to	Height measured to near- est 0.1 cm with sta- diometer	PedsQL	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 381 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

		1 decimal point with a standard anthropo- metric tape at the max- imal circumfer- ence MI ad- justed for age and gender to give a BMI- SDS with British 1990 growth ref- erence data from the Child Growth Founda- tion % body fat/body fat SDS by bioimpe- dence (ref- erence pro- vided)							
Nguyen 2012	Self- reported - dietary in- take assessed from 15- item food frequency question- naire. Un- clear if val- idated, not data abstracted Phys- ical activity	Anthro- pometry using stan- dard pro- cedures and cal- ibrated in- struments Weight measured with portable scales (model details provided)	Height measured to nearest 0.1 cm using fixed stadiome- ter at The Children's Hospital at Westmead (Holtain Limited; Crymych, Dyfed, UK) or portable	SF-36. 45-item Harter Self-Per- ception Profile for Ado- lescents provided measure of global self-worth (1 = low and 4 = high) and perceived	-	-	-	Questions about sat- isfaction with the Loozit pro- gramme	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 382 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	and seden- tary behaviours mea- sured with Children's Leisure Ac- tivities Study Sur- vey	to nearest 0.1 kg, with shoes and heavy clothing removed. By trained staff members, who are blinded to treatment allocation. BMI z scores calculated based on age- and gender- specific reference values	stadiome- ter (model details provided) when mea- surements were con- ducted at commu- nity health centres	mean compe- tence in 8 domains (scholastic, social ac- ceptance, athletic, physical appear- ance, job, romantic appeal, close friend- ship, be- havioural conduct) Impor- tance attributed to each do- main also measured using 16- item scale					
Grey 2009	Question- naire data collected by trained research staff. Health Be- havior Question- naire used to measure health be- haviours and attitudes Usual Food Choices (14-items, measured student's usual food	Measured with scale (model de- tails provided) . Measured in light in- door cloth- ing with bare feet	All mea- surements taken by research staff/ nurses. Wall- mounted stadiome- ter, cal- ibrated in 1/8 cm in- tervals. Measured in light in- door cloth- ing with bare feet	-	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 383 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

selections) , Dietary Self-Efficacy (15 items, e. "How g. sure are you that you can eat a baked potato instead of French fries?") and , Physical Activity Self-Efficacy (5 items, e. "How g. sure are that you you can choose to jog during recess?") scales used. Validity and consistency measured Revised Godin-Shephard Activity Survey, a self-administered instrument in which participants report number of times in an average

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 384 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	week that they spent > 15 min- utes in ac- tiv- ities classi- fied as mild (3 METs) , moderate (5 METs) or strenu- ous (9 METs)						
Vissers 2008		Weight mea- sured using digital col- umn scale (model de- tails provided) % body fat assessed using BIA. Skin- fold thick- ness mea- sured using a calliper at 4 sites: biceps, tri- ceps, sub- scapular, suprailiac Hip and waist circum- ference measured to nearest 1 mm using non- elastic measuring tape. Waist circum-	Height measured to nearest cm using stadiome- ter (model details pro- vided)			-	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 385 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	ference measured placing tape in horizontal plane around abdomen midway between iliac crest and float- ing ribs at end of a normal expiration WHR cal- culated							
NCT00132.	Change in BMI and proportion of partici- pants with reduction in BMI not defined	-	-	-	-	-	-	-
Pitetti - 2007	Weight measured to nearest 0.11 kg (or ¼ lb) mea- sured on a stan- dard physi- cian's scale (model de- tails provided)	-	-	-	-	-	-	-
Savoye - 2007	Weight measured (with par- ticipant in socks with no shoes and wear- ing a light	Height mea- sured with stadiome- ter (model details pro- vided), cal- ibrated in	-	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 386 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

		gown) in kg to nearest 0. 1 kg us- ing medi- cal weight scale (model de- tails provided), zeroed and calibrated before each weight % body fat deter- mined by body fat analyser (model details pro- vided). To- tal body fat calculated by mul- tiplying % body fat by weight in kg	0.1-cm in- tervals						
van Egmond- Frohlich 2006	Physical ac- tivity ques- tionnaire	-	-	KINDL question- naire	-	-	-	-	-
Daley 2005	Phys- ical Activ- ity Ques- tionnaire for Adoles- cents used to col- lect partic- ipants' in- volvement in different physical activities. Each phys-	Weight measured to nearest 0.1 kg us- ing balance scale. From these val- ues, BMI values cal- culated. All values expressed as SDS (z scores), rel-	Height measured to nearest completed 0.1 cm using wall- mounted stadiome- ter	-	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 387 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	ical activ- ity compo- nent scored be- tween 1 = not in- volved to 5 = involved 5-7 times per week	a- tive to cur- rent UK standards					
Resnicow 2005		Weight: Tanita scale (model de- tails provided). Shoes, socks and outer clothing removed. % body fat: same scale as used for weight. Waist and hip circum- ference: tape mea- surements obtained twice per site. Waist measured at navel, and hip measure- ment taken at broadest points on hips and buttocks. Third measure	Measured with a sta- diometer			Interven- tion: brief question- naire that queried their per- ceptions regard- ing overall pro- gramme and indi- vidual in- tervention elements Compara- tor: similar question- naire excluding items ad- dressing el- ements not in- cluded in their con- dition, e.g. pagers	

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 388 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

		obtained if first 2 mea- surements varied by > 2 cm							
Jiang 2005	-	Weight mea- sured with- out outer clothing and cal- ibrated to 0.1 kg	Height mea- sured with- out shoes and cal- ibrated to 0.1 cm	-	-	-	-	-	-
Carrel 2005	-	Weight measured on calibrated beam bal- ance plat- form scale to nearest 0.1 kg % body fat and % fat- free body mass mea- sured by DXA	Height measured on wall- mounted stadiome- ter to near- est 0.5 cm.	-	-	-	-	-	-
Ebbeling 2003	Dietary in- take: 7 days food diary (not validated)	BMI in kg/ m ² Fat mass mea- sured by DXA using Hologic instru- mentation (model details pro- vided)	Height measured using wall- mounted stadiome- ter (model details pro- vided)	-	-	-	-	-	-
Saelens 2002	2-day dietary re- call inter- view (not extracted as per re-	Weight measured at baseline in the paediatric	Stated height measured by sta- diometer,	-	-	-	-	Physi- cian coun- selling, be- havioural skills use	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 389 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	view pro- tocol) Seven- Day Physi- cal Activity Re- call inter- view (vali- dated). Sedentary behaviour through self-report question- naire (not validated) Cognitive dietary re- straint and eating dis- inhibition through the Three- Factor Eat- ing Ques- tionnaire (validated)	clinic using a calibrated standard digital scale. Weight measured at post- treatment and fol- low-up on calibrated balance beam scale	no other details			and partic- ipant satis- faction questions	
Brownell 1983	-	Weight; % above mean weight. BMI, De- velopmen- tal Index (based on normative changes in height and weight) . Weight measured with balance- beam scale in street clothes with no shoes	Mea- sured with balance- beam scale	-	-		

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 390 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Chandra 1968	-	Mean weight loss in kg.	-	-	-	-	-	-	-
NCT00807	Moderate to Vigor- ous Physi- cal Activity Measure. Seden- tary Activ- ity Check- list. Youth and Parent/ Guardian Eat- ing Ques- tionnaire. PACE + Fruit Veg- etable Screening Measure. PACE+ Dietary Fat Screening Measure	Z score cal- culated us- ing Baylor College of Medicine Chil- dren's Nu- trition Re- search Cen- ter's online BMI calculator	-	PedsQL	-	-	-	-	-

BASH: Beverages and Student Health; BES: Body Esteem Scale; BIA: bioelectrical impedence analysis; BMI: body mass index; CDC: Centers for Disease Control and Prevention; CHQ: Child Health Questionnaire; DXA: dual-energy x-ray absorptiometry; ISAK: International Society for the Advancement of Kinathropometry; KINDL: Fragebogen für KINDer und Jugendliche zur Erfassung der gesundheitsbezogenen Lebensqualität (questionnaire for children and adolescents to record health-related quality of life) ; MET: metabolic equivalent; MRI: magnetic resonance imaging; N/D: not defined; N/I: not investigated; PACE: Patient-Centered Assessment and Counseling for Exercise; PedsQL: Paediatric Quality of Life; SD: standard deviation; SDS: standard deviation score; SF-36: 36-item Short Form; TV: television; WHO: World Health Organization; WHR: waist-to-hip ratio

Appendix 8. Adverse events

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 391 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Trial ID	Interven- tion(s) and compara- tor(s)	Partici- pants included in analysis (n)	Deaths (n (%))	Partici- pants with adverse events (n (%))	Partici- pants with severe/ serious adverse events (n (%))	Partic- ipants dis- continu- ing study due to adverse events (n (%))	Partici- pants hospi- talised (n (%))	Partici- pants with outpa- tient treat- ment (n (%))	Partici- pants with specific adverse events (descrip- tion) (n (%))
Pat-	I1: activity	55	-	-	-	-	-	-	-
sopoulou 2017	I2: activity + diet	55	-	-	-	-	-	-	-
	C1: no in- tervention	56	-	-	-	-	-	-	-
Jelalian 2016	I1: CBT + healthy lifestyle	17	-	-	-	-	-	-	-
	C1: CBT	7	-	-	-	-	-	-	-
Norman 2016	I1: step down care	53	-	-	-	-	-	-	-
	C1: enhanced usual care	53	-	-	-	-	-	-	-
Hofs- teenge	I1: group education	71	-	-	-	-	-	-	-
2014	C1: dieti- tian only	51	-	-	-	-	-	-	-
Schranz 2014	I1: resistance training	30	-	-	-	-	-	-	-
	C1: no in- tervention	26	-	-	-	-	-	-	-
Vi- suthranuku	I1: low GI diet	25	-	-	-	-	-	-	-
2015	C1: con- ventional diet	27	-	-	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 392 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

1	\sim		7)
1	1 011	+111	110d
v	$\cup un$	un	ucu)
`			

Wong 2015	I1: standard weight loss diet + in- crease wa- ter intake	-							
	C1: stan- dard weight loss diet	-	-	-	-	-	-	-	-
Pakpour 2015	I1: motiva- tional in- terviewing	80	-	-	-	-	-	-	-
	I2: motiva- tional in- terviewing + parental involve- ment	119	-	-	-	-	-	-	-
	C1: passive control	119	-	-	-	-	-	-	-
Bean 2014	I1: motiva- tional in- terviewing	58	-	-	-	-	-	-	-
	C1: educa- tion control	41	-	-	-	-	-	-	-
Carraway 2014	I1: men- tor-led ex- ercise	11	-	-	-	-	-	-	-
	C1: wait list control	13	-	-	-	-	-	-	-
Sigal 2014	I1: diet + aer- obic train- ing	75	-	19 (25)	0	2 (3)	0	-	Upper body: 3 (4) Lower body: 9 (12) Muscu- loskeletal injury: 0

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 393 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
								Anx- iety or de- pression: 1 (1) Headache: 0 Fainting: 0 Respira- tory infec- tion: 0 Other: 1 (1)
I2: diet + resistance training	78	-	14 (19)	0	0	0	-	Upper body: 4 (5) Lower body: 10 (13) Muscu- loskele- tal injury: 1 (1) Anx- iety or de- pression: 0 Headache: 0 Fainting: 0 Respira- tory infec- tion: 1 (1) Other: 0
I3: diet + aer- obic+ resis- tance training	75	-	16 (21)	0	0	0	-	Upper body: 7 (9) Lower body: 8 (11) Muscu- loskele- tal injury: 2 (3) Anx- iety or de- pression: 0 Headache: 0

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 394 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

									Fainting: 0 Respira- tory infec- tion: 0 Other: 2 (3)
	C1: diet only	76	-	18 (24) ^{<i>a</i>}	0	0	0	-	Upper body: 6 (8) Lower body: 4 (5) Muscu- loskeletal injury: 0 Anx- iety or de- pression: 3 (4) Headache: 1 (1) Fainting: 1 (1) Respira- tory infec- tion: 1 (1) Other: 2 (3)
Love- Osborne 2014	I1: motiva- tional in- terviewing	82	-	-	-	-	-	-	-
	C1: control	83	-	-	-	-	-	-	-
Kong 2014	I1: low GI diet	52	-	-	-	-	-	-	-
	C1: usual Chi- nese diet	52	-	-	-	-	-	-	-
Luna- Pech 2014	I1: nor- mocaloric diet + physical activity	29	-	-	-	-	-	-	-
	C1: no in- tervention	29	-	-	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 395 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Boodai 2014	I1: multi- compo- nent group sessions	41	-	-	-	-	-	-	-
	C1: no in- tervention	41	-	-	-	-	-	-	-
Gourlan 2013	I1: motiva- tional In- terviewing + standard weight loss	28	-	-	-	-	-	-	-
	C1: stan- dard weight loss	34	-	-	-	-	-	-	-
Patrick 2013	I1: website in- tervention	26	-	-	-	-	-	-	-
	I2: website + group	26	-	-	-	-	-	-	-
	I3: website + SMS	24	-	-	-	-	-	-	-
	C1: usual care	25	-	-	-	-	-	-	-
Kong 2013	I1: ACTION	31	-	-	-	-	-	-	-
	C1: stan- dard care	29	-	-	-	-	-	-	-
Pbert 2013	I1: "Lookin' Good Feelin' Good"	42	-	-	-	-	-	-	-
	C1: control	40	-	-	-	-	-	-	-
Brennan 2013	I1: motiva- tional in- terviewing	42	-	-	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 396 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	C1: wait list control	21	-	-	-	-	-	-	-
Walpole 2013	I1: motiva- tional In- terviewing	20	-	-	-	-	-	-	-
	C1: social skills train- ing	20	-	-	-	-	-	-	-
Toulabi 2012	I1: be- havioural modifica- tion	76	-	-	-	-	-	-	-
	C1: control	76	-	-	-	-	-	-	-
Debar 2012	I1: multi- compo- nent inter- vention	105	-	-	-	-	-	-	-
	C1: usual care	103	-	-	-	-	-	-	-
Ebbeling 2012	I1: multi- compo- nent inter- vention	110	-	7 (6.4)	-	-	-	-	-
	C1: control	114	-	-	-	-	-	-	-
Vos 2011	I1: family- based CBT + nutrition	41	-	-	-	-	-	-	-
	C1: wait list control	40	-	-	-	-	-	-	-
	I1: HELP weight manage- ment	-	-	-	-	-	-	-	-
	C1: enhanced standard	-	-	-	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 397 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	care								
Wengle 2011	I1: mentored lifestyle in- tervention	20	-	-	-	-	-	-	-
	C1: un- mentored lifestyle in- tervention	18	-	-	-	-	-	-	-
Ford 2010	I1: Man- dometer	44	-	0	-	-	-	-	-
	C1: stan- dard care	43	-	0	-	-	-	-	-
Nguyen 2012	I1: Loozit + ATC	78	-	-	-	-	-	-	-
	C1: Loozit	73	-	-	-	-	-	-	-
Grey 2009	I1: coping skills	112	-	-	-	-	-	-	-
	C1: general ed- ucation	86	-	-	-	-	-	-	-
Vissers 2008	I1: school- based in- tervention	37	-	-	-	-	-	-	-
	C1: control	39	-	-	-	-	-	-	-
NCT00132	I1: be- havioural education	15	-	0	0	-	-	-	-
	C1: stan- dard care	15	-	0	0	-	-	-	-
Pitetti 2007	I1: tread- mill	5	-	-	-	-	-	-	-
	C1: control	5	-	-	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 398 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Savoye 2007	I1: Bright Bod- ies weight manage- ment	105	-	-	-	-	-	-	-
	C1: control	69	-	-	-	-	-	-	-
van Egmond- Frohlich 2006	I1: multi- compo- nent inter- vention	250	-	-	-	-	-	-	-
	C1: stan- dard care	271	-	-	-	-	-	-	-
Daley 2005	I1: exercise coun- selling	28	-	-	-	-	-	-	-
	C1: exercise placebo	23	-	-	-	-	-	-	-
	C2: control	30	-	-	-	-	-	-	-
Resnicow 2005	I1: GoGirls high-in- tensity be- havioural interven- tion	53	-	-	-	-	-	-	-
	C1: mod- erate-in- tensity be- havioural interven- tion	70	-	-	-	-	-	-	-
Jiang 2005	I1: family- based in- tervention	36	-	-	-	-	-	-	-
	C1: control	39	-	-	-	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 399 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Carrel 2005	I1: lifestyle- focused gym classes	27	-	-	-	-	-	-	-
	C1: stan- dard gym classes	23	-	-	-	-	-	-	-
Ebbeling 2003	I1: low GL diet	8	-	-	-	-	-	-	-
	C1: con- ventional diet	8	-	-	-	-	-	-	-
Saelens 2002	I1: healthy habits	23	-	-	-	-	-	-	-
	C1: stan- dard care	21	-	-	-	-	-	-	-
Brownell 1983	I1: mother + child sep- arate	14	-	-	-	-	-	-	-
	I2: mother + child to- gether	15	-	-	-	-	-	-	-
	C1: child only	13	-	-	-	-	-	-	-
Chandra 1968	I1: low- calorie for- mula Limi- cal	18	-	-	-	-	-	-	-
	C1: low- calorie diet	17	-	-	-	-	-	-	-
NCT00807	I1: family- based ther- apy for paedi- atric over- weight	38							

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 400 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

C1: nutri- tional edu-	39	-	-	0	-	-	-	-
ca- tional con- trol condi- tion								

"-" denotes not reported.

ATC: additional therapeutic contact; C: comparator; CBT: cognitive behavioural therapy; GI: glycaemic index; GL: glycaemic load; HELP: Healthy Eating and Lifestyle Programme; I: intervention; n: number of participants; SMS: short message service ^{*a*} injuries in the control group related to intervention occurred during run-in (prior to randomisation)

Appendix 9. Checklist to aid consistency and reproducibility of GRADE assessments

		Changes in BMI, BMI z score, body weight	Adverse events	Health-related quality of life
Study limitations (risk of bias) ^a	1. Was random sequence generation used (i.e. no potential for selection bias)?	Yes	Yes	Yes
	2. Was allocation con- cealment used (i.e. no potential for selection bias)?	Unclear	Unclear	Unclear
	3. Was there blinding of participants and person- nel (i.e. no potential for performance bias)?	No	Unclear	No ()
	4. Was there blinding of outcome assessment (i.e. no potential for detection bias)?	No	Unclear	No
	5. Was an objective out- come used?	Yes	Unclear	No
	6. Were x 80% of par- ticipants enrolled in tri- als included in the anal- ysis (i.e. no potential re- porting bias)? ^e	Yes	No ()	Yes

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 401 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

	7. Were data reported consistently for the out- come of interest (i.e. no potential selective re- porting)?	Yes	No ()	No (some studies did not re- port health-related quality of life despite mentioning)
	8. No other biases re- ported (i.e. no potential of other bias)?	Yes	No ()	Yes
	9. Did the trials end up as scheduled (i.e. not stopped early)?	Yes	Yes	Yes
Inconsistency ^b	1. Point estimates did not vary widely?	No (some variability)	N/A	Yes
	2. To what extent did con- fidence intervals over- lap (substantial: all confi- dence intervals overlap at least one of the included studies point estimate; some: confidence inter- vals overlap but not all overlap at least one point estimate; no: at least one outlier: where the confi- dence interval of some of the studies do not over- lap with those of most in- cluded studies)?	Some	N/A	Some
	3. Was the direction of effect consistent?	Yes	N/A	Yes
	4. What was the magnitude of statistical heterogeneity (as measured by I^2) - low ($I^2 < 40\%$), moderate ($I^2 40\%$ -60%)), high $I^2 > 60\%$)?	High ()	N/A	High ()
	5. Was the test for heterogeneity statistically significant (P < 0.1)?	Statistically significant ()	N/A	Statistically significant ()

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 402 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Indirectness ^a	1. Were the populations in included studies ap- plicable to the decision context?	Highly applicable	Applicable	Highly applicable
	2. Were the interven- tions in the included studies applicable to the decision context?	Highly applicable	Highly applicable	Highly applicable
	3. Was the included out- come not a surrogate outcome?	No () for BMI and BMI z score	Yes	Yes
	4. Was the outcome timeframe sufficient?	Sufficient	Sufficient	Sufficient
	5. Were the conclusions based on direct compar- isons?	Yes	Yes	Yes
Imprecision ^c	1. Was the confidence in- terval for the pooled esti- mate not consistent with benefit?	No	N/A	No
	2. What is the magni- tude of the median sam- ple size (high: 300 par- ticipants, interme- diate: 100-300 partici- pants, low: < 100 partic- ipants)? ^e	High	High	High
	3. What was the magni- tude of the number of included studies (large: > 10 studies, moderate: 5-10 studies, small: < 5 studies)? ^e	Large	Moderate	Moderate
	4. Was the outcome a common event (e.g. oc- curs more than 1/100)?	N/A	Unclear	N/A
Publication bias ^d	1. Was a comprehensive search conducted?	Yes	Yes	Yes
	2. Was grey literature searched?	Yes	Yes	Yes

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 403 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

3. Were no restrictions applied to study selec- tion on the basis of lan- guage?	Yes	Yes	Yes
4. There was no industry influence on studies in- cluded in the review?	Yes	Yes	Yes
5. There was no evidence of funnel plot asymme- try?	Unclear	N/A	Unclear
6. There was no dis- crepancy in findings be- tween published and un- published trials?	Unclear	Unclear	Unclear

 a Questions on risk of bias were answered in relation to the majority of the aggregated evidence in the meta-analysis rather than to individual studies.

 b Questions on inconsistency were primarily based on visual assessment of forest plots and the statistical quantification of heterogeneity based on I².

^cWhen judging the width of the confidence interval it was recommended to use a clinical decision threshold to assess whether the imprecision was clinically meaningful.

^dQuestions addressed comprehensiveness of the search strategy, industry influence, funnel plot asymmetry and discrepancies between published and unpublished trials.

^eDepended on the context of the systematic review area.

(): key item for potential downgrading the quality of the evidence (GRADE) as shown in the footnotes of the 'Summary of finding' table

BMI: body mass index; N/A: not applicable.

Appendix 10. Survey of study investigators providing information on included trials

Trial ID	Date trial author con- tacted	Date trial author replied	Date trial author was asked for additional in- formation (short summary)	Date trial author pro- vided data (short summary)
Cocca 2016	12 January 2017	No	12 January 2017 Aim of the study, par- ticipants weight status at baseline, weight out- comes	N/A

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 404 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Jelalian 2016	17 October 2016	18 October 2016	17 October 2016 Details of the interven- tion, randomisation and blinding	18 October 2016 Parents were involved in both conditions, re- search assistance were blinded, computer ran- domisation
Norman 2016	3 February 2016	4 February 2016	05 February 2016 Allocation concealment, details of blinding, se- lective reporting of out- comes and control out- comes	11 March 2016 Partic- ipants were randomised. Randomisation was per- formed by permutated block algorithm. Mea- sure- ment staff were blinded. There were other out- come measures that were not included in the pa- per. These included the following: physical ac- tivity based on self-re- port, quality of life, calories, food and nu- trient intake based on self-report, sedentary be- haviour based on self-re- port
Hofsteenge 2014	21 October 2015	22 October 2015	No information required	N/A
Schranz 2014	22 October 2015	22 October 2015	No information required	N/A
Visuthranukul 2015	29 October 2015	30 October 2015	19 November 2015 Details of blinding, se- lective reporting of out- comes	-
Christie 2011	22 October 2015	23 October 2015	22 October 2015 Request for BMI and further details on risk of bias (randomi- sation procedures, allo- cation concealment, de- tails of blinding, selective reporting of outcomes)	23 October 2015 Cannot release data be- fore publication
Wong 2015	17 January 2017	18 January 2017	18 January 2017 Further data	18 January 2017 Unable to share data at this stage

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 405 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Carraway 2014	17 January 2017	N/A	Stratified results, alloca- tion concealment, details of blinding, selective re- porting of outcomes	N/A
Pakpour 2015	22 October 2015	23 October 2015	No information required	N/A
Sigal 2014	22 October 2015	22 October 2015	No information required	N/A
Love-Osborne 2014	22 October 2015	No	N/A	N/A
Kong 2014	30 October 2015	30 October 2015	No information required	N/A
Luna-Pech 2014	22 October 2015	No	N/A	N/A
Gourlan 2013	23 October 2015	26 October 2015	26 October 2015 Randomisa- tion procedures, alloca- tion concealment, details of blinding, selective re- porting of outcomes	-
Patrick 2013	23 October 2015	23 October 2015	26 October 2015 Randomisa- tion procedures, alloca- tion concealment, details of blinding, selective re- porting of outcomes	-
Kong 2013	22 October 2015	No	N/A	N/A
Pbert 2013	23 October 2015	23 October 2015	26 October 2015 Request randomisa- tion procedures, alloca- tion concealment, details of blinding, selective re- porting of outcomes	28 October 2015 Computer random number gener- ator. Random allocation was conducted by the study statistician and in- vestigators were blinded to allocation. Impracti- cal to blind participants and personnel. Reported on all physiological and eating and activity be- havioural outcomes. We did not report on psy- chosocial outcomes that could be considered in- termediary variables

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 406 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Brennan 2013	23 October 2015	5 November 2015	19 November 2015 Allocation concealment and selective reporting of outcomes	-
Walpole 2013	23 October 2015	No	N/A	N/A
Toulabi 2012	13 January 2015	No	N/A	N/A
Ebbeling 2012	23 October 2015 23 October 2015		26 October 2015 Randomisa- tion procedures, alloca- tion concealment, details of blinding, selective re- porting of outcomes	12 November 2015 Data management soft- ware allocated treatment assignment. Participants and staff implementing the bev- erage delivery were not masked to group assign- ment. All personnel who assessed study outcomes were masked to group as- signment All outcomes measured were reported
Vos 2011	23 October 2015	23 October 2015	No information required	N/A
Nguyen 2012	21 October 2015	No	N/A	N/A
Wengle 2011	23 October 2015	23 October 2015	26 October 2015 Randomisa- tion procedures, alloca- tion concealment, details of blinding, selective re- porting of outcomes	N/A
Bean 2014	22 October 2015	22 October 2015	26 October 2015 Published data, antici- pated date of completion	N/A
Ford 2010	23 October 2015 23 October 20		26 October 2015 Allocation concealment, blinding, and attrition at 18 months	27 October 2015 Al- location concealed. Not possible to blind. Lost to follow-up at 18 months (stopped attending obe- sity clinic)

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 407 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

(Continued)

Grey 2009	23 October 2015	26 October 2015	29 October 2015 Request randomisa- tion procedures, alloca- tion concealment, details of blinding, selective re- porting of outcomes	29 October 2015 Randomisa- tion was electronic with permuted blocks. Allo- cation was conducted by the study statistician to assure concealment. Blinding was not car- ried out. Reported all the outcomes measured except for psychosocial outcomes which we are writing a manuscript for and anticipated submis- sion date January 2016
Vissers 2008	29/09/2015	No	N/A	N/A
NCT00132132	22 October 2015	No	N/A	N/A
Pitetti 2007	29 October 2013 23 October 2015	29 October 2013 23 October 2015	29 October 2013 23 October 2015 Request randomisa- tion procedures, alloca- tion concealment, details of blinding, selective re- porting of outcomes	23 October 2013 and 29 October 2015 Randomised allocation using random assignment or random placement. We flipped a coin and "heads" as- signed the participant to the treadmill group and "tails" assigned the par- ticipants to the control group. Participants were severely developmentally disabled therefore can- not identify group allo- cation. Outcome asses- sors were not part of the research team. All out- comes were reported
Savoye 2007	23 October 2015	26 October 2015	29 October 2015 Randomisa- tion procedures, alloca- tion concealment, details of blinding, selective re- porting of outcomes	29 October 2015 Randomisation was elec- tronic with permuted blocks. Randomisation sequence was maintained by the study statistician to assure con- cealment

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 408 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

			Partic- ipants were not blinded to treatment group. Per- sonnel were not blinded during treatment phase either because they knew if subject was going to the programme All outcomes measured except psychosocial out- comes are reported, these are being drafted for publication (self-concept of children and family dynamics of family using Piers-Harris Self Concept Scale and Family Assessment De- vice, respectively). Sub- mission aimed January 2016
22 October 2015	25 October 2015	No information required	N/A
6 August 2015	7 August 2015	6 August 2015 Published data	7 August 2015 A pilot study of a larger trial (already included in this review)
23 October 2015	No	N/A	N/A
23 October 2015	No	N/A	N/A
23 October 2015	No	N/A	N/A
23 October 2015	23 October 2015	26 October 2015 Randomisa- tion procedures, alloca- tion concealment, details of blinding, selective re- porting of outcomes	26 October 2015 Random number gener- ator from our statisti- cian to be assigned to intervention or control group. participants were not blinded to their in- tervention (they knew if they were in the inter- vention or control class) . We reported all out- comes
	22 October 2015 6 August 2015 23 October 2015 23 October 2015 23 October 2015 23 October 2015 23 October 2015	22 October 201525 October 20156 August 20157 August 201523 October 2015No23 October 2015No23 October 2015No23 October 2015No23 October 2015Soctober 201523 October 2015No	22 October 201525 October 2015No information required6 August 20157 August 20156 August 201523 October 2015NoN/A23 October 201523 October 2015Sandomisation procedures, allocation concealment, details of blinding, selective reporting of outcomes

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 409 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

(Continued)

Ebbeling 2003	23 October 2015	23 October 2015	26 October 2015 Randomisa- tion procedures, alloca- tion concealment, details of blinding, selective re- porting of outcomes	12 November 2015 Allocation in sealed en- velopes, opened by di- etitian in sequence. No details of whether en- velopes were opaque. Participants and staff im- plementing the dietary interventions were not masked to group assign- ment. All personnel who assessed study outcomes were masked to group as- signment. Not all out- comes measured were re- ported
Saelens 2002	23 October 2015	30 October 2015	30 October 2015 Randomisa- tion procedures, alloca- tion concealment, details of blinding, selective re- porting of outcomes	
Brownell 1983	No e-mail available	N/A	N/A	N/A
Chandra 1968	No e-mail available	N/A	N/A	N/A
NCT00807560	5 August 2015	N/A	5 August 2015 Published data	N/A
AC- TRN12607000632493	22 October 2015	N/A	22 October 2015 Published data	N/A
AC- TRN12611000862943	18 January 2017	Out of office	18 January 2017 Trial status	N/A
Chew 2016	12 January 2017	N/A	12 January 2017 Six months data	N/A
TCTR20130515001	02 September 2016	5 September 2016	2 September 2016 Published data	5 September 2016 Manuscript amend- ments, no published data
EUCTR2009-016921- 32-ES	6 August 2015 6 October 2016	N/A	6 August 2015 6 October 2016 Published data	N/A

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 410 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

IRCT201012235440N1	21 October 2016 6 October 2016	N/A	21 October 2016 6 October 2016 Published data	N/A
ISRCTN04152711	22 October 2015	N/A	22 October 215 Published data	N/A
NCT00562263	1 September 2016	N/A	1 September 2016 Published data	N/A
NCT00940966	5 August 2015 22 October 2016	5 August 2015 22 October 2016 N/A	Published data	NA
NCT01677923	2 September 2016	N/A	2 September 2016 Published data	N/A
NCT00940966	5 August 2015 06 October 2016	N/A	5 August 2015 06 October 2016 Published data	N/A
NCT01764113	5 August 2015	5 August 2015	5 August 2015 Published data	5 August 2015 Ongoing and will notify once complete
NCT01794546	22 October 2015	23 November 2015	22 October 2015 Published data	23 November 2015 Ongoing and cannot share
NCT02086851	21 October 2015	N/A	21 October 2015 Published data	N/A
NCT02228278	2 September 2016	06 September 2016	2 September2016 Published data	6 September 2016 Currently drafting a manuscript
NCT00998413	22 October 2015 22 October 2016	E-mail error	22 October 215 22 October 2016 Published data	N/A
Patsopoulou 2017	16 January 2017	18 January 2017	16 January2017 Further data/anticipated date of publication	18 January 2017 Shared published manuscript
NCT02745795	12 January 2017	N/A	12 January 2017 Anticipated completion date	N/A

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 411 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

NCT02794090	13 January 2017	N/A	13 January 2017 Further data/anticipated date of publication	N/A
Ramalho 2016	16 January 2017	16 January 2017	16 January2017 Further data/anticipated date of publication	16 January 2017 Initial phase of the project
N/A: not applicable				

Appendix II. Health-related quality of life: instruments

Trial ID	Name (type of measure- ment)	Dimensions (subscales) (number of items)	Validated instrument	Answer options	Scores	Direction of scales	Minimal im- portant difference
Hofsteenge 2014	PedsQL 4.0	Physical func- tion- ing (8 items), emotional functioning (5 items), social functioning (5 items), school functioning (5 items)	Yes	5-point Likert scale (0 = never a problem; 4 = almost always a problem)	Items reversed scored and lin- early trans- formed to 0- 100 scale. A total scale score and physical and psychoso- cial health summary scores also cal- culated	Higher scores indicate better HRQoL	-
	CHQ Child Form	12 domains assess physical, behavioural, mental, social functioning	Yes	Each item contains 4, 5 or 6 response alternatives	Items summed up (some recoded/recal- ibrated) and transformed to 0-100 scale. A physical summary scale computed, mean of CHQ-sub- scales physical	Higher scores indicate better HRQoL	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 412 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

					functioning, role/social limitations- physical, general health perceptions, bodily pain. Also a psy- chosocial summary scale, mean of CHQ- subscales of role/social limitations emotional, role/social limitations- behavioural, self-esteem, mental health and general behaviour		
Pakpour 2015	PedsQL 4.0 SF-15	15 items cov- ering 4 dimen- sions: physical functioning scale (5 items) , emotional functioning scale (4 items) , social func- tioning scale (3 items) , school func- tioning scale (3 items)	Yes	-	Items reverse scored and lin- early trans- formed to scale of 0-100	Higher scores indicate better QoL	-
Sigal 2014	Ped- sQL - Adoles- cent version	Physical func- tion- ing (8-items), emotional functioning (5-items), so- cial function- ing (5-items) , school func- tioning (5-	Yes	-	Total scale score derived by mean of all 23 items, as is a psychosocial health sum- mary scored (derived from mean of items in	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 413 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

		items)			the emotional, social, school functioning subscales)		
Luna-Pech 2014	PAQLQ, Spanish Ver- sion	Symptoms, activity limita- tion and emotional function	Yes	7-point inter- val scale, from 1 = severe im- pairment to 7 = no impair- ment	-	Higher scores indicate better outcomes	0.5
Patrick 2013	Ped QL	23-items	Yes	-	0-100 scale	Higher scores indicate better QoL	-
Debar 2012	PedsQL	-	-	-	-	-	-
Nguyen 2012	Mental Health Inven- tory 5, a men- tal health as- sessment com- ponent of the Medical Out- comes Study SF-36	5 questions	Yes	-	-	5 in- dicating most favourable health and 30 in- dicating least favourable health	-
Christie 2011	PedsQL	Physical, emotional, so- cial, school; 2 domain scores (physical and psychoso- cial func- tioning); total score	Yes	-	-	-	-
	IWQOL- Kids	27 items, 4 scales: physical com- fort (6 items) , body esteem (9 items), so- cial life (6 items), fam- ily relations (6 items)	Yes	-	-	-	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 414 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Vos 2011	DISABKIDS and KID- SCREEN	DIS- ABKIDS: 37 questions di- vided over 6 subscales of 6- 7 items each. Only the first 5 subscales (31 items) used to calcu- late HRQoL, because the last sub- scale focuses on medication use related to a disease. QOL- phys- ical, QOL-in- dependence, QOL-emo- tion, QOL-so- cial exclusion, QOL-social inclusion KID- SCREEN: 52 questions di- vided over 10 subscales of 3- 7 items each	Yes	5-point scale: 0 = never , 1 = almost never/seldom, 2 = average/ sometimes, 3 = quite often, 4 = always	Total and do- mains scores of ques- tionnaire ex- pressed as a % between 0 and 100	Higher scores reflect better HRQoL	-
Ford 2010	PedsQL 4.0	-	Yes	-	-	-	-
van Egmond- Frohlich 2006	KINDL- K (self-report) and KINDL- E (parents)	24 items with subscales fam- ily, friends, school, self- worth, mental and physical well- being (4 items per domain)	Yes	Children: 3-point scale: never, some- times, very of- ten. Parents: 5-point scale: never, seldom. sometimes. of- ten always	To- tal score, mean score, trans- formed score (0-100)	Higher scores reflect better HRQoL (10 or 11 items have to be re- versed)	-

CHQ: Child Health Questionnaire; DISABKIDS: disease-generic measure for children with chronic diseases; HRQoL: health-related quality of life; IWQOL: Impact of Weight on Quality of Life; PAQLQ: Standardized Paediatric Asthma Quality of Life Questionnaire; PedsQL: Paediatric Quality of Life; QoL: quality of life; SF-15: 15-item Short Form; SF-36: 36-item short-form health survey

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 415 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Appendix 12. Self-esteem: instruments

Trial ID	Name (type of measure- ment)	Dimensions (subscales) (number of items)	Validated instrument	Answer options	Scores	Direction of scales	Minimal im- portant difference
Hofsteenge 2014	BES	General feel- ings about ap- pearance, weight sat- isfaction and evaluations of attributions to others about one's body and appearance	Yes	Range of scores from 0 = worst pos- sible score to 4 = best possible score	Total mean scores calculated	Higher scores rep- resent a better body esteem	-
Schranz 2014	PSW scale	Measures global self- worth	Yes	4-choice structured al- ternative for- mat	To minimise socially desir- able responses, the PSW scale uses a 4-choice structured al- ternative for- mat (e.g. 1 scenario pre- sented to par- ticipants is as follows: 'Some kids are proud of themselves physically', but 'Other kids don't have much to be proud of phys- ically')	Higher score (or posi- tive effect size change) in- dicates higher self-efficacy/ confidence or beliefs/self- perception	-
	SPPA	Measures youth's per- ceived compe- tence in aca- demics and other ar- eas (e.g. ath- letics) as well as their sense of general self- worth	Yes	4-choice structured al- ternative for- mat	Using the same 4-choice structured al- ternative for- mat and scor- ing scale as the PSW scale	Higher score (or posi- tive effect size change) in- dicates higher self-efficacy/ confidence or beliefs/self- perception	-

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 416 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Pakpour 2015	WEL Questionnaire	20-item tool assessing ado- lescents' confi- dence in their ability to lose weight	Yes	10-point Lik- ert scale, rang- ing from 0 = not confident to 9 = very confident	Items scored on a 10-point Likert scale and items scores were av- eraged	Higher scores indicate better self-esteem	-
Patrick 2013	Rosen- berg Self-Es- teem Scale	10-item sur- vey that mea- sures self- esteem	Yes	Each item has 4-point Likert scale rang- ing from 1 = strongly agree to 4 = strongly disagree	Includes 10 items and re- spondents in- dicate their level of agree- ment to each item, score range 10-40	Higher scores indicate a pos- itive self-atti- tude while a low score indicates a negative at- titude towards the self	-
Brennan 2013	Rosenberg Self-Esteem Scale	-	Yes	-	-	-	-
Debar 2012	Rosenberg Self-Esteem Scale	-	Yes	-	-	-	-
Nguyen 2012	Harter Self- Percep- tion Profile for Adolescents	45-item pro- vided a mea- sure of global self-worth	Yes	1 = low and 4 = high	-	Higher scores indicate better self-esteem	
Daley 2005	Harter's Self- Perception Profile for Adolescents	Global self- worth subscale assesses extent to which par- ticipants like themselves as a person and the way they are living their lives	Yes	6 items devised in a structured alternative format on a scale between 1 = low com- petence and 4 = high compe- tence	Score responses 1-4	Higher scores indicate better global self- worth	-

BES: Body Esteem Scale; PSW: Physical Self-Worth; SPPA: Self-Perception Profile for Adolescents; WEL: Weight Efficacy Lifestyle

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 417 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

WHAT'S NEW

Date	Event	Description
26 April 2017	New search has been performed	This is an update of the former Cochrane Review 'Interven- tions for treating obesity in children and adolescents.'
26 April 2017	New citation required and conclusions have changed	 Given the rapid growth in the treatment of child and adolescent obesity, we have split the original review ('Interventions for treating obesity in children and adolescents') into six separate reviews, with a specific intervention and age focus Diet, physical activity, and behavioural interventions for the treatment of overweight or obesity in adolescents aged 12 to 17 years Diet, physical activity, and behavioural interventions for the treatment of overweight or obese children from the age of 6 to 11 years Diet, physical activity, and behavioural interventions for the treatment of overweight or obesity in preschool children up to the age of 6 years Drug interventions for the treatment of obesity in children and adolescents Parent-only interventions for childhood overweight or obesity

HISTORY

Date	Event	Description
11 October 2008	New citation required and conclusions have changed	This review concludes that combined behavioural lifestyle interventions compared to standard care or self- help can produce a significant and clinically meaningful reduction in overweight in children and adolescents The search was updated to May 2008. Some amend- ments were made to update the search strategies. No changes have been made to other aspects of the method- ology. Forty-six new studies have been included. These included information on drug interventions for treating obesity in adolescents. The added evidence suggests that lifestyle interventions appear to have positive effects in the treatment of child and adolescent obesity. Further- more, orlistat and sibutramine were found to have bene- ficial effects on adiposity in obese adolescents. However,

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 418 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

		a range of adverse effects was noted
3 July 2008	Amended	Converted to new review format. Authorship changed with new authors and new contact person

CONTRIBUTIONS OF AUTHORS

Lena Al-Khudairy (LA-K): acquiring trial reports, trial selection, data extraction, data analysis, data interpretation, review of drafts and future updates.

Emma Loveman (EL): acquiring trial reports, trial selection, data extraction, data analysis, data interpretation, review of drafts and future updates.

Jill Colquitt (JC): acquiring trial reports, trial selection and data extraction.

Emma Mead (EM): acquiring trial reports, trial selection, data extraction and screening trial alert.

Rebecca E Johnson (RJ): trial selection and data extraction.

Hannah Fraser (HF): trial selection and data extraction.

Omotayo Joan Olajide (JO): trial selection and data extraction.

Marie Murphy (MM): data extraction.

Rochelle Velho (RV): data extraction.

Claire O'Malley (CO): trial selection.

Liane Azevedo (LA): trial selection.

Louisa J Ells (LE): trial selection, review of drafts and update draft.

Maria-Inti Metzendorf (MIM): search strategy development and review of drafts.

Karen Rees (KR): trial selection, data extraction, data analysis, data interpretation, review of drafts and future updates.

DECLARATIONS OF INTEREST

LA-K: none known. EL: none known. JC: none known. EM: none known. RJ: none known. HF: none known. JO: none known. MM: none known. RV: none known.

CO: none known.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 419 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

LA: none known.

LE: Louisa Ells is seconded to Public Health England two days per week but undertook this review within her role as Reader in Public Health and Obesity at Teesside University.

MIM: none known.

KR: none known.

SOURCES OF SUPPORT

Internal sources

- University Medical Center, Groningen, Netherlands.
- The Children's Hospital at Westmead, Sydney, Australia.
- Centre for Food Physical Activity and Obesity Research, University of Teesside, UK.
- The Wolfson Research Institute, University of Durham, UK.
- Australian National Health & Medical Research Council, Australia.

Postgraduate Research Scholarship for Ms Shrewsbury

External sources

• No sources of support supplied

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

Given the rapid growth in the treatment of child and adolescent obesity, the original review was split into six separate reviews, with a specific intervention and age focus.

- Diet, physical activity and behavioural interventions for the treatment of overweight or obesity in adolescents aged 12 to 17 years.
- Diet, physical activity and behavioural interventions for the treatment of overweight or obesity in children aged 5 to 11 years.
- Diet, physical activity and behavioural interventions for the treatment of overweight or obesity in infants aged 0 to 4 years.
- Drug interventions for the treatment of obesity in children and adolescents.
- Parent-only interventions for childhood overweight or obesity.
- Surgery for the treatment of obesity in children and adolescents.

For behaviour changing interventions, we included only randomised controlled trials that were specifically designed to treat obesity in children and observed participants for a minimum of six months. The rationale for introducing this criterion arose from the belief that many interventions appear to be effective in the short term (up to three months), but not in the long term (Glenny 1997). It seemed to be more important to evaluate the longer-term effects of treatments, as this would provide a more valuable indication of effectiveness, given the chronic nature of obesity.

We did not present prediction intervals as originally described for the suite of reviews for consistency as the other reviews did not do this either in consultation with the review group.

We did not perform the following sensitivity analyses.

• Restricting the analysis taking into account risk of bias, as specified in the section Assessment of risk of bias in included studies section, but we did look at the effects of attrition bias and other potential bias introduced by analysis of cluster randomised controlled trials.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 420 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

- Restricting the analysis to very long or large studies to establish how much they dominated the results.
- Restricting the analysis to studies using the following filters: diagnostic criteria, funding source and country.

This is in line with other reviews in this series.

ΝΟΤΕS

Part of the background, the methods section, appendices, additional tables and figures 1 to 3 of this review are based on a standard template established by the Cochrane Metabolic and Endocrine Disorders Group.

Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years (Review) 421 Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.