Prevention of Overweight/Obesity in Children and Youth: A Systematic Review with Meta-analyses

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Abstract

Background: This report will be used by the Canadian Task Force on Preventive Health Care (CTFPHC) to provide guidelines on the prevention of overweight/obesity in normal weight children and youth. The last CTFPHC guideline (1994) included screening for and treatment of obesity in children but did not consider primary prevention.

Purpose: To synthesize evidence on behavioural interventions for preventing overweight/obesity in normal weight children and youth.

Data Sources: We searched EMBASE, Medline, Cochrane Central Registry of Controlled Trials, PsychINFO and CINAHL from January 2010 to August 1, 2013 to update the search conducted for the 2011 Cochrane review by Waters et al. on this topic. We also searched for evidence to answer the contextual questions, checked reference lists of included studies and relevant systematic reviews, and conducted a targeted grey literature search.

Study Selection: Titles and abstracts of papers considered for the key question and sub-questions were reviewed in duplicate; any article marked for inclusion by either team member went on to full text screening. Full text review was done independently by two people with consensus required for inclusion or exclusion. For intervention benefits we included randomized controlled trials of behavioural interventions for normal weight or mixed weight children/youth that reported data for at least one weight outcome of interest at a minimum 12 weeks post baseline assessment. All studies reporting adverse effects of interventions were included, regardless of design, timeframe or outcomes.

Data Abstraction: Review team members extracted data about the population, study design, intervention, analysis and results for outcomes of interest. One team member completed full abstraction; a second team member verified all extracted data and ratings. We assessed study quality using Cochrane's Risk of Bias tool and the GRADE framework. For the contextual questions, inclusion screening and abstraction were done by one person.

Results: A total of 90 studies were included in this systematic review (28 from the 2011 Cochrane review, 26 being considered for Cochrane update, and 36 located in more recent literature). Using GRADE the bodies of evidence were mostly rated as very low quality. Downgrading occurred primarily due to study limitations increasing the risk of bias, inconsistency, indirectness due to inclusion of mixed weight samples, and sometimes due to concerns regarding imprecision and/or reporting bias. No studies on the merits of screening for overweight/obesity were identified.

Overall, the prevention interventions showed a statistically significant, but very small effect, in terms of lowered BMI/BMIz. At post-intervention, compared to the control group, intervention participants showed a statistically significant reduced BMI/BMIz [SMD (95% CI) 0.07 (-0.10, -0.03); I2=74%]. Sensitivity analyses found significant differences between study groups in favour of intervention participants for several sub-groups including: children aged 6 to 12 and youth aged 13 to 18, boys and girls, interventions using a combined diet plus exercise strategy, interventions lasting one year or less, and all three ratings of study risk of bias (low, unclear, high). Only intervention setting (non-education, education, education plus other) explained some of the

variation across this evidence. The moderate to high statistical heterogeneity across studies in most sub-analyses is most likely due to small versus large intervention effects observed across studies.

Meta-analysis of 30 studies showed that intervention participants were significantly more likely to show a reduction in the prevalence of overweight/obesity and less risk of being overweight/obese compared to control participants [40% overweight/obese pre-intervention to 35% overweight/obese post-intervention compared to 33% overweight/obese at baseline to 31% overweight/obese at post-assessment; RR_i-RR_c (95% CI) 0.94 (0.89, 0.99); I^2=0%; ARR 1.96%; NNT (95% CI) 51 (29, 289)].

While the eight studies available to answer the question about post intervention maintenance of healthy BMI trajectories showed a small but statistically significant effect in terms of lowered BMI/BMIz, there was no statistically significant difference between groups on this outcome from the point of intervention completion to up to two years later [SMD (95% CI) -0.16 (-0.33, 0.02); I^2=85%].

Across secondary health outcomes (i.e., change in: total cholesterol, triglycerides, HDL-C, LDL-C, SBP, DBP, overall quality of life, physical fitness), the only pooled effect estimates significantly in favour of the intervention groups were for HDL-C [MD (95% CI) 0.07 mmol/L (0.04, 0.10); I^2=0%] and physical fitness [performance on shuttle run test SMD (95% CI) 0.32 (0.14, 0.50); I^2=85%].

Only three studies reported on adverse effects. One found no evidence of negative impacts on students' body image, one affirmed that the intervention was delivered without any major incidents, and the third study which involved more than 500 participants reported 43 adverse events, mostly described as mild or moderate, over the three year intervention period.

Of the 76 studies included in the BMI/BMIz meta-analysis, 16 (21%) showed a significant effect in favour of the intervention participants; these interventions were designated as efficacious. Fourteen interventions were situated in educational settings, 15 involved group sessions, four incorporated family involvement and six specified staff training was offered. The duration of intervention ranged from 12 weeks to three years with half of the programs lasting six months or less. Most interventions were offered to mixed gender groups and more than half targeted children in the 6 to 12 year age group.

Limitations: The findings are based on indirect evidence; the included studies contained mixed weight samples. Most studies could not reliably be assessed for risk of bias. Potential reporting bias was a frequent concern. Using GRADE, the evidence was assessed mostly as very low quality which reduces confidence in the pooled estimates of effect. Results for secondary health outcomes should be interpreted with caution as our review might have missed trials that reported these outcomes but not our primary weight outcomes. We searched only for papers in English or French.

Conclusion: There is very low quality evidence that behavioural interventions for preventing overweight/obesity are associated with reductions in weight and improvements in other health outcomes in mixed weight child and adolescent populations, but it is uncertain whether the benefits are clinically meaningful and can be maintained over time. Intervention research involving normal weight samples with long term follow-up is needed.

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List of Acronyms

ARR	Absolute Risk Reduction
BMI	Body Mass Index
BMIz	Body Mass Index Z-Score
CDC	Centers for Disease Control and Prevention
CHMS	Canadian Health Measures Survey
CI	Confidence Interval
CIHI	Canadian Institute for Health Information
CQ	Contextual Question(s)
CTFPHC	Canadian Task Force on Preventive Health Care
DBP	Diastolic Blood Pressure
GRADE	Grading of Recommendations Assessment, Development and Evaluation
HDL-C	High Density Lipoprotein Cholesterol
IV	Inverse Variance
kg	Kilograms
KQ	Key Question(s)
LDL-C	Low-Density Lipoprotein Cholesterol
MD	Mean Difference
m	Metre
mg/dL	Milligrams per Decilitre
mmol/L	Millimoles per Litre
NNT	Number Needed to Treat
OR	Odds Ratio
RCT	Randomized Controlled Trial
RR	Relative Risk / Risk Ratio
SBP	Systolic Blood Pressure
SD	Standard Deviation
SE	Standard Error
SES	Socioeconomic Status
SMD	Standardized Mean Difference
T2D	Type 2 Diabetes
UK	United Kingdom
US	United States
USPSTF	United States Preventive Services Task Force
WHO	World Health Organization

Chapter 1: Introduction

Purpose and Background

This review will be used by the Canadian Task Force on Preventive Health Care (CTFPHC) to provide guidelines to address prevention of overweight/obesity in children and adolescents. The previous guideline (1994) included screening for and treatment of obesity in children but did not consider primary prevention.[1] Other Canadian and international groups have provided guidance on obesity screening, management, and prevention, including the Canadian Clinical Practice Guidelines for the Prevention and Treatment of Obesity in Adults and Children (2007),[2] the Scottish Intercollegiate Guidelines Network (2010)[3] and the United States Preventive Services Task Force (USPSTF, 2010).[4] The lack of updated Canadian guidelines on this topic, the availability of new evidence and the growing burden of obesity were key reasons why this topic was chosen by the CTFPHC.

Definition

Obesity is a condition characterized by the accumulation of excess body fat or adipose tissue, resulting in disturbances in health. Though an imperfect measure, excess adiposity is most often approximated by calculation of the body mass index (BMI), utilizing measured weight (kg) and height (m) (kg/m^2). As BMI changes with growth in childhood and adolescence, classification of obesity in this population relies on the use of standardized curves and age and sex specific cut-off points.[5] In the absence of standardized Canadian growth curves, Canadian clinicians previously utilized the US Centers for Disease Control and Prevention (CDC) curves published in 2000,[6] while epidemiological studies including the recent Canadian Health Measures Survey (CHMS)[7] utilized a set of cut-offs established by the International Obesity Task Force.[8] Recently, prompted by the availability of improved growth charts developed by the World Health Organization (WHO), the Canadian Paediatric Society, College of Family Physicians of Canada, Dietitians of Canada and Community Health Nurses of Canada have published a collaborative statement urging use of the new WHO charts.[9] From birth to five years, the WHO chart represents a growth standard based on the growth of healthy, breastfed infants living in conditions of good hygiene and included participants from diverse geographical regions. Thus, this new standard reflects normal human growth in an ethnically diverse sample appropriate for use in multiethnic communities such as Canada.[10,11] For children five to 19 years of age, the WHO Growth Reference 2007, constructed from historical, cross-sectional data, is recommended. The Canadian collaborative statement encourages growth monitoring in all children and recommends tracking BMI rather than weight alone after two years of age. While trajectory in BMI is most important, cut-off points for overweight and obesity were assigned to alert the practitioner to the need for "further assessment, referral or intervention." The recommended cut-offs for five to 19 years are greater than the 85^{th} centile for overweight and greater than the 97^{th} centile for obese. At 19 years of age, these points coincide with adult cut-offs of 25 and 30 kg/m^2 for overweight and obesity respectively. In the preschool years, a more

conservative approach is applied with recommended cut-offs for children aged two to five years of greater than the 97th centile for overweight and greater than the 99.9th centile for obese.

BMI continues to be most widely used because of its relatively easy application and ability to predict presence of adverse health outcomes in adulthood.[12] It is however an indirect measure of adiposity and has some limitations as it does not specifically measure the amount or location of body fat. Among adults, waist circumference is more closely related to obesity-related health consequences than BMI, prompting the recommendation for classification in adults based on waist circumference cut-offs. There are preliminary data suggesting increased waist circumference is associated with cardiovascular risk factors but some data also suggest that waist circumference percentiles or waist/height add little to BMIz score in the identification of cardiovascular risk factors in children.[13,14] While different risk cut-offs for BMI in adults are suggested in some ethnic groups, it is recommended that the same cut-offs be applied across the pediatric population.

Prevalence and Burden of Obesity

The problem of childhood obesity has increased rapidly in Canada over the last three decades. The 2007-2009 CHMS survey reported obesity prevalence among six to 17 year old Canadian children and youth, based on measured height and weight, at 8.6% with an additional 17% classified as overweight.[7] The more recent CHMS (2009-2011) reported an increase in obesity prevalence among five to 17 year olds (11.7%), and a similar increase in prevalence of overweight (19.8%).[15] The rise in obesity prevalence was particularly notable between 1978 and 2004 when obesity prevalence increased two and a half fold, with somewhat greater increases in the 12 to 17 year age group (an increase from 3.0% to 9.4%).[16] These studies used the International Obesity Task Force BMI cut-offs to assign classification as overweight or obese.[17]

Prevalence among Canadian Aboriginal children and youth living off reserve is likely higher as 32% of six to eight year olds and 13.1% of nine to 14 year olds were classified as obese, based on self-reported height and weight, collected in the 2006 Aboriginal Peoples Survey.[18] In First Nation children and youth living on reserve, obesity prevalence was estimated at 14.1% for youth 12 to 17 years old, 26.4% for children aged nine to 11 years, and 48.7% for those three to five years of age.[19]

Obesity in childhood usually persists into adulthood[20] and is associated with adverse metabolic and psychosocial outcomes by adolescence.[21-24] Recent longitudinal studies highlight the increased risk of atherosclerotic coronary artery disease associated with increased BMI during adolescence, particularly if left untreated.[23,24] Metabolic disturbances identified in children with obesity include dyslipidemia, hypertension, impaired glucose tolerance, type 2 diabetes (T2D), and hepatosteatosis. Multiple cardiovascular disease risk factors are identified in up to 50% of obese children and youth attending weight management programs,[25] and the number of cardiovascular risk factors is related to extent of atherosclerosis in autopsy studies by the second

decade of life.[26] The presence of multiple cardiovascular risk factors in adolescence is associated with a 14-fold increased risk of a cardiac event by 50 years of age.[27]

Adverse health outcomes linked to obesity extend far beyond metabolic health and include disturbances in musculoskeletal, neurological, gastrointestinal, respiratory and psychosocial health. Perhaps most prevalent are the adverse psychosocial disturbances linked to childhood obesity including low self-esteem, increased risk of depression, and decreased health related quality of life.[28,29] Psychosocial disturbances and reduced quality of life are more prevalent in clinic-based studies than in population studies and are a common reason for referral.[30]

Etiology and Natural History of Obesity and Consequences if Left Untreated

Although obesity ultimately develops from a positive energy balance, the underlying causes include a complex web of interactions among genetic, biological, environmental, social and economic factors. Further, as these factors interact at the individual, family, community and national levels, solutions must also address obesity at multiple levels. Changes in the social and physical environments, together with behaviour changes have culminated in the markedly increased prevalence of obesity in childhood. Obesity prevalence in children is also linked to family history of obesity and is related to both genetic predisposition (heritability approximately 50%) and shared environment.[31] Parental obesity also predicts increased persistence of childhood obesity into adulthood.[20] Individual and family characteristics that increase the risk for obesity development include lifestyle behaviours of the parents and the child (nutrition, physical activity and sedentary time), lower socioeconomic status (SES) and early life determinants including maternal cigarette smoking in pregnancy, maternal diabetes and obesity, low birth weight, formula feeding and poor sleep habits in the preschool years.[32,33]

The natural history of obesity appears to vary with age of onset, but deciphering the natural history in light of rapidly rising prevalence is difficult. A tracking study which began prior to the current obesity epidemic showed that the likelihood that obese children will continue to be obese in adulthood increased with increasing age, increasing extent of obesity and with a parental history of obesity. Tracking refers to periodic monitoring of BMI percentiles, with particular attention paid to children whose BMI percentile increases over time even if it has not reached the threshold for classification of obesity.[9] Obese children from age three years to adolescence who had at least one obese parent had approximately an 80% chance of being obese as adults.[20] With no parental obesity, 33% of three to five year olds and 66% of 10 to 17 year olds with obesity were also obese as young adults.

Risk Factors

The most predominant risk factor for the development of childhood obesity is parental history of obesity. Age influences the probability of persistence of obesity into adulthood and also influences the development of obesity related health consequences. The prevalence of dysglycemia, dyslipidemia and hypertension increase in the second decade of life, and evidence from studies tracking lipid values and blood pressure from childhood into adulthood underscores

calls for early detection.[34] Low SES is an additional determinant thought to increase risk of developing obesity.

Rationale for Screening and Screening Strategies

The increasing prevalence of obesity among children and youth and recognition of related health consequences has prompted multiple organizations to recommend growth monitoring or serial measurements of height and weight for early identification of disturbed growth.[5,35,36] In relation to overweight and obesity, the calculation and plotting of BMI is recommended from two years of age onwards. Should an individual's BMI trajectory increase over time, discussion of lifestyle behaviours and other prevention strategies are recommended. Should the BMI fall within the overweight or obese range, further evaluation of obesity related health measures is recommended and development and implementation of a treatment plan is encouraged.[2,37] Given that growth monitoring is accepted as a critical component of well child visits for many reasons, it is expected that the additional step of calculating and plotting BMI should be easily incorporated.[9]

Monitoring BMI in children and youth is recommended within primary care practices and is also practiced in community settings such as public health clinics. Linkage to well child visits, immunizations and, for children that do not attend well child visits, at presentation for acute illness is encouraged.

Prevention Interventions in Children and Youth

Primary prevention interventions for obesity would be applicable to all children and youth, and must be differentiated from secondary prevention interventions designed to detect obesity at an early stage so that the progress of obesity can be arrested and, if possible, reversed. Given the complexity of the underlying causes contributing to the development of obesity, population based interventions that focus on change at multiple levels are encouraged.[38] Multiple population based approaches have been recommended including the implementation of school based programs and changes to the built environment (structures and resources constructed by humans with the purpose of supporting human activity) to promote physical activity, alter the nutrition environment and reduce child focused food advertising. The role of prevention at the individual and family levels through interventions that can be conducted or referred to by primary care is recommended in some clinical practice guidelines; evidence on this practice is the focus of this review.

At the individual and family levels, monitoring BMI in primary care practices for the purpose of screening for development of overweight or obesity has been recommended.[9] Referral for treatment of childhood obesity to specialized treatment centres utilizing a family-based, comprehensive, behavioural modification approach has been supported based on recent reviews suggesting short-term efficacy of such programs. Programs defined as having moderate to high intensity (>30 hours of individual or group intervention),[4,39,40] are efficacious in achieving moderate reductions in BMI, at least over the short-term (up to 12 months). While encouraging, many questions remain about the impact of treatment programs on health measures beyond BMI (e.g., blood pressure, lipids, and quality of life) and the sustainability of any short-term benefits.

Whitlock et al.[4] identified only seven papers that examined the influence of weight management programs on lipids, blood pressure, glucose and/or adiposity, and noted their lack of confidence in the conclusions given small sample sizes and methodological concerns across the studies. In the largest study, improvements in insulin resistance, glycaemia, blood pressure, HDL-C and triglyceride levels were identified in children and youth participating in a weight management program over the short-term and after one year of follow-up, but only in the children who demonstrated persistent weight loss.[41] Pharmacotherapy and surgical interventions have been identified more recently as being efficacious[42] but these approaches are only recommended in restricted populations after other weight loss strategies have been attempted and they are not without consequences.[43]

Current Clinical Practice

While CDC growth curves were previously recommended for clinical use in Canadian children, it is now recommended that health professionals utilize the 2007 WHO Child Growth Reference and Growth Standard as described above. The BMI growth curves generated by this research are described in detail on the WHO website.[10]

While screening for BMI is recommended throughout the world, implementation at the clinical practice level has been moderate at best.[44-46] Barriers to monitoring BMI centiles in children have been identified and include lack of familiarity with recommendations, disagreement with recommendations[46] and physician attitudes and beliefs relating to outcome.[47] While willing to engage in discussions with their patients around lifestyle behaviours, primary care physicians have expressed concerns over available resources for treatment and knowledge gaps have been identified.[48]

The availability of specialized weight management programs for children in Canada has historically been quite limited. This has changed in the last five years with 18 programs identified in a recent environmental scan.[49] These programs incorporate a multi-disciplinary approach to family based interventions designed to change nutrition and activity behaviours utilizing group and individual counseling. Most interventions have developed over the last five years and few have been formally evaluated. Given the national geography, proximity to treatment centres continues to influence referral patterns.[50] The fact that 72% of the identified programs are affiliated with academic institutions highlights the paucity of available programs connected to primary care in Canada.

Previous Review and Recommendations

The 1994 Canadian Periodic Health Examination[51] included two recommendations regarding screening and treatment of childhood obesity:

1. Detection: Physicians should continue to plot the height and weight of infants and children during a periodic health examination, primarily to identify children who are failing to thrive.

There is insufficient evidence to support screening children for obesity; however, there is no evidence that screening for obesity is harmful (C category recommendation).[51]

2. Intervention: There is insufficient evidence to include counseling about nutrition and exercise in or exclude it from the routine treatment of severely obese children (C category recommendation). There is fair evidence to exclude very-low-kilojoule diets from the routine treatment of preadolescent obese children (D category recommendation). There is conflicting evidence concerning the inclusion or exclusion of exercise in the routine treatment of obese children (C category recommendation).[51]

Other Guidelines

Previously the Obesity Canada Clinical Guidelines Expert Panel (2006),[2] recommended screening for overweight and obesity in children and adolescents aged two years and older with BMI using the CDC growth charts (overweight ≥85th to <95th centile; obesity ≥95th centile). In managing overweight or obesity these guidelines recommended a multi-disciplinary team including a registered dietician and utilizing behaviour modification strategies to assist families change eating patterns, increase physical activity and reduce sedentary activities. However, as noted above, it is currently recommended that health professionals utilize the 2007 WHO Child Growth Reference and Growth Standard.[10] The National Institute for Health and Care Excellence (2006) group recommends (with caution) using BMI to measure overweight and obesity and recommends lifestyle changes including decreasing sedentary behaviours and making dietary changes.[52] In 2010 the USPSTF recommended screening children aged six years and older for obesity using BMI and referring overweight and obese children to behavioural or intensive counseling.[53]

Chapter 2: Methods

Review Approach

At the outset of the review process the CTFPHC Working Group conceptualized an "ideal approach," considering the analytic framework and key questions for both screening and prevention of obesity in children and youth that they believed were most important for clinicians. An evidence based analysis on screening and prevention of obesity was planned to address key questions about the effectiveness of screening and preventive efforts for normal weight, overweight or obese children/youth in primary care on mortality, morbidity, various anthropometric measures of weight reduction or stabilization, costs and harms. However, our preliminary search revealed recent reviews by the USPSTF[53] and the Scottish Intercollegiate Guidelines Network[3] that asked similar questions and identified no evidence on screening. To avoid duplication of effort, we removed the key question related to screening and instead added a series of supplemental questions on screening. These questions were examined through a condensed review process that searched for evidence on screening for obesity published since the USPSTF review. The USPSTF also examined the effectiveness of weight management programs on children.[54] In addition, a preliminary review of the literature indicated that the Cochrane Collaboration had conducted a review that examined obesity prevention interventions in children.[40]

Based on the acquired knowledge and newly available products, the CTFPHC Working Group adopted a pragmatic approach to select the review questions, focusing on areas which the scoping review indicated there would be sufficient evidence upon which to formulate recommendations. In addition, to avoid duplication of work already completed, the Working Group directed the McMaster Evidence Review and Synthesis Centre team to:

- use the 2011 Cochrane review by Waters et al.[40] as a foundation for examining the effectiveness of prevention interventions for children and youth who are currently of normal weight, and
- use the 2010 USPSTF review[54] as a foundation for examining treatment interventions for children and youth who are already overweight and obese.

The protocol was registered with PROSPERO (#CRD42012002754).

Analytic Framework and Key Questions

The analytic framework, presented in Figure 1, includes both prevention and treatment of child/youth overweight/obesity. This review focuses only on the aspects related to prevention; a separate review was conducted to examine treatment (available on the CTFPHC website http://canadiantaskforce.ca/).

The key question (KQ) and sub-questions considered for this prevention focused review are:

KQ1. Do primary care relevant prevention interventions (behavioural) in normal weight children lead to improved health outcomes or short-term or sustained healthy BMI trajectories?

a. Does the efficacy of interventions vary between child subgroups (e.g., infants versus children or adolescents, sex, race-ethnicity, baseline cardiovascular risk status, low SES, parental history of obesity, maternal cigarette smoking in pregnancy, maternal diabetes, low birth weight, formula feeding, etc.)?
b. What are the adverse effects of primary care-relevant prevention in normal weight children (e.g., disordered eating, psychological distress such as anxiety, micronutrient deficits, abnormal growth trajectory, or growth restriction)?
c. Are there differences in adverse effects between child subgroups (e.g., infants versus children and adolescents, sex, race-ethnicity, baseline cardiovascular risk status, low SES, parental history of obesity, maternal cigarette smoking in pregnancy, maternal diabetes, low birth weight, formula feeding, etc.)?
d. How well are healthy BMI trajectories and health outcomes maintained, after interventions are completed?
e. What are common features of efficacious interventions for healthy BMI trajectories?

The contextual questions (CQ) considered for both the prevention and treatment reviews are:

CQ1. Is there evidence that the burden of disease, the risk/benefit ratio of prevention/treatment, the optimal prevention/treatment method, access, and implementation differ in any ethnic subgroups (e.g. Canadian Aboriginal youth) or by age (e.g., infant, child, adolescent), rural and remote populations, or lower SES populations?

CQ2. What are the resource implications and cost effectiveness of overweight and obesity prevention/treatment in Canada?

CQ3. What are parents' and children's values and preferences regarding overweight and obesity prevention/treatment?

CQ4. What are the most effective (accurate and reliable) risk assessment tools identified in the literature to identify those at higher risk of obesity or to assess future health risk as a result of obesity?

The supplemental questions (SQ) on obesity screening considered for both the prevention and the treatment reviews are:

SQ1. Does screening for overweight and obesity in children and youth in primary care practice reduce the risk of morbidity, and mortality and/or improve health outcomes (impaired glucose tolerance, T2D, hypertension, dyslipidemia, non-alcoholic fatty liver disease, sleep apnea, slipped capital femoral epiphysis and psychosocial disorders)?

a. Does screening for overweight/obesity in children and youth result in reduction or stabilization of adiposity?
b. What is the most effective method of screening for overweight and obesity in children in primary care?
c. What is the optimal interval/frequency for screening for overweight and obesity in children in primary care?
d. What is the most effective type of screening (opportunistic vs. organized/systematic) for overweight and obesity in children in primary care?

e. What are the harms associated with screening for overweight and obesity in children in primary care?
f. Do screening interventions decrease mortality and incidence of health outcomes in high risk groups such as but not limited to those with a family history of obesity, psychological issues or co-morbid conditions?

Search Strategy

For this review we updated the search conducted for the 2011 Cochrane review by Waters et al.[40] For the key and supplemental questions we searched EMBASE, Medline, Cochrane Central Registry of Controlled Trials, PsychINFO and CINAHL from January 2010 (the date of the last Cochrane search) to August 1, 2013 using terms such as *obesity, overweight, health promotion, primary prevention, weight control*, *weight maintenance, behavior therapy, diet, exercise, fitness* and *lifestyle*. Reference lists of the included studies of this review and the included studies of other on topic reviews were searched for any relevant studies that were not captured by our search. A separate search was conducted to look for evidence that would answer the contextual questions; this strategy included two databases (Medline and EMBASE) and covered the period between January 2007 and August 16, 2013. The full search strategies are provided in Appendix 1. In addition, a focused grey literature search of Canadian sources was undertaken for recent reports on obesity in Canada. All citations were uploaded to a web-based systematic review software program[55] for screening and data extraction.

Study Selection

Titles and abstracts of papers considered for the key question and sub questions were reviewed in duplicate; articles marked for inclusion by either team member went on to full text screening. Full text inclusion was done independently by two people. All disagreements were resolved through discussions rather than relying on a particular level of kappa score to indicate when discussions were no longer necessary. The inclusion results were reviewed by a third person. For papers located in the contextual questions search, title and abstract screening was done by one person.

Inclusion and Exclusion Criteria

Language

The published results of studies had to be available in either English or French.

Populations

Eligible studies included children and/or youth aged 0 to 18 or families with children and/or youth in this age range. Although the review question focuses on the normal weight population, many interventions target or recruit mixed weight samples (normal weight, overweight and obese) therefore these studies were considered for inclusion.

Studies were excluded if the participants were being treated for obesity. Studies that only recruited already obese children/youth were considered to be focused on treatment of obesity and

were therefore excluded from this review. Studies were also excluded if the population had serious illnesses or co-morbidities. In addition, studies designed to prevent obesity in pregnant adolescents were excluded.

Interventions

The type of intervention had to be behavioural. Behavioural interventions could include diet/nutrition, exercise/physical activity, diet plus exercise, social support, and lifestyle strategies. Lifestyle interventions were typically referred to as such by the study authors and often included counseling, education or support and environmental changes, in addition to diet and/or exercise. Interventions could use educational, psychological, family, behavioural, therapy, counseling, and/or management approaches.

Pharmacological interventions were excluded.

Settings

Trials were conducted in settings generalizable to Canadian primary care, feasible for conducting in primary care or feasible for referral from primary care.

The settings for intervention included community, clinic, primary care, home, school, after school program, childcare, nursery and preschool.

Comparator and Study Design

To answer the questions about the benefits of prevention interventions, only randomized controlled trials (RCTs) with true comparison groups were considered for inclusion. More specifically, an acceptable control group received no intervention, usual care or usual practice (e.g., regular curriculum) or minimal intervention (e.g., an information session or newsletter covering general health concepts). No limits were set for sample size. Case reports, case series and chart reviews were excluded.

Any study design (with or without comparison groups) with any number of participants was considered acceptable to answer the questions about adverse effects and the contextual questions.

Outcomes

To answer the questions about the benefits of prevention interventions, only studies that reported data for one or more of the specified weight outcomes were included (i.e., change in: BMI, BMIz-score, prevalence of overweight/obesity). There was no weight outcome requirement if a study reported data for adverse effects of interest (disordered eating; psychological distress such as anxiety; micronutrient deficits; abnormal growth trajectory; growth restriction). Secondary outcomes of interest included change in: total cholesterol, triglycerides, high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), systolic blood pressure (SBP), diastolic blood pressure (DBP), overall quality of life, and physical fitness.

Timeframe

There was no intervention duration criterion. However, for the questions regarding intervention effectiveness, studies were only included if they provided outcome data for a minimum of 12 weeks post baseline assessment.

There was no minimum duration requirement or 12 week minimum expectation for outcome measurements in studies that reported adverse effects or for inclusion of studies to address the contextual questions.

Data Abstraction

For each study used to answer the KQ, review team members extracted data about the population, study design, intervention, analysis and results for outcomes of interest. For each study one team member completed full abstraction (study characteristics, risk of bias assessment, outcome data) using electronic forms housed in a web-based systematic review software program.[55] A second team member verified all extracted data and ratings; disagreements were resolved through discussion and/or third party consultation when consensus could not be reached. Prior to performing meta-analyses, tables were produced for each outcome and all data were checked in a third round of verification.

Unadjusted immediate post assessment data was extracted for most studies. However, for a small number of studies the immediate post intervention data was not available. For two studies we extracted data at the point closest to the end of the intervention (i.e., nine months after a 12 week intervention, 18 months post baseline for a three-term school-based intervention). One other study reported interim results for longer term interventions (24 month results for a 36 month intervention). Since there was no condition that interventions must be completed to be included in this review, we extracted this interim data.

To answer the adverse effects KQ we selected the more inclusive option and looked for data for all reported adverse events of interest, regardless of whether they were attributed to study participation.

Assessing Risk of Bias

Arriving at a Grading of Recommendations Assessment, Development and Evaluation or GRADE rating for a body of evidence (see next section) requires a preliminary assessment of the risk of bias or study limitations for the individual studies. All RCTs included to answer the KQ of this review were assessed using the Cochrane Risk of Bias tool.[56]

This rating tool covers six domains: sequence generation; allocation concealment; blinding of participants, personnel and outcome assessors; incomplete outcome reporting; selective outcome reporting; and other risk of bias. A few adjustments were made for the purpose of this review: we separated our assessment of blinding of participants and personnel from our assessment of blinding of outcome assessors; we considered objective (total cholesterol, triglycerides, HDL-C, LDL-C), subjective (weight, blood pressure, quality of life, physical fitness, adverse effects) and self-report (quality of life, adverse effects) outcomes separately under the domains of blinding of outcome

assessors and incomplete outcome reporting; we selected insufficient study power and/or failure to account for clustering in the analysis as the main sources of other risk of bias; and we added an overall risk of bias rating specific to outcome group (objective, subjective, self-report).

Information to determine risk of bias was abstracted from the primary methodology paper for each study and any other relevant published papers. For each study, one team member completed the initial ratings which were then verified by a second person; disagreements were resolved through discussion and/or third party consultation when consensus could not be reached. To assign a high or low risk of bias rating for a particular domain we looked for explicit statements or other clear indications that the relevant methodological procedures were or were not followed. In the absence of such details we assigned unclear ratings to the applicable risk of bias domains. To determine the overall risk of bias rating for an outcome group we considered all domains, however greater emphasis was placed on the assessments of first three areas of randomization, allocation, and blinding of outcome assessment.

Table 1 summarizes the risk of bias ratings applied to the RCTs included in this review.

Assessing Strength or Quality of the Evidence

The strength of the evidence was determined based on the GRADE system of rating the quality of evidence.[57,58] This system of assessing evidence is widely used and is endorsed by over 40 major organizations including WHO, CDC and the Agency for Healthcare Research and Quality.[59] The GRADE system rates the quality of a body of evidence as high, moderate, low or very low; each of the four levels reflects a different assessment of the likelihood that further research will impact the estimate of effect (i.e., high quality: further research is unlikely to change confidence in the estimate of effect; moderate quality: further research is likely to have an important impact on confidence in the estimate of effect and may change the estimate; low quality: further research is very likely to have an important impact on confidence in the estimate of effect and is likely to change the estimate; very low quality: the estimate of effect is very uncertain).[59]

A GRADE quality rating is based on an assessment of five conditions: (1) risk of bias (limitations in study designs), (2) inconsistency (heterogeneity) in the direction and/or size of the estimates of effect, (3) indirectness of the body of evidence to the populations, interventions, comparators and/or outcomes of interest, (4) imprecision of results (few participants/events/observations, wide confidence intervals), and (5) indications of reporting or publication bias. Grouped RCTs begin with a high quality rating which may be downgraded if there are serious or very serious concerns across the studies related to one or more of the five conditions. For this review, key data were entered into the GRADEPro software along with the quality assessment ratings to produce two analytic products for each outcome and the comparisons of interest: (1) a GRADE Evidence Profile Table and (2) a GRADE Summary of Findings Table (presented in Evidence Sets 1 to 9).

There was no assessment of the quality of the evidence used to answer the contextual questions.

Data Analysis

To perform meta-analyses, immediate post-treatment data (means, standard deviations) were utilized for continuous outcomes such as BMI, BMIz-score (hereafter BMIz), total cholesterol, triglycerides, HDL-C, LDL-C, and systolic and diastolic blood pressure, while number of events data were utilized for binary outcomes (i.e., prevalence of overweight/obesity). For the primary outcome of weight change, we took BMI as the primary outcome measure and if BMI was not reported we took BMIz. The DerSimonian and Laird random effects model with inverse variance (IV) method was utilized to generate the summary measures of effect in the form of standardized mean difference (SMD) for the primary weight outcome of change in BMI/BMIz and mean difference (MD) for other continous outcomes.[60] The random effects model assumes the studies are a sample of all potential studies and incorporates an additional between-study component to the estimate of variability. The outcome of change in prevalence of overweight/obesity pre and post intervention as compared to control group was meta-analyzed using the differences in risk ratio ($RR_{Intervention}$ - $RR_{Control}$) along with its standard error (SE) and the summary measures of effect were generated utilizing the DerSimonian and Laird random effects model with inverse variance method.[60] The absolute numbers and absolute risk reduction were based on prevalence of overweight/obesity at post-intervention. We added the estimate of absolute risk reduction (ARR) and number needed to treat (NNT) to the GRADE table. The NNT was calculated using the absolute number presented in the GRADE table. GRADE estimates the absolute number per million using the control group event rate and risk ratio with the 95% confidence interval obtained from the meta-analysis.

SMD and MD were calculated using change from baseline data [i.e., mean difference between pre-treatment (baseline) and post-treatment (final/end-point) values along with the standard deviation (SD) for both intervention and control groups]. For studies that did not report SD, we calculated this value from the reported standard error (SE) of the mean, or from the 95% confidence intervals (CI) using equations provided in Chapter 9 of the *Cochrane Handbook for Systematic Reviews of Interventions.*[61] For studies that provided neither SD or SE for the follow-up data, we imputed the SD from either the baseline values or other included studies of similar sample size and for the same outcome. Based on Cohen's rule,[62] an SMD value of 0.2 or less indicates a very small effect, a value between 0.2 and 0.5 indicates a small effect, a value between 0.5 and 0.8 indicates a medium effect and a value of 0.8 or larger indicates a large effect.

The units of measurement for total cholesterol, triglycerides, HDL-C, and LDL-C, if reported in mg/dL, were converted to Canadian standard units (i.e., mmol/L).

For studies that recruited a single gender or for mixed gender studies that reported results for boys and for girls, we entered this data separately into the meta-analyses, using alphabetical extensions to identify gender (e.g., Ansari 2010-M, Ansari 2010-F). For studies with more than one intervention arm, we took different approaches depending on how similar the interventions were to one another. When groups were similar (e.g., two arms evaluating the benefits of a diet plus exercise intervention, one received dietary advice only, the other received the dietary advice plus

family involvement; two arms evaluating the benefits of a diet intervention, one consumed high protein foods the other consumed low protein foods) we pooled the intervention group data to do a pair-wise comparison with the control group. Alternatively, if the intervention groups were substantially different from each other (e.g., one intervention arm was delivered to parents and another was delivered to children) we included the data for each arm compared with the control group but split the sample size for the control group in half to avoid a unit-of-analysis error and double counting. In the meta-analysis for BMI/BMIz, multiple intervention arms are identified using numerical extensions (e.g., Beech 2003-1, Beech 2003-2) and in the prevalence meta-analysis alphabetical extensions are used (e.g., Crespo 2012-A, Crespo 2012-B). In the BMI/BMIz meta-analysis the -z exension indicates we used the BMIz data provided by this study. In the prevalence meta-analysis the values are for prevalence of overweight and obesity combined except if followed by an -ow extension (which indicates the only data provided was for prevalence of overweight) or an -ob extension (which indicates the only data provided was for prevalence of obesity).

Cochrane's Q (α=0.10) and I^2 statistic were used to quantify statistical heterogeneity between studies, where P<0.05 indicates high statistical heterogenity between studies. There are no strict rules for interpreting I^2 but an I^2 >50% may represent substantial heterogeneity.[61]

Sensitivity analyses were performed to evaluate statistical stability and effect on statistical heterogeneity. The sub-group analyses based on age groups (0 to 5, 6 to 12, and 13 to 18 years), type of intervention (diet, exercise, diet plus exercise, lifestyle), intervention setting (non-education, education only, and education plus other settings) length of intervention (≤12 months, >12 months), gender, and study risk of bias rating (low, unclear, high) were performed for change in BMI/BMIz because this was an outcome that most of the studies reported and, to be consistent, this was the outcome used for sensitivity analyses in the companion review on treatment interventions.

Meta-analyses were performed using Review Manager version 5.1 software.[63]. The Egger's test [64] for publication bias for each outcome was conducted using STATA version 12.[65]

For studies that provided data that could not be pooled, findings are reported narratively in the respective results sections.

Results presented throughout the body of this review are rounded and/or reported to the second decimal. However, at the request of the CTFPHC, we used four decimals in our calculations and in the presentation of results in the Evidence Sets.

To answer the sub-question about common elements of efficacious interventions (KQ1e) it was necessary to first to identify the efficacious interventions. For this review we identified efficacious interventions from studies included in the BMI/BMIz meta-analysis that showed a statistically significant effect size in favour of the intervention group. Some of the elements we examined in these interventions were adapted from the features list presented in the 2011 USPSTF review.[66] We also included intervention duration, focus and setting as we believe primary care physicians might want to take such features into consideration when making program recommendations to their patients and their families.

Chapter 3: Results

Summary of the Literature Search for Key Questions

The Cochrane 2011 child obesity prevention review by Waters et al.[40] was used as the foundation for this search. Therefore, the citations and articles we examined for inclusion were those found through our search, those included in the Cochrane 2011 review, and citations the Cochrane group were considering for inclusion in their updated review.

Our search located 7,268 unique citations (see Figure 2). At the time of conducting our review, the Cochrane group was updating their review and had updated their search to December 2012. From that search they shared with us 50 citations they had yet to screen and 27 citations they had screened and identified for potential inclusion in their update.

We screened 7,268 citations from our search, as well as the 50 unscreened citations Cochrane shared with us for title and abstract relevance (7,318 citations in total). We excluded 6,940 citations at this first level of screening. Of the 378 citations to be screened at full text, one could not be retrieved.

At the point of full text screening, we integrated 71 additional papers from the Cochrane group (the 37 studies included in the BMI/BMIz meta-analysis of their 2011 review and 34 studies they were considering for inclusion in their update). We also integrated 20 hand searched articles that became companion papers for the included studies. Full text screening took place on 468 citations. Of these 468 citations, 60 were identified as systematic reviews and 285 did not meet our inclusion criteria and thus were excluded (see list of excluded studies available on the CTFPHC website http://canadiantaskforce.ca/).

At the end of the search and selection process, 90 studies with 123 papers met the inclusion criteria for this review. This total includes 28 studies brought forward from the 2011 Cochrane review,[67-94] 16 studies the Cochrane group was considering for their update,[95-110] 10 studies from the pool of as yet un-reviewed citations from the Cochrane group (some of which were also found by our search),[111-120] and 36 unique studies located in the more recent literature covered by our search.[121-156]

Summary of the Included Studies

A total of 90 RCTs were included to answer the key question and sub-questions in this review.[67-156] As per the inclusion criteria, all studies reported weight outcome data. Most (81%) of the studies were rated as having unclear or high risk of bias for the weight outcomes, primarily due to the lack of information about or lack of procedures to ensure random sequence generation, allocation concealment and blinding of outcome assessment (see Table 1). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across all studies. Although this review focuses on the prevention of overweight and obesity, the population was not restricted to normal weight children and youth. Most studies did not identify weight as an inclusion criterion and as long as interventions were not treatment focused, the samples could include children or youth in any weight category. About one-fifth of the studies

(n=20) targeted children aged 0 to 5 years, more than half of the studies (n=53) were directed at children aged 6 to 12 years, and the remaining studies (n=17) targeted youth aged 13 to 18. Most studies (n=76) included mixed gender samples; 11 targeted only girls and three studies included only boys. The focus of intervention was diet in 16 studies, exercise in 20 studies, diet plus exercise in 32 studies, and lifestyle in 22 studies. In 21 studies the interventions used an interactive education strategy, in 36 studies a multi-component strategy was used, 25 interventions used a behavioural approach, and eight interventions used therapy, management or counseling. More than two-thirds of the studies (n=62) were conducted in education settings, 19 studies were conducted in non-education settings, eight studies were conducted in education plus other settings, and one study had one intervention group in an education setting and a second intervention group used education and other settings. The intervention duration was one year or less in more than two-thirds of the studies (n=61); in the remaining 29 studies the duration ranged from 15 months to up to 15 years, with 26 of these interventions running for three years or less. Most studies (n=64) included a no intervention or usual practice comparison group; about one-quarter of the studies provided control participants with a minimal component (e.g., information sessions or newsletters covering general health concepts). Two studies were situated in Canada[82,132] and one study was co-located in Canada and the US.[68] More than two-fifths of the studies (n=39) were conducted in the US, about one-third (n=29) were conducted in European countries, 10% (n=9) were located in Australia, two were conducted in Brazil and two in Israel, and one study was conducted in each of China, Egypt, India, Mexico, New Zealand, and Thailand. Three-quarters of the studies (n=68) were published in the last five years (2009-2013); the remaining 22 studies appeared in the literature between 1998 and 2008. The characteristics of the 90 included studies are reported individually in Table 2.

Results for Key Questions

High level summaries of the included studies and key findings across outcomes with pooled estimates of effect are provided in Tables 3 through 5. Detailed results for each outcome are presented below.

KQ1: Do primary care relevant prevention interventions (behavioural) in normal weight children lead to improved health outcomes or short-term or sustained healthy BMI trajectories?

This review is unable to conclusively answer the question regarding whether primary care relevant prevention interventions lead to short-term or sustained healthy BMI trajectories or to improved health outcomes specifically in normal weight children and youth. As noted above, most studies did not identify weight as an inclusion criterion and as long as interventions were not intended as treatment for already obese children and/or youth, they were included if they met the other criteria. This meant that the samples included mixed weight participants. There was substantial heterogeneity across studies in how participants' baseline weight status was reported; therefore we are unable to specify what percentage of the overall samples represented normal weight,

overweight and obese children/youth. Therefore, the following analyses, based on sub-groups of the 90 included RCTs, provide indirect evidence to address the key question and sub-questions.

To answer this key question we examined the included studies for three primary weight outcomes: change in BMI, BMIz and prevalence of overweight/obesity.

Primary Outcome: Weight

Change in BMI/BMIz

Evidence Set 1 provides the GRADE Evidence Profile Table (1.1), the GRADE Summary of Findings Table (1.1), the forest plots (1.1 to 1.7), the funnel plots (1.1 to 1.7) and the Egger's test results (for publication bias) generated for the outcome of change in BMI/BMIz for the comparison between intervention participation and usual practice or no intervention. An overall analysis was performed including 76 studies that reported BMI/BMIz data that could be pooled. Six sub-analyses were conducted to look more closely at this comparison: (1) by type of intervention (diet, exercise, diet plus exercise, lifestyle), (2) by setting of intervention (non-education, education only, education plus other settings), (3) by duration of intervention (≤12 months, >12 months), (4) by gender, (5) by age group (0 to 5 years, 6 to 12 years, 13 to 18 years), and (6) by study risk of bias rating (low, unclear, high). The effects for change in BMI/BMIz are presented as standardized mean difference (SMD). Using Cohen's guideline for interpreting the SMD statistic,[62] a value less than 0.2 indicates a very small effect, a value between 0.2 and 0.5 indicates a small effect, a value between 0.5 and 0.8 indicates a medium effect, and a value greater than 0.8 indicates a large effect. Results of a meta-analysis including only those studies reporting change in BMI as an outcome are also reported.

1.1 Overall

Seventy-six RCTs (n=56,342) of very low GRADE quality (downgraded for risk of bias, inconsistency, indirectness, and reporting bias) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.1).[67-86,88-101,103-105,107-113,116-129,133,134,136,137,139-143,146-148,150-152,154-156]
Across the 76 studies, most included mixed gender samples (n=63); 10 included only girls, three included only boys. About one-quarter (n=17) of the studies included children aged 0 to 5, about half (n=42) included children aged 6 to 12, and the remaining quarter (n=17) included youth aged 13 to 18. Most interventions were conducted in education settings (n=51); 17 studies conducted interventions in non-education settings, seven studies used education and other settings for interventions, and one study had one intervention group in an education setting and a second intervention group used education and other settings. In terms of type of intervention, 15 were diet, 18 were exercise, 26 were diet plus exercise, and 17 were lifestyle. Control participants received usual practice or no intervention in most studies (n=53); in about 30% of studies (n=23) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 54 (71%) studies (in about half of these studies the duration was six months or less) and duration was more than 12 months in 22 (29%) studies (range was from 13 to 48 months; most were two or three year programs). One study was conducted in Canada, one was jointly located in Canada and the US, 33 studies were

conducted in the US, 25 in European countries, nine in Australia or New Zealand, two in Israel, and one in each of Brazil, China, Egypt, India, and Thailand. Just under three-quarters of the studies (n=54) were published in the last five years (2009-2013); the remaining 22 studies were published between 1998 and 2008. Intervention participants had a statistically significant lowered BMI/BMIz as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.07 (-0.10, -0.03); I^2=74%].

Eight additional RCTs met the inclusion criteria of this review but could not be incorporated in the BMI/BMIz meta-analysis because: (1) baseline or follow-up values were missing with no change from baseline data provided, (2) only an effect size or P-value was reported without individual treatment group data, or (3) the authors only made a general statement that there was no difference between study groups at post assessment for this outcome.[102,106,115,135,138,145,149,153] A recent US study (n=263) of an 18 week school-based diet plus exercise intervention directed at children aged three to five years reported no significant increases in BMI for three year old participants or for already overweight and obese children, but found significant increases in this outcome for four and five year olds and for normal weight children.[145] A study (n=284) of a two year exercise intervention for 6 to 12 year old girls that was offered in school and community settings in the US reported a change per year in BMI of 1.28 kg/m^2 (SD 0.90) in the intervention group and 1.24 kg/m^2 (SD 1.01) in the control group, with an adjusted difference in change per year of 0.04 kg/m^2 (95% CI -0.18, 0.27).[106] A study (n=574) of a 40 week, nine session educationally-based diet intervention directed at Brazilian elementary school children reported no difference in BMI changes between the intervention and control groups.[149] At post assessment (study n=667), a two year community-based diet plus exercise intervention targeting first time mothers and their infants in Australia found the intervention children had a significantly lower mean BMI (16.53 kg/m^2) than the control group (16.82 kg/m^2) [MD (95% CI) 0.29 kg/m^2 (0.02, 0.55)].[135] Results of a recent study (n=1,119) of a 10 month lifestyle program focusing on physical activity, screen time and soda consumption, delivered using educational strategies to elementary school children in Germany reported no intervention effect for BMI.[138] In Finland in the early 1990s, over 1,000 families of five month old infants were recruited to participate in a 15 year RCT (n=1,062) examining the effects of individualized dietary and lifestyle counseling provided by a nutritionist and a physician in one to three month intervals for the first two years and semi-annually thereafter.[102] Results showed no difference in BMI between the intervention and control participants at age 15. A recent study (n=156) of an after-school exercise intervention delivered over one school year to 4th and 5th grade children in San Francisco found no significant difference in change in BMIz between the intervention and control students.[153]Finally, a two and a half year, multi-component program aimed at increasing fruit and vegetable intake among kindergarten and first grade students in the US reported no difference in BMIz between intervention and control children at post-intervention (study n=297).[115]

Meta-analysis (forest plot 1.1.1) considering only the 57 studies (n=40,214) reporting change in BMI as an outcome, showed a statistically significant lower BMI in the intervention group

compared to the control group [MD (95% CI) -0.09 kg/m^2 (-0.16, -0.03); I^2=76%].[67,69,71-77,79-86,88-95,97-99,101,103,105,107-112,116-119,121,122,126,128,133,134,136,137,140,142,143,146,147,152,154,155] The test for subgroup differences based on type of intervention (diet, exercise, diet plus exercise, lifestyle) was not significant [Chi^2=3.86, df=3 (P=0.28), I^2=22.3%)]. BMI was lowered in intervention participants significantly more than in control participants only for the 20 studies (n=8,372) involving diet plus exercise strategies [MD (95% CI) -0.15 kg/m^2 (-0.26, -0.03); I^2=76%].[69,71,73,76,91,93-95,105,107,110,112,116,119,122,128,134,137,143,152]

1.2 Type of Intervention

There was no evidence that the effect of intervention differed based on type of behavioural intervention (diet, exercise, diet plus exercise, lifestyle) [Chi^2=4.79, df=3 (P=0.19), I^2=37.4%].

Diet

Fifteen diet focused RCTs (n=11,568) of very low GRADE quality (downgraded for risk of bias, inconsistency, indirectness, and imprecision) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.2).[72,77,78,81,83,85,90,117,121,123,124,139,148,150,154] All diet studies included mixed gender samples. One-fifth (n=3) of the studies included children aged 0 to 5, about three-quarters (n=11) included children aged 6 to 12, and only one study included youth aged 13 to 18. Most interventions were conducted in education settings (n=9); five studies conducted interventions in non-education settings, and one study used education and other settings for the intervention. Control participants received usual practice or no intervention in most studies (n=9); in over one-third of studies (n=6) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 10 (67%) studies (in more than half of these studies the duration was six months or less) and duration was more than 12 months in five (31%) studies (range was from 15 to 36 months). Four studies were conducted in the US, eight in European countries, two in Australia, and one in Brazil. Just under two-thirds of the studies (n=9) were published in the last five years (2009-2013); the remaining six studies were published between 2003 and 2008. There was no difference in change in BMI/BMIz between the intervention and control groups [SMD (95% CI) -0.08 (-0.17, 0.01); I^2=81%].

Exercise

Eighteen exercise focused RCTs (n=15,902) of very low GRADE quality (downgraded for risk of bias, inconsistency, indirectness and imprecision) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.2).[67,70,79,80,82,84,86,92,98,101,103,108,109,120,136,140,142,156] Across the 18 exercise studies, most included mixed gender samples (n=16); one included only girls, one included only boys. Only two of the studies included children aged 0 to 5, most studies (n=11) included children aged 6 to 12, and the remaining five studies included youth aged 13 to 18. Almost all the interventions were conducted in education settings (n=17); one study used education and other settings for the intervention. Control participants received usual practice or no intervention in all 18 studies. Intervention duration was 12 months or less in 12 (67%) studies (in seven of these studies the duration was six months or less) and duration was more than 12 months in six

(33%) studies (range was from 20 to 48 months; most were two or three year programs). One study was conducted in Canada, four were conducted in the US, seven in European countries, three in Australia, and one in each of China, Egypt and Thailand. Two-thirds of the studies (n=12) were published in the last five years (2009-2013); the remaining six studies were published between 1998 and 2008. There was no difference in change in BMI/BMIz between the intervention and control groups [SMD (95% CI) -0.08 (-0.16, 0.003); I^2=79%].

Diet plus Exercise

Twenty-six diet plus exercise focused RCTs (n=14,923) of very low GRADE quality (downgraded for risk of bias, inconsistency and indirectness) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.2).[68,69,71,73,76,91,93-96,100,104,105,107,110,112,116,119,122,127,128,134,137,141,143,152]
Across the 26 studies, most included mixed gender samples (n=18); six included only girls, two included only boys. About one-third (n=9) of the studies included children aged 0 to 5, about two-fifths (n=11) included children aged 6 to 12, and the remaining six studies included youth aged 13 to 18. Most interventions were conducted in education settings (n=17); nine studies conducted interventions in non-education settings. Control participants received usual practice or no intervention in more than half of the studies (n=15); in about 42% of studies (n=11) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 20 (77%) studies (in about half of these studies the duration was six months or less) and duration was more than 12 months in six (23%) studies (range was from 24 to 36 months). One study was conducted in Canada and the US, 15 studies were conducted in the US, four in European countries, four in Australia or New Zealand, and two in Israel. Three-quarters of the studies (n=20) were published in the last five years (2009-2013); the remaining six studies were published between 2003 and 2008. Intervention participants had a statistically significant lowered BMI/BMIz as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.10 (-0.17, -0.03); I^2=70%].

Lifestyle

Seventeen lifestyle focused RCTs (n=13,949) of very low GRADE quality (downgraded for risk of bias, indirectness and imprecision) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.2).[74,75,88,89,97,99,111,113,118,125,126,129,133,146,147,151,155] Across the 17 studies, most included mixed gender samples (n=14); three included only girls. A few studies (n=3) included children aged 0 to 5, about half (n=9) included children aged 6 to 12, and the remaining five studies included youth aged 13 to 18. Most interventions were conducted in education settings (n=8); two studies conducted interventions in non-education settings, five studies used education and other settings for interventions, and one study had one intervention group in an education setting and a second intervention group used education and other settings. Control participants received usual practice or no intervention in two-thirds of the studies (n=11); in about six studies control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 12 (71%) studies (in about half of these studies the duration was six months or less) and duration was more than 12

months in five (29%) studies (range was from 24 to 36 months). Ten studies were conducted in the US, six in European countries, and one in India. Most of the studies (n=14) were published in the last five years (2009-2013); the remaining three studies were published in 2003. There was no difference in change in BMI/BMIz between the intervention and control groups [SMD (95% CI) -0.003 (-0.06, 0.06); I^2=53%].

1.3 Intervention Setting

The test for subgroup differences was significant [Chi^2=6.25, df=2 (P=0.04), I^2=68.0%] suggesting that, as compared to the control group, changes in BMI were greater for interventions based only in education settings than interventions based either in non-education or education plus other settings.

Non-Education Settings

Eighteen RCTs (n=3,070) of very low GRADE quality (downgraded for risk of bias, inconsistency, indirectness and imprecision) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.3).[68,73,74,76,90,100,104,107,113,116,117,122,125,127,139,147,148,150] Across the 18 studies, most included mixed gender samples (n=13); five included only girls. One-third (n=6) of the studies included children aged 0 to 5, half (n=9) included children aged 6 to 12, and the remaining three studies included youth aged 13 to 18. In terms of type of intervention, five were diet, nine were diet plus exercise, and four were lifestyle. Control participants received usual practice or no intervention in half of the studies (n=9); in the other half (n=9) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 15 (83%) studies (in most of these studies the duration was six months or less) and duration was more than 12 months in three (17%) studies (range was from 15 to 36 months). One study was conducted in Canada and the US, 12 studies were conducted in the US, two in European countries and three in Australia. Just under three-quarters of the studies (n=13) were published in the last five years (2009-2013); the remaining five studies were published between 2003 and 2006. There was no difference in change in BMI/BMIz between the intervention and control groups [SMD (95% CI) -0.04 (-0.15, 0.08); I^2=46%].

Education Settings

Fifty-one RCTs (n=47,975) of very low GRADE quality (downgraded for risk of bias, inconsistency, indirectness and reporting bias) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.3).[67,69,71,72,77-82,84-86,89,91-99,101,103,105,108-112,118-121,123,124,128,129,133,134,136,137,140-143,146,152,154,156] Across the 51 studies, most included mixed gender samples (n=44); three included only girls, four included only boys. A small number (n=8) of the studies included children aged 0 to 5, more than half (n=29) included children aged 6 to 12, and the remaining quarter (n=14) included youth aged 13 to 18. In terms of type of intervention, nine were diet, 17 were exercise, 17 were diet plus exercise, and eight were lifestyle. Control participants received usual care or no intervention in most studies (n=40); in about one-fifth of the studies (n=11) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 33 (65%) studies (in about half of these studies the

duration was six months or less) and duration was more than 12 months in 18 (35%) studies (range was from 18 to 36 months; most were two or three year programs). One study was conducted in Canada, 18 studies were conducted in the US, 19 in European countries, six in Australia or New Zealand, two in Israel, and one in each of Brazil, China, Egypt, India, and Thailand. Three-quarters of the studies (n=38) were published in the last five years (2009-2013); the remaining 13 studies were published between 1998 and 2008. Intervention participants had a statistically significant lowered BMI/BMIz as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.09 (-0.13, -0.04); I^2=78%].

Education plus Other Settings

Eight RCTs (n=5,297) of very low GRADE quality (downgraded for risk of bias, inconsistency, indirectness and imprecision) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.3).[70,75,83,88,125,126,151,155] Across the eight studies, most included mixed gender samples (n=7); one included only girls. Three of the studies included children aged 0 to 5, and five studies included children aged 6 to 12. In terms of type of intervention, one was diet, one was exercise, and six were lifestyle. Control participants received usual practice or no intervention in five studies; in the other three studies control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in six (75%) studies (in half of these studies the duration was six months or less) and duration was more than 12 months in two (25%) studies (range was from 24 to 36 months). Four studies were conducted in the US and four in European countries. Five of the studies were published in the last five years (2009-2013); the remaining three studies were published between 2003 and 2008. There was no difference in change in BMI/BMIz between the intervention and control groups [SMD (95% CI) 0.03 (-0.05, 0.12); I^2=52%].

1.4 Intervention Duration

There was no evidence that the effect of intervention differed based on duration of behavioural intervention (≤12 months, >12 months) [Chi^2=0.97, df=1 (P=0.32), I^2=0%].

Intervention Duration ≤12 Months

Fifty-four RCTs (n=28,220) of very low GRADE quality (downgraded for risk of bias, inconsistency, and indirectness) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.4).[67-71,73-79,82-85,88-90,93-95,97-101,103-105,107,109,110,112,113,117-122,124,126-128,133,136,139,142,143,147,150,152,155] Across the 54 studies, most included mixed gender samples (n=43); eight included only girls, three included only boys. About one-quarter (n=15) of the studies included children aged 0 to 5, about half (n=25) included children aged 6 to 12, and the remaining quarter (n=14) included youth aged 13 to 18. Most interventions were conducted in education settings (n=33); 15 studies conducted interventions in non-education settings, and six studies used education and other settings for interventions. In terms of type of intervention, 10 were diet, 12 were exercise, 20 were diet plus exercise, and 12 were lifestyle. Control participants received usual practice or no intervention in 34 studies; in 20 studies control groups received a minimal component (e.g., information sessions or newsletters

covering general health concepts). Intervention duration was six months or less in 33 (61%) studies. One study was conducted in Canada, one was jointly located in Canada and the US, 23 studies were conducted in the US, 16 in European countries, six in Australia, two in Israel, and one in each of Brazil, China, Egypt, India, and Thailand. Just under 70% of the studies (n=37) were published in the last five years (2009-2013); the remaining 17 studies were published between 1998 and 2008. Intervention participants had a statistically significant lowered BMI/BMIz as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.08 (-0.13, -0.03); I^2=67%].

Intervention Duration >12 Months

Twenty-two RCTs (n=28,122) of very low GRADE quality (downgraded for risk of bias, inconsistency, indirectness and imprecision) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.4).[72,80,81,86,91,92,96,108,111,116,123,125,129,134,137,140,141,146,148,151,154,156] Across the 22 studies, most included mixed gender samples (n=20); two included only girls. Only two of the studies included children aged 0 to 5, most (n=17) included children aged 6 to 12, and the remaining three studies included youth aged 13 to 18. Most interventions were conducted in education settings (n=18); two studies were conducted in non-education settings, one study used education and other settings for the intervention, and one study had one intervention group in an education setting and a second intervention group used education and other settings. In terms of type of intervention, five were diet, six were exercise, six were diet plus exercise, and five were lifestyle. Control participants received usual practice or no intervention in most studies (n=19); in three studies control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration ranged from 15 to 48 months; most were two or three year programs. Ten studies were conducted in the US, nine in European countries, and three in Australia or New Zealand. Just over three-quarters of the studies (n=17) were published in the last five years (2009-2013); the remaining five studies were published between 2003 and 2008. There was no difference in change in BMI/BMIz between the intervention and control groups [SMD (95% CI) -0.04 (-0.11, 0.02); I^2=74%].

1.5 Gender

Twenty-six of the 76 studies recruited a single gender of participants or provided separate data by gender for the outcome of change in BMI/BMIz.[67,73-76,79,84,89,91-94,101,105,107,108,110,116,119,120,128,129,134,136,140,143] There was no evidence that the effect of intervention differed based on gender [Chi^2=0.09, df=1 (P=0.76), I^2=0%].

Male

Sixteen RCTs (n=5,719) of very low GRADE quality (downgraded for risk of bias, indirectness and reporting bias) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.5).[67,79,84,91,93,94,101,108,110,119,120,129,134,136,140,143] Across the 16 studies that either included only boys or reported data separately for male participants, three included children aged 0 to 5, seven included children aged 6 to 12, and the remaining six included youth aged 13 to 18. All interventions were conducted in education settings. In terms of type of intervention, eight were

exercise, seven were diet plus exercise, and one was lifestyle. Control participants received usual practice or no intervention in all but one study (n=15); in the exception the control group received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 11 (69%) studies (in almost half of these studies the duration was six months or less) and duration was more than 12 months in five (31%) studies (range was from 20 to 28 months). Two studies were conducted in the US, six in European countries, four in Australia, two in Israel, and one in each of Egypt and Thailand. Most of the studies (n=12) were published in the last five years (2009-2013); the remaining four studies were published between 1998 and 2008. Intervention participants had a statistically significant lowered BMI/BMIz as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.16 (-0.29, -0.03); I^2=77%].

Female

Twenty-three RCTs (n=10,007) of very low GRADE quality (downgraded for risk of bias, inconsistency, indirectness and reporting bias) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.5).[67,73-76,79,84,89,91-93,101,105,107,108,110,116,128,129,134,136,140,143] Across the 23 studies, three of the studies included children aged 0 to 5, 12 included children aged 6 to 12, and the remaining eight included youth aged 13 to 18. Most interventions were conducted in education settings (n=17); five studies conducted interventions in non-education settings, and one study used education and other settings for the intervention. In terms of type of intervention, eight were exercise, 11 were diet plus exercise, and four were lifestyle. Control participants received usual care or no intervention in most studies (n=17); in six studies control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 16 (70%) studies (in half of these studies the duration was six months or less) and duration was more than 12 months in seven (30%) studies (range was from 20 to 36 months). Ten studies were conducted in the US, six in European countries, three in Australia, two in Israel, and one in each of Egypt and Thailand. Just over half of the studies (n=13) were published in the last five years (2009-2013); the remaining 10 studies were published between 1998 and 2008. Intervention participants had a statistically significant lowered BMI/BMIz as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.14 (-0.24, -0.03); I^2=80%].

1.6 Age Group

There was no evidence that the effect of intervention differed based on age group (aged 0-5, 6-12, 13-18) [Chi^2=1.22, df=2 (P=0.54), I^2=0%].

Aged 0 to 5 Years

Seventeen RCTs (n=6,930) of very low GRADE quality (downgraded for risk of bias, inconsistency, indirectness and imprecision) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.6).[67-71,110,112,122,126,127,133,139,143,148,150-152] All 17 studies included mixed gender samples. About half of the interventions were conducted in education settings (n=8); six

studies conducted interventions in non-education settings, and three studies used education and other settings for interventions. In terms of type of intervention, three were diet, two were exercise, nine were diet plus exercise, and three were lifestyle. Control participants received usual practice or no intervention in about half of the studies (n=9); in the other half (n=8) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 15 (88%) studies (in two thirds of these studies the duration was six months or less) and duration was more than 12 months in two (12%) studies (range was from 16 to 24 months). One study was conducted in Canada and the US, seven studies were conducted in the US, four in European countries, two in Australia, two in Israel, and one in Thailand. Just under three-quarters of the studies (n=12) were published in the last five years (2009-2013); the remaining five studies were published between 1998 and 2008. There was no difference in change in BMI/BMIz between the intervention and control groups [SMD (95% CI) -0.06 (-0.15, 0.02); I^2=62%].

Aged 6 to 12 Years

Forty-two RCTs (n=36,916) of very low GRADE quality (downgraded for risk of bias, inconsistency and indirectness) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.6).[72-86,88,95-98,103,104,107,108,111,116,117,119,121,123-125,129,134,137,140-142,147,154-156] Across the 42 studies, most included mixed gender samples (n=35); six included only girls, one included only boys. Most interventions were conducted in education settings (n=28); eight studies conducted interventions in non-education settings, four studies used education and other settings for interventions, and one study had one intervention arm in an education setting and a second intervention arm in education plus other settings. In terms of type of intervention, 11 were diet, 11 were exercise, 11 were diet plus exercise, and nine were lifestyle. Control participants received usual practice or no intervention in most studies (n=31); in about 25% of studies (n=11) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 25 (60%) studies (in just over half of these studies the duration was six months or less) and duration was more than 12 months in 17 (40%) studies (range was from 18 to 48 months; most were two or three year programs). One study was conducted in Canada, 19 studies were conducted in the US, 17 in European countries, three in Australia or New Zealand, and one in each of Brazil and China. Just under three-quarters of the studies (n=29) were published in the last five years (2009-2013); the remaining 13 studies were published between 2003 and 2008. Intervention participants had a statistically significant lowered BMI/BMIz as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.06 (-0.10, -0.01); I^2=73%].

Aged 13 to 15 Years

Seventeen RCTs (n=12,496) of very low GRADE quality (downgraded for risk of bias, inconsistency, indirectness and reporting bias) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.6).[89-94,99-101,105,109,113,118,120,128,136,146] Across the 17 studies, most included mixed gender samples (n=11); four included only girls, two included only boys. Most interventions

were conducted in education settings (n=14) and three studies conducted interventions in non-education settings. In terms of type of intervention, one was diet, five were exercise, six were diet plus exercise, and five were lifestyle. Control participants received usual practice or no intervention in most studies (n=13); in about one-quarter of studies (n=4) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 14 (82%) studies (in over half of these studies the duration was six months or less) and duration was more than 12 months in three (18%) studies (range was from 24 to 36 months). Seven studies were conducted in the US, four in European countries, four in Australia, and one in each of Egypt and India. Three-quarters of the studies (n=13) were published in the last five years (2009-2013); the remaining four studies were published between 2003 and 2008. Intervention participants had a statistically significant lowered BMI/BMIz as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.12 (-0.22, -0.02); I^2=80%].

1.7 Study Risk of Bias Rating

There was no evidence that the effect of intervention differed based on study risk of bias rating (low, unclear, high) [Chi^2=2.41, df=2 (P=0.30), I^2=17.1%].

Low Risk of Bias

Thirteen RCTs (n=8,542) of moderate GRADE quality (downgraded for indirectness) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.7).[70,72,84,90,93,100,103,104,110,123,133,141,143] All 13 studies included mixed gender samples. About one-third (n=4) of the studies included children aged 0 to 5, about half (n=6) included children aged 6 to 12, and the remaining three studies included youth aged 13 to 18. Most interventions were conducted in education settings (n=9); three studies conducted interventions in non-education settings, and one study used education and other settings for the intervention. In terms of type of intervention, three were diet, three were exercise, six were diet plus exercise, and one was lifestyle. Control participants received usual practice or no intervention in most studies (n=10); in three studies control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 10 (77%) studies (in four of these studies the duration was six months or less) and duration was more than 12 months in three (23%) studies (range was from 18 to 36 months). Three studies were conducted in the US, six in European countries, two in Australia or New Zealand, and two in Israel. About 70% of the studies (n=9) were published in the last five years (2009-2013); the remaining four studies were published between 2003 and 2008. Intervention participants had a statistically significant lowered BMI/BMIz as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.07 (-0.13, -0.0002); I^2=53%].

Unclear Risk of Bias

Sixty-two RCTs (n=47,342) of very low GRADE quality (downgraded for risk of bias, inconsistency and indirectness) were included in the meta-analysis assessing BMI/BMIz (forest plot 1.7).[67-69,71,73-83,85,86,88,89,91,92,94-99,101,105,107-109,111-113,116-122,124-129,134,136,137,139,140,142,146,147,150-152,154-156]

Across the 62 studies, most included mixed gender samples (n=49); 10 included only girls, three included only boys. About one-fifth (n=12) of the studies included children aged 0 to 5, just over half (n=36) included children aged 6 to 12, and the remaining 14 studies included youth aged 13 to 18. Most interventions were conducted in education settings (n=42); 13 studies conducted interventions in non-education settings, six studies used education and other settings for interventions, and one study had one intervention group in an education setting and a second intervention group used education and other settings. In terms of type of intervention, 11 were diet, 15 were exercise, 20 were diet plus exercise, and 16 were lifestyle. Control participants received usual practice or no intervention in most studies (n=43); in about 30% of studies (n=19) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 44 (71%) studies (in about half of these studies the duration was six months or less) and duration was more than 12 months in 18 (29%) studies (range was from 20 to 48 months; most were two or three year programs). One study was conducted in Canada, one was jointly located in Canada and the US, 30 studies were conducted in the US, 19 in European countries, six in Australia, and one in each of Brazil, China, Egypt, India, and Thailand. Just under three-quarters of the studies (n=44) were published in the last five years (2009-2013); the remaining 18 studies were published between 1998 and 2008. Intervention participants had a statistically significant lowered BMI/BMIz as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.06 (-0.11, -0.02); I^2=76%].

High Risk of Bias

One RCT (n=458) of very low GRADE quality (downgraded for very serious risk of bias and indirectness) provided data for BMI/BMIz (forest plot 1.7).[148] This study included a mixed gender sample of children aged 0 to 5. The 15 month diet intervention was conducted in a non-education setting in Australia. Control participants received a minimal component (e.g., newsletters covering general health concepts). The study was published in 2013. Results showed intervention participants had a statistically significant lowered BMI/BMIz as compared to the control group but the magnitude of the effect was small [SMD (95% CI) -0.21 (-0.40, -0.03)].

Change in Prevalence of Overweight/Obesity

Evidence Set 2 provides the GRADE Evidence Profile Table (2.1), the GRADE Summary of Findings Table (2.1), the forest plot (2.1), the funnel plot (2.1) and the Egger's test results (for publication bias) generated for the outcome of change in prevalence of overweight/obesity for the comparison between intervention participation and usual practice or no intervention. An overall analysis was performed including 30 studies that reported data on the outcome of change in prevalence of overweight/obesity.

Thirty RCTs (n=31,896) of very low GRADE quality (downgraded for risk of bias, indirectness and reporting bias) were included in the meta-analysis assessing prevalence of overweight/obesity (forest plot 2.1).[67,68,72,77,81,84,85,87,96,97,100,101,108,110,111,114,117,120,124-126,130-134,141,144,154,155] Across the 30 studies, most included mixed gender samples (n=29); one included only boys. Five of the studies

included children aged 0 to 5, about three-quarters (n=22) included children aged 6 to 12, and the remaining three studies included youth aged 13 to 18. Most interventions were conducted in education settings (n=24); three studies conducted interventions in non-education settings, two studies used education and other settings for interventions, and one study had one intervention group in an education setting and a second intervention group used education and other settings. In terms of type of intervention, seven were diet, five were exercise, nine were diet plus exercise, and nine were lifestyle. Control participants received usual practice or no intervention in most studies (n=27); in three studies control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 18 (60%) studies (in about half of these studies the duration was six months or less) and duration was more than 12 months in 12 (39%) studies (range was from 20 to 36 months; most were two or three year programs). One study was conducted in Canada, one was jointly located in Canada and the US, nine studies were conducted in the US, 12 in European countries, and one in each of Australia, New Zealand, Israel, Brazil, Egypt, Mexico, and Thailand. Most studies (n=24) were published in the last five years (2009-2013); the remaining six studies were published between 1998 and 2008. Intervention participants were significantly more likely to show a reduction in the prevalence of overweight/obesity and less risk of being overweight/obese as compared to control group participants [40% overweight/obese pre-intervention to 35% overweight/obese post-intervention compared to 33% overweight/obese at baseline to 31% overweight/obese at post-assessment; $RR_{intervention}$ - $RR_{control}$ (95% CI) 0.94 (0.89, 0.99); I^2=0%; absolute value 19,641 fewer per million, ranged from 3,462 fewer to 35,002 fewer; ARR 1.96%; NNT (95% CI) 51 (29, 289)].

One additional RCT met the inclusion criteria of this review but the data provided for this outcome could not be incorporated in the meta-analysis.[133] This study found no difference in change in prevalence of overweight in the sample of pre-school children in Switzerland who completed a 10 month lifestyle intervention focusing on physical activity, nutrition education, screen time and sleep.

Secondary Outcomes: Lipids

Change in Total Cholesterol

Evidence Set 3 provides the GRADE Evidence Profile Table (3.1), the GRADE Summary of Findings Table (3.1), the forest plot (3.1), the funnel plot (3.1) and the Egger's test results (for publication bias) generated for the outcome of change in total cholesterol for the comparison between intervention participation and usual practice or no intervention. An overall analysis was performed including five studies that reported on the outcome of change in total cholesterol.

Five RCTs (n=2,815) of very low GRADE quality (downgraded for risk of bias, inconsistency, indirectness and imprecision) were included in the meta-analysis assessing change in total cholesterol (forest plot 3.1).[80,82,84,101,108] All five studies included mixed gender samples. Four studies targeted children aged 6 to 12 and one study targeted youth aged 13 to 18. In terms of type of intervention, all were exercise. One intervention used a multi-component approach and four used behavioural approaches. All five of the interventions took place in education settings. Control

participants received usual practice or no intervention. Intervention duration was 12 months or less in three studies (for two of these studies the duration was six months or less) and more than 12 months in two studies (range from 20 to 48 months). One study was conducted in Canada, three in European countries, and one in Egypt. Two of the studies were published in 2010; the remaining three studies were published in 2008. There was no difference in change in total cholesterol between the intervention and control groups [MD (95% CI) -0.10 mmol/L (-0.20, 0.01); I^2=86%].

One additional RCT met the inclusion criteria of this review but the data provided for total cholesterol could not be incorporated in the meta-analysis. Results of this study (n=284) of a two year exercise intervention for 6 to 12 year old girls, offered in school and community settings in the US, showed a mean change per year of -0.19 mmol/L (SD 0.18) for the intervention group compared to -0.11 mmol/L (SD 0.18) in the control group [adjusted MD in change per year -0.09 mmol/L (95% CI, -0.14, -0.04)].[106]

Change in Triglycerides

Evidence Set 4 provides the GRADE Evidence Profile Table (4.1), the GRADE Summary of Findings Table (4.1), the forest plot (4.1), the funnel plot (4.1) and the Egger's test results (for publication bias) generated for the outcome of change in triglycerides for the comparison between intervention participation and usual practice or no intervention. An overall analysis was performed including four studies that reported on the outcome of change in triglycerides.

Four RCTs (n=3,097) of very low GRADE quality (downgraded for risk of bias, inconsistency, indirectness, and imprecision) were included in the meta-analysis assessing change in triglycerides.[80,84,103,108] All four studies included mixed gender samples, targeted children aged 6 to 12, were exercise focused, used behavioural approaches, took place in education settings, provided usual practice or no intervention to control participants and were conducted in European countries. Intervention duration was 12 months or less in two studies (for one of these studies the duration was six months or less) and more than 12 months in two studies (range from 20 to 48 months). Two of the studies were published in 2012; the other two studies were published in 2008. There was no difference in change in triglycerides between the intervention and control groups [MD (95% CI) -0.01 mmol/L (-0.05, 0.03); I^2=81%].

One additional RCT met the inclusion criteria of this review but the data provided for change in triglycerides could not be incorporated in the meta-analysis. Results of a study (n=284) of a two year exercise intervention for 6 to 12 year old girls, offered in school and community settings in the US, showed a mean change per year of -0.02 mmol/L (SD 0.23) for the intervention group and 0.01 mmol/L (SD 0.11) for the control group [adjusted MD in change per year -0.02 mmol/L (95% CI -0.07, 0.03)].[106]

Change in High Density Lipoprotein Cholesterol

Evidence Set 5 provides the GRADE Evidence Profile Table (5.1), the GRADE Summary of Findings Table (5.1), the forest plot (5.1), the funnel plot (5.1) and the Egger's test results (for publication bias) generated for the outcome of change in HDL-C for the comparison between

intervention participation and usual practice or no intervention. An overall analysis was performed including three studies that reported on the outcome of change in HDL-C.

Three RCTs (n=1,240) of low GRADE quality (downgraded for risk of bias and indirectness) were included in the meta-analysis assessing change in HDL-C.[80,103,118] All three studies included mixed gender samples. Two studies targeted children aged 6 to 12 and one study targeted youth aged 13 to 18. In terms of type of intervention two were exercise and one was lifestyle. One intervention used a multi-component approach and two used behavioural approaches. All three of the interventions took place in education settings. Control participants received usual practice or no intervention. Intervention duration was 12 months or less in two studies (for one of these studies the duration was six months or less) and more than 12 months in one study (48 months). Two studies were conducted in European countries and one in India. Two of the studies were published in the last five years (2009-2012); the remaining study was published in 2008. Intervention participants had a statistically significant greater increase in HDL-C as compared to the control group [MD (95% CI) 0.07 mmol/L (0.04, 0.10); I^2=0%].

One additional RCT met the inclusion criteria but the data provided for HDL-C could not be incorporated in the meta-analysis. Results of a study (n=284) of a two year exercise intervention for 6 to 12 year old girls, offered in school and community settings in the US, showed a mean change per year of -0.08 mmol/L (SD 0.08) for the intervention group and -0.08 mmol/L (SD 0.09) for the control group [adjusted MD in change per year -0.01 mmol/L (95% CI -0.03, 0.01)].[106]

Change in Low Density Lipoprotein Cholesterol

Two RCTs provided data for change in LDL-C that could not be pooled.[82,106] A Canadian based study published in 2008, included a mixed gender sample of 60 participants, targeted children aged 6 to 12, used a multi-component exercise intervention in an education setting that lasted for one school year (approximately 10 months), and provided usual practice to control participants.[82] The results for this study showed no statistically significant difference between the intervention and control groups in terms of change in LDL-C [MD (95% CI) -0.10 mmol/L (-0.28, 0.08)]. Results of a study (n=284) of a two year exercise intervention for 6 to 12 year old girls, offered in school and community settings in the US, showed a mean change per year of -0.10 mmol/L (SD 0.19) for the intervention group and -0.03 mmol/L (SD 0.15) for the control group [adjusted MD in change per year -0.08 mmol/L (95% CI -0.12, -0.03)].[106]

Secondary Outcomes: Blood Pressure

Change in Systolic Blood Pressure

Evidence Set 6 provides the GRADE Evidence Profile Table (6.1), the GRADE Summary of Findings Table (6.1), the forest plot (6.1), the funnel plot (6.1) and the Egger's test results (for publication bias) generated for the outcome of change in SBP for the comparison between intervention participation and usual practice or no intervention. An overall analysis was performed including eight studies that reported on the outcome of change in SBP.

Eight RCTs (n=4,289) of very low GRADE quality (downgraded for risk of bias, inconsistency, indirectness, and imprecision) were included in the meta-analysis assessing change in SBP.[80,82,84,101,103,104,108,156] All eight studies included mixed gender samples. Seven studies targeted children aged 6 to 12 and one study targeted youth aged 13 to 18. In terms of type of intervention seven were exercise and one was diet plus exercise. Two interventions used multi-component approaches and six used behavioural approaches. Seven of the interventions took place in education settings while one intervention took place in a non-education setting. Control participants received usual practice or no intervention. Intervention duration was 12 months or less in five studies (for three of these studies the duration was six months or less) and more than 12 months in three studies (range from 20 to 48 months). One study was conducted in Canada, one in the US, four in European countries, one in Australia, and one in Egypt. About two-thirds of the studies (n=5) were published in the last five years (2009-2012); the remaining three studies were published in 2008. There was no difference in change in SBP between the intervention and control groups [MD (95% CI) -0.83 mmHg (-2.98, 1.31); I^2=96%].

One additional RCT met the inclusion criteria of this review but the data provided for SBP could not be incorporated in the meta-analysis. Results of a study (n=284) of a two year exercise intervention for 6 to 12 year old girls, offered in school and community settings in the US, showed a mean change per year of 1.24 mmHg (SD 4.74) for the intervention group and 1.03 mmHg (SD 4.71) for the control group [adjusted MD in change per year 0.15 mmHg (95% CI -0.77, 1.06).[106]

Change in Diastolic Blood Pressure

Evidence Set 7 provides the GRADE Evidence Profile Table (7.1), the GRADE Summary of Findings Table (7.1), the forest plot (7.1), the funnel plot (7.1) and the Egger's test results (for publication bias) generated for the outcome of change in DBP for the comparison between intervention participation and usual practice or no intervention. An overall analysis was performed including eight studies that reported on the outcome of change in DBP.

Eight RCTs (n=4.289) of very low GRADE quality (downgraded for risk of bias, inconsistency, indirectness, and imprecision) were included in the meta-analysis assessing change in DBP.[80,82,84,101,103,104,108,156] All eight studies included mixed gender samples. Seven studies targeted children aged 6 to 12 and one study targeted youth aged 13 to 18. In terms of type of intervention seven were exercise and one was diet plus exercise. Two interventions used multi-component approaches and six used behavioural approaches. Seven of the interventions took place in education settings while one intervention took place in a non-education setting. Control participants received usual practice or no intervention. Intervention duration was 12 months or less in five studies (for three of these studies the duration was six months or less) and more than 12 months in three studies (range from 20 to 48 months). One study was conducted in Canada, one in the US, four in European countries, one in Australia, and one in Egypt. About two-thirds of the studies (n=5) were published in the last five years (2009-2012); the remaining three studies were published in 2008. There was no difference in change in DBP between the intervention and control groups [MD (95% CI) -0.31 mmHg (-1.71, 1.09); I^2=93%].

One additional RCT met the inclusion criteria of this review but the data provided for DBP could not be incorporated in the meta-analysis. Results of a study (n=284) of a two year exercise intervention for 6 to 12 year old girls, offered in school and community settings in the US, showed a mean change per year of -0.15 mmHg (SD 3.43) for the intervention group and 0.12 mmHg (SD 2.76) for the control group [adjusted MD in change per year -0.33 mmHg (95% CI -0.98, 0.33).[106]

Secondary Outcomes: Quality of Life and Physical Fitness

Change in Overall Quality of Life

There was no evidence that met the inclusion criteria for this review that reported on the outcome of change in overall quality of life.

Change in Physical Fitness

Evidence Set 8 provides the GRADE Evidence Profile Table (8.1), the GRADE Summary of Findings Table (8.1), the forest plot (8.1), the funnel plot (8.1) and the Egger's test results (for publication bias) generated for the outcome of change in physical fitness for the comparison between intervention participation and usual practice or no intervention. An overall analysis was performed including six studies that reported on the outcome of change in physical fitness, measured using laps or stages completed for the 20 metre shuttle run test.[157] Sub-analyses were conducted to look more closely at this comparison by type of measurement used for the shuttle run test (laps or stages). The effects are presented as standardized mean difference (SMD). Using Cohen's guideline for interpreting the SMD statistic,[62] a value less than 0.2 indicates a very small effect, a value between 0.2 and 0.5 indicates a small effect, a value between 0.5 and 0.8 indicates a medium effect, and a value greater than 0.8 indicates a large effect.

Overall

Six RCTs (n=4,903) of low GRADE quality (downgraded for risk of bias and indirectness) were included in the meta-analysis assessing change in performance on the 20 metre shuttle run test using laps or stages.[82,93,94,97,103,142] Across the six studies, five included mixed gender samples and one included only boys. Four studies targeted children aged 6 to 12 and two studies targeted youth aged 13 to 18. In terms of type of intervention three were exercise, two were diet plus exercise, and one was lifestyle. Four interventions used multi-component strategies and two used behavioural approaches. All of the interventions took place in education settings. Control participants received usual practice or no intervention in five studies and a minimal component (i.e., a concurrent activity) in one study. Intervention duration was 12 months or less in all studies (for two of these studies the duration was six months). One study was conducted in Canada, four in European countries, and one in Australia. All but one study (n=5) were published in the last five years (2009-2011); the remaining study was published in 2008. Intervention participants had a statistically significant improvement in performance on the shuttle run test as compared to the control group, but the magnitude of the effect was small [SMD (95% CI) 0.32 (0.14, 0.50); I^2=85%].

There was no evidence that the effect of intervention differed based on the type of measurement used (laps or stages) [Chi^2=0.00, df=1 (P=0.99), I^2=0%].

Running Laps

Four RCTs (n=3,944) of low GRADE quality (downgraded for risk of bias and indirectness) were included in the meta-analysis assessing change in performance on the 20 metre shuttle run test using laps.[82,93,94,97] Across the four studies, three included mixed gender samples and one included only boys. Two studies targeted children aged 6 to 12 and two studies targeted youth aged 13 to 18. In terms of type of intervention one was exercise, two were diet plus exercise, and one was lifestyle. All four interventions used multi-component strategies and all four took place in education settings. Control participants received usual practice or no intervention in three studies and a minimal component (i.e., a concurrent activity) in one study. Intervention duration was 12 months or less in all studies (for one of these studies the duration was six months). One study was conducted in Canada, two in European countries, and one in Australia. All but one study (n=3) were published in the last five years (2009-2011); the remaining study was published in 2008. Intervention participants had a statistically significant improvement in the number of laps completed in the shuttle run test as compared to the control group, but the magnitude of the effect was small [SMD (95% CI) 0.32 (0.07, 0.58); I^2=89%].

Running Stages

Two RCTs (n=959) of low GRADE quality (downgraded for risk of bias and indirectness) were included in the meta-analysis assessing change in performance on the 20 metre shuttle run test using stages.[103,142] The two studies included mixed gender samples, targeted children aged 6 to 12, were exercise focused, used behavioural approaches, were conducted in education settings and provided control participants with usual practice or no intervention. Intervention duration was 12 months or less in both studies and for one of these studies the duration was six months. Both studies were conducted in European countries and both were published in the last five years (2010, 2011). Intervention participants had a statistically significant improvement in the number of stages completed in the shuttle run test as compared to the control group, but the magnitude of the effect was small [SMD (95% CI) 0.33 (0.07, 0.58); I^2=75%].

KQ1a: Does the efficacy of interventions vary between child subgroups (e.g., infants versus children or adolescents, sex, race-ethnicity, baseline cardiovascular risk status, lower SES, parental history of obesity, maternal cigarette smoking in pregnancy, maternal diabetes, low birth weight, formula feeding, etc.)?

Subgroup analyses were conducted for the change in BMI/BMIz outcome for gender and age group (0 to 5 years, 6 to 12 years, 13 to 18 years). Results of these sub-analyses are presented above and in Evidence Set 1 (see Forest Plots 1.5, 1.6). The included studies did not target or provide separate results for race-ethnicity, baseline cardiovascular risk status, low SES, parental

history of obesity, maternal cigarette smoking in pregnancy, maternal diabetes, low birth weight, or formula feeding; therefore no differentiated analyses could be performed for these subgroups.

KQ1b: What are the adverse effects of primary care-relevant prevention in normal weight children (e.g., disordered eating, psychological distress such as anxiety, micronutrient deficits, abnormal growth trajectory, or growth restriction)?

Only one study with an unclear risk of bias rating was found that met the inclusion criteria of this review that addressed one of the adverse effects of interest.[81] Results of this two year school-based diet intervention with over 600 six to 12 year old boys and girls in the US found no evidence of negative impacts on students' body image; no specific data were presented. Two other studies mentioned adverse effects in their results sections that were not specific to the list provided in the KQ. One study involving elementary school children in the US only reported that the 12 week diet plus exercise intervention was delivered to participants without any major incidents.[95] The second study which examined the effects of a three year, after school, physical activity, obesity prevention program on more than 500 elementary school children, reported adverse event incident rates of 0.03 in year one, 0.02 in year 2 and 0.01 in year three.[156] The authors did not define the categories, they only indicated that of the 43 adverse events reported over the three year intervention period, 67% were mild in nature, 21% were moderate and 12% were severe. Given this scant evidence, we are unable to provide a direct answer to the questions regarding adverse effects of prevention interventions posed in this review.

KQ1c: Are there differences in adverse effects between child subgroups (e.g., infants versus children and adolescents, sex, race-ethnicity, baseline cardiovascular risk status, lower SES, parental history of obesity, maternal cigarette smoking in pregnancy, maternal diabetes, low birth weight, formula feeding, etc.)?

Given that only three studies mentioned adverse effects in their results sections and none reported any specific data, it was not possible to examine differences in adverse effects between child subgroups.

KQ1d: How well are healthy BMI trajectories and health outcomes maintained after interventions are completed?

Of the 49 studies that showed a benefit in terms of a lowered BMI/BMIz at the post intervention assessment (see Evidence Set 1, Forest Plot 1.1), eight studies also reported follow-up data for this outcome.[69,71,77,89,98-100,134] The duration of follow-up varied across four of the studies: 16 weeks,[89] 40 weeks,[99] 12 months[98] and 13 months.[100] For the other four studies, the BMI/BMIz follow-up data was reported at 24 months post intervention completion.[69,71,77,134] None of the studies that showed a benefit in any secondary outcome at the post assessment point reported follow-up results; therefore the only evidence available to answer KQ1d is for the outcome of change in BMI/BMIz.

Evidence Set 9 provides the GRADE Evidence Profile Table (9.1), the GRADE Summary of Findings Table (9.1), and the forest plots (9.1 to 9.2) generated for the outcome of change in BMI/BMIz for the comparison between intervention participation and usual practice or no intervention. An overall analysis was performed including all eight studies and a sub-group analysis was conducted to look at the three age categories (0 to 5 years, 6 to 12 years, 13 to 18 years). The body of evidence did not present any other meaningful options for sensitivity analyses. The effects for change in BMI/BMIz are presented as standardized mean difference (SMD). Using Cohen's guideline for interpreting the SMD statistic,[62] a value less than 0.2 indicates a very small effect, a value between 0.2 and 0.5 indicates a small effect, a value between 0.5 and 0.8 indicates a medium effect, and a value greater than 0.8 indicates a large effect.

Overall

Eight RCTs (n=5,648) of very low GRADE quality (downgraded for risk of bias, indirectness, and imprecision), were included in the meta-analysis assessing change in BMI/BMIz at follow-up.[69,71,77,89,98-100,134] Across the eight studies, seven included mixed gender samples and one included only girls. Two studies targeted children aged 0 to 5, three studies targeted children aged 6 to 12, and three studies targeted youth aged 13 to 18. In terms of type of intervention one was diet, one was exercise, four were diet plus exercise, and two were lifestyle. Five interventions used interactive education strategies, one used a multi-component strategy and two used behavioural approaches. Seven of the interventions took place in education settings and one took place in a non-education setting. Control participants received usual practice or no intervention in five studies and a minimal component (i.e., information sessions or newsletters on general health concepts) in three studies. Intervention duration was 12 months or less in seven studies (for four of these studies the duration was six months or less) and more than 12 months in one study (two years). Four studies were conducted in the US, three in European countries, and one in China. Half of the studies (n=4) were published in the last five years (2009-2013); the other half were published between 2003 and 2006. Meta-analysis of these eight studies showed intervention participants had significantly lower BMI/BMIz scores than control participants by the end of the intervention [SMD (95% CI) -0.25 (-0.39, -0.11); I^2=78%] (see Forest Plot 9.1), however, there was no difference in change in BMI/BMIz between the intervention and control groups from the point of intervention completion to up to two years later [SMD (95% CI) -0.16 (-0.33, 0.02); I^2=85%] (see Forest Plot 9.2).

Aged 0 to 5 Years

Two RCTs (n=631) of very low GRADE quality (downgraded for risk of bias, indirectness, and imprecision), were included in the meta-analysis assessing change in BMI/BMIz at follow-up. [69,71] Both studies included mixed gender samples, focused on diet plus exercise, used behavioural approaches, took place in education settings, provided a minimal component to the control groups (i.e., information sessions or newsletters on general health concepts), lasted 14 weeks and were conducted in the US. One study was published in 2005, the other in 2006. At post assessment the pooled point estimate showed a very small effect in terms of a benefit for change

in BMI/BMIz, but the effect was not statistically significant [SMD (95% CI) -0.07 (-0.22, 0.07); I^2=0%] (see Forest Plot 9.1). After two years of follow-up, the pooled point estimate showed further improvement in lowered BMI/BMIz in the intervention participants, but the comparison between intervention and control participants was not statistically significant [SMD (95% CI) -0.45 (-0.97, 0.06); I^2=90%] (see Forest Plot 9.2).

Aged 6 to 12 Years

Three RCTs (n=4,467) of very low GRADE quality (downgraded for risk of bias, indirectness, and imprecision) were included in the meta-analysis assessing change in BMI/BMIz at follow-up.[77,98,134] All three studies included mixed gender samples. In terms of type of intervention one was diet, one was exercise, and one was diet plus exercise. All three interventions used interactive education strategies, took place in education settings, and provided control participants with usual practice or no intervention. Intervention duration was 12 months or less in two studies and more than 12 months in one study (two years). Two studies were conducted in European countries and one in China. One study was published in the last five years; the other was published in 2004. Intervention participants showed significantly lower BMI/BMIz scores than control participants by the end of the intervention [SMD (95% CI) -0.33 (-0.58, -0.07); I^2=88%] (see Forest Plot 9.1), however, there was no difference in change in BMI/BMIz between the intervention and control groups from the point of intervention completion to up to two years later [SMD (95% CI) 0.01 (-0.08, 0.10); I^2=21%] (see Forest Plot 9.2).

Aged 13 to 18 Years

Three RCTs (n=550) of very low GRADE quality (downgraded for risk of bias, indirectness, and imprecision) were included in the meta-analysis assessing change in BMI/BMIz at follow-up.[89,99,100] Across the three studies, two included mixed gender samples and one included only girls. In terms of type of intervention one was diet plus exercise and two were lifestyle. Two interventions used interactive education strategies and one used a multi-component strategy. Two of the interventions took place in education settings and one took place in a non-education setting. Control participants received usual practice or no intervention in two studies and a minimal component (i.e., information sessions or newsletters on general health concepts) in one study. Intervention duration was 12 months or less in all three studies (for two of these studies the duration was six months or less). Two studies were conducted in the US, and one in Greece. Two studies were published in the last five years (2009-2010); the other study was published in 2003. Intervention participants showed significantly lower BMI/BMIz scores than control participants by the end of the intervention [SMD (95% CI) -0.29 (-0.59, -0.002); I^2=68%] (see Forest Plot 9.1), however, there was no difference in change in BMI/BMIz between the intervention and control groups from the point of intervention completion to up to 13 months later [SMD (95% CI) -0.20 (-0.58, 0.19); I^2=81%] (see Forest Plot 9.2).

KQ1e: What are common elements of efficacious interventions for healthy BMI trajectories?

Efficacious interventions were identified from studies included in the BMI/BMIz meta-analysis that showed a statistically significant effect size (see Evidence Set 1). A total of 16 studies included interventions that resulted in statistically significant effects at the immediate post intervention assessment point.[75,78,79,89,91,96,98,101,120,122,123,134,142,143,148,154] Some of the components we examined in these efficacious interventions were adapted from the features list presented in the 2011 USPSTF review of interventions to treat adult obesity.[66] We also included intervention duration, focus and setting as we believed that primary care physicians would want to take such features into consideration when making program recommendations to their patients. Table 6 offers a summary of the common elements of the 16 efficacious interventions identified in this review. Fourteen of the interventions were situated in educational settings.[75,78,79,89,91,96,98,101,120,123,134,142,143,154] The focus of the interventions varied and included diet,[78,123,148,154] exercise,[79,98,101,120,142] diet and exercise combined[91,96,122,134,143] and lifestyle.[75,89] Fifteen interventions involved group sessions;[75,78,79,89,91,96,98,101,120,122,134,142,143,148,154] none used individual sessions but several incorporated family involvement.[75,96,122,148] Six studies included staff training to support intervention delivery.[89,91,96,134,143,154] The duration of the efficacious interventions ranged from 12 weeks to three years. Ten interventions lasted one year or less and most of these interventions (n=8) were in place for six months or less.[75,78,79,89,98,101,120,122,142,143] It is also of interest that most of the interventions were offered to mixed gender groups (n=13) and more than half (n=9) targeted elementary school age children (three studies focused on younger children, four interventions were directed at adolescents). There was no consistency in the locations of the interventions; seven were conducted in various European countries, four in the US, two in Australia and one in each of China, Egypt and Israel.

Results for Contextual Questions

We searched Medline and EMBASE from January 2007 to August 2013 for any papers, with any study design, that might answer the Contextual Questions (CQ).

CQ1. Is there evidence that the burden of disease, the risk/benefit ratio of prevention, the optimal prevention method, access, and implementation differ in any ethnic subgroups (e.g. Canadian Aboriginal youth) or by age (e.g., infant, child, adolescent), rural and remote populations, or lower SES populations?

Summary of Findings

A total of 69 articles were screened for evidence relating to this question and 24[2,40,158-179] were selected for inclusion. Sixteen studies[159-163,166-170,172-174,176,178,179] addressed burden of disease; eight[160,163,167,169,172,174,176,179] provided information on ethnic subgroups, two[160,161] on age groups, three[159,168,173] on rural and remote populations and five[160,162,166,170,178] on SES in a Canadian context. Four studies[158,164,175,177] examined optimal prevention in ethnic subgroups, four

studies[2,40,165,171] looked at optimal prevention by age and one[40] in relation to SES. Only one of the studies that looked at optimal prevention was Canadian.[158] Studies of optimal prevention in rural and remote regions were not identified. Studies regarding the risk-benefit ratio of prevention were also not identified.

Burden of Disease

Ethnic Subgroups

Maximova et al.[163] studied differences in the rate of increase of BMI between first generation immigrant children, second generation immigrant children, and native-born children. Using data from a five-year heart health promotion program that targeted elementary school children (aged nine to 12 years) from 24 multi-ethnic disadvantaged neighbourhoods in Montréal, the authors studied changes in BMI individual growth models stratified by immigrant status, and found that average BMI increased by 0.59, 0.73, and 0.82 kg/m^2 per year among first generation, second-generation, and native-born children, respectively. These differences were observed through four origin groupings (European, Asian, Central/South American, and other). The authors concluded that the protective effect of immigrant status on BMI dissipated with the second generation, making this group's BMI similar to that of native-born Canadians.

Galloway et al.[169] reported the growth status of 388 preschool-age (three to five years) Canadian Inuit children, obtained from the *International Polar Year Inuit Health Survey*. Using data on BMI, the authors reported the overall prevalence of overweight in these children to be 50.8%, with a higher prevalence in boys (57.1%) than girls (45.2%).

Using a cross-sectional study design, Downs et al.[172] assessed associations among food environment, diet quality, and weight status in 201 Cree children (grades four to six) in Québec. Based on BMI estimates, the authors found that 29.9% of children were overweight and 34.3% were obese (total 64.2%). The authors found diets in this community commonly contained high-energy-density foods of low nutritional value.

Pigford et al.[174] studied abdominal adiposity, BMI, and physical activity in 105 Cree First Nations children (aged five to 12 years) living on-reserve in Alberta. The authors reported high rates of abdominal obesity (49.5%), overweight and obesity (56.2%), and physical inactivity (64.0%). Using multiple linear regression analysis that controlled for age, sex, and physical activity (steps/day), the authors found that age and daily step counts combined explained 42.6% of the variance in waist circumference.

Zorzi et al.[176] reported on a prospective study of the prevalence of impaired glucose tolerance and the components of metabolic syndrome in 192 Canadian Tsimshian Nation youth (aged six to 18 years). The authors found 19% were overweight, 26% were obese, and 36% had central obesity (waist circumference $\geq 90^{th}$ percentile for age and sex).

A Public Health Agency of Canada short report on *Obesity in Canada*[179] reported data from the 2002-03 *First Nations Regional Longitudinal Health Survey*, and stated that the prevalence of

obesity is particularly high among on-reserve First Nations people, affecting 14.0% of youth and 36.2% of children.

Anderson et al.[167] compared total and central adiposity in a prospective study of 212 Aboriginal children and 204 Caucasian children (aged eight to 17 years). Children were matched on age, gender, and three levels of maturity. Measurements of waist circumference, height, weight, and relative total body and trunk fatness as measured by dual energy x-ray absorptiometry were obtained. Aboriginal children were found to have consistently higher weight, BMI scores, waist circumference, as well as central and trunk adiposity, and a larger proportion were classified as being overweight and obese, in both genders, regardless of the level of maturity.

The weight status of Manitoba children and youth was described by Yu et al.[160] using data from the 2004 *Canadian Community Health Survey*. Over 41% of Aboriginal children were either overweight or obese compared to just over 29% of non-Aboriginal children.

Age

The study by Yu et al.[160] also estimated overweight and obesity by age groups (two to five years, six to 11 years, 12 to 17 years) and showed that prevalence of overweight and obesity generally increased with increasing age (see Table 7).

Janssen et al.[161] used data from several national surveys conducted between 1981 and 2009 to explore prevalence and secular changes in abdominal obesity in Canadian adolescents and adults. The authors reported that based on data from the 2007-09 *Canadian Health Measurement Survey* (CHMS) and waist circumference risk levels defined by the WHO, Health Canada, and Obesity Canada, approximately 9.5% of 12 to 19 year olds had waist circumference values in the increased risk zone, and 12.8% had values in the high risk zone.

Rural and Remote Regions

Ismailov and Leatherdale[168] published data from a 2005-06 cross-sectional study (SHAPES-Ontario) of 24,416 adolescent students, and looked at differences in the prevalence of overweight and obesity in urban, suburban and rural areas. The authors reported that the prevalence of overweight in urban, suburban and rural areas was 14.6%, 13.8%, and 15.11%, respectively, and for obesity, these estimates were 6.3%, 6.0%, and 6.7%, respectively. Using multivariate logistic regression, the authors found the following factors to be associated with obesity among rural residents: watching one to three hours of television per day in males [odds ratio (OR) 2.35, 95% CI 1.02, 5.38]; watching four or more hours of television per day in females (OR 3.12, 95% CI 1.15, 8.44); younger age among male adolescents (compared with grade 12, OR 1.86, 95% CI 1.01, 3.41 for grade 9; OR 1.92, 95% CI 1.06, 3.48 for grade 10; and OR 2.17, 95% CI 1.18, 4.02 for grade 11); and perception of being overweight (OR 61.75, 95% CI 40.88, 93.26 for males; and OR 58.58, 95% CI 25.42, 135.03 for females).

Bruner et al.[173] studied differences in obesity among 4,851 adolescents (grades six to 10) who lived in rural and urban regions using the 2001-02 *Health Behaviour in School-aged Children*

Survey. After adjusting for age, sex, SES, and region of Canada with logistic regression, the authors found a significant trend for increasing overweight (P=0.001) and obesity (P=0.03) as living areas became more rural.

Bilinski et al.[159] published descriptive data on the weight status and health characteristics of rural Saskatchewan children. Data on 99 children (grades one to seven) were obtained using the 1997-98 *Health Behaviour in School Aged Children Survey*. Based on BMI estimates, the authors reported that 34% of children were categorized as either overweight (23.7%) or obese (10.3%).

Socioeconomic Status

The study by Yu et al.[160] also estimated overweight and obesity rates in Manitoba children (aged two to 17 years), stratified by parental education and family income adequacy. Overweight and obesity rates tended to be higher in lower levels of education, with 45.4% of children of parents with less than a high school education being overweight or obese, and 25.2% of children of university graduates being overweight or obese. Similar trends were seen with respect to income; 40.7% of children from households in the lowest income category were overweight or obese, compared with 25.2% of children in the highest income category.

Using data from the *Québec Longitudinal Study of Child Development* (2008), Dubois et al.[162] used logistic regression on cross-sectional data to assess the relationship between food insecurity and overweight. They reported that the adjusted (for consumption of pastry and vegetables, and for physical activity) odds ratio for being overweight was 3.03 (95% CI 1.8, 5.0) among children in food insecure households, compared with children in food secure households.

Kuhle et al.[170] published an analysis of perinatal and childhood risk factors for overweight in grade five students from Nova Scotia. The authors linked data from a provincial perinatal registry to the 2003 *Children's Lifestyle and School Performance Study*. Family and socioeconomic risk factors were considered, including household income, parental education attainment, and neighbourhood dwelling value. Using logistic regression analysis, univariate models (and an adjusted model for household income only) showed decreasing odds of overweight with higher levels of income, parental education, and neighborhood dwelling value.

Tamayo et al.[166] conducted two systematic reviews to explore the impact of early psychosocial factors on future risk of T2D, metabolic disturbances, and obesity. Eleven studies from eight countries with a total sample size of 70,420 were included in their review of obesity. The authors found an independent association between low childhood SES and risk of overweight and obesity later in life in four of the 11 studies. One of these studies was a Canadian birth cohort study that reported a 2.5-fold increased odds (95% CI 1.3, 4.8) of overweight and obesity, an average of 4.5 years after birth, compared with household with incomes of $60,000 or more.

Findings of an evidence synthesis on urban health and healthy weights published by the Canadian Institute for Health Information (CIHI),[178] suggest that lower individual SES is associated with obesity among children. Among the evidence cited was a Canadian study[180] that showed that among children (aged six to 10 years) from differing SES neighbourhoods in

Hamilton Ontario, there were twice as many overweight and obese children in the two lowest SES schools, compared with the two highest SES schools. Interestingly, the authors of the CIHI report noted that no studies have assessed the impact of an intervention to improve SES on obesity.

Optimal Prevention Method/Access and Implementation

Ethnic Subgroups

Willows et al.[158] published a socioecological framework to understand weight-related issues in Aboriginal children in Canada, and described two interventions in Aboriginal communities that used a socioecological approach to address childhood obesity. The first was the Kahnawake Schools Diabetes Prevention Program which combined social learning theory, the precede-proceed model, the Ottawa Charter for Health Promotion, traditional learning styles, as well as collaborations from community organizations. Evaluations of the Kahawake Schools Diabetes Prevention Program showed no impact on reducing obesity prevalence in children. The researchers suggested that this may have been due to the concurrent introduction of satellite television, increased disposable income, and increased availability of fast food in the region. The Sandy Lake Health and Diabetes Project was a community-based primary prevention program that incorporated the principles of participatory research. It included radio programming to highlight healthy lifestyle activities, healthy food labelling at the local grocery store, home visits to promote healthy food preparation, health promotion activities during community events, walking clubs, walking trails, and increased opportunities for physical activity. While a first-year evaluation of the Sandy Lake Health and Diabetes Project found decreases in total fat intake, increased fibre intake, increased knowledge of low-fat foods among children, improved overall health knowledge, and dietary self-efficacy, there was no reduction in obesity in the children and in fact, mean BMI and body fat percentage increased. The authors of the evaluation suggested that longer follow-up was needed in order to observe program impacts.

A systematic review of childhood obesity prevention interventions targeting Hispanic children[164] identified nine studies (five RCTs and four quasi-experimental or pilot studies), and only four of these studies reported significant findings. The interventions were more likely to be successful among higher risk participants, if parental participation was part of the intervention, if the intervention had a theoretical basis, if children were older, if the intervention was longer in duration, and if the intervention was delivered by a dedicated staff.

Stevens et al.[175] conducted a literature review on obesity prevention interventions for ethnic minority middle school-age children. The authors identified eight studies, five of which were conducted in the United States. Ethnic minorities included African Americans, Hispanics, Asians, American Indians, Pacific Islanders, and others. While all the studies showed modest results for improving healthy eating and activity behaviours, the authors found a better response to interventions among girls compared with boys, particularly with diet-based interventions. Some improvement in physical-activity-based interventions was seen in boys. Based on their review, the authors suggested that influencing factors to be addressed in this age group include

self-esteem and motivation, sedentary behaviours, neighbourhood safety, and parental inclusion in intervention programs.

Butte[177] reported an analysis of the impact of feeding practices on childhood obesity, using data on 1,030 Hispanic children from the *Viva La Familia Study* in the United States. Among the risk factors examined in this analysis were exclusive breastfeeding, partial breastfeeding, breastfeeding duration, and age at introduction of solid food. The authors found no significant associations between early infant feeding practices and later obesity.

Age

Waters et al.[40] published a Cochrane systematic review of interventions for preventing obesity in children. The review included 55 controlled trials (randomized and non-randomized), 26 of which were conducted in the United States, two in Canada, six in the United Kingdom, four in Australia and New Zealand, and the remaining 17 trials were conducted in 10 other countries. The authors conducted a meta-analysis of 37 studies to estimate reductions in adiposity as measured by BMI, by three age subgroups (0 to 5 years, 6 to 12 years, and 13 to 18 years). Some unexplained heterogeneity was found in the analyses. The standardized mean difference (SMD) in BMI attributed to interventions in the seven studies included for the 0 to 5 year age group was -0.26 (95% CI -0.53, 0.00), and -0.15 (95% CI -0.23, -0.08) in 24 studies included for the 6 to 12 year age group. A smaller and non-significant decrease in BMI was estimated using data from six studies for the 13 to 18 year age group [SMD (95% CI) -0.09 (-0.20, 0.03)]. The overall SMD in BMI attributed to preventive interventions for all age groups combined was -0.15 (95% CI -0.21, -0.09). In terms of the specific interventions studied in each of the age groups, the authors reported only modest behavioural (dietary, physical activity) impacts in the zero to five year age group. One study reported a significant decrease in television viewing following a 12-week pre-school-based intervention. Follow-up of these interventions showed a lack of further impact on adiposity and behaviour. Among the 39 studies in children aged 6 to 12 years, six targeted dietary factors, 12 targeted factors related to physical activity, and 21 targeted both. The authors described the overall impacts of the interventions in this age group as modest as well. Only four of the studies in this age group reported on the sustainability of the interventions' effects, and all four reported a sustained impact up to 12 months post-intervention. The objectives of these interventions were to either decrease screen time, to improve diet, or to encourage physical activity. Finally, the eight studies on dietary and physical-activity-related interventions in adolescents also showed only modest impacts, with some sustained body fat reduction seen at 12 months post-intervention in one of the studies (only two studies reported post-intervention follow-up).

Bond et al.[165] published a systematic review of the effectiveness of weight management schemes for children under five years of age in 2009. Only controlled trials were considered and the authors identified four relevant studies (two from the United States, one from the United Kingdom, and one from Thailand). The four studies offered some combination of physical activity intervention and/or education, nutrition activities or education, and parental involvement. Only one study (Hip Hop Jr.), which combined all of the mentioned elements, showed a

statistically significant impact on BMI in African American children. Two years post intervention initiation, the reported mean BMI (and SD) was 17.1 (2.5) kg/m^2 for the intervention group, and 17.9 (3.3) kg/m^2 for the control group, with an increase in means of 0.48 (0.14) kg/m^2 in the intervention group and 1.14 (0.14) kg/m^2 in the control group (P=0.008).

A second systematic review of the effectiveness of weight management schemes for children under age five years was published by Bond et al.[171] in 2009, and this review considered systematic reviews as well as controlled trials. A total of 22 reports (16 systematic reviews or meta-analyses and six RCTs) were identified and included. Only the Hip Hop Jr. trial (previously described) showed a significant improvement in the intervention group among African Americans. Similar effectiveness results were not observed among Latino trial centres. The authors suggested that, based on close examination of the included studies, future interventions should include effective training of staff, cultural sensitivity, sustained physical activity and nutritional advice components, and active engagement of parents and caregivers.

As part of the 2006 Canadian clinical practice guidelines on the management and prevention of obesity in adults and children,[181] Berall and Desantadina[182] conducted a review of the effectiveness of prevention of childhood obesity through nutrition. In their review, they stated the conclusion of a meta-analysis of 28 studies that looked at the protective effects of breast-feeding on obesity in later life. This meta-analysis by Owen et al.[183] reported a statistically significant reduction in BMI with breastfeeding compared with formula feeding (OR 0.87, 95% CI 0.85, 0.89).

Socioeconomic Status

The systematic review by Waters et al.[40] examined the association between the intervention outcomes and measures of equity, and found generally positive impacts among groups of lower SES. One study reported that the association between weight-related outcomes and SES was less strong and not statistically significant in the intervention group, compared with the control group where the association was stronger and statistically significant in 19 of 20 analyses.[184]

CQ2. What are the resource implications and cost effectiveness of overweight and obesity prevention in Canada?

Summary of Findings

A total of five articles were screened for relevant information regarding this question, and three[40,171,185] were included.

Resource Implications

Using data from the *Canadian Health Measures Survey* (2007-09) Kuhle et al.[185] compared medication use in 2,087 normal weight and overweight children between the ages of six and 19 years. Weight status was based on BMI. The authors found no difference between normal weight and overweight children aged six to 11 years with respect to prescription, over-the-counter and natural health product use. A significantly higher frequency of prescription drug use was reported in overweight and obese 12 to 19 year-olds (adjusted incidence rate ratio 1.59, 95% CI

1.19, 2.14), and this group was less likely to use natural health products (adjusted incidence rate ratio 0.52, 95% CI 0.32, 0.82).

Cost-effectiveness

The systematic review of 55 international studies by Waters et al.[40] aimed to assess the cost-effectiveness of preventive interventions as a secondary outcome. Only a few of the studies reviewed provided some limited program costs, and none of the studies conducted a cost-effectiveness analysis of their interventions.

The systematic review on the effectiveness of weight management schemes for children under age five years by Bond et al.[171] also searched for relevant cost-effectiveness studies, however the authors were unable to find any studies that met their inclusion criteria.

CQ3. What are parents' and children's values and preferences regarding overweight and obesity prevention?

Our search located two papers that help to answer this question. The first paper, a systematic review of qualitative studies, explored barriers to physical activity in overweight and obese adolescents.[186] The 15 included studies identified 35 barriers. The review authors grouped the barriers thematically under the headings: environment, interpersonal and personal. In schools, children/youth thought that school rules such as having to change clothes in front of other students, the way activities were organized especially sports that had enrollment limits, and teaching practices such as punishing the entire class when overweight/obese students slowed the pace of activity were barriers to participation in physical activity. Barriers identified outside the education system included lack of resources, lack of neighbourhood safety, weather conditions and a perception that physical activity was not culturally valued. Participants identified bullying (both verbal and physical), stereotyping, and social exclusion as interpersonal barriers they experienced when trying to participate in physical activity. Personal barriers to physical activity that children and youth reported were that their households were chaotic with a lack of predictability, they lacked family and peer support, and they lacked personal motivation which they attributed to physical discomfort, being too out of shape and general fatigue. The review authors suggest that knowing the reasons children and youth give for not participating in physical activities can help shape practitioners approaches when trying to engage them in activities.

The second paper was based on a qualitative study designed to identify treatment preferences of overweight and obese youth and their parents.[187] This study was conducted in Edmonton Alberta with a group of 20 families seeking treatment for obesity in a pediatric weight management clinic. Findings from this study suggest that parents attempted to influence their children's lifestyle choices using inconsistent strategies that often represented extremes of control and leniency. The authors suggest that teaching parents to have authoritative and autonomy-supportive styles with regard to healthy eating and physical activity for their children may improve child adherence. Parents and children also expressed a hesitancy to reduce screen time, with some parents suggesting that screen time was important for their children's social life.

Participants thought there was sometimes a disconnect between what they needed and what was offered by healthcare professionals. While the authors did not ascribe blame for interpersonal conflicts between patients and professionals, they did suggest that healthcare professionals should take responsibility for initiating and developing a supportive and empathetic relationship with the children and their parents. Finally, the study identified a need for policy-level changes at all levels of government to create and maintain healthy environments.

CQ4. What are the most effective (accurate and reliable) risk assessment tools identified in the literature to identify those at higher risk of obesity or to assess future health risk as a result of obesity?

No relevant articles were identified to respond to this question.

General Summary of Evidence for Contextual Questions

Data Gaps

- There is a general lack of literature on overweight and obesity prevention in children and adolescents, particularly in a Canadian context;
- No information on optimal prevention in rural and remote regions was found;
- Long-term follow-up of preventive interventions is needed to assess the sustainability of effects;
- Comprehensive estimates of the economic burden of childhood obesity were not found;
- Cost-effectiveness assessments of preventive interventions for childhood obesity were not found.

Findings

- The protective effect of immigrant status reported in many Canadian studies may dissipate with second-generation immigrant children;
- Overweight and obesity rates among Aboriginal children are high, and are higher than children in the general Canadian population;
- A Manitoba study found that the prevalence of overweight and obesity in children increases with age, while an Ontario study found younger age to be associated with overweight and obesity among adolescent males;
- In general, the tendency for overweight and obesity in Canadian children increases as living areas become more rural;
- In general, an inverse relationship between SES level and overweight and obesity has been seen in Canadian children, where SES is assessed by family income, parental education, or neighbourhood dwelling value. A positive relationship has been seen between BMI and food insecurity;
- Limited information on Canadian community-based interventions has shown these strategies are not effective in reducing obesity; however other factors (increased incentives for sedentary behaviour and access to fast food, as well as inadequate follow-up) may explain this lack of impact;

- Authors suggest several potential influencing factors improve success with preventive interventions, including parental participation, a theoretical basis for the intervention(s), cultural sensitivity, longer intervention duration, delivery of interventions by dedicated staff, addressing self-esteem and motivation, sedentary behaviours, nutritional advice, and neighbourhood safety;
- A Cochrane systematic review of obesity prevention interventions (targeting diet and physical activity) found the strongest impact among children aged six to 12 years;
- A higher rate of prescription drug use has been reported in Canadian overweight and obese 12 to19 year-olds (compared with normal weight);
- Overweight/obese children and youth experience environmental, interpersonal and personal barriers to participation in physical activities;
- Parents and health care professionals can play important roles in supporting, managing and implementing strategies for treating obesity in children and youth.

Results for Supplemental Questions

SQ1: Does screening for overweight and obesity in children and youth in primary care practice reduce the risk of morbidity, and mortality and/or improve health outcomes (impaired glucose tolerance, type 2 diabetes, hypertension, dyslipidemia, non-alcoholic fatty liver disease, sleep apnea, slipped capital femoral epiphysis and psychosocial disorders)?

For the supplemental questions, we did not find any studies that examined primary care screening programs for childhood overweight or obesity that met the inclusion criteria for this review.

Chapter 4: Discussion, Limitations and Conclusion

Discussion

To address the questions of interest, this review used a systematic review process and the quality of the evidence provided by the included studies was evaluated using the GRADE system.[58] A substantial body of high level (RCT) but indirect evidence was found to answer most of the key questions.

Childhood and adolescence are characterized by substantial physical growth and development. Weight gain is expected and desirable as children get taller and older. However, problems arise when excess weight is gained. Children and teens who are overweight or obese face social, emotional and physical challenges, and if excess weight is retained into adulthood, these individuals will have greater risk for developing obesity related health problems.[188-192] The most recent data from Statistics Canada shows a downward trend in the prevalence of overweight/obesity in children and adolescents aged six to 17 years.[193] In 2004, the prevalence rate was 34.7%, the rate dropped to 32% between 2007 and 2009, and fell again, to 31.1% during the period 2009 to 2011. These reductions are a good sign, however, at a rate of 31%, which is 6% higher than the 2011 national estimate for prevalence in adults,[6] this means that almost one-third of Canadian elementary and secondary school aged children and youth are overweight or obese. This situation presents a context ripe for preventive efforts to promote healthy weight in childhood and adolescence as an end in itself, but also as a means to build a strong foundation for maintaining healthy weight in adulthood.

Obesity prevention programs targeting normal weight children and youth would expect to demonstrate healthy BMI trajectories in the intervention participants compared to hypothesized excess weight gain in control group participants. Overall, the prevention interventions included in this review showed a statistically significant, but very small effect, in terms of a lowered BMI/BMIz. At the post-intervention point, compared to the control group, intervention participants showed a statistically significant reduced BMI/BMIz [SMD (95% CI) 0.07 (-0.10, -0.03); I^2=74%]. For children and youth in an overweight or obese category, these changes are not clinically meaningful; although for preventing unhealthy weight gain, they could become clinically meaningful over time. However, long term follow-up evidence is limited and thus we cannot conclude if these results are clinically meaningful.

Sensitivity analyses performed on studies providing BMI/BMIz data found significant differences between intervention and control groups for several sub-groups including: children aged 6 to 12 and youth aged 13 to 18, boys and girls, interventions using a combined diet plus exercise strategy, interventions lasting one year or less, and all three ratings of risk of bias (low, unclear, high). No significant differences were found for subgroups of: children aged 0 to 5, interventions lasting more than 12 months, interventions situated either in non-education settings or in education plus other settings, or for diet alone, exercise alone, and lifestyle intervention strategies. Only one specified categorization (i.e., intervention setting: non-education, education,

education plus other) explained some of the variation across this evidence. The moderate to high statistical heterogeneity across studies in most sub-analyses is most likely due to small versus large intervention effects observed across studies.

Eight studies were available to address the key question about how well healthy BMI trajectories are maintained after prevention interventions are completed. This body of evidence showed a small but statistically significant effect in terms of lowering BMI/BMIz by the end of the interventions [SMD (95% CI) -0.25 (-0.39, -0.11); I^2=78%]; however, overall there was no statistically significant difference in BMI/BMIz in the intervention group participants as compared to the control group from the point of intervention completion to up to two years later [SMD (95% CI) -0.16 (-0.33, 0.02); I^2=85%]. A sub-group analysis performed using three age categories (0 to 5 years, 6 to 12 years, 13 to 18 years) found no significant effects for maintenance of lower BMI/BMIz.

This review also considered the outcome of change in prevalence of overweight/obesity. Results of a meta-analysis including 30 studies showed that intervention group participants were significantly more likely to show a reduction in the prevalence of overweight/obesity as compared to control group participants [$RR_{intervention}$ - $RR_{control}$ (95% CI) 0.94 (0.89, 0.99); absolute value 19,641 fewer per million, range from 3,462 to 35,002 fewer]. The absolute risk reduction is 1.96% and the number needed to treat is 51 (95% CI 29, 289).

In addition to the primary weight outcomes we examined the available evidence for eight secondary health outcomes: change in total cholesterol, triglycerides, HDL-C, LDL-C, SBP, DBP, overall quality of life and physical fitness. The only pooled effect estimates significantly in favour of the intervention groups were for HDL-C and physical fitness. Although interpreted as small effects, at the post-intervention point across studies, compared to the control group, intervention participants demonstrated a significantly greater increase in HDL-C [MD 0.07 mmol/L (95% CI 0.04, 0.10); I^2=0%] and significantly improved performance on the 20 metre shuttle run test (SMD for number of: laps 0.32; stages 0.33).

The benefits of program participation must be considered in light of any harm induced by or associated with the intervention. As expected, very few included studies (3/90) reported on adverse effects. One study found no evidence of negative impacts on students' body image and a second study affirmed that the intervention was delivered without any major incidents. The third study which examined the effects of an after school physical activity program on more than 500 elementary school children, reported 43 adverse events over the three year intervention period, 67% were described as mild in nature, 21% were moderate and 12% were severe. Given this scant evidence, we are unable to provide a direct answer to the questions regarding adverse effects of prevention interventions posed in this review.

To answer the key question about common elements of efficacious interventions we identified all studies included in the BMI/BMIz meta-analysis that showed a statistically significant effect at post assessment. Sixteen of the 76 studies in this meta-analysis met this criterion. Fourteen interventions were situated in educational settings, 15 involved group sessions, four incorporated family involvement, and six specified staff training was provided. The duration of the efficacious

interventions ranged from 12 weeks to three years. Ten interventions lasted one year or less and eight of these interventions were in place for six months or less. Most of the interventions were offered to mixed gender groups (n=13) and more than half (n=9) targeted elementary school age children (three studies focused on younger children aged 0 to 5, four interventions were directed at adolescents aged 13 to 18). There was variation across the interventions in terms of focus (four were diet, five were exercise, five were diet plus exercise, two were lifestyle) and location (seven were conducted in various European countries, four in the US, two in Australia and one in each of China, Egypt and Israel).

For the contextual questions, this review found a general lack of literature on the prevention and treatment of overweight and obesity in children and adolescents, particularly in a Canadian context. No evidence was found that provided information on optimal prevention/treatment in rural and remote regions, comprehensive estimates of the economic burden of childhood obesity, cost-effectiveness assessments of preventive/treatment interventions for child obesity, or effective tools for assessing future health risks associated with obesity. In general, for Canadian children/youth, the literature suggests that overweight and obesity is more of a problem for Aboriginal children/youth, older children/youth, children/youth living in rural areas, and children/youth who are members of low SES families. Overweight and obese children and youth encounter a variety of environmental, interpersonal and personal barriers to taking part in physical activities. Limited information on Canadian community-based primary prevention interventions indicates these strategies are not effective in reducing obesity. The contextual literature identified intervention features that may contribute to more successful outcomes, including family involvement, a theoretical basis, cultural sensitivity, longer duration, dedicated staff for delivery, and addressing self-esteem, motivation, sedentary behaviours, nutritional advice and neighbourhood safety.

Limitations

The findings of this review are impacted by the biases and limitations of the literature.

This review is unable to conclusively answer the question regarding whether primary care relevant prevention interventions lead to short-term or sustained healthy BMI trajectories or to improved health outcomes in normal weight children and youth. The included studies involved mixed weight populations (normal weight, overweight, obese) therefore all the analyses in this review provide indirect evidence to address the key question and sub-questions. The use of indirect evidence reduces confidence in the estimate of effect.

Most of the evidence used to answer the key questions was taken from studies that were assessed as having unclear risk of bias, primarily due to the lack of information about or lack of procedures to ensure random sequence generation, allocation concealment and blinding of outcome assessment as well as other sources of bias (i.e., study was underpowered and/or the analysis did not account for clustering). Due to the nature of behavioural interventions, there is a high risk of bias for blinding of participants and personnel across all studies. Potential reporting bias was also identified across a number of outcome/comparison-based study groupings. These

concerns further reduced the strength of the evidence, resulting in mostly very low quality GRADE ratings which weaken confidence in the estimates.

Results presented for the secondary health outcomes (change in: total cholesterol, triglycerides, HDL-C, LDL-C, SBP, DBP, overall quality of life and physical fitness) should be considered with caution as we did not conduct a full systematic review for these components. To be included in this review studies had to report data for the primary outcome of weight; therefore any investigations of relevant interventions that examined the secondary outcomes and/or adverse effects of interest that did not provide weight data were excluded.

We did not find any studies that examined primary care screening programs for child/youth overweight or obesity that met the inclusion criteria for this review; thus none of the supplemental questions could be answered.

Finally, we restricted our search to papers in English or French, thus we may have missed the opportunity to analyze data from papers written in other languages.

Conclusion

Greater health risks associated with obesity, alongside the high prevalence of overweight/obesity in Canadian children and youth, reinforce the need for preventive action. The evidence presented in this systematic review supports the conclusion that behavioural prevention interventions are associated with statistically significant improvements in weight outcomes in mixed weight samples. These benefits are also achieved without serious adverse effects. Clinical significance is difficult to judge due to the small effect sizes and range of weight in the study populations. The available evidence suggests there very few additional health benefits to be gained by participating in these interventions (e.g., increased HDL level, improved physical fitness); the observed benefits are small and the maintenance of such health improvements is unknown. Intervention research involving normal weight samples with long term follow-up is required to effectively answer the question whether behavioural prevention interventions in normal weight children and youth lead to short-term or sustained healthy BMI trajectories and improved health outcomes.

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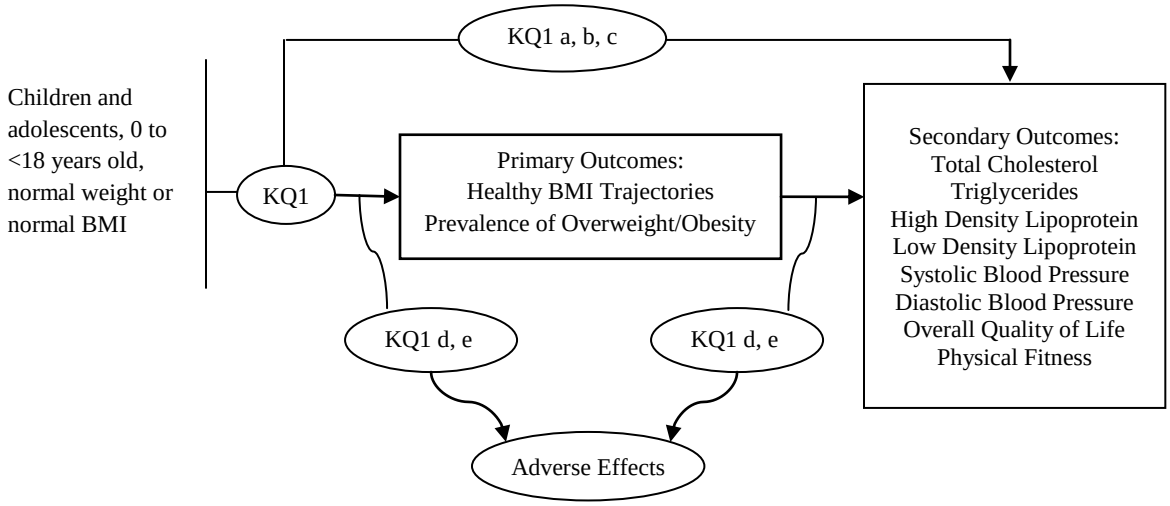
Figures

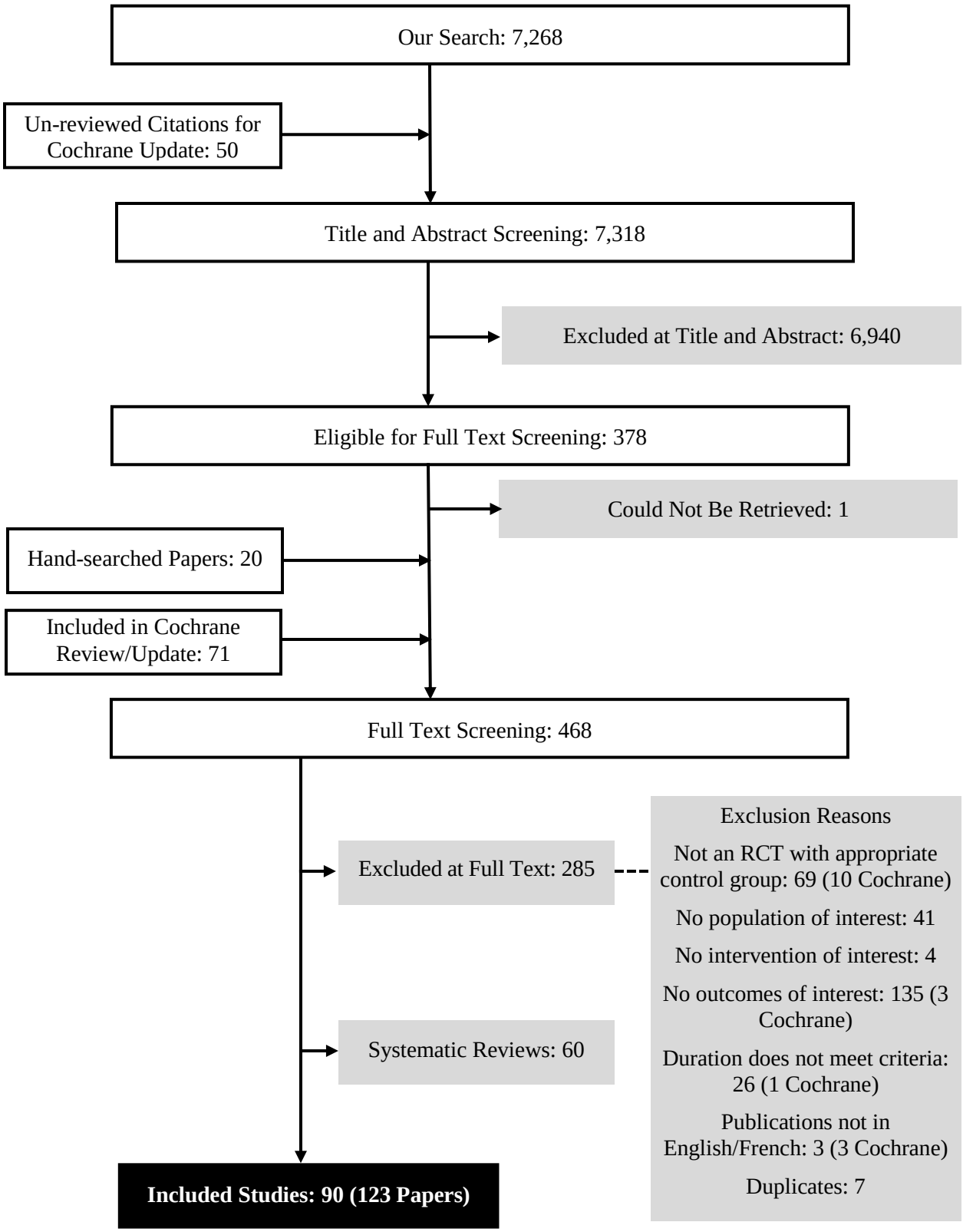
Figure 1: Analytic Framework



KQ1 refers to overweight/obesity prevention interventions

Healthy BMI trajectories refers to a child's BMI growth pattern that would be considered normal by *WHO's Child Growth Standards*[10]

Figure 2: Search and Selection Results



Tables

Table 1: Summary of Risk of Bias Assessment of Included RCTs

Study	Sequence Generation	Allocation Concealment	Blinding of Personnel/ Participants	Blinding of Outcome Assessors			Incomplete Reporting			Selective Reporting	Other Bias
				OBJ	SUB	S-R	OBJ	SUB	S-R		
Amaro 2006 [78]	U	U	H		U			H		L	L
Baranowski 2003 [76]	L	U	H		U			L		H	H
Barkin 2012 [122]	L	L	H		U			H		L	L
Beech 2003 [73]	L	U	H		U			L		H	H
Bellows 2013 [145]	U	U	H		H			U		L	L
Black 2010 [100]	L	U	H	L	L		L	L		L	L
Bonsergent 2013 [146]	U	U	H		L			H		L	L
Brandstetter 2012 [138]	U	U	H		U			L		L	L
Brown 2013 [147]	L	U	H		U			L		L	L
Burgi 2012 [133]	L	L	H	L	L		L	L		L	H
Caballero 2003 [72]	L	L	H	L	L	L	L	L	L	L	L
Campbell 2013 [148]	L	H	H		H			L		L	L
Crespo 2012 [125]	U	U	H		L			H		L	L
Cunha 2013 [149]	U	L	H		U			L		L	L
Daniels 2012 [150]	U	U	H		L			L		L	L
DeBar 2011 [144]	L	L	H	U	U	U		L		L	L
De Coen 2012 [151]	U	U	H		U			L		L	L
de Heer 2011 [95]	U	U	H		U			L		L	H
de Ruyter 2012 [123]	L	L	H		L			L		L	L
Donnelly 2009 [86]	U	U	H		L			L		L	L
Dzewaltowski 2010 [111]	L	U	H		H			L		L	L
Ebbeling 2006 [90]	L	L	H	L	L	L	L	L	L	L	L
El Ansari 2010 [101]	U	U	H	U	U			U		L	L
Escribano 2012 [139]	H	U	H		L			L		L	H
Fitzgibbon 2005 [69]	U	U	H		U			L		L	L
Fitzgibbon 2006 [71]	U	U	H		U			L		L	H
Fitzgibbon 2011 [112]	U	U	H		U			L		L	L
Fitzgibbon 2013 [152]	U	H	H		U			L		L	L
Foster 2008 [81]	U	U	H		H			H		L	L
Foster 2010 [96]	U	U	H	L	U		L	L		H	L
French 2011 [113]	U	U	H		U			L		L	H

Study	Sequence Generation	Allocation Concealment	Blinding of Personnel/ Participants	Blinding of Outcome Assessors			Incomplete Reporting			Selective Reporting	Other Bias
				OBJ	SUB	S-R	OBJ	SUB	S-R		
Fung 2012 [132]	H	H	H		U			L		L	L
Gentile 2009 [88]	U	U	H		U			U		L	L
Greening 2011 [114]	U	U	H	L	U		L	L		L	L
Haerens 2006 [91]	U	L	H		U			H		L	H
Hakanen 2010 [102]	U	U	H	L	U		H	H		L	L
Harvey-Berino 2003 [68]	U	U	H		L			L		L	H
Hoffman 2011 [115]	U	U	H		H			H		L	H
Howe 2011 [119]	U	U	H	U	U		U	U		L	L
James 2004 [77]	L	U	H		U			H		L	L
Jansen 2011 [97]	L	U	H		H			L		L	L
Katz 2001 [121]	U	U	H		U			L		L	H
Klesges 2011 [116]	L	H	H		L			H		L	L
Kriemler 2010 [103]	L	U	H	L	L	H	L	L	L	L	L
Lazaar 2007 [79]	L	U	H		U			L		L	H
Li 2010 [98]	U	U	H		L			L		L	H
Llargues 2012 [134]	U	U	H		U			H		L	H
Lloyd 2012 [130]	U	U	H	L	L		L	L		L	H
Lubans 2011 [120]	U	U	H		H			L		L	H
Lubans 2012 [128]	U	U	H	L	H		L	L		L	L
Madsen 2013 [153]	U	U	H		H			L		L	L
Magnusson 2012 [137]	U	U	H	L	U		H	H		L	L
Marcus 2009 [87]	U	U	H		U			H		L	L
Martinez 2008 [84]	L	L	H	L	H		L	L		L	L
Mihas 2009 [99]	L	U	H		H			L		L	L
Morgan 2011 [104]	L	L	H		H			L		L	L
Mo-suwan 1998 [67]	U	U	H		U	U		L	L	L	L
Muckelbauer 2012 [124]	U	U	H		U			H		L	H
Nemet 2011a [110]	L	U	H		L			L		L	L
Nemet 2011b [143]	L	U	H		L			L		L	L
Newmark-Sztainer 2010 [105]	U	U	H	L	U		L	L		L	L
Newumark-Sztainer 2003 [89]	U	H	H		U	U		L	L	L	L
Ostbye 2012 [127]	L	U	H		U	U		U	U	L	L

Study	Sequence Generation	Allocation Concealment	Blinding of Personnel/ Participants	Blinding of Outcome Assessors			Incomplete Reporting			Selective Reporting	Other Bias
				OBJ	SUB	S-R	OBJ	SUB	S-R		
Paineau 2008 [83]	L	U	H	L	U		L	L		L	H
Papadaki 2010 [117]	L	U	H	L	U		H	H		L	H
Peralta 2009 [94]	L	U	H		L			L		L	H
Reed 2008 [82]	U	U	H	L	U		L	L	L	L	L
Reilly 2006 [70]	L	L	H		L			L		L	L
Robinson 2003 [74]	L	U	H		L			L		H	H
Robinson 2010 [106]	U	U	H	L	L		L	L		L	H
Rosario 2013 [154]	L	U	H		L			H		L	U
Rosenkranz 2010 [107]	L	U	H		U			L		L	L
Rush 2012 [141]	L	L	H		L			H		L	L
Salcedo 2010 [108]	U	U	H	L	U		H	H		L	H
Shamah 2012 [131]	U	U	H		U			L		L	H
Sichieri 2009 [85]	U	U	H		U			L		L	L
Siegrist 2013 [155]	U	U	H		U			L		L	U
Simon 2008 [80]	U	U	H	L	U		L	L		L	L
Singh 2009 [93]	L	L	H		H			L		L	L
Singhal 2010 [118]	U	U	H	L	U		L	L		L	H
Story 2003 [75]	L	U	H		U			L		H	H
Story 2012 [126]	U	U	H		U			L		L	H
Telford 2012 [140]	U	U	H		U		U	U		L	L
Thivel 2010 [142]	U	U	H		U			L		L	H
Velez 2010 [109]	U	U	H	L	U		L	L		L	H
Webber 2008 [92]	U	U	H	L	L		L	L		L	L
Weeks 2012 [136]	U	U	H	L	U		L	L		L	L
Wen 2012 [135]	L	L	H		L			L		L	L
Williamson 2012 [129]	U	U	H	U	U		H	H		L	L
Yin 2012 [156]	U	U	H		H			H		L	L

L (green) = Low Risk; U (yellow) = Unclear Risk; H (red) = High Risk; OBJ = Objective Outcome; SUB = Subjective Outcome; S-R = Self-Reported Outcome

Table 2: Characteristics of Included Studies

Study/Location	Amaro 2006 [78] Italy
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Baranowski 2003 [76] United States
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Barkin 2012 [122] United States
Objective	To test the effect of a culturally tailored, family-centered, short-term behavioural intervention on BMI in Latino-American preschool-aged children
Methods	Design: RCT Selection: bilingual research assistant approached individuals in the waiting area of community agencies (e.g., pediatric clinics, community centers); study advertised via: flyers, community organizations; Spanish radio, Spanish newspapers, word-of-mouth Inclusion criteria: parents >18 years; self-defined as Hispanic/Latino; child aged 2-6; not currently enrolled in another healthy lifestyle program; valid telephone number; planning on remaining in the city for the next 6 months Unit of allocation: dyads Unit of analysis: child Intention to treat: yes
Participants	Sample: 106 Intervention n=54; Control n=52 Age mean (SD) (years): Intervention: 4.2 (0.9); Control: 4.1 (0.9) Gender [Female n (%)]: Intervention n=16 (45.7%); Control n=22 (55%) Loss to follow-up: Intervention n=19; Control n=12
Intervention	Description of intervention: Salud Con La Familia (Heart with the family); 12 weekly 90-minute skills-building sessions for parents and preschool-aged children to improve nutritional habits, increase physical activity, and decrease sedentary activity Description of control: brief school readiness program conducted as alternative to active intervention; met 3 times for 60 minutes over the 12-week study period Duration of intervention: 12 weeks Length of follow-up: immediate post
Study/Location	Beech 2003 [73] United States; Companion paper: Story [194]
Comments	See Cochrane Review by Waters et al.[40] for details

Study/Location	Bellows 2013 [145] United States
Objective	To assess the efficacy of an intervention on gross motor skill performance, physical activity, and weight status of preschoolers
Methods	Design: RCT Selection: NR Unit of allocation: child Unit of analysis: child Intention to treat analysis: no
Participants	Sample: 263 Intervention n=132; Control n=131 Age mean (SD) (months): Intervention: 53.0 (6.8); Control: 51.5 (6.6) Gender (Female): 45% Race/Ethnicity: 59% Hispanic SES: all participants considered to have low SES Loss to follow-up: Intervention n=34; Control n=28
Intervention	Description of intervention: "The Food Friends: Get Movin' With Mighty Moves": 18 weeks classroom based intervention 4 days/week for 15–20 min/day; 72 lessons that comprised multiple activities (143 total activities) focused on gross motor skill and healthy eating; led by classroom teacher Description of control: NR Duration of intervention: 18 weeks Length of follow-up: immediate post
Study/Location	Black 2010 [100] United States
Objective	To evaluate a 12-session home/community-based health promotion/obesity prevention program (Challenge!) on changes in BMI, body composition, physical activity, and diet
Methods	Design: RCT Selection: one group participated in investigation of growth and development; other group recruited from middle schools; researchers visited classes and described the project and the possibility of receiving a health program with a "personal trainer" Inclusion criteria: aged 11-16 years; reside in nearby low-income communities Unit of allocation: individuals Unit of analysis: individuals Intention to treat: No
Participants	Sample: 235 Intervention n=121; Control n=114 Age mean (SD) (years): Intervention: 13.3 (1.0); Control: 13.3 (1.0)

	Gender [Female n (%)]: Intervention n=62 (51.2%); Control n=54 (47.4%) Race/Ethnicity: Non-Hispanic blacks: Intervention: 118 (97.5%); Control: 110 (96.5%) Loss to follow-up: Intervention n=30; Control n=21
Intervention	Description of intervention: 12 sessions that included a challenge (e.g., persuade someone to drink water instead of soda), setting a personal goal related to diet or PA (e.g., eat 2 vegetables/day, walk 30 min/day), make and taste healthy snacks and engage in PA with mentors; taste tests (e.g., regular/diet soda), recipes for healthy snacks (e.g., breakfast sundae with yogurt, granola and fruit), and recommendations for PA; parents welcome to participate; mentors left recipes and information for the family Description of control: no mentor, no contact between baseline and follow-up Duration of intervention: 11 months Length of follow-up: 24 months
Study/Location	Bonsergent 2013 [146] France; Companion paper: Briancon [195]
Objective	To evaluate the 2-year effectiveness of three strategies aimed at preventing overweight and obesity among adolescents in a high school setting
Methods	Design: RCT Selection: 24 high schools randomly selected after stratification on department and type of education (general and technological or vocational) Inclusion criteria: high school must be a state administrated establishment Unit of allocation: school Unit of analysis: child Intention to treat: no
Participants	Sample: 5,354 Intervention n=2,641; Control n=2,713 (baseline and follow-up data only presented by completers and non-completers) Age mean (SD) (years): Completers: 15.6 (0.7) Gender (Female): completers 57.6% Loss to follow-up: 33.9% overall
Intervention	Description of intervention: dietary and physical activity lectures for 5 hours in Grade 10, 6 hours in Grade 11 and group work to exchange, find and present answers to problems related to eating habits, physical activity and the environment Description of control: non-education strategy Duration of intervention: 24 months Length of follow-up: immediate post
Study/Location	Brandsetter 2012 [138] Germany
Objective	To describe the effects of a school-based intervention for overweight prevention on children's BMI and other measures of fat mass

Methods	Design: RCT Selection: all principals were informed in writing about the study and were asked to invite first-grade teachers to participate Inclusion criteria: NR Unit of allocation: school Unit of analysis: child Intention to treat: no
Participants	Sample: 1,119 Intervention n=540; Control n=579 Age mean (SD) (years): Intervention: 7.61 (0.42); Control: 7.53 (0.42) Gender (Female): Intervention 44.9%; Control 47.9% Loss to follow-up: Intervention n=51; Control n=42
Intervention	Description of intervention: school-based, within existing curriculum focused on health promoting behaviour change with action alternatives in three areas: drinking sugar-sweetened beverages (drinking water, discovering hidden sugar in drinks), spending time with screen media (leisure activities without TV), and being physically active (learning about local sport and leisure facilities); 1 school year of materials covering: 29 30-60 minute teaching units; 2 short (5-7 minute) blocks of PA exercises a day, 6 family homework lessons; teacher training and parent information materials Description of control: no intervention Duration of intervention: 1 school year Length of follow-up: immediate post
Study/Location	Brown 2013 [147] United States
Objective	To develop a lifestyle change program for Native American youth by modifying the Diabetes Prevention Program (DPP) and to assess implementation indicators and short term behavioural and physiological outcomes of the intervention among a pilot sample
Methods	Design: RCT Selection: Northern Plains Indian youth 10-14 years old living on 2 American Indian reservations in north-central and southwestern Montana Unit of allocation: child Unit of analysis: child Intention to treat: no
Participants	Sample: 76 Intervention n=38; Control n=38 Age mean (SD) (years): Overall: 11.4 (1.1) Gender (Female): 50% Race/Ethnicity: Native American Loss to follow-up: Intervention n=6; Control n=6

Intervention	Description of intervention: general content and behavioural were based on the original DPP lifestyle change model; strategies targeted healthy weight maintenance, lowering fat intake, increasing physical activity; 9 sessions over 3 months; weight goal to slow or reduce BMI growth; emphasis on traditional activities (e.g., berry picking, horseback riding, dancing, hunting, hiking, and camping), use of storytelling and native language to convey information, and participation of elders; hands-on interactive activities Description of control: addressed risks for alcohol and drug use Duration of intervention: 3 months Length of follow-up: immediate post
Study/Location	Burgi 2012 [133] Switzerland; Companion papers: Puder,[196] Niederer [197]
Objective	To examine whether a multidimensional lifestyle intervention is equally effective in children of migrant and/or low educational level parents
Methods	Design: RCT Selection: public preschool classes randomly selected in areas with a high migrant population from two different socio-cultural and linguistic regions in Switzerland Inclusion criteria: for preschool classes a >40% prevalence of migrant children and no participation in any other prevention project Unit of allocation: class Unit of analysis: children Intention to treat: yes
Participants	Sample: 652 Intervention n=342; Control n=310 Age mean (SD) (years): Intervention: 5.2 (0.6); Control: 5.2 (0.6) Gender [Female n (%)]: Intervention n=167 (49%); Control n=159 (51%) Loss to follow-up: Intervention n=18; Control n=9
Intervention	Description of intervention: children participated in a PA program consisting of four 45 min sessions per week; teachers participated in two 3 hour workshops to learn the content and practical aspects of the intervention and in one informal meeting to exchange experiences; parents participated in three interactive information and discussion evenings about promotion of PA, healthy food, limiting TV use and the importance of sufficient sleep Description of control: Regular school curriculum Duration of intervention: 10 months Length of follow-up: immediate post
Study/Location	Caballero 2003 [72] United States
Comments	See Cochrane Review by Waters et al.[40] for details

Study/Location	Campbell 2013 [148] Australia; Companion paper: Campbell [198]
Objective	To assess the effectiveness of a parent-focused intervention on infants' obesity-risk behaviours and BMI
Methods	Design: RCT Selection: 14 local government areas randomly selected from 28 eligible; fifty percent of eligible first-time parents' groups in each area randomly selected (62/103 groups) and approached by research staff during a standard nurse-facilitated group session Inclusion criteria: parent groups eligible if ≥8 parents enrolled or ≥6 parents enrolled in areas of low SES Unit of allocation: parent group Unit of analysis: child Intention to treat: yes
Participants	Sample: 542 Intervention n=271; Control n=271 Age mean (SD) (months): Overall: 3.9 (1.6) Gender (Female): 47.4% Loss to follow-up: Intervention n=30; Control n=32
Intervention	Description of intervention: dietitian-delivered intervention comprised six 2-hour sessions delivered quarterly during the first-time parents' group regular meeting Description of control: 6 newsletters on non obesity-focused themes; parents received usual care from their MCH nurse, who may have provided lifestyle advice. Duration of intervention: 15 months Length of follow-up: immediate post
Study/Location	Crespo 2012 [125] United States; Companion paper: Elder [199]
Objective	To evaluate the impact of a community health advisor intervention to promote healthy eating and physical activity and prevent excess weight gain among Latino children
Methods	Design: RCT Selection: elementary schools within 3 school districts in south San Diego County Unit of allocation: school Unit of analysis: child Intention to treat: yes
Participants	Sample: 808 Intervention 1 n=198; Intervention 2 n=165; Intervention 3 n=218; Control n=227 Age mean (SD) (years): Overall: 5.9 (0.9) Gender (Female): 50% Loss to follow-up: Intervention 1 n=31; Intervention 2 n=20; Intervention 3 n=22; Control n=22

Intervention	Description of intervention 1: home/family environmental change – activities delivered by eight promotoras (community health advisors) consisted of home visits, newsletters, recipe cards, goal setting, booster phone calls Description of intervention 2: community-only environmental change – school playground improvements and implementation of salad bars/improvements to salad bars, improvements to community parks, change in classroom practices, physical education equipment, children's menus at restaurants Description of intervention 3: family-plus-community-environmental change – combination of interventions 1 and 2 Description of control: no intervention Duration of intervention: 3 years Length of follow-up: immediate post
Study/Location	Cunha 2013 [149] Brazil
Objective	To evaluate the effectiveness of a school-based intervention involving families and teachers to promote healthy eating habits in adolescents and reduce increase in BMI
Methods	Design: RCT Selection: selected 20 schools with fifth grade classes out of 35 municipal schools; all located in areas not considered high risk for violence Unit of allocation: school Unit of analysis: child Intention to treat: yes
Participants	Sample: 574 Intervention n=293; Control n=281 Age mean (SD) (years): Intervention: 11.2 (1.3): Control: 11.2 (1.3) Gender (Female): 48.6% Loss to follow-up: Intervention n=45; Control n=30
Intervention	Description of intervention: trained nutritionists gave monthly 1hour sessions in the classrooms, which included games, theater sketches, movies and puppet shows, writing and drawing contests, to encourage changes in eating habits and food consumption Description of control: one-hour section of orientation on general health and advice on healthy eating, at the end of the study Duration of intervention: 9 months Length of follow-up: immediate post
Study/Location	Daniels 2012 [150] Australia
Objective	To evaluate a universal obesity prevention intervention for infants
Methods	Design: RCT Selection: recruitment 4 hospitals in Adelaide and 3 in Brisbane; consecutive sample of

	first-time mothers (≥18 years old) who delivered a healthy term infant approached while still in hospital by hospital employed midwives, study-employed staff, or doctoral students; mothers who gave consent re-contacted when infant was 4-6 months Inclusion criteria: no documented history of domestic violence or intravenous drug use; no self-reported eating or psychiatric disorder; written and spoken English; ability to attend sessions; no serious infant health problems; score on the Kessler Psychological Distress Scale (K10) below 30 (not high maternal psychological distress). Unit of allocation: child Unit of analysis: child Intention to treat: yes
Participants	Sample: 698 Intervention n=352; Control n=346 Age mean (SD) (months): Intervention: 4.3 (1.0): Control: 4.3 (1.0) Gender (Female): Intervention 51%; Control 50% Loss to follow-up: Intervention n=92; Control n=65
Intervention	Description of intervention: comprehensive skills-based program that used a cognitive behavioural approach and focused on feeding and parenting practices; 2 modules of 6 fortnightly group sessions (10–15 mothers per group), each 1 to 1.5 hours; Module 1 delivered by 9 dietitians and 10 psychologists who worked in pairs Description of control: self-directed access to usual community child health services, which were similar in both states and largely targeted at high-risk families Duration of intervention: 3 months Length of follow-up: 15 months
Study/Location	DeBar 2011 [144] United States; Companion paper: The HEALTHY Study Group [200]
Objective	To examine whether student's "public commitment" - voluntary participation as a peer communicator or in student-generated media opportunities - in a school-based intervention to prevent diabetes and reduce obesity predicted improved study outcomes
Methods	Design: RCT Selection: schools where at least 50% of children ineligible for federally subsidized, free, or reduced-priced meals and/or at least 50% of students' ethnicity was Black or Hispanic. Students enrolled in 6th grade in Fall 2006 who had no conditions that would preclude active participation in physical education classes Unit of allocation: school Unit of analysis: child Intention to treat: no
Participants	Sample: 3,131 Intervention n=835; Control n=2,296 Age mean (SD) (years): Intervention: 11.3 (0.5); Control: 11.3 (0.5)

	Gender (Female): Intervention 58.6%; Control 69.6% Race/Ethnicity: Intervention 51% Hispanic; Control 53.5% Hispanic Loss to follow-up: 0
Intervention	Description of intervention: HEALTHY intervention, delivered over five semesters (Spring 2007, Fall 2007, Spring 2008, Fall 2008, Spring 2009) comprised four components: nutrition, physical education, behaviour and communications Description of control: no intervention Duration of intervention: 3 years Length of follow-up: immediate post
Study/Location	de Heer 2011 [95] United States
Objective	To evaluate the effectiveness and spillover of an after-school health education and physical activity program among Hispanic elementary school children
Methods	Design: RCT Selection: students recruited in third, fourth, and fifth grades by making announcements and passing out consent forms during PE classes Exclusion criteria: children were excluded if they were not in the target grades and/or if they had a condition that would endanger their own or others' safety Unit of allocation: individual Unit of analysis: individual Intention to treat: no
Participants	Sample: 646 Intervention n=292; Control n=354 Age mean (SD) (years): Intervention: 9.24 (0.87); Control: 9.10 (1.08) Gender (Female): 47.0% Loss to follow-up: Intervention n=50; Control n=28
Intervention	Description of intervention: after-school program ran twice weekly for 12 weeks for a total of 24 sessions at each school; each session took place in the schoolyard or in the multipurpose room and comprised a 20 to 30 minute health education component followed by 45 to 60 minutes of physical activity. Description of control: no treatment Duration of intervention: 3 months Length of follow-up: immediate post
Study/Location	De Coen 2012 [151] Belgium
Objective	To evaluate the effects of a school-based, 2-year, multi-component intervention on BMI, eating and physical activity behaviour
Methods	Design: RCT Selection: six communities selected from research regions in Flanders based on five

	socio-economic characteristics: (i) number of births in underprivileged families; (ii) proportion of pupils in primary school with a school delay; (iii) rate of unemployment; (iv) number of persons on welfare support; and (v) number of underprivileged foreigners; recruitment in schools; all pre-primary and primary schools invited Unit of allocation: community Unit of analysis: child Intention to treat: no
Participants	Sample: 3,242 Intervention n=2,034; Control n=1,208 Age mean (SD) (years): Intervention: 4.86 (1.25); Control: 5.04 (1.29) Gender (Female): 50% Loss to follow-up: Intervention n=1,364; Control n=766
Intervention	Description of intervention: based on the 'Nutrition and Physical Activity Health Targets': (i) increasing daily consumption of water and decreasing soft drinks consumption; (ii) increasing daily milk consumption; (iii) increasing daily consumption of vegetables and fruit; (iv) decreasing daily consumption of sweets and savoury snacks; and (v) increasing daily PA and decreasing screen-time behaviour Description of control: no intervention Duration of intervention: 24 months Length of follow-up: immediate post
Study/Location	de Ruyter 2012 [123] Netherlands; Companion paper: de Ruyter [201]
Objective	To examine the effect on weight gain of masked replacement of sugar-sweetened beverages with non-caloric, artificially sweetened beverages
Methods	Design: RCT Selection: recruited children at eight urban elementary schools near Amsterdam Inclusion criteria: children who commonly drank sugar-sweetened beverages Exclusion criteria: children with various medical conditions Unit of allocation: child Unit of analysis: child Intention to treat: yes
Participants	Sample: 641 Intervention n=319; Control n=322 Age mean (SD) (years): Intervention: 8.2 (1.8); Control:8.2 (1.8) Gender (Female): Intervention 46%; Control 47% Loss to follow-up: Intervention n=94; Control n=50
Intervention	Description of intervention: children received a box at school each week containing 8 cans, 1 for each day plus 1 spare in case a can was misplaced; teachers checked to see whether the children consumed their beverage during the morning break in class and

	reminded them to take cans home for the weekend and any holidays. The sugar-free beverages contained 24 mg of sucralose and 12 mg of acesulfame potassium per can. Description of control: control beverage contained 26 g of sucrose Duration of intervention: 18 months Length of follow-up: immediate post
Study/Location	Donnelly 2009 [86] United States; Companion paper: Gibson [202]
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Dzewaltowski 2010 [111] United States
Objective	To evaluate the prevention of childhood obesity through building the capacity of after-school staff to increase physical activity and fruit and vegetable opportunities
Methods	Design: RCT Selection: all schools participating in an after-school program alliance of the Lawrence Public School District Exclusion criteria: if after-school programs were not on the elementary school grounds Unit of allocation: school Unit of analysis: individual Intention to treat: no
Participants	Sample: 273 Intervention n=148; Control n=125 Age mean (SD) (years): Intervention: 9.34 (0.65); Control: 9.19 (0.66) Gender (Female): Intervention 53.0%; Control 46.0% SES (% eligible for free/reduced lunch): Intervention 44%; Control 58% Loss to follow-up: Intervention n=14; Control n=13
Intervention	Description of intervention: the HOP'N intervention model included three levels: a community/government/human service agency (County Cooperative Extension), after-school staff training, and after-school program quality elements. Description of control: standard after-school program Duration of intervention: 24 months Length of follow-up: immediate post
Study/Location	Ebbeling 2006 [90] United States
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	El Ansari 2010 [101] Egypt
Objective	To assess the association between a PA intervention and three anthropometric parameters (weight, body mass index, body fat) and four physiological parameters (cholesterol level,

	systolic blood pressure, diastolic blood pressure, heart rate) among adolescents
Methods	Design: RCT Selection: schools with sport facilities and sport equipment Unit of allocation: individual Unit of analysis: individual Intention to treat: no
Participants	Sample: 160 Intervention n=80; Control n=80 Age mean (SD) (years): Intervention: 15.7 (1.8); Control: 15.4 (1.6) Gender [Female n (%)]: Intervention n=45 (56%); Control n=45 (56%) Loss to follow-up: Intervention n=0; Control n=0
Intervention	Description of intervention: three, 60-minute PA sessions each week for three months Description of control: no intervention Duration of intervention: 3 months Length of follow-up: immediate post
Study/Location	Escribano 2012 [139] Germany/Spain; Companion paper: Koletzko [203]
Objective	To assess if the increases in weight gain velocity and BMI induced by protein intake early in life are related to an increase in fat or fat-free mass
Methods	Design: RCT Selection: 80 infants from the EU Childhood Obesity Programme sample; 37 from Germany and 43 from Spain; selected by recruitment order from 522 eligible subjects when they were 6 months old Unit of allocation: school Unit of analysis: individual Intention to treat: N/A
Participants	Sample: 66 Intervention 1 n=17; Intervention 2 n=24; Control n=25 Age: NR Gender [Female n (%)]: Intervention 1 n=8 (47%); Intervention 2 n=14 (58%); Control n=10 (40%) Loss to follow-up: NR
Intervention	Description of intervention: 41 infants randomized at birth to higher or lower protein content formula (HP=17 and LP=24); 25 breastfed infants also included; anthropometric measures assessed at baseline, 6, 12 and 24 months, and fat-free mass (FFM) and fat mass (FM) were assessed by isotope dilution at 6 months. Duration of intervention: 6 months Length of follow-up: 12, 24 months

Study/Location	Fitzgibbon 2005 [69] United States; Companion paper: Fitzgibbon [71]
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Fitzgibbon 2006 [71] United States
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Fitzgibbon 2011 [112] United States
Objective	To assess the feasibility and effectiveness of a teacher-delivered weight control intervention for black preschool children
Methods	Design: RCT Selection: no details regarding school recruitment Inclusion criteria: intervention took place during regular class time so all children in participating classrooms received intervention and were eligible to participate Unit of allocation: school Unit of analysis: individual Intention to treat: no
Participants	Sample: 589 Intervention n=309; Control n=280 Age mean (years): Overall: 4.3 Gender (Female): Intervention 52%; Control 55% Race/Ethnicity: 94% Black, 3% Latino Loss to follow-up: overall n=29
Intervention	Description of intervention: 14 week curriculum based intervention, 2 teacher delivered sessions per week each week on a specific theme/objective (one 20-minute lesson and one 20-minute physical activity component); parent involvement: weekly newsletter with parallel content, homework assignment with $ reward for completion Description of control: general health intervention Duration of intervention: 14 weeks Length of follow-up: immediate post
Study/Location	Fitzgibbon 2013 [152] United States
Objective	To test the feasibility of Family-Based Hip-Hop to Health, a school-based obesity prevention intervention for 3-5-year-old Latino children and their parents, and estimate its effectiveness in producing smaller average changes in BMI
Methods	Design: RCT Selection: principals and preschool teachers from four Chicago Public Schools agreed to allow children to participate. Two half-day classrooms from each school participated

	Unit of allocation: ECE program Unit of analysis: child Intention to treat: no
Participants	Sample: 147 Intervention n=73; Control n=74 Age mean (SD) (months): Overall: 54.2 (5.0) Gender (Female): 50% Race/Ethnicity: 94% Hispanic Loss to follow-up: Intervention n=12; Control n=7
Intervention	Description of intervention: child component included a 14-week (three times weekly) intervention led by a bilingual/bicultural educator; each session included 20 min of nutrition instruction (included activities led by puppets) and 20 min of aerobic activity; parent component included classes and newsletters adapted for a lower-income, Hispanic population; parents encouraged to attend six weekly 90-min classes that included 60 min of interactive instruction on healthful eating and family exercise plus 30 min of moderate physical activity (e.g., salsa aerobics, walking group) Description of control: control schools received a once weekly intervention for 14 weeks (20 min each week) that taught general health concepts such as dental health, seat belt safety, and calling 911; parents received parallel weekly newsletters Duration of intervention: 14 weeks Length of follow-up: immediate post; 12 months
Study/Location	Foster 2008 [81] United States
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	French 2011 [113] United States; Companion papers: Foster,[96] The HEALTHY study group [200]
Objective	To evaluate an intervention to prevent weight gain among households
Methods	Design: RCT Selection: households recruited over 8 months; recruitment sources: community libraries, worksites, schools, daycare centers, health clinics, religious institutions, park and recreation centers, grocery stores, and food co-ops Exclusion criteria: living too far from the university, household TV viewing hours below enrollment criteria, household configuration not meeting enrollment criteria Unit of allocation: household Unit of analysis: household/individual Intention to treat: no
Participants	Sample: 90 households Intervention n=45 households; Control n=45 households

	Age: aged <5 years n=23, aged 5-11 years n=84, aged 12-17 years n=75 Gender [Female n (%)]: only reported for adults as main respondents 93% Loss to follow-up: overall 4 households
Intervention	Description of intervention: 6 monthly face-to-face group sessions, monthly newsletters, and 12 home-based activities Description of control: no treatment Duration of intervention: 1 year Length of follow-up: immediate post
Study/Location	Fung 2012 [132] Canada
Objective	To examine the effectiveness of a Comprehensive School Health program by evaluating temporal changes in diets, activity levels and body weight
Methods	Design: RCT Selection: 10 schools selected from five jurisdictions in Alberta, all of which agreed to support healthy eating and active living initiatives among students Exclusion criteria: schools outside selected jurisdictions Unit of allocation: school Unit of analysis: child Intention to treat: N/A
Participants	Sample: 3,714 Intervention n=293; Control n=3,421 Age: NR (grade 5 students) Gender [Female n (%)]: Intervention n=149 (50.7%); Control n=1,762 (51.5%) Loss to follow-up: <10% dropout rate by the 2010 survey
Intervention	Description of intervention: "to make the healthy choice the easy choice" School Health Facilitators implemented healthy eating and active living strategies; engaged all stakeholders, including parents, staff and community; School Health Facilitators developed cross curriculum links and taught across curriculum; facilitated professional development days for teachers and staff, organized parent information nights, nutrition programs such as cooking clubs, after school physical activity programs, weekend events and celebrations, and circulated newsletters Description of control: no intervention Duration of intervention: 3 years Length of follow-up: -1 year
Study/Location	Gentile 2009 [88] United States
Comments	See Cochrane Review by Waters et al.[40] for details

Study/Location	Greening 2011 [114] United States
Objective	To evaluate a healthy lifestyle school-based obesity intervention in a rural southern community
Methods	Design: RCT Exclusion criteria: disabilities that precluded comprehending the questionnaires or performing the fitness tests Unit of allocation: school Unit of analysis: school Intention to treat: no
Participants	Sample: 450 Intervention n=204; Control n=246 Age mean (SD; range) (years): Overall: 8.34 (1.30; 6 to 10) Gender (Female): overall 48.0% Loss to follow-up: overall 11.0%
Intervention	Description of intervention: a 45 minute nutritional information session presented once during school year by a nutritionist; 45 minute physical education classes twice a week; healthy information incorporated into weekly class lectures; deep frying equipment replaced with baking ovens Description of control: standard health curriculum Duration of intervention: 8 months Length of follow-up: immediate post
Study/Location	Haerens 2006 [91] Belgium; Companion paper: Haerens [204]
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Hakanen 2010 [102] Finland
Objective	To evaluate the impact of individualized dietary and lifestyle counselling, primarily aimed to decrease serum low-density lipoprotein cholesterol, on the clustering of overweight-related cardiometabolic risk factors in children
Methods	Design: RCT Selection: recruited by nurses at well baby visit Exclusion criteria: children with chronic disease (e.g. chromosomal diseases, diabetes, familial hypercholesterolaemia) Unit of allocation: child Unit of analysis: child Intention to treat: no
Participants	Sample: 1,062 Intervention n=540; Control n=522

	Age mean (months): Intervention: 7; Control: 7 Gender: NR Loss to follow-up: Intervention n=291; Control n=246
Intervention	Description of intervention: individualized dietary and lifestyle counselling at 1 to 3 month intervals until child was 2 years old and twice a year thereafter; all children continued regular visits at the wellbaby clinics and school health care for vaccinations, growth and development follow-up and basic health education Description of control: contacted by the counselling team twice a year until age 7 years and once a year after that; received similar basic health education as routinely given at Finnish wellbaby clinics and school health care Duration of intervention: 2 years Length of follow-up: every two years for 8 years
Study/Location	Harvey-Berino 2003 [68] United States
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	HEALTHY Study Group 2010 [96] United States
Objective	To examine the effects of a multicomponent, school-based program addressing risk factors for diabetes among children whose race or ethnic group and SES placed them at high risk for obesity and type 2 diabetes
Methods	Design: RCT Selection/Exclusion criteria: ≥50% of children in school eligible for federally subsidized, free or reduced-price meals or ≥50% students black or Hispanic; Black and Hispanic children of lower SES oversampled given that these children are at a high risk for obesity and type 2 diabetes; Students in 6th grade in fall 2006 eligible if no diabetes or conditions that would preclude regular participation in physical education Unit of allocation: school Unit of analysis: individual Intention to treat: no
Participants	Sample: 6,358 Intervention n=3,189; Control n=3,169 Age mean (SD) (years): Intervention: 11.3 (0.5); Control: 11.3 (0.6) Gender (Female): Intervention 52.6%; Control 52.9% Loss to follow-up: overall 27.6%
Intervention	Description of intervention: four integrated components: nutrition, physical activity, behavioural knowledge and skills, and communications and social marketing. Description of control: assessment only Duration of intervention: 3 years Length of follow-up: immediate post

Study/Location	Hoffman 2011 [115] United States
Objective	To examine the effects of a multi-component, theory-based, 2.5-year intervention on children's fruit and vegetable consumption, preferences, knowledge and BMI
Methods	Design: RCT Selection: multiple approaches to recruit (e.g., teacher meetings, principal support, classroom presentations); four urban public schools from the same school district Inclusion criteria: signed parental consent required for inclusion Unit of allocation: school Unit of analysis: individual Intention to treat: yes
Participants	Sample: 297 Intervention n=149; Control n=148 Age mean (years): Overall: 6.2 Gender (Female): Overall 49.0% Loss to follow-up: Intervention n=46, Control n=43
Intervention	Description of intervention: school wide (daily loud speaker announcements), classroom (instructional DVD), lunchroom (daily stickers contingent on a bite of fruit or vegetable), and family (take-home activity books) components to promote F&V consumption with emphasis on F&V in school lunch; role models delivering consistent information across multiple settings. Description of control: no intervention Duration of intervention: 2.5 years Length of follow-up: immediate post
Study/Location	Howe 2011 [119] United States
Objective	To evaluate the efficacy of a 10-month PA intervention on: (a) the prevention of excessive age-related increases in body fatness and (b) cardiovascular fitness
Methods	Design: RCT Selection: Black boys (8-12 years) recruited from five elementary schools using fliers Inclusion criteria: all 3rd through 5th grade Black boys eligible if: (a) weight <300 lbs (equipment limitation), (b) not taking medications known to affect metabolism, body composition, or fat distribution, and (c) no known CV, metabolic, or respiratory disease or physical impairment that would limit participation in regular PA Unit of allocation: individual Unit of analysis: individual Intention to treat: no
Participants	Sample: 106 Intervention n=62; Control n=44

	Age range (years): 8 to 12 Gender: 100% boys Race/Ethnicity: African-American Loss to follow-up: NR
Intervention	Description of intervention: participants stayed at school at end of day (177+/- 8.6 days) to receive a 2-hour intervention; conducted by trained personnel with exercise-related education plus 1-2 trained classroom teachers; 30 minutes of homework time during which the boys provided with a healthy snack followed by 80 minutes of PA Description of control: no intervention, instructed not to change after-school routine Duration of intervention: 10 months Length of follow-up: immediate post
Study/Location	James 2007 [77] England; Companion paper: James [205]
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Jansen 2011 [97] Netherlands
Objective	To evaluate the effect of a school-based intervention program to reduce overweight and improve fitness in primary school children
Methods	Design: RCT Selection: primary schools in inner-city areas of Rotterdam; 27 schools applied Exclusion criteria: NR Unit of allocation: school Unit of analysis: individual Intention to treat: no
Participants	Sample: 1,386 Intervention n=657; Control n=729 Age mean (SD) (years): Intervention Grades 3-5: 7.7 (1.0), Grades 6-8: 10.8 (1.0); Control: Grades 3-5: 7.8 (1.0), Grades 6-8: 10.8 (1.0) Gender (Female): Grades 3-5 Intervention 50.5%; Control 51.0%; Grades 6-8 Intervention 52.8%; Control 49.0% Loss to follow-up: Intervention n=91; Control n=115
Intervention	Description of intervention: Lekker Fit! promoting healthy eating and active living; targeted individual behaviours, school policies and curriculum; 3 PA sessions/week by PA teacher for grades 3-8 (6-12 years), 3 classroom lessons on healthy nutrition, active living and healthy lifestyle choices adapted for each grade, administration of the Eurofit test, with measurements of height, weight and 9 fitness tests Description of control: usual curriculum Duration of intervention: 10 months Length of follow-up: immediate post

Study/Location	Katz 2011 [121] United States
Objective	To evaluate the effects of a nutrition education program designed to teach elementary students and their parents to distinguish between more healthful and less healthful choices in diverse food categories
Methods	Design: RCT Selection: During the 2007-2008 school year, participants second to fourth grade students recruited from 5 elementary schools in Independence, Missouri Exclusion criteria: Students excluded from data collection and program evaluation if parental consent not received or if the student was unwilling or unable to comply Unit of allocation: school Unit of analysis: school Intention to treat: yes
Participants	Sample: 1,180 Intervention n=628; Control n=552 Age range (years): 7 to 9 Gender (Female): Total: 51.1%; Intervention: 50.3%; Control: 52.2% Loss to follow-up: NR
Intervention	Description of intervention: The Nutrition Detectives program consists of 5 lessons (power point presentation plus hands on activity) presented by physical education instructors in four 20-minute sessions; a booster training session offered later in year Description of control: NR Duration of intervention: 1 school year Length of follow-up: 1 school year
Study/Location	Klesges 2010 [116] United States
Objective	To determine the efficacy of a 2-year obesity prevention intervention in African-American girls
Methods	Design: RCT Selection: recruitment in 5 waves primarily through television and radio ads and flyers and community presentations; ads described GEMS as a study of healthy growth Inclusion criteria: identified as African-American or Black by parent/caregiver; aged 8-10 years; BMI ≥25th age-sex specific percentile, or at least one parent with BMI ≥25; Girls were excluded if they had BMI >35 or conditions that would affect growth or limit participation in the study. Unit of allocation: individual Unit of analysis: individual Intention to treat: yes
Participants	Sample: 303

	Intervention n=153; Control n=150 Age mean (SD) (years): Intervention: 9.3 (0.9); Control: 9.3 (0.9) Gender: 100% female Race/Ethnicity: African-American Loss to follow-up: 20%
Intervention	Description of intervention: girls and caregivers participated in the obesity prevention intervention through a combination of separate and joint sessions. Description of control: intervention on improving self-esteem and social efficacy Duration of intervention: 2 years Length of follow-up: immediate post
Study/Location	Kriemler 2010 [103] Switzerland; Companion paper: Zahner [206]
Objective	To assess the effectiveness of a school based physical activity program during one school year on physical and psychological health in young schoolchildren
Methods	Design: RCT Selection: two provinces in Switzerland. Recruitment of participating schools based on willingness to be randomized either to an intervention group or a control group. Unit of allocation: school Unit of analysis: individual Intention to treat: yes
Participants	Sample: 502 Intervention (grades1 and 5 combined) n=297; Control (grades 1 and 5 combined) n=205 Age mean (SD) (years): Intervention (grade 1): 6.9 (0.3); Intervention (grade 5): 11 (0.5); Control (grade 1): 6.9 (0.3); Control (grade 5): 11.3 (0.6) Gender [Female n (%)]: Intervention 1 n=64 (49%); Intervention 2 n=91 (55%); Control 1 n=50 (55%); Control 2 n=52 (46%) Loss to follow-up: NR
Intervention	Description of intervention: children in both groups had three 45 minute PA lessons each week; intervention group had two more lessons on remaining school days; all intervention classes received same curriculum; 3-5 short activity breaks (2-5 minutes each) during academic lessons for motor skill tasks such as jumping or balancing on one leg, power games or coordinative tasks; children received daily PA homework of about 10 minutes including aerobic, strength, or motor skill tasks such as brushing their teeth while standing on one leg, hopping up and down the stairs, rope jumping. Description of control: three physical education lessons each week Duration of intervention: 9 months Length of follow-up: immediate post

Study	Lazaar 2001 [79] France
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Li 2010 [98] China
Objective	To determine whether a large-scale physical activity intervention could affect body composition in primary school students in Beijing, China
Methods	Design: RCT Selection: two school districts randomly selected from eight in urban Beijing Inclusion criteria: NR Unit of allocation: school Unit of analysis: individual Intention to treat: no
Participants	Sample: 4,700 Intervention n=2,329; Control n=2,371 Age mean (SD) (years): Overall: 9.3 (0.7) Gender [Female n (%)]: 2,242 (47.7%) Loss to follow-up: Intervention n=301; Control n=279
Intervention	Description of intervention: 20 min of daily exercise in the classroom Description of control: no intervention in control schools Duration of intervention: 1 year Length of follow-up: immediate post
Study/Location	Llargues 2012 [134] Spain; Companion paper: Llargues [207]
Objective	To assess whether the benefits seen in nutrition, physical activity and body mass index were maintained at 2 years of completion of the educational intervention
Methods	Design: RCT Selection: all children born in 2000 who attended any school in Granollers Exclusion criteria: school children requiring a special diet for a metabolic or digestive disorders, physical activity incapacity, no family acceptance of attendance to school Unit of allocation: school Unit of analysis: individual Intention to treat: no
Participants	Sample: 464 Intervention n=233; Control n=231 Age mean (years): Intervention: 6.03; Control: 6.03 Gender [Female n (%)]: Intervention n=216 (48.2%); Control n=178 (47.5%) Loss to follow-up: Intervention n=9; Control n=23

Intervention	Description of intervention: promotion of healthy dietary habits and PA using IVAC (Intervention using research, Vision, Action and Change) educational pedagogy for two consecutive school years. The IVAC method is used in health strategies because the perceptions and knowledge elaborated by schoolchildren are directed towards change, so that they make their own decisions based on their concepts of health, determination of priorities, and change. Teachers act as moderators in conversations between schoolchildren and help them develop skills to be able to change these conditions. At study start, a group of educators specializing in community projects trained teachers in the intervention group in the above methodology Description of control: no intervention Duration of intervention: 2 years Length of follow-up: 2 years
Study/Location	Lloyd 2012 [130] United Kingdom
Objective	To assess the behavioural and weight status outcomes in English children in a feasibility study of a novel primary school-based obesity prevention program
Methods	Design: RCT Selection: schools recruited via the local network of primary school head teachers Inclusion criteria: all State schools in Exeter were eligible if they had at least one single age year 5 class (9-10-year-olds) (i.e., not mixed classes, 8-10- or 9-11- year-olds) Unit of allocation: school Unit of analysis: child Intention to treat: yes
Participants	Sample: 202 Intervention n=80; Control n=122 Age mean (SD) (years): Overall: 9.69 (0.3) Gender (Female): 50% Loss to follow-up: Intervention n=7; Control n=8
Intervention	Description of intervention: HeLP is a multicomponent four-phase program delivered over three school terms; program based on the Information, Motivation and Behavioural Skills Model, which proposes adequate information, motivation and behavioural skills are essential to behaviour change; three key behaviours are emphasised: decrease in the consumption of sweetened fizzy drinks, increase in the proportion of healthy snacks to unhealthy snacks consumed and reduction in television viewing and other screen-based activities Description of control: no intervention Duration of intervention: 10 months Length of follow-up: 8 months, 14 months

Study/Location	Lubans 2011 [120] Australia; Companion papers: Lubans,[208] Morgan [209]
Objective	To evaluate the efficacy and feasibility of the Physical Activity Leaders program, an obesity prevention program for low-active adolescent boys from disadvantaged schools
Methods	Design: RCT Selection: 6 low SES co-educational secondary schools from the Hunter Region, NSW Australia were invited to participate and 4 consented. Schools were identified using the NSW DET Priority Schools Program (PSP) classification (identifies disadvantaged schools from communities with the highest concentrations of low SES families); physical education teachers were involved in identifying and recruiting low-active boys Inclusion criteria: adolescent boys in grade 9 attending one of the four study schools; students considered by the teachers to be disengaged in PE and/or not currently participating in organized team or individual sports Unit of allocation: school Unit of analysis: individual Intention to treat: NA
Participants	Sample: 100 Intervention n=50; Control n=50 Age mean (SD) (years): Intervention: 14.4 (0.7); Control: 14.2 (0.4) Gender: 100% boys SES: all schools had to be identified as disadvantaged schools (by PSP classification) Loss to follow-up: no loss
Intervention	Description of intervention: a multi-component school-based intervention including school sport sessions, interactive seminars, lunch-time activities, physical activity and nutrition handbooks, leadership sessions and pedometers for self-monitoring Description of control: program delivered at the wait-list control group schools at the completion of the study Duration of intervention: 6 months Length of follow-up: immediate post
Study/Location	Lubans 2012 [128] Australia
Objective	To evaluate the impact of a multicomponent school-based obesity prevention program, Nutrition and Enjoyable Activity for Teen Girls
Methods	Design: RCT Selection: state-funded secondary schools located in New South Wales, Australia, in areas with lower SES; 18 schools invited to participate, 12 were recruited; eligible participants were adolescent girls in grade 8 (second year of secondary school) Unit of allocation: school Unit of analysis: individual Intention to treat: yes

Participants	Sample: 357 Intervention n=178; Control n=179 Age mean (SD) (years): Intervention: 13.15 (0.44); Control: 13.20 (0.45) Gender (Female): 100% Loss to follow-up: Intervention n=37; Control n=26
Intervention	Description of intervention: enhanced school sport sessions, interactive seminars, nutrition workshops, lunch-time PA sessions, handbooks and pedometers for self-monitoring, parent newsletters, text messaging for social support; school champions (i.e., teachers responsible for program delivery) attended 1-day training workshop which focused on promoting PA, reducing sedentary behaviours, and encouraging low-cost healthy eating; delivered during 4 school terms; enhanced sport sessions (60-80 minutes) delivered by teachers involved a range of activities organized into 4-week units; three practical nutrition workshops delivered by dietitians to provide students with the confidence to select, prepare, and consume healthy low-cost foods; parents sent 4 newsletters; girls sent weekly text messages during second and third terms and biweekly during fourth term (e.g., "Sitting down for long periods of time is bad for you, but what makes it worse is that people often eat junk while sitting down in front of the TV. Try to avoid eating dinner while watching TV"). Description of control: no intervention Duration of intervention: 12 months Length of follow-up: immediate post
Study/Location	Madsen 2013 [153] United States
Objective	To evaluate the impact of a community-based after-school soccer and youth development program, America SCORES, on students' physical activity, weight status, and fitness
Methods	Design: RCT Selection: the study was presented at a regularly scheduled principals' meeting Inclusion criteria: all 4th and 5th grade students enrolled in the after-school program at participating schools Unit of allocation: school Unit of analysis: child Intention to treat: yes
Participants	Sample: 156 Intervention n=82; Control n=74 Age mean (SD) (years): Overall: 9.8 (8.6) Gender (Female): 40% Race/Ethnicity: 12% African American; 32% Asian and 42% Latino SES (Mother's education): 56% had high school or less Loss to follow-up: Intervention n=3; Control n=3

Intervention	Description of intervention: soccer and writing coaches trained with a standard curriculum to lead the SCORES program in the after-school setting; students spent 2 to 3 days per week in soccer drills or games for up to 2 hours each day; the 2 non-soccer days dedicated to creative writing and performance in the 12-week fall session and to community service projects in the 12-week spring session Description of control: NR Duration of intervention: 8-10 months (1 school year) Length of follow-up: immediate post
Study/Location	Magnusson 2012 [137] Iceland
Objective	To assess the effects of a 2-year intervention program among elementary participants on body composition and cardiorespiratory fitness
Methods	Design: RCT Selection: three pairs of schools in city of Reykjavik were selected and matched on size; all children attending second grade were invited to participate Unit of allocation: school Unit of analysis: individual Intention to treat: no
Participants	Sample: 321 Intervention n=128; Control n=138 Age mean (SD) (years): Intervention: 7.3 (0.3); Control: 7.4 (0.3) Gender [Female n (%)]: Intervention n=65 (51%); Control n=83 (60%) Loss to follow-up: Intervention n=23; Control n=32
Intervention	Description of intervention: focused on increasing PA during school hours and promoting healthy dietary habits; teacher-led daily implementation of various intervention tactics, more frequent outdoor teaching, organized fieldtrips, promotion of active commute to and from school, one extra PA lesson per week (three 40-min sessions per week instead of two compulsory 40-min sessions at the control schools) and more dietary intervention aimed to have positive impact on dietary knowledge, awareness, preferences/taste, self-efficacy and parental influence; nutrition education material was implemented during the latter intervention year; main focus of the dietary intervention was on fruit and vegetable intake Description of control: no intervention Duration of intervention: 2 years Length of follow-up: immediate post
Study	Marcus 2009 [87] Sweden
Comments	See Cochrane Review by Waters et al.[40] for details

Study/Location	Mihas 2010 [99] Greece
Objective	To assess short-term and long-term effects of a school-based health and nutrition education intervention on diet, nutrition intake and BMI
Methods	Design: RCT Exclusion criteria: participants with an organic cause for high or low weight, who had received any medication that might interfere with growth or weight control, or who were on specific diets Unit of allocation: individual Unit of analysis: individual Intention to treat: no
Participants	Sample: 213 Intervention n=108; Control n=105 Age mean (SD) (years): Intervention: 13.1 (0.8); Control: 13.3 (0.9) Gender [Female n (%)]: Intervention n=50 (51.0%); Control n=43 (50.5%) Loss to follow-up: Intervention n=10; Control n=12
Intervention	Description of intervention: multi-component workbooks covering mainly dietary issues, but also dental health and consumption attitudes; health and nutrition components conducted by home economics teacher supervised by a health visitor or family doctor and incorporated 12 hours of classroom material during 12 weeks; modules designed to develop behavioural capability, expectations and self-efficacy for healthful eating and healthy foods selection; learning activities designed to influence expectancies that value achieving these behaviours; parental involvement included two meetings where they were given a file containing their child's screening results Description of control: no intervention Duration of intervention: 12 weeks Length of follow-up: immediate post
Study/Location	Morgan 2011 [104] Australia
Objective	To evaluate the feasibility and efficacy of the Healthy Dads, Healthy Kids program, which was designed to help overweight fathers lose weight and be a role model of positive health behaviours for their children
Methods	Design: RCT Selection: Overweight or obese men with a child between 5 and 12 years of age were recruited through media releases, school newsletters and paid advertisements in local newspapers in; men were screened for eligibility through telephone interviews. Exclusion criteria: history of major medical problems (e.g., heart disease) in last 5 years, diabetes, orthopedic or joint problems that would be a barrier to PA, recent weight loss ≥4.5 kg, medication use that might affect body weight; a child with extreme obesity Unit of allocation: individual

	Unit of analysis: individual Intention to treat: yes
Participants	Sample: 53dads, 71 children Intervention n=27; Control n=26 Age mean (SD) (years): Intervention: 8.4 (2.1); Control: 7.9 (1.9) Gender [Female n (%)]: Intervention 48.7%; Control: 43.7% Loss to follow-up at 3 months: Intervention n=6; Control n=3 Loss to follow-up at 6 months: Intervention n=7, Control n=2
Intervention	Description of intervention: fathers attended 8 face-to-face group sessions (75 min each); 5 sessions for fathers only, delivered by male researcher; 3 sessions practical and involved both fathers and children, delivered by two male researchers, both with expertise in physical education; total contact time was 600 minutes; PA sessions for fathers emphasized modeling, reinforcing and providing opportunities and removing barriers to PA; father/child PA sessions were i) fundamental movement skills ii) rough and tumble play iii) health related fitness and iv) fun and active games; dietician developed nutrition components modeled on a previous successful intervention; healthy eating focused on parental influence on children's dietary intake, incorporating Satter's 'trust' paradigm, which suggests parents should supply healthy foods and a supportive eating environment and children can decide when and how much to eat Description of control: waitlist Duration of intervention: 3 months Length of follow-up: 3 and 6 months
Study/Location	Mo-suwan 1998 [67] Thailand
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Muckelbauer 2012 [124] Germany; Companion paper: Muckelbauer [210]
Objective	To test whether a simple overweight prevention program promoting water consumption in elementary schools is equally effective in children with an immigration background and in those without
Methods	Design: RCT Selection: schools eligible if located in deprived areas, as defined by: unemployment rate ≥15% and proportion of social welfare recipients ≥5%, and proportion of non-German residents ≥5% as indicated by local public authorities Unit of allocation: school Unit of analysis: individual Intention to treat: no
Participants	Sample: 3,190 Intervention n=1,641; Control n=1,309

	Age mean (SD) (years): Intervention: 8.26 (0.73); Control: 8.34 (0.76) Gender [Female n (%)]: Intervention n=817 (49.8%); Control n= 651 (49.7%) Loss to follow-up: Intervention n=65; Control n=60
Intervention	Description of intervention: in each school, 1 water fountain, or 2 for schools with >150 participants, was installed; each child received a plastic water bottle (500 mL), and teachers encouraged to organize filling of bottles each morning; four 45-minute classroom lessons dealing with the body's water needs and the water circuit in nature; teachers received curriculum and materials to implement the lessons; 3 months into the study, teachers introduced a motivation unit (booster sessions) that used a goal-setting strategy to reach a sustained increase in water consumption by giving quantitative targets and feedback; 5 months after baseline, each participant received a new water bottle with an improved handling design Description of control: no intervention Duration of intervention: 10 months (1 school year) Length of follow-up: immediate post
Study/Location	Nemet 2011a [110] Israel
Objective	To prospectively examine the effects of a randomized school-based intervention on nutrition and physical activity knowledge and preferences, anthropometric measures, and fitness in low SES kindergarten children
Methods	Design: RCT Selection: 30 kindergartens from low SES communities Unit of allocation: classes Unit of analysis: individual Intention to treat: no
Participants	Sample: 795 Intervention n=417; Control n=378 Age mean (SD) (years): Intervention: 5.20 (0.02); Control 5.24 (0.03) Gender (Female): Intervention 46%; Control 44% Loss to follow-up: NR
Intervention	Description of intervention: designed to improve nutritional knowledge, based on the nutritional program "It Fits Me" ("Tafur Alay") of the Israeli Ministry of Education; teaching topics included food groups, vitamins, healthy food choices, food preparation and cooking methods, and information on fast-food versus home cooking; topics taught through short lectures/talks, games and story reading; children participated in 45 minutes (three 15-minute sessions) per day of exercise training (6 days a week) Description of control: NR Duration of intervention: 1 school year Length of follow-up: 1 school year

Study/Location	Nemet 2011b [143] Israel
Objective	To examine the prevalence of obesity and to prospectively study the effects of a health promotion, school-based intervention on nutrition and physical activity knowledge and preferences, anthropometric measures, and fitness in Arab-Israeli kindergarten children
Methods	Design: RCT Selection: kindergarten classes randomly assigned by computerized program to participate in intervention or to serve as controls (6 control, 5 intervention) Exclusion criteria: students not coming from low SES communities Unit of allocation: school Unit of analysis: child Intention to treat: no
Participants	Sample: 342 Intervention n=154; Control n=188 Age mean (SD) (years): Intervention: 5.36 (0.03); Control: 5.40 (0.02) Gender (Female): 45% Race/Ethnicity: predominantly Arab-Israeli SES: schools were selected from low SES Loss to follow-up: Intervention n=20; Control n=25
Intervention	Description of intervention: preschool teachers attended an all-day training session that covered nutrition and physical activity; 2 additional days held to collect feedback on the program and introduce new materials; parents and children were invited to 2 Health Festival days that focused on the major themes of the program (introduction of healthy nutrition, prevention of childhood obesity and beneficial effects of exercise in children) Description of control: no intervention Duration of intervention: 1 school year Length of follow-up: immediate post
Study/Location	Neumark-Sztainer 2003 [89] United States
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Neumark-Sztainer 2010 [105] United States
Objective	To evaluate a school-based program aimed at preventing weight-related problems in adolescent girls
Methods	Design: RCT Selection: girls in intervention and control schools invited to register for an all-girls physical education class as an alternative to the regular coeducational class; in participating schools, students were required to take one or two physical education classes to graduate; participation in the study class counted toward that requirement;

	recruitment materials designed to appeal to inactive girls interested in healthy weight management; class description included in the school catalogue; posters and flyers about the program were displayed at schools Exclusion criteria: high physical activity levels (≥1 hour/day) and eating disorder behaviours (vomiting or laxative use weekly or more) Unit of allocation: school Unit of analysis: individual Intention to treat: no
Participants	Sample: 356 Intervention n=182; Control n=174 Age mean (SD) (years): Intervention: 15.7 (1.13); Control: 15.8 (1.22) Gender (Female): 100% Loss to follow-up: Intervention n=5; Control n=15
Intervention	Description of intervention: New Moves included (1) 16 week physical education class (Be Fit 4 days/week) which also incorporated nutrition (Be Fueled) and social support/self-empowerment (Be Fab) sessions 1 day/week; (2) individual counseling sessions using motivation interviewing techniques; (3) lunch get-togethers (lunch bunches) 1/week during maintenance period; (4) minimal parent outreach activities Description of control: all girls physical education class Duration of intervention: 9 months Length of follow-up: immediate post
Study/Location	Ostbye 2012 [127] United States; Companion paper: Ostbye [211]
Objective	To evaluate the effects of Kids and Adults Now - Defeat Obesity! on enhancing healthy lifestyle behaviours in mother-preschooler (2-5 years old) dyads
Methods	Design: RCT Selection: mothers primarily identified from state birth certificates and screened for eligibility at 2-6 months postpartum Inclusion criteria: eligible mothers had a preschooler aged 2-5 years, self-reported pre-pregnancy (and measured postpartum) BMI ≥25, no medical conditions preventing daily physical activity, English literacy, regular telephone access, ≥18 years of age Unit of allocation: dyads Unit of analysis: child Intention to treat: no
Participants	Sample: 400 mother-child dyads Intervention n=200; Control n=200 Age mean (SD) (years): 3.06 (1.0) Gender (Female): Intervention 43.5%; Control 45% Loss to follow-up: Intervention n=50; Control n=49

Intervention	Description of intervention: 8 monthly mailed interactive kits, followed each month by a 20-30 minute telephone coaching session using motivational interviewing techniques; kits included child activities and incentives reinforcing the month's topic (e.g. a rewards chart, yoga mat, pedometer, portion plate) Description of control: monthly newsletters emphasizing pre-reading skills; retention encouraged by monetary incentives (up to $100 for completing all assessments) Duration of intervention: 12 months Length of follow-up: immediate post
Study/Location	Paineau 2008 [83] France
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Papadaki 2010 [117] Netherlands, Denmark, United Kingdom, Greece, Germany, Spain, Bulgaria and Czech Republic; Companion paper: Larsen [212]
Objective	To investigate the effect of protein and glycemic index on body composition among European children in the DiOGenes (diet, obesity, and genes) family-based study
Methods	Design: RCT Selection: volunteer families from 8 countries (Netherlands, Denmark, United Kingdom, Greece, Germany, Spain, Bulgaria, and Czech Republic; families attended a screening examination to determine eligibility [eligible families were generally healthy, with at least 1 parent overweight (BMI<27) and younger than 65 years, and at least 1 child between the age of 5 and 18 years] Exclusion criteria (for children): special diets, food intolerances, systemic infections or chronic diseases, use of medications that might influence study outcomes, drug or alcohol abuse Unit of allocation: family Unit of analysis: children Intention to treat: no
Participants	Sample: 465 Intervention 1 (LP/LGI) n=102; Intervention 2 (LP/HGI) n=87; Intervention 3 (HP/LGI) n=92; Intervention 4 (HP/HGI) n=96; Control n=88 Age mean (SD) (years): Overall males 11.9 (3.4); Overall females 12.4 (3.5) Gender (Female): 76% Loss to follow-up: 48%
Intervention	Description of intervention: trained dietician gave instructions on ad libitum diets; all diets were low in fat (25-30% of energy); target was for protein content to comprise 10-15% of energy intake in the low protein (LP) and 23-28% in the high protein (HP) groups, complying with the acceptable range (10-30%) for children aged 4 to 18 years; children in the low glycemic index (LGI) groups were advised to consume the LGI foods, and those in the high glycemic index (HGI) groups to consume the HGI foods

	Description of control: diet followed national dietary guidelines, with medium protein content and no specific instructions on glycemic index Duration of intervention: 6 months Length of follow-up: immediate post
Study/Location	Peralta 2009 [94] Australia
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Reed 2008 [82] Canada; Companion papers: Naylor,[213] Naylor [214]
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Reilly 2006 [70] Scotland
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Robinson 2003 [74] United States; Companion paper: Rochon [215]
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Robinson 2010 [106] United States
Objective	To test a 2-year community- and family-based obesity prevention program for low-income African American girls: Stanford GEMS
Methods	Design: RCT Selection: recruited from schools, community centers, churches, and community events in low-income, predominantly African American neighbourhoods; identified as African American or black by parent/guardian; aged 8 to 10 years; to select a community-based group at higher risk, girls required to have BMI ≥25th percentile for age and/or at least 1 overweight parent/guardian (BMI ≥25) Exclusion criteria: girls with BMI >35; diagnosed with medical condition or taking medications affecting growth; condition limiting participation in the interventions or assessments; unable to understand or complete the informed consent document; planned to move from the area; homeless; had no television Unit of allocation: families/households Unit of analysis: individual Intention to treat: yes
Participants	Sample: 284 Intervention n=134; Control n=127 Age mean (years): Intervention: 9.5; Control: 9.4 Gender (Female): 100% Loss to follow-up: Intervention n=32; Control n=27

Intervention	Description of intervention: GEMS Jewels after-school dance intervention offered 5 days per week, 12 months per year (excluding school holidays), at community centers in selected neighborhoods; daily sessions lasted up to 2.5 hours and started with a 1-hour homework period and small snack followed by 45 to 60 minutes of learning and practicing dance routines; dance classes led by female African American college students and/or recent graduates from the local community Description of control: active-placebo health education comparison intervention consisting of culturally tailored, information-based health education on nutrition, physical activity, and reducing cardiovascular and cancer risk; 24 monthly newsletters for the girls and their parents/guardians and quarterly community center health lectures Duration of intervention: 2 years Length of follow-up: 6 months
Study/Location	Rosario 2013 [154] Portugal; Companion paper: Rosario [216]
Objective	To examine the effects of a program run by teachers trained in nutrition, on consumption of low nutrient, energy-dense foods, by children attending elementary schools
Methods	Design: RCT Selection: 7 out of 80 public elementary schools from a city from the north of Portugal randomly selected and invited to participate Unit of allocation: school Unit of analysis: child Intention to treat: no
Participants	Sample: 464 Intervention n=233; Control n=231 Age mean (SD) (years): Intervention: 8.3 (1.2); Control: 8.2 (1.2) Gender (Female): Intervention 50.2%; Control 52.8% SES (mother's education up to 9 years): Intervention n=116 (58.6%); Control n=128 (69.9%); SES (father's education up to 9 years): Intervention n=122 (62.9%); Control n=132 (75.9%) Loss to follow-up: Intervention n=82; Control n=88
Intervention	Description of intervention: teachers attended 12 sessions on: health promotion and overweight/obesity prevention; food and nutrition and dietary guidelines (Portuguese Food Wheel); hydration and the importance of water; appropriate physical activity levels and healthy eating practices; teaching and learning strategies on healthy eating in the classroom; strategies to reduce screen time; healthy cooking and strategies to get children and families involved in healthy cooking; teachers delivered content to students and developed creative and engaging classroom activities about the topics Description of control: NR Duration of intervention: 24 months Length of follow-up: immediate post

Study/Location	Rosenkranz 2010 [107] United States
Objective	To evaluate the effectiveness of an intervention delivered through Girl Scout Junior troops designed to foster healthful troop meeting environments and increase obesity prevention behaviours at home
Methods	Design: RCT Selection: registered Girl Scout Junior troops, with girls in 4th and 5th grades; troops meet at least twice/month in facilities allowing physical activity and food preparation Exclusion criteria: troops not primarily composed of Girl Scout Juniors, not regularly meeting during the study period, or not having leader and parental consent for troop participation; individual girls were excluded if they could not speak or read English Unit of allocation: troops Unit of analysis: individual Intention to treat: no
Participants	Sample: 76 Intervention n=34; Control n=42 Age mean (SD) years: Intervention: 10.6 (1.1); Control: 10.5 (1.3) Gender (Female): 100% Race/Ethnicity: Intervention: Caucasian: 79.4%, Racial minority: 20.6%; Control: Caucasian: 75%, Racial minority: 25% Loss to follow-up: Intervention n=1; Control n=3
Intervention	Description of intervention: three main components: 1) an interactive educational curriculum delivered by troop leaders (8 modules, 60 to 90 minutes each, delivered over 4 months); 2) troop meeting policies implemented by troop leaders; and 3) badge assignments completed at home by girls with parental assistance Description of control: standard care Duration of intervention: 7 months Length of follow-up: immediate post
Study/Location	Rush 2012 [141] New Zealand; Companion papers: Graham,[217] Cole [8]
Objective	To compare changes in blood pressure and body composition in children who attended Energize schools with children in control schools
Methods	Design: RCT Selection: NR Inclusion criteria: NR Unit of allocation: school Unit of analysis: children Intention to treat: N/A
Participants	Sample: 1,352

	Intervention 1 n=492; Intervention 2 n=200; Control 1 n=434; Control 2 n=226 Age range (years): Intervention 1: 5-7; Intervention 2: 10-12; Control 1: 5-7; Control 2: 10-12 Gender (Female): Intervention 1 n=51%; Intervention 2 n=51%; Control 1 n=51%; Control 2 n=50% Race/Ethnicity: Intervention 1: European: 67%, Maori: 23%, Other: 9%; Intervention 2: European: 60%, Maori: 33%, Other: 7%; Control 1: European: 67%, Maori: 26%, Other: 7%; Control 2: European: 68%, Maori: 25%, Other: 7% Loss to follow-up: NR
Intervention	Description of intervention: program staff received training as a group in order to share experience, resources and skills; classes included fundamental movement skill training, ideas for 'huff and puff' fitness activities, modified games, and ball activities and sport-related games; teachers provided with ideas for managing children during physical activity sessions; program staff promoted active transport, lunchtime games, bike days and leadership training for students to be leaders of physical activities before and after school; program staff available to assist schools with healthy-eating initiatives Description of control: no intervention Duration of intervention: 2 years Length of follow-up: immediate post
Study/Location	Salcedo 2010 [108] Spain; Companion paper: Martínez-Vizcaíno [84]
Objective	To assess the impact of a 2-year recreational physical activity program in 1,044 fourth- and fifth-grade primary schoolchildren
Methods	Design: RCT Selection: 20 public schools in 20 towns in Cuenca Province Exclusion criteria: schools outside of Cuenca province Unit of allocation: school Unit of analysis: individual Intention to treat: no
Participants	Sample: 1,119 Intervention n=513; Control n=606 Age mean (SD) (years): Intervention: 10.6 (1.1); Control: 10.5 (1.3) Gender [Female n (%)]: Intervention n=231 (45%); Control n=289 (48%) Loss to follow-up: Intervention n=138; Control n=60
Intervention	Description of intervention: MOVI was a non-competitive and recreational physical activity program consisting of three 90-minute sessions per week, during approximately 28 weeks every year; physical activity sessions were planned by 2 qualified physical education teachers and were supervised by sports instructors; standard physical education curriculum (3 hours per week of physical activity at low to moderate intensity) was also provided in intervention schools

	Description of control: standard physical education curriculum Duration of intervention: 7 months Length of follow-up: immediate post
Study/Location	Shamah 2012 [131] Mexico
Objective	To assess the effectiveness of a nutrition and physical activity strategy, called "Nutrition on the Go" in maintaining the BMI values of school children in Mexico
Methods	Design: RCT Selection: 60 schools selected at random Exclusion criteria: schools outside of the State of Mexico Unit of allocation: class Unit of analysis: children Intention to treat: no
Participants	Sample: 1,019 Intervention n=509; Control n=510 Age mean (years): Intervention: 10; Control: 10 Gender [Female n (%)]: Intervention n=263 (51.6 %); Control n=253 (49.7%) Loss to follow-up: Intervention n=13; Control n=12
Intervention	Description of intervention: nutrition and physical activity workshops; sale of fruit and vegetables and water in the school store; organized physical activity twice a week; banners; recipe calendar Description of control: no intervention Duration of intervention: 6 months Length of follow-up: immediate post
Study/Location	Sichieri 2009 [85] Brazil
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Siegrist 2013 [155] Germany
Objective	To investigate the effects of a school-based prevention program on physical activity, fitness, and obesity
Methods	Design: RCT Selection: 60 primary schools in Bavaria, Germany were invited by mail or telephone Inclusion criteria: attendance in 2nd or 3rd grade and written consent from parents Unit of allocation: school Unit of analysis: child Intention to treat: no

Participants	Sample: 902 Intervention n=486; Control n=340 Age mean (SD) (years): Overall 8.4 (0.7) Gender [Female n (%)]: n=350 (48.3%) Loss to follow-up: Intervention n=59; Control n=43
Intervention	Description of intervention: educating and encouraging children, teachers and parents to live active and healthy lifestyles; monthly lessons lasting 45 minutes with three parts: 10 minute warm-up of high intensity running games, 30 min of exercises to improve body awareness and self-esteem with conversation about health-related topics, and 5 min relaxation exercises; worksheets and homework assignments plus monthly newsletters to stimulate parent-child interaction and support physical activity at home and in sports clubs; school environment altered to promote more physical activity; 2 parent training sessions about health issues; teacher trainings to increase students' physical activity during lessons and breaks Description of control: usual physical education curriculum Duration of intervention: 12 months Length of follow-up: immediate post
Study/Location	Simon 2008 [80] France; Companion papers: Simon [218,219]
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Singh 2009 [93] Netherlands
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Singhal 2010 [118] India
Objective	To study the effectiveness of a multi-component intervention for nutrition and lifestyle education on behaviour, anthropometry and metabolic risk profile in urban adolescents
Methods	Design: RCT Selection: NR Inclusion criteria: NR Unit of allocation: school Unit of analysis: individual Intention to treat: no
Participants	Sample: 209 Intervention n=101; Control n=108 Age mean (SD) (years): Intervention: 16.04 (0.41); Control: 16.0 (0.5) Gender (Female %): Intervention 38.6%; Control 41.7% Loss to follow-up: Intervention n=2; Control n=6

Intervention	Description of intervention: multi-component model including seven components of nutrition and lifestyle education aimed at changing knowledge, behaviour and risk profile of urban Asian Indian adolescents Description of control: no intervention Duration of intervention: 6 months Length of follow-up: immediate post
Study/Location	Story 2003[75] United States; Companion papers: Rochon,[215] Story [194]
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Story 2012 [126] United States
Objective	To develop and test the effectiveness of a school environment intervention, supplemented with family involvement, to reduce excessive weight gain by increasing physical activity and healthy eating practices among kindergarten and first-grade American Indian children
Methods	Design: RCT Selection: NR Exclusion criteria: NR Unit of allocation: school Unit of analysis: child Intention to treat: yes
Participants	Sample: 454 Intervention n=267; Control n=187 Age mean (SD) (years): Intervention: 5.87 (0.54); Control: 5.80 (0.51) Gender (Female): 49% Race/Ethnicity: Native American Loss to follow-up: NR
Intervention	Description of intervention: at least 60 min of physical activity at school each day using school PE, class walks outdoors, in-class action breaks, and active recess; healthy eating promoted through offering 1% white milk instead of 2%, whole, chocolate or other flavoured milks, serving recommended portions, purchasing and using low-calorie/fat foods, offering low-fat portion-controlled salad dressing, providing more fruits and vegetables, offering second helpings only on fruits and vegetables, teachers trained to limit daily snacks; modify home environment to reduce excessive caloric intake, reduce television watching, and increase physical activity; 4 family events related to nutrition and physical activity held at the schools Description of control: no intervention Duration of intervention: 14 weeks or 31 weeks Length of follow-up: immediate post

Study/Location	Telford 2012 [140] Australia; Companion paper: Telford [220]
Objective	To determine whether physical education taught by specialists contributed to academic development and prevention of obesity in elementary school children
Methods	Design: RCT Selection: government-funded schools in outer-city suburbs of similar average family income from an Australian education jurisdiction through invitations to principals; of 30 invited, 29 schools accepted; 13 schools (32 classes) randomly assigned to specialist-taught PE group and 16 schools (36 classes) to common-practice PE group Inclusion criteria: NR Unit of allocation: school Unit of analysis: child Intention to treat: no
Participants	Sample: 620 Intervention n=312; Control n=308 Age: NR Gender [Female n (%)]: Intervention n=154 (49%); Control n=149 (48%) Race/Ethnicity: White: 86%, Asian: 8%, Australian Aboriginal or Torres Strait Islander: 3%, Polynesian: 1%, Data missing: 2% Loss to follow-up: NR
Intervention	Description of intervention: students received 150 minutes per week of PE; specialist-taught PE included 90 minutes per week of PE from visiting specialists Description of control: common practice (PE from generalist classroom teachers) Duration of intervention: 2 years Length of follow-up: immediate post
Study/Location	Thivel 2011 [142] France
Objective	To assess the effect of a 6-month physical activity program on body composition and physical fitness among primary school children
Methods	Design: RCT Selection: primary school children recruited from local public schools that agreed to participate in the study Inclusion criteria: attendance in 1st or 2nd grade, taking part in standard physical education classes, participating in no more than 3 hours of extracurricular sports activity per week, free of any known disease, not involved in any other study Unit of allocation: school Unit of analysis: individual Intention to treat: N/A
Participants	Sample: 457

	Intervention n=229; Control n=228 Age: NR (1st and 2nd grade) Gender [Female n (%)]: Intervention n=117 (51%); Control n=112 (49%) Loss to follow-up: NR
Intervention	Description of intervention: 120 min (two times for 60 min) of supervised physical activity; 2 additional hours of physical education classes per week managed and taught by sports science students; sessions consisted of a 10-min warm-up followed by psychometric activities and exercises to improve coordination, flexibility, strength, speed, and endurance Description of control: regular 2 hours of physical education per week Duration of intervention: 6 months Length of follow-up: immediate post
Study/Location	Velez 2010 [109] United States
Objective	To examine the effects of a structured resistance training program on strength, body composition, and self-concept in normal and overweight Hispanic adolescents
Methods	Design: RCT Selection: recruited from a predominantly Hispanic high school in central New Jersey; Hispanic youth selected because of this population's greater propensity for obesity and their underrepresentation in resistance training research Exclusion criteria: known health (i.e., bone, joint, musculoskeletal, or cardiovascular) problems that would severely limit involvement in the resistance training sessions; already participating in structured resistance or aerobic training programs Unit of allocation: individual Unit of analysis: individual Intention to treat: no
Participants	Sample: 28 Intervention n=13; Control n=15 Age mean (SD) years: Overall: 16.14 (0.19) Gender [Female n (%)]: Intervention n=5 (38%); Control n=7 (47%) Loss to follow-up: 3
Intervention	Description of intervention: resistance training consisting of 35-40-minute sessions, 3 non-consecutive days/week, in lieu of PE class; workouts divided into upper body and lower body days; trainers met 3-4 students at a time at the school weight room and led them through planned workouts; instructed to maintain usual outside activities and diets Description of control: typical daily physical education/health class; total activity time per day was similar to intervention participants Duration of intervention: 12 weeks Length of follow-up: immediate post

Study/Location	Vizcaino 2008 [84] Spain
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Webber 2008 [92] United States
Comments	See Cochrane Review by Waters et al.[40] for details
Study/Location	Weeks 2012 [136] Australia
Objective	To determine the effect of a twice-weekly, school-based 10-minute jumping regime on muscle and fat tissue in healthy adolescent boys and girls
Methods	Design: RCT Selection: adolescents in the 9th grade of a local high school were recruited Inclusion criteria: sound general health, fully ambulatory and had written consent of a parent or guardian Exclusion criteria: endocrine disorder, metabolic disease or chronic renal pathology, taking medication known to affect the musculoskeletal system, recovering from lower limb injury or affected by any condition not compatible with intense physical activity Unit of allocation: individual Unit of analysis: individual Intention to treat: yes
Participants	Sample: 99 Intervention n=52; Control n=47 Age mean (SD) years: Overall boys 13.8 (0.4), Overall girls 13.7 (0.4) Gender (Female):54% Loss to follow-up: Intervention: 9, Control: 9
Intervention	Description of intervention: 10 minutes of supervised jumping activity at the start of each physical education class, 2 times per week for 8 months Description of control: regular PE warm-ups and stretching Duration of intervention: 1 school year Length of follow-up: 1 school year
Study/Location	Wen 2012 [135] Australia
Objective	To assess the effectiveness of a home based early intervention on BMI at age 2
Methods	Design: RCT Selection: research assistants gave pregnant women attending antenatal clinics a letter of invitation and information about the study Inclusion criteria: women were eligible if aged ≥16, expecting first child, between weeks 24-34 of pregnancy, able to communicate in English, lived in the local area

	Unit of allocation: mother Unit of analysis: child Intention to treat: yes
Participants	Sample: 667 Intervention n=337; Control n=330 Age range (years): Overall 0 to 2 Gender: NR Loss to follow-up: Intervention n=88; Control n=96
Intervention	Description of intervention: 4 community nurses recruited and trained to make 8 home visits, once at 30-36 weeks' gestation and 7 times after the birth (at 1, 3, 5, 9, 12, 18 and 24 months); at each visit, the nurse spent about one to two hours with the mother and infant and teaching specific skills and knowledge in relation to healthy infant feeding practices and active play and discussing family physical activity, nutrition, and social support as well as any issues and concerns raised by the mother Description of control: usual childhood nursing service from community health service nurses (at least one nurse visit for general support at home; some vulnerable families are offered multiple home visits) Duration of intervention: 24 months Length of follow-up: immediate post
Study/Location	Williamson 2012 [129] United States; Companion paper: Williamson [221]
Objective	To test the efficacy of two-school based programs for prevention of body weight/fat gain in all participants and in overweight children
Methods	Design: RCT Selection: students recruited through presentations, fliers and word of mouth Inclusion criteria: for schools: one of the 28 schools or elementary feeder schools in the LA GEAR UP program, located in a rural section of Louisiana, minimum of 100 students available for study; for students: in grades 4 to 6 Unit of allocation: school Unit of analysis: child Intention to treat: no
Participants	Sample: 2,097 Intervention 1 n=713; Intervention 2 n=760; Control n=587 Age mean (SD) years: Overall 10.5 (1.2) Gender (Female): 45% Loss to follow-up: Intervention 1 n=224; Intervention 2 n=207, Control n=196
Intervention	Description of intervention: Intervention 1:emphasis on modification of environmental cues, enhancement of social support, and promotion of self-efficacy for health behaviour change; goals compatible with conventional nutrition recommendations;

	promotion of 60 minutes of moderate to vigorous activity per day; meeting USDA guidelines for the National School Lunch Program and legislated requirements related to advertising fast foods and contents of vending machines and concessions in schools Intervention 2: emphasis on behaviour modification approaches designed to change personal factors (i.e., increased healthy eating habits, increased physical activity, and decreased sedentary behaviour); used internet-based HIPTeens program as a part of regular classroom instruction, combined with synchronous (on-line) internet counseling and asynchronous (email) communications for children and their parents; frequent prompts to promote sustained website usage Description of control: none of the prevention components hypothesized to yield weight gain prevention; a nonspecific control condition Duration of intervention: 28 months Length of follow-up: immediate post
Study/Location	Yin 2012[156] United States
Objective	To determine the effects of a 3-year after-school physical activity program, without restriction of dietary energy intake, on cardiometabolic outcomes
Methods	Design: RCT Selection: recruitment of children in 2nd and 3rd grades Exclusion criteria: NR Unit of allocation: school Unit of analysis: child Intention to treat: yes
Participants	Sample: 617 Intervention n=324; Control n=293 Age mean (SD) years: Overall 8.7 (0.5) Gender (Female): 53% Loss to follow-up: Intervention n=129; Control n=88
Intervention	Description of intervention: 120 min structured after-school program consisting of 40 min snack and teacher-assisted homework; 20 min skill based PA; 40 min vigorous PA; 20 min stretching/cool down; weekly health-related lesson Description of control: NR Duration of intervention: 33 months Length of follow-up: immediate post

Table 3: Broad Features of the Available Evidence

Designs	• 90 RCTs
Populations	• Not limited to normal weight children (overweight and obese children included, not excluded in most studies) • 20 interventions targeted children aged 0 to 5; 53 targeted children aged 6 to 12; 17 targeted youth aged 13 to 18 • 76 studies included boys and girls; 11 included only girls; 3 included only boys
Interventions	• 16 diet interventions, 20 exercise interventions, 32 diet plus exercise interventions, 22 lifestyle interventions • 62 studies had intervention arms in educational settings, 19 had intervention arms in non-educational settings, 8 studies had intervention arms in education plus other settings, 1 study had two intervention arms (one offered only in an education setting and one offered in education plus other settings) • 21 interventions used interactive education approaches; 25 used behavioural approaches; 8 used therapy, management or counseling; 36 used multicomponent strategies • 61 interventions (68%) were 12 months or less in duration; 87 interventions (97%) were 3 years or less in duration
Quality Assessment	• 73 RCTs (81%) were rated as having unclear or high risk of bias for the weight outcomes • Most outcomes received very low GRADE ratings (downgraded for risk of bias, inconsistency, indirectness; sometimes also downgraded for imprecision and occasionally also for reporting bias)
Study Locations	• 2 studies in Canada, 1 in Canada and the US, 39 in the US, 29 in European countries, 9 in Australia, 2 in Brazil, 2 in Israel, 1 in each of China, Egypt, India, Mexico, New Zealand and Thailand
Publication Dates	• 68 studies (76%) were published in the last 5 years; 22 were published between 1998 and 2008

Table 4: Key Findings of Overall and Sub-group Analyses for Continuous Outcomes (Change in: BMI/BMIz, BMI, Total Cholesterol, Triglycerides, HDL-C, SBP, DBP, Physical Fitness)*

Group or Sub-group	Meta-analysis (95% CI)	Statistical Heterogeneity (Within Group) P-Value, I^2-Value	Test for Between Group Differences P-Value, I^2-Value	No. Participants	No. Studies	GRADE Rating
Outcome: Change in BMI/BMIz (Standardized Mean Difference)						
Overall	-0.07 (-0.10, -0.03)	<0.00001, 74%	na	56,342	76	Very Low
Diet	-0.08 (-0.17, 0.01)	<0.00001, 81%	0.19, 37.4%	11,568	15	Very Low
Exercise	-0.08 (-0.16, 0.003)	<0.00001, 79%		15,902	18	Very Low
Diet + Exercise	-0.10 (-0.17, -0.03)	<0.00001, 70%		14,923	26	Very Low
Lifestyle	-0.003 (-0.06, 0.06)	0.004, 53%		13,949	17	Very Low
Non-Education Setting	-0.04 (-0.15, 0.08)	0.01, 46%	0.04, 68.0%	3,070	18	Very Low
Education Setting	-0.09 (-0.13, -0.04)	<0.00001, 78%		47,975	51	Very Low
Education + Other Settings	0.03 (-0.05, 0.12)	0.04, 52%		5,297	8	Very Low
Duration ≤12 Months	-0.08 (-0.13, -0.03)	<0.00001, 67%	0.32, 0%	28,220	54	Very Low
Duration >12 Months	-0.04 (-0.11, 0.02)	<0.00001, 82%		28,122	22	Very Low
Male	-0.16 (-0.29, -0.03)	<0.00001, 77%	0.76, 0%	5,719	16	Very Low
Female	-0.14 (-0.24, -0.03)	<0.00001, 80%		10,007	23	Very Low
Aged 0-5 Years	-0.06 (-0.15, 0.02)	0.0001, 62%	0.54, 0%	6,930	17	Very Low
Aged 6-12 Years	-0.06 (-0.10, -0.01)	<0.00001, 73%		36,916	42	Very Low
Aged 13-18 Years	-0.12 (-0.22, -0.02)	<0.00001, 80%		12,496	17	Very Low
Low Risk of Bias	-0.07 (-0.13, -0.0002)	0.006, 53%	0.30, 17.1%	8,542	13	Moderate
Unclear Risk of Bias	-0.06 (-0.11, -0.02)	<0.00001, 76%		47,342	62	Very Low
High Risk of Bias	-0.21 (-0.40, -0.03)	na		458	1	Very Low
Outcome: Change in BMI (kg/m^2; Mean Difference)						
Overall	-0.09 (-0.16, -0.03)	<0.00001, 76%	na	40,214	57	Very Low
Outcome: Change in Total Cholesterol (mmol/L; Mean Difference)						
Overall	-0.10 (-0.20, 0.01)	<0.00001, 86%	na	2,815	5	Very Low

Group or Sub-group	Meta-analysis (95% CI)	Statistical Heterogeneity (Within Group) P-Value, I^2-Value	Test for Between Group Differences P-Value, I^2-Value	No. Participants	No. Studies	GRADE Rating
Outcome: Change in Triglycerides (mmol/L; Mean Difference)						
Overall	-0.01 (-0.05, 0.03)	<0.0001, 81%	na	3,097	4	Very Low
Outcome: Change in High Density Lipoproteins (mmol/L; Mean Difference)						
Overall	0.07 (0.04, 0.10)	0.54, 0%	na	1,240	3	Low
Outcome: Change in Systolic Blood Pressure (mmHg; Mean Difference)						
Overall	-0.83 (-2.98, 1.31)	<0.00001, 96%	na	4,289	8	Very Low
Outcome: Change in Diastolic Blood Pressure (mmHg; Mean Difference)						
Overall	-0.31 (-1.71, 1.09)	<0.00001, 93%	na	4,289	8	Very Low
Outcome: Change in Physical Fitness (20 Meter Shuttle Run Test Laps/Stages; Standardized Mean Difference)						
Overall – Laps and Stages	0.32 (0.14, 0.50)	<0.00001, 85%	na	4,903	6	Low
Laps	0.32 (0.07, 0.58)	<0.00001, 89%	0.99, 0%	3,944	4	Low
Stages	0.33 (0.07, 0.58)	0.04, 75%		959	2	Low

*Two outcomes do not appear in this table: LDL-C data from 2 studies could not be pooled; no evidence was found that met inclusion criteria for Overall Quality of Life

Table 5: Key Findings of Overall Analysis for Dichotomous Outcome (Change in Prevalence of Overweight/Obesity)

Group	Effect				No. Participants	No. Studies	GRADE Rating
	RRi-RRc* (95% CI)	Absolute Number per Million (Range)	ARR	NNT (95% CI)			
Outcome: Change in Prevalence of Overweight/Obesity							
Overall	0.94 (0.89, 0.99)	19,641 fewer (3,462 to 35,002 fewer)	1.96%	51 (29, 289)	31,896	30	Very Low

***** The pooled estimate is based on differences in the risk ratio of intervention and control groups (RRi=ratio of pre-post prevalence in intervention arm, RRc=ratio of pre-post prevalence in control arm).

Table 6: Summary of Features of Efficacious Interventions

Study	Gender	Target Age Group	Intervention Duration	Estimated # or Frequency of Sessions	Intervention Focus	Intervention Setting	Group Sessions	Family Involvement	Staff Training
Amaro 2006 [78]	mixed	6 to 12	24 weeks	1x / week	diet	education	Y	-	-
Ansari 2010 [101]	mixed	13 to 18	3 months	2x / week	exercise	education	Y	-	-
Barkin 2012 [122]	mixed	0 to 5	12 weeks	1x / week	diet + exercise	non-education	Y	Y	-
Campbell 2013 [148]	mixed	0 to 5	15 months	6 2-hour sessions	diet	non-education	Y	Y	-
de Ruyter 2012 [123]	mixed	6 to 12	1.5 years	NA (daily consumption of beverages)	diet	education	-	-	-
Foster 2010 [96]	mixed	6 to 12	3 years	unclear	diet + exercise	education	Y	Y	Y
Haerens 2006 [91]	mixed	13 to 18	2 years	unclear	diet + exercise	education	Y	-	Y
Lazaar 2007 [79]	mixed	6 to 12	6 months	2x / week	exercise	education	Y	-	-
Li 2010 [98]	mixed	6 to 12	1 year	2x / day	exercise	education	Y	-	-
Llargues 2012 [134]	mixed	6 to 12	2 years	unclear	diet + exercise	education	Y	-	Y
Lubans 2011 [120]	male	13 to 18	6 months	unclear	exercise	education	Y	-	-
Nemet 2011b [143]	mixed	0 to 5	10 months	daily	diet + exercise	education	Y	-	Y
Neumark-Sztainer 2003 [89]	female	13 to 18	16 weeks	>4x / week	lifestyle	education	Y	-	Y
Rosario 2013 [154]	mixed	6 to 12	2 years	12 sessions	diet	education	Y	-	Y
Story 2003 [75]	female	6 to 12	3 months	2x / week	lifestyle	education + other	Y	Y	-
Thivel 2011 [142]	mixed	6 to 12	6 months	2 hours / week	exercise	education	Y	-	-

Table 7: Prevalence of Overweight and Obesity in Manitoba Children and Youth by Age, 2004 [160]

Age Group (Years)	Overweight (%)	Obese (%)	Overweight/Obese (%)
2 to 5	15.0	8.2	23.2
6 to 11	21.8	8.1	29.9
12 to 17	25.9	10.0	35.9

EVIDENCE SETS

- **Evidence Set 1: Weight – Change in BMI/BMIz and BMI**
- **Evidence Set 2: Weight – Change in Prevalence of Overweight/Obesity**
- **Evidence Set 3: Health/Physiological Outcomes – Change in Total Cholesterol**
- **Evidence Set 4: Health/Physiological Outcomes – Change in Triglycerides**
- **Evidence Set 5: Health/Physiological Outcomes – Change in HDL-C**
- **Evidence Set 6: Health/Physiological Outcomes – Change in SBP**
- **Evidence Set 7: Health/Physiological Outcomes – Change in DBP**
- **Evidence Set 8: Health/Physiological Outcomes – Change in Physical Fitness**
- **Evidence Set 9: Maintenance of Prevention Intervention Benefits**

Evidence Set 1: Do primary care relevant prevention interventions (behavioural) in normal weight children lead to short-term or sustained healthy BMI trajectories?

- Summary of Change in BMI/BMIz Evidence
- GRADE Evidence Profile Table 1.1: Effect of Prevention Interventions on BMI/BMIz
- GRADE Summary of Findings Table 1.1: Effect of Prevention Interventions on BMI/BMIz
- Forest Plots 1.1 to 1.7: Effect of Prevention Interventions on BMI/BMIz
    - 1.1: Overall
    - 1.1.1: Effect of Prevention Interventions on BMI Only – Overall and by Type of Intervention (Diet, Exercise, Diet plus Exercise, Lifestyle)
    - 1.2: Type of Intervention (Diet, Exercise, Diet plus Exercise, Lifestyle)
    - 1.3: Intervention Setting (Non-Education, Education, Education plus Other)
    - 1.4: Intervention Duration (≤12 Months, >12 Months)
    - 1.5: Gender
    - 1.6: Age Group (0 to 5 Years, 6 to 12 Years, 13 to 18 Years)
    - 1.7: Study Risk of Bias Rating (Low, Unclear, High)
- Funnel Plots 1.1 to 1.7: Effect of Prevention Interventions on BMI/BMIz
    - Same as bulleted list above
- Egger's Test Results (for Publication Bias)

Summary of Change in BMI/BMIz Evidence

1.1 Overall

- 76 studies; 56,342 participants
- Statistically significant lowered BMI/BMIz in the intervention group as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.07 (-0.10, -0.03)]
- High statistical heterogeneity across studies [Chi^2=340.80, df=90 (P<0.00001), I^2=74%]

1.1.1 Only Studies Reporting BMI

- Overall: 57 studies; 40,214 participants; statistically significant lower BMI in the intervention group compared to the control group [MD (95% CI) -0.09 kg/m^2 (-0.16, -0.03); I^2=76%]
- Diet: 9 studies; 6,671 participants; no difference between intervention and control group [MD (95% CI) -0.04 kg/m^2 (-0.19, 0.12); I^2=77%]
- Exercise: 16 studies; 15,021 participants; no difference between intervention and control group [MD (95% CI) -0.11 kg/m^2 (-0.23, 0.02); I^2=79%]
- Diet plus Exercise: 20 studies; 6,671 participants; statistically significant lower BMI in the intervention group compared to control group [MD (95% CI) -0.15 kg/m^2 (-0.26, -0.03); I^2=76%]
- Lifestyle: 13 studies; 10,150 participants; no difference between intervention and control group [MD (95% CI) 0.01 kg/m^2 (-0.11, 0.12); I^2=57%]
- Test for subgroup differences is not significant [Chi^2=3.86, df=3 (P=0.28), I^2=22.3%)]; type of intervention (diet, exercise, diet plus exercise, lifestyle) does not explain variation across studies

1.2 Type of Intervention

Test for subgroup differences is not significant [Chi^2=4.79, df=3 (P=0.19), I^2=37.4%]; type of intervention does not explain variation across studies

Diet

- 15 studies; 11,568 participants
- No statistically significant difference between the intervention group and control group in terms BMI/BMIz [SMD (95% CI) -0.08 (-0.17, 0.01)]
- High statistical heterogeneity across studies [Chi^2=74.06, df=14 (P<0.00001), I^2=81%]

Exercise

- 18 studies; 15,902 participants
- No statistically significant difference between the intervention group and control group in terms BMI/BMIz [SMD (95% CI) -0.08 (-0.16, 0.003)]
- High statistical heterogeneity across studies [Chi^2=112.04, df=24 (P<0.00001), I^2=79%]

Diet plus Exercise

- 26 studies; 14,923 participants
- Statistically significant lowered BMI/BMIz in the intervention group as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.10 (-0.17, -0.03)]
- High statistical heterogeneity across studies [Chi^2=103.75, df=31 (P<0.00001), I^2=70%]

Lifestyle

- 17 studies; 13,949 participants
- No statistically significant difference between the intervention group and control group in terms BMI/BMIz [SMD (95% CI) -0.003 (-0.06, 0.06)]
- Moderate statistical heterogeneity across studies [Chi^2=38.07, df=18 (P=0.004), I^2=53%]

1.3 Intervention Setting

Test for subgroup differences is significant [Chi^2=6.25, df=2 (P=0.04), I^2=68%]; intervention setting explains some of the variation across studies

Non-Education

- 18 studies; 3,070 participants
- No statistically significant difference between the intervention group and control group in terms BMI/BMIz [SMD (95% CI) -0.04 (-0.15, 0.08)]
- Moderate statistical heterogeneity across studies [Chi^2=33.64, df=18 (P=0.01), I^2=46%]

Education

- 51 studies; 47,975 participants
- Statistically significant lowered BMI/BMIz in the intervention group as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.09 (-0.13, -0.04)]
- High statistical heterogeneity across studies [Chi^2=288.29, df=63 (P<0.00001), I^2=78%]

Education plus Other

- 8 studies; 5,297 participants
- No statistically significant difference between the intervention group and control group in terms BMI/BMIz [SMD (95% CI) 0.03 (-0.05, 0.12)]
- Moderate statistical heterogeneity across studies [Chi^2=14.58, df=7 (P=0.04), I^2=52%]

1.4 Duration of Intervention

Test for subgroup differences is not significant [Chi^2=0.97, df=1 (P=0.32), I^2=0%]; duration of intervention does not explain variation across studies

≤12 Months

- 54 studies; 28,220 participants
- Statistically significant lowered BMI/BMIz in the intervention group as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.08 (-0.13, -0.03)]
- Moderate statistical heterogeneity across studies [Chi^2=185.94, df=62 (P<0.00001), I^2=67%]

>12 Months

- 22 studies; 28,122 participants
- No statistically significant difference between the intervention group and control group in terms BMI/BMIz [SMD (95% CI) -0.04 (-0.11, 0.02)]
- High statistical heterogeneity across studies [Chi^2=151.46, df=27 (P<0.00001), I^2=82%]

1.5 Gender

Test for subgroup differences is not significant [Chi^2=0.09, df=1 (P=0.76), I^2=0%]; gender does not explain variation across studies

Male

- 16 studies; 5,719 participants
- Statistically significant lowered BMI/BMIz in the intervention group as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.16 (-0.29, -0.03)]
- High statistical heterogeneity across studies [Chi^2=64.15, df=15 (P<0.00001), I^2=77%]

Female

- 23 studies; 10,007 participants
- Statistically significant lowered BMI/BMIz in the intervention group as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.14 (-0.24, -0.03)]
- High statistical heterogeneity across studies [Chi^2=117.09, df=23 (P<0.00001), I^2=80%]

1.6 Age Group

Test for subgroup differences is not significant [Chi^2=1.22, df=2 (P=0.54), I^2=0%]; age groups does not explain variation across studies

0 to 5 Years

- 17 studies; 6,930 participants
- No statistically significant difference between the intervention group and control group in terms BMI/BMIz [SMD (95% CI) -0.06 (-0.15, 0.02)]
- Moderate statistical heterogeneity across studies [Chi^2=50.48, df=19 (P=0.0001), I^2=62%]

6 to 12 Years

- 42 studies; 36,916 participants
- Statistically significant lowered BMI/BMIz in the intervention group as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.06 (-0.10, -0.01)]
- High statistical heterogeneity across studies [Chi^2=178.57, df=49 (P<0.00001), I^2=73%]

13 to 18 Years

- 17 studies; 12,496 participants
- Statistically significant lowered BMI/BMIz in the intervention group as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.12 (-0.22, -0.02)]
- High statistical heterogeneity across studies [Chi^2=101.92, df=20 (P<0.00001), I^2=80%]

1.7 Study Risk of Bias Rating

Test for subgroup differences is not significant [Chi^2=2.41, df=2 (P=0.30), I^2=17%]; study risk of bias rating does not explain variation across studies

Low Risk

- 13 studies; 8,542 participants
- Statistically significant lowered BMI/BMIz in the intervention group as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.07 (-0.13, -0.0002)]
- Moderate statistical heterogeneity across studies [Chi^2=33.86, df=16 (P=0.006), I^2=53%]

Unclear Risk

- 62 studies; 47,342 participants
- Statistically significant lowered BMI/BMIz in the intervention group as compared to the control group but the magnitude of the effect was very small [SMD (95% CI) -0.06 (-0.11, -0.02)]
- High statistical heterogeneity across studies [Chi^2=302.07, df=72 (P<0.00001), I^2=76%]

High Risk

- 1 study; 458 participants
- Statistically significant lowered BMI/BMIz in the intervention group as compared to the control group but the magnitude of the effect was small [SMD (95% CI) -0.21 (-0.40, -0.03)]

GRADE Evidence Profile Table 1.1: Effect of Prevention Interventions on BMI/BMIz*

Quality Assessment							No. of Participants		Effect	Quality	Importance
No. of Studies	Design	Risk of Bias	Inconsistency	Indirectness	Imprecision	Other Considerations	Intervention	Control	Standardized Mean Difference (95% CI)		
Change in BMI/BMIz: Overall (Better indicated by lower values)											
76	randomized trials[1]	serious risk[2]	serious inconsistency[3]	serious indirectness[4,5]	no serious imprecision[6]	reporting bias[7]	30,225	26,117	0.0671 lower (0.1049 to 0.0293 lower)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz: by Type of Intervention - Diet (Better indicated by lower values)											
15	randomized trials[8]	serious risk[9]	serious inconsistency[10]	serious indirectness[4,11]	serious imprecision[12]	none[13]	6,313	5,255	0.0783 lower (0.1715 lower to 0.0149 higher)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz: by Type of Intervention - Exercise (Better indicated by lower values)											
18	randomized trials[14]	serious risk[15]	serious inconsistency[16]	serious indirectness[4,17]	serious imprecision[18]	none[19]	7,894	8,008	0.0776 lower (0.1581 lower to 0.0030 higher)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz: by Type of Intervention - Diet plus Exercise (Better indicated by lower values)											
26	randomized trials[20]	serious risk[21]	serious inconsistency[22]	serious indirectness[4,23]	no serious imprecision[24]	none[25]	8,131	6,792	0.0983 lower (0.1707 to 0.0258 lower)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz: by Type of Intervention - Lifestyle (Better indicated by lower values)											
17	randomized trials[26]	serious risk[27]	no serious inconsistency[28]	serious indirectness[4,29]	serious imprecision[30]	none[31]	7,887	6,062	0.0034 lower (0.0630 lower to 0.0561 higher)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz: by Intervention Setting - Non-Education (Better indicated by lower values)											
18	randomized trials[32]	serious risk[33]	serious inconsistency[34]	serious indirectness[4,35]	serious imprecision[36]	none[37]	1,693	1,377	0.0365 lower (0.1490 lower to 0.0760 higher)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz: by Intervention Setting - Education (Better indicated by lower values)											
51	randomized trials[38]	serious risk[39]	serious inconsistency[40]	serious indirectness[4,41]	no serious imprecision[42]	reporting bias[43]	25,532	22,443	0.0869 lower (0.1310 to 0.0428 lower)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz: by Intervention Setting - Education plus Other (Better indicated by lower values)											
8	randomized trials[44]	serious risk[45]	serious inconsistency[46]	serious indirectness[4,47]	serious imprecision[48]	none[49]	3,000	2,297	0.0341 higher (0.0513 lower to 0.1196 higher)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz: by Intervention Duration ≤12 Months (Better indicated by lower values)											
54	randomized trials[50]	serious risk[51]	serious inconsistency[52]	serious indirectness[4,53]	no serious imprecision[54]	none[55]	14,641	13,579	0.0823 lower (0.1305 to 0.0342 lower)	⊕OOO VERY LOW	CRITICAL

Quality Assessment							No. of Participants		Effect	Quality	Importance
No. of Studies	Design	Risk of Bias	Inconsistency	Indirectness	Imprecision	Other Considerations	Intervention	Control	Standardized Mean Difference (95% CI)		
Change in BMI/BMIz: by Intervention Duration >12 Months (Better indicated by lower values)											
22	randomized trials[56]	serious risk[57]	serious inconsistency[58]	serious indirectness[4,59]	serious imprecision[60]	none[61]	15,584	12,538	0.0427 lower (0.1051 lower to 0.0197 higher)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz: by Gender - Male (Better indicated by lower values)											
16	randomized trials[62]	serious risk[63]	no serious inconsistency[64]	serious indirectness[4,65]	no serious imprecision[66]	reporting bias[67]	3,566	2,153	0.1621 lower (0.2901 to 0.0340 lower)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz: by Gender - Female (Better indicated by lower values)											
23	randomized trials[68]	serious risk[69]	serious inconsistency[70]	serious indirectness[4,71]	no serious imprecision[72]	reporting bias[73]	5,295	4,712	0.1362 lower (0.2442 to 0.0281 lower)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz: by Age Group - 0 to 5 Years (Better indicated by lower values)											
17	randomized trials[74]	serious risk[75]	serious inconsistency[76]	serious indirectness[4,77]	serious imprecision[78]	none[79]	3,644	3,286	0.0640 lower (0.1472 lower to 0.0193 higher)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz: by Age Group - 6 to 12 Years (Better indicated by lower values)											
42	randomized trials[80]	serious risk[81]	serious inconsistency[82]	serious indirectness[4,83]	no serious imprecision[84]	none[85]	19,520	17,396	0.0550 lower (0.1007 to 0.0094 lower)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz: by Age Group - 13 to 18 Years (Better indicated by lower values)											
17	randomized trials[86]	serious risk[87]	serious inconsistency[88]	serious indirectness[4,89]	no serious imprecision[90]	reporting bias[91]	7,061	5,435	0.1188 lower (0.2224 to 0.0152 lower)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz: by Study Risk of Bias Rating - Low (Better indicated by lower values)											
13	randomized trials[92]	no serious risk[93]	no serious inconsistency[94]	serious indirectness[4,95]	no serious imprecision[96]	none[97]	4,389	4,153	0.0669 lower (0.1337 to 0.0002 lower)	⊕⊕⊕O MODERATE	CRITICAL
Change in BMI/BMIz: by Study Risk of Bias Rating – Unclear (Better indicated by lower values)											
62	randomized trials[98]	serious risk[99]	serious inconsistency[100]	serious indirectness[4,101]	no serious imprecision[102]	none[103]	25,607	21,735	0.0642 lower (0.1086 to 0.0198 lower)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz: by Study Risk of Bias Rating – High (Better indicated by lower values)											
1	randomized trial[104]	very serious risk[105]	no serious inconsistency[106]	serious indirectness[4,107]	no serious imprecision[108]	none[109]	229	229	0.2133 lower (0.3970 to 0.0297 lower)	⊕OOO VERY LOW	CRITICAL

* Footnotes appear after the Summary of Findings Table

GRADE Summary of Findings Table 1.1: Effect of Prevention Interventions on BMI/BMIz

Outcome: Change in BMI/BMIz	In terms of standardized mean difference (95% CI), compared to the control group, the BMI/BMIz in the intervention groups was	No. of Participants (Studies)	Quality of the Evidence (GRADE)
Overall	**0.0671 lower** (0.1049 to 0.0293 lower)	56,342 (76 studies[1])	⊕⊖⊖⊖ **very low**[2,3,4,5,6,7]
By Type of Intervention - Diet	**0.0783 lower** (0.1715 lower to 0.0149 higher)	11,568 (15 studies[8])	⊕⊖⊖⊖ **very low**[4,9,10,11,12,13]
By Type of Intervention - Exercise	**0.0776 lower** (0.1581 lower to 0.0030 higher)	15,902 (18 studies[14])	⊕⊖⊖⊖ **very low**[4,15,16,17,18,19]
By Type of Intervention - Diet plus Exercise	**0.0983 lower** (0.1707 to 0.0258 lower)	14,923 (26 studies[20])	⊕⊖⊖⊖ **very low**[4,21,22,23,24,25]
By Type of Intervention - Lifestyle	**0.0034 lower** (0.0630 lower to 0.0561 higher)	13,949 (17 studies[26])	⊕⊖⊖⊖ **very low**[4,27,28,29,30,31]
By Intervention Setting - Non-Education	**0.0365 lower** (0.1490 lower to 0.0760 higher)	3,070 (18 studies[32])	⊕⊖⊖⊖ **very low**[4,33,34,35,36,37]
By Intervention Setting - Education	**0.0869 lower** (0.1310 to 0.0428 lower)	47,975 (51 studies[38])	⊕⊖⊖⊖ **very low**[4,39,40,41,42,43]
By Intervention Setting - Education plus Other	**0.0341 higher** (0.0513 lower to 0.1196 higher)	5,297 (8 studies[44])	⊕⊖⊖⊖ **very low**[4,45,46,47,48,49]
By Intervention Duration ≤ 12 Months	**0.0823 lower** (0.1305 to 0.0342 lower)	28,220 (54 studies[50])	⊕⊖⊖⊖ **very low**[4,51,52,53,54,55]
By Intervention Duration >12 Months	**0.0427 lower** (0.1051 lower to 0.0197 higher)	28,122 (22 studies[56])	⊕⊖⊖⊖ **very low**[4,57,58,59,60,61]
By Gender - Male	**0.1621 lower** (0.2901 to 0.0340 lower)	5,719 (16 studies[62])	⊕⊖⊖⊖ **very low**[4,63,64,65,66,67]
By Gender - Female	**0.1362 lower** (0.2442 to 0.0281 lower)	10,007 (23 studies[68])	⊕⊖⊖⊖ **very low**[4,69,70,71,72,73]
By Age Group - 0 to 5 Years	**0.0640 lower** (0.1472 lower to 0.0193 higher)	6,930 (17 studies[74])	⊕⊖⊖⊖ **very low**[4,75,76,77,78,79]
By Age Group - 6 to 12 Years	**0.0550 lower** (0.1007 to 0.0094 lower)	36,916 (42 studies[80])	⊕⊖⊖⊖ **very low**[4,81,82,83,84,85]
By Age Group - 13 to 18 Years	**0.1188 lower** (0.2224 to 0.0152 lower)	12,496 (17 studies[86])	⊕⊖⊖⊖ **very low**[4,87,88,89,90,91]
By Study Risk Of Bias Rating – Low	**0.0669 lower** (0.1337 to 0.0002 lower)	8,542 (13 studies[92])	⊕⊕⊕⊖ **moderate**[4,93,94,95,96,97]
By Study Risk of Bias Rating - Unclear	**0.0642 lower** (0.1086 to 0.0198 lower)	47,342 (62 studies[98])	⊕⊖⊖⊖ **very low**[4,99,100,101,102,103]
By Study Risk of Bias Rating - High	**0.2133 lower** (0.3970 to 0.0297 lower)	458 (1 study[104])	⊕⊖⊖⊖ **very low**[4,105,106,107,108,109]

Footnotes for GRADE Evidence Profile and Summary of Findings Tables for Effect of Prevention Interventions on BMI/BMIz

[1] The 76 studies are:[67-86,88-101,103-105,107-113,116-129,133,134,136,137,139-143,146-148,150-152,154-156] Immediate post assessment for all but 1 study; for this 1 study the data point closest to the immediate post was selected (Daniels[150] presents outcomes at 9 months post baseline assessment for an intervention that lasted 12 weeks).

[2] Using Cochrane's Risk of Bias tool, for this outcome 1 study (1%) was rated as high risk, 62 studies (82%) were rated as unclear risk and 13 studies (17%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (58%), allocation concealment (86%), blinding of outcome assessors (71%), and other sources of bias (36%; i.e., insufficiently powered and/or analysis did not account for clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that most of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[3] The statistical heterogeneity is high [Chi^2=340.80, df=90 (P<0.00001); I^2=74%], the direction of the effect is not consistent across studies and the confidence intervals do not all overlap. This body of evidence was downgraded for inconsistency.

[4] This body of evidence was downgraded because the population was not restricted to normal weight children and youth. Most studies included mixed weight samples.

[5] Across the 76 studies, most included mixed gender samples (n=63); 10 included only girls, 3 included only boys. About one-quarter (n=17) of the studies included children aged 0 to 5, about half (n=42) included children aged 6 to 12, and the remaining quarter (n=17) included youth aged 13 to 18. Most interventions were conducted in education settings (n=51); 17 studies conducted interventions in non-education settings, 7 studies used education and other settings for interventions, and one study had one intervention group in an education setting and a second intervention group used education and other settings. In terms of type of intervention, 15 were diet, 18 were exercise, 26 were diet plus exercise, and 17 were lifestyle. Control participants received usual care or no intervention in most studies (n=53); in about 30% of studies (n=23) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 54 (71%) studies (in about half of these studies the duration was 6 months or less) and duration was more than 12 months in 22 (29%) studies (range was from 13 to 48 months; most were 2 or 3 year programs). One study was conducted in Canada, one was jointly located in Canada and the US, 33 studies were conducted in the US, 25 in European countries, 9 in Australia or New Zealand, 2 in Israel, and 1 in each of Brazil, China, Egypt, India, and Thailand. Just under three-quarters of the studies (n=54) were published in the last 5 years (2009-2013); the remaining 22 studies were published between 1998 and 2008.

[6] The sample size is adequate (30,225 intervention; 26,117 control) and the pooled effect estimate is precise with a narrow confidence interval [SMD (95% CI) -0.0671 (-0.1049, -0.0293)]. This body of evidence was not downgraded for imprecision.

[7] The funnel plot for these studies and this outcome is asymmetrical. The Egger's test was conducted to detect publication bias; results were significant (P=0.019). This body of evidence was downgraded for suspected reporting bias.

[8] The 15 studies are:[72,77,78,81,83,85,90,117,121,123,124,139,148,150,154] Immediate post assessment for all but 1 study; for this 1 study the data point closest to the immediate post was selected (Daniels[150] presents outcomes at 9 months post baseline assessment for an intervention that lasted 12 weeks).

[9] Using Cochrane's Risk of Bias tool, for this outcome 1 study (7%) was rated as high risk, 11 studies (73%) were rated as unclear risk and 3 studies (20%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (47%), allocation

concealment (80%), blinding of outcome assessors (60%), and other sources of bias (40%; i.e., insufficiently powered and/or analysis did not account for clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that most of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[10] The statistical heterogeneity is high [Chi^2=74.06, df=14 (P<0.00001); I^2=81%], the direction of the effect is not consistent across studies and the confidence intervals do not all overlap. This body of evidence was downgraded for inconsistency.

[11] All 15 diet only studies included mixed gender samples. One-fifth (n=3) of the studies included children aged 0 to 5, about three-quarters (n=11) included children aged 6 to 12, and only 1 study included youth aged 13 to 18. Most interventions were conducted in education settings (n=9); 5 studies conducted interventions in non-education settings, 1 study used education and other settings for the intervention. Control participants received usual care or no intervention in most studies (n=9); in over one-third of studies (n=6) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 10 (67%) studies (in more than half of these studies the duration was 6 months or less) and duration was more than 12 months in 5 (31%) studies (range was from 15 to 36 months). Four studies were conducted in the US, 8 in European countries, 2 in Australia, and 1 in Brazil. Just under two-thirds of the studies (n=9) were published in the last 5 years (2009-2013); the remaining 6 studies were published between 2003 and 2008.

[12] The sample size is adequate (6,313 intervention; 5,255 control) but the pooled effect estimate is not precise with a confidence interval that includes the no effect value [SMD (95% CI) -0.0783 (-0.1715, 0.0149)]. This body of evidence was downgraded for imprecision.

[13] The funnel plot for these studies and this outcome is roughly symmetrical. The Egger's test was conducted to detect publication bias; results were not significant (P=0.140). This body of evidence was not downgraded for reporting bias.

[14] The 18 studies are:[67,70,79,80,82,84,86,92,98,101,103,108,109,120,136,140,142,156] Immediate post assessment for all studies.

[15] Using Cochrane's Risk of Bias tool, for this outcome no studies were rated as high risk, 14 studies (78%) were rated as unclear risk and 4 studies (22%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (72%), allocation concealment (89%), blinding of outcome assessors (67%), and other sources of bias (33%; i.e., insufficiently powered and/or analysis did not account for clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that most of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[16] The statistical heterogeneity is high [Chi^2=112.04, df=24 (P<0.00001); I^2=79%], the direction of the effect is not consistent across studies and the confidence intervals do not all overlap. This body of evidence was downgraded for inconsistency.

[17] Across the 18 exercise studies, most included mixed gender samples (n=16); 1 included only girls, 1 included only boys. Only 2 of the studies included children aged 0 to 5, most studies (n=11) included children aged 6 to 12, and the remaining 5 studies included youth aged 13 to 18. Almost all the interventions were conducted in education settings (n=17); 1 study used education and other settings for the intervention. Control participants received usual care or no intervention in all 18 studies. Intervention duration was 12 months or less in 12 (67%) studies (in 7 of these studies the duration was 6 months or less) and duration was more than 12 months in 6 (33%) studies (range was from 20 to 48 months; most were 2 or 3 year programs). One study was conducted in Canada, 4

studies were conducted in the US, 7 in European countries, 3 in Australia, and 1 in each of China, Egypt, and Thailand. Two-thirds of the studies (n=12) were published in the last 5 years (2009-2013); the remaining 6 studies were published between 1998 and 2008.

[18] The sample size is adequate (7,894 intervention; 8,008 control) but the pooled effect estimate is not precise with a confidence interval that includes the no effect value [SMD (95% CI) -0.0776 (-0.1581, 0.0030)]. This body of evidence was downgraded for imprecision.

[19] The funnel plot for these studies and this outcome is roughly symmetrical. The Egger's test was conducted to detect publication bias; results were not significant (P=0.131). This body of evidence was not downgraded for reporting bias.

[20] The 26 studies are:[68,69,71,73,76,91,93-96,100,104,105,107,110,112,116,119,122,127,128,134,137,141,143,152] Immediate post assessment for all studies.

[21] Using Cochrane's Risk of Bias tool, for this outcome no studies were rated as high risk, 20 studies (77%) were rated as unclear risk and 6 studies (23%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (50%), allocation concealment (81%), blinding of outcome assessors (73%), and other sources of bias (31%; i.e., insufficiently powered and/or analysis did not account for clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that most of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[22] The statistical heterogeneity is high [Chi^2=103.75, df=31 (P<0.00001); I^2=70%], the direction of the effect is not consistent across studies and the confidence intervals do not all overlap. This body of evidence was downgraded for inconsistency.

[23] Across the 26 diet plus exercise studies, most included mixed gender samples (n=18); 6 included only girls, 2 included only boys. About one-third (n=9) of the studies included children aged 0 to 5, about two-fifths (n=11) included children aged 6 to 12, and the remaining 6 studies included youth aged 13 to 18. Most interventions were conducted in education settings (n=17); 9 studies conducted interventions in non-education settings. Control participants received usual care or no intervention in more than half of the studies (n=15); in about 42% of studies (n=11) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 20 (77%) studies (in about half of these studies the duration was 6 months or less) and duration was more than 12 months in 6 (23%) studies (range was from 24 to 36 months). One study was conducted in Canada and the US, 15 studies were conducted in the US, 4 in European countries, 4 in Australia or New Zealand, and 2 in Israel. Three-quarters of the studies (n=20) were published in the last 5 years (2009-2013); the remaining 6 studies were published between 2003 and 2008.

[24] The sample size is adequate (8,131 intervention; 6,792 control) and the pooled effect estimate is precise with a narrow confidence interval [SMD (95% CI) -0.0983 (-0.1707, -0.0258)]. This body of evidence was not downgraded for imprecision.

[25] The funnel plot for these studies and this outcome is roughly symmetrical. The Egger's test was conducted to detect publication bias; results were not significant (P=0.546). This body of evidence was not downgraded for reporting bias.

[26] The 17 studies are:[74,75,88,89,97,99,111,113,118,125,126,129,133,146,147,151,155] Immediate post assessment for all studies.

[27] Using Cochrane's Risk of Bias tool, for this outcome no studies were rated as high risk, 16 studies (94%) were rated as unclear risk and 1 study (6%) was rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (59%), allocation concealment (94%), blinding of outcome assessors (76%), and other sources of bias (41%; i.e., insufficiently powered and/or analysis did not account for

clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that most of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[28] The statistical heterogeneity is moderate [Chi^2=38.07, df=18 (P=0.004); I^2=53%], and apart from 1 study, either there is benefit toward the interventions or no effect. This body of evidence was not downgraded for inconsistency.

[29] Across the 17 lifestyle studies, most included mixed gender samples (n=14); 3 included only girls. A few studies (n=3) included children aged 0 to 5, about half (n=9) included children aged 6 to 12, and the remaining 5 studies included youth aged 13 to 18. Most interventions were conducted in education settings (n=8); 2 studies conducted interventions in non-education settings, 5 studies used education and other settings for interventions, and 1 study had one intervention group in an education setting and a second intervention group used education and other settings. Control participants received usual care or no intervention in two-thirds of the studies (n=11); in about 6 studies control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 12 (71%) studies (in about half of these studies the duration was 6 months or less) and duration was more than 12 months in 5 (29%) studies (range was from 24 to 36 months). Ten studies were conducted in the US, 6 in European countries, and 1 in India. Most of the studies (n=14) were published in the last 5 years (2009-2013); the remaining 3 studies were published in 2003.

[30] The sample size is adequate (7,887 intervention; 6,062 control) but the pooled effect estimate is not precise with a confidence interval that includes the no effect value [SMD (95% CI) -0.0034 (-0.0630, 0.0561)]. This body of evidence was downgraded for imprecision.

[31] The funnel plot for these studies and this outcome is roughly symmetrical. The Egger's test was conducted to detect publication bias; results were not significant (P=0.460). This body of evidence was not downgraded for reporting bias.

[32] The 18 studies are:[68,73,74,76,90,100,104,107,113,116,117,122,125,127,139,147,148,150] Immediate post assessment for all but 1 study; for this 1 study the data point closest to the immediate post was selected (Daniels[150] presents outcomes at 9 months post baseline assessment for an intervention that lasted 12 weeks).

[33] Using Cochrane's Risk of Bias tool, for this outcome 1 study (6%) was rated as high risk, 14 studies (78%) were rated as unclear risk and 3 studies (17%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (28%), allocation concealment (83%), blinding of outcome assessors (56%), and other sources of bias (39%; i.e., insufficiently powered and/or analysis did not account for clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that most of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[34] The statistical heterogeneity is moderate [Chi^2=33.64, df=18 (P=0.01); I^2=46%], the direction of the effect is not consistent across studies and the confidence intervals do not all overlap. This body of evidence was downgraded for inconsistency.

[35] Across the 18 non-education setting studies, most included mixed gender samples (n=13); 5 included only girls. One-third (n=6) of the studies included children aged 0 to 5, half (n=9) included children aged 6 to 12, and the remaining 3 studies included youth aged 13 to 18. In terms of type of intervention, 5 were diet, 9 were diet plus exercise, and 4 were lifestyle. Control participants received usual care or no intervention in half of the studies (n=9); in the other half (n=9) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 15 (83%) studies (in most of these studies the duration was 6 months or less) and duration was more than 12 months in 3 (17%) studies (range was from

15 to 36 months). One study was conducted in Canada and the US, 12 studies were conducted in the US, 2 in European countries and 3 in Australia. Just under three-quarters of the studies (n=13) were published in the last 5 years (2009-2013); the remaining 5 studies were published between 2003 and 2006.

[36] The sample size is adequate (1,693 intervention; 1,377 control) but the pooled effect estimate is not precise with a confidence interval that includes the no effect value [SMD (95% CI) -0.0365 (-0.1490, 0.0760)]. This body of evidence was downgraded for imprecision.

[37] The funnel plot for these studies and this outcome is roughly symmetrical. The Egger's test was conducted to detect publication bias; results were not significant (P=0.683). This body of evidence was not downgraded for reporting bias.

[38] The 51 studies are:[67,69,71,72,77-82,84-86,89,91-99,101,103,105,108-112,118-121,123,124,128,129,133,134,136,137,140-143,146,152,154,156] Immediate post assessment for all studies.

[39] Using Cochrane's Risk of Bias tool, for this outcome 42 studies (82%) were rated as unclear risk and 9 studies (18%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (69%), allocation concealment (84%), blinding of outcome assessors (75%), and other sources of bias (31%; i.e., insufficiently powered and/or analysis did not account for clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that most of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[40] The statistical heterogeneity is high [Chi^2=288.29, df=63 (P<0.00001); I^2=78%], the direction of the effect is not consistent across studies and the confidence intervals do not all overlap. This body of evidence was downgraded for inconsistency.

[41] Across the 51 education setting studies, most included mixed gender samples (n=44); 3 included only girls, 4 included only boys. A small number (n=8) of the studies included children aged 0 to 5, more than half (n=29) included children aged 6 to 12, and the remaining quarter (n=14) included youth aged 13 to 18. In terms of type of intervention, 9 were diet, 17 were exercise, 17 were diet plus exercise, and 8 were lifestyle. Control participants received usual care or no intervention in most studies (n=40); in about one-fifth of the studies (n=11) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 33 (65%) studies (in about half of these studies the duration was 6 months or less) and duration was more than 12 months in 18 (35%) studies (range was from 18 to 36 months; most were 2 or 3 year programs). One study was conducted in Canada, 18 studies were conducted in the US, 19 in European countries, 6 in Australia or New Zealand, 2 in Israel, and 1 in each of Brazil, China, Egypt, India, and Thailand. Three-quarters of the studies (n=38) were published in the last 5 years (2009-2013); the remaining 13 studies were published between 1998 and 2008.

[42] The sample size is adequate (25,532 intervention; 22,443 control) and the pooled effect estimate is precise with a narrow confidence interval [SMD (95% CI) -0.0869 (-0.1310, -0.0428)]. This body of evidence was not downgraded for imprecision.

[43] The funnel plot for these studies and this outcome is asymmetrical. The Egger's test was conducted to detect publication bias; results were significant (P=0.005). This body of evidence was downgraded for suspected reporting bias.

[44] The 8 studies are:[70,75,83,88,125,126,151,155] Immediate post assessment for all studies.

[45] Using Cochrane's Risk of Bias tool, for this outcome no studies were rated as high risk, 7 studies (88%) were rated as unclear risk and 1 study (12%) was rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (63%), allocation concealment (88%), blinding of outcome assessors (63%), and other sources of bias (50%; i.e., insufficiently powered and/or analysis did not account for

clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that most of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[46] The statistical heterogeneity is moderate [Chi^2=14.58, df=7 (P=0.04); I^2=52%], the direction of the effect is not consistent across studies and the confidence intervals do not all overlap. This body of evidence was downgraded for inconsistency.

[47] Across the 8 education plus other setting studies, most included mixed gender samples (n=7); 1 included only girls. Three of the studies included children aged 0 to 5, and five studies included children aged 6 to 12. In terms of type of intervention, 1 was diet, 1 was exercise, and 6 were lifestyle. Control participants received usual care or no intervention in 5 studies; in the other 3 studies control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 6 (75%) studies (in half of these studies the duration was 6 months or less) and duration was more than 12 months in 2 (25%) studies (range was from 24 to 36 months). Four studies were conducted in the US and 4 in European countries. Five of the studies were published in the last 5 years (2009-2013); the remaining 3 studies were published between 2003 and 2008.

[48] The sample size is adequate (3,000 intervention; 2,297 control) but the pooled effect estimate is not precise with a confidence interval that includes the no effect value [SMD (95% CI) 0.0341 (-0.0513, 0.1196)]. This body of evidence was downgraded for imprecision.

[49] Too few studies to assess reporting bias.

[50] The 54 studies are:[67-71,73-79,82-85,88-90,93-95,97-101,103-105,107,109,110,112,113,117-122,124,126-128,133,136,139,142,143,147,150,152,155] Immediate post assessment for all but 1 study; for this 1 study the data point closest to the immediate post was selected (Daniels[150] presents outcomes at 9 months post baseline assessment for an intervention that lasted 12 weeks).

[51] Using Cochrane's Risk of Bias tool, for this outcome 44 studies (81%) were rated as unclear risk and 10 studies (19%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (54%), allocation concealment (87%), blinding of outcome assessors (76%), and other sources of bias (43%; i.e., insufficiently powered and/or analysis did not account for clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that most of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[52] The statistical heterogeneity is high [Chi^2=185.94, df=62 (P<0.00001); I^2=67%], the direction of the effect is not consistent across studies and the confidence intervals do not all overlap. This body of evidence was downgraded for inconsistency.

[53] Across the 54 studies with interventions lasting 12 months or less, most included mixed gender samples (n=43); 8 included only girls, 3 included only boys. About one-quarter (n=15) of the studies included children aged 0 to 5, about half (n=25) included children aged 6 to 12, and the remaining quarter (n=14) included youth aged 13 to 18. Most interventions were conducted in education settings (n=33); 15 studies conducted interventions in non-education settings, and 6 studies used education and other settings for interventions. In terms of type of intervention, 10 were diet, 12 were exercise, 20 were diet plus exercise, and 12 were lifestyle. Control participants received usual care or no intervention in 34 studies; in 20 studies control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 6 months or less in 33 (61%) studies. One study was conducted in Canada, one was jointly located in Canada and the US, 23 studies were conducted in the US, 16 in European countries, 6 in Australia, 2 in Israel, and 1 in each

of Brazil, China, Egypt, India, and Thailand. Just under 70% of the studies (n=37) were published in the last 5 years (2009-2013); the remaining 17 studies were published between 1998 and 2008.

[54] The sample size is adequate (14,641 intervention; 13,579 control) and the pooled effect estimate is precise with a narrow confidence interval [SMD (95% CI) -0.0823 (-0.1305, -0.0342)]. This body of evidence was not downgraded for imprecision.

[55] The funnel plot for these studies and this outcome is roughly symmetrical. The Egger's test was conducted to detect publication bias; results were not significant (P=0.052). This body of evidence was not downgraded for reporting bias.

[56] The 22 studies are:[72,80,81,86,91,92,96,108,111,116,123,125,129,134,137,140,141,146,148,151,154,156] Immediate post assessment for all studies.

[57] Using Cochrane's Risk of Bias tool, for this outcome 1 study (5%) was rated as high risk, 18 studies (82%) were rated as unclear risk and 3 studies (14%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (68%), allocation concealment (82%), blinding of outcome assessors (59%), and other sources of bias (18%; i.e., insufficiently powered and/or analysis did not account for clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that most of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[58] The statistical heterogeneity is high [Chi^2=151.46, df=27 (P<0.00001); I^2=82%], the direction of the effect is not consistent across studies and the confidence intervals do not all overlap. This body of evidence was downgraded for inconsistency.

[59] Across the 22 studies with intervention durations over 12 months, most included mixed gender samples (n=20); 2 included only girls. Only 2 of the studies included children aged 0 to 5, most (n=17) included children aged 6 to 12, and the remaining 3 studies included youth aged 13 to 18. Most interventions were conducted in education settings (n=18); 2 studies conducted interventions in non-education settings, 1 study used education and other settings for the intervention, and one study had one intervention group in an education setting and a second intervention group used education and other settings. In terms of type of intervention, 5 were diet, 6 were exercise, 6 were diet plus exercise, and 5 were lifestyle. Control participants received usual care or no intervention in most studies (n=19); in 3 studies control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration ranged from 15 to 48 month; most were 2 or 3 year programs). Ten studies were conducted in the US, 9 in European countries, and 3 in Australia or New Zealand. Just over three-quarters of the studies (n=17) were published in the last 5 years (2009-2013); the remaining 5 studies were published between 2003 and 2008.

[60] The sample size is adequate (15,584 intervention; 12,538 control) but the pooled effect estimate is not precise with a confidence interval that includes the no effect value [SMD (95% CI) -0.0427 (-0.1051, 0.0197)]. This body of evidence was downgraded for imprecision.

[61] The funnel plot for these studies and this outcome is roughly symmetrical. The Egger's test was conducted to detect publication bias; results were not significant (P=0.301). This body of evidence was not downgraded for reporting bias.

[62] The 16 studies are:[67,79,84,91,93,94,101,108,110,119,120,129,134,136,140,143] Immediate post assessment for all studies.

[63] Using Cochrane's Risk of Bias tool, for this outcome no studies were rated as high risk, 12 studies (75%) were rated as unclear risk and 4 studies (25%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (63%), allocation concealment (81%), blinding of outcome assessors (81%), and other sources of bias (38%; i.e., insufficiently powered and/or analysis did not account for

clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that most of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[64] The statistical heterogeneity is high [Chi^2=64.15, df=15 (P<0.00001); I^2=77%], but aside from 1 study, the meta-analysis shows either benefits for the interventions or no effect. This body of evidence was not downgraded for inconsistency.

[65] Across the 16 studies that either included boys only or reported data separately for male participants 3 included children aged 0 to 5, 7 included children aged 6 to 12, and the remaining 6 included youth aged 13 to 18. All interventions were conducted in education settings. In terms of type of intervention, 8 were exercise, 7 were diet plus exercise, and 1 was lifestyle. Control participants received usual care or no intervention in all but one study (n=15); in the exception the control group received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 11 (69%) studies (in almost half of these studies the duration was 6 months or less) and duration was more than 12 months in 5 (31%) studies (range was from 20 to 28 months). Two studies were conducted in the US, 6 in European countries, 4 in Australia, 2 in Israel, and 1 in each of Egypt and Thailand. Most of the studies (n=12) were published in the last 5 years (2009-2013); the remaining 4 studies were published between 1998 and 2008.

[66] The sample size is adequate (3,566 intervention; 2,153 control) and the pooled effect estimate is precise with a narrow confidence interval [SMD (95% CI) -0.1621 (-0.2901, -0.0340)]. This body of evidence was not downgraded for imprecision.

[67] The funnel plot for these studies and this outcome is asymmetrical. The Egger's test was conducted to detect publication bias; results were significant (P=0.026). This body of evidence was downgraded for suspected reporting bias.

[68] The 23 studies are:[67,73-76,79,84,89,91-93,101,105,107,108,110,116,128,129,134,136,140,143] Immediate post assessment for all studies.

[69] Using Cochrane's Risk of Bias tool, for this outcome no studies were rated as high risk, 19 studies (83%) were rated as unclear risk and 4 studies (17%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (52%), allocation concealment (87%), blinding of outcome assessors (78%), and other sources of bias (35%; i.e., insufficiently powered and/or analysis did not account for clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that most of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[70] The statistical heterogeneity is high [Chi^2=117.09, df=23 (P<0.00001); I^2=80%], the direction of the effect is not consistent across studies and the confidence intervals do not all overlap. This body of evidence was downgraded for inconsistency.

[71] Across the 23 studies that included only girls or provided data separately for female participants, 3 of the studies included children aged 0 to 5, 12 included children aged 6 to 12, and the remaining 8 included youth aged 13 to 18. Most interventions were conducted in education settings (n=17); 5 studies conducted interventions in non-education settings, and 1 study used education and other settings for the intervention. In terms of type of intervention, 8 were exercise, 11 were diet plus exercise, and 4 were lifestyle. Control participants received usual care or no intervention in most studies (n=17); in 6 studies control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 16 (70%) studies (in half of these studies the duration was 6 months or less) and duration was more than 12 months in 7 (30%) studies (range was from 20 to 36 months). Ten studies were conducted in the US, 6 in European countries, 3 in Australia, 2 in Israel, and 1 in each of Egypt and Thailand. Just over half of the studies (n=13) were published in the last 5 years (2009-2013); the remaining 10 studies were published between 1998 and 2008.

[72] The sample size is adequate (5,295 intervention; 4,712 control) and the pooled effect estimate is precise with a narrow confidence interval [SMD (95% CI) -0.1362 (-0.2422, -0.0281)]. This body of evidence was not downgraded for imprecision.

[73] The funnel plot for these studies and this outcome is asymmetrical. The Egger's test was conducted to detect publication bias; results were significant (P=0.011). This body of evidence was downgraded for suspected reporting bias.

[74] The 17 studies are:[67-71,110,112,122,126,127,133,139,143,148,150-152] Immediate post assessment for all but 1 study; for this 1 study the data point closest to the immediate post was selected (Daniels[150] presents outcomes at 9 months post baseline assessment for an intervention that lasted 12 weeks).

[75] Using Cochrane's Risk of Bias tool, for this outcome 1 study (6%) was rated as high risk, 12 studies (71%) were rated as unclear risk and 4 studies (23%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (59%), allocation concealment (82%), blinding of outcome assessors (59%), and other sources of bias (29%; i.e., insufficiently powered and/or analysis did not account for clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that most of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[76] The statistical heterogeneity is moderate [Chi^2=50.48, df=19 (P=0.0001); I^2=62%], the direction of the effect is not consistent across studies and the confidence intervals do not all overlap. This body of evidence was downgraded for inconsistency.

[77]All 17 studies included mixed gender samples of children aged 0 to 5 years. About half of the interventions were conducted in education settings (n=8); 6 studies conducted interventions in non-education settings, and 3 studies used education and other settings for interventions. In terms of type of intervention, 3 were diet, 2 were exercise, 9 were diet plus exercise, and 3 were lifestyle. Control participants received usual care or no intervention in about half of the studies (n=9); in the other half (n=8) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 15 (88%) studies (in two thirds of these studies the duration was 6 months or less) and duration was more than 12 months in 2 (12%) studies (range was from 16 to 24 months). One study was conducted in Canada and the US, 7 studies were conducted in the US, 4 in European countries, 2 in Australia, 2 in Israel, and 1 in Thailand. Just under three-quarters of the studies (n=12) were published in the last 5 years (2009-2013); the remaining 5 studies were published between 1998 and 2008.

[78] The sample size is adequate (3,644 intervention; 3,286 control) but the pooled effect estimate is not precise with a confidence interval that includes the no effect value [SMD (95% CI) -0.0640 (-0.1472, 0.0193)]. This body of evidence was downgraded for imprecision.

[79] The funnel plot for these studies and this outcome is roughly symmetrical. The Egger's test was conducted to detect publication bias; results were not significant (P=0.240). This body of evidence was not downgraded for reporting bias.

[80] The 42 studies are:[72-86,88,95-98,103,104,107,108,111,116,117,119,121,123-125,129,134,137,140-142,147,154-156] Immediate post assessment for all studies.

[81] Using Cochrane's Risk of Bias tool, for this outcome 36 studies (86%) were rated as unclear risk and 6 studies (14%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (52%), allocation concealment (86%), blinding of outcome assessors (76%), and other sources of bias (38%; i.e., insufficiently powered and/or analysis did not account for clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that most of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[82] The statistical heterogeneity is high [Chi^2=178.57, df=49 (P<0.00001); I^2=73%], the direction of the effect is not consistent across studies and the confidence intervals do not all overlap. This body of evidence was downgraded for inconsistency.

[83] Across the 42 studies, most included mixed gender samples (n=35); 6 included only girls, 1 included only boys. All studies included children aged 6 to 12. Most interventions were conducted in education settings (n=28); 8 studies conducted interventions in non-education settings, 4 studies used education and other settings for interventions, and one study had one intervention arm in an education setting and a second intervention arm in education plus other settings. In terms of type of intervention, 11 were diet, 11 were exercise, 11 were diet plus exercise, and 9 were lifestyle. Control participants received usual care or no intervention in most studies (n=31); in about 25% of studies (n=11) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 25 (60%) studies (in just over half of these studies the duration was 6 months or less) and duration was more than 12 months in 17 (40%) studies (range was from 18 to 48 months; most were 2 or 3 year programs). One study was conducted in Canada, 19 studies were conducted in the US, 17 in European countries, 3 in Australia or New Zealand, and 1 in each of Brazil and China. Just under three-quarters of the studies (n=29) were published in the last 5 years (2009-2013); the remaining 13 studies were published between 2003 and 2008.

[84] The sample size is adequate (19,520 intervention; 17,396 control) and the pooled effect estimate is precise with a narrow confidence interval [SMD (95% CI) -0.0550 (-0.1007, -0.0094)]. This body of evidence was not downgraded for imprecision.

[85] The funnel plot for these studies and this outcome is roughly symmetrical. The Egger's test was conducted to detect publication bias; results were not significant (P=0.607). This body of evidence was not downgraded for reporting bias.

[86] The 17 studies are:[89-94,99-101,105,109,113,118,120,128,136,146] Immediate post assessment for all studies.

[87] Using Cochrane's Risk of Bias tool, for this outcome no studies were rated as high risk, 14 studies (82%) were rated as unclear risk and 3 studies (18%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (71%), allocation concealment (82%), blinding of outcome assessors (71%), and other sources of bias (35%; i.e., insufficiently powered and/or analysis did not account for clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that most of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[88] The statistical heterogeneity is high [Chi^2=101.92, df=20 (P<0.00001); I^2=80%], the direction of the effect is not consistent across studies and the confidence intervals do not all overlap. This body of evidence was downgraded for inconsistency.

[89] Across the 17 studies, most included mixed gender samples (n=11); 4 included only girls, 2 included only boys. All studies included youth aged 13 to 18. Most interventions were conducted in education settings (n=14) and 3 studies conducted interventions in non-education settings. In terms of type of intervention, 1 was diet, 5 were exercise, 6 were diet plus exercise, and 5 were lifestyle. Control participants received usual care or no intervention in most studies (n=13); in about one-quarter of studies (n=4) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 14 (82%) studies (in over half of these studies the duration was 6 months or less) and duration was more than 12 months in 3 (18%) studies (range was from 24 to 36 months). Seven studies were conducted in the US, 4 in European countries, 4 in Australia, and 1 in each of Egypt and India. Three-quarters of the studies (n=13) were published in the last 5 years (2009-2013); the remaining 4 studies were published between 2003 and 2008.

[90] The sample size is adequate (7,061 intervention; 5,435 control) and the pooled effect estimate is precise with a narrow confidence interval [SMD (95% CI) -0.1188 (-0.2224, -0.0152)]. This body of evidence was not downgraded for imprecision.

[91] The funnel plot for these studies and this outcome is asymmetrical. The Egger's test was conducted to detect publication bias; results were significant (P=0.008). This body of evidence was downgraded for suspected reporting bias.

[92] The 13 studies are:[70,72,84,90,93,100,103,104,110,123,133,141,143] Immediate post assessment for all studies.

[93] Using Cochrane's Risk of Bias tool, for this outcome 13 studies were rated as low risk. Across studies, there was some lack of certainty (unclear ratings) or a high risk of bias associated with allocation concealment (31%), blinding of outcome assessors (23%), and other sources of bias (8%; i.e., insufficiently powered and/or analysis did not account for clustering). Due to the nature of behavioural interventions, there is a high risk of bias for blinding of participants and personnel across studies. Given that all of the information is from studies at low risk of bias, this body of evidence was not downgraded for study limitations.

[94] The statistical heterogeneity is moderate [Chi^2=33.86, df=16 (P=0.006); I^2=53%] and the meta-analysis shows either benefits toward the interventions or no effect. This body of evidence was not downgraded for inconsistency.

[95] All 13 studies assigned a low risk of bias, included mixed gender samples. About one-third (n=4) of the studies included children aged 0 to 5, about half (n=6) included children aged 6 to 12, and the remaining 3 studies included youth aged 13 to 18. Most interventions were conducted in education settings (n=9); 3 studies conducted interventions in non-education settings, and 1 study used education and other settings for the intervention. In terms of type of intervention, 3 were diet, 3 were exercise, 6 were diet plus exercise, and 1 was lifestyle. Control participants received usual care or no intervention in most studies (n=10); in 3 studies control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 10 (77%) studies (in 4 of these studies the duration was 6 months or less) and duration was more than 12 months in 3 (23%) studies (range was from 18 to 36 months). Three studies were conducted in the US, 6 in European countries, 2 in Australia or New Zealand, and 2 in Israel. About 70% of the studies (n=9) were published in the last 5 years (2009-2013); the remaining 4 studies were published between 2003 and 2008.

[96] The sample size is adequate (4,389 intervention; 4,153 control) and the pooled effect estimate is precise with a narrow confidence interval [SMD (95% CI) -0.0669 (-0.1337, -0.0002)]. This body of evidence was not downgraded for imprecision.

[97] The funnel plot for these studies and this outcome is roughly symmetrical. The Egger's test was conducted to detect publication bias; results were not significant (P=0.200). This body of evidence was not downgraded for reporting bias.

[98] The 62 studies are:[67-69,71,73-83,85,86,88,89,91,92,94-99,101,105,107-109,111-113,116-122,124-129,134,136,137,139,140,142,146,147,150-152,154-156] Immediate post assessment for all but 1 study; for this 1 study the data point closest to the immediate post was selected (Daniels[150] presents outcomes at 9 months post baseline assessment for an intervention that lasted 12 weeks).

[99] Using Cochrane's Risk of Bias tool, for this outcome 62 studies were rated as unclear risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (71%), allocation concealment (97%), blinding of outcome assessors (81%), and other sources of bias (42%; i.e., insufficiently powered and/or analysis did not account for clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that all of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[100] The statistical heterogeneity is high [Chi^2=302.07, df=72 (P<0.00001); I^2=7%], the direction of the effect is not consistent across studies and the confidence intervals do not all overlap. This body of evidence was downgraded for inconsistency.

[101] Across the 62 studies assessed as having unclear risk of bias, most included mixed gender samples (n=49); 10 included only girls, 3 included only boys. About one-fifth (n=12) of the studies included children aged 0 to 5, just over half (n=36) included children aged 6 to 12, and the remaining 14 studies included youth aged 13 to 18. Most interventions were conducted in education settings (n=42); 13 studies conducted interventions in non-education settings, 6 studies used education and other settings for interventions, and one study had one intervention group in an education setting and a second intervention group used education and other settings. In terms of type of intervention, 11 were diet, 15 were exercise, 20 were diet plus exercise, and 16 were lifestyle. Control participants received usual care or no intervention in most studies (n=43); in about 30% of studies (n=19) control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 44 (71%) studies (in about half of these studies the duration was 6 months or less) and duration was more than 12 months in 18 (29%) studies (range was from 20 to 48 months; most were 2 or 3 year programs). One study was conducted in Canada, one was jointly located in Canada and the US, 30 studies were conducted in the US, 19 in European countries, 6 in Australia, and 1 in each of Brazil, China, Egypt, India, and Thailand. Just under three-quarters of the studies (n=44) were published in the last 5 years (2009-2013); the remaining 18 studies were published between 1998 and 2008.

[102] The sample size is adequate (25,607 intervention; 21,735 control) and the pooled effect estimate is precise with a narrow confidence interval [SMD (95% CI) -0.0642 (-0.1086, -0.0198)]. This body of evidence was not downgraded for imprecision.

[103] The funnel plot for these studies and this outcome is roughly symmetrical. The Egger's test was conducted to detect publication bias; results were not significant (P=0.068). This body of evidence was not downgraded for reporting bias.

[104] The 1 study is:[148] Immediate post assessment.

[105] Using Cochrane's Risk of Bias tool, for this outcome 1 study was rated as high risk. In this study there was a high risk of bias associated with allocation concealment and blinding of outcome assessors. Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that all of the information is from a study at high risk of bias, this body of evidence was downgraded for very serious study limitations.

[106] Single study; therefore cannot assess for inconsistency.

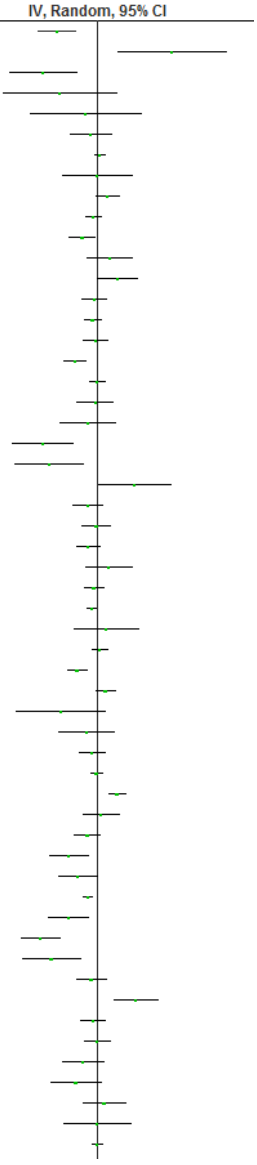
[107] This high risk of bias study included a mixed gender sample of children aged 0 to 5. The 15 month diet intervention was conducted in a non-education setting in Australia. Control participants received a minimal component (e.g., newsletters covering general health concepts). The study was published in the last 5 years (2013).

[108] The sample size is adequate (229 intervention; 229 control) and the pooled effect estimate is precise with a narrow confidence interval [SMD (95% CI) -0.2133 (-0.3970, -0.0297)]. This body of evidence was not downgraded for imprecision.

[109] Too few studies to assess reporting bias.

Forest Plot 1.1: Effect of Prevention Interventions on BMI/BMIz – Overall

Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
Amaro 2006-z	-0.125	0.683	153	0.255	0.634	88	1.0%	-0.5691 [-0.8363, -0.3020]
Baranowski 2003-F	3.5	3.527	17	-2.2	6.927	14	0.2%	1.0422 [0.2823, 1.8021]
Barkin 2012	-0.51	0.87	35	0.06	0.61	40	0.5%	-0.7598 [-1.2303, -0.2892]
Beech 2003-1F	-1.2	6.587	21	2.1	4.85	9	0.2%	-0.5228 [-1.3165, 0.2708]
Beech 2003-2F	1.3	4.792	21	2.1	4.85	9	0.2%	-0.1619 [-0.9440, 0.6202]
Black 2010-z	-0.03	0.539	91	0.02	0.504	93	0.9%	-0.0955 [-0.3846, 0.1937]
Bonsergent 2013	0.71	1.49	1949	0.66	1.45	1589	1.8%	0.0340 [-0.0323, 0.1002]
Brown 2013	0.3	0.7	31	0.3	1.2	32	0.5%	0.0000 [-0.4939, 0.4939]
Burgi 2012	0.1	0.656	333	0	0.744	292	1.5%	0.1430 [-0.0143, 0.3003]
Caballero 2003	3	1.858	727	3.1	1.933	682	1.7%	-0.0528 [-0.1573, 0.0517]
Campbell 2013-z	1.2	0.488	229	1.3	0.447	229	1.3%	-0.2133 [-0.3970, -0.0297]
Crespo 2012-1z	0.06	0.54	96	-0.03	0.49	67	0.8%	0.1722 [-0.1403, 0.4848]
Crespo 2012-2z	0.109	0.487	211	-0.03	0.49	67	1.0%	0.2842 [0.0083, 0.5601]
Daniels 2012-z	0.61	0.95	260	0.65	0.84	281	1.4%	-0.0447 [-0.2133, 0.1240]
De Coen 2012-z	-0.01	0.45	670	0.02	0.406	442	1.6%	-0.0692 [-0.1894, 0.0509]
de Heer 2011	-0.17	1.971	242	-0.12	1.933	326	1.4%	-0.0256 [-0.1919, 0.1407]
de Ruyter 2012-z	0.02	0.41	319	0.15	0.42	322	1.5%	-0.3128 [-0.4686, -0.1571]
Donnelly 2009	2	1.9	792	2	1.9	698	1.7%	0.0000 [-0.1018, 0.1018]
Dzewaltowski 2010	0.1	3.473	134	0.2	3.175	112	1.0%	-0.0298 [-0.2808, 0.2211]
Ebbeling 2006	0.07	1.019	53	0.21	1.061	50	0.6%	-0.1337 [-0.5205, 0.2532]
El Ansari 2010-F	-1.3	5.774	45	3.3	6.114	45	0.6%	-0.7670 [-1.1958, -0.3382]
El Ansari 2010-M	-1.2	4.493	35	2.1	5.092	35	0.5%	-0.6796 [-1.1623, -0.1970]
Escribano 2012-z	0.399	0.421	41	0.18	0.412	25	0.4%	0.5182 [0.0126, 1.0238]
Fitzgibbon 2005	0.05	0.669	179	0.14	0.676	183	1.2%	-0.1335 [-0.3398, 0.0727]
Fitzgibbon 2006	0.11	1.54	196	0.13	1.504	187	1.3%	-0.0131 [-0.2135, 0.1872]
Fitzgibbon 2011	0.11	0.879	309	0.22	0.837	280	1.4%	-0.1278 [-0.2897, 0.0340]
Fitzgibbon 2013	0.16	0.421	71	0.09	0.424	72	0.8%	0.1648 [-0.1636, 0.4932]
Foster 2008	1.99	2.203	479	2.1	2.133	364	1.6%	-0.0506 [-0.1869, 0.0857]
Foster 2010-z	-0.05	0.474	2307	-0.01	0.49	2296	1.9%	-0.0830 [-0.1408, -0.0252]
French 2011-z	-0.02	0.55	38	-0.09	0.55	38	0.5%	0.1260 [-0.3241, 0.5761]
Gentile 2009	0.6	2.873	582	0.5	2.847	619	1.7%	0.0349 [-0.0782, 0.1481]
Haerens 2006-F	1.183	1.711	499	1.66	1.609	352	1.6%	-0.2854 [-0.4225, -0.1483]
Haerens 2006-M	1.396	1.591	1201	1.22	1.29	239	1.5%	0.1138 [-0.0250, 0.2527]
Harvey-Berino 2003-z	-0.27	1.1	20	0.31	1.1	20	0.3%	-0.5168 [-1.1480, 0.1144]
Howe 2011-M	0.15	2.339	62	0.5	2.022	44	0.6%	-0.1570 [-0.5439, 0.2300]
James 2004	0.62	0.79	237	0.71	1.45	237	1.4%	-0.0770 [-0.2571, 0.1032]
Jansen 2011	0.58	1.706	1240	0.599	1.639	1382	1.8%	-0.0114 [-0.0880, 0.0653]
Katz 2011	0.5	1.5	622	0.003	2.1	526	1.6%	0.2760 [0.1593, 0.3926]
Klesges 2010-F	3	4.325	118	2.8	3.887	127	1.1%	0.0486 [-0.2021, 0.2992]
Kriemler 2010	0.23	1.171	297	0.4	1.26	205	1.4%	-0.1405 [-0.3187, 0.0377]
Lazaar 2007-F	-0.13	1.216	99	0.318	1.034	115	1.0%	-0.3979 [-0.6693, -0.1265]
Lazaar 2007-M	-0.1	1.365	99	0.218	0.976	115	1.0%	-0.2704 [-0.5403, -0.0004]
Li 2010	0.56	1.15	2072	0.72	1.2	2115	1.9%	-0.1361 [-0.1967, -0.0754]
Llargues 2012-F	0.8	1.354	109	1.4	1.606	95	1.0%	-0.4048 [-0.6828, -0.1269]
Llargues 2012-M	0.8	1.158	116	1.8	1.354	106	1.0%	-0.7939 [-1.0676, -0.5202]
Lubans 2011-M	-0.7	1.074	50	0	1.074	50	0.6%	-0.6468 [-1.0493, -0.2442]
Lubans 2012-F	0.6	2.104	178	0.78	2.059	179	1.2%	-0.0863 [-0.2939, 0.1213]
Magnusson 2012	1.4	0.976	90	0.8	1.222	76	0.8%	0.5452 [0.2342, 0.8563]
Martinez 2008-F	0.2	1.614	231	0.3	1.61	299	1.4%	-0.0620 [-0.2337, 0.1098]
Martinez 2008-M	0.4	1.635	234	0.4	1.521	280	1.4%	0.0000 [-0.1736, 0.1736]
Mihas 2009	-0.1	1.412	98	0.2	1.57	93	0.9%	-0.2004 [-0.4849, 0.0841]
Mo-suwan 1998-F	-0.67	0.85	65	-0.39	0.994	57	0.7%	-0.3024 [-0.6602, 0.0553]
Mo-suwan 1998-M	-0.33	1.226	82	-0.44	1.064	88	0.9%	0.0956 [-0.2054, 0.3967]
Morgan 2011-z	0	0.316	39	0	0.286	32	0.5%	0.0000 [-0.4675, 0.4675]
Mucklebauer 2012-z	0.005	0.289	1641	0.007	0.295	1309	1.8%	-0.0069 [-0.0795, 0.0658]



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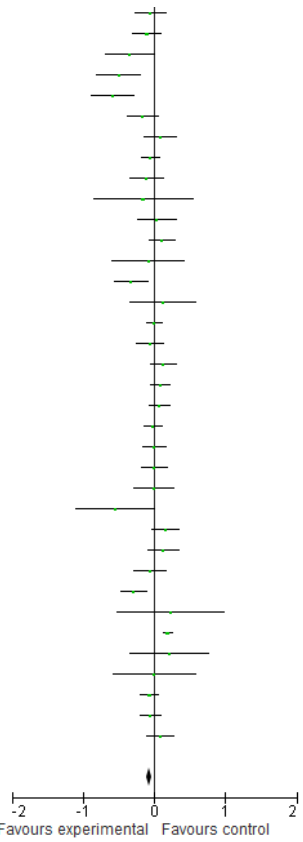
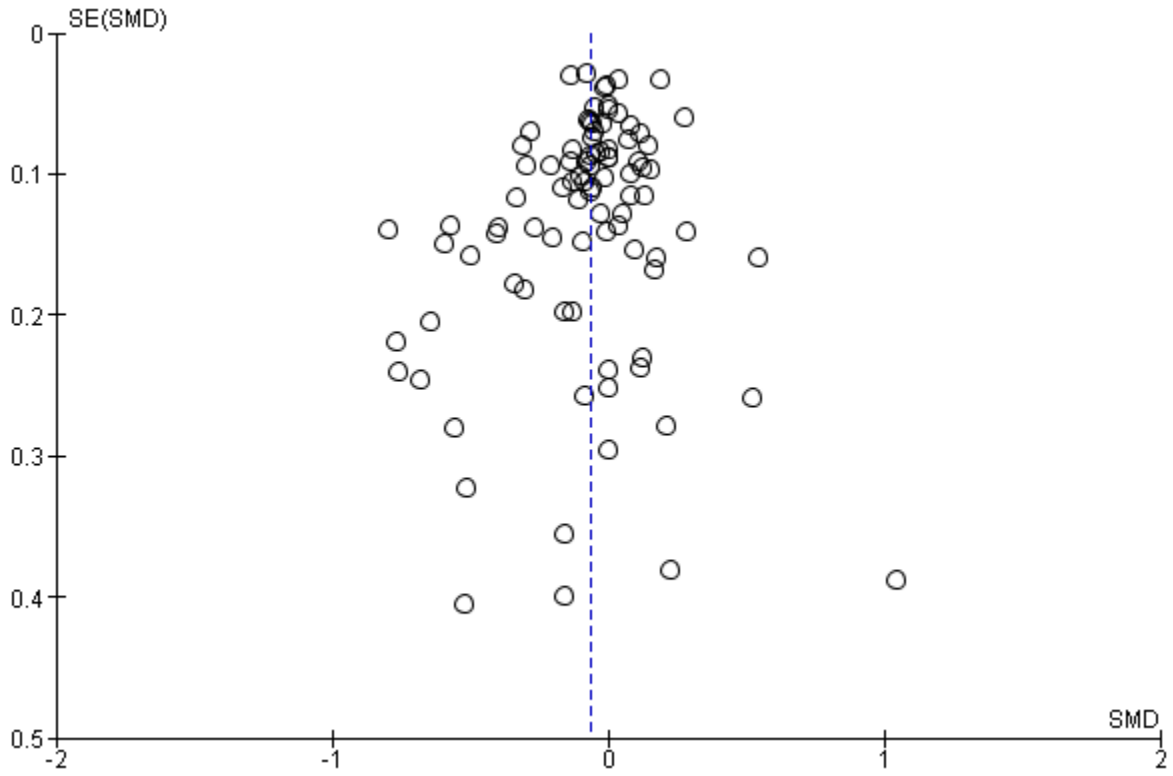
Forest Plot 1.1 continued from previous page

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Nemet 2011a-F	-0.17	0.794	175	-0.13	0.626	157	1.2%	-0.0555 [-0.2710, 0.1600]
Nemet 2011a-M	-0.32	0.709	201	-0.24	0.831	192	1.3%	-0.1036 [-0.3015, 0.0944]
Nemet 2011b-F	-0.6	0.533	58	-0.37	0.764	72	0.7%	-0.3407 [-0.6891, 0.0076]
Nemet 2011b-M	-0.79	0.61	76	-0.44	0.763	91	0.8%	-0.4994 [-0.8088, -0.1901]
Neumark-Sztainer 2003-F	-0.96	3.22	84	0.75	2.594	106	0.9%	-0.5899 [-0.8824, -0.2974]
Neumark-Sztainer 2010-F	0.1	3.18	177	0.6	2.902	159	1.2%	-0.1635 [-0.3780, 0.0510]
Ostbye 2012-z	0.03	0.612	150	-0.02	0.614	151	1.2%	0.0814 [-0.1447, 0.3074]
Paineau 2008	0.075	1.059	595	0.13	0.939	418	1.6%	-0.0543 [-0.1795, 0.0708]
Papadaki 2010	-0.127	1.856	372	0.07	1.804	88	1.1%	-0.1065 [-0.3390, 0.1259]
Peralta 2009-M	0.3	1.858	16	0.6	1.834	16	0.3%	-0.1584 [-0.8526, 0.5358]
Reed 2008	0.4	2.418	156	0.3	2.901	81	1.0%	0.0384 [-0.2300, 0.3069]
Reilly 2006-z	0.07	0.452	231	0.02	0.472	250	1.4%	0.1079 [-0.0711, 0.2869]
Robinson 2003-F	0.5	2.435	28	0.71	2.469	33	0.4%	-0.0845 [-0.5883, 0.4193]
Rosario 2013	0.6	1.189	151	1	1.234	143	1.1%	-0.3294 [-0.5597, -0.0992]
Rosenkranz 2010-F	0.3	1.992	33	0.1	1.323	39	0.5%	0.1190 [-0.3450, 0.5830]
Rush 2012-z	0.654	0.463	692	0.655	0.458	660	1.7%	-0.0022 [-0.1088, 0.1045]
Salcedo 2010-F	0.8	1.476	185	0.9	1.68	289	1.3%	-0.0623 [-0.2468, 0.1223]
Salcedo 2010-M	1	1.622	190	0.8	1.546	257	1.3%	0.1265 [-0.0612, 0.3142]
Sichieri 2009	0.32	1.435	434	0.22	1.076	493	1.6%	0.0795 [-0.0496, 0.2086]
Siegrist 2013	0.7	1.395	422	0.6	1.439	297	1.5%	0.0707 [-0.0778, 0.2192]
Simon 2008	2.38	2.203	479	2.42	2.133	475	1.6%	-0.0184 [-0.1453, 0.1085]
Singh 2009-F	0.5	1.367	337	0.5	1.546	254	1.4%	0.0000 [-0.1629, 0.1629]
Singh 2009-M	0.4	1.223	295	0.4	1.297	222	1.4%	0.0000 [-0.1741, 0.1741]
Singhal 2010	-0.07	0.71	99	-0.06	1.11	102	1.0%	-0.0107 [-0.2872, 0.2659]
Story 2003-F	-0.2	5.002	26	2	2.408	27	0.4%	-0.5556 [-1.1052, -0.0059]
Story 2012	1.44	2.218	263	1.1	2.142	177	1.3%	0.1551 [-0.0357, 0.3460]
Telford 2012-F	1.2	1.565	154	1	1.565	149	1.2%	0.1275 [-0.0980, 0.3529]
Telford 2012-M	1	1.565	158	1.1	1.565	159	1.2%	-0.0637 [-0.2840, 0.1565]
Thivel 2011	-0.099	1.224	229	0.228	0.988	228	1.3%	-0.2934 [-0.4778, -0.1091]
Velez 2010	0.3	2.155	13	-0.1	1.226	15	0.2%	0.2260 [-0.5194, 0.9714]
Webber 2008-F	2.1	1.614	1751	1.8	1.614	1751	1.8%	0.1858 [0.1195, 0.2522]
Weeks 2012-F	0.7	1.565	30	0.4	1.234	23	0.4%	0.2065 [-0.3383, 0.7512]
Weeks 2012-M	0.3	1.57	22	0.3	2.05	24	0.4%	0.0000 [-0.5785, 0.5785]
Williamson 2012-Fz	0.056	0.476	854	0.088	0.507	352	1.6%	-0.0659 [-0.1901, 0.0583]
Williamson 2012-Mz	0.024	0.611	729	0.06	0.69	235	1.5%	-0.0570 [-0.2040, 0.0900]
Yin 2012-z	-0.04	0.512	195	-0.08	0.495	205	1.3%	0.0793 [-0.1168, 0.2755]
Total (95% CI)			**30225**			**26117**	**100.0%**	**-0.0671 [-0.1049, -0.0293]**

Heterogeneity: Tau² = 0.02; Chi² = 340.80, df = 90 (P < 0.00001); I² = 74%
Test for overall effect: Z = 3.48 (P = 0.0005)



Funnel Plot 1.1: Effect of Prevention Interventions on BMI/BMIz – Overall

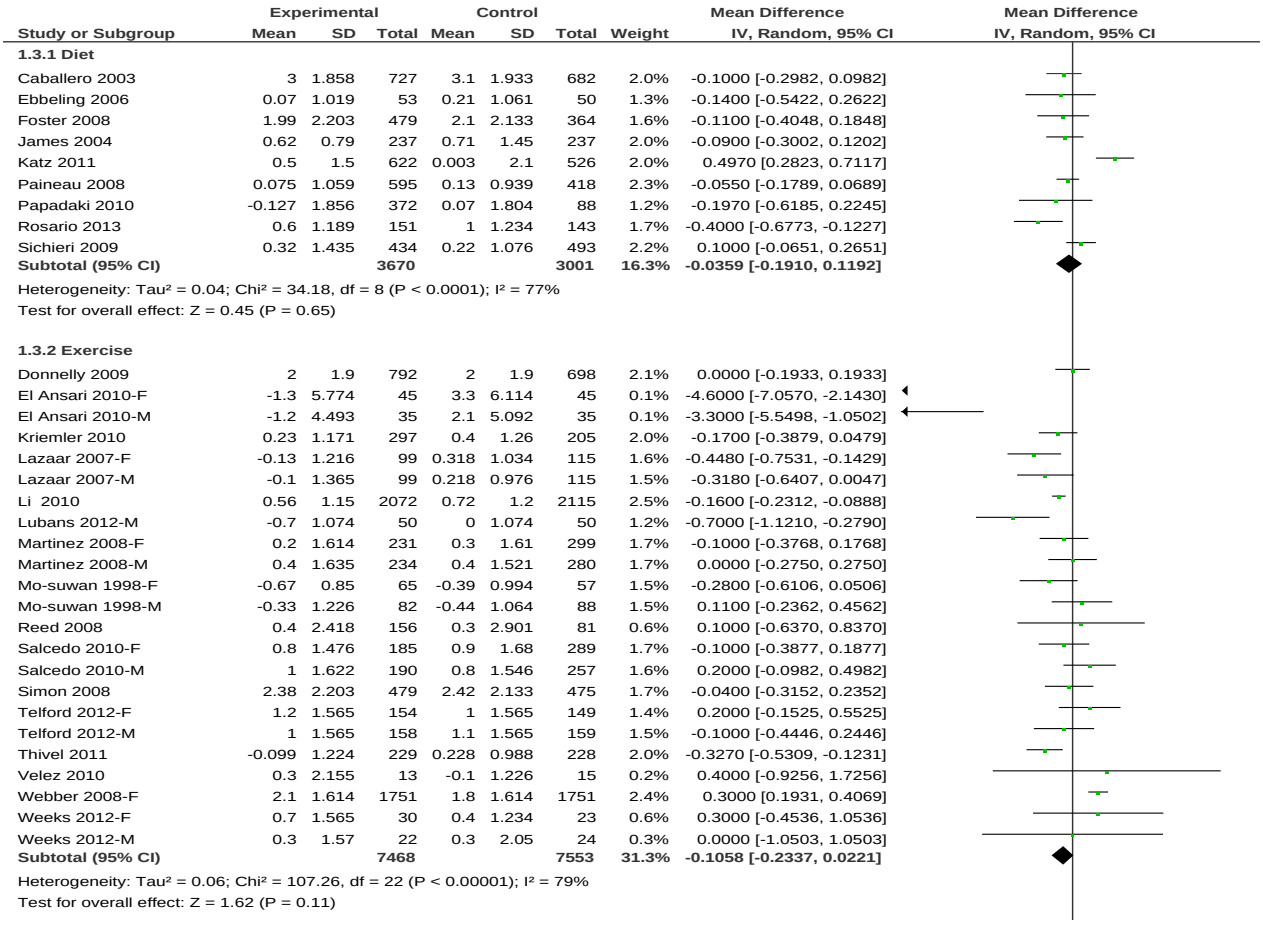


Egger's Test to Detect Publication Bias: Change in BMI/BMIz – Overall

Included Studies	P-value
Overall	0.019*

* Significant p≤0.05

Forest Plot 1.1.1: Effect of Prevention Interventions on BMI Only – Overall and by Type of Intervention (Diet, Exercise, Diet plus Exercise, Lifestyle)



Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Random, 95% CI
1.3.1 Diet								
Caballero 2003	3	1.858	727	3.1	1.933	682	2.0%	-0.1000 [-0.2982, 0.0982]
Ebbeling 2006	0.07	1.019	53	0.21	1.061	50	1.3%	-0.1400 [-0.5422, 0.2622]
Foster 2008	1.99	2.203	479	2.1	2.133	364	1.6%	-0.1100 [-0.4048, 0.1848]
James 2004	0.62	0.79	237	0.71	1.45	237	2.0%	-0.0900 [-0.3002, 0.1202]
Katz 2011	0.5	1.5	622	0.003	2.1	526	2.0%	0.4970 [0.2823, 0.7117]
Paineau 2008	0.075	1.059	595	0.13	0.939	418	2.3%	-0.0550 [-0.1789, 0.0689]
Papadaki 2010	-0.127	1.856	372	0.07	1.804	88	1.2%	-0.1970 [-0.6185, 0.2245]
Rosario 2013	0.6	1.189	151	1	1.234	143	1.7%	-0.4000 [-0.6773, -0.1227]
Sichieri 2009	0.32	1.435	434	0.22	1.076	493	2.2%	0.1000 [-0.0651, 0.2651]
Subtotal (95% CI)			**3670**			**3001**	**16.3%**	**-0.0359 [-0.1910, 0.1192]**
Heterogeneity: Tau² = 0.04; Chi² = 34.18, df = 8 (P < 0.0001); I² = 77%								
Test for overall effect: Z = 0.45 (P = 0.65)								
1.3.2 Exercise								
Donnelly 2009	2	1.9	792	2	1.9	698	2.1%	0.0000 [-0.1933, 0.1933]
El Ansari 2010-F	-1.3	5.774	45	3.3	6.114	45	0.1%	-4.6000 [-7.0570, -2.1430]
El Ansari 2010-M	-1.2	4.493	35	2.1	5.092	35	0.1%	-3.3000 [-5.5498, -1.0502]
Kriemler 2010	0.23	1.171	297	0.4	1.26	205	2.0%	-0.1700 [-0.3879, 0.0479]
Lazaar 2007-F	-0.13	1.216	99	0.318	1.034	115	1.6%	-0.4480 [-0.7531, -0.1429]
Lazaar 2007-M	-0.1	1.365	99	0.218	0.976	115	1.5%	-0.3180 [-0.6407, 0.0047]
Li 2010	0.56	1.15	2072	0.72	1.2	2115	2.5%	-0.1600 [-0.2312, -0.0888]
Lubans 2012-M	-0.7	1.074	50	0	1.074	50	1.2%	-0.7000 [-1.1210, -0.2790]
Martinez 2008-F	0.2	1.614	231	0.3	1.61	299	1.7%	-0.1000 [-0.3768, 0.1768]
Martinez 2008-M	0.4	1.635	234	0.4	1.521	280	1.7%	0.0000 [-0.2750, 0.2750]
Mo-suwan 1998-F	-0.67	0.85	65	-0.39	0.994	57	1.5%	-0.2800 [-0.6106, 0.0506]
Mo-suwan 1998-M	-0.33	1.226	82	-0.44	1.064	88	1.5%	0.1100 [-0.2362, 0.4562]
Reed 2008	0.4	2.418	156	0.3	2.901	81	0.6%	0.1000 [-0.6370, 0.8370]
Salcedo 2010-F	0.8	1.476	185	0.9	1.68	289	1.7%	-0.1000 [-0.3877, 0.1877]
Salcedo 2010-M	1	1.622	190	0.8	1.546	257	1.6%	0.2000 [-0.0982, 0.4982]
Simon 2008	2.38	2.203	479	2.42	2.133	475	1.7%	-0.0400 [-0.3152, 0.2352]
Telford 2012-F	1.2	1.565	154	1	1.565	149	1.4%	0.2000 [-0.1525, 0.5525]
Telford 2012-M	1	1.565	158	1.1	1.565	159	1.5%	-0.1000 [-0.4446, 0.2446]
Thivel 2011	-0.099	1.224	229	0.228	0.988	228	2.0%	-0.3270 [-0.5309, -0.1231]
Velez 2010	0.3	2.155	13	-0.1	1.226	15	0.2%	0.4000 [-0.9256, 1.7256]
Webber 2008-F	2.1	1.614	1751	1.8	1.614	1751	2.4%	0.3000 [0.1931, 0.4069]
Weeks 2012-F	0.7	1.565	30	0.4	1.234	23	0.6%	0.3000 [-0.4536, 1.0536]
Weeks 2012-M	0.3	1.57	22	0.3	2.05	24	0.3%	0.0000 [-1.0503, 1.0503]
Subtotal (95% CI)			**7468**			**7553**	**31.3%**	**-0.1058 [-0.2337, 0.0221]**
Heterogeneity: Tau² = 0.06; Chi² = 107.26, df = 22 (P < 0.00001); I² = 79%								
Test for overall effect: Z = 1.62 (P = 0.11)								

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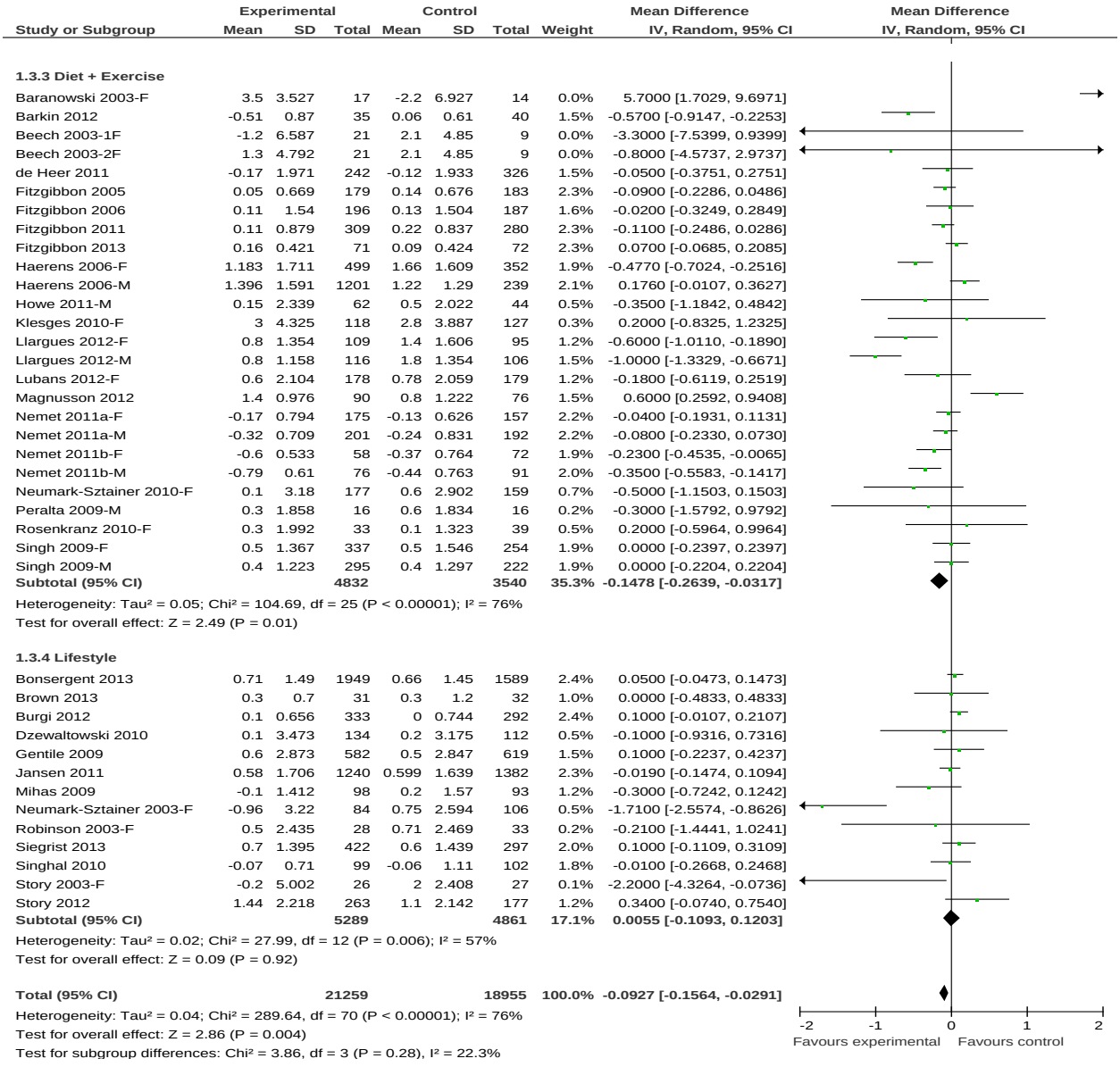
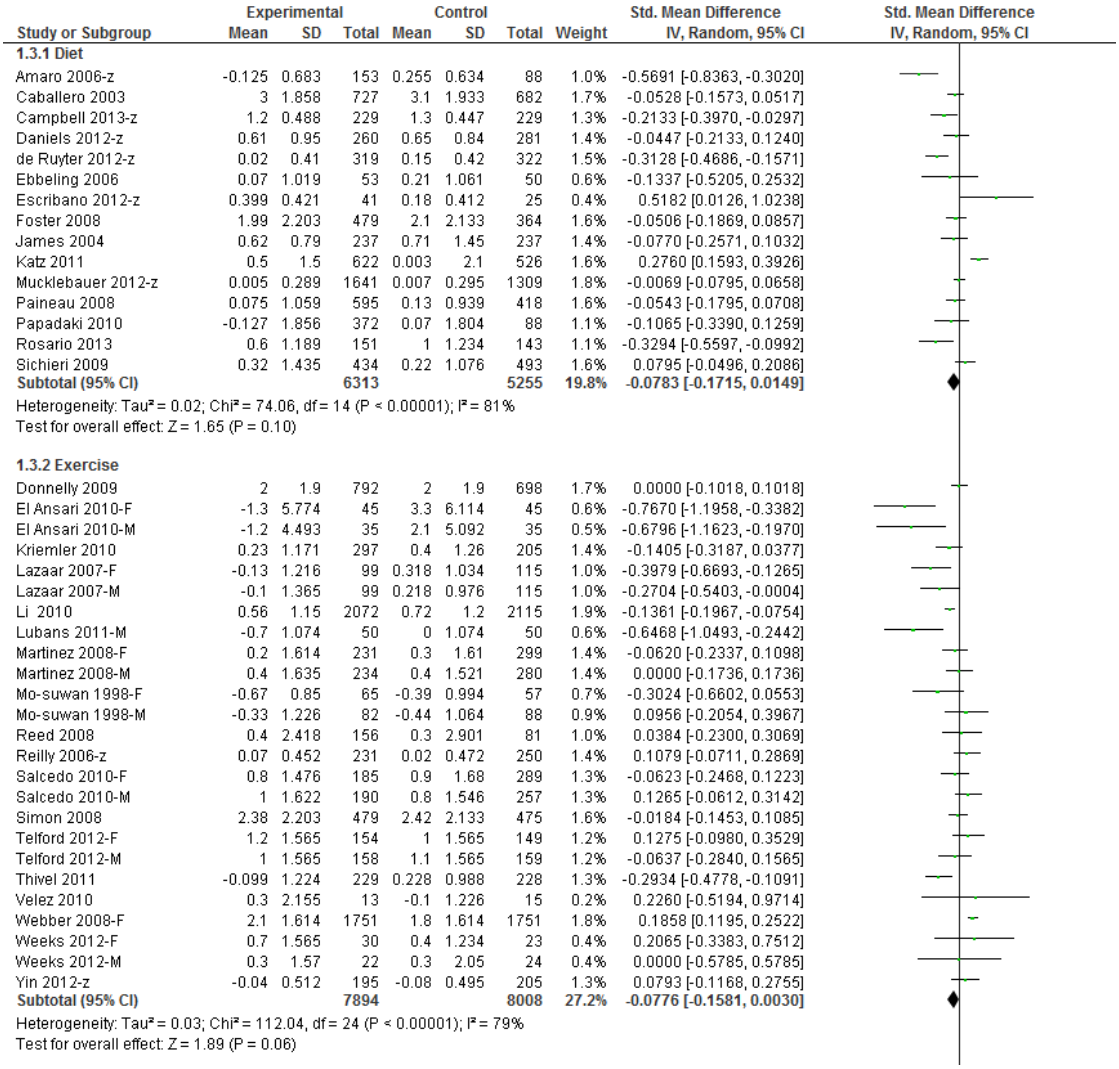
Forest Plot 1.1.1 continued from previous page



Forest Plot 1.2: Effect of Prevention Interventions on BMI/BMIz – by Type of Intervention (Diet, Exercise, Diet plus Exercise, Lifestyle)



Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.3.1 Diet								
Amaro 2006-z	-0.125	0.683	153	0.255	0.634	88	1.0%	-0.5691 [-0.8363, -0.3020]
Caballero 2003	3	1.858	727	3.1	1.933	682	1.7%	-0.0528 [-0.1573, 0.0517]
Campbell 2013-z	1.2	0.488	229	1.3	0.447	229	1.3%	-0.2133 [-0.3970, -0.0297]
Daniels 2012-z	0.61	0.95	260	0.65	0.84	281	1.4%	-0.0447 [-0.2133, 0.1240]
de Ruyter 2012-z	0.02	0.41	319	0.15	0.42	322	1.5%	-0.3128 [-0.4686, -0.1571]
Ebbeling 2006	0.07	1.019	53	0.21	1.061	50	0.6%	-0.1337 [-0.5205, 0.2532]
Escribano 2012-z	0.399	0.421	41	0.18	0.412	25	0.4%	0.5182 [0.0126, 1.0238]
Foster 2008	1.99	2.203	479	2.1	2.133	364	1.6%	-0.0506 [-0.1869, 0.0857]
James 2004	0.62	0.79	237	0.71	1.45	237	1.4%	-0.0770 [-0.2571, 0.1032]
Katz 2011	0.5	1.5	622	0.003	2.1	526	1.6%	0.2760 [0.1593, 0.3926]
Mucklebauer 2012-z	0.005	0.289	1641	0.007	0.295	1309	1.8%	-0.0069 [-0.0795, 0.0658]
Paineau 2008	0.075	1.059	595	0.13	0.939	418	1.6%	-0.0543 [-0.1795, 0.0708]
Papadaki 2010	-0.127	1.856	372	0.07	1.804	88	1.1%	-0.1065 [-0.3390, 0.1259]
Rosario 2013	0.6	1.189	151	1	1.234	143	1.1%	-0.3294 [-0.5597, -0.0992]
Sichieri 2009	0.32	1.435	434	0.22	1.076	493	1.6%	0.0795 [-0.0496, 0.2086]
Subtotal (95% CI)			**6313**			**5255**	**19.8%**	**-0.0783 [-0.1715, 0.0149]**
Heterogeneity: Tau² = 0.02; Chi² = 74.06, df = 14 (P < 0.00001); I² = 81%								
Test for overall effect: Z = 1.65 (P = 0.10)								
1.3.2 Exercise								
Donnelly 2009	2	1.9	792	2	1.9	698	1.7%	0.0000 [-0.1018, 0.1018]
El Ansari 2010-F	-1.3	5.774	45	3.3	6.114	45	0.6%	-0.7670 [-1.1958, -0.3382]
El Ansari 2010-M	-1.2	4.493	35	2.1	5.092	35	0.5%	-0.6796 [-1.1623, -0.1970]
Kriemler 2010	0.23	1.171	297	0.4	1.26	205	1.4%	-0.1405 [-0.3187, 0.0377]
Lazaar 2007-F	-0.13	1.216	99	0.318	1.034	115	1.0%	-0.3979 [-0.6693, -0.1265]
Lazaar 2007-M	-0.1	1.365	99	0.218	0.976	115	1.0%	-0.2704 [-0.5403, -0.0004]
Li 2010	0.56	1.15	2072	0.72	1.2	2115	1.9%	-0.1361 [-0.1967, -0.0754]
Lubans 2011-M	-0.7	1.074	50	0	1.074	50	0.6%	-0.6468 [-1.0493, -0.2442]
Martinez 2008-F	0.2	1.614	231	0.3	1.61	299	1.4%	-0.0620 [-0.2337, 0.1098]
Martinez 2008-M	0.4	1.635	234	0.4	1.521	280	1.4%	0.0000 [-0.1736, 0.1736]
Mo-suwan 1998-F	-0.67	0.85	65	-0.39	0.994	57	0.7%	-0.3024 [-0.6602, 0.0553]
Mo-suwan 1998-M	-0.33	1.226	82	-0.44	1.064	88	0.9%	0.0956 [-0.2054, 0.3967]
Reed 2008	0.4	2.418	156	0.3	2.901	81	1.0%	0.0384 [-0.2300, 0.3069]
Reilly 2006-z	0.07	0.452	231	0.02	0.472	250	1.4%	0.1079 [-0.0711, 0.2869]
Salcedo 2010-F	0.8	1.476	185	0.9	1.68	289	1.3%	-0.0623 [-0.2468, 0.1223]
Salcedo 2010-M	1	1.622	190	0.8	1.546	257	1.3%	0.1265 [-0.0612, 0.3142]
Simon 2008	2.38	2.203	479	2.42	2.133	475	1.6%	-0.0184 [-0.1453, 0.1085]
Telford 2012-F	1.2	1.565	154	1	1.565	149	1.2%	0.1275 [-0.0980, 0.3529]
Telford 2012-M	1	1.565	158	1.1	1.565	159	1.2%	-0.0637 [-0.2840, 0.1565]
Thivel 2011	-0.099	1.224	229	0.228	0.988	228	1.3%	-0.2934 [-0.4778, -0.1091]
Velez 2010	0.3	2.155	13	-0.1	1.226	15	0.2%	0.2260 [-0.5194, 0.9714]
Webber 2008-F	2.1	1.614	1751	1.8	1.614	1751	1.8%	0.1858 [0.1195, 0.2522]
Weeks 2012-F	0.7	1.565	30	0.4	1.234	23	0.4%	0.2065 [-0.3383, 0.7512]
Weeks 2012-M	0.3	1.57	22	0.3	2.05	24	0.4%	0.0000 [-0.5785, 0.5785]
Yin 2012-z	-0.04	0.512	195	-0.08	0.495	205	1.3%	0.0793 [-0.1168, 0.2755]
Subtotal (95% CI)			**7894**			**8008**	**27.2%**	**-0.0776 [-0.1581, 0.0030]**
Heterogeneity: Tau² = 0.03; Chi² = 112.04, df = 24 (P < 0.00001); I² = 79%								
Test for overall effect: Z = 1.89 (P = 0.06)								

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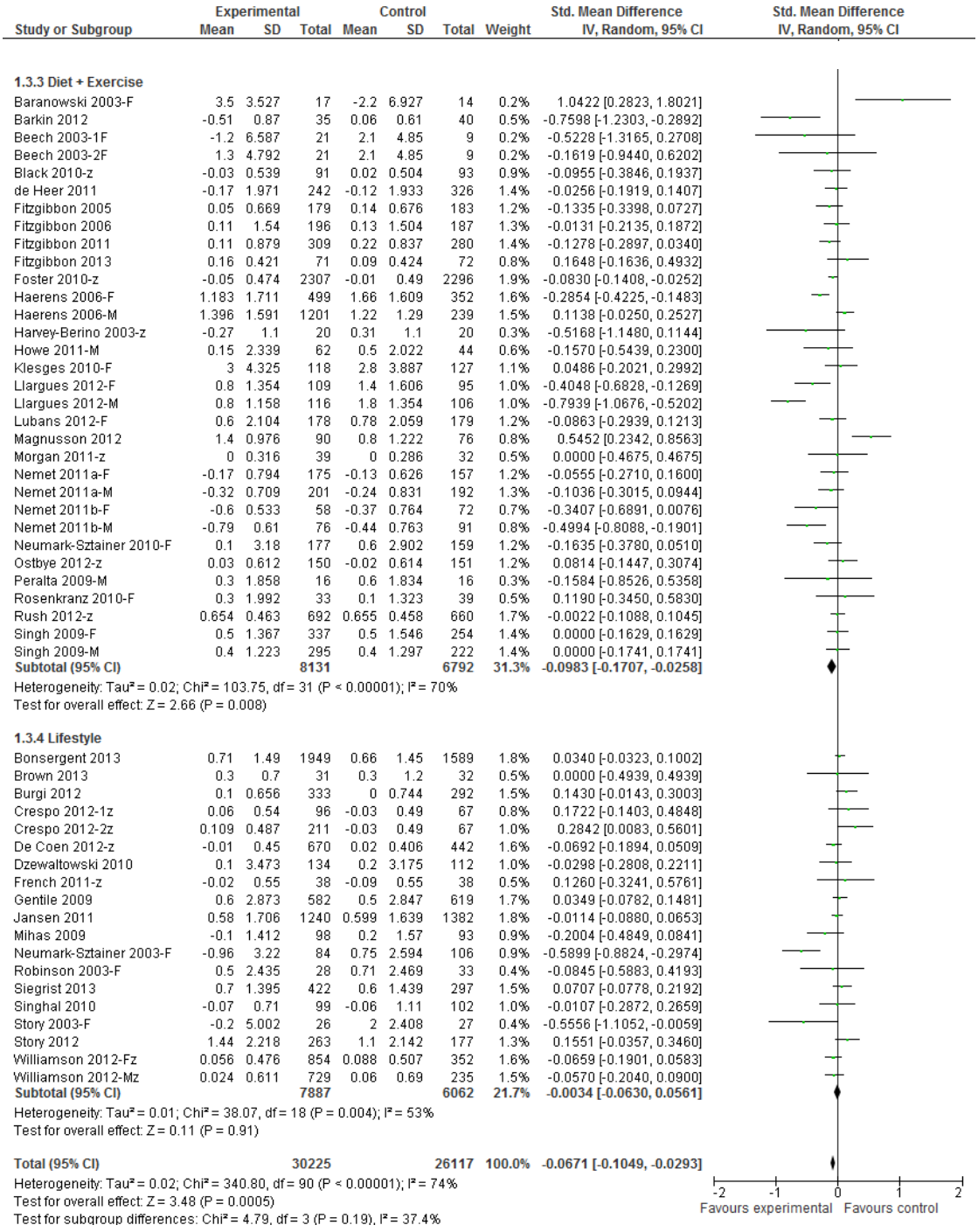
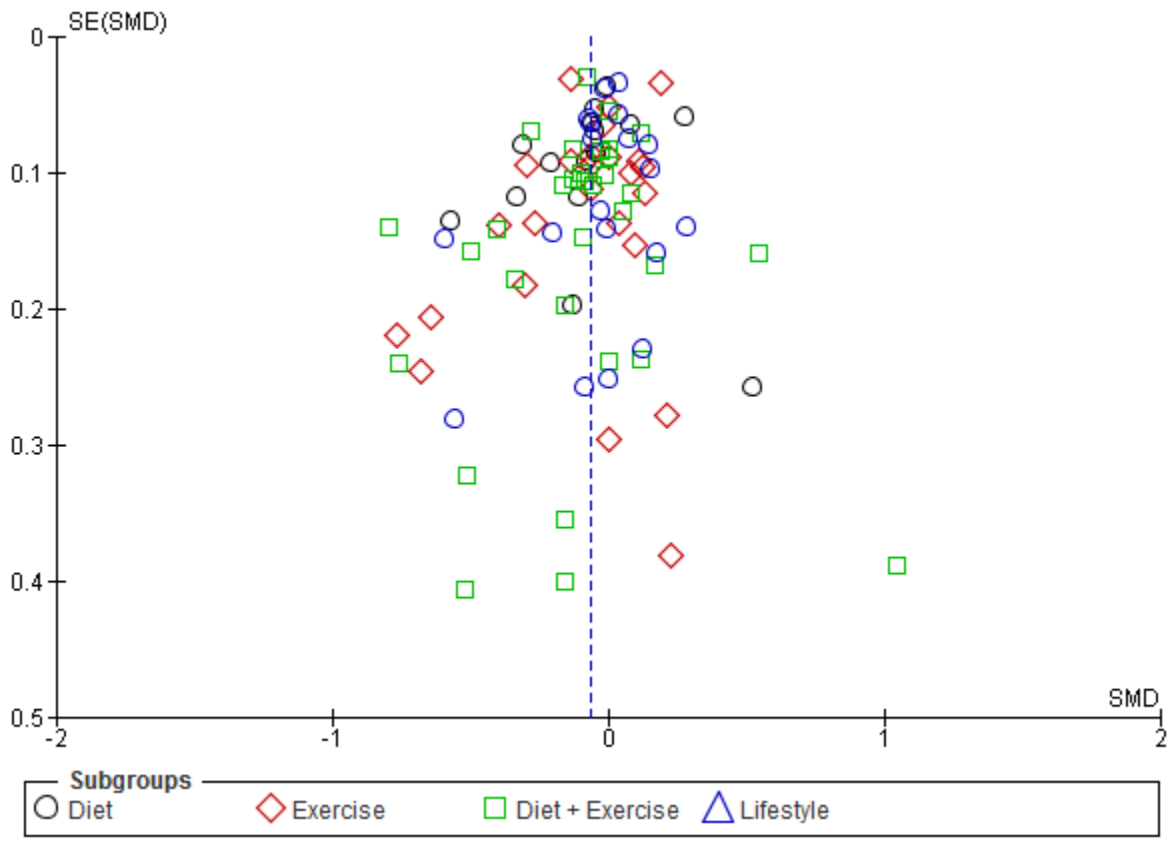
Forest Plot 1.2 continued from previous page



Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.3.3 Diet + Exercise								
Baranowski 2003-F	3.5	3.527	17	-2.2	6.927	14	0.2%	1.0422 [0.2823, 1.8021]
Barkin 2012	-0.51	0.87	35	0.06	0.61	40	0.5%	-0.7598 [-1.2303, -0.2892]
Beech 2003-1F	-1.2	6.587	21	2.1	4.85	9	0.2%	-0.5228 [-1.3165, 0.2708]
Beech 2003-2F	1.3	4.792	21	2.1	4.85	9	0.2%	-0.1619 [-0.9440, 0.6202]
Black 2010-z	-0.03	0.539	91	0.02	0.504	93	0.9%	-0.0955 [-0.3846, 0.1937]
de Heer 2011	-0.17	1.971	242	-0.12	1.933	326	1.4%	-0.0256 [-0.1919, 0.1407]
Fitzgibbon 2005	0.05	0.669	179	0.14	0.676	183	1.2%	-0.1335 [-0.3398, 0.0727]
Fitzgibbon 2006	0.11	1.54	196	0.13	1.504	187	1.3%	-0.0131 [-0.2135, 0.1872]
Fitzgibbon 2011	0.11	0.879	309	0.22	0.837	280	1.4%	-0.1278 [-0.2897, 0.0340]
Fitzgibbon 2013	0.16	0.421	71	0.09	0.424	72	0.8%	0.1648 [-0.1636, 0.4932]
Foster 2010-z	-0.05	0.474	2307	-0.01	0.49	2296	1.9%	-0.0830 [-0.1408, -0.0252]
Haerens 2006-F	1.183	1.711	499	1.66	1.609	352	1.6%	-0.2854 [-0.4225, -0.1483]
Haerens 2006-M	1.396	1.591	1201	1.22	1.29	239	1.5%	0.1138 [-0.0250, 0.2527]
Harvey-Berino 2003-z	-0.27	1.1	20	0.31	1.1	20	0.3%	-0.5168 [-1.1480, 0.1144]
Howe 2011-M	0.15	2.339	62	0.5	2.022	44	0.6%	-0.1570 [-0.5439, 0.2300]
Klesges 2010-F	3	4.325	118	2.8	3.887	127	1.1%	0.0486 [-0.2021, 0.2992]
Llargues 2012-F	0.8	1.354	109	1.4	1.606	95	1.0%	-0.4048 [-0.6828, -0.1269]
Llargues 2012-M	0.8	1.158	116	1.8	1.354	106	1.0%	-0.7939 [-1.0676, -0.5202]
Lubans 2012-F	0.6	2.104	178	0.78	2.059	179	1.2%	-0.0863 [-0.2939, 0.1213]
Magnusson 2012	1.4	0.976	90	0.8	1.222	76	0.8%	0.5452 [0.2342, 0.8563]
Morgan 2011-z	0	0.316	39	0	0.286	32	0.5%	0.0000 [-0.4675, 0.4675]
Nemet 2011a-F	-0.17	0.794	175	-0.13	0.626	157	1.2%	-0.0555 [-0.2710, 0.1600]
Nemet 2011a-M	-0.32	0.709	201	-0.24	0.831	192	1.3%	-0.1036 [-0.3015, 0.0944]
Nemet 2011b-F	-0.6	0.533	58	-0.37	0.764	72	0.7%	-0.3407 [-0.6891, 0.0076]
Nemet 2011b-M	-0.79	0.61	76	-0.44	0.763	91	0.8%	-0.4994 [-0.8088, -0.1901]
Neumark-Sztainer 2010-F	0.1	3.18	177	0.6	2.902	159	1.2%	-0.1635 [-0.3780, 0.0510]
Ostbye 2012-z	0.03	0.612	150	-0.02	0.614	151	1.2%	0.0814 [-0.1447, 0.3074]
Peralta 2009-M	0.3	1.858	16	0.6	1.834	16	0.3%	-0.1584 [-0.8526, 0.5358]
Rosenkranz 2010-F	0.3	1.992	33	0.1	1.323	39	0.5%	0.1190 [-0.3450, 0.5830]
Rush 2012-z	0.654	0.463	692	0.655	0.458	660	1.7%	-0.0022 [-0.1088, 0.1045]
Singh 2009-F	0.5	1.367	337	0.5	1.546	254	1.4%	0.0000 [-0.1629, 0.1629]
Singh 2009-M	0.4	1.223	295	0.4	1.297	222	1.4%	0.0000 [-0.1741, 0.1741]
Subtotal (95% CI)			**8131**			**6792**	**31.3%**	**-0.0983 [-0.1707, -0.0258]**
Heterogeneity: Tau² = 0.02; Chi² = 103.75, df = 31 (P < 0.00001); I² = 70%								
Test for overall effect: Z = 2.66 (P = 0.008)								
1.3.4 Lifestyle								
Bonsergent 2013	0.71	1.49	1949	0.66	1.45	1589	1.8%	0.0340 [-0.0323, 0.1002]
Brown 2013	0.3	0.7	31	0.3	1.2	32	0.5%	0.0000 [-0.4939, 0.4939]
Burgi 2012	0.1	0.656	333	0	0.744	292	1.5%	0.1430 [-0.0143, 0.3003]
Crespo 2012-1z	0.06	0.54	96	-0.03	0.49	67	0.8%	0.1722 [-0.1403, 0.4848]
Crespo 2012-2z	0.109	0.487	211	-0.03	0.49	67	1.0%	0.2842 [0.0083, 0.5601]
De Coen 2012-z	-0.01	0.45	670	0.02	0.406	442	1.6%	-0.0692 [-0.1894, 0.0509]
Dzewaltowski 2010	0.1	3.473	134	0.2	3.175	112	1.0%	-0.0298 [-0.2808, 0.2211]
French 2011-z	-0.02	0.55	38	-0.09	0.55	38	0.5%	0.1260 [-0.3241, 0.5761]
Gentile 2009	0.6	2.873	582	0.5	2.847	619	1.7%	0.0349 [-0.0782, 0.1481]
Jansen 2011	0.58	1.706	1240	0.599	1.639	1382	1.8%	-0.0114 [-0.0880, 0.0653]
Mihas 2009	-0.1	1.412	98	0.2	1.57	93	0.9%	-0.2004 [-0.4849, 0.0841]
Neumark-Sztainer 2003-F	-0.96	3.22	84	0.75	2.594	106	0.9%	-0.5899 [-0.8824, -0.2974]
Robinson 2003-F	0.5	2.435	28	0.71	2.469	33	0.4%	-0.0845 [-0.5883, 0.4193]
Siegrist 2013	0.7	1.395	422	0.6	1.439	297	1.5%	0.0707 [-0.0778, 0.2192]
Singhal 2010	-0.07	0.71	99	-0.06	1.11	102	1.0%	-0.0107 [-0.2872, 0.2659]
Story 2003-F	-0.2	5.002	26	2	2.408	27	0.4%	-0.5556 [-1.1052, -0.0059]
Story 2012	1.44	2.218	263	1.1	2.142	177	1.3%	0.1551 [-0.0357, 0.3460]
Williamson 2012-Fz	0.056	0.476	854	0.088	0.507	352	1.6%	-0.0659 [-0.1901, 0.0583]
Williamson 2012-Mz	0.024	0.611	729	0.06	0.69	235	1.5%	-0.0570 [-0.2040, 0.0900]
Subtotal (95% CI)			**7887**			**6062**	**21.7%**	**-0.0034 [-0.0630, 0.0561]**
Heterogeneity: Tau² = 0.01; Chi² = 38.07, df = 18 (P = 0.004); I² = 53%								
Test for overall effect: Z = 0.11 (P = 0.91)								
Total (95% CI)			**30225**			**26117**	**100.0%**	**-0.0671 [-0.1049, -0.0293]**
Heterogeneity: Tau² = 0.02; Chi² = 340.80, df = 90 (P < 0.00001); I² = 74%								
Test for overall effect: Z = 3.48 (P = 0.0005)								
Test for subgroup differences: Chi² = 4.79, df = 3 (P = 0.19), I² = 37.4%								

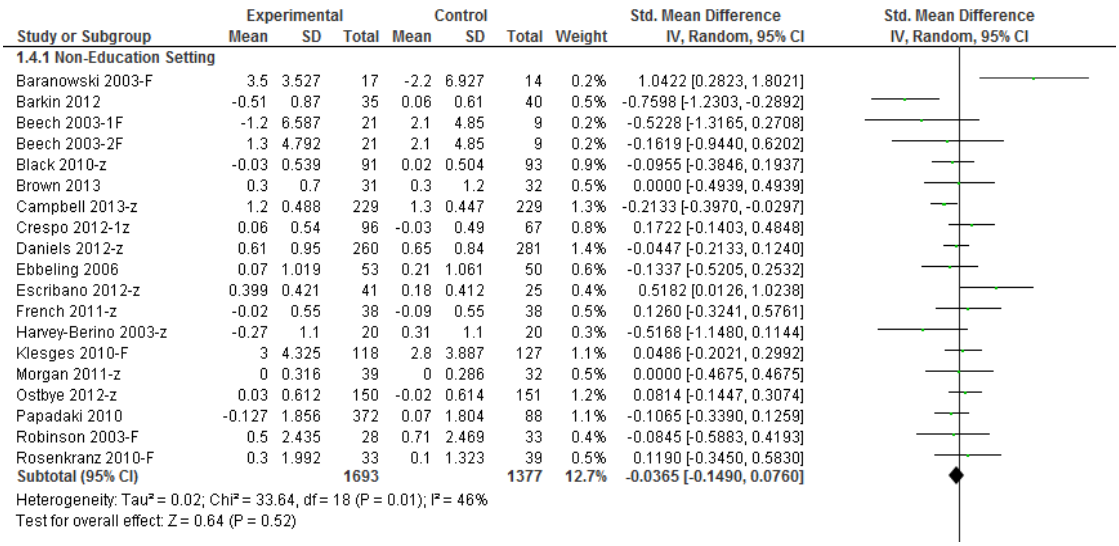
Funnel Plot 1.2: Effect of Prevention Interventions on BMI/BMIz – by Type of Intervention (Diet, Exercise, Diet plus Exercise, Lifestyle)



Egger's Test to Detect Publication Bias: Change in BMI/BMIz – by Type of Intervention (Diet, Exercise, Diet plus Exercise, Lifestyle)

Included Studies	P-value
Diet	0.140
Exercise	0.131
Diet plus Exercise	0.546
Lifestyle	0.460

Forest Plot 1.3: Effect of Prevention Interventions on BMI/BMIz – by Intervention Setting (Non-Education, Education, Education plus Other)



Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.4.1 Non-Education Setting								
Baranowski 2003-F	3.5	3.527	17	-2.2	6.927	14	0.2%	1.0422 [0.2823, 1.8021]
Barkin 2012	-0.51	0.87	35	0.06	0.61	40	0.5%	-0.7598 [-1.2303, -0.2892]
Beech 2003-1F	-1.2	6.587	21	2.1	4.85	9	0.2%	-0.5228 [-1.3165, 0.2708]
Beech 2003-2F	1.3	4.792	21	2.1	4.85	9	0.2%	-0.1619 [-0.9440, 0.6202]
Black 2010-z	-0.03	0.539	91	0.02	0.504	93	0.9%	-0.0955 [-0.3846, 0.1937]
Brown 2013	0.3	0.7	31	0.3	1.2	32	0.5%	0.0000 [-0.4939, 0.4939]
Campbell 2013-z	1.2	0.488	229	1.3	0.447	229	1.3%	-0.2133 [-0.3970, -0.0297]
Crespo 2012-1z	0.06	0.54	96	-0.03	0.49	67	0.8%	0.1722 [-0.1403, 0.4848]
Daniels 2012-z	0.61	0.95	260	0.65	0.84	281	1.4%	-0.0447 [-0.2133, 0.1240]
Ebbeling 2006	0.07	1.019	53	0.21	1.061	50	0.6%	-0.1337 [-0.5205, 0.2532]
Escribano 2012-z	0.399	0.421	41	0.18	0.412	25	0.4%	0.5182 [0.0126, 1.0238]
French 2011-z	-0.02	0.55	38	-0.09	0.55	38	0.5%	0.1260 [-0.3241, 0.5761]
Harvey-Berino 2003-z	-0.27	1.1	20	0.31	1.1	20	0.3%	-0.5168 [-1.1480, 0.1144]
Klesges 2010-F	3	4.325	118	2.8	3.887	127	1.1%	0.0486 [-0.2021, 0.2992]
Morgan 2011-z	0	0.316	39	0	0.286	32	0.5%	0.0000 [-0.4675, 0.4675]
Ostbye 2012-z	0.03	0.612	150	-0.02	0.614	151	1.2%	0.0814 [-0.1447, 0.3074]
Papadaki 2010	-0.127	1.856	372	0.07	1.804	88	1.1%	-0.1065 [-0.3390, 0.1259]
Robinson 2003-F	0.5	2.435	28	0.71	2.469	33	0.4%	-0.0845 [-0.5883, 0.4193]
Rosenkranz 2010-F	0.3	1.992	33	0.1	1.323	39	0.5%	0.1190 [-0.3450, 0.5830]
Subtotal (95% CI)			**1693**			**1377**	**12.7%**	**-0.0365 [-0.1490, 0.0760]**

Heterogeneity: Tau² = 0.02; Chi² = 33.64, df = 18 (P = 0.01); I² = 46%
Test for overall effect: Z = 0.64 (P = 0.52)

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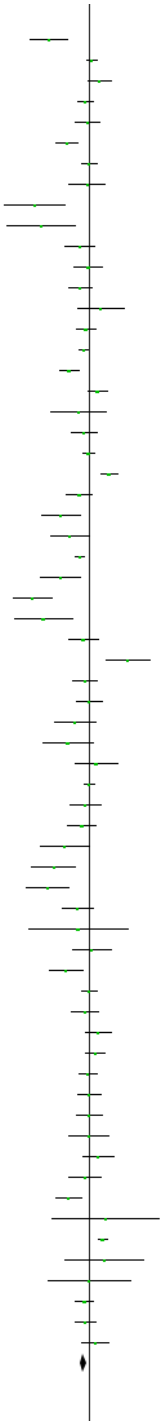
Forest Plot 1.3 continued from previous page

Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.4.2 Education Only Setting								
Amaro 2006-z	-0.125	0.683	153	0.255	0.634	88	1.0%	-0.5691 [-0.8363, -0.3020]
Bonsergent 2013	0.71	1.49	1949	0.66	1.45	1589	1.8%	0.0340 [-0.0323, 0.1002]
Burgi 2012	0.1	0.656	333	0	0.744	292	1.5%	0.1430 [-0.0143, 0.3003]
Caballero 2003	3	1.858	727	3.1	1.933	682	1.7%	-0.0528 [-0.1573, 0.0517]
de Heer 2011	-0.17	1.971	242	-0.12	1.933	326	1.4%	-0.0256 [-0.1919, 0.1407]
de Ruyter 2012-z	0.02	0.41	319	0.15	0.42	322	1.5%	-0.3128 [-0.4686, -0.1571]
Donnelly 2009	2	1.9	792	2	1.9	698	1.7%	0.0000 [-0.1018, 0.1018]
Dzewaltowski 2010	0.1	3.473	134	0.2	3.175	112	1.0%	-0.0298 [-0.2808, 0.2211]
El Ansari 2010-F	-1.3	5.774	45	3.3	6.114	45	0.6%	-0.7670 [-1.1958, -0.3382]
El Ansari 2010-M	-1.2	4.493	35	2.1	5.092	35	0.5%	-0.6796 [-1.1623, -0.1970]
Fitzgibbon 2005	0.05	0.669	179	0.14	0.676	183	1.2%	-0.1335 [-0.3398, 0.0727]
Fitzgibbon 2006	0.11	1.54	196	0.13	1.504	187	1.3%	-0.0131 [-0.2135, 0.1872]
Fitzgibbon 2011	0.11	0.879	309	0.22	0.837	280	1.4%	-0.1278 [-0.2897, 0.0340]
Fitzgibbon 2013	0.16	0.421	71	0.09	0.424	72	0.8%	0.1648 [-0.1636, 0.4932]
Foster 2008	1.99	2.203	479	2.1	2.133	364	1.6%	-0.0506 [-0.1869, 0.0857]
Foster 2010-z	-0.05	0.474	2307	-0.01	0.49	2296	1.9%	-0.0830 [-0.1408, -0.0252]
Haerens 2006-F	1.183	1.711	499	1.66	1.609	352	1.6%	-0.2854 [-0.4225, -0.1483]
Haerens 2006-M	1.396	1.591	1201	1.22	1.29	239	1.5%	0.1138 [-0.0250, 0.2527]
Howe 2011-M	0.15	2.339	62	0.5	2.022	44	0.6%	-0.1570 [-0.5439, 0.2300]
James 2004	0.62	0.79	237	0.71	1.45	237	1.4%	-0.0770 [-0.2571, 0.1032]
Jansen 2011	0.58	1.706	1240	0.599	1.639	1382	1.8%	-0.0114 [-0.0880, 0.0653]
Katz 2011	0.5	1.5	622	0.003	2.1	526	1.6%	0.2760 [0.1593, 0.3926]
Kriemler 2010	0.23	1.171	297	0.4	1.26	205	1.4%	-0.1405 [-0.3187, 0.0377]
Lazaar 2007-F	-0.13	1.216	99	0.318	1.034	115	1.0%	-0.3979 [-0.6693, -0.1265]
Lazaar 2007-M	-0.1	1.365	99	0.218	0.976	115	1.0%	-0.2704 [-0.5403, -0.0004]
Li 2010	0.56	1.15	2072	0.72	1.2	2115	1.9%	-0.1361 [-0.1967, -0.0754]
Llargues 2012-F	0.8	1.354	109	1.4	1.606	95	1.0%	-0.4048 [-0.6828, -0.1269]
Llargues 2012-M	0.8	1.158	116	1.8	1.354	106	1.0%	-0.7939 [-1.0676, -0.5202]
Lubans 2011-M	-0.7	1.074	50	0	1.074	50	0.6%	-0.6468 [-1.0493, -0.2442]
Lubans 2012-F	0.6	2.104	178	0.78	2.059	179	1.2%	-0.0863 [-0.2939, 0.1213]
Magnusson 2012	1.4	0.976	90	0.8	1.222	76	0.8%	0.5452 [0.2342, 0.8563]
Martinez 2008-F	0.2	1.614	231	0.3	1.61	299	1.4%	-0.0620 [-0.2337, 0.1098]
Martinez 2008-M	0.4	1.635	234	0.4	1.521	280	1.4%	0.0000 [-0.1736, 0.1736]
Mihas 2009	-0.1	1.412	98	0.2	1.57	93	0.9%	-0.2004 [-0.4849, 0.0841]
Mo-suwan 1998-F	-0.67	0.85	65	-0.39	0.994	57	0.7%	-0.3024 [-0.6602, 0.0553]
Mo-suwan 1998-M	-0.33	1.226	82	-0.44	1.064	88	0.9%	0.0956 [-0.2054, 0.3967]
Mucklebauer 2012-z	0.005	0.289	1641	0.007	0.295	1309	1.8%	-0.0069 [-0.0795, 0.0658]
Nemet 2011a-F	-0.17	0.794	175	-0.13	0.626	157	1.2%	-0.0555 [-0.2710, 0.1600]
Nemet 2011a-M	-0.32	0.709	201	-0.24	0.831	192	1.3%	-0.1036 [-0.3015, 0.0944]
Nemet 2011b-F	-0.6	0.533	58	-0.37	0.764	72	0.7%	-0.3407 [-0.6891, 0.0076]
Nemet 2011b-M	-0.79	0.61	76	-0.44	0.763	91	0.8%	-0.4994 [-0.8088, -0.1901]
Neumark-Sztainer 2003-F	-0.96	3.22	84	0.75	2.594	106	0.9%	-0.5899 [-0.8824, -0.2974]
Neumark-Sztainer 2010-F	0.1	3.18	177	0.6	2.902	159	1.2%	-0.1635 [-0.3780, 0.0510]
Peralta 2009-M	0.3	1.858	16	0.6	1.834	16	0.3%	-0.1584 [-0.8526, 0.5358]
Reed 2008	0.4	2.418	156	0.3	2.901	81	1.0%	0.0384 [-0.2300, 0.3069]
Rosario 2013	0.6	1.189	151	1	1.234	143	1.1%	-0.3294 [-0.5597, -0.0992]
Rush 2012-z	0.654	0.463	692	0.655	0.458	660	1.7%	-0.0022 [-0.1088, 0.1045]
Salcedo 2010-F	0.8	1.476	185	0.9	1.68	289	1.3%	-0.0623 [-0.2468, 0.1223]
Salcedo 2010-M	1	1.622	190	0.8	1.546	257	1.3%	0.1265 [-0.0612, 0.3142]
Sichieri 2009	0.32	1.435	434	0.22	1.076	493	1.6%	0.0795 [-0.0496, 0.2086]
Simon 2008	2.38	2.203	479	2.42	2.133	475	1.6%	-0.0184 [-0.1453, 0.1085]
Singh 2009-F	0.5	1.367	337	0.5	1.546	254	1.4%	0.0000 [-0.1629, 0.1629]
Singh 2009-M	0.4	1.223	295	0.4	1.297	222	1.4%	0.0000 [-0.1741, 0.1741]
Singhal 2010	-0.07	0.71	99	-0.06	1.11	102	1.0%	-0.0107 [-0.2872, 0.2659]
Telford 2012-F	1.2	1.565	154	1	1.565	149	1.2%	0.1275 [-0.0980, 0.3529]
Telford 2012-M	1	1.565	158	1.1	1.565	159	1.2%	-0.0637 [-0.2840, 0.1565]
Thivel 2011	-0.099	1.224	229	0.228	0.988	228	1.3%	-0.2934 [-0.4778, -0.1091]
Velez 2010	0.3	2.155	13	-0.1	1.226	15	0.2%	0.2260 [-0.5194, 0.9714]
Webber 2008-F	2.1	1.614	1751	1.8	1.614	1751	1.8%	0.1858 [0.1195, 0.2522]
Weeks 2012-F	0.7	1.565	30	0.4	1.234	23	0.4%	0.2065 [-0.3383, 0.7512]
Weeks 2012-M	0.3	1.57	22	0.3	2.05	24	0.4%	0.0000 [-0.5785, 0.5785]
Williamson 2012-Fz	0.056	0.476	854	0.088	0.507	352	1.6%	-0.0659 [-0.1901, 0.0583]
Williamson 2012-Mz	0.024	0.611	729	0.06	0.69	235	1.5%	-0.0570 [-0.2040, 0.0900]
Yin 2012-z	-0.04	0.512	195	-0.08	0.495	205	1.3%	0.0793 [-0.1168, 0.2755]
Subtotal (95% CI)			**25532**			**22443**	**76.9%**	**-0.0869 [-0.1310, -0.0428]**

Heterogeneity: $Tau^2 = 0.02$; $Chi^2 = 288.29$, df = 63 ($P < 0.00001$); $I^2 = 78\%$

Test for overall effect: $Z = 3.86$ ($P = 0.0001$)



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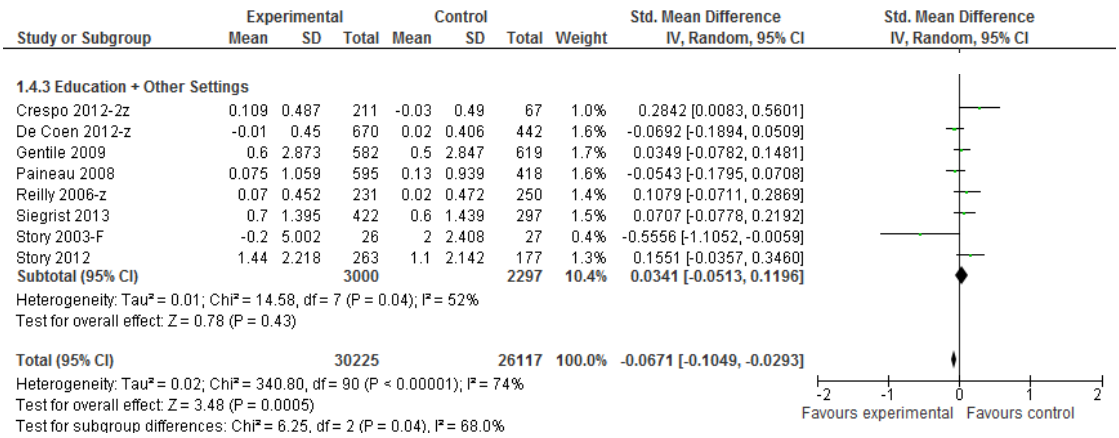
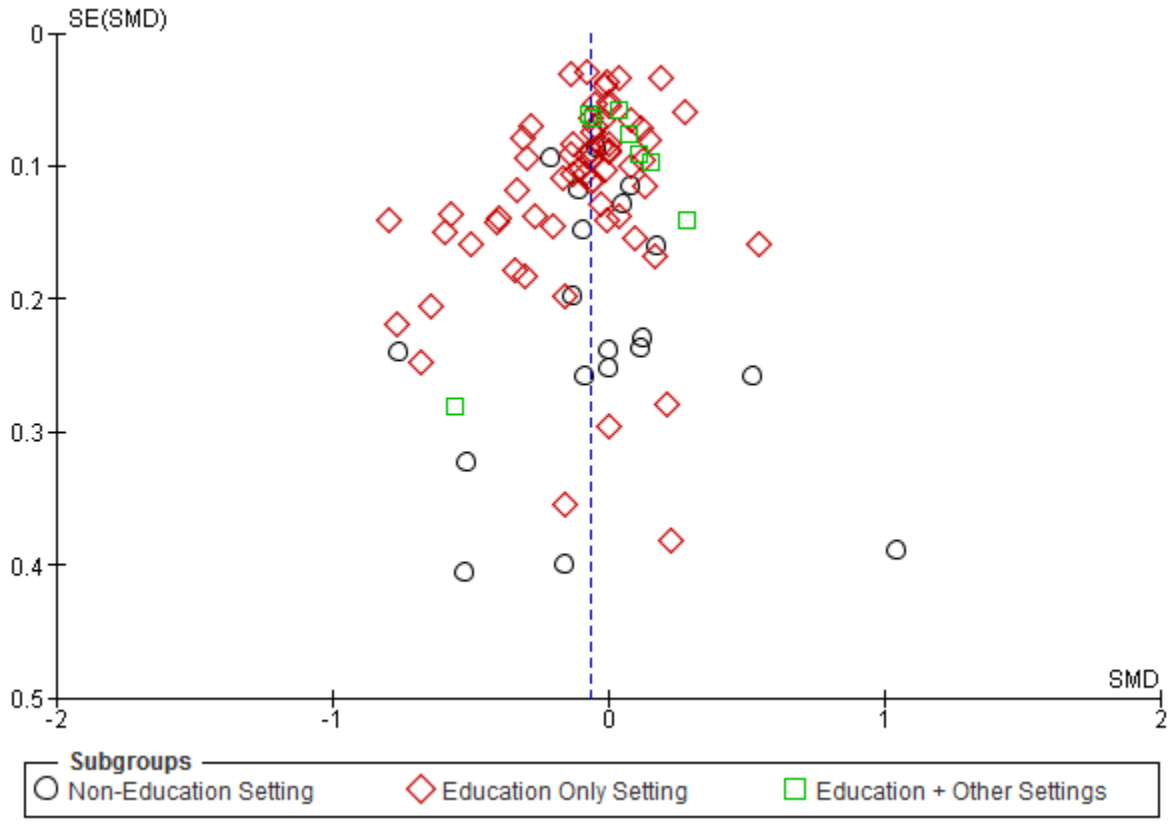
Forest Plot 1.3 continued from previous page



Funnel Plot 1.3: Effect of Prevention Interventions on BMI/BMIz – by Intervention Setting (Non-Education, Education, Education plus Other)



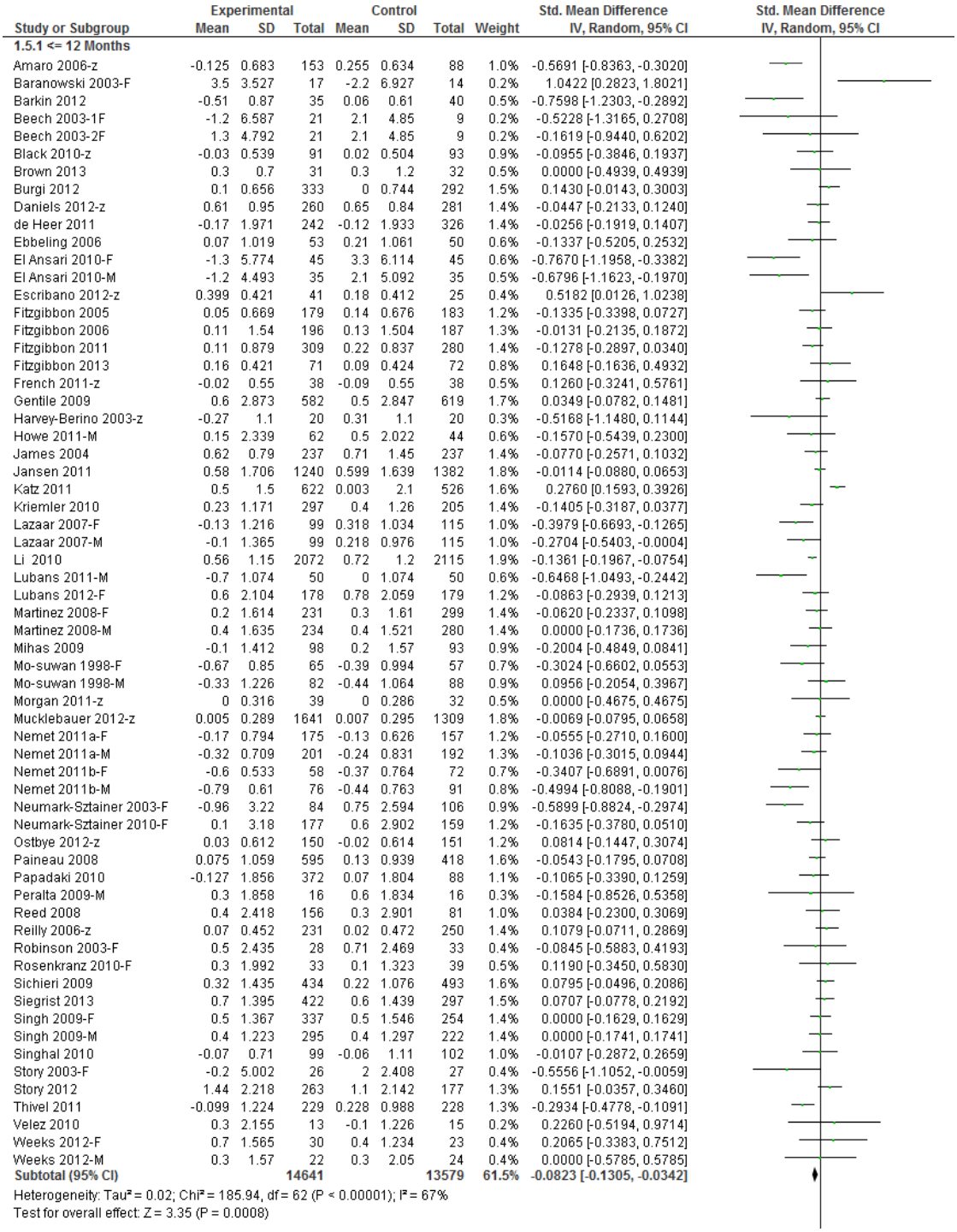
Egger's Test to Detect Publication Bias: Change in BMI/BMIz – by Intervention Setting (Non-Education, Education, Education plus Other)

Included Studies	P-value
Non-Education	0.683
Education	0.005*
Education plus Other	**

* Significant p≤0.05

** Too few studies (n<10) to assess

Forest Plot 1.4: Effect of Prevention Interventions on BMI/BMIz – by Intervention Duration (≤12 Months, >12 Months)



Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.5.1 <= 12 Months								
Amaro 2006-z	-0.125	0.683	153	0.255	0.634	88	1.0%	-0.5691 [-0.8363, -0.3020]
Baranowski 2003-F	3.5	3.527	17	-2.2	6.927	14	0.2%	1.0422 [0.2823, 1.8021]
Barkin 2012	-0.51	0.87	35	0.06	0.61	40	0.5%	-0.7598 [-1.2303, -0.2892]
Beech 2003-1F	-1.2	6.587	21	2.1	4.85	9	0.2%	-0.5228 [-1.3165, 0.2708]
Beech 2003-2F	1.3	4.792	21	2.1	4.85	9	0.2%	-0.1619 [-0.9440, 0.6202]
Black 2010-z	-0.03	0.539	91	0.02	0.504	93	0.9%	-0.0955 [-0.3846, 0.1937]
Brown 2013	0.3	0.7	31	0.3	1.2	32	0.5%	0.0000 [-0.4939, 0.4939]
Burgi 2012	0.1	0.656	333	0	0.744	292	1.5%	0.1430 [-0.0143, 0.3003]
Daniels 2012-z	0.61	0.95	260	0.65	0.84	281	1.4%	-0.0447 [-0.2133, 0.1240]
de Heer 2011	-0.17	1.971	242	-0.12	1.933	326	1.4%	-0.0256 [-0.1919, 0.1407]
Ebbeling 2006	0.07	1.019	53	0.21	1.061	50	0.6%	-0.1337 [-0.5205, 0.2532]
El Ansari 2010-F	-1.3	5.774	45	3.3	6.114	45	0.6%	-0.7670 [-1.1958, -0.3382]
El Ansari 2010-M	-1.2	4.493	35	2.1	5.092	35	0.5%	-0.6796 [-1.1623, -0.1970]
Escribano 2012-z	0.399	0.421	41	0.18	0.412	25	0.4%	0.5182 [0.0126, 1.0238]
Fitzgibbon 2005	0.05	0.669	179	0.14	0.676	183	1.2%	-0.1335 [-0.3398, 0.0727]
Fitzgibbon 2006	0.11	1.54	196	0.13	1.504	187	1.3%	-0.0131 [-0.2135, 0.1872]
Fitzgibbon 2011	0.11	0.879	309	0.22	0.837	280	1.4%	-0.1278 [-0.2897, 0.0340]
Fitzgibbon 2013	0.16	0.421	71	0.09	0.424	72	0.8%	0.1648 [-0.1636, 0.4932]
French 2011-z	-0.02	0.55	38	-0.09	0.55	38	0.5%	0.1260 [-0.3241, 0.5761]
Gentile 2009	0.6	2.873	582	0.5	2.847	619	1.7%	0.0349 [-0.0782, 0.1481]
Harvey-Berino 2003-z	-0.27	1.1	20	0.31	1.1	20	0.3%	-0.5168 [-1.1480, 0.1144]
Howe 2011-M	0.15	2.339	62	0.5	2.022	44	0.6%	-0.1570 [-0.5439, 0.2300]
James 2004	0.62	0.79	237	0.71	1.45	237	1.4%	-0.0770 [-0.2571, 0.1032]
Jansen 2011	0.58	1.706	1240	0.599	1.639	1382	1.8%	-0.0114 [-0.0880, 0.0653]
Katz 2011	0.5	1.5	622	0.003	2.1	526	1.6%	0.2760 [0.1593, 0.3926]
Kriemler 2010	0.23	1.171	297	0.4	1.26	205	1.4%	-0.1405 [-0.3187, 0.0377]
Lazaar 2007-F	-0.13	1.216	99	0.318	1.034	115	1.0%	-0.3979 [-0.6693, -0.1265]
Lazaar 2007-M	-0.1	1.365	99	0.218	0.976	115	1.0%	-0.2704 [-0.5403, -0.0004]
Li 2010	0.56	1.15	2072	0.72	1.2	2115	1.9%	-0.1361 [-0.1967, -0.0754]
Lubans 2011-M	-0.7	1.074	50	0	1.074	50	0.6%	-0.6468 [-1.0493, -0.2442]
Lubans 2012-F	0.6	2.104	178	0.78	2.059	179	1.2%	-0.0863 [-0.2939, 0.1213]
Martinez 2008-F	0.2	1.614	231	0.3	1.61	299	1.4%	-0.0620 [-0.2337, 0.1098]
Martinez 2008-M	0.4	1.635	234	0.4	1.521	280	1.4%	0.0000 [-0.1736, 0.1736]
Mihas 2009	-0.1	1.412	98	0.2	1.57	93	0.9%	-0.2004 [-0.4849, 0.0841]
Mo-suwan 1998-F	-0.67	0.85	65	-0.39	0.994	57	0.7%	-0.3024 [-0.6602, 0.0553]
Mo-suwan 1998-M	-0.33	1.226	82	-0.44	1.064	88	0.9%	0.0956 [-0.2054, 0.3967]
Morgan 2011-z	0	0.316	39	0	0.286	32	0.5%	0.0000 [-0.4675, 0.4675]
Mucklebauer 2012-z	0.005	0.289	1641	0.007	0.295	1309	1.8%	-0.0069 [-0.0795, 0.0658]
Nemet 2011a-F	-0.17	0.794	175	-0.13	0.626	157	1.2%	-0.0555 [-0.2710, 0.1600]
Nemet 2011a-M	-0.32	0.709	201	-0.24	0.831	192	1.3%	-0.1036 [-0.3015, 0.0944]
Nemet 2011b-F	-0.6	0.533	58	-0.37	0.764	72	0.7%	-0.3407 [-0.6891, 0.0076]
Nemet 2011b-M	-0.79	0.61	76	-0.44	0.763	91	0.8%	-0.4994 [-0.8088, -0.1901]
Neumark-Sztainer 2003-F	-0.96	3.22	84	0.75	2.594	106	0.9%	-0.5899 [-0.8824, -0.2974]
Neumark-Sztainer 2010-F	0.1	3.18	177	0.6	2.902	159	1.2%	-0.1635 [-0.3780, 0.0510]
Ostbye 2012-z	0.03	0.612	150	-0.02	0.614	151	1.2%	0.0814 [-0.1447, 0.3074]
Paineau 2008	0.075	1.059	595	0.13	0.939	418	1.6%	-0.0543 [-0.1795, 0.0708]
Papadaki 2010	-0.127	1.856	372	0.07	1.804	88	1.1%	-0.1065 [-0.3390, 0.1259]
Peralta 2009-M	0.3	1.858	16	0.6	1.834	16	0.3%	-0.1584 [-0.8526, 0.5358]
Reed 2008	0.4	2.418	156	0.3	2.901	81	1.0%	0.0384 [-0.2300, 0.3069]
Reilly 2006-z	0.07	0.452	231	0.02	0.472	250	1.4%	0.1079 [-0.0711, 0.2869]
Robinson 2003-F	0.5	2.435	28	0.71	2.469	33	0.4%	-0.0845 [-0.5883, 0.4193]
Rosenkranz 2010-F	0.3	1.992	33	0.1	1.323	39	0.5%	0.1190 [-0.3450, 0.5830]
Sichieri 2009	0.32	1.435	434	0.22	1.076	493	1.6%	0.0795 [-0.0496, 0.2086]
Siegrist 2013	0.7	1.395	422	0.6	1.439	297	1.5%	0.0707 [-0.0778, 0.2192]
Singh 2009-F	0.5	1.367	337	0.5	1.546	254	1.4%	0.0000 [-0.1629, 0.1629]
Singh 2009-M	0.4	1.223	295	0.4	1.297	222	1.4%	0.0000 [-0.1741, 0.1741]
Singhal 2010	-0.07	0.71	99	-0.06	1.11	102	1.0%	-0.0107 [-0.2872, 0.2659]
Story 2003-F	-0.2	5.002	26	2	2.408	27	0.4%	-0.5556 [-1.1052, -0.0059]
Story 2012	1.44	2.218	263	1.1	2.142	177	1.3%	0.1551 [-0.0357, 0.3460]
Thivel 2011	-0.099	1.224	229	0.228	0.988	228	1.3%	-0.2934 [-0.4778, -0.1091]
Velez 2010	0.3	2.155	13	-0.1	1.226	15	0.2%	0.2260 [-0.5194, 0.9714]
Weeks 2012-F	0.7	1.565	30	0.4	1.234	23	0.4%	0.2065 [-0.3383, 0.7512]
Weeks 2012-M	0.3	1.57	22	0.3	2.05	24	0.4%	0.0000 [-0.5785, 0.5785]
Subtotal (95% CI)			**14641**			**13579**	**61.5%**	**-0.0823 [-0.1305, -0.0342]**

Heterogeneity: Tau² = 0.02; Chi² = 185.94, df = 62 (P < 0.00001); I² = 67%
Test for overall effect: Z = 3.35 (P = 0.0008)

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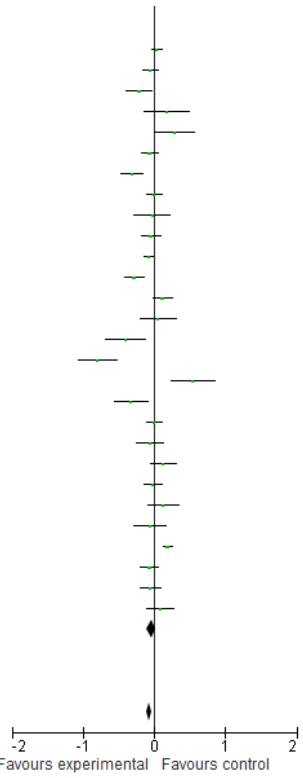
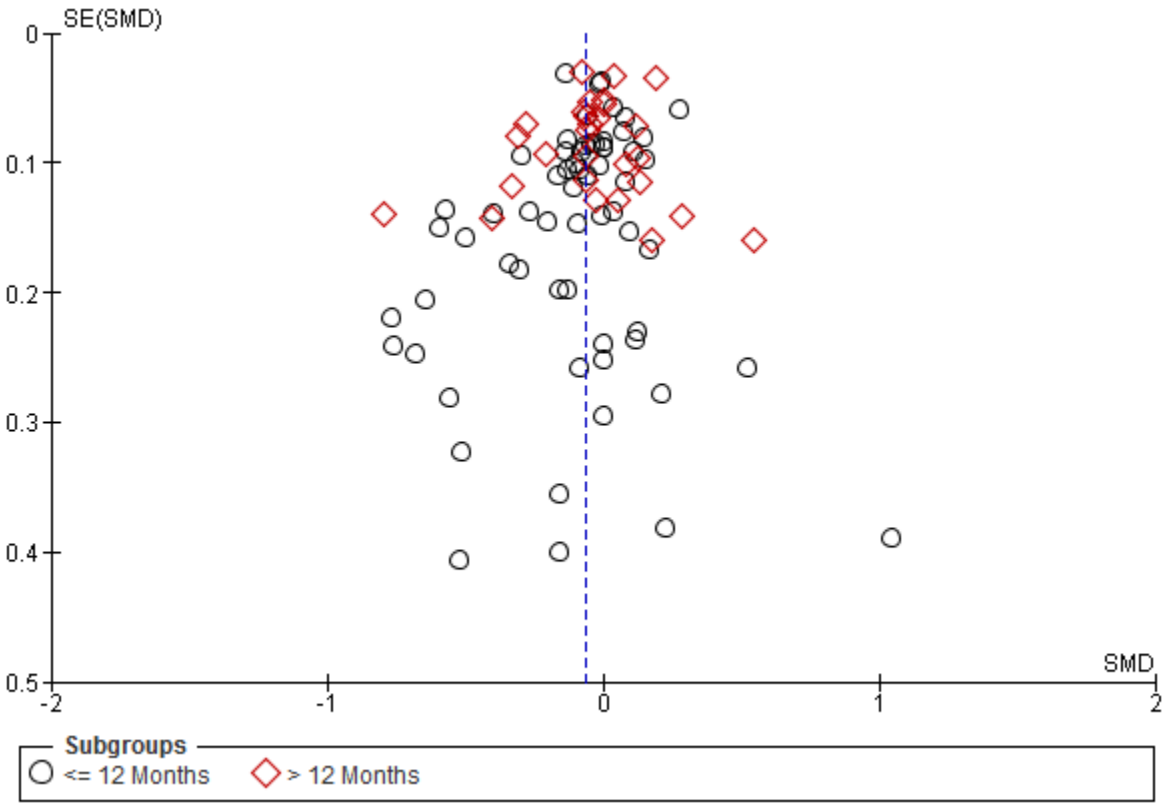
Forest Plot 1.4 continued from previous page

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.5.2 > 12 Months								
Bonsergent 2013	0.71	1.49	1949	0.66	1.45	1589	1.8%	0.0340 [-0.0323, 0.1002]
Caballero 2003	3	1.858	727	3.1	1.933	682	1.7%	-0.0528 [-0.1573, 0.0517]
Campbell 2013-z	1.2	0.488	229	1.3	0.447	229	1.3%	-0.2133 [-0.3970, -0.0297]
Crespo 2012-1z	0.06	0.54	96	-0.03	0.49	67	0.8%	0.1722 [-0.1403, 0.4848]
Crespo 2012-2z	0.109	0.487	211	-0.03	0.49	67	1.0%	0.2842 [0.0083, 0.5601]
De Coen 2012-z	-0.01	0.45	670	0.02	0.406	442	1.6%	-0.0692 [-0.1894, 0.0509]
de Ruyter 2012-z	0.02	0.41	319	0.15	0.42	322	1.5%	-0.3128 [-0.4686, -0.1571]
Donnelly 2009	2	1.9	792	2	1.9	698	1.7%	0.0000 [-0.1018, 0.1018]
Dzewaltowski 2010	0.1	3.473	134	0.2	3.175	112	1.0%	-0.0298 [-0.2808, 0.2211]
Foster 2008	1.99	2.203	479	2.1	2.133	364	1.6%	-0.0506 [-0.1869, 0.0857]
Foster 2010-z	-0.05	0.474	2307	-0.01	0.49	2296	1.9%	-0.0830 [-0.1408, -0.0252]
Haerens 2006-F	1.183	1.711	499	1.66	1.609	352	1.6%	-0.2854 [-0.4225, -0.1483]
Haerens 2006-M	1.396	1.591	1201	1.22	1.29	239	1.5%	0.1138 [-0.0250, 0.2527]
Klesges 2010-F	3	4.325	118	2.8	3.887	127	1.1%	0.0486 [-0.2021, 0.2992]
Llargues 2012-F	0.8	1.354	109	1.4	1.606	95	1.0%	-0.4048 [-0.6828, -0.1269]
Llargues 2012-M	0.8	1.158	116	1.8	1.354	106	1.0%	-0.7939 [-1.0676, -0.5202]
Magnusson 2012	1.4	0.976	90	0.8	1.222	76	0.8%	0.5452 [0.2342, 0.8563]
Rosario 2013	0.6	1.189	151	1	1.234	143	1.1%	-0.3294 [-0.5597, -0.0992]
Rush 2012-z	0.654	0.463	692	0.655	0.458	660	1.7%	-0.0022 [-0.1088, 0.1045]
Salcedo 2010-F	0.8	1.476	185	0.9	1.68	289	1.3%	-0.0623 [-0.2468, 0.1223]
Salcedo 2010-M	1	1.622	190	0.8	1.546	257	1.3%	0.1265 [-0.0612, 0.3142]
Simon 2008	2.38	2.203	479	2.42	2.133	475	1.6%	-0.0184 [-0.1453, 0.1085]
Telford 2012-F	1.2	1.565	154	1	1.565	149	1.2%	0.1275 [-0.0980, 0.3529]
Telford 2012-M	1	1.565	158	1.1	1.565	159	1.2%	-0.0637 [-0.2840, 0.1565]
Webber 2008-F	2.1	1.614	1751	1.8	1.614	1751	1.8%	0.1858 [0.1195, 0.2522]
Williamson 2012-Fz	0.056	0.476	854	0.088	0.507	352	1.6%	-0.0659 [-0.1901, 0.0583]
Williamson 2012-Mz	0.024	0.611	729	0.06	0.69	235	1.5%	-0.0570 [-0.2040, 0.0900]
Yin 2012-z	-0.04	0.512	195	-0.08	0.495	205	1.3%	0.0793 [-0.1168, 0.2755]
Subtotal (95% CI)			**15584**			**12538**	**38.5%**	**-0.0427 [-0.1051, 0.0197]**
Heterogeneity: Tau² = 0.02; Chi² = 151.46, df = 27 (P < 0.00001); I² = 82%								
Test for overall effect: Z = 1.34 (P = 0.18)								
Total (95% CI)			**30225**			**26117**	**100.0%**	**-0.0671 [-0.1049, -0.0293]**
Heterogeneity: Tau² = 0.02; Chi² = 340.80, df = 90 (P < 0.00001); I² = 74%								
Test for overall effect: Z = 3.48 (P = 0.0005)								
Test for subgroup differences: Chi² = 0.97, df = 1 (P = 0.32), I² = 0%								



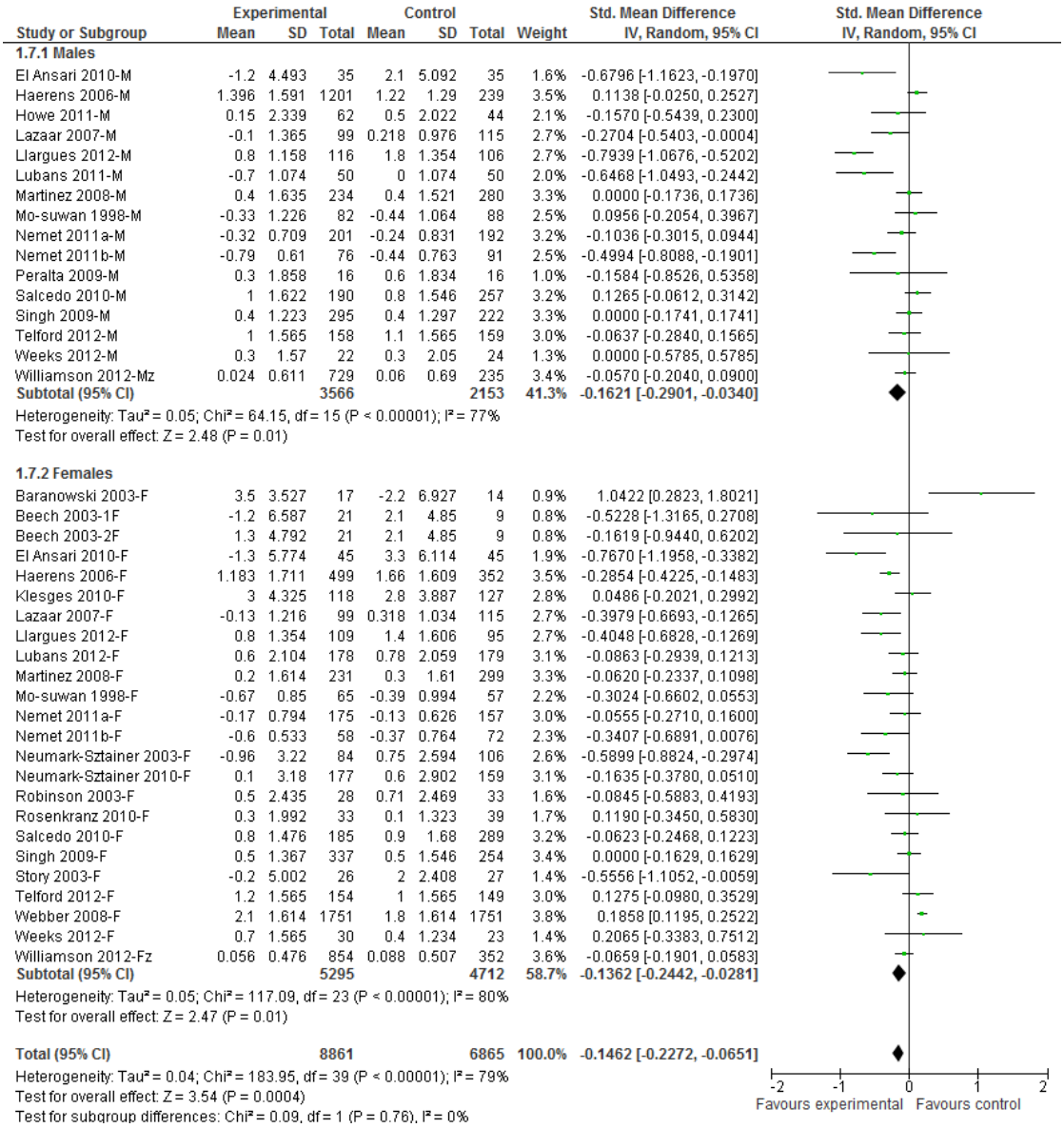
Funnel Plot 1.4: Effect of Prevention Interventions on BMI/BMIz – by Intervention Duration (≤12 Months, >12 Months)



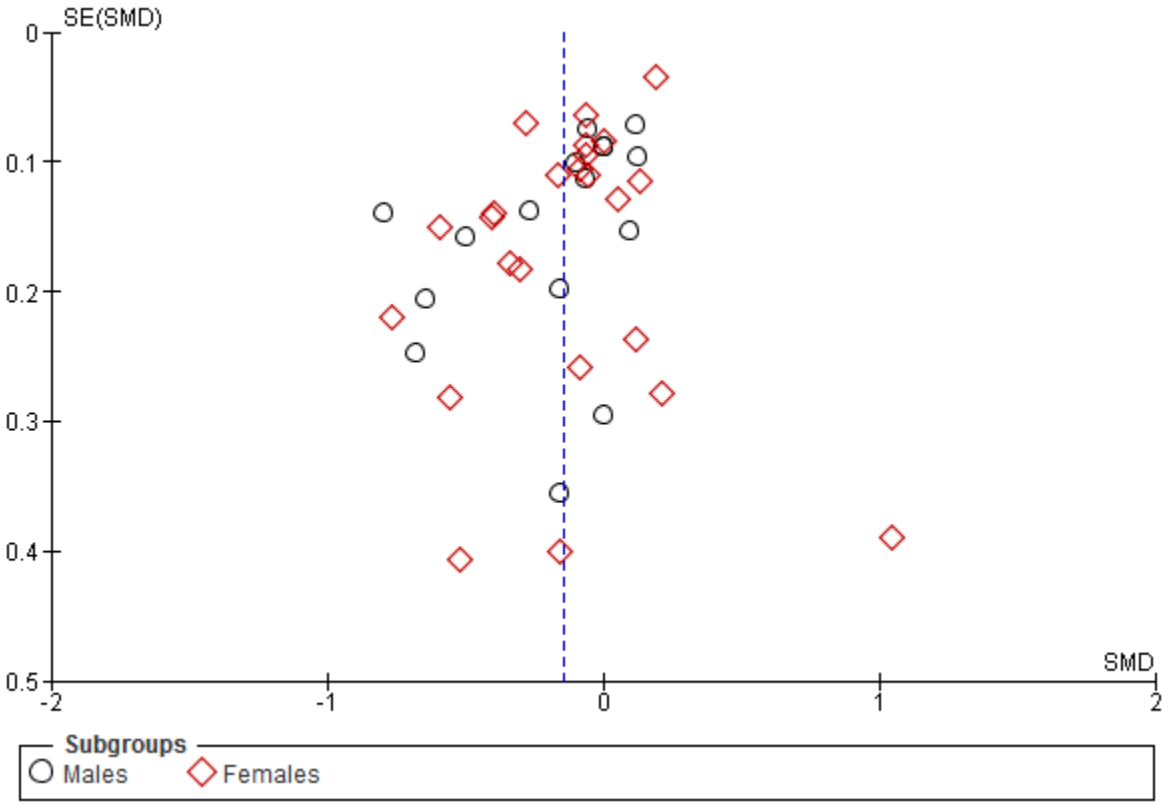
Egger's Test to Detect Publication Bias: Change in BMI/BMIz – by Intervention Duration (≤12 Months, >12 Months)

Included Studies	P-value
≤12 Months	0.052
>12 Months	0.301

Forest Plot 1.5: Effect of Prevention Interventions on BMI/BMIz – by Gender



Funnel Plot 1.5: Effect of Prevention Interventions on BMI/BMIz – by Gender

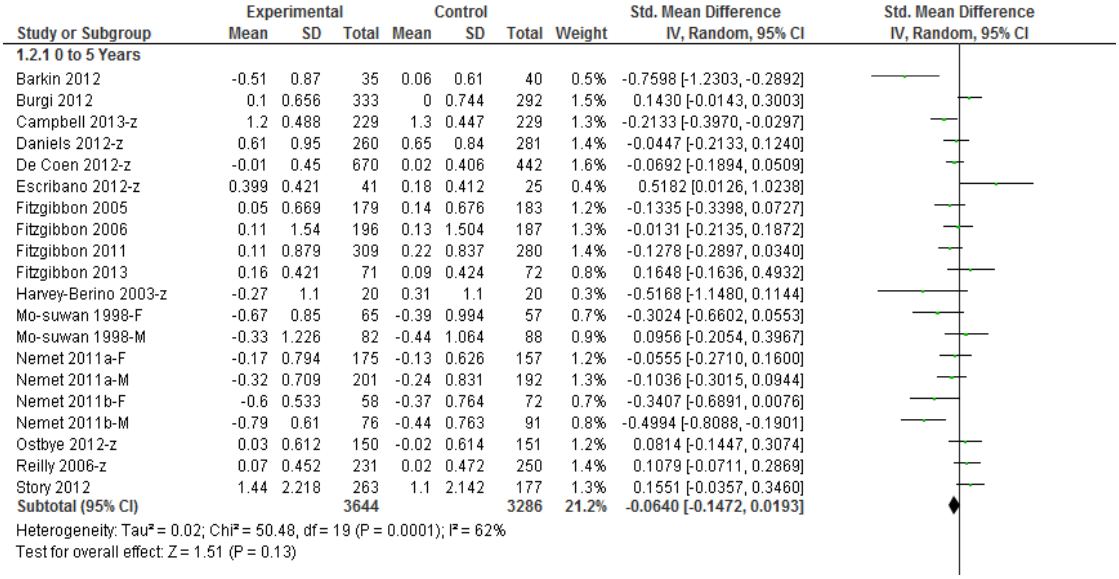


Egger's Test to Detect Publication Bias: Change in BMI/BMIz – by Gender

Included Studies	P-value
Male	0.026*
Female	0.011*

* Significant p≤0.05

Forest Plot 1.6: Effect of Prevention Interventions on BMI/BMIz – by Age Group (0 to 5 Years, 6 to 12 Years, 13 to 18 Years)



Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.2.1 0 to 5 Years								
Barkin 2012	-0.51	0.87	35	0.06	0.61	40	0.5%	-0.7598 [-1.2303, -0.2892]
Burgi 2012	0.1	0.656	333	0	0.744	292	1.5%	0.1430 [-0.0143, 0.3003]
Campbell 2013-z	1.2	0.488	229	1.3	0.447	229	1.3%	-0.2133 [-0.3970, -0.0297]
Daniels 2012-z	0.61	0.95	260	0.65	0.84	281	1.4%	-0.0447 [-0.2133, 0.1240]
De Coen 2012-z	-0.01	0.45	670	0.02	0.406	442	1.6%	-0.0692 [-0.1894, 0.0509]
Escribano 2012-z	0.399	0.421	41	0.18	0.412	25	0.4%	0.5182 [0.0126, 1.0238]
Fitzgibbon 2005	0.05	0.669	179	0.14	0.676	183	1.2%	-0.1335 [-0.3398, 0.0727]
Fitzgibbon 2006	0.11	1.54	196	0.13	1.504	187	1.3%	-0.0131 [-0.2135, 0.1872]
Fitzgibbon 2011	0.11	0.879	309	0.22	0.837	280	1.4%	-0.1278 [-0.2897, 0.0340]
Fitzgibbon 2013	0.16	0.421	71	0.09	0.424	72	0.8%	0.1648 [-0.1636, 0.4932]
Harvey-Berino 2003-z	-0.27	1.1	20	0.31	1.1	20	0.3%	-0.5168 [-1.1480, 0.1144]
Mo-suwan 1998-F	-0.67	0.85	65	-0.39	0.994	57	0.7%	-0.3024 [-0.6602, 0.0553]
Mo-suwan 1998-M	-0.33	1.226	82	-0.44	1.064	88	0.9%	0.0956 [-0.2054, 0.3967]
Nemet 2011a-F	-0.17	0.794	175	-0.13	0.626	157	1.2%	-0.0555 [-0.2710, 0.1600]
Nemet 2011a-M	-0.32	0.709	201	-0.24	0.831	192	1.3%	-0.1036 [-0.3015, 0.0944]
Nemet 2011b-F	-0.6	0.533	58	-0.37	0.764	72	0.7%	-0.3407 [-0.6891, 0.0076]
Nemet 2011b-M	-0.79	0.61	76	-0.44	0.763	91	0.8%	-0.4994 [-0.8088, -0.1901]
Ostbye 2012-z	0.03	0.612	150	-0.02	0.614	151	1.2%	0.0814 [-0.1447, 0.3074]
Reilly 2006-z	0.07	0.452	231	0.02	0.472	250	1.4%	0.1079 [-0.0711, 0.2869]
Story 2012	1.44	2.218	263	1.1	2.142	177	1.3%	0.1551 [-0.0357, 0.3460]
Subtotal (95% CI)			**3644**			**3286**	**21.2%**	**-0.0640 [-0.1472, 0.0193]**

Heterogeneity: Tau² = 0.02; Chi² = 50.48, df = 19 (P = 0.0001); I² = 62%
Test for overall effect: Z = 1.51 (P = 0.13)

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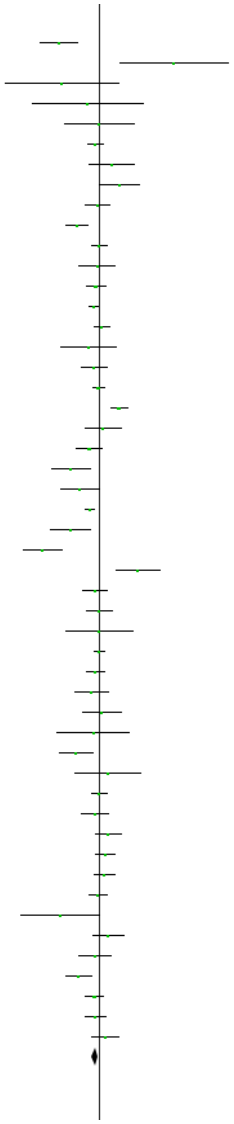
Forest Plot 1.6 continued from previous page

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.2.2 6 to 12 Years								
Amaro 2006-z	-0.125	0.683	153	0.255	0.634	88	1.0%	-0.5691 [-0.8363, -0.3020]
Baranowski 2003-F	3.5	3.527	17	-2.2	6.927	14	0.2%	1.0422 [0.2823, 1.8021]
Beech 2003-1F	-1.2	6.587	21	2.1	4.85	9	0.2%	-0.5228 [-1.3165, 0.2708]
Beech 2003-2F	1.3	4.792	21	2.1	4.85	9	0.2%	-0.1619 [-0.9440, 0.6202]
Brown 2013	0.3	0.7	31	0.3	1.2	32	0.5%	0.0000 [-0.4939, 0.4939]
Caballero 2003	3	1.858	727	3.1	1.933	682	1.7%	-0.0528 [-0.1573, 0.0517]
Crespo 2012-1z	0.06	0.54	96	-0.03	0.49	67	0.8%	0.1722 [-0.1403, 0.4848]
Crespo 2012-2z	0.109	0.487	211	-0.03	0.49	67	1.0%	0.2842 [0.0083, 0.5601]
de Heer 2011	-0.17	1.971	242	-0.12	1.933	326	1.4%	-0.0256 [-0.1919, 0.1407]
de Ruyter 2012-z	0.02	0.41	319	0.15	0.42	322	1.5%	-0.3128 [-0.4686, -0.1571]
Donnelly 2009	2	1.9	792	2	1.9	698	1.7%	0.0000 [-0.1018, 0.1018]
Dzewaltowski 2010	0.1	3.473	134	0.2	3.175	112	1.0%	-0.0298 [-0.2808, 0.2211]
Foster 2008	1.99	2.203	479	2.1	2.133	364	1.6%	-0.0506 [-0.1869, 0.0857]
Foster 2010-z	-0.05	0.474	2307	-0.01	0.49	2296	1.9%	-0.0830 [-0.1408, -0.0252]
Gentile 2009	0.6	2.873	582	0.5	2.847	619	1.7%	0.0349 [-0.0782, 0.1481]
Howe 2011-M	0.15	2.339	62	0.5	2.022	44	0.6%	-0.1570 [-0.5439, 0.2300]
James 2004	0.62	0.79	237	0.71	1.45	237	1.4%	-0.0770 [-0.2571, 0.1032]
Jansen 2011	0.58	1.706	1240	0.599	1.639	1382	1.8%	-0.0114 [-0.0880, 0.0653]
Katz 2011	0.5	1.5	622	0.003	2.1	526	1.6%	0.2760 [0.1593, 0.3926]
Klesges 2010-F	3	4.325	118	2.8	3.887	127	1.1%	0.0486 [-0.2021, 0.2992]
Kriemler 2010	0.23	1.171	297	0.4	1.26	205	1.4%	-0.1405 [-0.3187, 0.0377]
Lazaar 2007-F	-0.13	1.216	99	0.318	1.034	115	1.0%	-0.3979 [-0.6693, -0.1265]
Lazaar 2007-M	-0.1	1.365	99	0.218	0.976	115	1.0%	-0.2704 [-0.5403, -0.0004]
Li 2010	0.56	1.15	2072	0.72	1.2	2115	1.9%	-0.1361 [-0.1967, -0.0754]
Llargues 2012-F	0.8	1.354	109	1.4	1.606	95	1.0%	-0.4048 [-0.6828, -0.1269]
Llargues 2012-M	0.8	1.158	116	1.8	1.354	106	1.0%	-0.7939 [-1.0676, -0.5202]
Magnusson 2012	1.4	0.976	90	0.8	1.222	76	0.8%	0.5452 [0.2342, 0.8563]
Martinez 2008-F	0.2	1.614	231	0.3	1.61	299	1.4%	-0.0620 [-0.2337, 0.1098]
Martinez 2008-M	0.4	1.635	234	0.4	1.521	280	1.4%	0.0000 [-0.1736, 0.1736]
Morgan 2011-z	0	0.316	39	0	0.286	32	0.5%	0.0000 [-0.4675, 0.4675]
Mucklebauer 2012-z	0.005	0.289	1641	0.007	0.295	1309	1.8%	-0.0069 [-0.0795, 0.0658]
Paineau 2008	0.075	1.059	595	0.13	0.939	418	1.6%	-0.0543 [-0.1795, 0.0708]
Papadaki 2010	-0.127	1.856	372	0.07	1.804	88	1.1%	-0.1065 [-0.3390, 0.1259]
Reed 2008	0.4	2.418	156	0.3	2.901	81	1.0%	0.0384 [-0.2300, 0.3069]
Robinson 2003-F	0.5	2.435	28	0.71	2.469	33	0.4%	-0.0845 [-0.5883, 0.4193]
Rosario 2013	0.6	1.189	151	1	1.234	143	1.1%	-0.3294 [-0.5597, -0.0992]
Rosenkranz 2010-F	0.3	1.992	33	0.1	1.323	39	0.5%	0.1190 [-0.3450, 0.5830]
Rush 2012-z	0.654	0.463	692	0.655	0.458	660	1.7%	-0.0022 [-0.1088, 0.1045]
Salcedo 2010-F	0.8	1.476	185	0.9	1.68	289	1.3%	-0.0623 [-0.2468, 0.1223]
Salcedo 2010-M	1	1.622	190	0.8	1.546	257	1.3%	0.1265 [-0.0612, 0.3142]
Sichieri 2009	0.32	1.435	434	0.22	1.076	493	1.6%	0.0795 [-0.0496, 0.2086]
Siegrist 2013	0.7	1.395	422	0.6	1.439	297	1.5%	0.0707 [-0.0778, 0.2192]
Simon 2008	2.38	2.203	479	2.42	2.133	475	1.6%	-0.0184 [-0.1453, 0.1085]
Story 2003-F	-0.2	5.002	26	2	2.408	27	0.4%	-0.5556 [-1.1052, -0.0059]
Telford 2012-F	1.2	1.565	154	1	1.565	149	1.2%	0.1275 [-0.0980, 0.3529]
Telford 2012-M	1	1.565	158	1.1	1.565	159	1.2%	-0.0637 [-0.2840, 0.1565]
Thivel 2011	-0.099	1.224	229	0.228	0.988	228	1.3%	-0.2934 [-0.4778, -0.1091]
Williamson 2012-Fz	0.056	0.476	854	0.088	0.507	352	1.6%	-0.0659 [-0.1901, 0.0583]
Williamson 2012-Mz	0.024	0.611	729	0.06	0.69	235	1.5%	-0.0570 [-0.2040, 0.0900]
Yin 2012-z	-0.04	0.512	195	-0.08	0.495	205	1.3%	0.0793 [-0.1168, 0.2755]
Subtotal (95% CI)			**19520**			**17396**	**59.0%**	**-0.0550 [-0.1007, -0.0094]**

Heterogeneity: Tau² = 0.02; Chi² = 178.57, df = 49 (P < 0.00001); I² = 73%
Test for overall effect: Z = 2.36 (P = 0.02)



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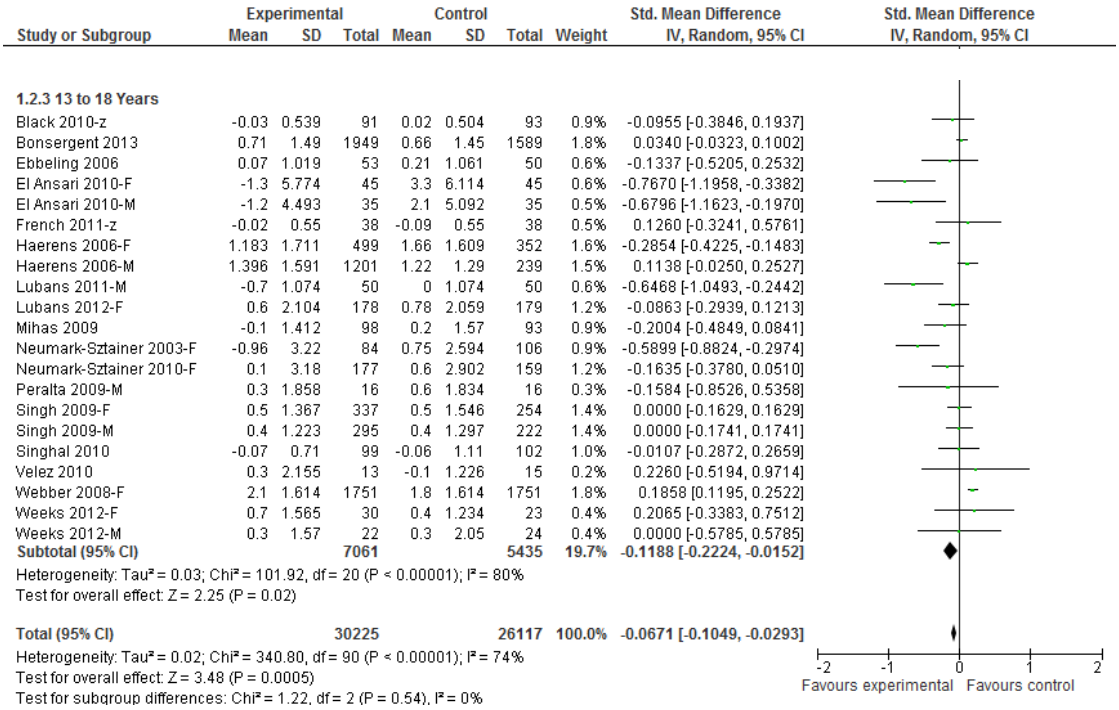
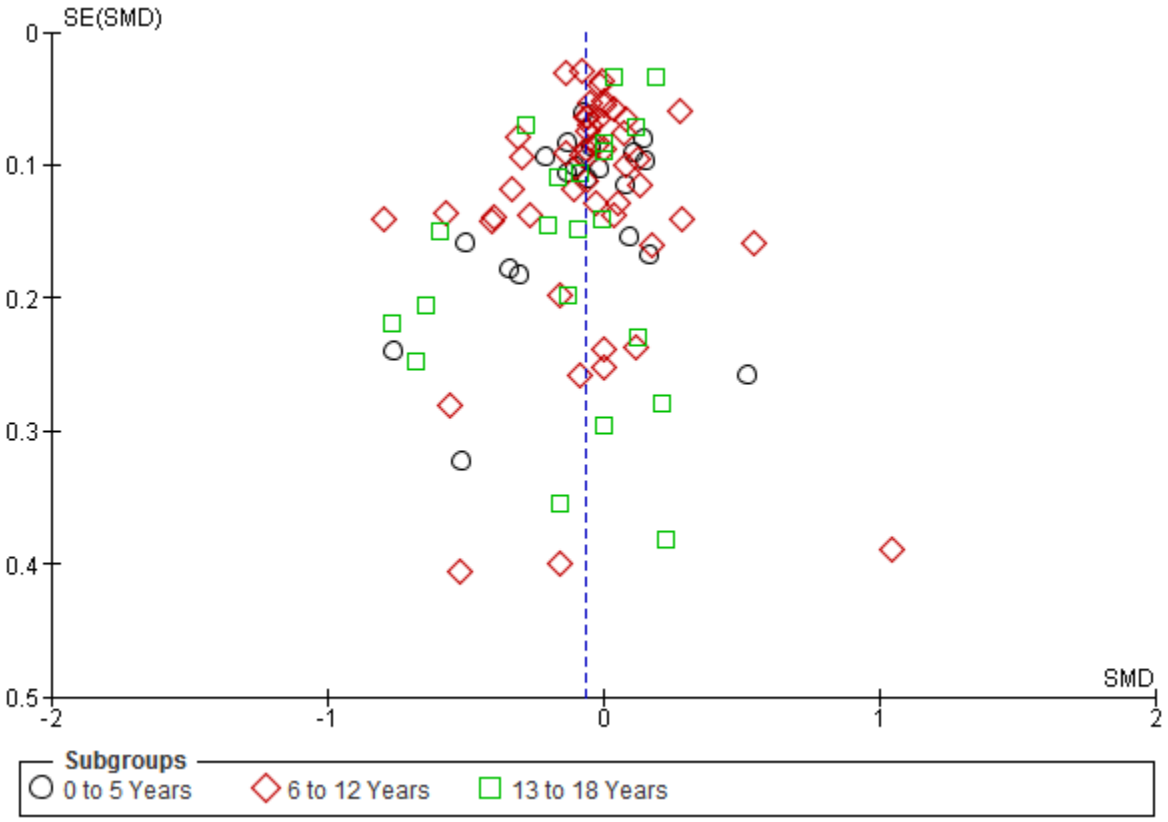
Forest Plot 1.6 continued from previous page



Funnel Plot 1.6: Effect of Prevention Interventions on BMI/BMIz – by Age Group (0 to 5 Years, 6 to 12 Years, 13 to 18 Years)

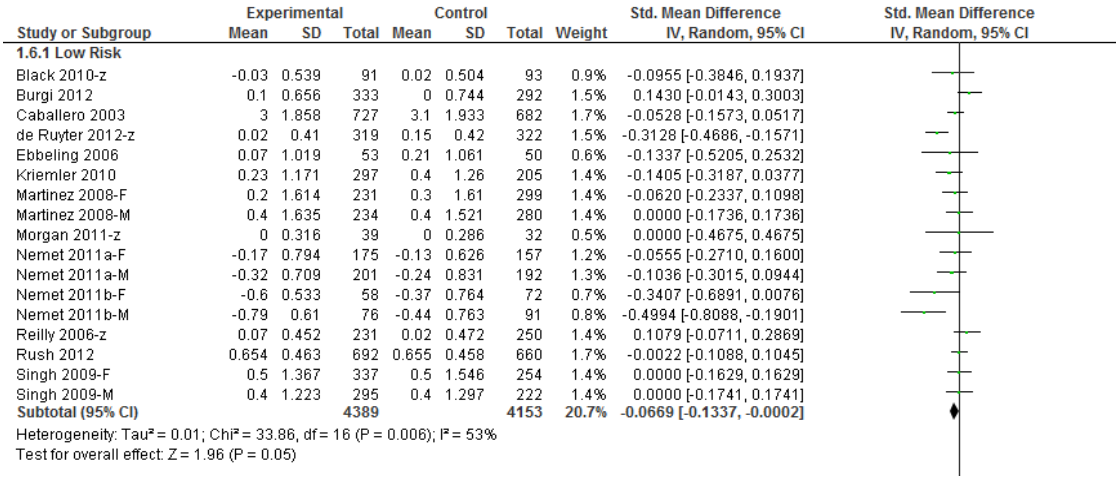


Egger's Test to Detect Publication Bias: Change in BMI/BMIz – by Age Group (0 to 5 Years, 6 to 12 Years, 13 to 18 Years)

Included Studies	P-value
0 to 5 Years	0.240
6 to 12 Years	0.607
13 to 18 Years	0.008*

* Significant p≤0.05

Forest Plot 1.7: Effect of Prevention Interventions on BMI/BMIz – by Study Risk of Bias Rating (Low, Unclear, High)



Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.6.1 Low Risk								
Black 2010-z	-0.03	0.539	91	0.02	0.504	93	0.9%	-0.0955 [-0.3846, 0.1937]
Burgi 2012	0.1	0.656	333	0	0.744	292	1.5%	0.1430 [-0.0143, 0.3003]
Caballero 2003	3	1.858	727	3.1	1.933	682	1.7%	-0.0528 [-0.1573, 0.0517]
de Ruyter 2012-z	0.02	0.41	319	0.15	0.42	322	1.5%	-0.3128 [-0.4686, -0.1571]
Ebbeling 2006	0.07	1.019	53	0.21	1.061	50	0.6%	-0.1337 [-0.5205, 0.2532]
Kriemler 2010	0.23	1.171	297	0.4	1.26	205	1.4%	-0.1405 [-0.3187, 0.0377]
Martinez 2008-F	0.2	1.614	231	0.3	1.61	299	1.4%	-0.0620 [-0.2337, 0.1098]
Martinez 2008-M	0.4	1.635	234	0.4	1.521	280	1.4%	0.0000 [-0.1736, 0.1736]
Morgan 2011-z	0	0.316	39	0	0.286	32	0.5%	0.0000 [-0.4675, 0.4675]
Nemet 2011a-F	-0.17	0.794	175	-0.13	0.626	157	1.2%	-0.0555 [-0.2710, 0.1600]
Nemet 2011a-M	-0.32	0.709	201	-0.24	0.831	192	1.3%	-0.1036 [-0.3015, 0.0944]
Nemet 2011b-F	-0.6	0.533	58	-0.37	0.764	72	0.7%	-0.3407 [-0.6891, 0.0076]
Nemet 2011b-M	-0.79	0.61	76	-0.44	0.763	91	0.8%	-0.4994 [-0.8088, -0.1901]
Reilly 2006-z	0.07	0.452	231	0.02	0.472	250	1.4%	0.1079 [-0.0711, 0.2869]
Rush 2012	0.654	0.463	692	0.655	0.458	660	1.7%	-0.0022 [-0.1088, 0.1045]
Singh 2009-F	0.5	1.367	337	0.5	1.546	254	1.4%	0.0000 [-0.1629, 0.1629]
Singh 2009-M	0.4	1.223	295	0.4	1.297	222	1.4%	0.0000 [-0.1741, 0.1741]
Subtotal (95% CI)			**4389**			**4153**	**20.7%**	**-0.0669 [-0.1337, -0.0002]**

Heterogeneity: Tau² = 0.01; Chi² = 33.86, df = 16 (P = 0.006); I² = 53%
Test for overall effect: Z = 1.96 (P = 0.05)

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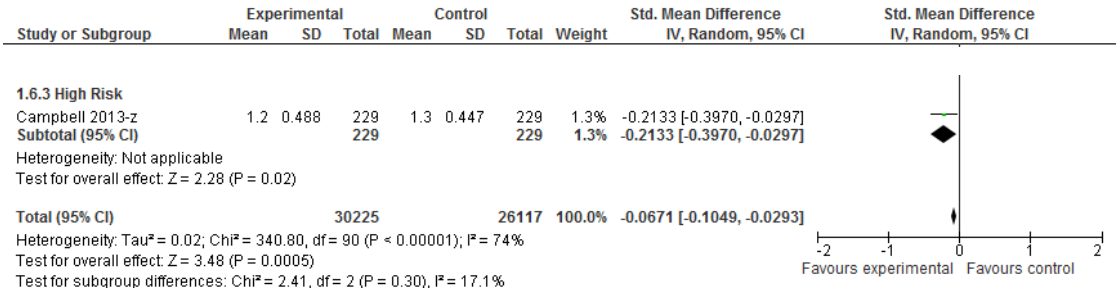
Forest Plot 1.7 continued from previous page

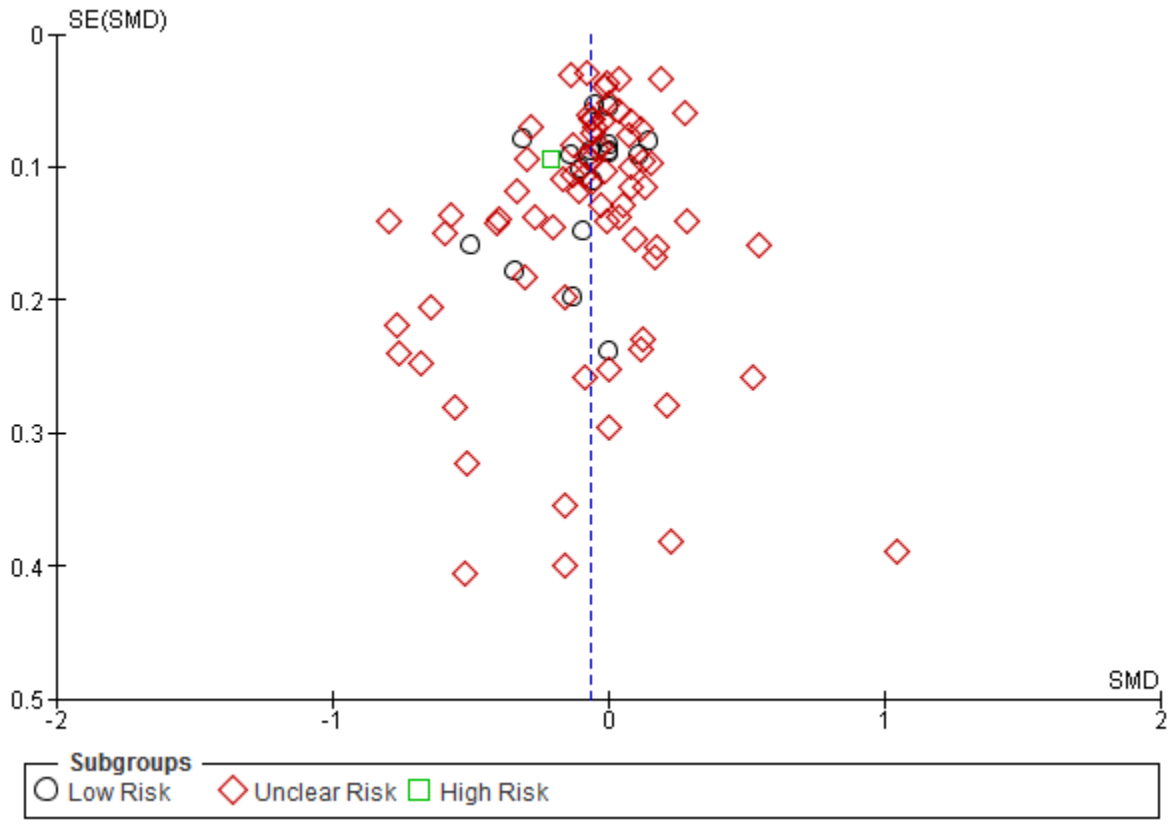
Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.6.2 Unclear Risk								
Amaro 2006-z	-0.125	0.683	153	0.255	0.634	88	1.0%	-0.5691 [-0.8363, -0.3020]
Baranowski 2003-F	3.5	3.527	17	-2.2	6.927	14	0.2%	1.0422 [0.2823, 1.8021]
Barkin 2012	-0.51	0.87	35	0.06	0.61	40	0.5%	-0.7598 [-1.2303, -0.2892]
Beech 2003-1F	-1.2	6.587	21	2.1	4.85	9	0.2%	-0.5228 [-1.3165, 0.2708]
Beech 2003-2F	1.3	4.792	21	2.1	4.85	9	0.2%	-0.1619 [-0.9440, 0.6202]
Bonsergent 2013	0.71	1.49	1949	0.66	1.45	1589	1.8%	0.0340 [-0.0323, 0.1002]
Brown 2013	0.3	0.7	31	0.3	1.2	32	0.5%	0.0000 [-0.4939, 0.4939]
Crespo 2012-1z	0.06	0.54	96	-0.03	0.49	67	0.8%	0.1722 [-0.1403, 0.4848]
Crespo 2012-2z	0.109	0.487	211	-0.03	0.49	67	1.0%	0.2842 [0.0083, 0.5601]
Daniels 2012-z	0.61	0.95	260	0.65	0.84	281	1.4%	-0.0447 [-0.2133, 0.1240]
De Coen 2012-z	-0.01	0.45	670	0.02	0.406	442	1.6%	-0.0692 [-0.1894, 0.0509]
de Heer 2011	-0.17	1.971	242	-0.12	1.933	326	1.4%	-0.0256 [-0.1919, 0.1407]
Donnelly 2009	2	1.9	792	2	1.9	698	1.7%	0.0000 [-0.1018, 0.1018]
Dzewaltowski 2010	0.1	3.473	134	0.2	3.175	112	1.0%	-0.0298 [-0.2808, 0.2211]
El Ansari 2010-F	-1.3	5.774	45	3.3	6.114	45	0.6%	-0.7670 [-1.1958, -0.3382]
El Ansari 2010-M	-1.2	4.493	35	2.1	5.092	35	0.5%	-0.6796 [-1.1623, -0.1970]
Escribano 2012-z	0.399	0.421	41	0.18	0.412	25	0.4%	0.5182 [0.0126, 1.0238]
Fitzgibbon 2005	0.05	0.669	179	0.14	0.676	183	1.2%	-0.1335 [-0.3398, 0.0727]
Fitzgibbon 2006	0.11	1.54	196	0.13	1.504	187	1.3%	-0.0131 [-0.2135, 0.1872]
Fitzgibbon 2011	0.11	0.879	309	0.22	0.837	280	1.4%	-0.1278 [-0.2897, 0.0340]
Fitzgibbon 2013	0.16	0.421	71	0.09	0.424	72	0.8%	0.1648 [-0.1636, 0.4932]
Foster 2008	1.99	2.203	479	2.1	2.133	364	1.6%	-0.0506 [-0.1869, 0.0857]
Foster 2010-z	-0.05	0.474	2307	-0.01	0.49	2296	1.9%	-0.0830 [-0.1408, -0.0252]
French 2011-z	-0.02	0.55	38	-0.09	0.55	38	0.5%	0.1260 [-0.3241, 0.5761]
Gentile 2009	0.6	2.873	582	0.5	2.847	619	1.7%	0.0349 [-0.0782, 0.1481]
Haerens 2006-F	1.183	1.711	499	1.66	1.609	352	1.6%	-0.2854 [-0.4225, -0.1483]
Haerens 2006-M	1.396	1.591	1201	1.22	1.29	239	1.5%	0.1138 [-0.0250, 0.2527]
Harvey-Berino 2003-z	-0.27	1.1	20	0.31	1.1	20	0.3%	-0.5168 [-1.1480, 0.1144]
Howe 2011-M	0.15	2.339	62	0.5	2.022	44	0.6%	-0.1570 [-0.5439, 0.2300]
James 2004	0.62	0.79	237	0.71	1.45	237	1.4%	-0.0770 [-0.2571, 0.1032]
Jansen 2011	0.58	1.706	1240	0.599	1.639	1382	1.8%	-0.0114 [-0.0880, 0.0653]
Katz 2011	0.5	1.5	622	0.003	2.1	526	1.6%	0.2760 [0.1593, 0.3926]
Klesges 2010-F	3	4.325	118	2.8	3.887	127	1.1%	0.0486 [-0.2021, 0.2992]
Lazaar 2007-F	-0.13	1.216	99	0.318	1.034	115	1.0%	-0.3979 [-0.6693, -0.1265]
Lazaar 2007-M	-0.1	1.365	99	0.218	0.976	115	1.0%	-0.2704 [-0.5403, -0.0004]
Li 2010	0.56	1.15	2072	0.72	1.2	2115	1.9%	-0.1361 [-0.1967, -0.0754]
Llargues 2012-F	0.8	1.354	109	1.4	1.606	95	1.0%	-0.4048 [-0.6828, -0.1269]
Llargues 2012-M	0.8	1.158	116	1.8	1.354	106	1.0%	-0.7939 [-1.0676, -0.5202]
Lubans 2011-M	-0.7	1.074	50	0	1.074	50	0.6%	-0.6468 [-1.0493, -0.2442]
Lubans 2012-F	0.6	2.104	178	0.78	2.059	179	1.2%	-0.0863 [-0.2939, 0.1213]
Magnusson 2012	1.4	0.976	90	0.8	1.222	76	0.8%	0.5452 [0.2342, 0.8563]
Mihas 2009	-0.1	1.412	98	0.2	1.57	93	0.9%	-0.2004 [-0.4849, 0.0841]
Mo-suwan 1998-F	-0.67	0.85	65	-0.39	0.994	57	0.7%	-0.3024 [-0.6602, 0.0553]
Mo-suwan 1998-M	-0.33	1.226	82	-0.44	1.064	88	0.9%	0.0956 [-0.2054, 0.3967]
Mucklebauer 2012-z	0.005	0.289	1641	0.007	0.295	1309	1.8%	-0.0069 [-0.0795, 0.0658]
Neumark-Sztainer 2003-F	-0.96	3.22	84	0.75	2.594	106	0.9%	-0.5899 [-0.8824, -0.2974]
Neumark-Sztainer 2010-F	0.1	3.18	177	0.6	2.902	159	1.2%	-0.1635 [-0.3780, 0.0510]
Ostbye 2012-z	0.03	0.612	150	-0.02	0.614	151	1.2%	0.0814 [-0.1447, 0.3074]
Paineau 2008	0.075	1.059	595	0.13	0.939	418	1.6%	-0.0543 [-0.1795, 0.0708]
Papadaki 2010	-0.127	1.856	372	0.07	1.804	88	1.1%	-0.1065 [-0.3390, 0.1259]
Peralta 2009-M	0.3	1.858	16	0.6	1.834	16	0.3%	-0.1584 [-0.8526, 0.5358]
Reed 2008	0.4	2.418	156	0.3	2.901	81	1.0%	0.0384 [-0.2300, 0.3069]
Robinson 2003-F	0.5	2.435	28	0.71	2.469	33	0.4%	-0.0845 [-0.5883, 0.4193]
Rosario 2013	0.6	1.189	151	1	1.234	143	1.1%	-0.3294 [-0.5597, -0.0992]
Rosenkranz 2010-F	0.3	1.992	33	0.1	1.323	39	0.5%	0.1190 [-0.3450, 0.5830]
Salcedo 2010-F	0.8	1.476	185	0.9	1.68	289	1.3%	-0.0623 [-0.2468, 0.1223]
Salcedo 2010-M	1	1.622	190	0.8	1.546	257	1.3%	0.1265 [-0.0612, 0.3142]
Sichieri 2009	0.32	1.435	434	0.22	1.076	493	1.6%	0.0795 [-0.0496, 0.2086]
Siegrist 2013	0.7	1.395	422	0.6	1.439	297	1.5%	0.0707 [-0.0778, 0.2192]
Simon 2008	2.38	2.203	479	2.42	2.133	475	1.6%	-0.0184 [-0.1453, 0.1085]
Singhal 2010	-0.07	0.71	99	-0.06	1.11	102	1.0%	-0.0107 [-0.2872, 0.2659]
Story 2003-F	-0.2	5.002	26	2	2.408	27	0.4%	-0.5556 [-1.1052, -0.0059]
Story 2012	1.44	2.218	263	1.1	2.142	177	1.3%	0.1551 [-0.0357, 0.3460]
Telford 2012-F	1.2	1.565	154	1	1.565	149	1.2%	0.1275 [-0.0980, 0.3529]
Telford 2012-M	1	1.565	158	1.1	1.565	159	1.2%	-0.0637 [-0.2840, 0.1565]
Thivel 2011	-0.099	1.224	229	0.228	0.988	228	1.3%	-0.2934 [-0.4778, -0.1091]
Velez 2010	0.3	2.155	13	-0.1	1.226	15	0.2%	0.2260 [-0.5194, 0.9714]
Webber 2008-F	2.1	1.614	1751	1.8	1.614	1751	1.8%	0.1858 [0.1195, 0.2522]
Weeks 2012-F	0.7	1.565	30	0.4	1.234	23	0.4%	0.2065 [-0.3383, 0.7512]
Weeks 2012-M	0.3	1.57	22	0.3	2.05	24	0.4%	0.0000 [-0.5785, 0.5785]
Williamson 2012-Fz	0.056	0.476	854	0.088	0.507	352	1.6%	-0.0659 [-0.1901, 0.0583]
Williamson 2012-Mz	0.024	0.611	729	0.06	0.69	235	1.5%	-0.0570 [-0.2040, 0.0900]
Yin 2012-z	-0.04	0.512	195	-0.08	0.495	205	1.3%	0.0793 [-0.1168, 0.2755]
Subtotal (95% CI)			**25607**			**21735**	**78.0%**	**-0.0642 [-0.1086, -0.0198]**

Heterogeneity: Tau² = 0.02; Chi² = 302.07, df = 72 (P < 0.00001); I² = 76%
Test for overall effect: Z = 2.83 (P = 0.005)

Forest Plot 1.7 continued from previous page



Funnel Plot 1.7: Effect of Prevention Interventions on BMI/BMIz – by Study Risk of Bias Rating (Low, Unclear, High)



Egger's Test to Detect Publication Bias: Change in BMI/BMIz – by Study Risk of Bias Rating (Low, Unclear, High)

Included Studies	P-value
Low Risk	0.200
Unclear Risk	0.068
High Risk	**

** Too few studies (n<10) to assess

Evidence Set 2: Do primary care relevant prevention interventions (behavioural) in normal weight children lead to reduced prevalence of overweight/obesity?

- Summary of Change in Prevalence of Overweight/Obesity Evidence
- GRADE Evidence Profile Table 2.1: Effect of Prevention Interventions on Prevalence of Overweight/Obesity
- GRADE Summary of Findings Table 2.1: Effect of Prevention Interventions on Prevalence of Overweight/Obesity
- Forest Plot 2.1: Effect of Prevention Interventions on Prevalence of Overweight/Obesity
- Funnel Plot 2.1: Effect of Prevention Interventions on Prevalence of Overweight/Obesity
- Egger's Test Results (for Publication Bias)

Summary of Change in Prevalence of Overweight/Obesity Evidence

- 30 studies; 31,896 participants
- Intervention participants were significantly more likely to show a reduction in the prevalence of overweight/obesity and less risk of being overweight/obese as compared to control group participants [40% overweight/obese pre-intervention to 35% overweight/obese post-intervention compared to 33% overweight/obese at baseline to 31% overweight/obese at post-assessment; $RR_{intervention}$ - $RR_{control}$ (95% CI) 0.94 (0.89, 0.99)
- ARR 1.96%
- NNT=51 (95% CI 29, 289)
- Low statistical heterogeneity across studies [Chi^2=18.68, df=35 (P=0.99), I^2=0%]

GRADE Evidence Profile Table 2.1: Effect of Prevention Interventions on Prevalence of Overweight/Obesity*

Quality Assessment							No. of Participants		Effect				Quality	Importance
No. of Studies	Design	Risk of Bias	Inconsistency	Indirectness	Imprecision	Other	Intervention	Control	Relative (95% CI)	Absolute per Million (Range)	ARR	NNT (95% CI)		
Change in Prevalence of Overweight/Obesity														
30	randomized trials[1]	serious risk[2]	no serious inconsistency[3]	serious indirectness[4,5]	no serious imprecision[6]	reporting bias[7]	6,239/15,694 (39.7516%)[8] 5,001/14,178 (35.2730%)[8]	6,448/19,279 (33.4456%)[8] 5,577/17,718 (31.4765%)[8]	RRi - RRc 0.9376 (0.8888 to 0.9890)[9]	19,641 fewer (from 3,462 to 35,002 fewer)[10]	1.9641%	51 (29, 289)	⊕OOO VERY LOW	CRITICAL

* Footnotes appear after the Summary of Findings Table

GRADE Summary of Findings Table 2.1: Effect of Prevention Interventions on Prevalence of Overweight/Obesity

Outcome: Change in Prevalence of Overweight/Obesity	Illustrative Comparative Risks* (95% CI)		Relative Effect (95% CI)	No. of Participants (Studies)	Quality of the Evidence (GRADE)
	Assumed Risk Number per Million Control	Corresponding Risk Number per Million Intervention			
All Studies Reporting Change in Prevalence	**314,765**[8]	**295,123** (279,763 to 311,302)[8,10]	**RRi - RRc 0.9376** (0.8888 to 0.9890)[9]	31,896 (30 studies[1])	⊕⊖⊖⊖ **very low**[2,3,4,5,6,7]

*The assumed risk is the mean control group risk across studies. The corresponding risk (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

Footnotes for GRADE Evidence Profile and Summary of Findings Tables for Effect of Prevention Interventions on Prevalence of Overweight/Obesity

[1] The 30 studies are:[67,68,72,77,81,84,85,87,96,97,100,101,108,110,111,114,117,120,124-126,130-134,141,144,154,155] Immediate post assessment for all but 2 studies; for these 2 studies the data point closest to the immediate post was selected [Lloyd[130] provides 18 month post baseline data following an intervention delivered during one school year (approximately 10 months); Fung[132] presents 24 month interim outcomes for a 36 month intervention].

[2] Using Cochrane's Risk of Bias tool, for this outcome 2 studies (7%) were rated as high risk, 23 studies (77%) were rated as unclear risk and 5 studies (17%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (67%), allocation concealment (93%), blinding of outcome assessors (70%), and other sources of bias (47%; i.e., insufficiently powered and/or analysis did not account for

clustering). Due to the nature of behavioural interventions, there is also a high risk of bias for blinding of participants and personnel across studies. Given that most of the information is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[3] The statistical heterogeneity is low [Chi^2=18.68, df=35 (P=0.99); I^2=0%]. The direction of the effect is not consistent across all studies but the confidence intervals overlap. This body of evidence was not downgraded for inconsistency.

[4] This body of evidence was downgraded because the population was not restricted to normal weight children and youth. Most studies included mixed weight samples.

[5] Across the 30 studies, most included mixed gender samples (n=29); 1 included only boys. Five of the studies included children aged 0 to 5, about three-quarters (n=22) included children aged 6 to 12, and the remaining 3 studies included youth aged 13 to 18. Most interventions were conducted in education settings (n=24); 3 studies conducted interventions in non-education settings, 2 studies used education and other settings for interventions, and one study had one intervention group in an education setting and a second intervention group used education and other settings. In terms of type of intervention, 7 were diet, 5 were exercise, 9 were diet plus exercise, and 9 were lifestyle. Control participants received usual care or no intervention in most studies (n=27); in about 3 studies control groups received a minimal component (e.g., information sessions or newsletters covering general health concepts). Intervention duration was 12 months or less in 18 (60%) studies (in about half of these studies the duration was 6 months or less) and duration was more than 12 month s in 12 (39%) studies (range was from 20 to 36 months; most were 2 or 3 year programs). One study was conducted in Canada, one was jointly located in Canada and the US, 9 studies were conducted in the US, 12 in European countries, and 1 in each of Australia, New Zealand, Israel, Brazil, Egypt, Mexico, and Thailand. Most studies (n=24) were published in the last 5 years (2009-2013); the remaining 6 studies were published between 1998 and 2008.

[6] The sample size is adequate (14,178 intervention, 17,718 control), the number of events is sufficient (5,001 intervention, 5,577 control), and the pooled effect estimate is precise with a narrow confidence interval [$RR_{intervention}$ – $RR_{control}$ 0.9376 (0.8888, 0.9890)]. This body of evidence was not downgraded for imprecision.

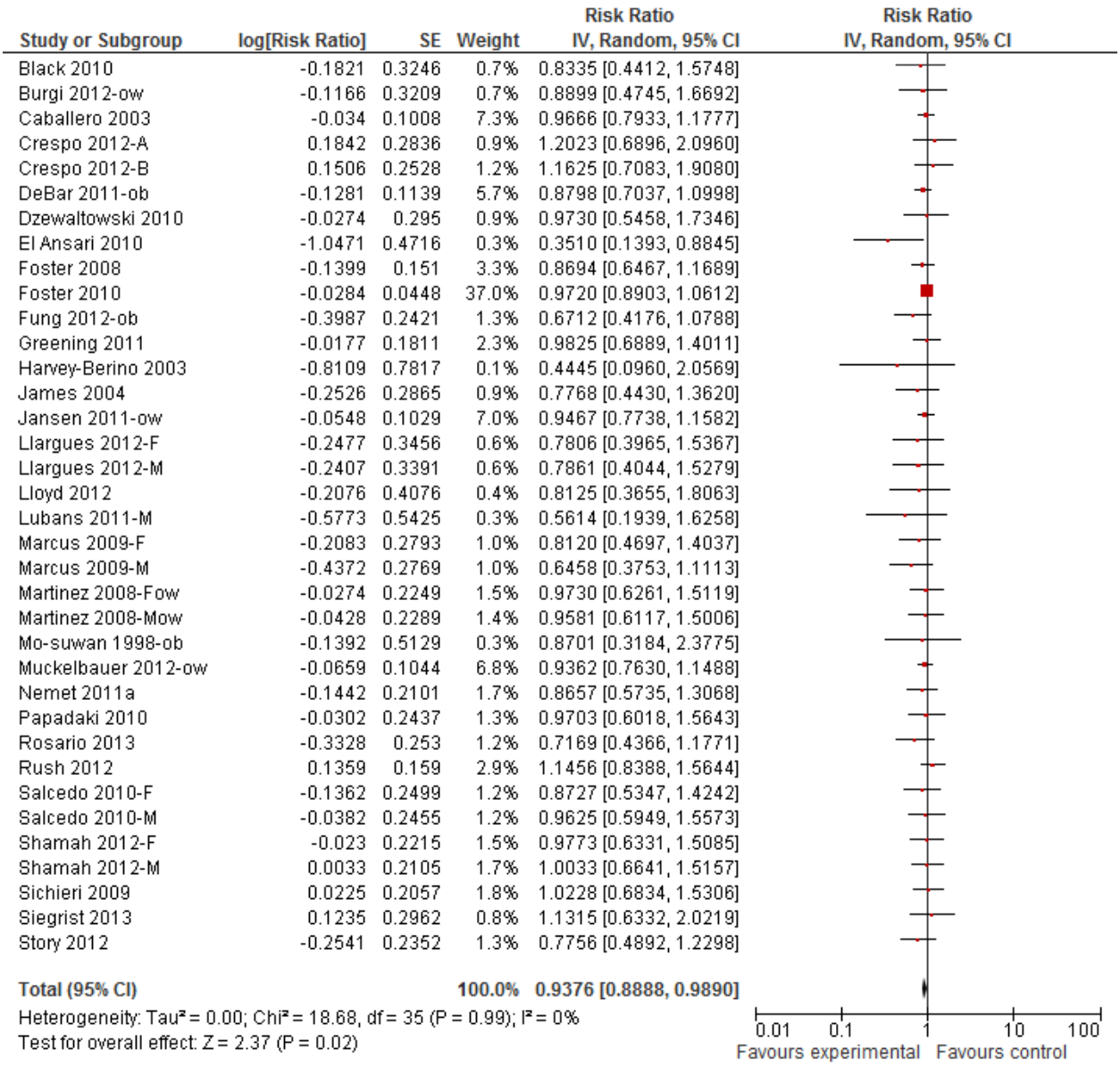
[7] The funnel plot for these studies and this outcome is asymmetrical. The Egger's test was conducted to detect publication bias; results were significant (P=0.010). This body of evidence was downgraded for suspected reporting bias.

[8] The number of events in the top cell is based on baseline assessment; the number of events in the bottom cell is based on post intervention assessment.

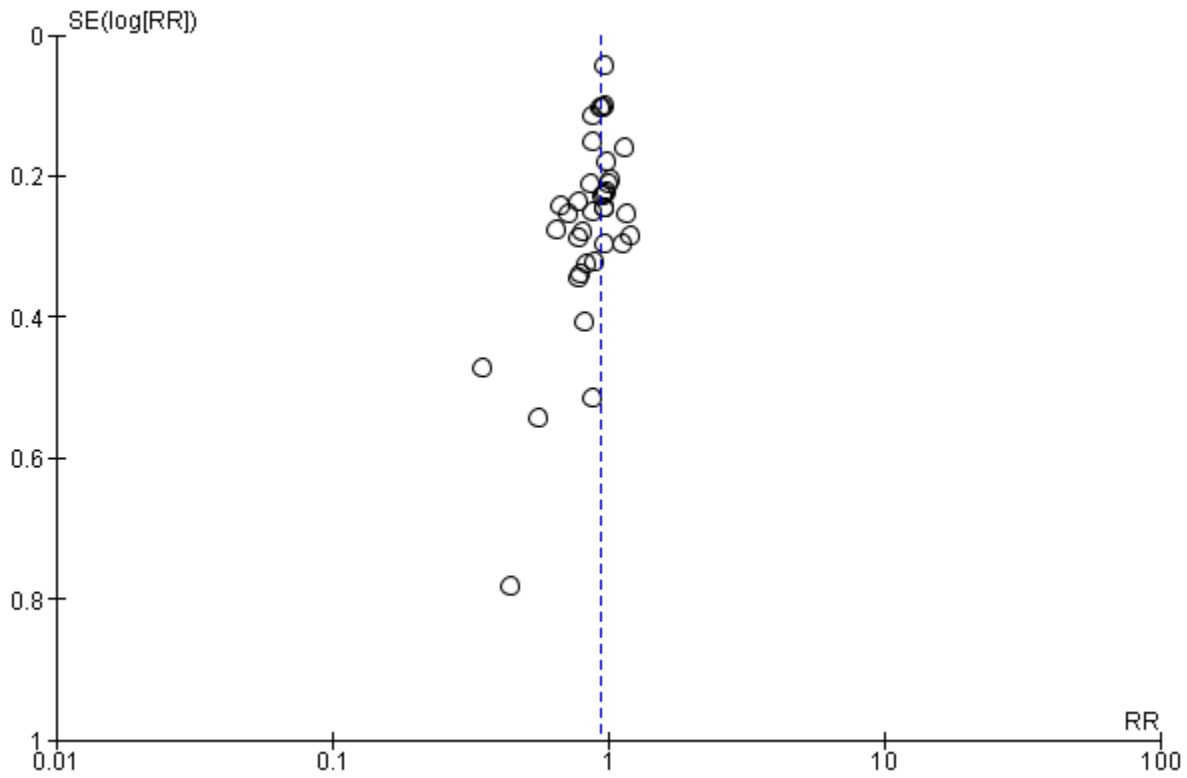
[9] The pooled estimate is based on differences in the risk ratio of intervention and control groups (RRc=ratio of pre-post prevalence in control arm, RRi=ratio of pre-post prevalence in intervention arm).

[10] Absolute numbers are based on prevalence at post intervention.

Forest Plot 2.1: Effect of Prevention Interventions on Prevalence of Overweight/Obesity



Funnel Plot 2.1: Effect of Prevention Interventions on Prevalence of Overweight/Obesity



Egger's Test to Detect Publication Bias: Change in Prevalence of Overweight/Obesity

Included Studies	P-value
All Studies Reporting Change in Prevalence	0.010*

* Significant p≤0.05

Evidence Set 3: Do primary care relevant prevention interventions (behavioural) in normal weight children lead to improved health outcomes (reduction in total cholesterol)?

- Summary of Change in Total Cholesterol Evidence
- GRADE Evidence Profile Table 3.1: Effect of Prevention Interventions on Total Cholesterol
- GRADE Summary of Findings Table 3.1: Effect of Prevention Interventions on Total Cholesterol
- Forest Plot 3.1: Effect of Prevention Interventions on Total Cholesterol
- Funnel Plot 3.1: Effect of Prevention Interventions on Total Cholesterol
- Egger's Test Results (for Publication Bias)

Summary of Change in Total Cholesterol Evidence

- 5 studies; 2,815 participants
- No statistically significant difference between the intervention group and control group in terms of change in total cholesterol [MD (95% CI) -0.10 mmol/L (-0.20, 0.01)]
- High statistical heterogeneity across studies [Chi^2=51.74, df=7 (P<0.00001); I^2=86%]

GRADE Evidence Profile Table 3.1: Effect of Prevention Interventions on Total Cholesterol*

Quality Assessment							No. of Participants		Effect	Quality	Importance
No. of Studies	Design	Risk of Bias	Inconsistency	Indirectness	Imprecision	Other Considerations	Intervention	Control	Mean Difference (95% CI)		
Change in Total Cholesterol (mmol/L): Overall (Better indicated by lower values)											
5	randomized trials[1]	serious risk[2]	serious inconsistency[3]	serious indirectness[4,5]	serious imprecision[6]	none[7]	1,261	1,554	0.0977 lower (0.2027 lower to 0.0073 higher)	⊕OOO VERY LOW	CRITICAL

***** Footnotes appear after Summary of Findings Table

GRADE Summary of Findings Table 3.1: Effect of Prevention Interventions on Total Cholesterol

Outcome: Change in Total Cholesterol (mmol/L)	Compared to the control group, the mean change in total cholesterol (95% CI) in the intervention groups was	No. of Participants (Studies)	Quality of the Evidence (GRADE)
All Studies Reporting Change in Total Cholesterol	**0.0977 lower** (0.2027 lower to 0.0073 higher)	2,815 (5 studies[1])	⊕⊖⊖⊖ **very low**[2,3,4,5,6,7]

Footnotes for GRADE Evidence Profile and Summary of Findings Tables for Effect of Prevention Interventions on Total Cholesterol

[1] The 5 studies are:[80,82,84,101,108] Immediate post assessment for all studies.

[2] Using Cochrane's Risk of Bias tool, for this outcome 4 studies (80%) were rated as unclear risk and 1 study (20%) was rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (80%) and allocation concealment (80%). Due to the nature of behavioural interventions, there is a high risk of bias for blinding of participants and personnel across all studies. Given that most of the information for this outcome is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[3] The statistical heterogeneity is high [Chi^2=51.74, df=7 (P<0.00001); I^2=86%]. The direction of the effect is not consistent across studies and the confidence intervals do not all overlap. This body of evidence was downgraded for inconsistency.

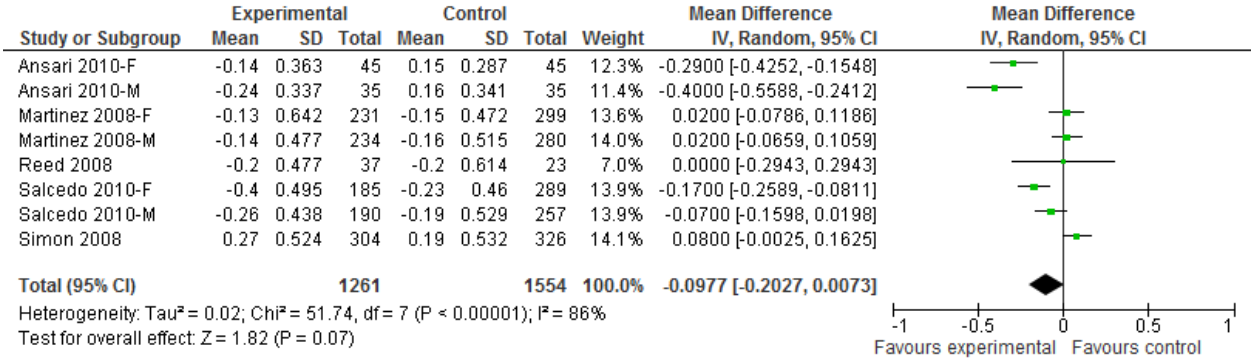
[4] This body of evidence was downgraded because the population was not restricted to normal weight children and youth.

[5] All 5 studies included mixed gender samples. Four studies targeted children aged 6 to 12 and 1 study targeted youth aged 13 to 18. In terms of type of intervention, all were exercise. One intervention used a multi-component approach and 4 used behavioural approaches. All 5 of the interventions took place in education settings. Control participants received usual practice or no intervention. Intervention duration was 12 months or less in 3 studies (for 2 of these studies the duration was 6 months or less) and more than 12 months in 2 studies (range from 20 to 48 months). One study was conducted in Canada, 3 in European countries, and 1 in Egypt. Two of the studies were published in 2010; the remaining 3 studies were published in 2008.

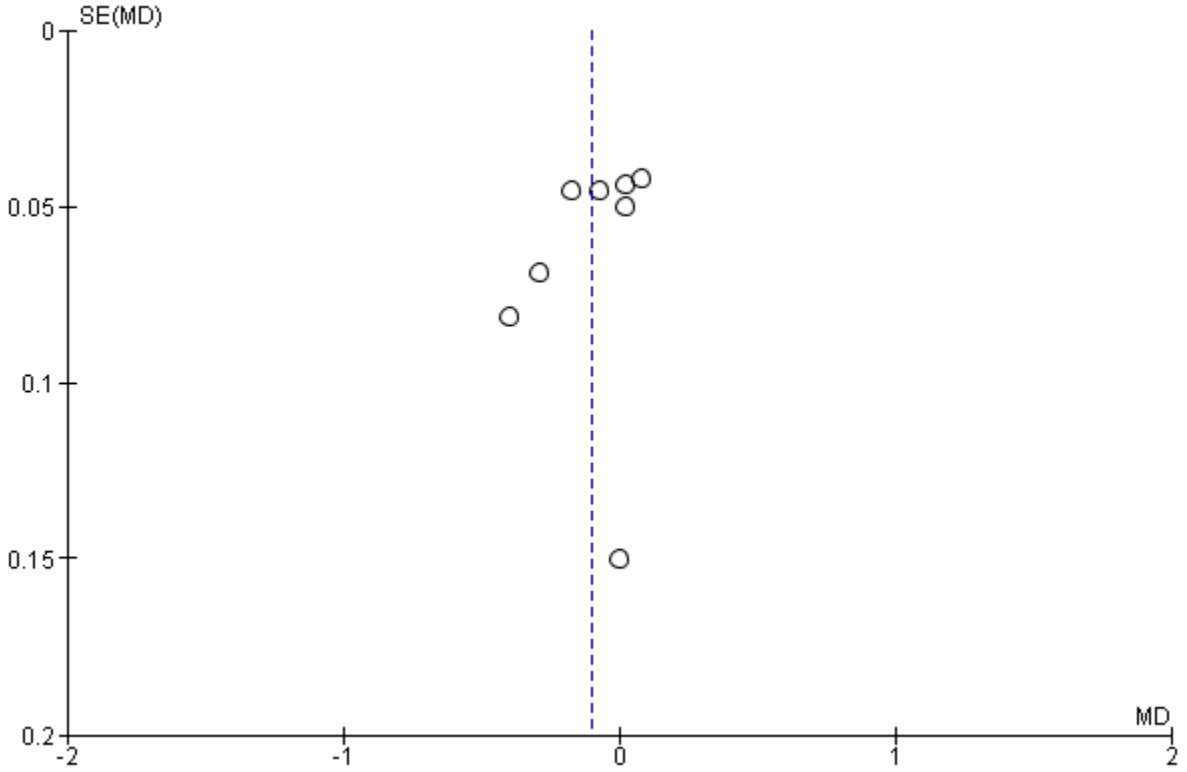
[6] The sample size is adequate (1,261 intervention arm, 1,554 control arm) but the pooled effect estimate is not precise with a confidence interval that includes the no effect value [MD -0.0977 mmol/L (-0.2027, 0.0073)]. This body of evidence was downgraded for serious concerns regarding imprecision

[7] Too few studies (n<10) to assess reporting bias.

Forest Plot 3.1: Effect of Prevention Interventions on Total Cholesterol



Funnel Plot 3.1: Effect of Prevention Interventions on Total Cholesterol



Egger's Test to Detect Publication Bias: Change in Total Cholesterol

Included Studies	P-value
All Studies Reporting Change in Total Cholesterol	**

** Too few studies (n<10) to assess

Evidence Set 4: Do primary care relevant prevention interventions (behavioural) in normal weight children lead to improved health outcomes (reduction in triglycerides)?

- Summary of Change in Triglycerides Evidence
- GRADE Evidence Profile Table 4.1: Effect of Prevention Interventions on Triglycerides
- GRADE Summary of Findings Table 4.1: Effect of Prevention Interventions on Triglycerides
- Forest Plot 4.1: Effect of Prevention Interventions on Triglycerides
- Funnel Plot 4.1: Effect of Prevention Interventions on Triglycerides
- Egger's Test Results (for Publication Bias)

Summary of Change in Triglycerides Evidence

- 4 studies; 3,097 participants
- No statistically significant difference between the intervention group and control group in terms of change in triglycerides [MD (95% CI) -0.01 mmol/L (-0.05, 0.03)]
- High statistical heterogeneity across studies [Chi^2=26.42, df=5 (P<0.0001); I^2=81%]

GRADE Evidence Profile Table 4.1: Effect of Prevention Interventions on Triglycerides*

Quality Assessment							No. of Participants		Effect	Quality	Importance
No. of Studies	Design	Risk of Bias	Inconsistency	Indirectness	Imprecision	Other Considerations	Intervention	Control	Mean Difference (95% CI)		
Change in Triglycerides (mmol/L): Overall (Better indicated by lower values)											
4	randomized trials[1]	serious risk[2]	serious inconsistency[3]	serious indirectness[4,5]	serious imprecision[6]	none[7]	1,441	1,656	0.0091 lower (0.0482 lower to 0.0300 higher)	⊕OOO VERY LOW	CRITICAL

***** Footnotes appear after Summary of Findings Table

GRADE Summary of Findings Table 4.1: Effect of Prevention Interventions on Triglycerides

Outcome: Change in Triglycerides (mmol/L)	Compared to the control group, the mean reduction in triglycerides (95% CI) in the intervention groups was	No. of Participants (Studies)	Quality of the Evidence (GRADE)
All Studies Reporting Change in Triglycerides	0.0091 lower (0.0482 lower to 0.0300 higher)	3,097 (4 studies[1])	⊕⊖⊖⊖ **very low**[2,3,4,5,6,7]

Footnotes for GRADE Evidence Profile and Summary of Findings Tables for Effect of Prevention Interventions on Triglycerides

[1] The 4 studies are:[80,84,103,108] Immediate post assessment for all studies.

[2] Using Cochrane's Risk of Bias tool, for this outcome 2 studies (50%) were rated as unclear risk and 2 studies (50%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (50%), allocation concealment (75%) and blinding of outcome assessors (75%). Due to the nature of behavioural interventions, there is a high risk of bias for blinding of participants and personnel across all studies. Given that half of the information for this outcome is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[3] The statistical heterogeneity is high [Chi^2=26.42, df=5 (P<0.0001); I^2=81%]. The direction of the effect is not consistent across studies and the confidence intervals do not all overlap. This body of evidence was downgraded for inconsistency.

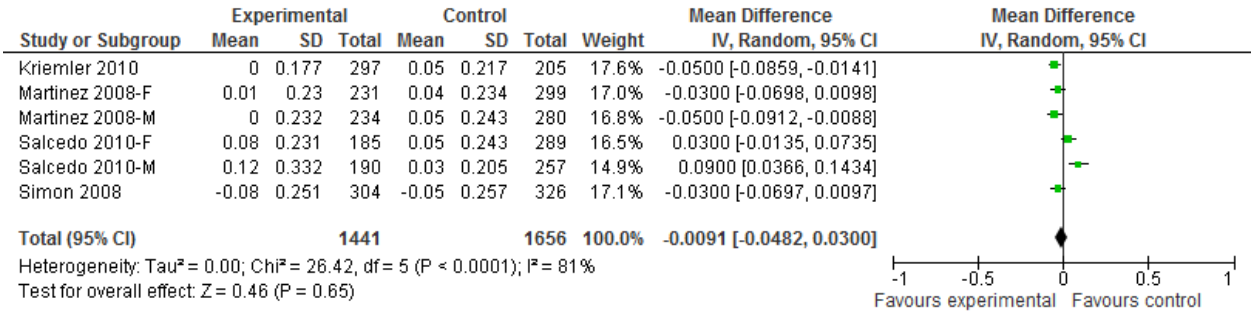
[4] This body of evidence was downgraded because the population was not restricted to normal weight children and youth.

[5] All 4 studies included mixed gender samples, targeted children aged 6 to 12, were exercise focused, used behavioural approaches, took place in education settings, provided usual practice or no intervention to control participants, and were conducted in European countries. Intervention duration was 12 months or less in 2 studies (for 1 of these studies the duration was 6 months or less) and more than 12 months in 2 studies (range from 20 to 48 months). Two of the studies were published in 2012; the other 2 studies were published in 2008.

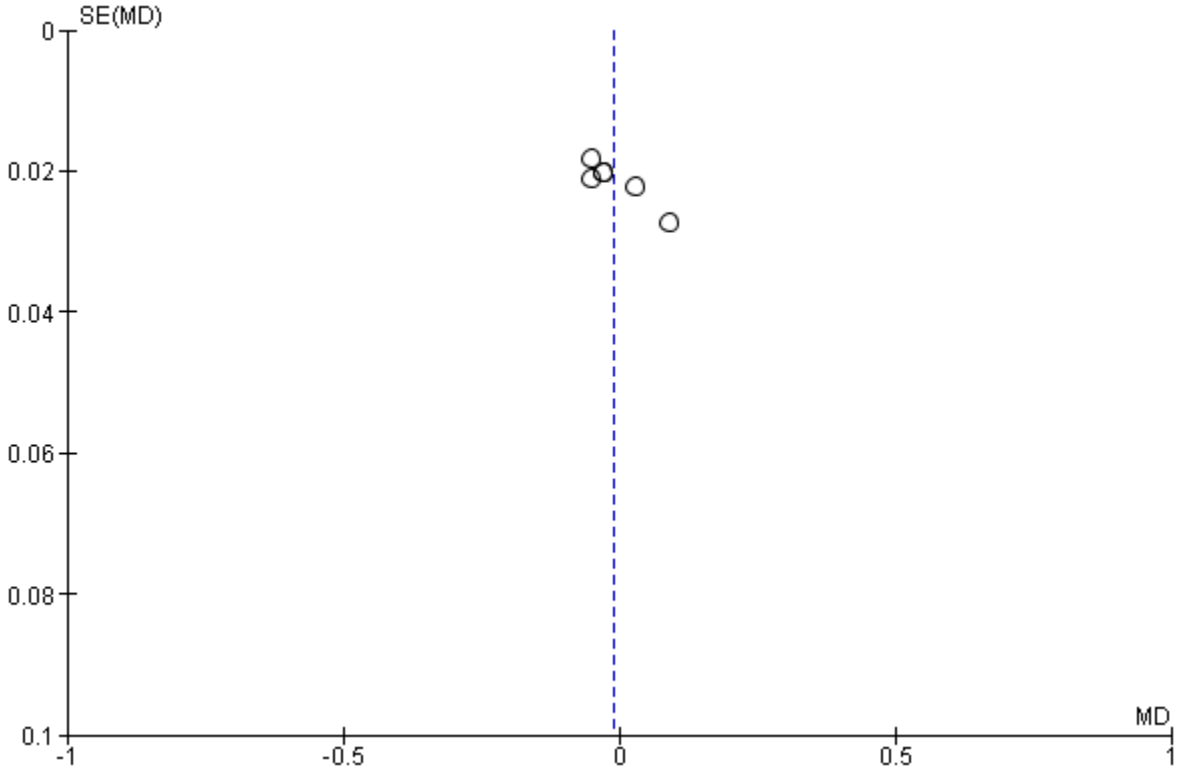
[6] The sample size is adequate (1,441 intervention arm, 1,656 control arm) but the pooled effect estimate is not precise with a confidence interval that includes the no effect value [MD -0.0091 mmol/L (-0.0482, 0.0300)]. This body of evidence was downgraded for serious concerns regarding imprecision.

[7] Too few studies (n<10) to assess reporting bias.

Forest Plot 4.1: Effect of Prevention Interventions on Triglycerides



Funnel Plot 4.1: Effect of Prevention Interventions on Triglycerides



Egger's Test to Detect Publication Bias: Change in Triglycerides

Included Studies	P-value
All Studies Reporting Change in Triglycerides	**

** Too few studies (n<10) to assess

Evidence Set 5: Do primary care relevant prevention interventions (behavioural) in normal weight children lead to improved health outcomes (reduction in high density lipoprotein cholesterol)?

- Summary of Change in HDL-C Evidence
- GRADE Evidence Profile Table 5.1: Effect of Prevention Interventions on HDL-C
- GRADE Summary of Findings Table 5.1: Effect of Prevention Interventions on HDL-C
- Forest Plot 5.1: Effect of Prevention Interventions on HDL-C
- Funnel Plot 5.1: Effect of Prevention Interventions on HDL-C
- Egger's Test Results (for Publication Bias)

Summary of Change in HDL-C Evidence

- 3 studies; 1,240 participants
- Statistically significant increase in HDL-C in the intervention group as compared to the control group [MD (95% CI) 0.07 mmol/L (0.04, 0.10)]
- High statistical heterogeneity across studies [Chi^2=1.22, df=2 (P=0.54); I^2=0%]

GRADE Evidence Profile Table 5.1: Effect of Prevention Interventions on HDL-C*

Quality Assessment							No. of Participants		Effect	Quality	Importance
No. of Studies	Design	Risk of Bias	Inconsistency	Indirectness	Imprecision	Other Considerations	Intervention	Control	Mean Difference (95% CI)		
Change in HDL-C (mmol/L): Overall (Better indicated by higher values)											
3	randomized trials[1]	serious risk[2]	no serious inconsistency[3]	serious indirectness[4,5]	no serious imprecision[6]	none[7]	659	581	0.0707 higher (0.0368 to 0.1045 higher)	⊕⊕OO LOW	CRITICAL

* Footnotes appear after the Summary of Findings Table

GRADE Summary of Findings Table 5.1: Effect of Prevention Interventions on HDL-C

Outcome: Change in HDL-C (mmol/L)	Compared to the control group, the mean change in HDL-C (95% CI) in the intervention groups was	No. of Participants (Studies)	Quality of the Evidence (GRADE)
All Studies Reporting Change in HDL-C	0.0707 higher (0.0368 to 0.1045 higher)	1,240 (3 studies[1])	⊕⊕⊖⊖ **low**[2,3,4,5,6,7]

Footnotes for GRADE Evidence Profile and Summary of Findings Tables for Effect of Prevention Interventions on HDL-C

[1] The 3 studies are:[80,103,118] Immediate post assessment for all studies.

[2] Using Cochrane's Risk of Bias tool, for this outcome 2 studies (67%) were rated as unclear risk and 1 study (33%) was rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (67%), allocation concealment (100%) and blinding of outcome assessors (67%). Due to the nature of behavioural interventions, there is a high risk of bias for blinding of participants and personnel across all studies. Given that most of the information for this outcome is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[3] The statistical heterogeneity is low [Chi^2=1.22, df=2 (P=0.54); I^2=0%], the direction of the effect is consistent across studies and the confidence intervals overlap. This body of evidence was not downgraded for inconsistency.

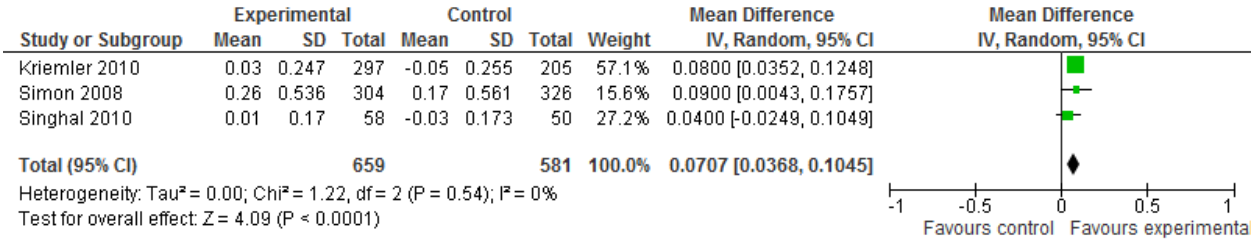
[4] This body of evidence was downgraded because the population was not restricted to normal weight children and youth.

[5] All 3 studies included mixed gender samples. Two studies targeted children aged 6 to 12 and 1 study targeted youth aged 13 to 18. In terms of type of intervention 2 were exercise and 1 was lifestyle. One intervention used a multi-component approach and 2 used behavioural approaches. All 3 of the interventions took place in education settings. Control participants received usual practice or no intervention. Intervention duration was 12 months or less in 2 studies (for 1 of these studies the duration was 6 months or less) and more than 12 months in 1 study (48 months). Two studies were conducted in European countries and 1 in India. Two of the studies were published in the last 5 years (2009-2012); the remaining study was published in 2008.

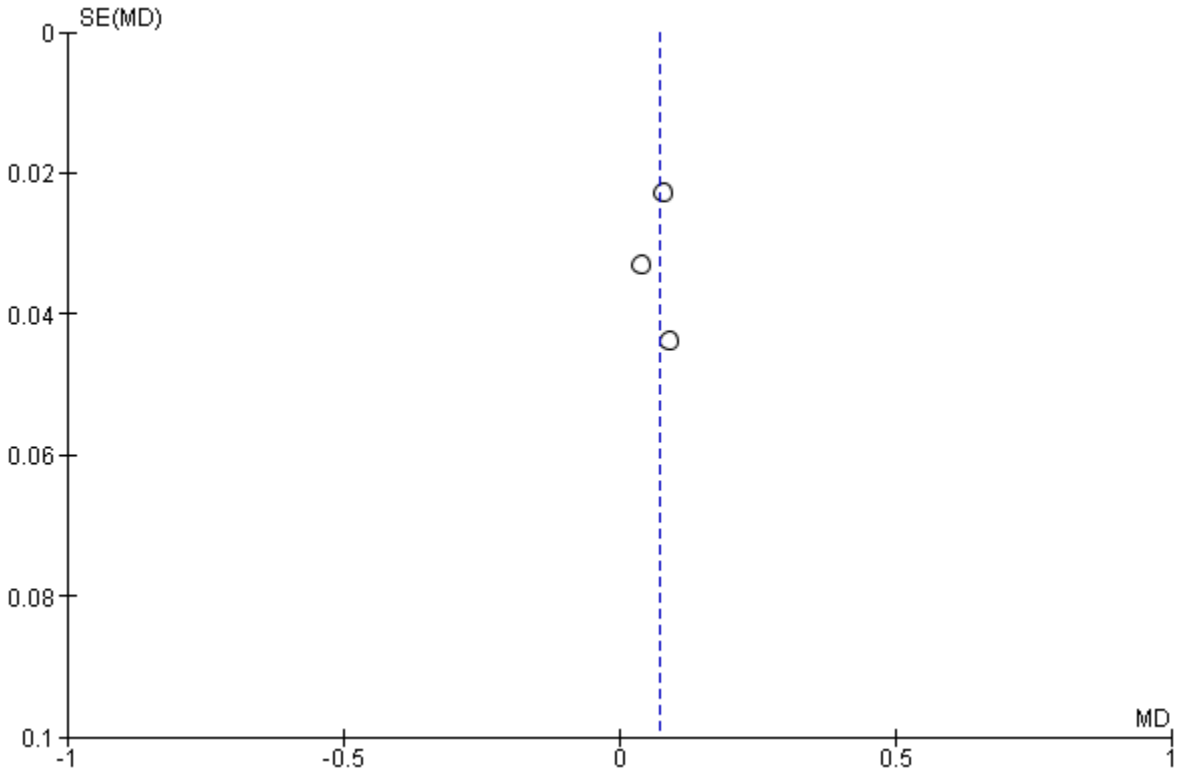
[6] The sample size is adequate (659 intervention arm, 581 control arm) and the pooled effect estimate is precise with a narrow confidence interval [MD 0.0707 mmol/L (0.0368, 0.1045)]. This body of evidence was not downgraded for imprecision.

[7] Too few studies (n<10) to assess reporting bias.

Forest Plot 5.1: Effect of Prevention Interventions on HDL-C



Funnel Plot 5.1: Effect of Prevention Interventions on HDL-C



Egger's Test to Detect Publication Bias: Change in HDL-C

Included Studies	P-value
All Studies Reporting Change in HDL-C	**

** Too few studies (n<10) to assess

Evidence Set 6: Do primary care relevant prevention interventions (behavioural) in normal weight children lead to improved health outcomes (reduction in systolic blood pressure)?

- Summary of Change in SBP Evidence
- GRADE Evidence Profile Table 6.1: Effect of Prevention Interventions on SBP
- GRADE Summary of Findings Table 6.1: Effect of Prevention Interventions on SBP
- Forest Plot 6.1: Effect of Prevention Interventions on SBP
- Funnel Plot 6.1: Effect of Prevention Interventions on SBP
- Egger's Test Results (for Publication Bias)

Summary of Change in SBP Evidence

- 8 studies; 4,289 participants
- No statistically significant difference between intervention and control group for the outcome of change in SBP [MD (95% CI) -0.83 mmHg (-2.98, 1.31)]
- High statistical heterogeneity across studies [Chi^2=224.87, df=10 (P<0.00001); I^2=96%]

GRADE Evidence Profile Table 6.1: Effect of Prevention Interventions on SBP*

Quality Assessment							No. of Participants		Effect	Quality	Importance
No. of Studies	Design	Risk of Bias	Inconsistency	Indirectness	Imprecision	Other Considerations	Intervention	Control	Mean Difference (95% CI)		
Change in SBP (mmHg): Overall (Better indicated by lower values)											
8	randomized trials[1]	serious risk[2]	serious inconsistency[3]	serious indirectness[4,5]	serious imprecision[6]	none[7]	2,086	2,203	0.8344 lower (2.9799 lower to 1.3110 higher)	⊕OOO VERY LOW	CRITICAL

* Footnotes appear after the Summary of Findings Table

GRADE Summary of Findings Table 6.1: Effect of Prevention Interventions on SBP

Outcome: Change in SBP (mmHg)	Compared to the control group, the mean change in SBP (95% CI) in the intervention groups was	No. of Participants (Studies)	Quality of the Evidence (GRADE)
All Studies Reporting Change in SBP	0.8344 lower (2.9799 lower to 1.3110 higher)	4,289 (8 studies[1])	⊕⊖⊖⊖ **very low**[2,3,4,5,6,7]

Footnotes for GRADE Evidence Profile and Summary of Findings Tables for Effect of Prevention Interventions on SBP

[1] The 8 studies are:[80,82,84,101,103,104,108,156] Immediate post assessment for all studies.

[2] Using Cochrane's Risk of Bias tool, for this outcome 5 studies (63%) were rated as unclear risk and 3 studies (37%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (63%), allocation concealment (75%) and blinding of outcome assessors (88%). Due to the nature of behavioural interventions, there is a high risk of bias for blinding of participants and personnel across all studies. Given that most of the information for this outcome is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[3] The statistical heterogeneity is high [Chi^2=224.87, df=10 (P<0.00001); I^2=96%]. The direction of the effect is not consistent across studies and the confidence intervals do not overlap. This body of evidence was downgraded for inconsistency.

[4] This body of evidence was downgraded because the population was not restricted to normal weight children and youth.

[5] All 8 studies included mixed gender samples. Seven targeted children aged 6 to 12 and 1 study targeted youth aged 13 to 18. In terms of type of intervention 7 were exercise and 1 was diet plus exercise. Two interventions used multi-component approaches and 6 used behavioural. Seven of the interventions took place in education settings while 1 intervention took place in a non-education setting. Control participants received usual practice or no intervention. Intervention duration was ≤12 months in 5 studies (for 3 of these studies ≤6 months) and >12 months in 3 studies (range 20 to 48 months). One study was conducted in Canada, 1 in the US, 4 in European countries, 1 in Australia, and 1 in Egypt. Five studies were published in the last 5 years (2009-2012); 3 studies were published in 2008.

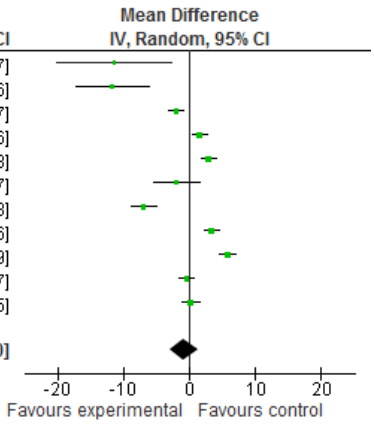
[6] The sample size is adequate (2,086 intervention arm, 2,203 control arm) but the pooled effect estimate is not precise with a confidence interval that includes the no effect value [MD -0.8344 mmHg (-2.9799, 1.3110)]. This body of evidence was downgraded for serious concerns regarding imprecision.

[7] Too few studies (n<10) to assess reporting bias.

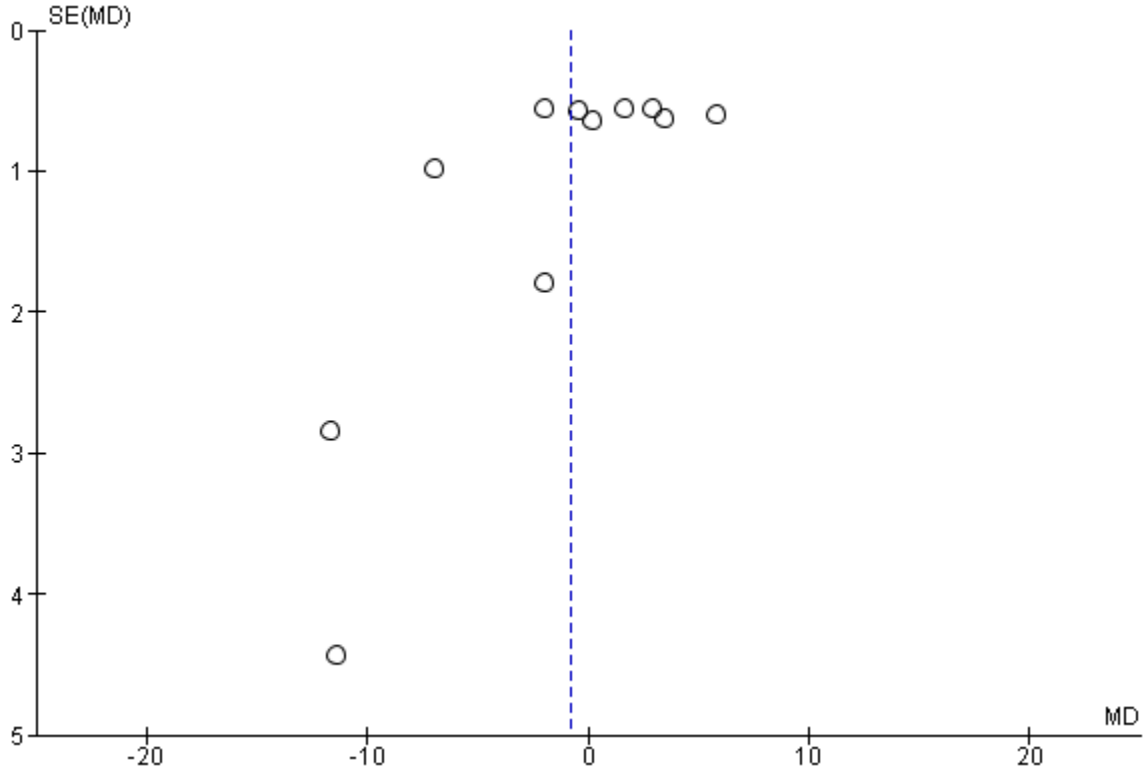
Forest Plot 6.1: Effect of Prevention Interventions on SBP

Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Random, 95% CI
Ansari 2010-F	-7.4	25.135	45	4	15.794	45	3.9%	-11.4000 [-20.0733, -2.7267]
Ansari 2010-M	-7.5	10.484	35	4.2	13.18	35	6.2%	-11.7000 [-17.2794, -6.1206]
Kriemler 2010	-3	6.364	297	-1	6.083	205	10.3%	-2.0000 [-3.1033, -0.8967]
Martinez 2008-F	-2.7	6.413	231	-4.3	6.487	299	10.3%	1.6000 [0.4934, 2.7066]
Martinez 2008-M	-1	5.982	234	-3.9	6.644	280	10.3%	2.9000 [1.8077, 3.9923]
Morgan 2011	-4	7.905	39	-2	7.161	32	8.3%	-2.0000 [-5.5087, 1.5087]
Reed 2008	-3	6.576	156	4	7.425	81	9.8%	-7.0000 [-8.9182, -5.0818]
Salcedo 2010-F	0.9	6.72	185	-2.5	6.53	289	10.2%	3.4000 [2.1734, 4.6266]
Salcedo 2010-M	1.8	5.917	190	-4	6.72	257	10.3%	5.8000 [4.6241, 6.9759]
Simon 2008	6.29	8.685	479	6.71	9.05	475	10.3%	-0.4200 [-1.5457, 0.7057]
Yin 2012	0.88	6.732	195	0.68	6.248	205	10.2%	0.2000 [-1.0745, 1.4745]
Total (95% CI)			**2086**			**2203**	**100.0%**	**-0.8344 [-2.9799, 1.3110]**

Heterogeneity: Tau² = 11.31; Chi² = 224.87, df = 10 (P < 0.00001); I² = 96%
Test for overall effect: Z = 0.76 (P = 0.45)



Funnel Plot 6.1: Effect of Prevention Interventions on SBP



Egger's Test to Detect Publication Bias: Change in SBP

Included Studies	P-value
All Studies Reporting Change in SBP	**

** Too few studies (n<10) to assess

Evidence Set 7: Do primary care relevant prevention interventions (behavioural) in normal weight children lead to improved health outcomes (reduction in diastolic blood pressure)?

- Summary of Change in DBP Evidence
- GRADE Evidence Profile Table 7.1: Effect of Prevention Interventions on DBP
- GRADE Summary of Findings Table 7.1: Effect of Prevention Interventions on DBP
- Forest Plot 7.1: Effect of Prevention Interventions on DBP
- Funnel Plot 7.1: Effect of Prevention Interventions on DBP
- Egger's Test Results (for Publication Bias)

Summary of Change in DBP Evidence

- 8 studies; 4,289 participants
- No statistically significant difference between intervention and control group for the outcome of change in DBP [MD (95% CI) -0.31 mmHg (-1.71, 1.09)]
- Moderate statistical heterogeneity across studies [Chi^2=147.29, df=10 (P<0.00001); I^2=93%]

GRADE Evidence Profile Table 7.1: Effect of Prevention Interventions on DBP*

Quality Assessment							No. of Participants		Effect	Quality	Importance
No. of Studies	Design	Risk of Bias	Inconsistency	Indirectness	Imprecision	Other Considerations	Intervention	Control	Mean Difference (95% CI)		
Change in DBP (mmHg): Overall (Better indicated by lower values)											
8	randomized trials[1]	serious risk[2]	serious inconsistency[3]	serious indirectness[4,5]	serious imprecision[6]	none[7]	2,086	2,203	0.3102 lower (1.7073 lower to 1.0869 higher)	⊕OOO VERY LOW	CRITICAL

* Footnotes appear after the Summary of Findings Table

GRADE Summary of Findings Table 7.1: Effect of Prevention Interventions on DBP

Outcome: Change in DBP (mmHg)	Compared to the control group, the mean change in DBP (95% CI) in the intervention groups was	No. of Participants (Studies)	Quality of the Evidence (GRADE)
All Studies Reporting Change in DBP	0.3102 lower (1.7073 lower to 1.0869 higher)	4,289 (8 studies[1])	⊕⊖⊖⊖ **very low**[2,3,4,5,6,7]

Footnotes for GRADE Evidence Profile and Summary of Findings Tables for Effect of Prevention Interventions on DBP

[1] The 8 studies are:[80,82,84,101,103,104,108,156] Immediate post assessment for all studies.

[2] Using Cochrane's Risk of Bias tool, for this outcome 5 studies (63%) were rated as unclear risk and 3 studies (37%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (63%), allocation concealment (75%) and blinding of outcome assessors (88%). Due to the nature of behavioural interventions, there is a high risk of bias for blinding of participants and personnel across all studies. Given that most of the information for this outcome is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[3] The statistical heterogeneity is high [Chi^2=147.29, df=10 (P<0.00001); I^2=93%]. The direction of the effect is not consistent across studies and the confidence intervals do not overlap. This body of evidence was downgraded for inconsistency.

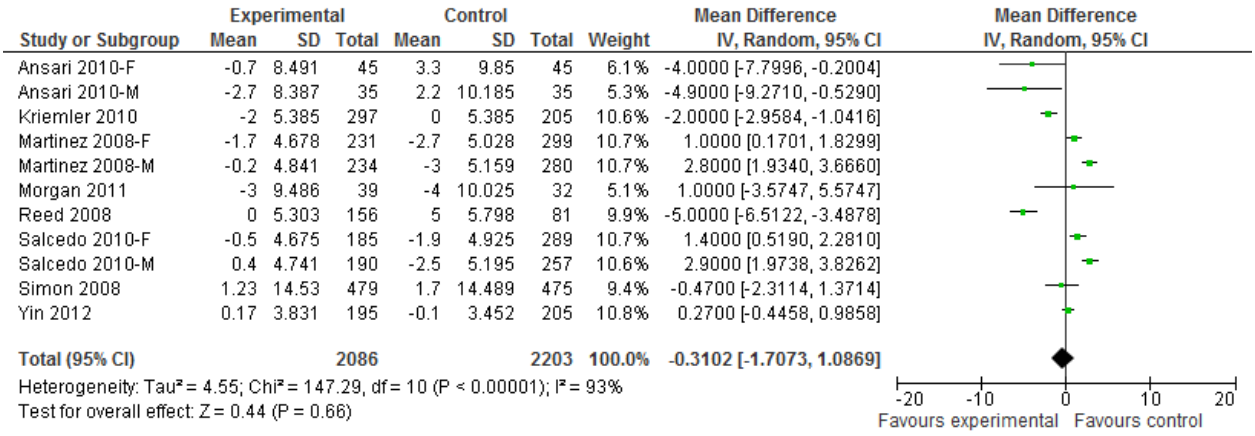
[4] This body of evidence was downgraded because the population was not restricted to normal weight children and youth.

[5] All 8 studies included mixed gender samples. Seven targeted children aged 6 to 12 and 1 study targeted youth aged 13 to 18. In terms of type of intervention 7 were exercise and 1 was diet plus exercise. Two interventions used multi-component approaches and 6 used behavioural. Seven interventions took place in education settings while 1 took place in a non-education setting. Control participants received usual practice or no intervention. Intervention duration was ≤12 months in 5 studies (for 3 of these studies ≤ 6 months) and > 12 months in 3 studies (from 20 to 48 months). One study was conducted in Canada, 1 in the US, 4 in European countries, 1 in Australia, and 1 in Egypt. Five studies were published in the last 5 years (2009-2012); 3 studies were published in 2008.

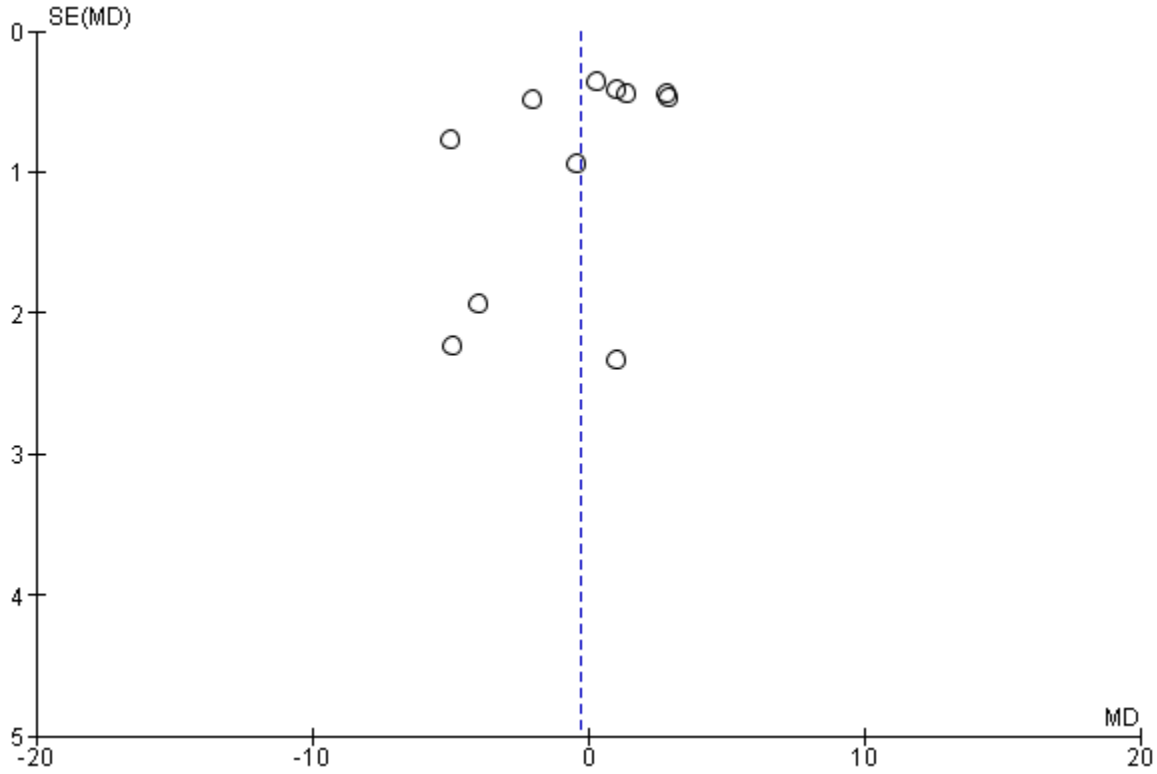
[6] The sample size is adequate (2,086 intervention arm, 2,203 control arm) but the pooled effect estimate is not precise with a confidence interval that includes the no effect value [MD -0.3102 mmHg (-1.7073, 1.0869)]. This body of evidence was downgraded for serious concerns regarding imprecision.

[7] Too few studies (n<10) to assess reporting bias.

Forest Plot 7.1: Effect of Prevention Interventions on DBP



Funnel Plot 7.1: Effect of Prevention Interventions on DBP



Egger's Test to Detect Publication Bias: Change in DBP

Included Studies	P-value
All Studies Reporting Change in DBP	**

** Too few studies (n<10) to assess

Evidence Set 8: Do primary care relevant prevention interventions (behavioural) in normal weight children lead to improved health outcomes (improved physical fitness – performance on 20 metre shuttle run test)?

- Summary of Change in Physical Fitness Evidence – Performance on 20 Metre Shuttle Run Test
- GRADE Evidence Profile Table 8.1: Effect of Prevention Interventions on Physical Fitness – Performance on 20 Metre Shuttle Run Test
- GRADE Summary of Findings Table 8.1: Effect of Prevention Interventions on Physical Fitness – Performance on 20 Metre Shuttle Run Test
- Forest Plot 8.1: Effect of Prevention Interventions on Physical Fitness – Performance on 20 Metre Shuttle Run Test
- Funnel Plot 8.1: Effect of Prevention Interventions on Physical Fitness – Performance on 20 Metre Shuttle Run Test
- Egger's Test Results (for Publication Bias)

Summary of Change in Physical Fitness Evidence – Performance on 20 Metre Shuttle Run Test

Overall

- 6 studies; 4,903 participants
- Statistically significant improvement in performance on the 20 meter shuttle run test in the intervention group as compared to the control group, but the magnitude of the effect was small [SMD (95% CI) 0.32 (0.14, 0.50)]
- High statistical heterogeneity across studies [Chi^2=40.37, df=6 (P<0.00001), I^2=85%]

Test for subgroup differences is not significant [Chi^2=0.00, df=1 (P=0.99), I^2=0%]; type of measurement (laps or stages) does not explain variation across studies

Laps

- 4 studies; 3,944 participants
- Statistically significant improvement in number of laps run in the 20 meter shuttle run test in the intervention group as compared to the control group, but the magnitude of the effect was small [SMD (95% CI) 0.32 (0.07, 0.58)]
- High statistical heterogeneity across studies [Chi^2=35.76, df=4 (P<0.00001), I^2=89%]

Stages

- 2 studies; 959 participants
- Statistically significant improvement in number of stages completed in the 20 meter shuttle run test in the intervention group as compared to the control group, but the magnitude of the effect was small [SMD (95% CI) 0.33 (0.07, 0.58)]
- High statistical heterogeneity across studies [Chi^2=4.02, df=1 (P=0.04), I^2=75%]

GRADE Evidence Profile Table 8.1: Effect of Prevention Interventions on Physical Fitness – Performance on 20 Metre Shuttle Run Test

Quality Assessment							No. of Participants		Effect	Quality	Importance
No. of Studies	Design	Risk of Bias	Inconsistency	Indirectness	Imprecision	Other Considerations	Intervention	Control	Standardized Mean Difference (95% CI)		
Change in Physical Fitness (measured with: 20 Meter Shuttle Run Test – Laps and Stages; Better indicated by higher values)											
6	randomized trials[1]	serious risk[2]	no serious inconsistency[3]	serious indirectness[4,5]	no serious imprecision[6]	none[7]	2,538	2,365	0.3194 higher (0.1411 to 0.4977 higher)	⊕⊕OO LOW	CRITICAL
Change in Physical Fitness (measured with: 20 Meter Shuttle Run Test - Laps; Better indicated by higher values)											
4	randomized trials[8]	serious risk[9]	no serious inconsistency[10]	serious indirectness[4,11]	no serious imprecision[12]	none[7]	2,012	1,932	0.3240 higher (0.0694 to 0.5785 higher)	⊕⊕OO LOW	CRITICAL
Change in Physical Fitness (measured with: 20 Meter Shuttle Run Test - Stages; Better indicated by higher values)											
2	randomized trials[13]	serious risk[14]	no serious inconsistency[15]	serious indirectness[4,16]	no serious imprecision[17]	none[7]	526	433	0.3265 higher (0.0682 to 0.5847 higher)	⊕⊕OO LOW	CRITICAL

* Footnotes appear after the Summary of Findings Table

GRADE Summary of Findings Table 8.1: Effect of Prevention Interventions on Physical Fitness – Performance on 20 Metre Shuttle Run Test

Outcome: Change in Physical Fitness - Performance on 20 Metre Shuttle Run Test	In terms of standardized mean difference (95% CI), compared to the control group, the change in performance on the 20 metre shuttle run test in the intervention groups was	No. of Participants (Studies)	Quality of the Evidence (GRADE)
All Studies Reporting 20 Metre Shuttle Run Test – Laps or Stages	**0.3194 higher** (0.1411 to 0.4977 higher)	4,903 (6 studies[1])	⊕⊕⊖⊖ **low**[2,3,4,5,6,7]
All Studies Reporting 20 Metre Shuttle Run Test - Laps	**0.3240 higher** (0.0694 to 0.5785 higher)	3,944 (4 studies[8])	⊕⊕⊖⊖ **low**[4,7,8,9,10,11,12]
All Studies Reporting 20 Metre Shuttle Run Test - Stages	**0.3265 higher** (0.0682 to 0.5847 higher)	959 (2 studies[13])	⊕⊕⊖⊖ **low**[4,7,14,15,16,17]

Footnotes for GRADE Evidence Profile and Summary of Findings Tables for Effect of Prevention Interventions on Physical Fitness – Performance on 20 Metre Shuttle Run Test

[1]The 6 studies are:[82,93,94,97,103,142] Immediate post assessment for all studies.

[2] Using Cochrane's Risk of Bias tool, for this outcome 4 studies (67%) were rated as unclear risk and 2 studies (33%) were rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (33%), allocation concealment (83%) and blinding of outcome assessors (67%). Due to the nature of behavioural interventions, there is a high risk of bias for blinding of participants and personnel across all studies. Given that most of the information for this outcome is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[3] The statistical heterogeneity is high [Chi^2=40.37, df=6 (P<0.00001); I^2=85%] but the direction of the effect is consistent across studies and the confidence intervals overlap. This body of evidence was not downgraded for inconsistency.

[4] This body of evidence was downgraded because the population was not restricted to normal weight children and youth.

[5] Across the 6 studies, 5 included mixed gender samples and 1 included only boys. Four studies targeted children aged 6 to 12 and 2 studies targeted youth aged 13 to 18. In terms of type of intervention 3 were exercise, 2 were diet plus exercise, and 1 was lifestyle. Four interventions used multi-component strategies and 2 used behavioural approaches. All of the interventions took place in education settings. Control participants received usual practice or no intervention in 5 studies and a minimal component (i.e., a concurrent activity) in 1 study. Intervention duration was 12 months or less in all studies (for 2 of these studies the duration was 6 months). One study was conducted in Canada, 4 in European countries, and 1 in Australia. All but one study (n=5) were published in the last 5 years (2009-2011); the remaining study was published in 2008.

[6] The sample size is adequate (2,538 intervention arm, 2,365 control arm) and the pooled effect estimate is precise with a narrow confidence interval [SMD (95% CI) 0.3194 (0.1411, 0.4977)]. This body of evidence was not downgraded for imprecision.

[7] Too few studies (n<10) to assess reporting bias.

[8] The 4 studies are:[82,93,94,97] Immediate post assessment for all studies.

[9] Using Cochrane's Risk of Bias tool, for this outcome 3 studies (75%) were rated as unclear risk and 1 study (25%) was rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (25%), allocation concealment (75%) and blinding of outcome assessors (75%). Due to the nature of behavioural interventions, there is a high risk of bias for blinding of participants and personnel across all studies. Given that most of the information for this outcome is from studies at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[10] The statistical heterogeneity is high [Chi^2=35.76, df=4 (P<0.00001); I^2=89%] but the direction of the effect is consistent across studies and the confidence intervals overlap. This body of evidence was not downgraded for inconsistency.

[11] Across the 4 studies, 3 included mixed gender samples and 1 included only boys. Two studies targeted children aged 6 to 12 and 2 studies targeted youth aged 13 to 18. In terms of type of intervention 1 was exercise, 2 were diet plus exercise, and 1 was lifestyle. All four interventions used multi-component strategies and all four took place in education settings. Control participants received usual practice or no intervention in 3 studies and a minimal component (i.e., a concurrent activity) in 1 study. Intervention duration was 12 months or less in all studies (for 1 of these studies the duration was 6 months). One study was

conducted in Canada, 2 in European countries, and 1 in Australia. All but one study (n=3) were published in the last 5 years (2009-2011); the remaining study was published in 2008.

[12] The sample size is adequate (2,012 intervention arm, 1,932 control arm) and the pooled effect estimate is precise with a narrow confidence interval [SMD (95% CI) 0.3240 (0.0694, 0.5785)]. This body of evidence was not downgraded for imprecision.

[13]The 2 studies are:[103,142] Immediate post assessment for both studies.

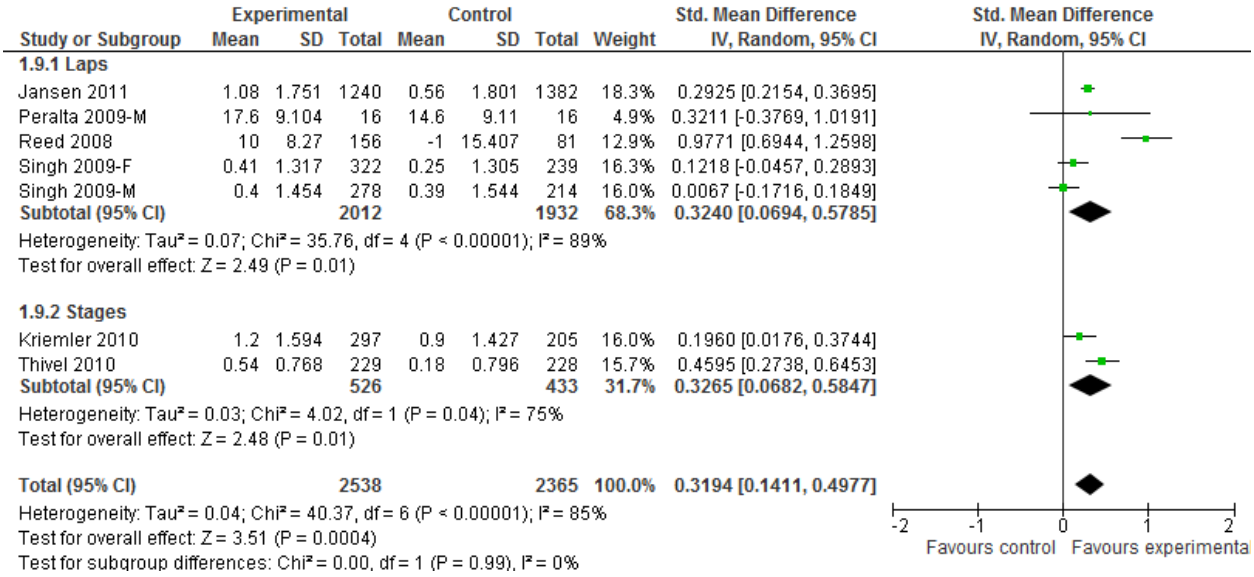
[14] Using Cochrane's Risk of Bias tool, for this outcome 1 study (50%) was rated as unclear risk and 1 study (50%) was rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (50%), allocation concealment (100%) and blinding of outcome assessors (50%). Due to the nature of behavioural interventions, there is a high risk of bias for blinding of participants and personnel across all studies. Given that half of the information for this outcome is at moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[15] The statistical heterogeneity is high [Chi^2=4.02, df=1 (P=0.04) I^2=75%], the direction of the effect is consistent across studies and the confidence intervals overlap. This body of evidence was not downgraded for inconsistency.

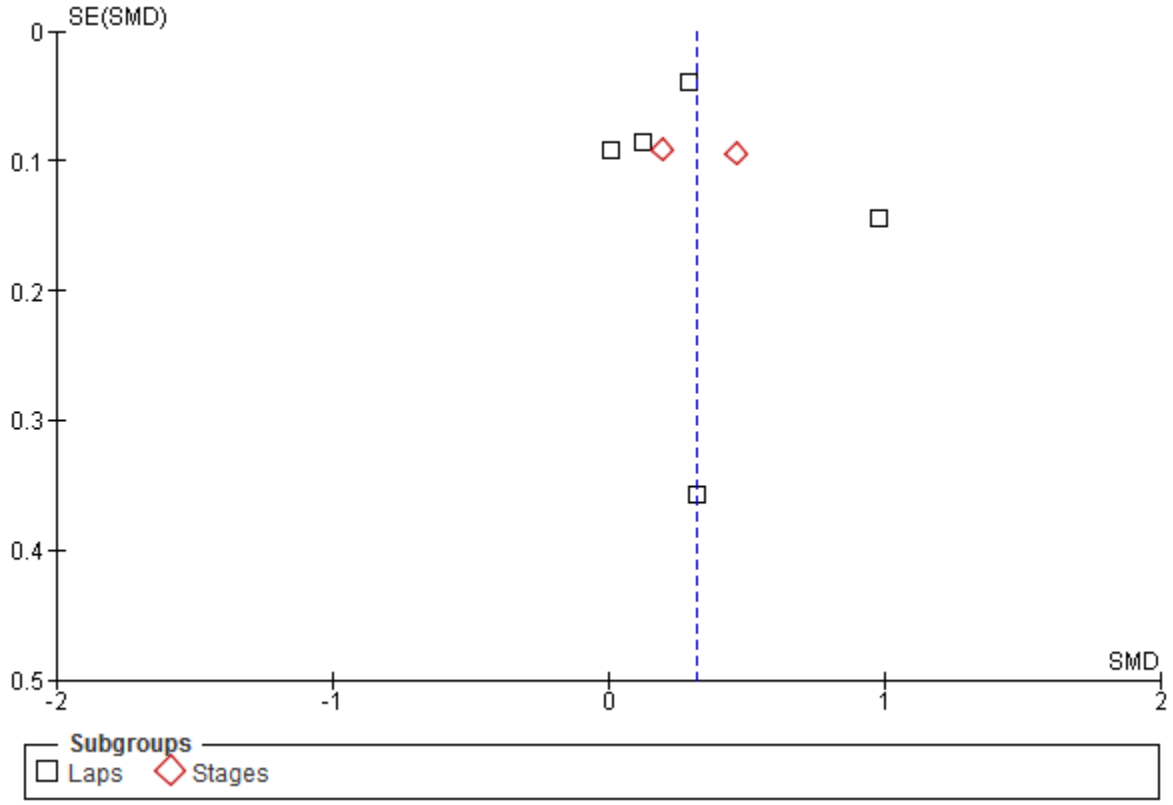
[16] The 2 studies included mixed gender samples, targeted children aged 6 to 12, were exercise focused, used behavioural approaches, were conducted in education settings, and provided control participants with usual practice or no intervention. Intervention duration was 12 months or less in both studies and for 1 of these studies the duration was 6 months. Both studies were conducted in European countries and both were published in the last 5 years (2010, 2011).

[17] The sample size is adequate (526 intervention arm, 433 control arm) and the pooled effect estimate is precise with a narrow confidence interval [SMD (95% CI) 0.3265 (0.0682, 0.5847)]. This body of evidence was not downgraded for imprecision.

Forest Plot 8.1: Effect of Prevention Interventions on Physical Fitness - Performance on 20 Metre Shuttle Run Test



Funnel Plot 8.1: Effect of Prevention Interventions on Physical Fitness – Performance on 20 Metre Shuttle Run Test



Egger's Test to Detect Publication Bias: Change in Physical Fitness -- Performance on 20 Metre Shuttle Run Test

Included Studies	P-value
All Studies Reporting 20 Metre Shuttle Run Test	**

** Too few studies (n<10) to assess

Evidence Set 9: How well are healthy BMI trajectories and health outcomes maintained after interventions are completed?

- Summary of Maintenance of Prevention Intervention Benefits
- GRADE Evidence Profile Table 9.1: Maintenance of Prevention Intervention Benefits
- GRADE Summary of Findings Table 9.1: Maintenance of Prevention Intervention Benefits
- Forest Plot 9.1: Maintenance of Prevention Intervention Benefits – Baseline to Immediate Post Assessment for Change in BMI/BMIz
- Forest Plot 9.2: Maintenance of Prevention Intervention Benefits – Immediate Post to Follow-up Assessment for Change in BMI/BMIz

Summary of Maintenance of Prevention Intervention Benefits

Overall – Immediate Post to Follow-up
- 8 studies; 5,648 participants
- No statistically significant difference between the intervention group and control group in terms of change in BMI/BMIz [SMD (95% CI) -0.16 (-0.33, 0.02)]
- High statistical heterogeneity across studies [Chi^2=54.71, df=8 (P<0.00001), I^2=85%]

Test for subgroup differences is not significant [Chi^2=3.91, df=2 (P=0.14), I^2=48.8%]; age groups does not explain variation across studies

Aged 0 to 5 – Immediate Post to Follow-up
- 2 studies; 631 participants
- No statistically significant difference between the intervention group and control group in terms of change in BMI/BMIz [SMD (95% CI) -0.45 (-0.97, 0.06)]
- High statistical heterogeneity across studies [Chi^2=10.35, df=1 (P=0.001), I^2=90%]

Aged 6 to 12 – Immediate Post to Follow-up
- 3 studies; 4,467 participants
- No statistically significant difference between the intervention group and control group in terms of change in BMI/BMIz [SMD (95% CI) 0.01 (-0.08, 0.10)]
- Low statistical heterogeneity across studies [Chi^2=3.81, df=3 (P=0.28), I^2=21%]

Aged 13 to 18 – Immediate Post to Follow-up
- 3 studies; 550 participants
- No statistically significant difference between the intervention group and control group in terms of change in BMI/BMIz [SMD (95% CI) -0.20 (-0.58, 0.19)]
- High statistical heterogeneity across studies [Chi^2=10.33, df=2 (P=0.006), I^2=81%]

GRADE Evidence Profile Table 9.1: Maintenance of Prevention Intervention Benefits

Quality Assessment							No. of Participants		Effect	Quality	Importance
No. of Studies	Design	Risk of Bias	Inconsistency	Indirectness	Imprecision	Other Considerations	Intervention	Control	Standardized Mean Difference (95% CI)		
Change in BMI/BMIz Overall – Immediate Post to Follow-up (16 weeks to 2 years) (Better indicated by lower values)											
8	randomized trial[1]	serious risk[2]	no serious inconsistency[3]	serious indirectness[4,5]	serious imprecision[6]	none[7]	2,800	2,848	0.1573 lower (0.3344 lower to 0.0197 higher)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz Aged 0 to 5 Years – Immediate Post to Follow-up (2 years) (Better indicated by lower values)											
2	randomized trial[8]	serious risk[9]	no serious inconsistency[10]	serious indirectness[4,11]	serious imprecision[12]	none[7]	317	314	0.4534 lower (0.9655 lower to 0.0586 higher)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz for Aged 6 to 12 Years – Immediate Post to Follow-up (1 to 2 years) (Better indicated by lower values)											
3	randomized trial[13]	serious risk[14]	no serious inconsistency[15]	serious indirectness[4,16]	serious imprecision[17]	none[7]	2,215	2,252	0.0072 higher (0.0817 lower to 0.0960 higher)	⊕OOO VERY LOW	CRITICAL
Change in BMI/BMIz for Aged 13 to 18 Years – Immediate Post to Follow-up (16 weeks to 13 months) (Better indicated by lower values)											
3	randomized trial[18]	serious risk[19]	no serious inconsistency[20]	serious indirectness[4,21]	serious imprecision[22]	none[7]	268	282	0.1954 lower (0.5787 lower to 0.1879 higher)	⊕OOO VERY LOW	CRITICAL

* Footnotes appear after the Summary of Findings Table

GRADE Summary of Findings Table 9.1: Maintenance of Prevention Intervention Benefits

Outcome	Compared to the control group, the standardized mean difference (95% CI) in the intervention groups was	No. of Participants (Studies)	Quality of the Evidence (GRADE)
Change in BMI/BMIz Overall – Immediate Post to Follow-up (16 weeks to 2 years)	**0.1573 lower** (0.3344 lower to 0.0197 higher)	5,648 (8 studies[1])	⊕⊖⊖⊖ **very low**[2,3,4,5,6,7]
Change in BMI/BMIz Aged 0 to 5 Years – Immediate Post to Follow-up (2 years)	**0.4534 lower** (0.9655 lower to 0.0586 higher)	631 (2 studies[8])	⊕⊖⊖⊖ **very low**[4,7,9,10,11,12]
Change in BMI/BMIz for Aged 6 to 12 Years – Immediate Post to Follow-up (1 to 2 years)	**0.0072 higher** (0.0817 lower to 0.0960 higher)	4,467 (3 studies[13])	⊕⊖⊖⊖ **very low**[4,7,14,15,16,17]
Change in BMI/BMIz for Aged 13 to 18 Years – Immediate Post to Follow-up (16 weeks to 13 months)	**0.1954 lower** (0.5787 lower to 0.1879 higher)	550 (3 studies[18])	⊕⊖⊖⊖ **very low**[4,7,19,20,21,22]

Footnotes for GRADE Evidence Profile and Summary of Findings Tables for Maintenance of Prevention Intervention Benefits

[1] The 8 studies are:[69,71,77,89,98-100,134] Follow-up points varied in 4 studies from 16 weeks, to 40 weeks, to 12 months, to 13 months; in the other 4 studies the follow-up assessment occurred at 2 years post intervention completion.

[2] Using Cochrane's Risk of Bias tool, for this outcome 7 studies (88%) were rated as unclear risk and 1 study (12%) was rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (73%), allocation concealment (100%) and blinding of outcome assessors (75%). Due to the nature of behavioural interventions, there is a high risk of bias for blinding of participants and personnel across all studies. Given that most of the information for this outcome is from studies with moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[3] The statistical heterogeneity is high [Chi^2=54.71, df=8 (P<0.00001) I^2=85%] but the meta-analysis shows either benefits towards the interventions or no effect. This body of evidence was not downgraded for inconsistency.

[4] This body of evidence was downgraded because the population was not restricted to normal weight children and youth.

[5] Across the 8 studies, 7 included mixed gender samples and 1 included only girls. Two studies targeted children aged 0 to 5, 3 studies targeted children aged 6 to 12, and 3 studies targeted youth aged 13 to 18. In terms of type of intervention 1 was diet, 1 was exercise, 4 were diet plus exercise, and 2 were lifestyle. Five interventions used interactive education strategies, 1 used a multi-component strategy and 2 used behavioural approaches. Seven of the interventions took place in education settings, 1 took place in a non-education setting. Control participants received usual practice or no intervention in 5 studies and a minimal component (i.e., information sessions or newsletters on general health concepts) in 3 studies. Intervention duration was 12 months or less in 7 studies (for 4 of these studies the duration was 6 months or less) and more than 12 months in 1 study (2 years). Four studies were conducted in the US, 3 in European countries, and 1 in China. Half of the studies (n=4) were published in the last 5 years (2009-2013); the other half was published between 2003 and 2006.

[6] The sample size is adequate (2,800 intervention arm, 2,848 control arm) but the pooled effect estimate is not precise with a confidence interval that includes the no effect value [SMD (95% CI) -0.1573 (-0.3344, 0.0197)]. This body of evidence was downgraded for imprecision.

[7] Too few studies (n<10) to assess reporting bias.

[8] The 2 studies are:[69,71] Follow-up occurred at 2 years post intervention completion in both studies.

[9] Using Cochrane's Risk of Bias tool, for this outcome both studies were rated as unclear risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (100%), allocation concealment (100%) and blinding of outcome assessors (100%). Due to the nature of behavioural interventions, there is a high risk of bias for blinding of participants and personnel across all studies. Given that all of the information for this outcome is from studies with moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[10] The statistical heterogeneity is high [Chi^2=10.35, df=1 (P=0.001) I^2=90%], the direction of the effect is consistent across studies, but the confidence intervals do not overlap. High heterogeneity is likely due to small versus large intervention effects observed across studies. This body of evidence was not downgraded for inconsistency.

[11] Both studies included mixed gender samples, focused on diet plus exercise, used behavioural approaches, took place in education settings, provided a minimal component to the control groups (i.e., information sessions or newsletters on general health concepts), lasted 14 weeks and were conducted in the US. One study was published in 2005, the other in 2006.

[12] The sample size is adequate (317 intervention arm, 314 control arm) but the pooled effect estimate is not precise with a confidence interval that includes the no effect value [SMD (95% CI) -0.4534 (-0.9655, 0.0586)]. This body of evidence was downgraded for imprecision.

[13] The 3 studies are:[77,98,134] Follow-up occurred at 1 year post intervention completion for 1 study and at 2 years post completion for 2 studies.

[14] Using Cochrane's Risk of Bias tool, for this outcome all 3 studies were rated as unclear risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (67%), allocation concealment (100%) and blinding of outcome assessors (67%). Due to the nature of behavioural interventions, there is a high risk of bias for blinding of participants and personnel across all studies. Given that most of the information for this outcome is from studies with moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[15] The statistical heterogeneity is low [Chi^2=3.81, df=3 (P=0.28) I^2=21%], the meta-analysis shows no effect across studies, and the confidence intervals overlap. This body of evidence was not downgraded for inconsistency.

[16] All 3 studies included mixed gender samples. In terms of type of intervention 1 was diet, 1 was exercise, and 1was diet plus exercise. All 3 interventions used interactive education strategies, took place in education settings, and provided control participants with usual practice or no intervention. Intervention duration was 12 months or less in 2 studies and more than 12 months in 1 study (2 years). Two studies were conducted in European countries and 1 in China. One study was published in the last 5 years, the other was published in 2004.

[17] The sample size is adequate (2,215 intervention arm, 2,252 control arm) but the pooled effect estimate is not precise with a confidence interval that includes the no effect value [SMD (95% CI) 0.0072 (-0.0817, 0.0960)]. This body of evidence was downgraded for imprecision.

[18] The 3 studies are:[89,99,100] Follow-up points varied from 16 weeks, to 40 weeks, to 13 months post intervention completion.

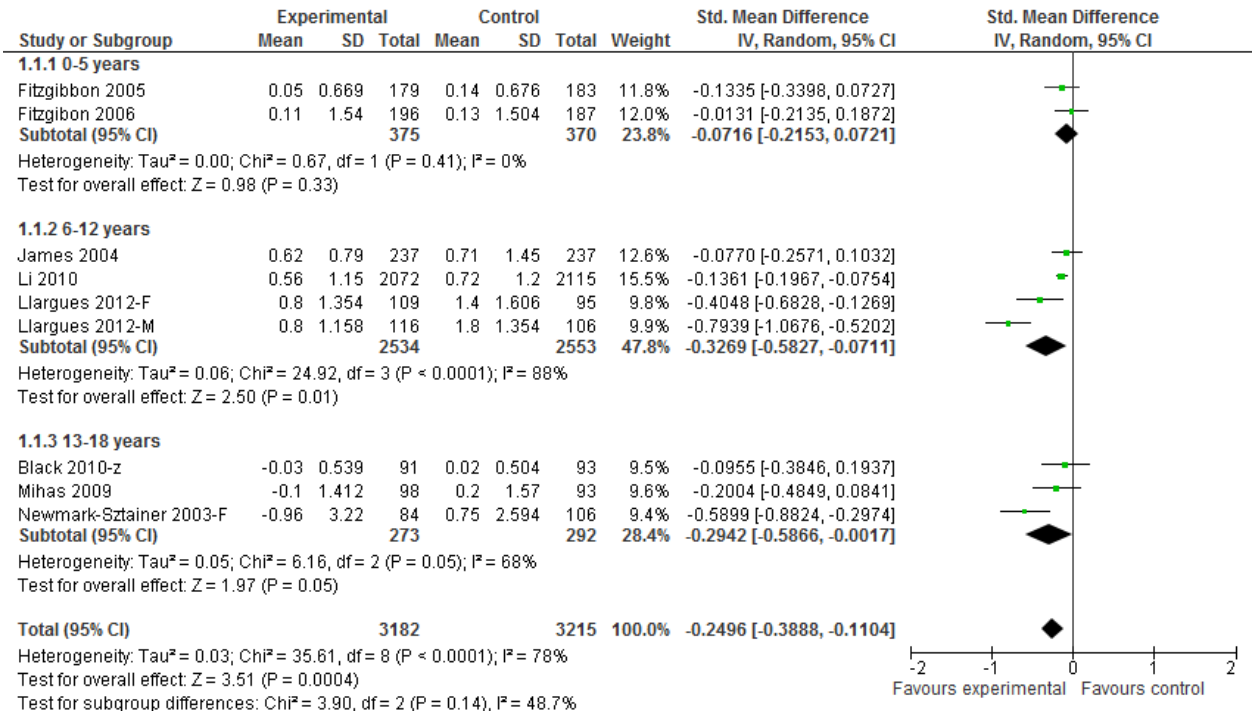
[19] Using Cochrane's Risk of Bias tool, for this outcome 2 studies (67%) were rated as unclear risk and 1 study (33%) was rated as low risk. Across studies, there was a lack of certainty (unclear ratings) or a high risk of bias associated with sequence generation (33%), allocation concealment (100%) and blinding of outcome assessors (67%). Due to the nature of behavioural interventions, there is a high risk of bias for blinding of participants and personnel across all studies. Given that most of the information for this outcome is from studies with moderate risk of bias, this body of evidence was downgraded for serious study limitations.

[20] The statistical heterogeneity is high [Chi^2=10.33, df=2 (P=0.006) I^2=81%], but the meta-analysis shows either benefits towards the interventions or no effect and the confidence intervals overlap. This body of evidence was not downgraded for inconsistency.

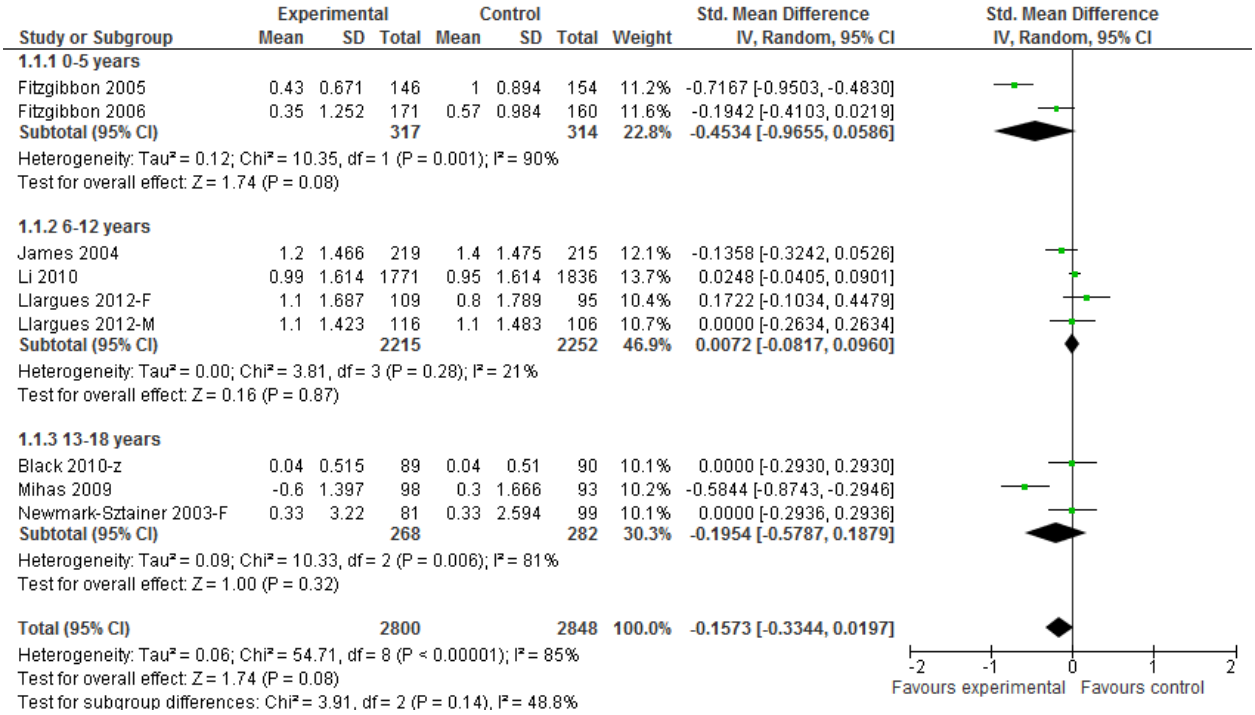
[21] Across the 3 studies, 2 included mixed gender samples and 1 included only girls. In terms of type of intervention 1 was diet plus exercise and 2 were lifestyle. Two interventions used interactive education strategies and 1 used a multi-component strategy. Two of the interventions took place in education settings, 1 took place in a non-education setting. Control participants received usual practice or no intervention in 2 studies and a minimal component (i.e., information sessions or newsletters on general health concepts) in 1 study. Intervention duration was 12 months or less in all 3 studies (for 2 of these studies the duration was 6 months or less). Two studies were conducted in the US, and 1 in a European country. Two studies were published in the last 5 years (2009-2010); the other study was published in 2003.

[22] The sample size is adequate (268 intervention arm, 282 control arm) but the pooled effect estimate is not precise with a confidence interval that includes the no effect value [SMD (95% CI) -0.1954 (-0.5787, 0.1879)]. This body of evidence was downgraded for imprecision.

Forest Plot 9.1: Maintenance of Prevention Intervention Benefits – Baseline to Immediate Post Assessment for Change in BMI/BMIz



Forest Plot 9.2: Maintenance of Prevention Intervention Benefits – Immediate Post to Follow-up Assessment for Change in BMI/BMIz



Appendices

- Appendix 1: Search Strategies for Key Questions (KQ) and Contextual Questions (CQ)
- Appendix 2: Acknowledgements

Appendix 1: Search Strategies for Key Questions (KQ) and Contextual Questions (CQ)

Medline-OVID (KQ)
Search Last Run Aug 1 2013
1. exp Obesity/
2. Weight Gain/
3. exp Weight Loss/
4. obes$.af.
5. (weight gain or weight loss).af.
6. (overweight or over weight or overeat$ or over eat$).af.
7. weight change$.af.
8. ((bmi or body mass index) adj2 (gain or loss or change)).af.
9. or/1-8
10. exp Behavior Therapy/
11. social support/
12. exp Psychotherapy, Group/
13. ((psychological or behavio?r$) adj (therapy or modif$ or strateg$ or intervention$)).af.
14. (group therapy or family therapy or cognitive therapy).af.
15. ((lifestyle or life style) adj (chang$ or intervention$)).af.
16. counsel?ing.af.
17. social support.af.
18. (peer adj2 support).af.
19. (children adj3 parent$ adj3 therapy).af.
20. or/10-19
21. exp OBESITY/dh [Diet Therapy]
22. exp Diet Therapy/
23. Fasting/
24. (diets or diet or dieting).af.
25. (diet$ adj (modif$ or therapy or intervention$ or strateg$)).af.
26. (low calorie or calorie control$ or healthy eating).af.
27. (fasting or modified fast$).af.
28. exp Dietary Fats/
29. (fruit or vegetable*).af.
30. (high fat$ or low fat$ or fatty food$).af.
31. formula diet$.af.
32. or/21-31
33. exp Exercise/
34. exp Exercise Therapy/
35. exercis$.af.
36. (aerobics or physical therapy or physical activity or physical inactivity).af.
37. (fitness adj (class$ or regime$ or program$)).af.
38. (aerobics or physical therapy or physical training or physical education).af.
39. dance therapy.af.
40. Sedentary Lifestyle/ or sedentary behavio?r.af.
41. or/33-40

42. exp Complementary Therapies/
43. (alternative medicine or complementary therap$ or complementary medicine).af.
44. (hypnotism or hypnosis or hypnotherapy).af.
45. (acupuncture or homeopathy or homoeopathy).af.
46. (chinese medicine or indian medicine or herbal medicine or ayurvedic).af.
47. or/42-46
48. ((diet or dieting or slim$) adj (club$ or organi?ation)).af.
49. (weightwatcher$ or weight watcher$).af.
50. (correspondence adj (course$ or program$)).af.
51. (fat camp$ or diet$ camp$).af.
52. or/48-51
53. exp Health Promotion/
54. exp Health Education/
55. (health promotion or health education).af.
56. (media intervention$ or community intervention$).af.
57. health promoting school$.af.
58. ((school or community) adj2 program$).af.
59. ((school or community) adj2 intervention$).af.
60. (family intervention$ or parent$ intervention).af.
61. (parent$ adj2 (behavio?r or involve$ or control$ or attitude$ or educat$)).af.
62. or/53-61
63. exp Health Policy/
64. (health polic$ or school polic$ or food polic$ or nutrition polic$).af.
65. 63 or 64
66. exp OBESITY/pc [Prevention & Control]
67. exp Primary Prevention/
68. (primary prevention or secondary prevention).af.
69. (preventive measure$ or preventative measure$).af.
70. (preventive care or preventative care).af.
71. (obesity adj2 (prevent$ or treat$)).af.
72. or/66-71
73. randomized controlled trial.pt.
74. controlled clinical trial.pt.
75. Random Allocation/
76. Double-Blind Method/
77. single-blind method/
78. Placebos/
79. *Research Design/
80. intervention studies/
81. evaluation studies/
82. Comparative Study/
83. exp Longitudinal Studies/
84. cross-over studies/
85. clinical trial.tw.
86. clinical trial.pt.
87. latin square.tw.

88. (time adj series).tw.
89. (before adj2 after adj3 (stud$ or trial$ or design$)).tw.
90. placebo$.tw.
91. random$.tw.
92. (matched communities or matched schools or matched populations).tw.
93. control$.tw.
94. (comparison group$ or control group$).tw.
95. matched pairs.tw.
96. (outcome study or outcome studies).tw.
97. ((singl$ or doubl$ or trebl$ or tripl$) adj5 (blind$ or mask)).tw.
98. (quasiexperimental or quasi experimental or pseudo experimental).tw.
99. (nonrandomi?ed or non randomi?ed or pseudo randomi?sed or quasi randomi?ed).tw.
100. prospectiv$.tw.
101. volunteer$.tw.
102. or/73-101
103. 20 or 32 or 41 or 47 or 52 or 62 or 65 or 72
104. 9 and 102 and 103
105. Animals/
106. exp Child/
107. Adolescent/
108. exp Infant/
109. (child$ or adolescen$ or infant$).af.
110. (teenage$ or young people or young person or young adult$).af.
111. (schoolchildren or school children).af.
112. (pediatr$ or paediatr$).af.
113. (boys or girls or youth or youths).af.
114. or/106-113
115. 104 not 105
116. 114 and 115
117. limit 116 to ed=20120101-20121122
118. limit 116 to ed=20121122-20130801

Embase-OVID (KQ)
Search Last Run Aug 1 2013
1. exp obesity/
2. weight gain/
3. weight reduction/
4. obes$.af.
5. (weight gain or weight loss).af.
6. (overweight or over weight or overeat$ or over eat$).af.
7. weight change$.af.
8. ((bmi or body mass index) adj2 (gain or loss or change)).af.
9. or/1-8
10. behavior therapy/
11. social support/
12. family therapy/

13. group therapy/
14. ((psychological or behavio?r$) adj (therapy or modif$ or strateg$ or intervention$)).af.
15. (group therapy or family therapy or cognitive therapy).af.
16. ((lifestyle or life style) adj (chang$ or intervention$)).af.
17. counsel?ing.af.
18. social support.af.
19. (peer adj2 support).af.
20. (children adj3 parent$ adj3 therapy).af.
21. or/10-20
22. exp diet therapy/
23. (diets or diet or dieting).af.
24. (diet$ adj (modif$ or therapy or intervention$ or strateg$)).af.
25. (low calorie or calorie control$ or healthy eating).af.
26. (fasting or modified fast$).af.
27. exp fat intake/
28. (fruit or vegetable$).af.
29. (high fat$ or low fat$ or fatty food$).af.
30. formula diet$.af.
31. or/22-30
32. exp exercise/
33. exp kinesiotherapy/
34. exercis$.af.
35. (aerobics or physical therapy or physical activity or physical inactivity).af.
36. (fitness adj (class$ or regime$ or program$)).af.
37. (aerobics or physical therapy or physical training or physical education).af.
38. dance therapy.af.
39. sedentary behavio?r.af.
40. or/32-39
41. exp alternative medicine/
42. (alternative medicine or complementary therap$ or complementary medicine).af.
43. (hypnotism or hypnosis or hypnotherapy).af.
44. (acupuncture or homeopathy or homoeopathy).af.
45. (chinese medicine or indian medicine or herbal medicine or ayurvedic).af.
46. or/41-45
47. ((diet or dieting or slim$) adj (club$ or organi?ation)).af.
48. (weightwatcher$ or weight watcher$).af.
49. (correspondence adj (course$ or program$)).af.
50. (fat camp$ or diet$ camp$).af.
51. or/47-50
52. exp health education/
53. (health promotion or health education).af.
54. (media intervention$ or community intervention$).af.
55. health promoting school$.af.
56. ((school or community) adj2 program$).af.
57. ((school or community) adj2 intervention$).af.
58. (family intervention$ or parent$ intervention).af.

59. (parent$ adj2 (behavio?r or involve$ or control$ or attitude$ or educat$)).af.
60. or/52-59
61. health care policy/
62. (health polic$ or school polic$ or food polic$ or nutrition polic$).af.
63. 61 or 62
64. exp obesity/pc [Prevention]
65. primary prevention/
66. (primary prevention or secondary prevention).af.
67. (preventive measure$ or preventative measure$).af.
68. (preventive care or preventative care).af.
69. (obesity adj2 (prevent$ or treat$)).af.
70. or/64-69
71. exp clinical trial/
72. exp Randomized Controlled Trial/
73. randomization/
74. exp Double-Blind procedure/
75. exp Single-Blind procedure/
76. exp Crossover procedure/
77. clinical trial.tw.
78. ((singl$ or doubl$ or treble$ or tripl$) and (mask$ or blind$)).tw.
79. latin square.tw.
80. placebo/
81. placebo$.tw.
82. random$.tw.
83. Comparative Study/
84. evaluation/
85. clinical trial.tw.
86. latin square.tw.
87. (before adj2 after adj3 (stud$ or trial$ or design$)).tw.
88. ((singl$ or doubl$ or trebl$ or tripl$) adj5 (blind$ or mask)).tw.
89. (matched communities or matched schools or matched populations).tw.
90. control$.tw.
91. (comparison group$ or control group$).tw.
92. matched pairs.tw.
93. (outcome study or outcome studies).tw.
94. (quasiexperimental or quasi experimental or pseudo experimental).tw.
95. (nonrandomi?ed or non randomi?ed or pseudo randomi?sed or quasi randomi?ed).tw.
96. prospectiv$.tw.
97. volunteer$.tw.
98. or/71-97
99. 21 or 31 or 40 or 46 or 51 or 60 or 63 or 70
100. 9 and 98 and 99
101. animal/
102. exp child/
103. exp ADOLESCENT/
104. exp preschool child/

105. exp infant/
106. (child$ or adolescen$ or infant$).af.
107. (teenage$ or young people or young person or young adult$).af.
108. (schoolchildren or school children).af.
109. (pediatr$ or paediatr$).af.
110. (boys or girls or youth or youths).af.
111. or/102-110
112. 100 not 101
113. 111 and 112
114. limit 113 to em=201201-201246
115. limit 113 to em=201246-201330

PsycINFO-OVID (KQ)
Search Last Run Aug 1 2013
1. exp overweight/
2. weight control/
3. obes*.tw.
4. weight gain*.tw.
5. weight loss*.tw.
6. (overweight or over weight).tw.
7. weight loss/
8. weight gain/
9. (overeat* or over eat*).tw.
10. weight change*.tw.
11. ((bmi or body mass) adj3 (gain* or loss* or change*)).tw.
12. or/1-11
13. (adolescence 13 17 yrs or childhood birth 12 yrs or infancy 2 23 mo or neonatal birth 1 mo or preschool age 2 5 yrs or school age 6 12 yrs).ag.
14. (child* or adolescen*).tw.
15. (child* or adololescen* or infant*).tw.
16. (pediatr* or paediatr*).tw.
17. (boys or girls or youth or youths).tw.
18. or/13-17
19. 12 and 18
20. exp experimental design/
21. exp clinical trials/
22. (clinical* stud* or single-blind or single blind or triple-blind or triple blind).tw.
23. (random* or clinical trial* or controlled study or double-blind or double blind).tw.
24. (matched communit* or matched school* or matched population*).tw.
25. ((control or comparison) adj group).tw.
26. (outcome study or outcome studies).tw.
27. matched pair*.tw.
28. (quasiexperimental or quasi experimental or pseudo experimental).tw.
29. prospectiv*.tw.
30. volunteer*.tw.
31. ((before and after) adj3 (trial* or study or studies or design*)).tw.

32. time series.tw.
33. latin square.tw.
34. or/20-33
35. 19 and 34
36. limit 35 to up=20120101-20121126
37. limit 35 to up=20121126-20130801

Cochrane Central-OVID (KQ)
Last Run August 1, 2013
1. exp Obesity/
2. Weight Gain/
3. exp Weight Loss/
4. obes$.af.
5. (weight gain or weight loss).af.
6. (overweight or over weight or overeat$ or over eat$).af.
7. weight change$.af.
8. ((bmi or body mass index) adj2 (gain or loss or change)).af.
9. or/1-8
10. exp Behavior Therapy/
11. social support/
12. exp Psychotherapy, Group/
13. ((psychological or behavio?r$) adj (therapy or modif$ or strateg$ or intervention$)).af.
14. (group therapy or family therapy or cognitive therapy).af.
15. ((lifestyle or life style) adj (chang$ or intervention$)).af.
16. counsel?ing.af.
17. social support.af.
18. (peer adj2 support).af.
19. (children adj3 parent$ adj3 therapy).af.
20. or/10-19
21. exp OBESITY/dh [Diet Therapy]
22. exp Diet Therapy/
23. Fasting/
24. (diets or diet or dieting).af.
25. (diet$ adj (modif$ or therapy or intervention$ or strateg$)).af.
26. (low calorie or calorie control$ or healthy eating).af.
27. (fasting or modified fast$).af.
28. exp Dietary Fats/
29. (fruit or vegetable*).af.
30. (high fat$ or low fat$ or fatty food$).af.
31. formula diet$.af.
32. or/21-31
33. exp Exercise/
34. exp Exercise Therapy/
35. exercis$.af.
36. (aerobics or physical therapy or physical activity or physical inactivity).af.
37. (fitness adj (class$ or regime$ or program$)).af.

38. (aerobics or physical therapy or physical training or physical education).af.
39. dance therapy.af.
40. Sedentary Lifestyle/ or sedentary behavio?r.af.
41. or/33-40
42. exp Complementary Therapies/
43. (alternative medicine or complementary therap$ or complementary medicine).af.
44. (hypnotism or hypnosis or hypnotherapy).af.
45. (acupuncture or homeopathy or homoeopathy).af.
46. (chinese medicine or indian medicine or herbal medicine or ayurvedic).af.
47. or/42-46
48. ((diet or dieting or slim$) adj (club$ or organi?ation)).af.
49. (weightwatcher$ or weight watcher$).af.
50. (correspondence adj (course$ or program$)).af.
51. (fat camp$ or diet$ camp$).af.
52. or/48-51
53. exp Health Promotion/
54. exp Health Education/
55. (health promotion or health education).af.
56. (media intervention$ or community intervention$).af.
57. health promoting school$.af.
58. ((school or community) adj2 program$).af.
59. ((school or community) adj2 intervention$).af.
60. (family intervention$ or parent$ intervention).af.
61. (parent$ adj2 (behavio?r or involve$ or control$ or attitude$ or educat$)).af.
62. or/53-61
63. exp Health Policy/
64. (health polic$ or school polic$ or food polic$ or nutrition polic$).af.
65. 63 or 64
66. exp OBESITY/pc [Prevention & Control]
67. exp Primary Prevention/
68. (primary prevention or secondary prevention).af.
69. (preventive measure$ or preventative measure$).af.
70. (preventive care or preventative care).af.
71. (obesity adj2 (prevent$ or treat$)).af.
72. or/66-71
73. 20 or 32 or 41 or 47 or 52 or 62 or 65 or 72
74. Animals/
75. exp Child/
76. Adolescent/
77. exp Infant/
78. (child$ or adolescen$ or infant$).af.
79. (teenage$ or young people or young person or young adult$).af.
80. (schoolchildren or school children).af.
81. (pediatr$ or paediatr$).af.
82. (boys or girls or youth or youths).af.
83. or/75-82

84. 73 not 74
85. 9 and 83 and 84
86. limit 85 to yr="2011 -Current"

CINAHL-EBSCO (KQ)
Last Run August 1, 2013
S1 (MH "Obesity/PC") OR (MH "Obesity, Morbid/PC") OR (MH "Weight Gain/PC")
S2 TX weight maintenance OR TX weight management
S3 TX prevent* N2 obes*
S4 TX prevent* N2 overweight OR TX prevent* N2 over weight OR TX prevent* N2 weight gain
S5 S1 or S2 or S3 or S4
S6 MH "Weight Reduction Programs"
S7 (MM "Diet Therapy+")
S8 TX diet* N1 counsel*
S9 TX diet* N1 education*
S10 TX (nutrition* N1 (counsel* or education* or intervention))
S11 TX (diet* N1 (modi* or therapy or intervention* or strateg* or healthy))
S 12 TX (weightwatcher* or weight watcher* or commerical weightloss or commerical weight loss or Jenny Craig)
S13 TX ((healthy living or healthy lifestyle) N1 (program* or intervention* or group or club or strategy))
S14 TX ((diet or dieting or slim*) N1 (club* or organi?ation*))
S15 S7 or S8 or S9 or S10 or S11 or S12 or S13 or S14
S16 (MM "Exercise+")
S17 (MM "Therapeutic Exercise+")
S18 (MM "Physical Fitness+") OR (MM "Physical Activity")
S19 TX (exercise N3 (program* or intervention* or strategy or club*))
S20 (MH "Fitness Centers")
S21 S16 or S17 or S18 or S19 or S20
S22 (MH "Health Promoting Behavior (Iowa NOC)") OR (MH "Health Promotion+")
S23 (MM "Preventive Health Care")
S24 (MH "Primary Health Care")
S25 TI prevent*
S26 S22 or S23 or S24 or S25
S27 (MM "Obesity")
S28 (MM "Weight Gain")
S29 S27 or S28
S30 S26 and S29
S31 S15 or S21
S32 S26 and S31
S33 (MH "Obesity+")
S34 TI overweight
S35 (MH "Weight Gain") OR (MH "Weight Loss")
S36 TI (weight or bmi or body mass index or waist circumference or obese or obesity)
S37 S33 or S34 or S35 or S36
S38 S32 and S37

S39 S32 and S37
S40 (MH "Breast Feeding")
S41 TX screen time
S42 (MH "Television")
S43 (MH "Video Games")
S44 (MH "Computers and Computerization+")
45 (MH "Life Style, Sedentary")
S46 S40 or S41 or S42 or S43 or S44 or S45
S47 S37 and S46
S48 S39 or S47
S49 or S47
S50 S39 or S47-- Limiters - Age Groups: Infant, Newborn: birth-1 month, Infant: 1-23 months
Search modes - Boolean/Phrase
S51 S39 or S47-- Limiters - Publication Type: Biography, Book, Book Chapter, Book Review, Commentary, Computer Program, Diagnostic Images, Directories, Doctoral Dissertation, Editorial, Exam Questions, Letter, Masters Thesis, Obituary, Pamphlet, Pamphlet Chapter, Pictorial, Poetry, Response
S52 S50 NOT S51
S53 S48 Limiters - Published Date: 20120101-20130731; Age Groups: All Infant, All Child
S54 S53-- Limiters - Publication Type: Biography, Book, Book Chapter, Book Review, Case Study, Commentary, Consumer/Patient Teaching Materials, Diagnostic Images, Doctoral Dissertation, Editorial, Letter, Listservs, Masters Thesis, Obituary, Pamphlet, Pamphlet Chapter, Pictorial, Poetry
S55 S53 NOT S54
S56 S55 Limiters - Publication Type: Systematic Review
Search modes - Boolean/Phrase
S57 S55 Limiters - Publication Type: Review
Search modes - Boolean/Phrase
S58 S57 NOT S56
S59 S55 NOT S57

Medline - OVID (CQ)

August 16, 2013
1. exp continental population groups/
2. exp Ethnic Groups/
3. indians, north american/ or inuits/
4. first nations.tw.
5. (aboriginal? and canada).tw.
6. native canadians.tw.
7. (immigran* or new canadians).tw.
8. ((African or Asian or Indo or Columbian or Spanish or Chinese) adj2 Canadian?).mp.
9. Rural Population/
10. (rural adj (population? or area? or region?)).tw.
11. Rural Health/ or Rural Health Services/
12. Healthcare Disparities/
13. Social Class/

14. poverty/
15. socioeconomic.tw.
16. Socioeconomic Factors/
17. (poor or disadvantaged or poverty or social status).tw.
18. exp homeless persons/ or vulnerable populations/
19. exp "Costs and Cost Analysis"/
20. (cost or costs).tw.
21. *"patient acceptance of health care"/ or *patient compliance/ or *patient participation/ or patient satisfaction/ or patient preference/ or *treatment refusal/
22. (women? adj3 (acceptance or preference? or satisfaction or experience?)).tw.
23. (consumer? adj3 (acceptance or preference? or satisfaction or experience?)).tw.
24. (patient? adj3 (acceptance or perference? or satisfaction or experience?)).tw.
25. willingness to pay.tw.
26. ((conjoint or contingent) adj3 (valuation or analysis)).tw.
27. exp Canada/
28. (Canada or Canadian or Ontario or British Columbia or Alberta or Saskatchewan or Manitoba or Quebec or Nova Scotia or Prince Edward Island or Newfoundland or New Brunswick or Yukon or Northwest Territories or Nunavut).tw.
29. (meta anal* or metaanal*).ti,ab.
30. meta-analysis.pt,ti,ab,sh.
31. (meta anal$ or metaanal$).ti,ab,sh.
32. ((methodol$ or systematic$ or quantitativ$) adj3 (review$ or overview$ or survey$)).ti.
33. ((methodol$ or systematic$ or quantitativ$) adj3 (review$ or overview$ or survey$)).ab.
34. ((pool$ or combined or combining) adj (data or trials or studies or results)).ti,ab.
35. (medline or embase or cochrane or pubmed or pub med).ti,ab.
36. or/33-35
37. review.pt,sh.
38. 36 and 37
39. or/30-32
40. 38 or 39
41. "Process Assessment (Health Care)"/ or Quality Indicators, Health Care/ or Quality Assurance, Health Care/
42. Benchmarking/
43. (performance adj2 (indicators or measures)).tw.
44. or/41-43
45. or/1-28
46. 44 or 45
47. 40 and 46
48. Weight Reduction Programs/
49. exp obesity/pc
50. Overweight/pc
51. weight maintenance.tw.
52. weight management.tw.
53. exp *obesity/
54. *overweight/
55. *Weight Gain/

56. exp obesity/
57. overweight/
58. weight gain/
59. Weight Loss/
60. (weight or bmi or body mass index or waist circumference or obese or obesity).ti.
61. or/48-60
62. 47 and 61
63. limit 62 to yr="2007 -Current"
64. limit 63 to (english or french)
65. 29 or 30 or 31 or 32 or 33 or 34
66. 46 and 61 and 65
67. limit 66 to yr="2007 -Current"
68. limit 67 to (english or french)
69. (Canada or Canadian or Ontario or British Columbia or Alberta or Saskatchewan or Manitoba or Quebec or Nova Scotia or Prince Edward Island or Newfoundland or New Brunswick or Yukon or Northwest Territories or Nunavut).ti.
70. 53 or 54 or 55 or 60
71. 69 and 70
72. limit 71 to yr="2007 -Current"
73. limit 72 to (english or french)
74. weight gain/de
75. molecular weight.ti.
76. 74 or 75
77. (Meta-analysis or review).pt. or systematic review.ti.
78. 64 and 77
79. 73 or 78
80. 79 not 76
81. limit 80 to ed=20121017-20130816

EMBASE – OVID (CQ)
August 16, 2013
1. meta analysis/
2. systematic review/
3. (systematic* adj3 (review* or overview*)).tw.
4. exp "ethnic and racial groups"/
5. first nations.tw.
6. (aboriginal? and canada).tw.
7. native canadians.tw.
8. (immigran* or new canadians).tw.
9. ((African or Asian or Indo or Columbian or Spanish or Chinese) adj2 Canadian).mp.
10. rural health care/
11. rural population/
12. (rural adj (population? or area? or region?)).tw.
13. exp economic evaluation/
14. cost.tw.
15. or/13-14

16. exp patient attitude/
17. (women? adj3 (acceptance or preference? or satisfaction or experience?)).tw.
18. (consumer? adj3 (acceptance or preference? or satisfaction or experience?)).tw.
19. (patient? adj3 (acceptance or preference? or satisfaction or experience?)).tw.
20. willingness to pay.tw.
21. ((conjoint or contingent) adj3 (valuation or analysis)).tw.
22. or/16-21
23. ((process or performance or outcome) adj2 (measure? or indicator?)).tw.
24. performance measurement system/
25. or/23-24
26. exp socioeconomics/
27. exp social status/
28. (poor or disadvantaged or poverty or social status).tw.
29. health care disparity/
30. miscellaneous named groups/ or lowest income group/ or medically underserved/ or vulnerable population/
31. or/4-12
32. or/26-30
33. 15 or 22 or 25 or 31 or 32
34. exp Canada/
35. (Canada or Canadian or Ontario or British Columbia or Alberta or Saskatchewan or Manitoba or Quebec or Nova Scotia or Prince Edward Island or Newfoundland or New Brunswick or Yukon or Northwest Territories or Nunavut).tw.
36. or/34-35
37. *obesity/
38. *diabetic obesity/
39. *abdominal obesity/
40. *morbid obesity/
41. *weight reduction/
42. obes$.ti.
43. overweight.ti.
44. weight.ti.
45. or/37-44
46. (weight loss adj (intervention$ or program$ or trial$)).ti,ab.
47. (weight reduc$ adj (intervention$ or program$ or trial$)).ti,ab.
48. (weight management adj (intervention$ or program$ or trial$)).ti,ab.
49. (weight control adj (intervention$ or program$ or trial$)).ti,ab.
50. 37 or 38 or 39 or 40
51. 41 and 50
52. 33 and 45
53. 1 or 2 or 3
54. 15 or 22 or 25 or 31 or 32 or 36
55. 53 and 54
56. 45 or 51
57. 55 and 56
58. limit 57 to yr="2007 -Current"

59. limit 58 to (english or french)
60. (Canada or Canadian or Ontario or British Columbia or Alberta or Saskatchewan or Manitoba or Quebec or Nova Scotia or Prince Edward Island or Newfoundland or New Brunswick or Yukon or Northwest Territories or Nunavut).ti.
61. 56 and 60
62. limit 61 to yr="2007 -Current"
63. limit 62 to (english or french)
64. 59 or 63
65. limit 64 to em="201237-201332"

Appendix 2: Acknowledgements

We would like to thank the following reviewers and staff members for their advice and work on this review:

Catherine S. Birken MD, MSc, FRCPC	Staff Physician, Division of Paediatric Medicine Hospital for Sick Children; Assistant Professor, Department of Paediatrics, University of Toronto	Full Draft Reviewer
Sylvia Robinson	Joint Director, Public and Primary Care Collaboration, Ministry of Health Services, Victoria, British Columbia	Full Draft Reviewer
Mary Gauld	McMaster Evidence Review and Synthesis Centre	Research Assistance
Sharon Peck-Reid	McMaster Evidence Review and Synthesis Centre	Research Assistance

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