School-based interventions on childhood obesity: a meta-analysis
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CRD summary
The authors concluded there was convincing evidence that school-based programmes were effective, at least short-term, in reducing the prevalence of childhood obesity. Longer-running programmes were more effective than shorter programmes. The reliability of the authors' conclusions is uncertain due to some methodological weaknesses in the review and because results of some outcomes were based on only a few studies.

Authors' objectives
To evaluate the effectiveness of school-based programs in the prevention and management of childhood obesity.

Searching
MEDLINE, EMBASE, PsycINFO, EBM Reviews, The Cochrane Library, CINAHL, Current Contents, BioMed Central AustHealth, SCOPUS, TRIP, Science Direct, Health Source (Nursing/Academic edition), AMED and Academic Elite were searched for English-language studies published between 1995 and 2007. Reference lists of retrieved articles were searched for additional studies.

Study selection
Randomised controlled trials (RCTs) or controlled trials that evaluated school-based programmes aimed at addressing overweight and obesity in pre-adolescent and adolescent schoolchildren of any nationality who were of normal body mass index (BMI), overweight or obese were eligible for inclusion. "Fatness" was classified using criteria of the International Obesity Task Force or by country-specific norms. Eligible interventions were those with a specific approach to increase physical activity, improve dietary behaviours, modify poor exercise or dietary behaviours, or a combination of these. Outcomes of interest were BMI, waist girth, percentage body fat and triceps skinfold.

School-based interventions in the included studies varied widely. They were designed to decrease overweight by increased physical activity, decreased participation in sedentary activities and to decrease intake of food with high fat and sugar content. Programmes were delivered as physical education classes and/or classroom lessons. Many programmes were multicomponent.

Mean age of participants (where reported) ranged from six years to 14 years. School grades (where reported) ranged from 1 to 7. Outcomes included BMI and measurements of waist girth, triceps skinfold thickness, percentage body fat, sum of skinfolds, waist-hip ratio and subscapular skinfold thickness. Most studies included multiple measures of obesity and used a variety of methods of measurements.

The authors did not state how studies were selected for inclusion.

Assessment of study quality
Validity was assessed using a modified version of the Joanna Briggs Institute Critical Appraisal of Evidence of Effectiveness tool for adequacy of randomisation, allocation concealment, withdrawals, blinding of outcome assessors, comparability of groups, comparability and reliability of outcomes and appropriateness of statistical analysis (maximum score of 10). Studies that scored 6 or above were deemed to be of appropriate methodological quality and were included in the analysis.

Two reviewers independently assessed quality; disagreements were resolved by recourse to a third reviewer.

Data extraction
Data on odds ratios (ORs) were extracted for binary outcome measures together with corresponding 95% confidence intervals (CIs). Standardised mean differences (SMDs) and 95% CIs were extracted continuous measures. Where odds ratios or SMDs were not reported these were calculated using available data. Each "measure of fatness" was analysed.
separately. Only studies that reported odds ratios or SMDs and their 95% CIs or that included data from which these could be calculated were included in the meta analysis.

Methods of synthesis
Pooled odds ratios and weighted mean differences (WMDs) were calculated together with corresponding 95% CIs. Heterogeneity was assessed using the $I^2$ statistic. A random-effects model was used to combine data where there was evidence of statistical heterogeneity ($I^2=75\%$). A fixed-effect model was used in the absence of statistical heterogeneity.

Results of the review
Nineteen studies (at least 15,964 participants) were included in the analysis: 14 RCTs, one controlled trial, one quasi-experimental trial and three described as follow-up studies. In terms of methodological quality, one study scored 9 points, five studies scored 8 points, nine studies scored 7 points and three studies scored 6 points.

Prevalence of Overweight and Obesity (seven studies): Overall, school-based obesity interventions were more effective in decreasing the number of participants who became overweight or obese than control groups (OR 0.74, 95% CI 0.60 to 0.92; seven studies). Studies with a duration of less than six months reported no significant differences between groups. Interventions that lasted one to two years reported a significantly lower likelihood of participants being overweight or obese compared to control (OR 0.81, 95% CI 0.68 to 0.92; three studies), as did interventions that lasted more than two years (OR 0.59, 95% CI 0.37 to 0.94; two studies). There were no statistically significant differences between groups for long-term follow up (three studies). There was evidence of significant statistical heterogeneity for the analysis of studies of interventions of more than two years duration ($I^2=83\%$).

BMI (11 studies): Overall there were no statistically significant differences between school-based intervention programmes and controls for BMI (11 studies). There was a significantly greater decrease in BMI with school-based interventions of between one and two years duration (WMD -0.10, 95% CI -0.14 to -0.06; two studies) compared to control. No significant differences between groups were found for studies with an intervention duration of less than six months to one year (six studies) and for studies with an intervention duration of more than two years (two studies). School-based intervention programmes reported a significantly greater reduction in BMI compared to control for long-term follow-up of between one and 10 years (WMD -0.42, 95% CI -0.69 to -0.14; two studies). There was evidence of statistical heterogeneity for the overall analysis ($I^2=98.1\%$) and for analyses of studies with a duration of intervention of less than six months ($I^2=93.5\%$) and more than two years ($I^2=99\%$).

Results were also reported for subgroup analyses and other measures of obesity.

Authors' conclusions
There was convincing evidence that school-based interventions were effective, at least short-term, in reducing the prevalence of childhood obesity. Longer-running programmes were more effective than shorter programmes.

CRD commentary
The review question was clear with appropriate inclusion criteria. Several relevant sources were searched. Inclusion of only studies published in English meant that there was potential for language and publication biases. Appropriate methods were used to reduce reviewer error and bias in validity assessment; it was unclear whether similar efforts were made for studies selection and data extraction. Validity was assessed with appropriate published criteria and results of the assessment were reported. Only studies of appropriate methodological quality were included in the analysis. Interventions and reporting of outcomes varied widely between studies; therefore, combining studies in a meta-analysis may not have been appropriate. Statistical heterogeneity was assessed. Results for some outcomes were based on only two or three studies. The reliability of the authors' conclusions is uncertain due to some methodological weaknesses of the review and because results of some outcomes were based on only a few studies.

Implications of the review for practice and research
Practice: The authors stated that school principals and policymakers should consider implementing school-based interventions as long-term strategies for prevention and management of childhood overweight and obesity.
Research: The authors stated that further methodologically robust research with large sample sizes and greater power to determine the effectiveness of school-based interventions in reducing childhood overweight and obesity levels was required. Future studies should include multicomponent interventions with dietary and physical activity interventions and provide detailed reporting of these. Outcomes in future studies should include more than one measure of obesity, have a duration of more than two years and include long term follow-up.

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