Effect of school-based physical activity interventions on body mass index in children: a meta-analysis

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CRD summary
The authors’ concluded that school-based physical activity interventions did not improve body mass index, but there were other beneficial health effects. The authors’ conclusions are in line with the evidence presented, but it should be borne in mind that there were considerable differences between included trials.

Authors’ objectives
To determine the effects of school-based physical activity interventions on body mass index in children.

Searching
MEDLINE, EMBASE, CINAHL and the Cochrane Central Register of Controlled Trials (CENTRAL) were searched to September 2008 with no language restrictions. Search terms were reported. Journals and reference lists of relevant articles and reviews were also searched.

Study selection
Randomised controlled trials (RCTs) and controlled clinical trials (CCTs) that evaluated school-based exercise or physical activity interventions, where the intervention took place during regular class time, and lasted for a minimum of six months, were eligible for inclusion. To be included, control groups must not have received the intervention and must have continued with existing physical education curriculum, with no changes to duration or intensity. Eligible participants were aged 5 to 18 years. Height and weight data had to have been objectively measured in both intervention and control groups. The primary outcome was change in body mass index.

The interventions in the included trials varied widely and focused on increasing moderate to vigorous physical activity, increasing the time devoted to general physical activity, implemented weight-bearing exercise, activities using large muscle groups or personalised physical education programmes. Assessment of physical activity varied between trials (details reported in the review). The majority of the trials had some type of co-intervention including classroom nutrition, health education or family involvement. The majority of the included participants were elementary school children in grades 3 to 6 (range grades 1 to 12). Ethnicity of the included participants, where reported, included white, American Indian, Chinese, African American and Hispanic. Participants were drawn from the general school population, or included obese children or those from low socio-economic backgrounds. Included trials were conducted in Australia, USA, Canada, Chile and Sweden.

Two reviewers independently selected studies for inclusion. Disagreements were resolved through discussion.

Assessment of study quality
Validity was assessed using modified criteria derived from the Jadad scale and the Cochrane Effective Practice and Organisation of Care Review Group criteria that evaluated baseline characteristics, method of randomisation, a priori power calculation, blinding of outcome assessors, withdrawals and drop-outs, and description of statistical analysis. Data were reported on how individual trials were rated for each criterion.

Two authors independently assessed studies for validity. Disagreements were resolved through discussion.

Data extraction
Data were extracted to calculate effect sizes as the difference in mean change in body mass index and standard deviation (SD) before and after the intervention, and mean change in body mass index in the intervention group minus mean change in body mass index in the control group. Where available, data were also extracted on other measures of body composition including percent body fat, waist circumference, waist-to-hip ratio, triceps skin-fold thickness and...
subscapular skin-fold thickness. Where cluster controlled trials reported measurements at the individual level but randomisation at the school level, examination was conducted to ensure that cluster-adjusted analyses had been performed; authors carried out appropriate cluster adjustments where necessary. Authors were contacted where data were missing.

Two authors independently extracted data. Disagreements were resolved through discussion.

**Methods of synthesis**
Data from individual studies were combined using a random-effects model and taking into account the inverse of the variance to calculate the weighted mean difference in body mass index and corresponding 95% confidence interval (CI). Statistical heterogeneity was assessed using the $I^2$ statistic. Changes in other measures of body composition were reported narratively. Subgroup analyses were conducted (trials with and without co-interventions; trials of more than one year duration and trials of less than one year; trials including boys plus girls and trials with only girls or boys; RCTs and CCTs). Sensitivity analyses were performed to assess the robustness of the results including removing each individual trial to assess its impact on the summary estimate. Publication bias was assessed using a funnel plot.

**Results of the review**
Eighteen trials (n=18,141 school-children) were included in the review (13 RCTs including 12 cluster trials, and five cluster CCTs), but only fifteen were included in the analysis. The duration of trials ranged from six months to three years. Only four RCTs were deemed to be of the highest methodological quality. Ten studies described method of randomisation, three studies reported blinding of outcome assessors, six studies reported an a priori power calculation, and 13 studies reported attrition rate.

Overall results found that body composition did not improve with physical activity, as there were no significant differences between children who received a school-based physical activity intervention and children in control groups (mean difference in BMI -0.05 kg/m², 95% CI -0.19 to 0.10; 15 trials). There was evidence of high statistical heterogeneity ($I^2=54\%$). There was no evidence of publication bias (data not reported). Subgroup and sensitivity analyses did not significantly change the results.

Results of other measures of body composition were reported in the review.

**Authors’ conclusions**
School-based physical activity interventions did not improve body mass index, although there were other beneficial health effects.

**CRD commentary**
The review question was clear and supported by detailed inclusion criteria. Several relevant sources were searched and efforts were made to reduce language bias. Although authors report formal assessment of publication bias, the results of this are not reported. Validity was assessed using appropriate criteria and the results of the assessment were reported. Appropriate methods were used minimise reviewer error and bias in the selection of studies, assessment of validity and extraction of data. Trials were combined in a meta-analysis and heterogeneity was assessed. However, given the presence of significant heterogeneity and the differences between studies in terms of interventions and assessment of outcomes, a meta-analysis may not have been appropriate. The majority of the included trials were conducted in the USA, so the results from the analyses may not be generalisable to other settings. The authors appropriately discussed limitations of the review, including the wide range of physical activity interventions implemented, the lack of assessment of adherence to study protocols and the lack of objective assessment of amount of physical activity. The authors’ conclusions are in line with the evidence presented, but it should be borne in mind that there were considerable differences between included trials.

**Implications of the review for practice and research**
**Practice**: The authors stated that the results indicated school-based physical activity interventions did not improve body mass index, but the authors suggested that it is important to promote school based physical activity for its demonstrated health benefits, even though there was no evidence that it was effective for reducing body mass index in children.
Research: The authors stated that further methodologically robust research is needed to evaluate school-based physical activity interventions. Future studies should be of sufficient duration to enable observation of clinically important changes in body composition and should be adequately powered to detect small but meaningful changes in body mass index; they should ensure adequate assessment of adherence to study protocols at school and individual levels, and they should employ objective assessment of the "dose" of physical activity achieved with the interventions. Future research should also evaluate the impact of school-based physical activity interventions on the metabolic profile of children.

Funding
No funding source.

Bibliographic details

PubMedID
19332753

DOI

Original Paper URL
http://www.cmaj.ca/content/180/7/719.abstract

Indexing Status
Subject indexing assigned by NLM

MeSH
Adolescent; Body Composition; Body Mass Index; Child; Diet; Female; Health Education /methods; Humans; Male; Obesity /epidemiology /prevention & control; Physical Education and Training /methods; Physical Fitness /physiology; Randomized Controlled Trials as Topic; Risk Factors; School Health Services /organization & administration; Sensitivity and Specificity

AccessionNumber
12009104249

Date bibliographic record published
13/05/2009

Date abstract record published
11/11/2009

Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.