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Review

School-based physical activity and nutritional education interventions on body mass index: A meta-analysis of randomised community trials — Project PANE

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ABSTRACT

Objective. To evaluate the effect of school-based physical activity (PA) and nutritional education (NE) interventions on children's and adolescents' body mass index.

Methods. We conducted a systematic search in fourteen databases until September 2012 for randomised controlled trials on PA and NE, conducted in the school setting, and delivered to children and adolescents. Additionally, we performed a cross-reference check in related papers. The title and abstract review and the quality assessment were performed by two independent researchers. The software EPPI-Reviewer3 was used to store, manage and analyse all data. The meta-analysis was conducted using the random-effects model, and the outcomes were reported as standardised mean difference (SMD). As a secondary analysis, we pooled together the interventions that considered PA or NE alone.

Results. Thirty-eight studies met the eligibility criteria. The main analysis showed a SMD between intervention and control groups of −0.03 (95% CI: −0.09, 0.04; n = 28,870; I^2 = 83%). When we considered all 57 trials, there was no difference between the results of the primary analysis.

Conclusion. The synthesis of school-based PA and NE interventions showed no statistically significant mean reduction on children's and adolescents' body mass index. The high heterogeneity among studies requires caution in the generalisation of the results.

Contents

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Introduction

Excessive weight gain in children and adolescents is due to a complex network of biological and environmental factors (Butland et al., 2007). The World Health Organization (WHO) reported that changes in the food intake pattern and physical inactivity are the most relevant factors associated with the fast progression of childhood overweight and obesity (WHO, 2010). Due to the failure of preventive strategies, the problem has extended to several ethnic groups and socioeconomic classes in the last four decades, although the incidence is still higher in highly industrialised countries (Wang and Lobstein, 2006; Wang et al., 2002).

Schools provide a particularly favourable setting for interventions focussing on the promotion of healthy lifestyles, as children and adolescents spend a large part of their time there and are exposed to various educational mechanisms.

The growing body of research on strategies to prevent and reduce childhood obesity has resulted in an exponential increase in publications on this topic and has led to the performance of eight meta-analyses with similar aims to the ones of the present study, but diverging as to methodological features Such divergence is at the root of an ongoing controversy about the effectiveness of intervention programmes conducted in schools. Four studies have reported favourable effects of school-based interventions in terms of the reduction of the body mass index, three of which included non-randomised controlled clinical studies.

The main objective of this study was to assess the effect of school-based physical activity (PA) and nutritional education (NE) interventions by randomised controlled studies on the reduction of BMI among children and adolescents. As a secondary analysis, we added 19 studies considered in previous publications (Guerra et al., 2013; Silveira et al., 2013), which analysed the effect of PA or NE-only interventions on BMI (Ahamed et al., 2007; Amaro et al., 2006; Aquilani et al., 2007; Ask et al., 2010; Donnelly et al., 2009; Foster et al., 2008; Henaghan et al., 2008; James et al., 2004; Jiang et al., 2007; Kriemler et al., 2010; Lubans et al., 2010; Martinez Vizcaino et al., 2008; McManus et al., 2008; Muckelbauer et al., 2009; Sichieri et al., 2009; Simon et al., 2008; Thivel et al., 2011; Walther et al., 2009; Young et al., 2006).

Methods

The present study is a part of "Physical Activity and Nutritional Education as School-based Interventions to Control Obesity in Children and Adolescents (Project PANE)", which was registered at ClinicalTrials.gov (NCT00985972), and made in accordance with PRISMA statement (Liberati et al., 2009).

Inclusion criteria

The research question and eligibility criteria were elaborated following the Population, Intervention, Comparison, Outcome, and Study design (PICOS) model (Centre for Reviews and Dissemination, 2009; Richardson et al., 1995).

We included only school-based randomised controlled community trials that 1) performed PA and NE interventions for children and adolescents aged 6 to 18 years old, independently of their anthropometric conditions, ethnicity, purchasing power, and gender; 2) included one control group for the purpose of comparison, which was followed up for the same period as the intervention group; 3) described the BMI outcome in both intervention and control groups (means and variability); and 4) did not include samples representative of children and adolescents with physical or mental deficiency, eating disorders, anaemia, diabetes, or dyslipidaemias.

Search for relevant articles

We searched for articles in 14 databases up to 30 September 2012: Applied Social Sciences Index and Abstracts (ASSIA); Cochrane CENTRAL; Cumulative Index to Nursing and Allied Health Literature CINAHL; EMBASE; Education Resources Information Center (ERIC); ISI Web of Knowledge; Latin American and Caribbean Literature on Health Science (Literatura Latinoamericana e do Caribe em Ciências da Saúde — LILACS); Physical Education Index; PsycINFO; PubMed/Medline; Social Care Online; Social Services Abstracts; Sociological Abstracts; and SPORTDiscus. No language limitations were established, except that we excluded languages that use logograms (e.g., Japanese and Chinese). Additionally, we performed a cross-reference check in related systematic reviews and in the selected trials for this meta-analysis.

The search strategy was based on the research question, using PubMed database as reference. Following careful keyword selection, these search terms were used: (school) AND (physical activity) OR (physical education) OR (exercise) OR (physical fitness) OR (sports) OR (nutrition) OR (nutritional science) OR (child nutrition sciences) OR (nutrition education) OR (diet) OR (energy intake) OR (energy density) OR (calories) OR (calorie) OR (food) OR (fruit) OR (vegetable)) AND ((weight) OR (obese) OR (overweight) OR (weight reduction) OR (anthropometric) OR (anthropometry) OR (nutritional status) OR (nutrition assessment) OR (body mass index) OR (BMI) OR (body weights and measures) OR (waist circumference) OR (adipose tissue)) AND (randomised controlled trial[ptyp] AND (child[MeSH:noexp] OR adolescent[MeSH])). In addition, we performed a manual search in previous studies. Full description of 14 systematic searches is found in Appendix 1.

Study selection

Two independent reviewers selected the studies in two different stages: based on the title and abstract, and based on the full text. In the case of duplicates (e.g., secondary analysis, subgroups) and studies with more than one intervention group, we selected the ones that best met the eligibility criteria. Instances of doubt or disagreement were solved by consensus, including the participation of two other experienced researchers (MN and JT).

Quality assessment

The methodological quality of the studies was assessed using two tools: Quality Assessment Tool for Quantitative Studies of Effective Public Health Practice Project (EPHPP) (Thomas et al., 2004) and Grading of Recommendations Assessment, Development and Evaluation (GRADE) (Atkins et al., 2004), which include important domains of community-based randomised studies: selection, control of confounding factors, study stages in which blinding was used, data collection method, losses to follow up, integrity or contamination of intervention, unit for allocation and analysis, type of analysis, capacity of generalisation, and effect size. Based on the corresponding percentage of items that were appropriately met on a 21-point scale, the original studies were classified as to their methodological quality (high, average, or low). In the case of borderline results, the score in EPHPP was defining.

Data extraction and synthesis

Following the assessment of methodological quality, two independent reviewers (PG and JS) extracted the data available in the selected studies related to the number of participants, number of involved schools, intervention protocol,