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Review

The effectiveness of interventions to increase physical activity among young girls: A meta-analysis

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ABSTRACT

Context. Pre-adolescent girls are an important target population for physical activity behaviour change as it may enhance tracking into the crucial period of adolescence. The quantification of intervention effectiveness for this age group of girls has not been previously reported.

Evidence acquisition. Studies published in English up to and including August 2013 were located from computerised (MedLine, PsychInfo, Science Direct, Web of Science, EPPI centre databases, and Cochrane Library database) and manual searches. Intervention studies aimed at promoting physical activity, which included pre-adolescent girls aged 5–11 years, and a non-physical activity control/comparison group were included.

Evidence synthesis. A random effects meta-analysis was conducted. The average treatment effect for pre-adolescent girls involved in physical activity interventions was significant but small ($g = 0.314$, $p < .001$). Moderator analyses showed larger effects for interventions that catered for girls only and used educational and multicomponent strategies.

Conclusions. Interventions to increase physical activity in pre-adolescent girls show small but significant effects, suggesting that behaviour change may be challenging, but results suggest some strategies that could be successful.

Contents

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Introduction

Given the well documented health benefits of physical activity and concerns about low levels of physical activity in all age groups, there is a clear need for effective interventions that increase population levels of physical activity (Biddle et al., 2012). Within the general population, there are subgroups that warrant particular focus. Pre-adolescent children are the most active segment of society, yet there remains concern that even for this age group many children have physical activity levels lower than those recommended for good health. For example, objective assessment data from England shows that only 34% of 4–10 year olds meet national recommendations (i.e., 60 min or more of at least moderate activity on all 7 days of the week), and this figure falls to zero for adolescent girls (Townsend et al., 2012).

Recent studies have shown that the decline in physical activity during early adolescence is greater among girls than boys, and that the decline in girls begins earlier than that in boys (Dumith et al., 2011). Moreover, given the small-to-moderate strength of tracking of physical activity from pre to adolescence (Telama, 2009), it may be wise to promote physical activity early in life if maintenance of this health behaviour is desired, even though it is recognised that there are a multitude of influences on physical activity across the lifespan.

Using the behavioural epidemiological framework (Sallis and Owen, 1999) and having identified the levels of physical activity in girls and the factors affecting participation (correlates), it is important to appraise the evidence concerning how effective interventions are in this age group. One of the first reviews of the effects of physical activity interventions in young people was reported by Stone et al. (1998). They concluded that the effects were stronger for interventions that used randomised designs, had valid and reliable measures, and included more extensive intervention strategies. However, they recommended that future research involves studies that investigate the success of interventions attempting to prevent the decline in physical activity in females. More recently, a comprehensive review was reported by van Sluijs et al. (2007). In this review, interventions conducted with pre-adolescent children showed no or inconclusive effectiveness when analysed across different settings. However, no distinction was made in the results by gender. Thus it is not possible to conclude whether interventions for girls are successful. For example, while we know that physical activity levels of boys and girls differ, we do not yet know whether targeting girls alone is more effective than mixed interventions. The question about effective strategies to address and increase pre-adolescent girls' PA is an important public health topic that has yet to be adequately explored. How to best address low levels and declines in physical activity in pre-adolescent girls is unclear. The purpose of this meta-analysis, therefore, is to quantify the effect of physical activity interventions for pre-adolescent girls by including intervention studies that provided results for girls separately.

Methods

Search strategy

Search strategies were built around four groups of keywords: population, study design, behaviour, and intervention type. Keywords used to guide the searching process included 'girls', 'youth', 'children', 'adolescents', 'teens', 'teenagers', 'young people', 'controlled trial', 'random', 'intervention', 'prospective', 'trial', 'cluster', 'physical activity', 'activities', 'exercise', 'physical education', 'play', 'leisure', 'sport', 'school', 'community', 'family', 'primary health care', 'counselling', and 'education'. Science Direct, PubMed, PsychInfo, Web of Science, Cochrane Libraries, and EPPI Centre databases were searched using the key terms. In addition, manual searches of personal files were conducted along with screening of reference lists of previous physical activity reviews (Brown, 2009; Camacho-Minano et al., 2011; De Bourdeaudhuij et al., 2011; De Meester et al., 2009; DeMattia et al., 2007; Foley and Maddison, 2010; Hamel et al., 2011; Jago and Baranowski, 2004; Lubans et al., 2009; Ogilvie et al., 2007; Pate and O'Neill, 2009; Salmon et al., 2007; Timperio et al., 2004; van Sluijs et al., 2007; Ward et al., 2010) and identified articles for titles that included the key terms.

Inclusion and exclusion criteria

For inclusion, studies were required to (i) be an intervention study in which the main component or one of the components was aimed at promoting physical activity through behaviour change in any setting; (ii) include girls aged 5–11 years (or a mean within these ranges) as subjects of study at baseline; (iii) include a non-physical activity control group or comparison group (randomised or nonrandomised); (iv) include a quantitative outcome assessment of physical activity behaviour; (v) be published in the English Language up to and including August 2013.

Identification of relevant studies

Potentially relevant articles were selected by (i) screening the titles; (ii) screening the abstracts; and (iii) if abstracts were not available or did not provide sufficient data, the entire article was retrieved and screened to determine whether it met the inclusion criteria.

Data extraction and coding

Information extracted from each article included sample characteristics, inclusion criteria, intervention type, setting, components/description, length of intervention and follow-up, theoretical framework, physical activity outcome, assessment of physical activity, and measures of physical activity (see Tables 1 and 2). Study design information extracted included sampling and group-assignment procedures. The sample size at group assignment and each assessment point and the number of participants included in the analysis also were recorded. Finally, information about study outcomes, including means and associated SDs and mean change from baseline to post test, was extracted for use in calculating effect sizes. Data were extracted using a standard data extraction instrument developed specifically for this study.

Risk of bias

The Cochrane Collaboration tool for Assessing Risk of Bias was used to assess the included studies (Higgins et al., 2011). For each study seven domains were scored with high, low or unclear risk for bias: sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective outcome reporting and 'other' issues (similarity in baseline characteristics and timing of outcome assessment). These seven domains assess the level of risk regarding selection bias, allocation bias, performance bias, detection bias, attrition bias, reporting bias and other biases. The quality assessment was performed independently by two authors and the findings were compared and discussed until consensus was achieved. For the purpose of this meta-analysis, each domain was scored as −1 for high risk, 0 for unclear risk and 1 for low risk. Scores were then summed with a possible range of scores from −6 to 6 ('other' was not scored), with positive values meaning lower risk of bias.

Statistical procedures

Outlier and publication bias analyses were used to evaluate and manage the influence of extreme values or missing studies on the overall treatment effect. Outliers were considered to be studies with inflated residual values approximately two standard deviations ($z = \pm 1.96$) above or below the average treatment effect. If outliers were present a "one study removed" procedure was performed to determine if study removal from the analysis was appropriate. The two criteria used to evaluate outlier inclusion were based on small changes in the overall treatment effect that remained significant ($p < .05$) and results were within the 95% confidence interval. Publication bias refers to an underrepresentation of non-significant studies from published literature preventing accurate conclusions from being drawn from research (Rothstein et al., 2005). Three separate methods were used to evaluate publication bias including review of the funnel plot, Duval and Tweedie's (2000a,b) "trim and fill" procedure, and the Fail Safe *N* calculation. Funnel plots graph studies according to the effect size (vertical-axis) and standard error (horizontal-axis) with asymmetrical plots representing publication bias. The "trim and fill" procedure is an iterative statistical