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Review Paper

The prevalence of sufficient physical activity among primary and high school students in Mainland China: a systematic review and meta-analysis

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ABSTRACT

Objectives: This study aims to estimate the prevalence of sufficient physical activity (PA) for primary and high school students in China.
Study design: This is a meta-analysis study.
Methods: The literature search was carried out using both English and Chinese online databases, including articles published from January 2005 to May 2018. Statistical analyses were performed with STATA 13.0.
Results: Of 1439 articles initially retrieved, 18 studies met the inclusion criteria. The prevalence of sufficient PA among Chinese students varied from 8.96% to 56.02%. With meta-analysis, the sufficient PA prevalence was 31.1% (27.1%–35.2%). Boys were more likely to achieve sufficient PA compared to girls (boys vs girls: 42.4% vs 31.5%, $P < 0.001$), while urban students engaged in more sufficient PA than their rural counterparts (urban vs rural: 42.7% vs 38.5%, $P < 0.001$). Primary school students spent more time in overall PA than junior (primary vs junior: 45.4% vs 40.6%, $P < 0.001$) or senior high school students (primary vs senior: 45.4% vs 27.9%, $P < 0.001$). Students tended to be more physically active on weekdays than weekends (weekdays vs weekend: 57.2% vs 45.2%, $P < 0.001$).
Conclusions: The prevalence of sufficient PA was 31% among Chinese students. Intervention campaigns are needed for promoting PA level among students in China.
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Introduction

As physical activity (PA) is beneficial for children's health,[1,2] the promotion of PA is a useful and logical way to improve children's health and prevent chronic diseases. It has been approved that long-term school-based PA and nutrition program could reduce prevalence of excess body weight and gain physical fitness.[3,4] For children and adolescents, their recognitive and learning abilities are under the stage of development. Compared to adults, children and adolescents can more easily be educated to adopt healthy lifestyle and behavior.[5] Furthermore, healthy lifestyles and behavioral patterns adopted at childhood stage tend to be effectively maintained at adulthood stage.[6] Therefore, school-based childhood PA education and promotion will be of optimized input–output effectiveness.

The World Health Organization (WHO) recommends that children/youth should participate in sufficient PA by engaging in moderate-to-vigorous physical activity (MVPA) for at least 60 min daily per week.[7–9] PA with moderate intensity is defined as an activity that increases breathing, sweating, and heart rate, while PA with vigorous intensity refers to an activity that substantially increases breathing, sweating, and heart rate.[10] China is suffering the burden caused by declining PA level among school-aged children due to the transition of lifestyle and behavior patterns.[11] There is an urgent need to implement a long-term school-based PA intervention campaign to promote PA among school students in China.

Considering that PA monitoring is necessary for evaluation of community-based PA intervention, it is of particular public health importance to investigate/estimate the level of sufficient PA in children/adolescents to support PA promotion campaigns. However, up to date data on the level of sufficient PA is limited among primary and high school students in China. Among the known population-based cross-sectional surveys conducted to estimate sufficient PA among school children in China, the majority of available surveys have a small sample size and therefore do not yield representative PA data for the general child population in China.

To estimate the proportion of children achieving sufficient PA in Chinese schools in the last decade, we conducted a systematic review and meta-analysis based on studies published in both English and Chinese during the period from January 2005 to May 2018. Based on the recommendation by WHO, sufficient PA was defined using MVPA. Therefore, we focused our systematic review on MVPA in this meta-analysis study.

Methods

Study design and literature search strategy

This is a systematic review and meta-analysis study. All relevant original articles published in English or Chinese peer-reviewed journals reporting the participation rate of PA among Chinese primary (grade 1–6) and high school (junior high school: grade 7–9; senior high school: grade 10–12) students were retrieved by internet searching through Embase, PubMed database, the China National Knowledge Infrastructure (CNKI, in Chinese) and the Weipu database (in Chinese), using the following MeSH terms 'physical activity', 'student', and 'China' as key words, following the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) statement.[12] The published language was limited to both English and Chinese, and the publication years were limited from January 2005 to May 2018. The reference lists of included studies and related publications were also searched manually until no potential new citations could be found. The flow chart of the search strategy is shown in Fig. 1. This study was approved by the Academic and Ethical Committee of Nanjing Municipal Center for Disease Control and Prevention.

Inclusion and exclusion criteria

Studies were included in the meta-analysis if they met all of the following criteria: (1) Participants were randomly selected from either primary school (grade 1–6) or high school (grade7–12) students in China; (2) the study was designed as a population-based cross-sectional survey; (3) PA level was assessed with validated questionnaires; and (4) the information on PA (either 1-h/day MVPA or sufficient PA) in the last week was collected.

Studies failing to meet the inclusion criteria were excluded. In addition, sub-analysis, reviews, and studies with missing adequate statistical analysis information were also excluded. In China, there were very few surveys reporting information on objectively measured PA among school students, and the sample sizes were very small for these available surveys, so we limited our searched articles to those reported PA assessed with a validated questionnaire only.

Available study selection and data extraction

All potentially relevant original articles were reviewed by two independent reviewers. The references were screened by titles and further selected by reading the abstracts. For those articles that were not excluded based on title and abstract, the full texts were retrieved. The final decisions of inclusion were made based on the two reviewers' unanimous agreement after discussion. If no agreement between them, a third reviewer was invited to join the discussion and the decision was made based on the same opinion from two of the three reviewers. Multiple references for the same study were considered as one publication, and only the most recent or complete study was examined. Articles were also obtained from cross-checking references of publications.

Data from all included studies were also independently extracted from each article by two independent reviewers, who were blinded to each other, using standardized data extraction forms, including: (1) basic information of the included studies (including the first author, year of publication, and location where the study was performed); (2) study characteristics (including number of participants, structured questionnaire type, evaluation standard, sampling approach, and corresponding participation rate); (3) participants' characteristics (including median age, gender, grade, location, and PA evaluating index); (4) information on the quality of surveys (quality score); (5) PA measures, including the participation

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