Effects of physical activity interventions on the body mass index of children and adolescents in Latin America: a protocol for a systematic review and meta-analysis

Andrés Godoy-Cumillaf, Armando Diaz, Celia Álvarez-Bueno, Vicente Martínez-Vizcaino, Iván Cavero-Redondo

ABSTRACT

Introduction In Latin America, the number of children and adolescents who are overweight or obese has significantly increased in recent decades, and this situation has become a major public health concern. To address this problem, several intervention programmes, based on factors such as physical activity and nutrition, have been implemented, and body mass index (BMI) has been widely used as a means of measuring the impact of such interventions. Although some Latin America-based systematic reviews have been performed, there have been no previous meta-analyses of findings regarding the effect of physical activity interventions on BMI. Thus, the objective of the systematic review and meta-analysis will be to provide an up-to-date synthesis of the effects of physical activity interventions on BMI of Latin American children and adolescents aged 4–18 years.

Methods and analysis This systematic review and meta-analysis protocol is based on the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA) statement. The literature search will involve MEDLINE, EMBASE, Cochrane Library, Web of Science and Scielo for articles published up to July 2019. This search will include randomised controlled trials (RCTs), non-randomised experimental studies and single-arm pre–post studies. Further, the Cochrane Collaboration’s tool for RCT studies and the Quality Assessment Tool for Quantitative Studies for non-randomised experimental and single-arm pre–post studies will be used to assess the risk of bias among the studies included in the systematic review. For the meta-analysis, the statistical program STATA V.14 will be used, and standardised mean differences are calculated as the primary outcomes. Subgroup analyses will then be performed based on the characteristics of the interventions and populations included in the studies examined.

Ethics and dissemination This systematic review protocol is designed to provide updated evidence regarding the effects of physical activity interventions on the Latin American population; such evidence may be useful for institutions responsible for the development of public health policies and for those tasked with implementing such interventions among children and adolescents in Latin America. The results should be disseminated through publication in a peer-reviewed journal. Since the data used in systematic reviews of this type will be extracted exclusively from published studies, approval from an ethics committee will not be required.

Strengths and limitations of this study

In the protocol, two reviewers will independently perform the study selection, data extraction and quality assessments.

This review may produce the first Latin America-based meta-analysis that provides scientific information regarding the effect of physical activity interventions on body mass index.

Differences among the study designs, sample characteristics, types of physical activity interventions and poor methodological quality may restrict comparison of the selected studies and negatively affect the quality of the evidence obtained through associated systematic reviews and meta-analyses.

INTRODUCTION

In Latin America, levels of overweight and obesity among children and adolescents have significantly increased in recent decades, and this issue has now become a major public health concern. A tool that facilitates a quick assessment of whether a person is overweight or obese, as well as his/her level of general adiposity, is body mass index (BMI). As a result of BMI-based assessments, it is now estimated that between 20% and 25% of the total Latin American population of children and adolescents are overweight or obese. This is a worrying situation, as studies have suggested that these conditions are maintained into and during adulthood, and that they increase risk factors for cardiovascular disease, high blood pressure, some types of cancer and all causes of premature mortality. In fact,
BMI has become such a reliable predictor of mortality that in 2015 over 4.5 million deaths worldwide were associated with high BMI values.

However, in children and adolescents BMI values should be used and interpreted cautiously, as there is evidence that, although such values are useful for classifying adiposity, they can be a poor measure of changes in adiposity. Moreover, childhood weight gain can generally be attributed to fat-free mass rather than fat mass, and this means that BMI is unable to precisely reflect changes that occur over time, particularly in adolescent men and children with low BMI. Despite these problems, BMI will be used because it is one of the most practical methods to evaluate the changes in adiposity in children and adolescents. Furthermore, it is widely used to measure the prevalence of overweight, obesity and underweight in childhood.

Physical activity plays an important role in reducing BMI, along with lowering risk factors for cardiovascular disease and improving cardiorespiratory fitness; this, in turn, leads to a reduction in risk factors for overall health. As a result of these benefits, researchers have implemented physical activity-focused interventions, nutrition-focused interventions or a combination of both, and have used BMI to measure their effect. Underlining this approach, previous systematic reviews performed in Latin America have shown that, while few studies have implemented physical activity interventions to treat overweight and obesity, the implementation of physical education policies and programmes is necessary to promote children’s and adolescents’ health, because these interventions can effectively create positive changes among this population, such as having a significant positive effect on BMI, as well as some anthropometric variables in children and youth with overweight and obesity, all through the promotion of physical activity and healthy diet. However, there have been no previous Latin America-based meta-analyses of the effects of physical activity interventions have on BMI. Considering this, the present study aims to attract more attention to the necessity of such interventions, and to generate evidence that can encourage changes in public policy that can contribute to addressing this public health crisis.

OBJECTIVE
The systematic review and meta-analysis will provide an up-to-date synthesis of the effects of physical activity interventions on BMI of Latin American children and adolescents aged 4–18 years.

METHODS AND ANALYSIS
This systematic review and meta-analysis protocol is based on the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) statement and the Cochrane Collaboration Handbook. Inclusion/exclusion criteria for study selection

For this protocol, in order to be included in associated systematic reviews studies must have reported physical activity interventions that meet the following criteria: (1) involving the population of a Latin American country; (2) including participants aged 4–18 years; (3) reporting any type of physical activity (physical endurance, sports or alternative exercise (eg, games, dancing, optimised physical education classes), which may or may not have included nutritional interventions); (4) being a randomised controlled trial (RCT), non-randomised experimental study or single-arm pre–post study; (5) reporting BMI both before and after the intervention; (6) written in Spanish, English or Portuguese and (7) published before October 2019.

Meanwhile, the following exclusion criteria will be set: (1) including only participants younger than 4 or older than 18 years old and (2) providing self-reported data for BMI.

Studies that feature different age ranges, but that nevertheless include population data for the ages of 4–18 years, will be included in the analysis.

Search strategy
Literature searches will be conducted through the MEDLINE (via PubMed), EMBASE, Cochrane Library, Web of Science and Scielo databases. Meanwhile, searches for unpublished studies will be conducted using OPEN GRAY, ProQuest Dissertations & Thesis Global, Theseo, Networked Digital Library of Theses and Dissertations and Google Scholar. Further, a search of ClinicalTrials.gov and EudraCT clinical trial records will also be conducted. The literature search will be complemented by screening references included in articles that are considered eligible for systematic review. Study records will then be managed using the Mendeley reference manager. The search strategy will include free text terms, combining Boolean operators from the Mendeley reference manager. The search strategy will also be scanned for additional references. Finally, reference lists of included papers will be hand-searched.

Study selection
After excluding duplicated records, two researchers will independently evaluate the titles and abstracts of the retrieved articles in order to identify eligible studies for the systematic review. Abstracts that meet inclusion criteria or that do not provide sufficient information regarding the inclusion/exclusion criteria will then be evaluated through a full-text reading. Then, two researchers will examine the included and excluded studies to verify the reason for each decision. Inconsistencies between these two researchers regarding selection will be resolved by a third researcher, who will make the final decision, always based on the inclusion/exclusion criteria.
Researchers will summarise the main characteristics of each included study, including the general profile of the study, the methods, the characteristics of the study participants and the results (as shown in table 2). A meta-analysis will be performed on studies that showed BMI pre–post interventions (separating studies that included physical activity interventions from those in which physical activity and nutritional health were combined). Studies providing insufficient data to perform such analyses will be included in the systematic review but will be omitted from the meta-analysis.

For studies for which a meta-analysis is appropriate, STATA V.14 software will be used to combine the pooled mean differences with 95% CIs. If there is no evidence of heterogeneity, a fixed effects model will be used; otherwise, a random effects model will be used. Study heterogeneity will be assessed using the I² statistic. Specifically, I² values will be stratified as follows: ‘might not be important’ (0%–40%); ‘may represent moderate heterogeneity’ (30%–60%); ‘may represent substantial heterogeneity’ (50%–90%) and ‘considerable heterogeneity’ (75%–100%); the corresponding p values will also be taken into account.

For RCTs, data from intention-to-treat analyses will be considered, whenever available. Specifically, two analyses will be performed: (1) mean difference in BMI pre–post physical activity-based intervention (with or without nutritional intervention) versus a control group and (2) mean difference in BMI pre–post physical activity-based intervention (with or without nutritional intervention), without a control group. Standardised mean differences will be calculated for BMI levels. Additionally, publication bias will be assessed using a funnel plot, following the method proposed by Egger.
Subgroup analysis and meta-regression

Next, subgroup analyses and meta-regression will be performed, considering the main factors that may cause heterogeneity, such as gender; age (children aged 4–12 years and/or adolescents aged 12–18 years); type of population (general population, indigenous population or a mix of both); country; type of study design; participant population (underweight, normal weight, overweight and/or obese); type of intervention (only physical activity or combined with nutritional intervention); type of physical activity (endurance, sports, games, dancing and/or lifestyle physical activity intervention); length of the intervention (above or below 12 weeks); the setting in which the intervention occurs and duration of physical activity per week (above or below 150 min). Moreover, the methodological quality of the selected studies will be considered for additional subgroup analyses.

Sensitivity analysis

Finally, to assess the robustness of summary estimates and to detect whether any singular study accounts for a large proportion of heterogeneity, sensitivity analyses will be performed, removing the included studies one-by-one from the pooled analyses.

ETHICS AND DISSEMINATION

Given that, in this protocol, researchers will not collect primary data for their reviews, ethical approval will not be required. Once the outcomes of the associated systematic reviews and meta-analyses are disseminated in scientific publications, they may be shared through social networks and presented in scientific conferences related to the subject; thus, the conclusions may contribute to improving the health of the Latin American population.
Table 2  Characteristics of studies included in the systematic review and/or meta-analysis

<table>
<thead>
<tr>
<th>Reference</th>
<th>Country</th>
<th>Study design</th>
<th>Age distribution</th>
<th>Sample size</th>
<th>Type of population</th>
<th>Intervention characteristics</th>
<th>Physical activity intervention</th>
<th>Physical activity characteristics</th>
<th>Nutritional intervention</th>
<th>Nutritional characteristics</th>
</tr>
</thead>
</table>

Studies conducted among populations in Europe and the USA have shown that physical activity interventions are associated with reductions of BMI, and are also an effective method of decreasing the percentage of adipose tissue. However, there have been no previous meta-analyses of the effects of these interventions in the context of Latin America, which has geographical, socio-economic and cultural characteristics that are inherent to a developing region. Thus, a suitable systematic review and, if appropriate, a meta-analysis, will enable us to gain an overview of the current Latin American literature regarding the study subject and, concurrently, could contribute to the efficient development of discussions regarding the benefits of physical activity interventions in the region. To this end, the systematic review protocol provides a structure for the extraction and synthesis of relevant information. This could provide us with evidence regarding the types of interventions that are most beneficial for reducing BMI values, particularly in regard to the prevention and treatment of overweight and obesity among Latin American children and adolescents.

In conclusion, the systematic review and meta-analysis will provide an up-to-date synthesis of the effects of physical activity interventions on BMI of children and adolescents aged 4–18 years. Such information will assist the roles of public health policy makers and those responsible for the implementation of such interventions.
Contributors AG-C and IC-R designed the study; AG-C was the principal investigator. AG-C and IC-R coordinated the study. AG-C and AD conducted the study. AG-C, CA-B, VM-V and IC-R provided statistical and epidemiological support. AG-C wrote the article with the support of IC-R, CA-B, VM-V and AD. All authors reviewed and approved the final version of the manuscript.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/.

ORCID iDs Andrés Godoy-Cumillaf http://orcid.org/0000-0001-8613-6838
Celia Álvarez-Bueno http://orcid.org/0000-0003-4250-5309

REFERENCES