

## Effect of Socioeconomic Inequality on Overweight and Obesity in Children: A Review of Systematic Reviews

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### ABSTRACT

**Background and objectives:** Obesity has become a global epidemic. Previous studies have reported a relationship between obesity in adults and socioeconomic factors, but the results regarding such relationship in the case of childhood obesity have been inconsistent. Therefore, this study aimed to determine the relationship between socioeconomic inequalities and overweight/obesity in children.

**Methods:** All meta-analysis, systematic and descriptive or correlational reviews on obesity in children and adolescents that have been published in English between January 2001 and January 2019 were included in the study. We performed the search for articles in the following databases: MEDLINE, Embase, Web of Science, Cochrane Library and Google Scholar. Each review article was subjected to qualitative evaluation using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) tool.

**Results:** Of 46 articles that met the inclusion criteria, five systematic reviews were included after carefully reading the abstract and the full text of the articles. The prevalence of overweight and obesity in children differed in different socioeconomic groups. Ethnicity was a confounding factor that could change this relationship.

**Conclusion:** Strong evidence supports the relationship between socioeconomic status and overweight or obesity in children. Therefore, it is recommended to consider the socioeconomic status when planning for control and prevention of childhood obesity.

**Keywords:** Inequality; socioeconomic; obesity; children

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## INTRODUCTION

In recent years, the prevalence of overweight and obesity in children has become a concern and a major risk factor for non-communicable diseases, such as cardiovascular disease, diabetes and some types of cancer in children (1). According to the latest report by the World Health Organization, childhood obesity is one of the most serious public health challenges of the 21<sup>st</sup> century, which is steadily expanding in many low- and middle-income countries, especially in urban areas (2). The prevalence of obesity in children is increasing at an alarming rate in a way that over 41 million children under the age of five were overweight in 2016. Almost half of overweight children under the age of five live in Asia and a quarter of them live in Africa (3). There are different methods to measure obesity and overweight in children and adolescents, but there is no single definition for these problems. Nevertheless, body mass index (BMI) is commonly used as an indicator of overweight or obesity, which is obtained by dividing weight (kg) by height (cm) squared. A BMI of lower than 5<sup>th</sup>, 85<sup>th</sup> to 94<sup>th</sup> and more than 95<sup>th</sup> percentile indicates healthy weight, overweight and obesity, respectively (4, 5).

The relationship between socioeconomic inequality and children's health has been the

focus of many studies (6). Inequality is an issue at the social level that imposes a high burden and cost on the society. Individuals gain different socioeconomic positions based on occupational status and level of education and income (7). Conceptually, socioeconomic inequality in children's health is defined as differences in the incidence or prevalence of health problems, such as obesity and overweight among populations with low and high socioeconomic status (8).

Previous studies have reported a correlation between obesity in adults and socioeconomic factors (9, 10), but results of the studies on childhood obesity have been inconclusive (11). The present study is a systematic review of published studies with the aim of determining the relationship between socioeconomic inequalities and childhood overweight or obesity.

## MATERIALS AND METHODS

The terms "obesity", "overweight", "child", "socioeconomic" and "inequality" and their combinations with and/or were searched in the title, abstract or keyword sections of MEDLINE, Embase, Web of Science, Cochrane Library and the Google Scholar databases (Appendix 1).

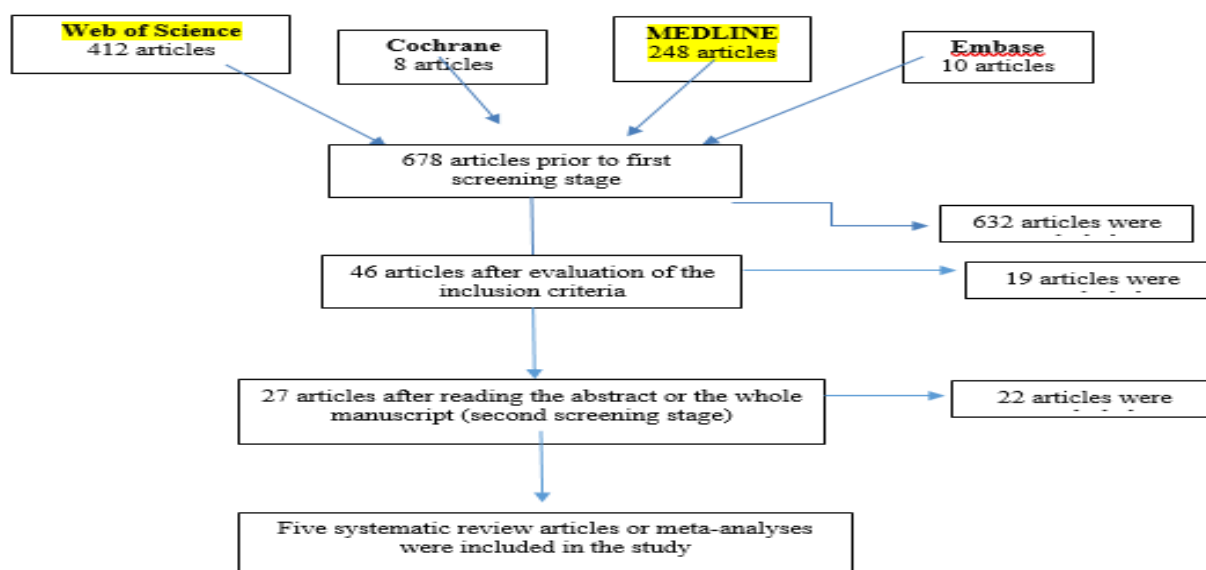
### Appendix 1. Search strategies used in the study

Database	Search strategy	Number of articles included in the study
MEDLINE/PubMed	(((((((((meta-analysis[Publication Type]) OR review[Publication Type]) OR metanalysis[Publication Type]) OR synthesis[Publication Type]) AND obes*[Title/Abstract]) OR overweight[Title/Abstract]) AND child*[Title/Abstract]) OR adolescent[Title/Abstract]) AND socioeconomic[Title/Abstract]) AND inequal*[Title/Abstract]	248 titles, 26 were selected by title
Cochrane Library	'socioeconomic in Title Abstract Keyword AND child* in Title Abstract Keyword AND obes* in Title Abstract Keyword OR overweigh in Title Abstract Keyword - with Cochrane Library publication date Between Jan 2001 and Jan 2019, in Cochrane Reviews (Word variations have been searched)'	8 titles, none were selected by title

<b>Web of Science Core Collection</b>	TITLE: (socioeconomic) AND TITLE: (obesity) OR TITLE: (overweight) AND TITLE: (inequal*) AND TITLE: (child*) AND TITLE: (adolescent) Timespan: 2001-2019. Indexes: SCI-EXPANDED, SSCI, CPCI-S, CPCI-SSH, ESCI.	10 titles, 3 were selected by title.
<b>Embase</b>	'socioeconomic':ti AND 'inequal*':ab,ti AND 'child*':ab,ti AND 'obes*':ab,ti AND 'review':ab,ti	412 titles, 17 were selected by title.

All meta-analysis, systematic and descriptive or correlational reviews on obesity in children and adolescents that have been published in English between January 2001 and January 2019 were included in the study. Studies that were not available in full text were excluded.

Selection of articles was done based on titles and abstracts and then on the inclusion criteria. The full text of the articles was read in detail (Figure 1). References of the included articles were also used to manually search for related articles.



**Figure 1. Flowchart of article selection process on the relationship between socioeconomic inequalities and obesity**

The search strategy in the MEDLINE database was as follows: meta-analysis or systematic review or synthesis were selected in the publication type section. In the advance search section, the keywords (overweight, adolescent, child\*, obes\* and inequal\*) and their combination (using and) were put in the title and abstract. Overall, 248 articles were searched, 26 of which were selected. The

search strategies for other databases are listed in appendix 1. The mesh term from the MEDLINE database was used to find relevant synonyms.

For quality assessment, first, the references of the review articles were analyzed using the critical appraisal skills programs (CASP) with an emphasis on the qualitative evaluation methodology (12). Then, each article was

assessed using the grading of recommendations assessment, development and evaluation (GRADE) tool, which is an appropriate process for evaluating the quality and power of evidence and health-related recommendations in systematic reviews and guidelines (13).

## RESULTS

After reading the manuscripts of 46 articles that met the inclusion criteria, five systematic

reviews were selected (Table 1). Obesity indices used in the review articles included height, weight, BMI z-scores, waist circumference, waist-to-hip ratio, body fat percentage, skin thickness and growth charts. The socioeconomic indices used in the articles included parents' education level and occupation, household income and neighborhood or school socioeconomic index. All articles analyzed in this review were observational, longitudinal and cross-sectional, non-interventional studies.

**Table 1. Characteristics of systematic review articles that were included in the study of relationship between socioeconomic inequality and obesity**

Author / Year	Main objective(s)	Method of study	Inclusion criteria	Database(s) used in the study	Search time	Country of study
<b>El-Sayed 2012 (13)</b>	Reviewing articles on the relationship between socioeconomic status and childhood obesity in the UK	Longitudinal cross-sectional	1. Articles that have examined the relationship between socioeconomic status and obesity 2. Non-interventional articles 3- Age of 2 to 18 years	MEDLINE	1980-2010	New York, USA
<b>Chung 2016 (12)</b>	Investigating changes in obesity trends in different socioeconomic groups in advanced countries	Cohort	1. Articles that have reported the prevalence of overweight or obesity based on the socioeconomic status 2. Articles on children and adolescents	MEDLINE Embase, CINAHL, Scopus and Cochrane Library	1990-2015	Melbourne, Australia
<b>Shrewsbury 2007 (16)</b>	Investigating the relationship between socioeconomic level and obesity in school-age children in developed Western countries	Cross-sectional	1. Cross-sectional studies 2. Studies in the specific period 3. Children and adolescents	MEDLINE	1990-2005	London, UK
<b>Dinsa 2012 (14)</b>	Reviewing articles on the relationship between socioeconomic status and childhood obesity in low- and	Observational	1. Cross-sectional studies 2. Studies in the specific period 3. Children and adolescents	MEDLINE and Google Scholar	2004-2011	Norwich, UK

	middle-income countries					
<b>Tamayo 2010 (15)</b>	Determining the relationship of socioeconomic status with incidence of diabetes, obesity and metabolic disorders in children	Longitudinal, population based	1. Articles that have reported the prevalence of diabetes, obesity and metabolic disorders. 2. Population-based studies that have evaluated the relationship between socioeconomic status and obesity 3. Homogeneity of data	MEDLINE	1994-2010	Germany

Of the five review articles, two (12, 13) were only on the results of economically developed countries and one article (14) was on developing countries. The rest (15, 16) were on both developed and developing countries. Only one article (12) completely covered the MEDLINE, Embase, CINAHL, Web of Science and Cochrane Library databases, while the other four used the MEDLINE database only. Although two articles (12, 13) had higher grades due to publication bias, other articles (14-16) received a negative score on this item. From the inconsistency

aspect of the GRADE tool, only one (12) of the five articles referred to heterogeneity, while the other articles had reduced scores. Articles by El-Sayed (13) and Dinsa (14) had not separately reported important confounding factors such as age, gender or ethnicity, but the rest of the articles received a positive score in terms of potential confounders.

The paper by Chung et al. (12) published in the journal of Obesity Reviews obtained the highest grade of evidence quality according to GRADE (Table 2).

**Table 2. Qualitative analysis of systematic review articles using the GRADE tool to study the relationship between socioeconomic inequality and obesity**

Study	Number of studies reviewed	Study limitations	Inconsistency	Indirectness	Imprecision	Publication bias	Overall quality of evidence
El-Sayed, 2012 (13)	23	No: Low risk	Low	No	Not applicable	Low	⊕⊕OO Low
Dinsa, 2012 (14)	11	Yes: 3/5 high risk 1 level down	Moderate	No	Not applicable	Not observed	⊕⊕⊕O Moderate
Chung, 2016 (12)	30	No: Low risk	No inconsistency	No	Not applicable	Low	⊕⊕⊕⊕ High

Tamayo, 2010 (15)	10	No: Low risk	Not applicable	No	Not applicable	Not observed	⊕⊕⊕○ Moderate
Shrewsbury, 2008 (16)	45	Yes: 1 high 1 low risk 1 level down	Low	No	Not applicable	Not observed	⊕○○○ Very Low

The main question was whether recent trends in childhood (2 to 18 years old) obesity and overweight changed in developed countries considering the socioeconomic status. The study found that the prevalence of obesity and overweight in children continued to increase in populations with a high socioeconomic status, while this increasing trend was slower in populations with a lower socioeconomic status (across all age groups).

The study by El-Sayed et al. (13) published in the journal of Obesity Facts aimed to determine the impact of socioeconomic inequalities on the risk of childhood obesity in the UK while focusing on regional indicators. The study reviewed 23 longitudinal and cross-sectional papers that had been done on area-level socioeconomic indicators. They found a direct link between childhood obesity and area deprivation levels. The article also showed that household income, parents' education level, household size, free school meals, father's occupational status and social class status of the head of household are influential factors in childhood obesity and overweight.

Tamayo et al. reported that metabolic disorders and type 2 diabetes during childhood could be predictors of obesity. Dinsa et al. (14) reviewed 11 articles on childhood obesity and reported that the prevalence of childhood obesity varies from 1 to 18%, with a higher incidence rate in boys. It also stated that the prevalence of obesity was directly related to the increase in countries' income. India and Vietnam had the lowest prevalence of childhood obesity, while

Guatemala and Ukraine had the highest prevalence of childhood obesity. They also found a positive relationship between socioeconomic status and obesity regardless of age, gender, level of obesity, level of Gini coefficient per capita and measurement indicators.

None of the articles examined socioeconomic inequality at both the individual/family or regional levels. In addition, none of the review articles had performed a meta-analysis on the results of the various studies. Another limitation of the analyzed articles was failure to investigate the causal relation between socioeconomic status and childhood obesity.

## DISUCSSION

Our findings showed that the prevalence of overweight and obesity in children varies among different socioeconomic groups in all systematic review articles published from 2001 to January 2019. In developed countries, the prevalence of childhood obesity is higher in those with a lower socioeconomic status (12). However, in developing countries or countries with a low human development index, the prevalence of childhood obesity is higher in families with a higher socioeconomic status (14). The prevalence of obesity and overweight in children is rising worldwide, with an increasing trend in populations with higher socioeconomic status (8, 12, 17).

Although previous studies have demonstrated the relationship of obesity with age and gender in adults, no study has yet determined such relationship in the case of childhood

obesity. Some evidence suggests that there may be a direct, positive link between socioeconomic status and obesity in adult men and women in low-income countries. In such countries, a higher income level or education level increases the likelihood of obesity. In middle-income countries, there is an inverse relationship between obesity among adult women and income or education level (13, 14).

One of the limitations of the present study is that we merely examined the association between socioeconomic status and obesity, not strengths and effect size. Given that all evaluated articles were systematic reviews and not meta-analyses, we were unable to draw a quantitative conclusion on this issue. Nevertheless, this paper is the first to analyze published secondary evidence on the relationship of socioeconomic status with childhood obesity using the GRADE tool. We believe that the results of the present study could be beneficial for health policy makers.

## CONCLUSION

There is a relationship between socioeconomic status and overweight or obesity in children. Therefore, it is recommended to consider the socioeconomic status when planning for control and prevention of childhood obesity.

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## DECLARATIONS

### *Funding*

Not applicable.

### *Ethics approvals and consent to participate*

Not applicable.

## *Conflict of interest*

The authors declare that there is no conflict of interest regarding the publication of this article.

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