Prevalence of obesity and overweight in Iranian children aged less than 5 years: a systematic review and meta-analysis

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Purpose: The present study aimed to determine the prevalence of childhood obesity and overweight in Iranian children under 5 years of age using a systematic review and meta-analysis.

Methods: We searched MEDLINE (PubMed), Web of Science, Google Scholar, Scopus, CINHAL, and the Iranian databases, including Scientific Information Database (www.sid.ir), Iranian Research Institute for Information Science and Technology (IranDoc.ac.ir), Iranmedex (www.iranmedex.com), and Magiran (www.magiran.com), for all articles published between January 1989 and August 2017. Sources of heterogeneity were determined using subgroup analysis and meta-regression.

Results: Six articles were ultimately included in the meta-analysis to estimate the pooled prevalence, based on which the prevalence of obesity and overweight were estimated to be 8% (95% confidence interval [CI], 6%–10%) and 9% (95% CI, 7%–11%), respectively. The results of the subgroup analysis showed that the prevalence of obesity in boys and girls was 9% (95% CI, 6%–13%) and 7% (95% CI, 4%–10%), respectively, and the prevalence of overweight in boys and girls was 10% (95% CI, 5%–15%) and 9% (95% CI, 5%–13%), respectively.

Conclusion: Despite high heterogeneity among the results of the articles included in the meta-analysis, the prevalence of obesity and overweight is higher in Iranian children under 5 years of age. Therefore, parents and the health system must pay more attention to the lifestyle, nutritional habits, and physical activity of these children.

Key words: Prevalence, Overweight, Obesity, Child

Key message
It first, this study provides research evidence on the pooled of obesity and overweight among Iranian children aged less than 5 years. Our results highlighted that the pooled prevalence of obesity and overweight in Iranian children under 5 years of age was 8% (95% CI, 6%–10%) and 9% (95% CI, 7%–11%), respectively. Therefore, parents and healthcare providers must pay more attention to the lifestyle, nutritional habits, and physical activity of Iranian children.
Introduction

The prevalence of childhood obesity and overweight has increased significantly in developed and developing countries over the past few decades and will most likely continue to increase. A study assessed the global burden of obesity and overweight in 2005 and reported that the total number of overweight and obese people is 937 million (23.2%) and 396 million (24.0%), respectively, and the number of overweight and obese people is expected to increase to 1.35 billion and 573 million, respectively, in 2030. Childhood obesity may cause problems, such as high blood pressure, blood lipid disorders, chronic inflammation, an increased tendency to develop blood clots, endothelial dysfunction, and increased blood insulin levels. Early childhood is an important time to examine the determinants of childhood obesity because most habits related to physical activity, nutrition, and lifestyle are formed during this period. Studies have reported that many cases of adult obesity originate in childhood; therefore, obesity is an important predictor of all-cause death and disease prevalence in adulthood, while childhood obesity is a major concern among health professionals.

The epidemiological transition and worldwide changes in lifestyle, especially in the Middle East, led to a significantly increased prevalence of overweight and obesity. The major disease burden consists of non-communicable diseases, particularly cardiovascular diseases and cancers. Iran, as a country in this region, has a high prevalence of obesity and its related disorders in different age groups, which imposes significant costs on the country’s health care system. Therefore, awareness of the prevalence of obesity and overweight, especially in children, can provide important information to health policymakers for designing and implementing prevention programs. In contrast, improving physical fitness is an important public health factor to reduce the prevalence of lifestyle-related diseases in developed and developing countries.

In recent years, several studies conducted on the prevalence of obesity and overweight in Iranian children have reported controversial results that have raised a variety of questions about the prevalence of obesity and overweight. Therefore, the present systematic review and meta-analysis aimed to determine the prevalence of childhood obesity and overweight in Iran.

Materials and methods

1. Search strategy

All original articles were searched from international databases including MEDLINE (PubMed), Web of Science, Google Scholar, Scopus, CINHAL, and the Iranian databases including the Scientific Information Database (www.sid.ir), Iranian Research Institute for Information Science and Technology (Iranmedex.ac.ir), Iranmedex (www.irancell.com), and Magiran (www.magiran.com). We searched these engines without language or time limitations for articles published between January 1989 and June 2018. The search was performed using 8 keywords in English and Persian including Malnutrition, PEM (Protein Energy Malnutrition), Growth Disorders, Overweight, Obesity, Body Weight, Children under 5 years, and Children. All keywords were searched electronically using 2 Boolean operators with separate search strategies (Table 1).

| Table 1. Search strategy |
|--------------------------|
| PubMed/MEDLINE           |
| (“Malnutrition” OR “Growth Disorders”) AND (Overweight OR Obesity OR Body Weight) AND (Children OR “Children under 5 years”) AND (“Iran” OR Iranian OR I.R. Iran OR “persia” OR “persia” [MeSH Terms] OR “persia” [All Fields]) AND (“1989/01/01” [PDAT]: “2017/08/31” [PDAT]) |
| ISI Web of Science       |
| Time span=1989-2017. Databases=SCI-EXPANDED, SSCI, CPCI-S, CPCI-SSH. Topic= (“Malnutrition” OR “Growth Disorders”) AND (Overweight OR Obesity OR Body Weight) AND (Children OR “Children under 5 years”) AND (“Iran” OR Iranian OR I.R. Iran OR “persia” OR Address= (Iran)) |
| Scopus                   |
| (TITLE-ABS-KEY (“Malnutrition” OR “Growth Disorders”) AND (Overweight OR Obesity OR Body Weight)) AND (TITLE-ABS-KEY (Children OR “Children under 5 years”)) AND (TITLE-ABS-KEY (Iran OR Iranian OR I.R. Iran OR Persia) OR (AFFILIATION (Iran)) AND PUBYEAR >1989 AND PUBYEAR < 2017) |

2. Inclusion/exclusion criteria

We investigated the search results and then excluded some studies after title review. In the present study, the identified studies were evaluated by 2 reviewers individually (MY and MK) based on the inclusion and exclusion criteria. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement was used as a guide to enhance the reporting quality of this review. In this study, the inclusion criteria were: (1) cross-sectional study design; (2) estimated prevalence of growth disorders, overweight, obesity, and body weight; (3) sample age less than 5 years. The exclusion criteria were: (1) other study design except cross-sectional; (2) animal study; and (3) sample age older than 5 years.

3. Data extraction, quality assessment, and risk of bias

Study quality was assessed by the Modified Newcastle-Ottawa Scale for cross-sectional studies and PRISMA checklist. Two authors (MY and MK) independently reviewed the retrieved studies. After evaluation by the reviewing team, articles from our checklist included the following factors: (1) first author; (2) publication date; (3) date of study; (4) total sample size; (5) sampling method; (6) study design; (7) sample size (female versus male); (8) questionnaire type; (9) appraisal tool score; (10) main variable; (11) prevalence of malnutrition, growth disorders, overweight, obesity, and body weight based on a variety of questionnaires; and (12) inclusion criteria.
4. Statistical analysis

We used a random effects model to generate a pooled prevalence presented as percentage and 95% confidence interval (CI). Inter study heterogeneity was assessed using the $I^2$ heterogeneity statistic and reported as a percentage (%) to determine the extent of inter study variation. A subgroup analysis was conducted based on sex, while a meta-regression was performed to examine the impact of publication year on prevalence. A forest plot was used to schematically present the meta-analysis results. All analyses were performed using Stata ver. 14 (Stata Corp, College Station, TX, USA).

Results

In the present study, 242 articles were identified according to the search strategy. After the exclusion of 132 duplicate articles, 110 articles were reviewed; of them, 78 were excluded because of lack of full text or no relevance. The full text of the remaining 32 articles was evaluated based on the developed checklist; finally, 6 articles were included in the meta-analysis (Fig. 1, Table 2). The reviewed studies were published between 2005 and 2014. The sample sizes of these studies varied from 400 to 1417 subjects.

1. Assessment of pooled prevalence

Six studies were evaluated in this meta-analysis to estimate the pooled prevalence of obesity and overweight in Iranian children under 5 years of age.

The study results showed that the pooled prevalence of obesity in Iranian children under 5 years of age was 8% (95% CI, 6%–10%). The $I^2$ index was used to illustrate the heterogeneity of the studies included in the meta-analysis, and the results indicated a high heterogeneity among studies included to estimate the pooled prevalence of obesity ($I^2$, 99.7%, $P<0.001$). The results of the subgroup analysis of sex showed that the prevalence of obesity in Iranian boys and girls under 5 years of age was 9% (95% CI, 6%–13%) and 7% (95% CI, 4%–10%), respectively. It should be mentioned that the $I^2$ index implied high interstudy heterogeneity between boys ($I^2$, 99.5%; $P<0.001$) and girls ($I^2$, 99.8%; $P<0.001$) (Fig. 2).

The findings of this study indicated that the pooled prevalence of

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Table 2. Characteristics of the studies included in the meta-analyses

| Study                  | Year | Sample size | Type of study | City           | Measurement’s | Sex     | Prevalence (%) | Overweight | Obesity |
|------------------------|------|-------------|---------------|----------------|---------------|---------|----------------|------------|---------|
| Talaie-Zanjani et al.   | 2011 | 742         | Cross sectional| Arak           | NCHS/WHO      | Male    | 9.85           | 6.27       |         |
|                        |      |             |               |                |               | Female  | 7.86           | 3.19       |         |
|                        |      |             |               |                |               | Total   | 8.76           | 4.58       |         |
| Akhavan-Karbasi et al.  | 2008 | 400         | Cross sectional| Yazd           | NCHS/WHO      | Male    | 5.0            | 5.5        |         |
|                        |      |             |               |                |               | Female  | 3.5            | 2.0        |         |
|                        |      |             |               |                |               | Total   | 4.25           | 3.75       |         |
| Fatemeh et al.         | 2014 | 500         | Cross sectional| South Khorasan | NCHS/WHO      | Male    | -              | -          | 7.6      |
|                        |      |             |               |                |               | Female  | -              | -          |         |
|                        |      |             |               |                |               | Total   | -              | 7.6        |         |
| Houshiar Rad et al.    | 2008 | 1,417       | Cross sectional| Iran           | NCHS/WHO      | Male    | 4.5            | -          |         |
|                        |      |             |               |                |               | Female  | 5.9            | -          |         |
|                        |      |             |               |                |               | Total   | 5.2            | -          |         |
| Noujeh et al.          | 2011 | 1,035       | Cross sectional| Ahvaz          | NCHS/WHO      | Male    | 16.7           | 9.0        |         |
|                        |      |             |               |                |               | Female  | 13.3           | 5.6        |         |
|                        |      |             |               |                |               | Total   | 15.0           | 7.3        |         |
| Sharabi et al.         | 2005 | 1,042       | Cross sectional| Tehran         | NCHS/WHO      | Male    | 13.55          | 16.20      |         |
|                        |      |             |               |                |               | Female  | -              | 17.51      |         |
|                        |      |             |               |                |               | Total   | -              | 16.96      |         |
overweight in Iranian children under 5 years of age was 9% (95% CI, 7%–11%). As shown in Fig. 3, the $I^2$ index showed high interstudy heterogeneity ($I^2$, 95.6%; $P<0.001$). The results of the subgroup analysis based on sex showed that the prevalence of overweight in Iranian boys and girls under 5 years of age was 10% (95% CI, 5%–15%) and 9% (95% CI, 5%–13%), respectively. It should be noted that the $I^2$ index indicated high interstudy heterogeneity for boys ($I^2$, 99.5%; $P<0.001$) and girls ($I^2$, 99.8%; $P<0.001$) (Fig. 3).

2. Meta-regression

Meta-regression analysis was used to explore the sources of interstudy heterogeneity, including gender. The results of this analysis showed that the prevalence of overweight and obesity was not related to gender ($B=-0.00073; P=0.875; 95\% \text{ CI}, -0.010\text{ to }0.009$).
Discussion

The present systematic review and meta-analysis aimed to determine the prevalence of obesity and overweight in Iranian children under 5 years of age. The study results showed that the pooled prevalence of obesity and overweight in Iranian children under 5 years of age was 8% (95% CI, 6%–10%) and 9% (95% CI, 7%–11%), respectively, regardless of sex. A study by Kelishadi et al. that aimed to determine the prevalence and trends of childhood obesity and overweight in Iran showed that the prevalence of childhood obesity was approximately 5.1%, and it remained constant between 2004 and 2010, regardless of sex. However, the sex-specific prevalence increased during this period, as follows: the prevalence of obesity in girls increased from 4.8% to 5.8%, while that in boys increased from 5.8% to 7.5%. In a population-based cross-sectional study by Salehiniya et al., the prevalence of overweight and obesity among children below 5 years of age was 12% and 23.7%, respectively in Tehran in 2012. Hajian-Tilaki and Heidari reported that the prevalence of overweight and obesity was 11.8% and 15% in preschool children aged 2–5 years in the urban area of Babol (Iran) in 2013. The study by Karimi and Ghorbani aimed to determine the prevalence of overweight and obesity among schoolchildren in Semnan Province (Iran) showed that 8.2% and 11.5% of schoolchildren have obesity and overweight, respectively. A study in the United States showed that the prevalence of obesity and overweight in children was 31.7% and 16.9%, respectively. Another study in the same country stated that 25.6% of children are obese. Generally, although various studies showed that the estimated prevalence of overweight and obesity differs worldwide and may vary according to the definition of the population under study, definitions of obesity and overweight, sample size, and sampling methods, most studies have shown an increasing trend in prevalence. For example, de Onis et al. reported a worldwide increasing trend in the prevalence of obesity and overweight in children under 5 years of age over 1990–2010. Thus, along with changes in lifestyle and global industrialization, the prevalence of obesity and overweight has increased significantly in children.

Generally, compared with other studies in this field, we noted an increase in the prevalence of obesity and overweight in Iranian children. This finding may reflect an epidemiological transition along with significant nutritional changes in Iranian children due to increased caloric intake and fast food consumption, increased time spent watching television and playing computer games, decreased physical activity, increased consumption of snacks when watching television, increasing number of television commercials about ready-made foods, and a lack of facilities for physical activity and outdoor play for children. Considering that the nutritional status of children under 5 years of age is an important indicator of a community’s health status and considering the outcomes and complications associated with obesity and overweight in adulthood and the increased nutritional changes in Iran and their implications, careful planning and implementation of interventions and prevention programs are necessary to reduce and eliminate these complications at the community level.

This study showed that the prevalence of obesity in Iranian boys and girls under 5 years of age was 9% (95% CI, 6%–13%) and 7% (95% CI, 4%–10%), respectively, while the prevalence of overweight in boys and girls of the same age group was 10 (95% CI, 5%–15%) and 9% (95% CI, 5%–13%), respectively. The prevalence of obesity and overweight was higher in boys than in girls in our study. This result is inconsistent with those of some other studies in this field. Salehiniya et al. showed that the prevalence of overweight was higher in girls than in boys (13.6% vs. 10.6%), while the prevalence of obesity was higher in boys than in girls (26.4% vs. 20.9%). This study also reported a significant association between sex and the prevalence of obesity and overweight. The study by Majid et al. in Ahwaz (Iran) revealed that the prevalence of obesity is higher in girls than in boys. A study in Australia also indicated that the prevalence of obesity and overweight was significantly higher in girls than in boys (29.6% vs. 23.9%, respectively; $\chi^2=9.01$; $P=0.003$). However, other studies reported that the prevalence of obesity was higher in boys than in girls; these results are consistent with those of our study. For example, the study by Amini et al. in Tehran (Iran) showed that the prevalence of obesity among boys was twice as high as that among girls and that the difference was statistically significant. Another study in Babol (Iran) showed that the prevalence of obesity and overweight in girls was significantly lower than that in boys. Studies have generally reported that sex-based differences may be due to various factors, such as differences in nutritional status, hormone levels, physiological and behavioral characters, and socioeconomic status. Cultural differences and sex-based differences can affect a child’s nutritional status, health, and care. In the present study, the attitude of the Iranian people towards obesity and overweight in boys and girls and their degree of sensitivity to fitness can explain the higher prevalence of overweight and obesity in boys than in girls because obesity and overweight are less socially acceptable in girls than in boys.

In conclusion, our results highlighted that the pooled prevalence of obesity and overweight in Iranian children under 5 years of age was 8% (95% CI, 6%–10%) and 9% (95% CI, 7%–11%), respectively. Despite high heterogeneity among the results of the articles included in this meta-analysis, the prevalence of obesity and overweight is higher in Iranian children under 5 years of age. Therefore, parents and healthcare providers must pay more attention to the lifestyle, nutritional habits, and physical activity of Iranian children.
Conflicts of interest

No potential conflict of interest relevant to this article was reported.

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