

Comparing the role of standard references on the prevalence of Iranian children and adolescents' overweight and obesity: A systematic review and meta-analysis

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Background: Obesity is a major risk factor for chronic diseases and has a role on high blood pressure, diabetes type II, etc., This review assesses the prevalence of Iranian children obesity and overweight for different age categories and compares the three standard definitions of obesity. **Materials and Methods:** To retrieve desirable studies concerning childhood anthropometric data from different area of Iran, the MEDLINE, Scopus, and different local databases such as Scientific Information database were used. The studies reported the prevalence of obesity or overweight of children < 6, 6–12, and 12–20 years old, despite differences between definitions of childhood obesity, were included in the study. We combined the reported prevalence of the overweight and obesity with regard to age and gender, and also by the different standard references which are the Centers for Disease Control and Prevention (CDC), the World Health Organization (WHO) definition, and the International Obesity Task Force (IOTF) references. The analysis was carried out using STATA software. **Results:** Our review covered 75 articles reported the prevalence of overweight or obesity among children and adolescents for different age groups in Iran. Our meta-regression analysis showed that the prevalence of obesity and overweight did not vary significantly in gender and age categories, but different definitions provide different prevalence of overweight and obesity. **Conclusion:** The effective factors on obesity and overweight included administration policy and organizational, interpersonal, intrapersonal, and social factors. CDC and WHO references intended in monitoring children's growth and the IOTF cutoffs would rather provide a common set of definitions that researchers and policymakers could use for descriptive and comparative purposes.

Key words: Children, Iran, meta-analysis, obesity, overweight, prevalence

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INTRODUCTION

Obesity and overweight have been considered as susceptible factors that affect individual and public health level. Similar to several medical terms, obesity is the result of interplay between genetic and environmental factors. Studies that have focused on inheritance patterns rather than on specific genes have found that 80% of the offspring of two obese parents were also obese, in contrast, <10% of the offspring of two parents who were of normal weight.^[1,2] There are substantial evidences that show the prevalence of obesity and overweight has been significantly increased

among children in recent years. Childhood obesity has been rising in both the developing country and developed country. Rates of obesity in Canadian boys have increased from 11% in the 1980s to over 30% in the 1990s, while during the same time increased from 4 to 14% in Brazilian children.^[3] The statistics states that there are 155 million (1 in 10) overweighted children, and around 30–45 million classified as obese worldwide.^[4] The problem is no more limited to high-income countries and is rapidly growing in low- and middle-income countries. Overweight or obese children are at risk for high blood pressure, dyslipidemia, and diabetes type II and may become overweight or obese adults in the end.^[5] Prevention, screening, and early control of increased weight and related risk factors

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might help create desire intervention strategies against the rising burden of noncommunicable diseases. Diet programs may produce weight loss over the short-term, and all types of low-carbohydrate and low-fat diets appear equally beneficial; however, maintaining weight loss is frequently difficult and often requires making exercise which is a permanent part of a person's lifestyle.^[6-8] The World Health Organization (WHO) estimates that three-quarters of all deaths in the developing world by the year 2020 will be due to noncommunicable diseases, so is working to implement the Global Strategy on Diet, Physical Activity and Health to encounter childhood obesity.^[9,10] Definitions of overweight and obesity are similar in sense and they are based on body mass index (BMI), and despite this underlying similarity, they have considerable differences. The different standard definitions for obesity and overweight are the Centers for Disease Control and Prevention (CDC) reference, the WHO definition, and the International Obesity Task Force (IOTF) reference. In the United States, the CDC 2000 growth charts for the US were developed from five nationally representative survey data sets (The National Health Examination Surveys II and III in the 1960s, the National Health and Nutrition Examination Survey [NHANES] I and II in the 1970s, and NHANES III, 1988–1994). The IOTF reference gave lower estimates for young children and higher estimates for older children than the CDC references.^[4,11] In 2006, the WHO released a new set of growth charts for children from birth through 5 years of age based on data from the multicenter Growth Reference Study conducted by the WHO.^[12] Hence, for calculating prevalence estimates of obesity or overweight, which reference should be used? As a result, there are numerous analyses comparing the use of different definitions with the same population. As seen repeatedly, the various definitions do not give the same results and prevalence of overweight and obesity and may be used interchangeably or contrasted with each other. Since Iran is the 18th largest country in the world, with an area of 1,648,195 km², and a population of around 78 million, about 1.11% of the world population,^[13,14] in order to achieve a general perception about overweight and obesity among Iranian children and adolescents, we attempt to provide a brief outline of the prevalence of obesity and overweight for different age categories of Iranian children and adolescent, and compare the different standard definitions, age categories, and gender categories in a meta-regression analysis.

MATERIALS AND METHODS

We retrieved surveys concerning children's anthropometric data from different regions of Iran.

Search strategy

An extensive literature review was performed to retrieve desirable studies concerning childhood anthropometric data from different areas of Iran and using the MEDLINE,

Scopus, Google Scholar search engine, and different local databases such as Scientific Information Database. All paper headings pertaining to children and adolescents' obesity and overweight related to Iran which had been published in English and Persian up to December 30, 2015, were assessed. To retrieve related studies, the search joining keywords and thesaurus terms with the following concepts, children, adolescents, prevalence, obesity, overweight, Iran, and related Medical Subject Headings terms. In addition, to find more related studies, the reference list of all systematic review which found was screened.

Study selection and exclusion criteria

This article included the studies which were reported the prevalence of obesity and/or overweight of children and adolescents up to 20 years old, children <6 years, between 6 and 12 years, and 12–20 years old separately by gender or totally, in different regions of Iran. The different reference values currently used as the standards to assess children's obesity and overweight, the CDC reference uses BMI percentiles for ages 2–20 years, Overweight: BMI <85th and <95th percentile and obese: BMI <95th percentile. WHO Child Growth Standards (birth to age 5), obese: BMI >3 standard deviations above the WHO growth standard median and overweight: BMI >2 standard deviations above the WHO growth standard median. WHO Reference 2007 (ages 5–19), obese: BMI >2 standard deviations above the WHO growth standard median and overweight: BMI >1 standard deviation above the WHO growth standard median. The reference values include age- and sex-specific data from the first NHANES I collected in 1971–74 in the United States.^[4,9,11] The Childhood Obesity Working Group of the IOTF provides international BMI cut points by age and sex for overweight and obesity for children age 2–18 reference uses sex- and age-specific BMI cutoffs that correspond to BMI 25 kg/m² for overweight and 30 kg/m² for obesity.^[15,16] Studies were excluded if they did not report the prevalence of obesity or overweight separately for different age categories, provide prevalence of obesity or overweight without reporting the sample size, the studies did not specify the reference of obesity or overweight and the studies reported a combined prevalence of obesity and overweight.

Quality assessment and data extraction

Papers that had inclusion criteria of our review were appraised by two researchers independently in a qualitative manner. Furthermore, the Strengthening the Reporting of Observational Studies in Epidemiology statement was used for quality assessment.

Statistical analysis

The suitable studies were entered for meta-analysis. Separate meta-analysis has been done to estimate the overall

obesity and overweight prevalence's as well as age-sex and age-sex-definition specific. Heterogeneity among studies was tested by I^2 ; for no heterogeneity, the fixed model was used and in other respects random effects model used. Moreover, meta-regression was used to assess the association of prevalence of obesity and overweight with age, sex and definition. All statistical analyses were carried out By STATA version 10 software.

RESULTS

Two thousand one-hundred and two papers were found in electronic search of which 852 remain after removing duplicated articles. Six hundred twenty-five articles were excluded because of no relevant in titles and abstracts. Finally, 75 studies were included in this systematic review and meta-analysis. Flowchart of selecting studies is presented in Figure 1. A total number of 155,839 children and adolescents up to 20 years old were included from the selected studies.^[9-11,13,14,17-86] Comparison of the overall estimates in different age group represents that the

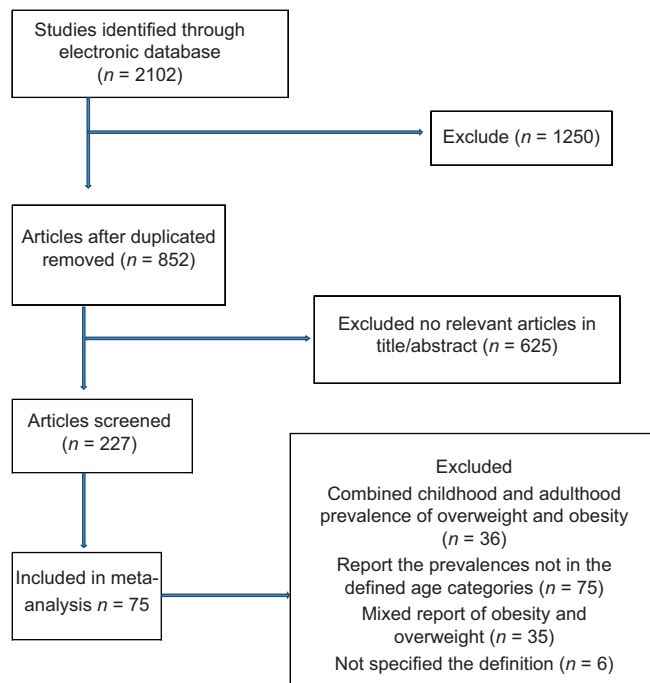


Figure 1: Flowchart of study selection

overweight and obesity prevalence for children between 6- and 12-year-old is minimum for boys and girls, but in all age categories the overweight girls prevalence are higher than boys while the obesity boys prevalence are higher than girls [Table 1].

Comparison of the overall estimate of overweight and obesity prevalence in different definition and age categories for boys, girls and totally are shown in Table 2. It seems that the pooled estimate of overweight prevalence is higher for the studies using IOTF reference than others and the studies were used CDC definition to illustrate higher pooled proportion of obese children and adolescent. The most reported articles on prevalence of overweight and obesity in Iranian children and adolescents used the CDC reference. Our findings in Table 3 for meta-regression analysis show the effect of gender (boy, girl), different standard definitions (CDC, IOTF, and WHO) and age (<6-year-old, 6–12-year-old, and 12–20-year-old) on the prevalence of obesity and overweight.

According to Table 3, there is no significant different on prevalence of overweight and obesity between gender categories ($P = 0.892$ and 0.767 , respectively), and also between age categories ($P = 0.062$ and 0.407 , respectively), but prevalence of overweight and obesity is different significantly in different standard definitions ($P = 0.011$ and <0.001 , respectively).

DISCUSSION

Overweight and obesity is becoming an increasingly prevalent problem in both developing country and developed country, and is one of the most serious public health challenges of the 21st century. This systematic review and meta-analysis has provided an accurate estimation for the prevalence of overweight and obesity by standard age group and sex in Iranian children and adolescents. These findings may suggest that the prevalence of overweight in girls is higher than boys for all age categories and the boys are more obese, but our meta-regression analysis showed that the prevalence of obesity and overweight did not vary significantly in girls and boys and also there is no significant difference between age categories. According to Table 3, results show that there are significant differences between

Table 1: The overall estimations of overweight and obesity with respect to gender and age

	Pooled estimate (95% CI) %		Pooled estimate (95% CI) %		Pooled estimate (95% CI) %	
	Boy (OW)	Boy (Ob)	Girl (OW)	Girl (Ob)	Totally (OW)	Totally (Ob)
<6, %	10.6 (0.100-0.113)	8.6 (0.080-0.092)	12.8 (0.119-0.136)	4.3 (0.038-0.048)	15.1 (0.145-0.158)	5.4 (0.051-0.058)
Number of studies (I^2)	8 (96.8)	8 (97.8)	8 (97.3)	8 (96.6)	8 (98.3)	8 (97.5)
6–12, %	7.2 (0.068-0.076)	4.8 (0.045-0.051)	9.8 (0.095-0.102)	2.5 (0.023-0.027)	4.6 (0.044-0.047)	3.9 (0.038-0.041)
Number of studies (I^2)	17 (99)	19 (98.9)	20 (98.5)	22 (99)	31 (99)	35 (99)
12–20, %	7.8 (0.073-0.083)	5.7 (0.053-0.061)	10 (0.096-0.104)	3.5 (0.033-0.037)	9.1 (0.088-0.094)	4.2 (0.040-0.044)
Number study (I^2)	12 (97.7)	13 (96.9)	25 (94.6)	23 (96.5)	16 (98.3)	19 (98.2)

OW = Overweight; Ob = Obesity; CI = Confidence interval

Table 2: Overall estimate and 95% confidence interval for the prevalence of overweight and obesity among Iranian children and adolescents with respect to age, gender and standard definitions

	Age											
	<6 years old				6-12 years old				12-20 years old			
	CDC	IOTF	WHO	Pooled estimate (95% CI) (%)	CDC	IOTF	WHO	Pooled estimate (95% CI) (%)	CDC	IOTF	WHO	Pooled estimate (95% CI) (%)
OW												
Boy, %	9 (0.08-0.10)	18.2 (0.17-0.20)	4.9 (0.03-0.07)	5.8 (0.05-0.06)	19.4 (0.18-0.21)	10.2 (0.09-0.11)	9.5 (0.09-0.10)	5.2 (0.04-0.06)	9.2 (0.08-0.10)			
Number of studies (I ²)	4 (4.4)	3 (96)	1	10 (99)	2 (96.4)	5 (99.4)	6 (61.3)	3 (99.2)	3 (98.7)			
Girl, %	11.3 (0.09-0.13)	18.4 (0.17-0.19)	3.1 (0.015-0.05)	9.9 (0.09-0.10)	10.9 (0.10-0.12)	7.7 (0.06-0.09)	8.4 (0.08-0.09)	11.5 (0.11-0.12)	10.4 (0.01-0.11)			
Number of studies (I ²)	3 (0.0)	4 (87.3)	1	12 (97.5)	4 (99.2)	4 (99.4)	9 (95)	8 (95.7)	8 (89.4)			
Totally, %	10.8 (0.09-0.12)	22.2 (0.21-0.23)	4 (0.03-0.05)	7.6 (0.07-0.08)	2.2 (0.02-0.024)	10 (0.09-0.11)	7.5 (0.07-0.08)	8.2 (0.075-0.09)	13.5 (0.13-0.14)			
Number of studies (I ²)	3 (0.0)	4 (88.7)	1	20 (98.8)	6 (99.6)	5 (99.7)	7 (95.4)	4 (97.2)	6 (98.9)			
Ob												
Boy, %	13 (0.12-0.14)	8.8 (0.08-0.10)	1.6 (0.004-0.03)	5.6 (0.05-0.06)	4.1 (0.03-0.05)	2.8 (0.02-0.03)	6.3 (0.06-0.07)	5.8 (0.05-0.07)	4.4 (0.04-0.05)			
Number of studies (I ²)	4 (96.2)	3 (72.4)	1	12 (99.3)	2 (96.8)	5 (95.6)	7 (98.2)	3 (33.3)	3 (93.4)			
Girl, %	6.7 (0.05-0.08)	7.4 (0.07-0.08)	0.7 (0.001-0.015)	7.8 (0.07-0.08)	2.4 (0.02-0.03)	0.3 (0.001-0.006)	5.6 (0.05-0.06)	3.5 (0.03-0.04)	2.3 (0.02-0.03)			
Number of studies (I ²)	3 (89.2)	4 (91.1)	1	14 (99.2)	4 (98.3)	4 (95.6)	9 (97.5)	7 (95.5)	8 (91.6)			
Totally, %	7.4 (0.06-0.09)	8 (0.074-0.085)	1.7 (0.01-0.023)	5.5 (0.053-0.057)	3.1 (0.028-0.033)	1.8 (0.015-0.02)	4.8 (0.045-0.051)	2.9 (0.025-0.033)	4.3 (0.04-0.05)			
Number of studies (I ²)	3 (95.8)	4 (91.1)	2 (95.7)	23 (99.5)	7 (98)	6 (96.6)	9 (98.8)	4 (95.9)	6 (97)			

CI = Confidence interval; CDC = Centers for Disease Control and Prevention; IOTF = International Obesity Task Force; WHO = World Health Organization

Table 3: The results of meta-regression on prevalence of overweight and obesity

Variables	β	SE (β)	P	95% CI	R^2 (%)
Prevalence of OW					
Age	-0.0213	0.0113	0.062	-0.04-0.001	98.97
Gender	0.0013	0.010	0.892	-0.018-0.021	
Definition	0.025	0.009	0.011	0.0058-0.044	
Constant	0.132	0.036	0.000	0.06-0.20	
Prevalence of Ob					
Age	-0.006	0.008	0.407	-0.023-0.009	98.72
Gender	-0.002	0.007	0.767	-0.016-0.012	
Definition	-0.036	0.007	0.000	-0.050--0.022	
Constant	0.167	0.026	0.000	0.115-0.220	

SE = Standard error; CI = Confidence interval; OW = Overweight; Ob = Obesity

prevalence of overweight and obesity in different definitions. As illustrated in Table 2, the studies used IOTF references report higher overweight prevalence and the ones used CDC, report higher prevalence of obesity. Most definitions of childhood overweight and obesity are similar in the sense that they are based on BMI. Despite this underlying similarity, the results present some differences. Definitions of overweight and obesity are used for several purposes. For international comparisons of prevalence, the same definition should be used across countries. However, it is not yet clear that any one definition is better than another for this purpose.^[9,12] A given definition may be more suitable for one country than others. The IOTF cutoffs were not intended as clinical definitions, but provide a common set of definitions that researchers and policy makers in different countries could use internationally for descriptive and comparative purposes. The 2000 CDC Growth Charts and the WHO charts are intended for clinical use in monitoring children's growth. The use of selected percentiles of such charts to define overweight and obesity is a secondary purpose.^[12] There is a wide variety of national and international reference data sets used to establish criteria. The selection of cutoff values is generally based on statistical considerations rather than on clear relations to health risks or the degree of body fatness. BMI is a screening tool, however, not a diagnostic tool. Children with a BMI over these cutoffs do not necessarily have clinical complications or health risks related to over-fatness.^[12] Taking into account all available studies we can discuss about the main influencing factors on increase of obesity and overweight in children addition to genetic factors. The first is the administration policy which includes physical education guidelines and effects of media (the high cost and insignificant accessibility of physical activity facilities, fast food supply and availability of ready-to-eat meals at lower cost than healthy foods were frequent quoted as the result of poor public policy).^[13] The second includes social factors such as social restrictions on girls and women (social and cultural influences within Iranian communities were highlighted). The third is interpersonal, misperception regarding healthy eating and parents as role models (limited

and inaccurate health information for parents, in addition it was noted that a considerable percentage of mothers in large cities work and fathers have multiple jobs which result in using fast food rather healthy foods, social pressures, and weak relationship between families and school) and finally intrapersonal factors like preference for certain foods (children's preferences for unhealthy foods such as snakes and computer playing and activities and recently being addicted to the internet were seen as a cause of overweight and obesity).^[13] In general, the other point that should be considered for the developing countries such as Iran is that their people tend to follow the western people lifestyle. To decrease the rate of obesity and overweight, more physical education class along with providing suitable places and standard facilities, family education to raising health information and familiarize children in school to harms of unhealthy foods are recommended by the nutrition experts.

CONCLUSIONS

The only significant factor on prevalence of obesity and overweight is definitions of this criteria. Different references are used for different purposes. Using a given reference may be more suitable for one country than others. The IOTF cutoffs is used by researchers and policy makers in different countries for descriptive and comparative purposes but The 2000 CDC Growth Charts, and the WHO charts are intended for clinical use in monitoring children's growth. So the importance of using the references depends on the purposes.

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Conflicts of interest

The authors have no conflicts of interest.

AUTHORS' CONTRIBUTION

SMT A contributed in the conception of the work, conducting the study, revising the draft, approval of the final version of the manuscript, and agreed for all aspects of the work. SGh contributed in the conception of the work, revising the draft, approval of the final version of the manuscript, and agreed for all aspects of the work.

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