

The prevalence of obesity among school-aged children and youth aged 6-18 years in Iran: A systematic review and meta-analysis study

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Review Article

Abstract

BACKGROUND: Obesity is considered as a major health problem of children and adolescents. The present meta-analysis was conducted by extensive search of studies on the prevalence of obesity among school-aged children and youth aged 6-18 years in Iran.

METHODS: All conducted cross-sectional studies on the prevalence of obesity in Iranian students in all grades were extracted, without applying any restriction on time in national and international databases including Magiran, Iranmedex, SID, Scopus, Google Scholar, and PubMed. Statistical software Stata 12 was used to analyze the data and to obtain the prevalence of obesity among Iranian students. The heterogeneity between the results was determined using statistical test I^2 .

RESULTS: In this meta-analysis, 51 papers met our inclusion criteria and were therefore considered for the analysis. The prevalence of obesity was equal to 5.82% [95% confidence interval (CI): 5-6.66] in Iranian students. The prevalence of obesity was higher in boys than in girls (6.85% compared to 5.13%) ($P = 0.300$). The highest prevalence of obesity was related to students living in the North and Northwest areas with 7.07% (95% CI: 4.35-9.78).

CONCLUSION: The prevalence of obesity among Iranian students is not high when compared to Western countries. However, due to lifestyle changes in recent years, it is necessary to plan intervention programs within families and schools to improve dietary patterns and physical activity of this age group.

Keywords: Prevalence, Obesity, Meta-Analysis, Student, Iran

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Introduction

Obesity is mainly caused by an imbalance between energy intake and expenditure.¹ In recent years, the prevalence of obesity and being overweight has grown and now it has become a serious problem worldwide.² The obesity growth in childhood is not only limited to industrialized countries but also the existing reports about developing countries refer to this important matter. Existing reviews show that the countries of the Eastern Mediterranean region, North Africa, and Latin America have the highest

prevalence rate.³ Reports of the World Health Organization (WHO) showed that Iran is one of the seven countries having the highest prevalence of childhood obesity while the percentage of increase in obesity and being overweight doubled in Iranian children and adolescents between 1993 and 2001.⁴ Obesity and being overweight in adolescence are the most common major health problems in countries mostly related to sedentary lifestyle and changes in dietary habits; the prevalence of obesity in some parts of Iran is alarming.⁵

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General and abdominal obesity is significantly associated with some diseases such as cardiovascular, gastrointestinal diseases and cancers. In addition, obesity is considered an important risk factor in developing hypertension, type 2 diabetes, and hyperlipidemia. It is also noted that obesity is not only associated with medical consequences but also with social status.^{6,7} In recent years, changes in lifestyles in different countries have led them to face the challenges and consequences of being overweight and obese in all ages. Meanwhile, childhood and adolescence obesity has become a public health problem whether in developed or developing countries.⁸ The WHO studies show that the prevalence of being overweight in children in the Middle East is relatively higher than in other developing countries.³ It is believed that several factors cause obesity in people, such as the compilation of unhealthy dietary pattern, incorrect lifestyle, lack of physical activity, biological factors such as race, gender, and age, consumption of some medications, alcohol consumption, and some diseases being major causes of the increased prevalence of obesity in the world.⁸ Since obesity is considered as the most important modifiable risk factor of many diseases, and due to their increasing prevalence in all age groups especially children and adolescents, this study was conducted to provide comprehensive and reliable rate of obesity among school-aged children and youth aged 6-18 years in Iran to assist policy-makers in developing preventive strategies and guide further research.

Materials and Methods

In this systematic review and meta-analysis study, our inclusion criteria were all cross-sectional studies that have investigated the prevalence of obesity and overweight among school-aged children and youth aged 6-18 years and have used one of the three standard definitions, including Iranian reference,⁹ the Centers for Disease Control and Prevention 2000,¹⁰ as well as the International Obesity Task Force 2000.¹¹ Exclusion criterion was a lack of access to full text of articles.

All conducted studies in the field of the prevalence of obesity in Iranian students were investigated without any restriction on language, place, and year of publication. The study population was students studying in primary school, guidance school, and high school.

National databases, including Magiran, Iranmedex, and SID, and international databases, including PubMed and Scopus, were searched using

relevant keywords to obtain studies from January 1, 1998 to April 1, 2015. Keyword combinations of “obesity/fat,” “body mass index,” “students,” “pupils,” “prevalence,” and “Iran” in the Persian language for the Iranian database and in English for the international database were also used. No limits on date were imposed in the search, and all published cross-sectional studies with English and Persian language that is conducted in Iran included in the study.

The summary of articles has been studied by two independent authors, based on inclusion and exclusion criteria, then the related articles were identified to receive their full text and to do data extraction. The two coauthors have been responsible for selecting articles independently to ensure the correct selection of articles related to the subject of the research and in accordance with the inclusion criteria. After entering accepted articles, the required data were entered in a form of summarization and collected in a spreadsheet of pre-designed electronic data which included the variables: (1) name of the first author, (2) year of publication, (3) location of study conduction, (4) study sample size, (5) educational level (primary school/guidance school/high school), (6) overall prevalence of obesity and overweight, and (7) prevalence of obesity by gender (boy/girl).

At first, each study was weighted with inverse of their variance. The heterogeneity of results across studies was checked using Cochran's Q test (with $P < 0.100$) and it was quantified by the I^2 statistic. The I^2 statistic greater than 50% was considered as a significant heterogeneity across studies. Begg and Egger's linear regression test was used to investigate publication bias. Subgroups analysis was conducted on the basis of gender and geographical region.

To estimate a weighted mean estimate of the prevalence of obesity across included studies, prevalence estimates by each study were pooled using a random effects meta-analysis model at a confidence level of 95%. All meta-analyses were performed using Stata software (version 12, Stata Corp, College Station, TX, USA). We utilized PRISMA statement as a guide to enhance quality reporting of the review.

Results

Description of studies: In this study, a total of 305 references were identified after searching the national and international databases, and 16 references were found through search in reference lists and gray literatures. The title and abstract of 64

articles were studied after removing duplicate references between two or more databases (215 references), and by considering inclusion and exclusion criteria of the study (42 references did not in relation to the objective of this study), a total of 54 articles remained. However, the text of three papers was incomplete despite the follow-up through email, and finally, a number of 51 articles remained in the final analysis (Figure 1). Total case study people in these studies during years 1998-2013 included 83,241 people of whom 35,348 were boys and 47,893 were girls. Specifications of investigated studies are shown in table 1.

From a total of 51 investigated studies, 25 studies investigated primary school students, 7 studies the grade of guidance students, 14 studies high school students, 3 studies guidance and high school students, and 2 studies all the grades. Fifteen of these articles studied the prevalence of obesity in girls, four articles the prevalence in boys, and the rest of the articles the prevalence in both sexes. The lowest prevalence of obesity was related to Tuyserkan city with 0.5%, and the highest prevalence was related to Ahwaz with 17.7%. The characteristics of studies are shown in table 1.

Estimated prevalence: The prevalence of obesity was estimated in students of Iran with the random

effects model; accordingly, the prevalence of obesity in a sample of 83,241 Iranian students recruited in 51 studies was equal to 5.82% (95% confidence interval: 5.00-6.66). According to figure 2, heterogeneity index was $I^2 = 97.4$ in investigated studies that showed that the results are highly heterogeneous. In only five studies, the reported prevalence was 10% and above. Ten studies reported the prevalence as less than 3%. To reduce the heterogeneity, we divided the studies into subgroups by gender and geographical location to achieve homogeneity. Nonetheless, homogeneity was not achieved.

Subgroup analysis: The prevalence estimates in subgroups of gender and geographical region are also shown in table 2. The prevalence of obesity is higher in boys than girls (6.85% compared to 5.13%). The highest prevalence of obesity among students was related to the geographical regions of the north and northwest with 7.07%,^{4,9,12} and the lowest prevalence was related to the East and Northeast regions of the country with 4.25%.^{2,6,10,13}

Publication bias: The results of statistical test for publication bias, including Begg and Egger's linear regression test, for the prevalence of obesity among students were statistically significant ($P < 0.001$). These results indicated the presence of publication bias in this study.

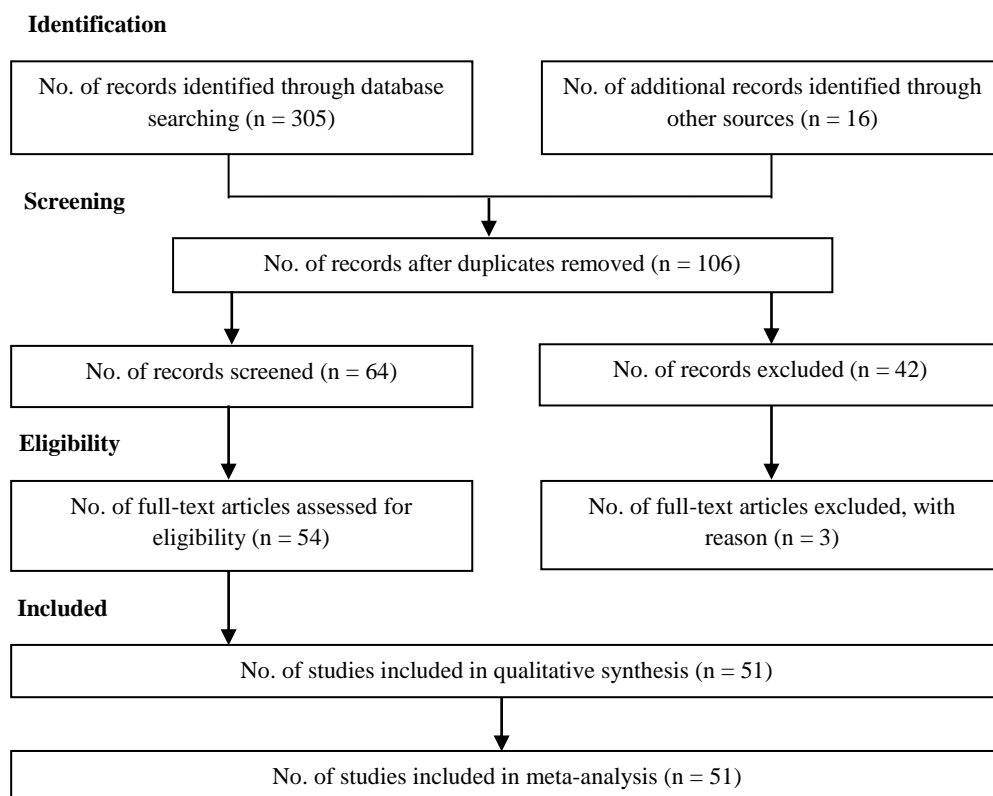


Figure 1. Flow diagram of the meta-analysis

Table 1. Characteristics of studied articles about the prevalence of obesity among students in Iran

First author	City	Age (year)	Grade	Sample size (number)	Prevalence of obesity (%)			Scale
					Girl	Boy	Total	
Karandish et al. ¹²	Tehran	11-16	G. school and H. school	2321	8.30	7.3	7.80	BMI > P95
Dorosty et al. ¹³	Neishabour	6-12	P. school	1471	7.55	9.4	8.50	CDC2000
Basiratnia et al. ¹⁴	Shiraz	11-17	G. school and H. school	2000	7.90	6.2	7.00	CDC2000
Pourgasem Gargari et al. ¹⁵	Tabriz	14-18	H. school	1650	3.90	-	3.90	BMI > P95
Montazery Fard et al. ¹⁶	Sistan	14-18	H. school	752	1.50	-	1.50	IOTF
Hajian et al. ¹⁷	Babol	7-12	P. school	1000	3.80	8.8	5.80	CDC2000
Solki et al. ¹⁸	Shahriar	7-12	P. school	325	3.63	10.3	7.10	BMI > P95
Dorosty Motlagh et al. ¹⁹	Tuysarkan	14-18	H. school	400	0.50	-	0.50	WHO
Basirat et al. ²⁰	Farokhshahr	6-12	P. school	314	2.60	13.6	8.30	CDC2000
Shakeri et al. ²¹	Tehran	12-16	G. school	810	4.40	-	4.40	BMI > P95
Soheilifar et al. ²²	Hamedan	6-11	P. school	1400	5.60	5.8	5.70	BMI > P95
Bazhan et al. ²³	Lahijan	14-17	H. school	400	5.30	-	5.30	WHO
Taheri et al. ²⁴	Birjand	7-12	P. school	1772	4.30	2.5	3.30	CDC2000
Akbari ²⁵	Khorramabad	14-18	H. school	986	3.70	-	3.70	BMI > 30
Assar et al. ²⁶	Ahwaz	7-14	P. school	4793	2.50	2.0	2.20	BMI > P95
Asadi Noghabi ²⁷	Bandar Abbas	7-11	P. school	1350	6.20	10.9	8.50	CDC2000
Mozafari and Nabaei ²⁸	Tehran	7-12	P. school	1800	7.70	-	7.70	BMI > P95
Shidfar et al. ²⁹	Tehran	10-13	P. school	1184	6.08	4.5	5.30	IOTF
Shahidi et al. ³⁰	Tabriz	14-16	H. school	341	-	4	4.00	NCHS
Mozaffari et al. ³¹	Yazd	14-18	H. school	1400	3.90	-	3.90	CDC2000
Taheri et al. ³²	Birjand	11-15	G. school	2105	1.50	2.8	2.10	CDC2000
Taheri et al. ³³	Birjand	15-18	H. school	2230	1.80	2.8	2.30	CDC2000
Sodaei Zenooghagh et al. ³⁴	Marand	6-16	All grades	10649	3.50	3.6	3.50	WHO
Behzadnia et al. ³⁵	Sari	7-12	P. school*	653	12.00	12.0	12.00	BMI > P95
Mohamadpour Koldeh et al. ³⁶	Bushehr	14-17	H. school	500	7.10	-	7.10	CDC2000
Aminzadeh et al. ³⁷	Ahwaz	6-10	P. school	1594	21.10	14.6	17.70	BMI > P95
Mohammadpour-Ahrajani et al. ³⁸	Tehran	11-16	G. school** and H. school***	2321	8.30	7.3	7.80	NCHS
Sohailifar and Sadri ³⁹	Hamedan	6-11	P. school	2000	7.20	4	5.55	NCHS
Veghari and Rahmati ⁴⁰	Golestan	6-11	P. school	7399	12.60	15.3	14.10	CDC2000
Amanolahi et al. ⁴¹	Tehran	9-12	P. school	1040	8.65	-	8.65	CDC2000-
Khabazkhoob et al. ⁴²	Dezful	7-19	All grades	5508	2.30	2.9	2.60	NCHS
Karajibani et al. ⁴³	Zahedan	6-11	P. school	2067	1.40	-	1.40	BMI > P95
Montazerifar et al. ⁴⁴	Zahedan	11-14	G. school	687	1.70	-	1.70	NCHS
Ahmadi et al. ⁴⁵	Sanandaj	14-18	H. school	694	1.10	5.3	3.20	WHO
Amidi Mazaheri and Hoseini ⁴⁶	Isfahan	14-18	H. school	384	1.04	-	1.04	NHANES-1
Mahmudi et al. ⁴⁷	Pakdasht	11-14	G. school	995	9.10	-	9.10	CDC2000
Mohammadian et al. ⁴⁸	Gorgan	11-13	G. school	844	6.30	-	6.30	WHO
Mirzaei and Karimi ⁴⁹	Yazd	6-8	P. school	2768	2.30	2.6	2.40	BMI > P95
Ghanbari et al. ⁵⁰	Shiraz	8-12	P. school	478	-	7.1	7.10	CDC2000
Nabavi et al. ⁵¹	Semnan	7-12	P. school	400	10.40	17.9	14.30	BMI > P95
Amini et al. ⁵²	Tehran	10-15	G. school	398	6.50	13.0	10.00	CDC2000
Taheri et al. ⁵³	Birjand	6-11	P. school	1541	7.90	10.9	9.20	CDC2000
Ahmadi et al. ⁵⁴	Kerman	7-11	P. school	1566	0.12	1.04	9.70	CDC2000
Zekavat et al. ⁵⁵	Tehran	7-13	P. school	1158	4.90	5.1	5.00	CDC2000
Tabatabaei et al. ⁵⁶	Ahwaz	6-12	P. school	3482	3.50	3.7	3.60	IOTF 2000
Mozafari et al. ⁵⁷	Yazd	6-10	P. school	463	3.40	4.3	3.85	BMI > P95
Talaie-Zanjani et al. ⁵⁸	Arak	6-12	P. school	742	3.20	6.3	4.58	CDC2000
Jalilvand et al. ⁵⁹	Khorasan	14-17	H. school	450	7.00	2.7	4.90	CDC2000
Rahmaninia et al. ⁶⁰	Rasht	12-17	H. school	728	-	6.5	6.50	BMI > P95
Didarloo et al. ⁶¹	Makoo	12-14	G. school	650	-	8.0	8.00	CDC2000
Sokhandani and Vizeshtar ⁶²	Lar	14-18	H. school	278	3.00	4.2	3.60	CDC2000

* P. school: Primary school; ** G. school: Guidance school; *** H. school: High school; BMI: Body mass index; NCHS: National Center for Health Statistics; CDC: Centers for Disease Control and Prevention; IOTF: International Obesity Task Force; WHO: World Health Organization; NHANES: National health and nutrition examination survey

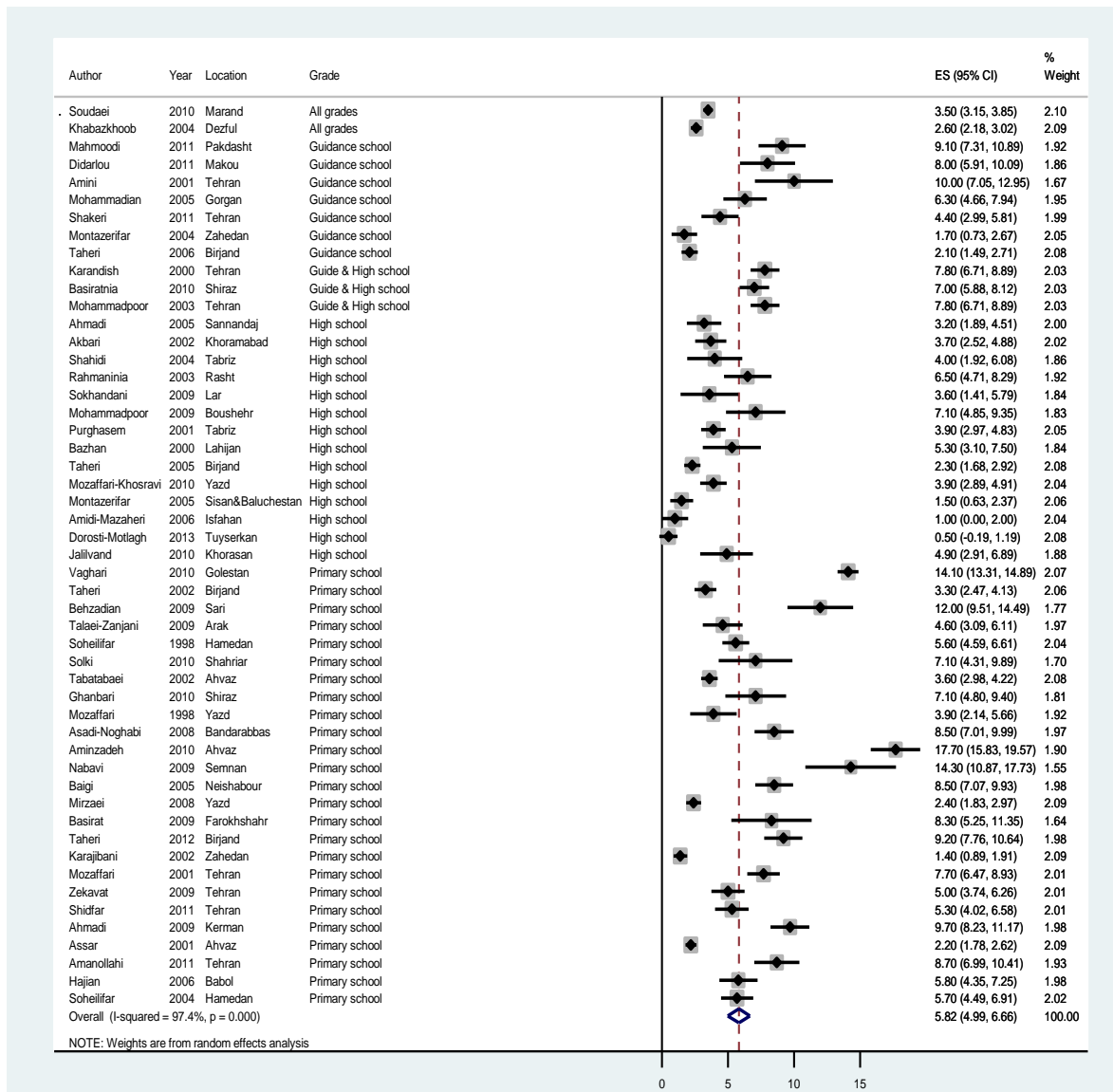


Figure 2. The prevalence rate of obesity among students and its 95% confidence interval

Discussion

In the present study, a total of 51 studies were investigated to conduct a meta-analysis. The prevalence of obesity in the entire studied population and that based on gender was calculated separately. The overall prevalence of obesity was 5.82% in all included studies; it was 5.3% and 6.85% in girls and boys, respectively. The prevalence was lower compared to Egypt in North Africa and was higher than countries of Central and Southern Africa. Although based on a meta-analysis study conducted on children aged 11-17 years in seven African countries in the year 2014, the prevalence of obesity was ranged from 0.6% in Benin to 9.3% in Egypt.⁶³ In China, the prevalence of being overweight and obesity was reported at

10.4% based on a meta-analysis which was conducted on elementary schoolchildren in the year 2013, and this amount was higher in boys than in girls (12.6% vs. 7.2%).⁶⁴ In a meta-analysis conducted in Brazil in 2015, the overall prevalence of obesity in adolescents was 14.1%. It was 16.1% in boys and 14.95% in girls.⁶⁵

The prevalence of obesity was higher in boys than in girls in our study which was similar to other studies^{64,65} as generally obesity is more common in boys than in girls in high-income countries. Our results were also similar to those obtained from studies in China and Brazil.^{64,65} While the prevalence of being overweight and obesity was higher in girls in the conducted study in African countries, with the exception of Malawi and Egypt.⁶³

Table 2. Pooled prevalence of obesity among students by gender and area

Subgroups	Number of studies	Prevalence of obesity (95% CI)
Gender		
Boy	35	6.85 (5.73-7.97)
Girl	46	5.13 (4.29-6.00)
Geographical location		
North and Northwest (Lahijan, Tabriz, Rasht, Gorgan, Babol, Makoo, Marand, Golestan)	10	7.07 (4.35-9.78)
West and Southwest (Hamadan, Ahwaz, Khorramabad, Dezful, Sanandaj, Tuyserkan, Farokhshahr)	9	5.08 (3.50-6.65)
East and Northeast (Birjand, Neishabour, Khorasan)	4	4.25 (2.38-6.10)
South and Southeast (Zahedan, Sistan and Baluchestan, Kerman, Shiraz, Bushehr, Lar)	9	5.40 (3.32-7.47)
Center of the country (Yazd, Tehran, Isfahan, Arak, Pakdasht, Shahriar)	14	6.20 (4.72-7.65)

CI: Confidence interval

The cultural differences of mental image of the body can be one of the reasons to justify this difference. So that, in our culture, girls prefer to be thinner as opposed to boys who have a bigger and more powerful bulk physically and have more acceptability, or it may be related to some traditional beliefs in our families which lead them to consider bigger food portions for their sons. On the other hand, it may be that boys spend more time playing computer games and this leads to the reduction of physical activity and to obesity, as well as boys having more access to outdoor foods and the higher calories of these foods than homemade foods, which cause greater obesity in them.

In the present study, the prevalence of obesity in the North and Northwest regions of the country was higher than in the Eastern and Northeastern areas, which is similar to the study by Jin et al.⁶⁴ in which the prevalence of obesity was higher in Northern areas of China. These differences can be attributed to the socioeconomic status and different food habits of different areas in addition to genetic differences. Since a higher level of welfare and economic situation is seen in the Northern and Central areas of the country, people have tended to an urban life, and the subsequent decline in physical activity and use of high-calorie foods as an alternative to traditional foods may cause a higher rate of being overweight and obesity. Omigbodun et al. concluded that different distribution of populations in rural and urban areas has been considered as an important factor for generate difference in distribution of obesity among different geographical areas of a country.⁶⁶ The types of studies included which are cross-sectional, fluctuations in sample size, high heterogeneity in results, different scales in the studies to calculate obesity, and lack of access to

some unpublished studies as well as lack of information about other subgroups affecting obesity, such as place of residence and the economic situation, can be mentioned as limitations of this study. This is similar to many systematic review studies and other meta-analyses, particularly regarding observational studies.

Conclusion

In this study, were investigated numerous articles on obesity among Iranian students related to the past 15 years, which were different with each other in terms of age groups and study location. A systematic review and meta-analysis were done, and the results showed that the prevalence of obesity is 5.82% in students, which was higher in boys than in girls, but not high compared to other countries. However, due to changes in lifestyle, especially in recent years, the need for planning and implementation of intervention programs to improve the lifestyles and dietary patterns of this age range in their families, schools, and community is essential.

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Conflict of Interests

Authors have no conflict of interests.

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