



## The Prevalence of Obesity and Overweight in Iranian High School Students: A Systematic Review

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### Abstract

**Background:** Obesity is a public health problem worldwide. Many non-invasive hub patients are affected by this. This study aimed to assess the prevalence of obesity and overweight in Iranian and high school students.

**Materials and Methods:** In this systematic review, a systemic search of online databases (Medline, EMBASE, Scopus, Web of Science, Cochrane Library, CIVILICA, SID, Magiran, and Google Scholar search engine) was conducted for related studies with no time limit up to September 2021 using the related Mesh keywords. Two reviewers evaluated the quality of eligible studies and carried out the selection procedure. The quality of the data was evaluated using the STROBE positioning guidelines.

**Results:** Finally, 12 studies were included. The prevalence of overweight and obesity in students were 20.5% (ranged: 2.3-20.5%), and 21% (ranged: 6.1-21%), respectively. The highest prevalence of overweight and obesity was observed in students in Urmia and Yazd, respectively. There was a significant relationship between obesity and overweight of students and birth weight, formula or breastfeeding, time of starting solid foods, family income, family history of obesity, parents' education, physical activity, time spent on TV and computer games, taking snacks, private school, and having rice during a week ( $p < 0.05$ ).

**Conclusion:** The prevalence of obesity and overweight was high among high school students in Urmia and Yazd, respectively. So, it seems necessary to inform students and families about the underlying factors of obesity, increasing physical activity, improving nutrition, and observing preventive interventions in adolescence.

**Key Words:** Iran, High school, Students, Obesity, Overweight.

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## 1- INTRODUCTION

Children, adolescents, and young students are the main assets and the makers of the future of countries. One of the primary factors endangering the health of the growing population is overweight and obesity in childhood and adolescence. The increase in obesity and overweight is due to the expansion of urbanization, industrialization of societies, economic growth, globalization of the market, and the resulting changes in dietary patterns and lifestyles (1, 2). According to the World Health Organization, more than one billion people worldwide are overweight, and more than three hundred million are obese (3). A review study by Gupta et al. (2012) in developing countries found that 41.8%, 22.1%, 22%, and 19.3% of adolescents in Mexico, Brazil, India, and Argentina are obese, respectively (4).

A review study by Kelishadi et al. on Iranian adolescents from 1995 to 1997 showed that 8.8% and 4.5% of adolescents were overweight and obese, growing to 10.8% and 5.1% in 2007 (5). Obesity increases the risk of hypertension, cardiovascular diseases, diabetes, osteopathy, asthma, and cancer in adulthood (6-12). Recent studies show that the prevalence of obesity in children has more than doubled and in adolescents, it is about four times higher than in the past three decades (13). Today, obesity is the most common chronic health problem in many developed and developing countries (14).

Humankind has overcome many diseases and problems thanks to scientific and technological advances. However, changes in lifestyle, industrialization of societies, and the subsequent transformation of physical work into intellectual and administrative work, longer working hours, physical inadequacy of the body, inactivity, and higher mental stress have increased significantly. Weight gain and obesity in childhood and adolescence

affect physical health further into adulthood (15). The increase in body mass index (BMI) in childhood is indicative of excessive BMI in adulthood (16). Overweight and obesity not only endanger the health of children and adolescents during school but also affect their future lives, create hygiene and health problems, and spread non-communicable diseases. As there is no general estimate of the prevalence of obesity and overweight in high school students at the national level, a systematic review was necessary to provide an accurate and credible measure for health planners and policy-makers to have a clear picture of all the studies conducted in this regard. The present study aimed to determine the prevalence of obesity and overweight in high school students in Iran.

## 2- MATERIALS AND METHODS

The Preferred Reporting Items for Systematic review and Meta-Analysis (PRISMA) checklist was used as the template for this review (17).

### 2-1. Eligibility criteria

Participants, interventions, comparators, and outcome (PICO) was used to formulate the review objective and inclusion criteria.

**2-1-1. Participants:** Iranian high school students.

**2-1-2. Interventions:** The included research are non- interventional studies, so we did not have a comparison group.

**2-1-3. Comparators:** We did not have a comparison group and intervention.

**2-1-4. Outcomes:** Obesity and overweight.

**2-2. Included studies:** The review included studies containing any quantitative assessment, measurement, and evaluation of overweight and obesity in high school students in Iran. The inclusion criteria were: focusing on overweight or

obesity among high school students only, published up to September 2021, written in English or Persian, exclusively using BMI index (18), CDC, 2000 (19), and the International Obesity Task Force (IOTE), 2000 (20) for assessment, and published articles with full-text available.

**2-3. Exclusion criteria:** The exclusion criteria were abstracts without the full article, studies on elementary students, use of diagnostic instruments other than the BMI index, CDC, 2000, and IOTE, 2000, articles not written in English or Persian, review articles, meta-analyses, letters to the editor, editorials, short reports, case reports, and briefs.

#### 2-4. Information sources

A systemic search of electronic databases Medline, EMBASE, Scopus, Web of Science, Cochrane Library, CIVILICA, SID, Magiran, and Google Scholar search engine was conducted. The search was done independently and in duplication by two reviewers, and any disagreement between the reviewers was resolved by the supervisor.

#### 2-5. Search

Search words were a combination of (Students OR High school students OR Adolescent) AND (Obesity OR Overweight) AND (Prevalence).

#### 2-6. Study selection

A database search was done for possible studies, abstracts were screened for eligible studies, full-text articles were obtained and assessed, and a final list of included studies was made. This process

was done independently and in duplication by two reviewers, and any disagreement was resolved by the third reviewer. References were organized and managed using EndNote software (version X8).

#### 2-7. Data collection

A researcher form was developed and followed for each study. Two reviewers collected the data independently. The collected data were combined and compared for accuracy, and any discrepancies were solved by a third reviewer.

#### 2-8. Risk of bias in individual studies

The risk of bias was assessed following the standard STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) positioning guidelines (21). It is a valuable tool for evaluating the quality of observational studies. This checklist has 22 items, scored based on the importance of each item in the present study. The final score of the checklist was 30, and the minimum was 15.0. The assessment was done by two reviewers independently and in duplication, and any discrepancies were resolved by the third reviewer.

### 3- RESULTS

Finally, 12 studies from 18 cities or regions, consisting of 9,012 high school students, were selected (**Figure.1**). The main characteristics of the selected studies are summarized in **Table.1** and the following:

**Table-1:** General characteristics of included studies.

Author, Reference	Year,	City/ Province	Gender	Age, year	Sample size	Prevalence	
						Overweight	Obese
Rahmaninia et al., 2003, (22)		Rasht	boys	12-17	728	10.9	6.5
Hosseini et al., 2005, (24)		Damghan	boy/girl	11-14	300	Public school students=7 Private	Public school students=4 Private

					school students=16	school students=5
Taheri et al., 2005, (32)	Birjand		15-18	2230	6.1	2.3
Moqadam et al., 2010, (23)	Tehran	girls		385	15	
Mohamadpour Koldeh et al., 2010, (27)	Bushehr	girls	14-17	500	14.5	7.1
Jalilvand et al., 2011, (31)	North Khorasan province	boy/girl	14-16	450	age, girl/boy 14-<15, 10/8.8 15-<16, 10.9/6.5 16-<17, 9.5/6.3	age, girl/boy 14-<15, 10/2.9 15-<16, 9.6/3.2 16-<17, 3.8/2.4
Nasiry Zarrin Ghabaee et al., 2012, (26)	Bojnurd	girls	15-16	250	12	3.2
Torabi et al., 2013, (25)	Zanjan	boy/girl	12-14	1366	12.2	3.9
Abdollahi et al., 2005-2014, (29)	Mazandran province	boy/girl	7, 12, and 15	1230	8.3, 10.1, and 10	3.1, 4, and 2.9
Hemati Maslak Pak et al., 2016, (30)	Urmia	girls	12-18	800	20.5	10.9
Fallahzadeh Abargouei et al., 2019, (28)	Yazd	boy/girl	12-14	334	17.7	21
Azizi et al., 2019, (33)	Kermanshah	boys	13-15	439	10.8	15.8

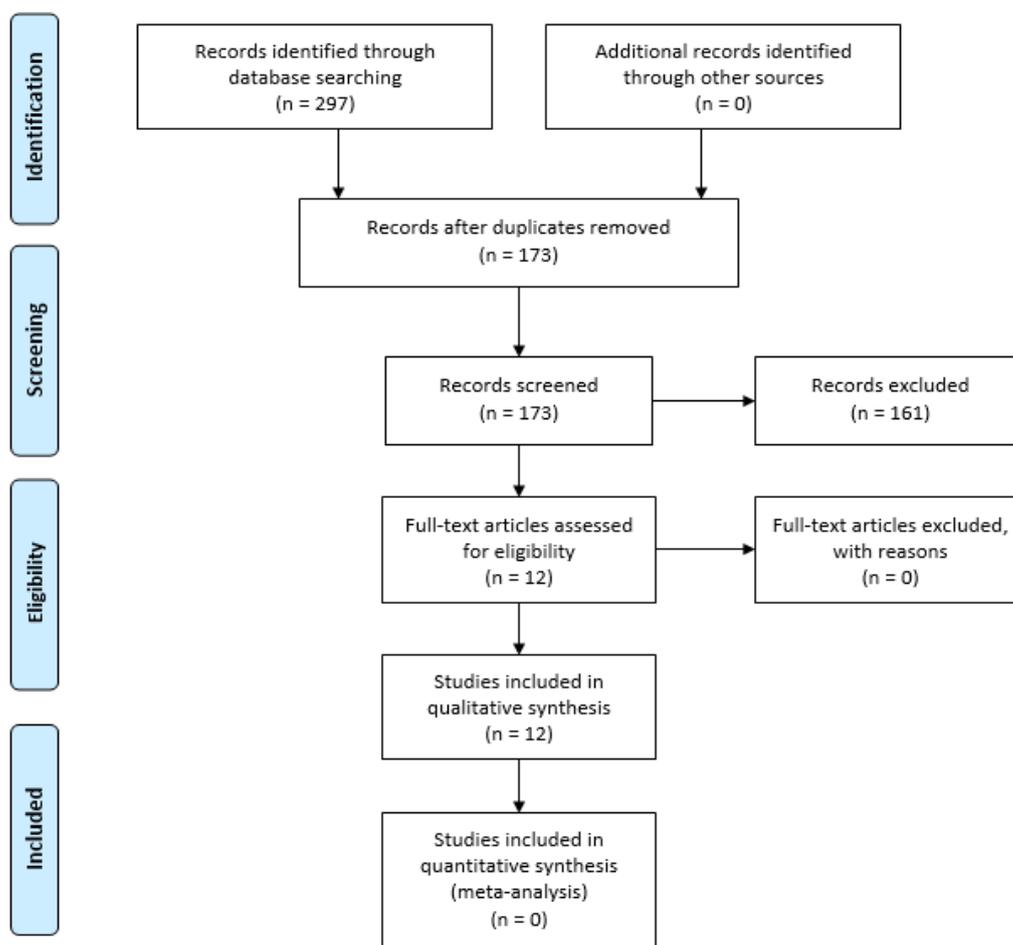


Fig.1: PRISMA flowchart.

- 1.** A cross-sectional study in 2003 on 728 male high school students in Rasht aimed to determine the prevalence of overweight and obesity in male students aged 12 to 17 years. The results showed that the prevalence of overweight and obesity in male students was 10.9 and 6.5%, respectively. A significant relationship existed between the prevalence of overweight and obesity and the level of physical activity (22).
- 2.** In a descriptive correlational study in 2008, 385 female high school students were studied in western Tehran. The results showed that according to the criterion of fat under the skin of the back muscle, 18%, and according to the body mass index, 15% of students were overweight and obese. Also, nearly half of the students were sedentary, and third-grade students had the lowest physical activity (23).
- 3.** In a descriptive-analytical study on 300 adolescent students in state and private schools in Damghan in 2005, the nutritional status and factors in 11- to 14-year-old students were investigated. The results showed that based on the grouping of BMI percentiles for age, underweight, normal, overweight, and obese adolescent students in state schools were 10%, 79%, 7%, and 4%, respectively. In private schools, these percentages were 6%, 73%, 16%, and 5%, respectively. This difference did not depend on the gender of the students.
- 4.** A cross-sectional study was conducted on 1366 random adolescents, aged 12 to 14 in high schools in Zanjan in 2013. The results showed that 4.5% of female and 3.1% of male students were obese. The prevalence of overweight and obesity was 12.2% and 3.9%, respectively. There was a significant relationship between obesity and birth weight, formula or breastfeeding, time of starting solid foods, family history of obesity, physical activity, time spent watching TV, taking snacks, and having rice during a week ( $p < 0.05$ ) (25).
- 5.** A cross-sectional study on 250 high school girls in 2012 investigated the relationship of food habits with body mass index and fat distribution in high school girls in Bojnurd. The results showed that the prevalence of obesity and overweight was 3.2 and 12%, respectively. Among obese students, 43 (17.1%) had abdominal obesity. A significant relationship existed between BMI and fat mass index ( $p < 0.05$ ). The average intake of fat and energy in overweight and obese students was significantly higher than in underweight and normal-weight individuals ( $p < 0.05$ ) (26).
- 6.** A cross-sectional study was conducted on 500 high school girls (aged 14 to 17 years) in 2010 to determine the prevalence of obesity and overweight in high school girls in Bushehr. The results showed that the prevalence of obesity, overweight, and underweight was 7.1, 14.5, and 2.9%, respectively. Obesity and overweight had a significant relationship with education, the job of parents, and students' physical activity. Among obese girls, 58.3% had an activity of lower than 30 minutes every day, 25% watched TV for more than four hours, 50% consumed snacks twice per day, and 38.9% reported obesity in first-degree relatives (27).
- 7.** A cross-sectional study on 334 students aged 12 to 14 in 2019 aimed to determine the relationship between obesity, physical activity, eating habits, and watching television in students in Yazd. The results showed that the prevalence of overweight and obesity was 17.7% and 21%, respectively. The prevalence of obesity was significantly higher in boys ( $p = 0.006$ ) and students whose mothers had higher education ( $p = 0.02$ ). The logistic regression model showed that fruit consumption once a week or less increased the risk of overweight and obesity by 20.07 and 14.76%, respectively. A

significant relationship existed between longer hours of playing computer games and obesity (28).

**8.** A descriptive study was conducted on the health history of 1230 students in the first level of three educational levels (primary, lower-secondary and upper-secondary) from 2005 to 2014 to assess the prevalence, trend, and factors of obesity and overweight in adolescent students in Mazandaran province. The results showed that based on BMI Z-score, 3.1%, 4%, and 2.9% of the population at ages 7, 12, and 15 years were obese, respectively. Moreover, overweight students increased from 8.3% (98) at age 7 to 10.1% (121), and 10% (119) at ages 12 and 15 years, respectively. At 15, the prevalence of obesity and overweight in girls was twice that of boys (1.9% vs. 1.1% and 7% vs. 3%). There was no significant relationship between obesity and overweight and parents' occupation and education, type of school, and students' places of residence (29).

**9.** A cross-sectional study was performed on 800 female high school students in 2016 to determine the prevalence of general and abdominal obesity and overweight among high school girls in Urmia. The results showed that the prevalence of underweight, overweight, and obesity among all female students was 2.9, 20.5, and 10.9%, respectively. The prevalence of abdominal obesity was 42.7%. There was no significant relationship between BMI and the first- and second-period high school students (30).

**10.** A cross-sectional study on 450 high school students in 2011 aimed to determine the prevalence and factors of overweight and obesity among high school students aged 14 to 17 in North Khorasan. The results showed that the mean BMI was significantly higher among female students. The prevalence of overweight and obesity was two times higher in

females in three age categories (14 to 16 years). A statistically significant relationship existed between BMI and gender, job, family income, hours spent at the computer, and fathers' BMI (31).

**11.** A cross-sectional study on 2230 students (1115 boys and 1115 girls) aged 15 to 18 in 2005 aimed to estimate the overweight and obesity in high school students in Birjand. The results showed that the prevalence of overweight and obesity were 6.1% and 2.3%, respectively. The prevalence of overweight was 5% in high school boys and 7.1% in girls, and obesity was 2.8% in boys and 1.8% in girls. Overweight and obesity had a direct relationship with the educational levels of parents, working fathers, and private schools (32).

**12.** A descriptive correlational study on 439 male students aged 13 to 15 in Kermanshah in 2019 assessed the prevalence of obesity and its relationship with physical activity in male students. The results showed that the prevalence of overweight and obesity was 10.8% and 15.8%, respectively. A significant negative correlation was found between weight categories (underweight, normal, overweight, and obese), and physical activity, BMI and physical activity, and body fat and physical activity (33).

#### **4- DISCUSSION**

The present study investigated the prevalence of obesity and overweight and their factors in Iranian high school students. The results showed that the prevalence of overweight and obesity in students was 20.5 and 21%, respectively. Various factors, such as parents' literacy level, economic and social status, lifestyle, and snack consumption, influenced the incidence of overweight and obesity. Obesity is a chronic disease caused by a combination of genetic and environmental factors (34). The evidence of the global increase in obesity and overweight is

growing (35). In the United States, approximately one-third of adolescents are overweight or obese (34), and in Spain, the prevalence of obesity in children and adolescents is 13.9% (36). According to WHO, more than 30% of people in the Middle East are overweight (37). The WHO states that 20% of the world's population are adolescents, 84% of whom live in developing countries (38). Studies on the nutritional status of adolescents in developed countries show that overweight and obesity are prevalent (38). Studies also indicate a relationship between nutritional and economic status and the income level of individuals (39). In Iran, studies have found a prevalence of underweight in lower-income populations and overweight and obesity in higher-income families (40).

Studies on the nutritional status of adolescents in different countries show the high prevalence of overweight and obesity, which is directly related to the economic status and income level of their families. On the contrary, overweight and obesity are more prevalent in higher-income families (41, 39). Various factors influence obesity, including low physical activity, excessive food intake, and obesity of parents (particularly the mother), parents' educational level, eating behaviors, nutritional status, social status, and economic status of families (42). Over the last decade, the consumption of fast foods, soft drinks, and sweets has increased. In addition, the physical activity of adolescents and young people has decreased due to more time spent watching TV, playing computer games, and on the Internet (43). Evidence suggests that TV commercials influence the choice of snacks for children and adolescents. Watching TV and advertisements for high-calorie, high-fat, and low-nutrition foods increase their consumption among children and adolescents. Consuming unhealthy food along with inactivity leads to obesity (44). This way, overweight and obesity

during adolescence have become the most prevalent health problems in all countries, and obesity prevention and treatment are of significant importance in public health (45). Evidence shows the recent prevalence of a sedentary lifestyle among adolescents following the mechanization and modernization of societies, and this unhealthy lifestyle continues into adulthood (46). Obese adolescents are likely to be obese also in adulthood and exposed to complications such as diabetes, high blood pressure, cardiovascular diseases, and other chronic diseases and health problems (47, 48). US guidelines recommend young people be physically active for 30 to 60 minutes a day (49). However, physical activity has decreased, as more time is spent watching TV and playing computer games.

Countering childhood obesity requires continuous political and social commitment and the cooperation of public and private organizations. Government, society, non-governmental organizations (NGOs), and the private sector should gather to create a healthy environment, choosing a healthy, affordable, and accessible diet. Parents can also influence their children by providing healthy and accessible foods and drinks and encouraging physical activity. The worst consequences of overweight and obesity on the health of children and adolescents are the increased risk of adult obesity, diabetes, cardiovascular diseases, and cancer.

According to the CDC, a BMI lower than the 5th percentile for age and gender is lean, BMI between the 5th to 84.9th percentiles is normal, BMI between the 85th and 94th percentile is overweight, and BMI of 95th percentile and more is obese (50). As 20.5% and 21% of children and adolescents in Iran are overweight and obese, a national program is necessary to prevent and control overweight and obesity. This program should include pre-

pregnancy care for a healthy pregnancy. Feeding a newborn plays a significant role in the development of overweight and obesity of the baby. Breastfed and exclusively breastfed children for the first six months are less likely to be obese than non-breastfed children. An unhealthy diet, especially excessive calorie-intake in the early years of life (complementary nutrition, nutrition in the first to fifth years of life), inappropriate eating habits in the family, consumption of fast foods, low physical activity, and numerous other factors are involved in the development of overweight and obesity in children and adolescents. These factors should be addressed in a comprehensive program for the prevention and control of obesity and overweight (51).

#### 4-1. Study Limitations

One of the limitations of this study was the existence of different criteria for defining obesity and overweight.

#### 5- CONCLUSION

Based on the results, the prevalence of obesity and overweight in high school students was 20.5% (ranged: 2.3 to 20.5%), and 21% (ranged: 6.1 to 21%), respectively. Being overweight was more prevalent in students in Urmia, and the prevalence of obesity was higher in students in Yazd. Also, overweight and obesity were less prevalent among Birjandi students. There was a significant relationship between obesity and birth weight, formula or breastfeeding, time of starting solid foods, family history of obesity, physical activity, and time spent watching TV, taking snacks, having rice during a week, education, the job of parents, family income, and the time spent at a computer ( $p < 0.05$ ). The average intake of fat and energy in overweight and obese students was significantly higher than in the underweight and normal population ( $p < 0.05$ ). The logistic regression model

showed that consumption of fruit once a week and less increased the risk of overweight and obesity by 20.07 and 14.76%, respectively. Therefore, it is necessary to inform students and families about the underlying factors of obesity and recommend higher physical activity, better nutritional behaviors, and appropriate and preventive interventions in adolescence.

**6- CONFLICT OF INTEREST:** None.

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