

The prevalence of obesity and overweight in Northeastern Iran

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ABSTRACT

Objective: The aim of this study was to assess obesity and overweight by WHO criteria in Mashhad, Iran. **Method:** This cross-sectional study was performed on 4453 people from Mashhad in 2009. Comprehensive data of age, height, weight, education, and marriage was collected. Overweight and obesity were calculated according to the body mass index (BMI). **Results:** A total of 1828 participants entered study, of whom 70.4% were women. The mean age of the population was 39.8 ± 13.5 years. The prevalence of overweight and obesity was 36.5% (95% CI 34.3-38.6) and 16.9% (95% CI 15.1-18.8), respectively. The prevalence of overweight was 39.0% in men and 35.4% in women which increased significantly by age ($P < 0.001$ & $OR = 1.055$). The prevalence of obesity in men and women was 12.3% and 18.9% respectively which showed women had a significantly higher risk ($P < 0.001$). The risk of overweight and obesity was higher in married but lower in educated people. **Conclusion:** This study showed a rapid increase in obesity and overweight, especially in women, in Mashhad population as a sample of the Iranian society. Attention to preventive and education plans should be the priority of health policies.

Key words: Cross Sectional Study, Obesity, Overweight, Prevalence

BACKGROUND

The increasing trend of non-communicable diseases is one of the greatest public health challenges, especially in developed countries¹. Obesity is one of the most important risk factors of cardiovascular diseases, diabetes, and cancer, and is the 5th cause of mortality and morbidity worldwide². According to the WHO reports, more than 1.5 billion people aged 20 years and older are obese in the world³. More than 65% of the world population lives in countries where most people die of obesity and overweight. Moreover, 44% of the burden of diabetes and 23% of the burden of cardiac ischemic diseases is attributed to obesity⁴. Many studies underline the importance of obesity every year⁵⁻⁷. Based on the latest reports of the WHO, the BMI has had an increasing trend since 1980; for this reason, its estimate for the coming years is concerning⁸. According to the WHO reports, the highest prevalence of obesity is observed in American and European countries followed by the countries located in the eastern Mediterranean region and the lowest prevalence is seen in South African countries⁹. Iran is one of the densely populated countries in the Eastern Mediterranean region. In a report on the trend of obesity and overweight, Esteghamati reported an increasing trend between 1999 and 2007¹⁰. According to the findings of this study, obesity can be the cause of a high percentage of non-communicable diseases

in Iran in recent years¹⁰. This study suggested that periodic studies in Iran could provide health managers with information on the epidemic of obesity in different parts of the country; in addition, information on the status of obesity in Iran can help to have an estimate on the incidence of cardiovascular diseases and even cancers that result from obesity¹⁰. Furthermore, considering the variety in the ethnicity, socio-economic status, educational level, and even the occupational status of the Iranian population, different studies are required to determine the status of obesity in different groups¹¹⁻¹³. Due to the importance of obesity and since it is a major public health concern worldwide, we decided to evaluate the prevalence of obesity and overweight in a population based study according to the WHO criteria.

METHODS

This cross sectional population based study was conducted in Mashhad, northeast of Iran. The target population of this study was the over-1-year population of Mashhad. The population of Mashhad is 2,451,712 according to the 2005 census. The city of Mashhad has 11 municipality districts, which were considered as strata. The random stratified cluster sampling method was used to select the participants. The number of people in each strata was considered proportion of that strata to whole population in sampling.

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A total of 120 clusters of the blocks determined by the Statistics Center of Khorasan Razavi Province were randomly selected. The first house number of each cluster was considered the head cluster. In each cluster, sampling continued systematically for up to 10 households. After introducing themselves and explaining the importance of the project to the households and completing a demographic questionnaire, the interviewers invited the households to the Optometry Clinic of Mashhad University of Medical Sciences for a complete examination. If a household declined the invitation, the next household according to the house number was invited. Accordingly, 10 households were invited to the study systematically in a clock-wise fashion. The travel costs of the households were covered by the research team.

After selecting the households and their visit to the Optometry Clinic, their demographic characteristics and history of ophthalmic examination were evaluated through an interview. The height and weight of the participants were measured after the interview.

In this study, the height of the participants was measured with a plastic tape measure attached to the wall. The height was measured in the standing position with shoes removed and 5 body points making contact with the wall. A SECA digital scale was used to weight measurement.

Definitions

The BMI was used to calculate obesity and overweight. The BMI was calculated as the body mass (kg) divided by the square of the body height (m). A BMI of 25-29.9 was considered overweight and a BMI ≥ 30 was considered obese. To calculate the level of obesity, a BMI of 30-34.9, 35-39.9, and ≥ 40 was considered obesity grade 1, obesity grade 2, and obesity grade 3, respectively.

Ethical Considerations

After the households visited the clinic willingly, the protocol of the study was again explained to the head of the household explicitly. Then, if the household was willing to participate in the study, informed consent was obtained from the head of the household. The consent form included the commitments of the research team to confidentiality and anonymity of the data. The protocol of the study was approved by the Ethics Committee of Mashhad University of Medical Sciences.

Statistical Analysis

The prevalence of overweight and obesity is reported as percentage with 95% CI. The method of cluster sampling was considered when calculating 95% CI. Simple and multiple logistic regression models were used to investigate the relationships. Overweight and obese individuals were compared with those whose BMI was below 25 to evaluate the correlations. When there was not a linear relationship, continuous variables were dummy and a group was considered as a reference for comparison with other groups.

RESULTS

Of 4453 participants who were invited, 70.4% participated in the study. Of them, 1828 were 20 years and older whose data was analyzed in this study. Female participants comprised 70.4% of the study population. The mean age of the participants was 39.8 ± 13.5 years (range: 20-90 years). The mean BMI standardized according to age and gender was 25.7 (95% CI 25.4-25.9). **Figure 1** shows the distribution of BMI in the study population. The BMI was 25.6 in women and 25.4 in men, which had a significant difference ($P < 0.001$). The relationship was also observed after adjusting for age. The BMI increased significantly until 60 years of age and then decreased; this trend was true in both sexes (**Figure 2**).

Overweight

The prevalence of overweight was 36.5% (95% CI 34.3-38.6) in our study. The prevalence of overweight was 39.0% (95% CI 34.6-43.5) in men and 35.4% (95% CI 32.4-38.0) in women. Logistic regression showed no correlation between sex and overweight ($P = 0.782$). This relationship was observed after adjusting for age ($P = 0.658$). The prevalence of overweight did not have a linear relationship with age. According to **Table 1**, the prevalence of overweight increased from 20 to 49 years of age and then decreased thereafter. Logistic regression showed that the prevalence of overweight increased from 20 to 49 years of age (OR=1.055, $P < 0.001$). The changes of overweight did not have a significant relationship with age after 49 years of age ($P = 0.779$). The prevalence of overweight did not have a significant correlation with the level of education. Chi-2 showed no significant difference between the educational level and overweight ($P = 0.367$). The prevalence of overweight was significantly higher in married participants; the prevalence of overweight was 17.9% in single and 38.9% in married participants. Simple logistic regression showed

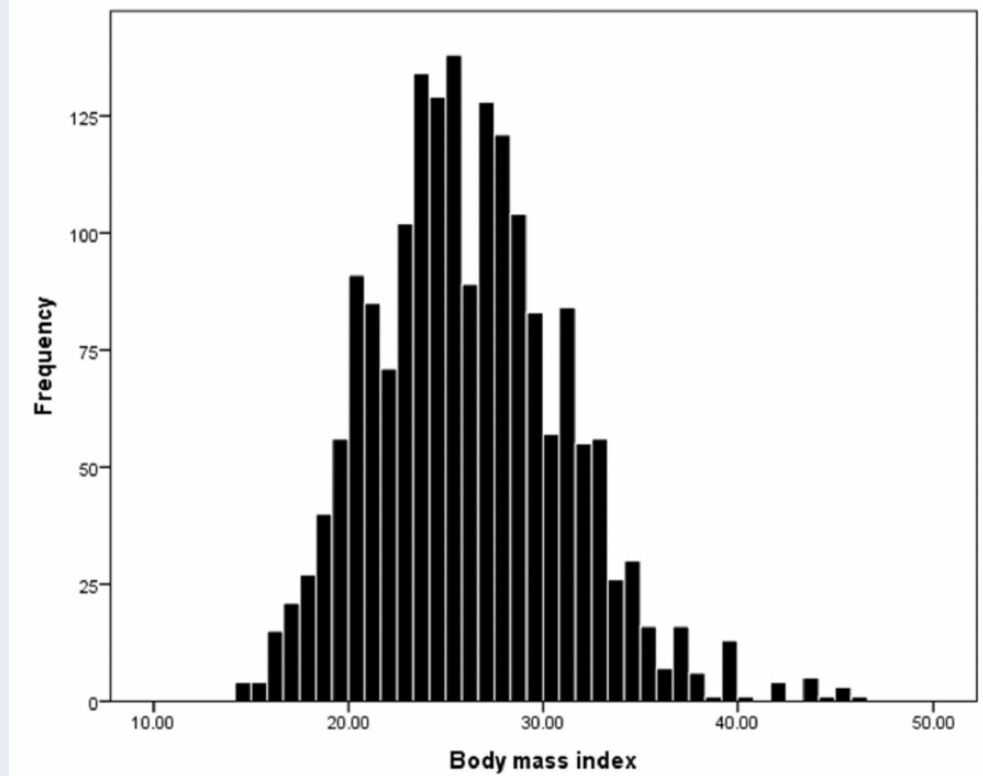


Figure 1: Distribution of BMI in the study population.

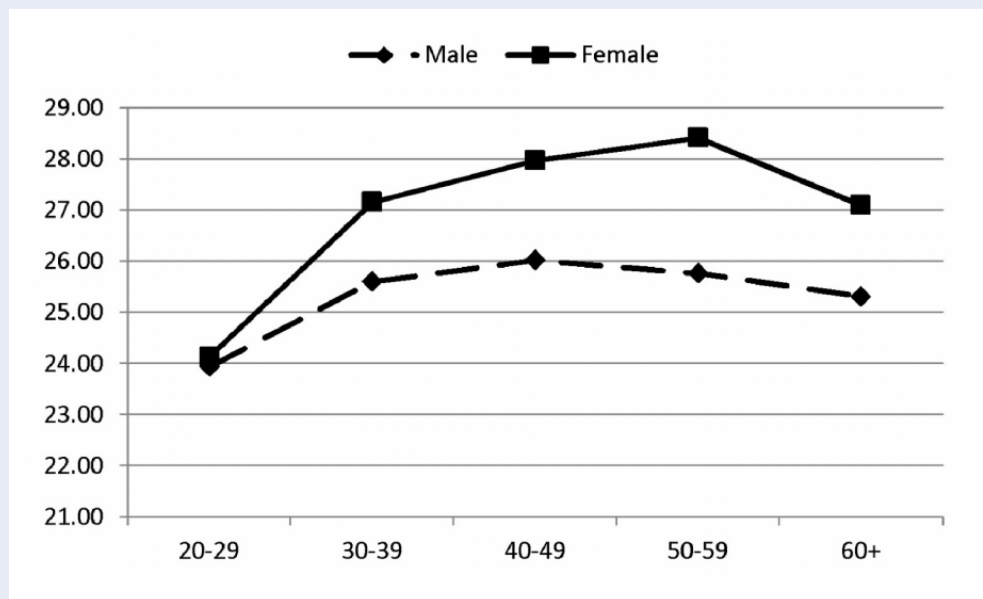


Figure 2: BMI in different age groups of men and women.

Table 1: The prevalence of overweight and obesity in the study population according to the evaluated variables

	Overweight	Obese
	% (95%CI)	% (95%CI)
Male		
20-29	35.1(26.1 - 44.20)	7.2(2.3 - 12.1)
30-39	43.9(34.4 - 53.30)	11.4(5.5 - 17.3)
40-49	35.2(27.4 - 43)	17.9(11.7 - 24.1)
50-59	39(29.2 - 48.90)	10.5(4.7 - 16.2)
60+	46(32.4 - 59.60)	12.7(4.8 - 20.6)
Total	39(34.6 - 43.50)	12.3(9.5 - 15)
Female		
20-29	23.9(19.6 - 28.30)	10(6.7 - 13.3)
30-39	38.6(33.2 - 43.90)	21.2(16.6 - 25.7)
40-49	44.8(39.8 - 49.80)	25.2(20.2 - 30.1)
50-59	38.3(29.7 - 46.90)	22.8(16 - 29.5)
60+	34.1(24 - 44.30)	19.5(10 - 29)
Total	35.4(32.8 - 38)	18.9(16.7 - 21.1)
Both gender		
20-29	26.5(22.5 - 30.40)	9.4(6.5 - 12.2)
30-39	39.9(35.1 - 44.60)	18.7(15.1 - 22.4)
40-49	41.7(37.5 - 45.80)	22.8(18.8 - 26.9)
50-59	38.6(32.4 - 44.90)	18(12.9 - 23.1)
60+	39.3(31.5 - 47.10)	16.6(10.6 - 22.5)
Total	36.5(34.3 - 38.60)	16.9(15.1 - 18.8)
Mariage status		
Single	17.9(12.4 - 23.40)	5.3(2.1 - 8.6)
Married	38.9(36.5 - 41.20)	18.4(16.4 - 20.5)
Educational level		
Illiterate	37.3(30.2 - 44.30)	17.7(12.5 - 22.9)
High school diploma or less	37(34.4 - 39.60)	18.1(15.8 - 20.4)
Associate degree	33.7(29 - 38.40)	13.9(10.3 - 17.4)
Masters degree or more	43.8(25.4 - 62.10)	3.1(-3.00 - 9.3)

Table 2: The relationship of obesity and overweight with study variables in a multiple model

		Overweight		Obese	
		Or (95%ci)	P-value	Or (95%ci)	<0.001
Gender	Male/Female	1.04 (0.80 - 1.35)	0.795	1.98 (1.44 - 2.72)	
Age	20-29	1		1	<0.001
	30-39	1.75 (1.25 - 2.45)	<0.001	2.36 (1.50 - 3.72)	<0.001
	40-49	2.14 (1.55 - 2.96)	<0.001	3.59 (2.24 - 5.77)	0.002
	50-59	1.60 (1.10 - 2.31)	0.013	2.40 (1.37 - 4.20)	0.017
	60+	1.70 (1.07 - 2.69)	0.023	2.41 (1.17 - 4.96)	
Educational level	Illiterate	1		1	0.278
	High school diploma or less	1.20 (0.80 - 1.81)	0.385	1.35 (0.78 - 2.32)	0.337
	Associate degree	1.20 (0.76 - 1.91)	0.436	1.36 (0.72 - 2.57)	0.438
	Masters degree or more	1.58 (0.75 - 3.31)	0.228	0.41 (0.04 - 3.85)	
Marital status	Single	1		1	0.002
	Married	2.69 (1.73 - 4.20)	<0.001	3.24 (1.56 - 6.75)	

that the odds of overweight was 3.3 times greater in married versus single participants ($P<0.001$). The results of the multiple regression model are presented in Table 2. Accordingly, age and marital status had a significant relationship with overweight.

Obesity

The prevalence of obesity was 16.9% (95% CI 15.1-18.8). The prevalence of obesity was 12.3% (95% CI 9.5-15.0) in women and 18.9% (95% CI 16.7-21.1) in men. According to the simple logistic regression model, the odds of obesity were significantly higher in women ($OR=1.6$, 95% CI 1.2-2.2 $P<0.001$). The prevalence of obesity increased significantly from 9.5% in participants aged 20-29 years to 22.8% in the age group 40-49 years ($P<0.001$); however, the changes of obesity were not significantly correlated with age after 50 years of age ($P=0.904$). This relationship was true in both sexes. According to Table 1, the lowest prevalence of obesity was observed in individuals with a master's degree or higher. Logistic regression showed that the odds of obesity were higher in individuals with a master's degree or higher versus illiterate participants ($OR=1.6$, 95% CI 0.11-0.96 $P=0.046$). The prevalence of obesity was significantly higher in married people ($P<0.001$). Table 2 shows the results of the multiple logistic regression model. According to Table 2, female sex, age, and marital status had a significant correlation with obesity.

DISCUSSION

In this study, we reported the prevalence of obesity and overweight by sex, marital status, and educational level in a population of Mashhad, as a representative of the Iranian population, according to the WHO criteria.

According to our results, 36.5% of the participants were overweight and 16.9% were obese. A review of the previous studies shows a lower prevalence of overweight and obesity in Mashhad when compared with Gorgan, Tehran, and Shiraz in both sexes while its prevalence was higher in Isfahan¹⁴⁻¹⁸. However, the prevalence of overweight and obesity in Mashhad is lower than the whole country; a national study that evaluated the BMI of Iranian men and women ($BMI \leq 25$) reported that the prevalence of overweight and obesity was 42.8% and 57%¹⁹. In 2008, the WHO reported a prevalence of 48.0% for overweight and 7.18% for obesity in the Middle East. A number of studies have reported a high prevalence of obesity and overweight in neighboring countries of Iran like the KSA, Turkey, and Oman but the prevalence is lower than countries like Italy, China, and Portugal²⁰⁻²⁶. These studies indicate that Iran, like its neighbors and as a developing country, is undertaking a socioeconomic transition; access to food and high calorie diets has increased in the past 10 years and physical activity has decreased due to the use of public and personal vehicles²⁷. These changes, along with the prevalence of obesity, result in energy imbalance and increased burden of different diseases resulting from obesity; car-

diovascular diseases are now the first cause of mortality and morbidity due to non-traumatic events in Iran²⁸. However, the difference in the prevalence of obesity also depends on factors such as diet, access to food products, education level, and GDP. The prevalence of obesity and overweight is on the rise in Europe and America; According to a WHO report, the highest and lowest prevalence of obesity is observed in North America and Southeast Asia, respectively. In another study, Flegal *et al.* reported a prevalence of 68.8% for overweight and 35.7% for obesity in American population aged 20 years and over²⁹. Concerns about the epidemic of obesity among the young generation are a major public health challenge because it increased the burden of the diseases incurs heavy costs on the society and increases the risk of atherosclerotic diseases and diabetes in the future. Therefore, preventive measures, increasing public awareness and knowledge, and physical activity are recommended to lower the prevalence of obesity. According to a study performed in a Japanese young population between 2003 and 2009, lifestyle modification decreased the prevalence of overweight and obesity³⁰.

Our results showed that the prevalence of obesity and overweight was higher in women and men, respectively. These prevalence rates were higher than the finding of a national study that reported a prevalence of 11.1% for obesity in Iranian men¹⁹. Farhadian *et al.* also reported that the prevalence of obesity in men residing in Khorasan razavi Province was higher than other provinces³¹. The results of the studies performed in Tehran, Golestan, Mazandaran, and Shiraz indicate the higher prevalence of obesity and overweight in women across the country^{11,16-18,31,32}. There are also reports of the rather high prevalence of overweight and obesity in women living in neighboring countries of Iran like Oman, Kuwait, and Turkey; for example, 62.65% of the women in Saudi Arabia suffer from overweight²⁰⁻²³. The reason could be that their lifestyle is similar to the lifestyle of Iranian women; most women in the Middle East are housewives and have little physical activity which is a major risk factor of obesity. In this regard, the prevalence of overweight and obesity is 4% and 10% lower respectively in Iranian female clerks that have more physical activity than their housewife counterparts³³. There is not^{her} reason to doubt the results of the above-mentioned studies. Most of these study collected information through census and door-to-door interview and as mentioned earlier, women spend most of their time at home in these countries and as a result, the information of the height and weight of other members of the household may not have been collected accurately. As

mentioned in Results, the prevalence of obesity and overweight was higher in married versus single participants. A number of studies performed in Iran and other countries have confirmed the higher prevalence of Overweight in married people in both sexes^{11,34-37}. The reason is not yet clear but cultural reasons like persuading the spouse to dine together or more attention to meals could be involved¹⁶.

It was mentioned earlier that the prevalence of overweight and obesity was lower in people with higher education (master's degree and higher) versus people with lower education. Previous studies^{26,31,38-40} have shown that people with higher education, in addition to having a correct insight and attitude toward the complications of obesity and observing an appropriate diet, have a higher income and spend money on appropriate foods more easily. The results of a cohort study on healthy women with normal BMI in England showed that they spent about 1000£ on buying high fiber, protein, and vitamin foods while the opposite was observed in people with a low income that spent most of their money on unhealthy fast foods containing high amounts of fat and carbohydrates, resulting in an increased risk of obesity^{26,31,38-40}. However, another study³⁷ reported that people with an academic education are more prone to obesity because they mostly have office jobs and a sedentary lifestyle as compared to illiterate or low educated people who are mostly labors requiring a lot of energy.

CONCLUSIONS

According to the results of our study, the rising trend of the prevalence of overweight and obesity is concerning in the urban population of Mashhad. Due to the association of overweight and obesity with cardiovascular diseases and diabetes, it seems that more attention should be paid to obesity and overweight in Mashhad, which can be regarded as a necessity and a health system priority in Mashhad. For this reason, preventive measures like enhancing the socioeconomic status of the target population, increasing their awareness, and providing them with education on nutrition should be considered as the main objectives of health managers in this regard.

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not to be applied.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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REFERENCES

- Rivera JA, Barquera S, Campirano F, Campos I, Safdie M, Tovar V. Epidemiological and nutritional transition in Mexico: rapid increase of non-communicable chronic diseases and obesity. *Public health nutrition*. 2002;5(1a):113–122. Available from: [10.1079/PHN2001282](https://doi.org/10.1079/PHN2001282).
- Parkin DM, Bray F, Ferlay J, Pisani P. Global cancer statistics, 2002. *CA: a cancer journal for clinicians*. 2005;55(2):74–108.
- organization (WHO World H, et al. Global Health Risks-Mortality and burden of disease attributable to selected major risks. *Cancer*. 2017;.
- Fox CS, Coady S, Sorlie PD, D'Agostino RB, Pencina MJ, Vasan RS, et al. Increasing cardiovascular disease burden due to diabetes mellitus: the Framingham Heart Study. *Circulation*. 2007;115(12):1544–1550. Available from: [10.1161/CIRCULATIONAHA.106.658948](https://doi.org/10.1161/CIRCULATIONAHA.106.658948).
- Johnson ML, Burke BS, Mayer J. Relative importance of inactivity and overeating in the energy balance of obese high school girls. *The American journal of clinical nutrition*. 1956;4(1):37–44.
- Hubert HB, Feinleib M, McNamara PM, Castelli WP. Obesity as an independent risk factor for cardiovascular disease: a 26-year follow-up of participants in the Framingham Heart Study. *Circulation*. 1983;67(5):968–977.
- Bell JF, Wilson JS, Liu GC. Neighborhood greenness and 2-year changes in body mass index of children and youth. *American journal of preventive medicine*. 2008;35(6):547–553.
- Finucane MM, Stevens GA, Cowan MJ, Danaei G, Lin JK, Paciorek CJ, et al. National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9.1 million participants. *The Lancet*. 2011;377(9765):557–567.
- Flegal KM, Carroll MD, Ogden CL, Johnson CL. Prevalence and trends in obesity among US adults, 1999–2000. *Jama*. 2002;288(14):1723–1727.
- Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The lancet*. 2014;384(9945):766–781.
- Hajian-Tilaki KO, Heidari B. Prevalence of obesity, central obesity and the associated factors in urban population aged 20–70 years, in the north of Iran: a population-based study and regression approach. *Obesity reviews*. 2007;8(1):3–10.
- Azadbakht L, Esmailzadeh A. Dietary and non-dietary determinants of central adiposity among Tehranian women. *Public health nutrition*. 2008;11(5):528–534.
- Azadbakht, Mirmiran, Shiva, Azizi. General obesity and central adiposity in a representative sample of Tehranian adults: prevalence and determinants. *International journal for vitamin and nutrition research*. 2005;75(4):297–304.
- Rashidy-Pour A, Malek M, Eskandarian R, Ghorbani R. Obesity in the Iranian population. *Obesity reviews*. 2009;10(1):2–6.
- Veghari G, Sedaghat M, Jashghani H, Banihashem S, Moharloe P, Angizeh A, et al. Obesity and risk of hypercholesterolemia in Iranian northern adults. *ARYA atherosclerosis*. 2013;9(1):2.
- Moghimidehkhordi B, Safaee A, Vahedi M, Pourhoseingholi A, Pourhoseingholi MA, Ashtari S, et al. Overweight and obesity and related factors in urban Iranian population aged between 20 to 84 years. *Annals of medical and health sciences research*. 2013;3(2):171–176.
- Ayatollahi SMT, Ghoreshizadeh Z. Prevalence of obesity and overweight among adults in Iran. *Obesity reviews*. 2010;11(5):335–337.
- Åghdakh P, et al. Survey of obesity, underweight and associated factors in elderly people, using some of anthropometric indices in Isfahan City, 2004. *Journal of Mazandaran University of Medical Sciences*. 2006;16(52):117–125.
- Janghorbani M, Amini M, Willett WC, Gouya MM, Delavari A, Alikhani S, et al. First nationwide survey of prevalence of overweight, underweight, and abdominal obesity in Iranian adults. *Obesity*. 2007;15(11):2797–2808.
- Al-Lawati JA, Jousilahti PJ. Prevalence and 10-year secular trend of obesity in Oman. *Saudi medical journal*. 2004;25(3):346–351.
- Alsaif MA, Hakim IA, Harris RB, Alduwaihi M, Al-Rubeaan K, Al-Nuaim AR, et al. Prevalence and risk factors of obesity and overweight in adult Saudi population. *Nutrition Research*. 2002;22(11):1243–1252.
- Musaiger AO, Al-Mannai M, Tayyem R, Al-Lalla O, Ali EY, Kalam F, et al. Prevalence of overweight and obesity among adolescents in seven Arab countries: a cross-cultural study. *Journal of obesity*. 2012;2012.
- Yumuk VD, Hatemi H, Tarakci T, Uyar N, Turan N, Bagrı N, et al. High prevalence of obesity and diabetes mellitus in Konya, a central Anatolian city in Turkey. *Diabetes research and clinical practice*. 2005;70(2):151–158.
- Micciolo R, Francesco VD, Fantin F, Canal L, Harris TB, Bosello O, et al. Prevalence of overweight and obesity in Italy (2001–2008): is there a rising obesity epidemic? *Annals of epidemiology*. 2010;20(4):258–264.
- Tian H, Xie H, Song G, Zhang H, Hu G. Prevalence of overweight and obesity among 2.6 million rural Chinese adults. *Preventive medicine*. 2009;48(1):59–63.
- Santos AC, Barros H. Prevalence and determinants of obesity in an urban sample of Portuguese adults. *Public health*. 2003;117(6):430–437.
- Ghassemi H, Harrison G, Mohammad K. An accelerated nutrition transition in Iran. *Public health nutrition*. 2002;5(1a):149–155.
- Shab-Bidar S, Hosseini-Esfahani F, Mirmiran P, Hosseinpour-Niazi S, Azizi F. Metabolic syndrome profiles, obesity measures and intake of dietary fatty acids in adults: Tehran Lipid and Glucose Study. *Journal of human nutrition and dietetics*. 2014;27(52):98–108.
- Flegal KM, Carroll MD, Kit BK, Ogden CL. Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999–2010. *Jama*. 2012;307(5):491–497.
- Kurokawa N, Satoh H. Recent trends of body mass index distribution among school children in Sendai, Japan: Decrease of the prevalence of overweight and obesity, 2003–2009. *Obesity research & clinical practice*. 2011;5(1):e1–e8.
- Farhadian M, Moghimbeigi A, Aliabadi M. Mapping the obesity in Iran by bayesian spatial model. *Iranian journal of public health*. 2013;42(6):581.
- Bahrami H, Sadatsafavi M, Pourshams A, Kamangar F, Nouraei M, Semnani S, et al. Obesity and hypertension in an Iranian cohort study; Iranian women experience higher rates of obesity and hypertension than American women. *BMC public health*. 2006;6(1):158.
- Navadeh S, Sajadi L, Mirzazadeh A, Asgari F, Haghzalil M. Housewives' obesity determinant factors in Iran; national survey-stepwise approach to surveillance. *Iranian journal of public health*. 2011;40(2):87.
- Dinour L, Leung MM, Tripicchio G, Khan S, Yeh MC. The association between marital transitions, body mass index,

- and weight: a review of the literature. *Journal of obesity*. 2012;2012.
35. Harris KM, Lee H, DeLeone FY. Marriage and health in the transition to adulthood: Evidence for African Americans in the Add Health Study. *Journal of Family Issues*. 2010;31(8):1106–1143.
36. Umberson D, Liu H, Powers D. Marital status, marital transitions, and body weight. *Journal of Health and Social Behavior*. 2009;50(3):327–343.
37. Laurier D, Guiguet M, Chau NP, Wells JA, Valleron AJ. Prevalence of obesity: a comparative survey in France, the United Kingdom and the United States. *International journal of obesity and related metabolic disorders: journal of the International Association for the Study of Obesity*. 1992;16(8):565–572.
38. Gutiérrez-Fisac JL, Regidor E, Rodríguez C. Trends in obesity differences by educational level in Spain. *Journal of Clinical Epidemiology*. 1996;49(3):351–354.
39. Cade J, Upmeier H, Calvert C, Greenwood D. Costs of a healthy diet: analysis from the UK Women's Cohort Study. *Public health nutrition*. 1999;2(4):505–512.
40. Dayan YB, Elishkevits K, Grotto I, Goldstein L, Goldberg A, Shvarts S, et al. The prevalence of obesity and associated morbidity among 17-year-old Israeli conscripts. *Public Health*. 2005;119(5):385–389.

