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Prevalence of obesity in Iran and its related socio-economic factors

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Abstract. The goal of this study was to investigate the prevalence of adiposity in a sample of 35–65 years old individuals from Mashhad in North Eastern Iran, and to ascertain the socioeconomic factors contributing to obesity. The MASHAD study was initiated in 2010 and is a longitudinal cohort study of 9765 individuals aged 35–65 years old. It used a stratified cluster randomized sampling design. Anthropometric measurements [height, weight and waist circumference (WC)] were measured by standard methods. The criteria for under-weight, normal-weight, overweight, and obesity were a BMI of 18.5>, 18.5 to 24.9, 25 to 29.9, 30< (kg/m^2), respectively. Abdominal obesity was defined as WC $\geq$102 cm in men and WC $\geq$88 cm in women and obesity was defined as BMI $\geq$30. Logistic regression analysis was used to determine the adjusted odds ratio (OR) and chi-square tests were used to determine whether different categories of demographic and lifestyle variables were associated with different degrees of adiposity. The overall prevalence of obesity and overweight were 30.9% and 42.8% respectively. The overall prevalence of central obesity was 46.7%. The prevalence of obesity in women was higher than in men ($P < 0.0001$). There was an inverse relationship between the risk of obesity and increasing socioeconomic status ($P < 0.0001$). Adiposity is prevalent in Mashhad, and appears to be particularly common in women. This may be due to the high levels of physical inactivity in the population as a whole and among women in particular.

Keywords: Body mass index, central obesity, obesity prevalence, overweight, waist circumference

1. Introduction

According to the World Health Organization (WHO), obesity is now a global epidemic; there are estimated to be 250 million obese people in the world (7% of the adult population). Twenty seven percent of the American adult population is obese, and the prevalence of overweight and obesity for adults, ranges from 15% to 60% globally [1]. Obesity is highly prevalent among the elderly who are particularly a vulnerable group; and its complications may lead to disability and hence a major health concern in this group [2]. The epidemic of obesity has been aggravated by sedentary lifestyles and an increased caloric intake. Adiposity is a major risk factor for many chronic diseases,

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including hypertension, type 2 diabetes mellitus, coronary heart disease (CHD) and stroke [3]. Abdominal obesity is an independent predictor of cardiovascular disease (CVD) morbidity and mortality [4]. Measures of central adiposity such as waist circumference (WC), waist tohip ratio (WHR), waist to height ratio (WHtR), have been proposed to be more accurate predictors of CVD risk and are used in several definitions of metabolic syndromes [5]. The prevalence of obesity varies substantially globally, ranging from 5% in countries such as China, Japan and certain African nations to as high as 75% in urban Samoa [6–8]. Rapid increases in obesity and related comorbidities have occurred in Iran and many other developing countries [9, 10]. Based on a large population-based study in Tehran, 58% and 75% of Iranian middle –aged men and women were reported to be either overweight or obese, respectively [11]. The prevalence of obesity in Mashhad was reported to be 11.7% in 15–65 years old people in 2009 [12]. Whilst the data on the prevalence of obesity are available for some developing countries, few studies have been performed in Iran, so the current study was performed to investigate the prevalence of the different degrees of adiposity and the socioeconomic factors that may contribute to it,using a representative sample of 35–65 year old individuals living in Mashhad in North Eastern Iran.

2. Method and material

2.1. Study design, subjects and sampling techniques

The MASHAD survey [34] started in 2010 and will continue until 2020. Participants were drawn from three areas in the city of Mashhad (in the North Eastern Iran) using a stratified cluster random sampling method. Each area was divided into 9 locations centered upon Mashhad Healthcare Center divisions. Families were identified initially by finding family members who were within the qualifying age range (35 to 65 years). The local authorities were provided with information brochures and were asked to offer these to qualifying families. Community leaders who were acquainted with the families in the community, helped with the identification and enrollment of potential participants. The demographic, anthropometric and lifestyle figures were collected by two expert health care professionals and a nurse and comprised:

1. Standard health examination and anthropometric measures: weight, height, BMI, waist-to-hip ratio (WHR), and blood pressure.
2. A health-related questionnaire comprising a demographic data, physical activity and tobacco usage and use of therapeutic and non-therapeutic drugs.

2.2. Anthropometric measurements and data collection

Height (centimeters) was documented in all individuals without shoes, and weight (kilograms) was measured using electronic weighing scales with participants wearing light clothing. BMI was calculated using weight in kilograms divided by the square of the height in meters. Waist (at the level of the umbilicus) and hip (defined as the widest part of the body below the waist) measurements were also taken, and the WHR was calculated. WC was determined by measuring waist diameter at the level of the midpoint between iliac crest and lower border of tenth rib. For all the antropometrical parameteres the average of three measurements were used. A current smoker was defined as a person smoking cigarettes at least once a day. An ex-smoker was formerly a daily smoker, but someone who currently did not smoke. A non-smoker was defined as an individual who had never smoked previously.

Obesity was defined using WHO criteria in which a BMI 25–29.9 kg/m^2 was regarded as overweight; BMI $\geq$30 kg/m^2 as obesity [9]. Central obesity was assessed on the basis of WC measurements using cut-off values of WC >88 cm for women and WC >102 cm for men [9].

2.3. Data management

Data collected at the field centers were transferred to the central data bank using Microsoft visual studio. NET software which was used for the overall data management in the MASHAD study. The data were kept consistent with standard operating procedures to maintain subject confidentiality.

2.4. Statistical analysis

SPSS software (version 11.5, Chicago, IL, USA) was used for statistical analysis. Kolomogrov-Smirnov test was used to evaluate the normality of data. Baseline demographics and clinical characteristics were compared between groups using independent samples *t*-test, chi-square and/or Fisher's exact test, as appropriate. We used binary logistic regression for determine the association. For all analyses, a *p*-value ≤ 0.01 was considered significant.

3. Results

3.1. Demographic findings

The characteristics of study population who enrolled in the study are shown in Table 1. There were a total of 9775 participants, of whom 40 % were males ($n = 3907$) and 60 % females ($n = 5866$). Moreover, overall, 59 (0.6%)

Table 1
The distribution of demographic characteristics and lifestyle – related factors with respect to gender

Characteristics	Male ($n = 3907$) *n* (%)	Female ($n = 5866$) *n* (%)	Total ($n = 9775$)* *n* (%)
Age (years)			
35–44	1350 (36.2%)	2261 (39.8%)	3611 (38.4%)
45–54	1452 (38.9%)	2286 (40.2)	3738 (39.7%)
55–65	937 (24.9%)	1133 (19.9%)	2064 (21.9%)
Educational attainment			
Illiterate	303 (7.8%)	1010 (17.4%)	1313 (13.65)
Primary level	1306 (33.7%)	2670 (46.1%)	3979 (41.2%)
High school level	1592 (41.1%)	1735 (30.0%)	3327 (34.4%)
College	219 (5.7%)	143 (2.5%)	362 (3.7%)
License	378 (9.8%)	209 (3.6%)	587 (6.0%)
MS(Master of Science)	57 (1.5%)	17 (0.35%)	74 (0.8%)
PhD	15 (0.4%)	5 (0.1%)	20 (0.2%)
Marital status			
Single	19 (0.5%)	40 (0.7%)	59 (0.6%)
Married	3848 (98.7%)	5237 (89.4%)	9085 (93.1%)
Divorced	17 (0.4%)	118 (2.0%)	135 (1.4%)
Widow	14 (0.4%)	462 (7.9%)	476 (4.9%)
Employment status			
Student	10 (0.3%)	11 (0.2%)	21 (0.2%)
Employed	2846 (73.5%)	698 (12.0%)	3544 (36.6%)
Unemployed	319 (8.2%)	4866 (83.6%)	5185 (53.5%)
Retired	696 (18.0%)	247 (4.2%)	943 (9.7%)
Smoking status			
Never smoker	2242 (57.5%)	4442 (75.8%)	6684 (68.5%)
Current smoker	1115 (28.6%)	1046 (17.9%)	2161 (22.1%)
Ex-smoker	543 (13.9%)	371 (6.3%)	914 (9.4%)
Physical activity level (PAL)			
Sedentary	2390 (64.4%)	2973 (53.2%)	5363 (57.7%)
Low active	784 (21.1%)	1498 (26.8%)	2282 (24.5%)
Active	346 (9.3%)	730 (13.1%)	1076 (11.6%)
Very active	193 (5.2%)	388 (6.9%)	581 (6.2%)

*Lack of corresponding of sum of frequencies of subgroups with sample size was due to the missing data. Distribution of demographic characteristics and lifestyle were assessed using crosstab test. *P*-value ≤ 0.01 was considered significant.

were single, 9085 (93.1%) were married, 135 (1.4%) were divorced and 476 (4.9%) were widowed. Among the participants, 303 (7.8%) of men and 1010 (17.4%) of women were illiterate and (17.5%) of men and (8.6%) of women had various levels of university diploma.

Of the male population, 2846 (73.5%) were employed and 696 (18%) were retired. Among the female population, 698 (12.0%) were employed and 247 (4.2%) were retired.

3.2. Smoking status

Among our study participants, 57.5% of men and 75.8% of women were non-smokers. Approximately, 28.6% of men and 17.9% of women were current smokers and 13.9% of men and 6.3% of women were ex-smokers.

3.3. Adiposity

The prevalence rates of obesity and overweight are presented in Table 2. The overall prevalence of obesity and overweight were 30.9% and 42.3% respectively. The overall prevalence rate of central obesity by WHO criteria was 46.7% (women 73.3% and men 20.1%). The rate of obesity in women was approximately two and half times greater than for men. The lowest obesity rates in women and men were 8.7% and 4.5% for the 55–65 year age group, and the highest rates were 16.5% and 7.3 % for the 45–54 year age group, respectively. The prevalence of obesity was consistently higher in women compared with men in all age groups. As shown in Table 2, The overall prevalence

Table 2
The prevalence of obesity and overweight based on the distribution of BMI and central obesity with respect to age and gender

	Age groups (years)			
	35–44 y, *n* (%)	45–54 y, *n* (%)	55–65 y, *n* (%)	Total
Male gender				
Underweight (BMI <18.5)	42 (1.2%)	35 (1.00%)	13 (0.4%)	90 (2.5%)
Normal (18.5≤ BMI <24.9)	490 (13.4%)	472 (12.9%)	284 (7.8%)	1246 (34.1%)
Overweight (25≤ BMI <29.9)	573 (15.7%)	642 (17.6%)	453 (12.4%)	1668 (45.7%)
Obese (BMI ≥30)	216 (5.9%)	267 (7.3%)	163 (4.5%)	646 (17.7%)
Central obesity	210 (5.8%)	298 (8.2%)	218 (6.0%)	726 (20.1%)
Inappropriate WC (WC >102 cm)				
Female gender				
Underweight (BMI <18.5)	16 (0.3%)	17 (0.3%)	10 (0.2%)	43 (0.8%)
Normal (18.5≤ BMI <24.9)	485 (8.7%)	394 (7.1%)	214 (3.8%)	1093 (19.6%)
Overweight (25≤ BMI <29.9)	914 (16.4%)	911 (16.4%)	402 (7.2%)	2227 (40.0%)
Obese (BMI ≥30)	800 (14.4%)	921 (16.5%)	485 (8.7%)	2206 (39.6%)
Central obesity	1477 (26.7%)	1700 (30.8%)	876 (15.95)	4053 (73.4%)
InappropriateWC (WC >88 cm)				

The *P*-value less than 0.01 was considered as statistical significant level. BMI: Body Mass Index, WC: waist circumference.

Table 3
The overall prevalence of obesity and overweight based on the distribution of BMI with respect to age

	Age category				
BMI category k/m^2	30–39 *n* (%)	40–49 *n* (%)	50–59 *n* (%)	60–70 *n* (%)	Total *n* (%)
≤18.5	33 (1.9%)	61 (1.7%)	30 (1%)	10 (1.3%)	134 (1.4%)
18.5–24.9	526 (30.1%)	901 (24.5%)	728 (23.9%)	195 (24.7%)	2350 (25.4%)
25–29.9	738 (42.2%)	1520 (41.4%)	1299 (42.7%)	354 (44.8%)	3911 (42.3%)
≥30	453 (25.9%)	1191 (32.4%)	986 (32.4%)	231 (29.2%)	2861 (30.9%)

Table 4
The estimated crude odds ratio (OR) of the risk of obesity and age adjusted odds ratio with different levels of demographic and lifestyle –related factors with 95% confidence interval (CI) using logistic regression model

Variables	Crude OR (95% CI)	Adjusted age OR (95% CI)
Age (years)		
35–44	1.00	–
45–54	1.19 (1.07–1.31)	–
55–65	1.16 (1.03–1.31)	–
Gender		
Male	1.00 (–)	1.00(–)
Female	3.03 (2.75–3.34)	3.09 (2.79–3.41)
Educational attainment		
Illiterate	1.00	1.00
Primary School level	1.00 (0.09–11.32)	0.98 (0.86–1.13)
High school level	0.78 (0.88–0.89)	0.77 (0.66–0.89)
College	0.63 (0.48–0.83)	0.62 (0.47–0.81)
License	0.34 (0.26–0.44)	0.34 (0.26–0.44)
MS(master of science)	0.42 (0.23–0.77)	0.42 (0.23–0.78)
PhD	0.10 (0.01–0.77)	0.10 (0.01–0.77)
Marital status		
Single	1.00	1.00
Married	2.39 (1.17–4.87)	2.63 (1.24–5.57)
Divorced	2.87 (1.29–6.35)	3.00(1.31–6.90)
Widow	3.47 (1.67–7.24)	3.72 (1.72–8.07)
Smoking status		
Never smoker	1.00	1.00
Ex- smoker	0.83 (0.74–0.92)	0.82 (0.74–0.92)
Current smoker	0.83 (0.71–0.96)	0.79 (0.67–0.93)
Job status		
Student	1.00	1.00
Employment	1.10 (0.37–3.28)	0.94 (0.31–2.88)
Unemployment	2.70 (0.90–8.03)	2.36 (0.76–6.94)
Retired	1.24 (0.41–3.74)	1.01 (0.33–3.54)
Physical activity level (PAL)		
Sedentary	1.00	1.00
Low active	0.32 (0.28–0.36)	0.32 (0.28–0.36)
Active	0.38 (0.33–0.45)	0.39 (0.33–0.46)
Very active	0.35 (0.28–43)	0.35 (0.28–0.44)

Logistic regression analysis were used to estimate the crude and age-adjusted odds ratio (OR) of obesity and central obesity risks for different levels of demographic and lifestyle factors. The 95% confidence interval of OR. The *P*-value less than 0.01 was considered as statistical significant level.

of obesity and overweight based on distribution of BMI with respected to age, is shown in Table 4, in which the estimated OR (with 95% CI) of obesity are also presented. With respect to results derived from the logistic regression model compared with the group aged 35–44 years, the OR increased to 1.19 and 1.16 for the 45–54 and 55–65 year age groups respectively, and all the results were significant. The age-adjusted OR for female subjects was 3.03 times higher than male subjects ($P < 0.0001$). There was a statistical significant inverse relationship between the presence of obesity and the levels of educational attainment. Married status was associated with an increased risk of obesity as the adjusted OR increased significantly compare to single status and the risk of obesity increased in married, divorced and widowed status in both men and women ($P < 0.0001$).

Table 5
The prevalence of obesity with different levels of demographic and lifestyle variables

Variables	BMI				
BMI category (k/m^2)	<18.5	18.5≤ BMI <24.9	25≤ BMI <29.9	≥30	*P* value*
	n (%)	*n* (%)	*n* (%)	*n* (%)	
Educational attainment					
Illiterate	21 (1.6%)	335 (26.1%)	488 (38%)	440 (34.3%)	
Primary School level	65 (1.7%)	960 (24.6%)	1538 (39.4%)	1339 (34.3%)	$P<0.001$
High school level	39 (1.2%)	795 (24.4%)	1484 (45.6%)	939 (28.8%)	
College	5 (1.4%)	109 (30.9%)	151 (42.8%)	88 (24.9%)	
License	4 (0.7%)	196 (35.3%)	272 (48.9%)	84 (15.1%)	
MS(master of science)	2 (0.7%)	20 (25%)	47 (55.6%)	17 (18.1%)	
PhD	1 (5%)	5 (25%)	13 (65%)	1 (5%)	
Smoking status					
Never smoker	67 (1.0%)	1563 (23.9%)	2821 (43.1%)	2095 (32.0%)	$P<0.001$
Current smoker	56 (2.6%)	641 (30.3%)	823 (38.9%)	594 (28.1%)	
Ex-smoker	15 (1.7%)	235 (26.3%)	393 (43.9%)	252 (28.2%)	
Marital statue					
Single	2 (3.4%)	20 (33.9%)	28 (47.5%)	9 (15.3%)	
Married	132 (1.5%)	2297 (25.8%)	3758 (42.3%)	2703 (30.4%)	$P<0.001$
Divorced	1 (0.7%)	41 (30.4%)	47 (34.8%)	46 (34.1%)	
Widow	3 (0.6%)	81 (17.3%)	202 (43.3%)	181 (38.8%)	
Job status					
Student	1 (4.8%)	2 (9.5%)	14 (66.7%)	4 (19%)	
Employment	72 (2.1%)	1156 (33.4%)	1517 (43.8%)	721 (20.8%)	$P<0.001$
Unemployment	51 (1%)	1024 (20.1%)	2018 (39.7%)	1991 (39.2%)	
Retired	12 (1.3%)	240 (26.1%)	455 (49.6%)	211 (23%)	
Gender					
Male	93 (2.4%)	1315 (34.5%)	1734 (45.4%)	675 (17.7%)	$P<0.001$
Female	46 (0.8%)	1127 (19.6%)	2306 (40.1%)	2267 (39.5%)	
Physical activity level (PAL)					
Sedentary	10 (0.2%)	834 (15.8%)	2354 (44.6%)	2079 (39.4%)	$P<0.001$
Low active	49 (2.2%)	859 (38.4%)	942 (42.1%)	387 (17.3%)	
Active	48 (4.6%)	394 (37.4%)	399 (37.9%)	213 (20.2%)	
Very active	20 (3.6%)	215 (38.9%)	214 (38.8%)	103 (18.7%)	

Chi-square test were used for comparing socio economic factors between age groups. *The chi-square *P*-value less than 0.01 was considered as statistical significant level. BMI: body mass index.

In contrast, there was an inverse relationship between the smoking status and risk of obesity as the risk of obesity decreased in ex-smoker and current smoker respectively (adjusted OR = 0.82, CI: 0.74–0.92, OR = 0.79, CI: 0.67–0.93, $P<0.0001$). Similarly there was an inverse relationship between employment status and the risk of obesity; the risk of obesity was higher in those who were unemployed (adjusted OR = 2.36, CI = 0.76–6.96) though the results did not attain statistical significance. The prevalence of obesity fell with increasing physical activity; obesity was reduced by 61% and 65% in subjects with active and very active life-styles, respectively (OR = 0.39, CI = 0.33–0.46 and OR = 0.35, CI = 0.28–0.44). Table 5 shows the prevalence of different degrees of adiposityin relation to the different categories of demographic and lifestyle variables. A χ-square test was used to assess the relationship between degrees of adiposity and various variables (education, gender, employment, marital status and smoking). Thirty eight percent of illiterate persons were overweight and 34% of individuals who were educated to primary school level were obese.

Forty three percent of subjects who had never smoked were overweight and 39% of those who were unemployed were obese. Of those individuals who reported a sedentary life style, 39% and 44.6% of subjects were obese and

Table 6
The prevalence of central obesity with different levels of smoking statue using

	Smoke status				*P-value
	Never smoker *n* (%)	Ex-smoker *n* (%)	Current smoker *n* (%)	Total *n* (%)	
Male					
WC <102 cm	1715 (79.1%)	388 (74.0%)	908 (83.5%)	3011 (79.7%)	$P<0.001$
≥102 cm	452 (20.9%)	136 (26.0%)	179 (16.5%)	767 (20.3%)	
Female					
WC <88 cm	1213 (28.1%)	79 (22.1%)	216 (21.1%)	1508 (26.5%)	
≥88 cm	3103 (71.9%)	279 (77.9%)	808 (78.9%)	4190 (73.5%)	

*Chi -square test. WC: waist circumference.

overweight respectively ($p<0.001$). Table 6 shows the prevalence of central obesity with different categories of smoking status; 78.9% of females who were smokers were also centrally obese ($P<0.001$) but this relationship was not significant in men.

4. Discussion

4.1. Trend in adiposity

Our findings confirm the increase in prevalence of obesity and overweight of about 2.5 fold since the report of a similar study in 2009 [12]. Both obesity and central obesity were more prevalent in women than men with an age adjusted OR of 2.03 and 3.03 for men and female gender respectively. Iranian women may have less physical activity than men because of their limited participation in outdoor activities due to specific climatic and social constraints. With respect to results derived from logistic regression analysis, risk factors for obesity and central obesity were similar. Increasing age, lack of exercise or sedentary lifestyle, unemployed status, residence in urban areas and low levels of educational attainment were the major factors contributing to both obesity and central obesity in women and men in the north east of Iran, which is similar to others reports [12, 13]. The results of the present study are different to the results reported from other geographical areas of Iran. In a study of a representative sample of Tehranian adults, obesity and central obesity were higher in women than in men; 67% vs. 29% for obesity and 93% vs. 74.1% for central obesity, respectively [14] Our result show a lower prevalence of obesity and overweight compared to the latter study. The prevalence of obesity in other parts of the world varies as shown in Table 7. The prevalence of obesity in some countries (Spain, Mexico and Saudi Arabia) is similar to those in Mashhad [15–17]. Mirzazadeh et al. have

Table 7
Worldwide prevalence of obesity and overweight

Author	Publication date	Country	Sample size			Obesity prevalence %			Overweight prevalence %			Age
			Total	Male	Female	Total	Male	Female	Total	Male	Female	
Iseriet et al. [28]	2007	Turkey	4205	2263	1942	16–56%	–	–	–	–	–	20–85
XI et al. [29]	1993–2009	China	52621	–	–	–	2.9–11.4	5–10.1%	–	8–17.1%	10.7–14.4	–
Asreddine et al. [30]	2009	Lebanon	3636	1720	1916	28.2%	27.4%	28.8%	–	–	–	6–60
Al-Nozha et al. [17]	2005	Saudi	17232	–	–	35.6%	26.4%	44%	36.9%	42.4%	31.8%	30–70
Diouf et al. [31]	1997–2006	France	20000	–	–	10–15%	–	–	–	–	–	>15
Fisac et al. [15]	2008–2010	Spain	12883	–	–	22.9%	24.4%	21.4%	–	–	–	>18
Chu et al. [32]	2005	Taiwan	–	–	–	–	15.9%	10.7%	–	–	–	–
Ducharm et al. [33]	2005	Canada	–	–	–	15%	–	–	33%	–	–	>18
Cruz et al. [16]	2013	Mexico	–	–	–	30%	–	–	–	–	–	–

Table 8
Trend of obesity and overweight prevalence in Mashhad, Iran

Author	Survey year	Sample size			Obesity prevalence %			Overweight prevalence %			Age
		Male	Female	Total	Male	Female	Total	Male	Female	Total	
Esmaeily et al.	2009	2481	2496	4977	7.8	19.7	13.8	27.7	30.5	29.1	15–65
Nematy et al.	2009	917	1045	1962	7.3	15.5	11.7	26.5	31.2	28.9	>60
Ghayour et al.	2013	3907	5866	9775	17.5	39.5	30.9	45.6	40.15	42.3	30–65

reported the trend of obesity from 1990–2010 in Iran. They have found that the prevalence of obesity from 1990–2005 increased from 4.3% to 21.3%, but was 14.1% in 2010 [18]. Data from Mashhad shows an increasing trend in obesity and overweight from 2009 [2, 12]. The prevalence of obesity in men and women in the USA reported as 35.5% and 35.8% respectively in 2010. There has been a trend to an increase in the prevalence of obesity in USA since 2002 and it is predicted that the prevalence of obesity, overweight, and extreme obesity will plateau by about 2030 at 28%, 32%, and 9%, respectively [19–21]. Modeled trends from more than 200 countries (1980–2008) indicate steadily increasing prevalence of obesity in every region of the world, including most low and middle income countries, with the steepest increases in higher income countries [22] as exemplified by Iran. Two studies conducted in Mashhad to measure the prevalence of obesity are summarized in Table 8.

4.2. Socio-economic status

Socio-economic status is a complex construct, comprising income, educational attainment, occupation and residential status. This study showed an inverse relation between measures of socio-economic status and obesity that is similar to the results of the study reported in 2009 by Esmaeily. Education may play a role in spreading the awareness about obesity through its impact on knowledge acquisition by individuals about diet, physical activity and their consequences on health status [23]. Similar to other studies [24, 25] the risk of obesity increased with age, with the 45–54 years age group being most at risk of obesity. The frequency of overweight and obesity were found to be higher among individuals who were, or had been, married than among single persons after adjustment for other confounders (OR = 2.39, CI = 1.17–4.87); individuals (particularly men), may have less physical activity, change their dietary pattern, after marriage; these results are similar to those reported by Janghorbani and colleagues [13]. We found that 64.4% and 53.3% of men and women respectively had a sedentary life style and only 14.5% and 20% of men and women respectively were either active or very active. Current smoking rates among men and women were 28.6% and 17.9%, respectively, and this may contribute to the differences in prevalence of obesity and overweight between men and women. A high proportion of the men in this study were smokers, and smoking habit was inversely related to weight, and significantly related to central obesity in women. The inverse association seen between smoking and obesity should not be used to counteract the efforts undertaken against this habit. There is a general belief that smoking may decrease bodyweight by reducing appetite and therefore caloric intake, enhancing metabolism, and reducing fat accumulation [26]. In one previous study weight gain was observed in current smokers as well as ex-smokers and non-smokers, suggesting that the factors promoting weight gain were overcoming the inverse effect of smoking [27].

This current study had several limitations, one of which was that the subjects below 35 years and over 65 years were not included because of financial constraints.

5. Conclusions

Adiposity is common in Mashhad, a city in the north east of Iran, and appears to be particularly so among women. Its prevalence appears to be rising when compared with previous reports from population samples in Iran. This may be due to the high levels of physical inactivity. Furthermore, some socio-economic factors and smoking habit were strongly related to the presence of obesity.

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Conflict of interest

None.

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