

Prevalence and correlates of obesity among older adults

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Abstract: **Background:** Obesity has been called the disease of the twenty-first century. There are more than 1 billion overweight people ($BMI \geq 25$) in the world. Of those, approximately 350 million are obese ($BMI \geq 30.0$). The prevalence of obesity is also increasing in older populations throughout the world. The prevalence of obesity among elderly people in industrialized countries estimates suggest ranging from 15% to over 30%. In Iran, as of 2008, 6.3% of the population is obese. Overweight was more among women (39.5%) than men (24.5%). The prevalence of obesity is also increasing in older populations throughout the world. **Method:** This study is a cross sectional study. Participants included 2200 women and 2180 men aged 50-75 years. The logistic regression was applied to model the relationship between the odds of obesity and age, gender marital status, educational level, alcohol consumption and smoking. **Results:** Obesity odds ratios were 2.16 (95% CI: 1.71-2.72) for women, 0.68 (95% CI: 0.47-0.97) for smokers and 1.96 (95% CI: 1.53-2.52) for the subjects with alcohol consumption. Regarding the people aged 50-55 years as the reference group, the obesity odds ratios were 0.86 (95% CI: 0.66-1.10) for ages 56-60 years, 0.75 (95% CI: 0.57-0.97) for ages 61-65 years, 0.43 (95% CI: 0.30-0.60) for ages 66-70 years and 0.36 (95% CI: 0.20-0.63) for ages 71-75 years. Using the High school degree or below as the reference group of education level, obesity odds ratios were 1.38 (95% CI: 1.08-1.76) for the diploma level and 0.92 (95% CI: 0.56-1.52) for the B.Sc ad B.A degree and higher level group. **Conclusion:** Using High school degree or below as the reference group of educational level, Obesity odds ratios for the diploma level, and B.Sc ad B.A degree and higher level groups were 1.38 and 0.93, respectively. The findings show that in Iran people gain weight up to age of around 50-60 years old and after that BMI tends to decrease. Our results on the association between age and obesity. In our study, obesity was strongly associated with alcohol consumption. Compared to non consumer elderly subjects, consumer elderly subjects were twice as likely to be obese. The environment can influence access to healthy food, lifestyle behaviors such as the trend toward 'eating out', lack of sidewalks and accessible recreation areas. To avoid strong declines in the quality of life due to population ageing, and to ensure sustainability of the health care system, reductions in the burden of disability among elderly populations are urgently needed. Therefore, a community-based multiple strategies are required to combat with increasing rate of obesity and its subsequent complications such as diabetes hypertension and cardiovascular disease, osteoarthritis.

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Introduction

Obesity has been called the disease of the twenty-first century. There are more than 1 billion overweight people ($BMI \geq 25$) in the world [1]. Of those, approximately 350 million are obese ($BMI \geq 30.0$) [1]. The prevalence of obesity is also increasing in older populations throughout the world [2]. The prevalence of obesity among elderly people in industrialized countries estimates suggest ranging from 15% to over 30% [3, 4]. In Iran, as of 2008, 6.3% of the population is obese. Overweight was more among women (39.5%) than men (24.5%) [5].

Obesity has been linked to genetic factors as it seems to run families. However, the contribution of environmental factors cannot be ruled out in familial obesity. Such families may share dietary and lifestyle habits predisposing to obesity [1]. Environmental factors such as diet and the level of physical activity strongly influence obesity [1].

Obesity has been reported to be a risk factor for cardiovascular diseases, diabetes, hypertension, some cancers and also some other diseases [6,20]. In general, obesity is related to morbidity, mortality as well as poor quality of life [21]. Although some

studies showed that the impact of obesity on mortality may have decreased over time [22]. Obese elderly people are more likely to become disabled than elderly people at a normal weight [23].

Obesity has been linked to a variety of factors. Himes [24] found that older men are less likely than older women to be obese but Kaplan [25] found that older men are more likely to be obese. Although some studies showed that the prevalence of obesity is going up in all age groups, including older people [26]. Another study suggested that in industrialized countries, people gain weight up to age of 50-60 and then BMI tends to decrease [27]. Flegal and colleagues have also found that the prevalence of obesity increases from 20 to 60 years of age and decreases after the age of 60 [28]. It has been shown that prevalence of obesity increases with age. The association of obesity and age can be explained, in part, by a decrease in the degree of physical activity with age in both men and women [29]. On the other hand, a decrease in metabolism with age, particularly in women after menopause is another reported explanation [30]. Indeed, globally, women have higher rates of obesity than men [31]. Other risk factors positively associated with obesity include marriage, high educational level, alcohol use and high socio-economic status [29, 33].

Another predictor for obesity in elderly people is marital status which has been analyzed in some studies but the findings are not consistent [24, 25].

Himes found that an inverse relationship between educational level and obesity [24] and Kaplan et al. showed lower education as a factor which was associated with obesity in both genders [25].

The association of obesity in elderly people with smoking has been analyzed in some studies. An inverse association between smoking and obesity was observed in both genders [34] but not meaningful for men [25].

The association of obesity in elderly people with alcohol consumption has been analyzed in some studies. Tolstrup et al. showed drinking pattern may be associated with development of abdominal obesity; in this prospective study, drinking frequency was inversely associated with major waist gain and was unassociated with major waist loss [32].

In Iran, it is commonly believed that overweight and obese people are lazy and gluttonous and they lack self-control. A considerable number of obese people do not go out in public due to the fact that public facilities are very poor comfort levels. For example, the seats in the cinemas are too small for the subject population. Obese people are also more likely to lose the benefits of exercise, which may

cause gaining further additional weight. They often feel inferior to others due to the fact that many people would not socialize with an obese person. In Some cases, it is believed that an obese person is taking up more space than he or she should and a job is often refused because of their weights. Until recently, no studies of the association between factors related to obesity have been carried out in a representative sample of the Iranian elderly population. Thus, it is time to invest more to address the issue and the factors related to obesity of the elderly people in this country. According to effect of obesity is an undesirable outcome of changing of lifestyle and behaviors. It is also reversible predisposing factor for the development of several debilitating diseases, this study aimed at determining the prevalence of obesity based on age, sex, marital status, education level, smoking and alcohol consumption among a sample of Iranian men and women elderly population aged 50-75 years.

Method:

This was a cross sectional study conducted in a sample of 2200 women and 2180 men with population aged between 50-75 years whom living in province of Tehran, Iran. They were randomly chosen by cluster sampling. The study protocol was submitted to the university ethics committee and written informed consent was obtained from all participating patients. This study has been approved by the Ethic Committee of the University of Tehran Medical Sciences. All participants gave their written informed consent to participate in the study.

Variables:

Height and weight and BMI: Height and weight of the sample population were measured. BMI (Body Mass Index) was calculated as weight in kilograms divided by the square of the height in meters (kg/m^2). Subjects were also classified into obese ($\text{BMI} \geq 30 \text{ kg}/\text{m}^2$) and non-obese ($\text{BMI} < 30 \text{ kg}/\text{m}^2$).

Independent variable:

Age: Information about the respondents' age was based on their self-reported birth year. Participants into five age groups (50-55, 56-60, 61-65, 66-70 and 71-75 years).

Marital status: Participants who lived with their spouse was coded 0 (married), versus others single -widowed -divorced who lived without spouse were coded as 1 (single -widowed -divorced).

Educational level: Educational level was defined as the total number of years of education. The respondents were categorized into three groups: those with high school degree and below (low level), diploma degree (Medium level) or B.Sc ad B.A degree and higher (high level) education levels.

Smoking status: Smoking status was dichotomized into smokers versus non-smokers.

Alcohol consumption: Alcohol consumption dichotomized into consumer or non-consumer.

History of diseases: The respondents were grouped according to some health issues including diabetes, high blood pressure, asthma, arthritis and mental diseases.

Statistical analysis

The distribution of independent variables and BMI groups were tested with χ^2 -test. The logistic regression was applied to model the relationship between the odds of an obesity and age, gender, marital status and the educational level, smoking and alcohol consumption. All independent variables were entered into a logistic model simultaneously to assess the predictive ability of each variable while controlling for all other variables. All 2-way interaction terms were dropped from the model because they were not statistically significant.

The results are presented as the odds ratios and their 95% confidence intervals (CI). The Hosmer and Lemeshow test was used in this model to evaluate the significance of improved port with introduction of additional variables. All analyses

were carried out by using the SPSS software Package, version 15.

Results

Among 4380 (2200 women and 2180 men) older adult subjects aged 50-75 years, the mean BMI were ($n = 2545$) 25.28 kg/m² ($SD = 4.54$) for females and ($n = 1835$) 23.15 kg/m² ($SD = 4.23$) for males. The mean BMI for older adults with alcohol consumption was 25.13 kg/m² ($SD = 4.96$) and for older adults with non alcohol consumption was 23.64 kg/m² ($SD = 3.92$).

Overall, 11.2% of respondents were classified as obese. Table 1 displays the prevalence of obesity within categories of the independent variables by using χ^2 -test. There were statistically significant differences between genders, age groups, marital status, smokers and non-smokers, alcohol consumer and non alcohol consumer. Participants were single - widowed -divorced more obese. The prevalence of obesity was higher among older adults who had diabetes, high blood pressure, cardiovascular diseases, asthma or arthritis diseases.

Table 1: The prevalence of obesity risk factors in a random sample among 4380 male and females Iranian older adults aged between 50-75 years

Variable		Frequency of obesity	Percent of obesity	P-value
Gender	Male	120	6.5	
	Female	371	14.6	< 0.001
Age	50-55	182	14.1	
	56-60	128	12.3	
	61-65	117	11.4	< 0.001
	66-70	49	6.5	
	70-75	15	5.6	
Marital status	married	335	10.6	= 0.036
	single -Widowed -divorced	156	12.8	
Educational level	High school degree or below	342	10.7	
	Diploma degree	128	13.2	= 0.079
	B.Sc ad B.A degree and higher	21	9.9	
Smoking	Smoker	39	5.9	< 0.001
	Non smoker	452	12.2	
Alcohol consumption	Consumer	341	15.5	< 0.001
	Non consumer	150	6.9	
History of disease	Diabetes	Yes	23.5	< 0.001
		No	10	
	High blood pressure	Yes	18.2	< 0.001
		No	8.4	
	Cardiovascular diseases	Yes	14.6	< 0.001
		No	7.5	
	Asthma	Yes	11.2	= 0.098
		No	11.2	
	Arthritis	Yes	16.9	
		No	10.9	= 0.006

Turning to the logistic regression analysis, Table 2 summarizes the adjusted odds ratios and their 95% CI's. Using 50-55 years as the reference group, the obesity odds ratios for age groups 50-55 were

0.86 (95% CI: 0.66-1.10), for ages 56-60 years, 0.75 (95% CI: 0.57-0.97) for ages 61-65 years, 0.43 (95% CI: 0.30-0.60) for ages 66-70 years and 0.36 (95% CI: 0.20-0.63) for ages 71-75 years.

Table 2: Adjusted^a odds ratios for obesity^b risk factors in a random sample among 4380 male and females Iranian older adults aged between 50-75 years in the logistic analysis

Variable		OR ^c	95% CI ^d
Gender	Male	1.00	
	Female	2.16	1.71-2.72
Age	50-55	1.00	
	56-60	0.86	0.66-1.10
	61-65	0.75	0.57-0.97
	66-70	0.43	0.30-0.60
	70-75	0.36	0.20-0.63
Marital status	married	1.17	0.92-1.48
	single -Widowed -divorced	1.00	
Educational level	High school degree or below	1.00	
	Diploma degree	1.38	1.08-1.76
	B.Sc ad B.A degree and higher	0.92	
Smoking	Smoker	0.68	0.47-0.97
	Non smoker	1.00	0.56-1.52
Alcohol consumption	Consumer	1.96	1.53-2.52
	Non consumer	1.00	

In general, Women were more obese. The obesity odds ratio was 2.16 (95% CI: 1.71-2.72) for women.

An association was observed between alcohol consumption and obesity. The obesity odds ratio was 1.96 (95% CI: 1.53-2.52) for consumer participants.

An association was observed between marital status and obesity (but non-significant). Obesity odds ratio was 1.17 (95% CI: 0.92-1.48) for married older adults.

Using High school degree or below as the reference group of educational level, obesity odds ratios for the diploma level was 1.38 (95% CI: 1.08-1.76), and B.Sc ad B.A degree and higher level group was 0.92 (95% CI: 0.56- 1.52).

Results indicated a statistically significant inverse association between smoking and obesity. For smoker participants, the adjusted odds ratio was 0.68 (95% CI: 0.47-0.97).

Discussion

This cross-sectional study provided findings regarding the possible associations of some factors with obesity in older adults after the age of 50. Using 50-55 years as the reference group, the obesity odds ratios for age groups 50-55 were 0.86 (95% CI: 0.66-1.10), for ages 56-60 years, 0.75 (95% CI: 0.57-0.97) for ages 61-65 years, 0.43 (95% CI: 0.30-0.60) for ages 66-70 years and 0.36 (95% CI: 0.20-0.63) for ages 71-75 years respectively. Obesity odds ratios

were 2.16 for women, 0.68 for smokers, and 1.96 for alcohol consumer elder people. Using High school degree or below as the reference group of educational level, Obesity odds ratios for the diploma level, and B.Sc ad B.A degree and higher level groups were 1.38 and 0.93, respectively. Some of our results are consistent with other studies. Overall, 11.2% of respondents were obese. The prevalence of obesity in older adult population varies enormously among countries. This prevalence in some Asian and African populations is 0% and in some industrial countries is more than 30% [3, 4, 39].

The findings show that in Iran people gain weight up to age of around 50-60 years old and after that BMI tends to decrease. Our results on the association between age and obesity are basically in line with some studies [3, 25, 27, 28]. To gain a higher view of the relationship between obesity and age in older people, we have to understand the changes in food intake, energy expenditure, appetite and body composition (that occurs along with ageing) is inevitable. With aging, come bone and muscle losses that influence the body composition. After the age of 30, fat mass increases; whereas fat-free mass (FFM) progressively decreases. FFM (primarily skeletal muscle) decreases by up to 40% from age of 20 to 70 [26, 40-42].

Maximal FFM is usually reached at age of 20-30 years, and maximal fat mass is usually reached at age of 60-70. After that, both fat measures

subsequently decline [26, 40, 41]. Therefore, both decrease during old age.

In our present report, women were more likely by 96% to be obese. Elderly women tend to have higher prevalence of obesity than elderly men in most of the Latin American countries [43-45]. Regarding gender, our results are basically in line with these studies.

In our study, obesity was strongly associated with alcohol consumption. Compared to non consumer elderly subjects, consumer elderly subjects were twice as likely to be obese. The environment can influence access to healthy food, lifestyle behaviors such as the trend toward 'eating out', lack of sidewalks and accessible recreation areas. To avoid strong declines in the quality of life due to population ageing, and to ensure sustainability of the health care system, reductions in the burden of disability among elderly populations are urgently needed. Life style interventions may help to reduce the years lived with one or more disabilities, but it is not fully understood which life style factor has the largest potential for such reductions. In a cohort study, Tolstrup et al. showed drinking pattern may be associated with development of abdominal obesity; in this prospective study, drinking frequency was inversely associated with major waist gain and was unassociated with major waist loss [32]. Klijns et al. found that Compared with smoking and drinking alcohol, obesity is most strongly associated with an increased risk of spending many years of life with disability. Although employing information on the relation of disability with time to death improves the precision of Sullivan life table estimates, the relative importance of risk factors remained unchanged [46]. Ryu et al. study showed that a high alcohol intake was related to high waist circumference. Such association remained independently even after adjustment for smoking, which is strongly related to abdominal obesity [47].

The finding in the current research agrees with the observations by Gutierrez et al, [48] in some countries in Latin America and a population study conducted in Canada on the relationship between obesity and geographical region [25].

The results in our study suggested an inverse association between smoking and obesity. The inverse association seen between smoking and obesity should not be used to counteract the efforts undertaken against this habit, although smokers often report that they smoke to control their weight. Biological mechanisms as well as psychological factors may be involved. Smoking decreases appetite. Mineur et al showed that nicotine-induced, that reduces appetite, is due to hypothalamic melanocortin system [49]. Gonseth et al found that some tobacco companies had added some substances into their cigarette in order to

reduce smokers' appetite [50]. An increase of energy expenditure while smoking, both in resting and in light physical activity conditions, may relate to lower prevalence of obesity in smokers. Our results are consistent with the findings of some studies [25, 34].

Although we did not find a significant association between marriage and obesity, Iranian elderly people who lived with their spouse (married) were more likely to be obese than their single -widowed -divorced who didn't live with their spouse counterparts. Kaplan et al. found that marriage was positively associated with obesity among older adult women but not men [25]. No evidence was found for an association between obesity and marital status in Taiwanese elderly people [51].

Using High school degree or below as the reference group of educational level, our results showed that diploma degree educational level was associated with a higher likelihood for obesity. The inverse relationships between education status and obesity exist in some societies [3, 25].

It is not a straightforward matter to compare those results with ours, due to the different study designs, time spans, regions, and methods of analysis. Our results are consistent with some studies in developing countries [51].

Our results are subjected to some limitations. This study is a cross-sectional study, which means that the direction of these associations cannot be conclusively determined and a causal relationship cannot be inferred but this should be confirmed by further longitudinal studies. We were not able to consider all of the risk factors that may be related to obesity. Income, eating behavior and physical activity were not used in our investigation. The consumption of alcohol is prohibited in Iran. Therefore we had no information on alcohol consumption. However, our study had several strengths. It was performed in a nationally representative sample of the Iranian older adults. To our knowledge, this is the first study that had a sample size sufficient to study factors related to obesity in older adults. This study included men and women aged 60 and over and our findings could be generalized to other people. Height and weight were actually measured rather than self-reported. It is well known that self-reports underestimate the prevalence of obesity [52, 53].

Conclusion

As the result of findings, we are optimistic that we would be able to contribute to the aged community of the society, which could be achieved by means of better treatments and reductions in the rate of obesity.

Competing interests

The author declares that they have no competing interests.

Authors' contributions

EB and KM originated the idea for this study, did the research proposal, data analysis and prepared the manuscript. AB co-ordinated the research project, while BS helped and edited the final as the physiology consultant. All authors read and approved the final manuscript.

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