Overweight, Obesity, and Its Associated Factors in Adult Women Referring to Health Centers in Shiraz in 2013-2014

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ABSTRACT

Background: Obesity is one of the major health problems in the world; in this regard Iran is not an exception. The present study was conducted to investigate the overweight, obesity, and its related factors in adult women who referred to health centers in Shiraz, Iran. **Methods:** In this cross-sectional study, 240 women who referred to health centers and aged 18-65 years old were selected through multi-stage random sampling, in 2013-2014. Height, weight, as well as waist and hip circumferences were measured, participants' body mass index (BMI) and waist to hip ratio (WHR) were also calculated. The questionnaire of demographic factors, physical activity, and food frequency were completed. **Results:** The prevalence of overweight and obesity based on BMI was 29.2% and 13.8%, respectively. The mean of WHR was 0.89 ± 0.06 and based on this index, 79.2% of the participants had visceral obesity. There was a direct correlation between BMI and age, number of children, labor, energy, and fat intake. However, the correlation between BMI and physical activity, age of marriage, and protein intake was inverse ($P < 0.05$). No meaningful correlation was found between BMI and marital status, occupation, education level, income level, metropolitan area, smoking, and history of parental obesity. Based on logistic regression modeling, menopause, high energy intake, and low physical activity were associated factors of overweight and obesity ($P < 0.05$). **Conclusions:** Generally, despite extensive programs of public education, there is an alarming prevalence rate of both generalized as well as central overweight and obesity in the present study.

Keywords: *Overweight; Obesity; Women; Shiraz*

Introduction

Obesity is the most common nutritional disorder that has emerged as a public health problem throughout the world (Caballero B, 2005).

According to the World Health Organization (WHO), there will be about 2.3 billion overweight people aged 15 years and above and over 700 million obese people worldwide in 2015 (WHO,

2013). Iran, like many other developing countries, is experiencing epidemics of obesity and its adverse effects (Mohammadi N, 2012). Previous studies indicated that mortality rate and significant reduction in life expectancy increase with increasing degrees of overweight and obesity (Serdula MK, 1993; Kelishadi R, 2003). Obesity and overweight lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides (TG), insulin resistance, risk of coronary heart diseases, ischemic stroke, and type 2 diabetes, there are also a number of cancers which increase steadily with increase of the body mass index (BMI) (Sanchez-Villegas A, 2003; Priya D).

Findings of several studies in Iran have shown that women had roughly 10 to 15% obesity prevalence more than men of the same age group (Bahrami H, 2006). On the other hand, major complications of obesity in women are mostly associated with intra-abdominal fat or visceral obesity. Surprisingly, it has been reported that 67% of women older than 20 years are centrally obese in Iran (Azadbakht and Esmaillzadeh, 2007). Visceral fat accumulation is strongly related to increase in the risk of various metabolic disorders such as the metabolic syndrome and polycystic ovary syndrome (PCOs) (Morris E, 2010).

Obese women are particularly susceptible to have a higher risk of low back pain and knee osteoarthritis. Moreover, the risks of multiple cancers, including breast, endometrial, cervical, and ovarian cancer are higher in them (Li X, 2010; Li X, 2010).

Numerous factors may be related to obesity in both men and women which include age, gender, ethnicity, education, socio-economic status, physical activity level, family history of obesity, dietary habits, smoking, and alcohol consumption (Li M, 2006;Kulie T, 2011) . Recognition of the associated factors of obesity and the policy on how to deal with it can effectively reduce the burden of chronic diseases and the cost of treatment programs and financial burdens (Nuri R, 2012;Maddah M, 2012). The study of nutritional, behavioral, and socio-economic factors associated with obesity in high-risk subgroup of populations makes it easy to focus

on limited resources for intervention (Farbakhsh F, 2007). So, given the importance of women's role in breeding a healthy family and generation, the present study was carried out to investigate the associated factors of overweight and obesity in adult women referring to health centers in Shiraz.

Materials and Methods

Study design and participants: In this cross-sectional study, 240 women aged 18-65 years old, who referred to medical health centers, were selected through multistage random sampling. Initially, by considering lists of health centers existing in 7 metropolitan areas of Shiraz city and then by taking into account the population density of each area, one center in each area was selected. In the second stage, samples were selected randomly from each center. The sample size was estimated according to Nuri et al. 's (Nuri R, 2012) study in which the following formula was applied:

$$Cr = \frac{1}{2} Ln \; 1 + r / 1 - r$$
$$r = 0.18$$
$$Z \; 1 - \alpha/2 = 1.96 \quad (95\%)$$
$$Z1 - \beta = 0.84 \quad (80\%)$$

Measurements: This study was approved by the ethics committee of Shiraz University of Medical Sciences. All participants were recruited from different Shiraz health centers and written consent was obtained from them. All healthy women aged between 18-60 years could participate in this study. Women with endocrine or metabolic disease and pregnant women were excluded and replaced with another sample. Participants' anthropometric factors (height, weight, waist, and hip circumferences) were measured by standard methods. Height was measured in standing position using Seca (Deutschland, Germany, Hamburg) scales; participants were supposed to lean against the wall without shoes, so that their shoulders, hip, head, and heels were in contact with the wall. Weight was measured using digital scales (measurement accuracy of 100g) while participants were in light clothing and without shoes. Waist circumference (WC) was also measured at standing position from midway between the lower rib margin and iliac crest.

Additionally, hip circumference was measured at the largest circumference, with light clothing, using an outstretched tape meter to the nearest 0.5 cm. Then, BMI was calculated by dividing weight in kilograms by the square of height in meters to evaluate the overall obesity. Overweight and obesity were defined as $25 \leq BMI \leq 29.9$ and $BMI \geq 30$, respectively (WHO, 2000). Waist to hip ratio (WHR) was computed as WC divided by hip circumference and central obesity was defined as $WHR \geq 0.85$ (Heshmat R, 2004).

Data were collected by trained dietitians during a structured interview, using pre-tested questionnaires. Data on age, marital status, age of marriage, occupation (housewife, student, employee, or retired), education level (illiterate, less than diploma, diploma, bachelor, and above), number of children and pregnancy (0 to 3 or above), family income per month (less than 5 million Rials (One US dollar equivalent of about 30,000 Rials), 5 million to 10 million Rials, 10 to 20 million Rials, 20 million Rials and above), metropolitan area (1 to 7), history of addiction to smoking (yes/no), menopause status, history of obesity in family or childhood (yes/no), and sleep duration, were collected using the multivariable questionnaire, according to their self-reports through face to face interviews.

Physical activity level was then measured by Beacke physical activity questionnaire, on 3 levels of activity: at work, sport, and leisure time (Baecke JA, 1982). The total physical activity level was computed by accumulating the score of each section.

Dietary intake was assessed by applying a semi-quantitative food frequency questionnaire, including a list of foods with a standard serving size. Participants were asked to mention each food item's frequency of consumption during the previous year, according to a daily (e.g., bread), weekly (e.g., meat), monthly (e.g., fish), or yearly (e.g., shrimp) consumption. The daily nutrient intake was calculated by a nutrient database (Nut IV) for each participant.

Data analysis: Data from 240 individuals were analyzed using SPSS software (SPSS Inc., Chicago IL., and Version 19). Basic characteristics such as frequency, mean, and standard deviation were calculated for different variables. The prevalence of overweight and obesity was also measured based on BMI and WHR. The relationship between BMI and different variables was examined independently, using nonparametric univariate correlation (Spearman and chi square) tests. Binary logistic regression modeling (Inter method) was used to perform multivariate analysis. By multi-stage logistic regression, factors that had a P-value less than 0.1 were considered to enter the final stage of logistic regression. P-value < 0.05 was considered statically significant.

Results

The participant's mean age was 32.9 years, while collected data indicated that majority of participants were in the age-group of 18 to 30 years (52.9%), 67.1% were married and 42.9% of them were housewives. The education level of 55% of the participants was bachelors' degree or higher. Moreover, 47.5% of the population did not have children or pregnancy, 85.5% of them were not menopause, and 44.6% reported their income between 5 million to 10 million Rials per month.

The distribution of the BMI and WHR were shown in **Table 1**. As it shows, in the population of this study indicates that the overall prevalence of overweight and obesity was 29.2% and 13.8%, respectively. Since the mean of WHR was 0.89 ± 0.06, 79.2% of the women had obesity based on WHR.

Table 1. Body mass index (**kg/m²**) and waist to hip ratio distributions

Variables	n	%
Body mass index (kg/m²)		
< 18.5 (underweight)	13	5.4
18.5-24.9 (normal)	124	51.7
25-29.9 (overweight)	70	29.2
≥ 30 (obese)	33	13.8
Waist to hip ratio		
< 0.85	50	20.8
≥ 0.85	190	79.2

Nonparametric tests indicated a direct correlation between BMI and age, number of child or pregnancy ($P < 0.001$), also an inverse correlation was reported between physical activity level and age of marriage ($P < 0.001$). Dietary intake analysis showed that there was a direct and significant correlation between BMI and energy ($P < 0.001$), total consumption of bread and cereals ($P < 0.001$), meat ($P = 0.037$), and fat intake ($P < 0.001$), however, an inverse relation with protein intake was determined for BMI ($P = 0.007$). There was no meaningful relationship between BMI and marital status, occupation, education level, income level, metropolitan area, smoking, menopause, and history of parental obesity.

According to the multi-stage logistic regression, menopause, high energy intake, low physical activity ($P = 0.013$), and probably sleep deprivation ($P = 0.057$) are associated factors of overweight and obesity (**Table 2**).

Table 2. The association of overweight and obesity with determinant factors based on logistic regression modeling

Variables	B[a]	OR[b]	P-value	95% CI[c] for OR Lower	Upper
History of parents' obesity	-0.116	0.89	0.592	0.58	1.36
History of childhood obesity	0.719	2.05	0.273	0.56	7.42
Menopause	1.575	4.83	0.004	1.63	14.27
Energy intake	0.008	1.00	0.004	1.00	1.01
Bread and cereal serving size	0.228	1.25	0.277	0.83	1.89
Meat serving size	0.133	1.14	0.59	0.70	1.86
Fat serving size	-0.118	0.88	0.331	0.70	1.12
Physical activity	-0.301	0.74	0.013	0.58	0.93
Sleep duration	-0.219	0.80	0.057	0.64	1.00

[a]:Regression coefficient; [b]: Odds Ratio; [c]: Confidence interval

Discussion

Obesity negatively impacts women's health in many ways. The relative risk of diabetes, coronary artery diseases, and some types of cancer increased by being overweight or obese (Sanchez-Villegas A, 2003;Priya D, 2010). The present study was conducted to investigate dominant factors related to women's obesity in Shiraz. The current survey showed that the prevalence of overweight and obesity was 43% based on BMI and 79.2% based on WHR; this is similar to a few other studies (Ghadiri-AnariA, 2013). Nuri et al. reported that the prevalence of obesity and overweight in women was 9.3% and 36.1%, respectively in 2012 in Shiraz (Nuri R, 2012). Furthermore, a study in Tehran on women's Lipid and Glucose revealed that respectively 67.1% and 82.1% of them had abdominal obesity (in1999 and 2002, respectively) (Azizi F, 2005). Therefore, it could be concluded that there is an alarming prevalence rate of both

generalized and central overweight and obesity in the present study.

Based on our findings, there was a direct correlation between age and prevalence of obesity and overweight independently. Although this association was not significant in multivariate regression, the highest prevalence of obesity was represented in the age group of 51-65 years, while overweight was most prevalent in the age group of 18 to 30 years. Increase in age by enhancement of body fat and consequently decrease in basal metabolic rate, also some changes in lifestyle, such as sedentary life can result in increase of body weight.

Mohammadi et al. showed an independent significant association between BMI and age as well as number of pregnancies and family member; this is inconsistent with the result of the present research (Mohammadi N, 2012). In the current study, the prevalence of overweight and obesity increased with increase in age and number of children. This can be due to hormonal and weight changes during pregnancy, failure to obtain the pre-conception weight after delivery, and increase the number of childbirth with aging (Azizi F, 2005).

Our results showed a negative correlation between the BMI and physical activity level; underweight group had the highest, while obese group had the lowest level of physical activity. Therefore, low physical activity can be a determinant factor for overweight and obesity. According to the findings obtained in Nuri et al.'s study in Shiraz, it seems that inactivity is a very important factor in development of obesity and overweight (Nuri R, 2012). Physical activity can plausibly protect against weight gain, overweight, and obesity through the increase of fat oxidation that is in turn the result of insulin sensitivity improvement, although this affect might be attenuated in obese people. Besides, previous studies showed that physical activity can potentially influence appetite regulation by increasing the sensitivity of satiety signals, modifying the pleasure response to food, and altering food choice or macro-nutrient preference (Research, 2007). On the other hand, exercise may boost serotonin and tryptophan levels of the brain which is another beneficial effect of physical activity in regulating the appetite (Meeusen R, 1995).

In this study, menopause is one of the associated factors related to BMI, which is consistent with Sarshar et al.'s study. Apparently, the hormonal changes that occur during menopause reduce fat metabolism and also increase the prevalence of overweight and obesity (Sarshar N, 2006). Decrease in circulation of estrogen tends to be associated with an increased risk of obesity, shift to visceral fat distribution, and consequently increase health risk {Morris E, 2010).

Other related factors of overweight and obesity were high energy and fat as well as lower protein intake. This result is similar to those of the Lipid and Glucose study conducted in Tehran; it was found that prevalence of overweight and obesity had a significant and independent correlation with high intake of fat and energy and low protein intake (Mirmiran P, 2006). Although, after adjusting for other factors by regression model, only energy intake remained as an associated factor for obesity and overweight, which can be active or passive. Active overeating is partly the result of excessive portion sizes that are accepted as the norm, but passive overeating refers to eating energy dense diets; the amount of food is not too much but the calorie content is. However, these two types of energy intakes were not differentiated in this study's participant.

Moreover, sleep deprivation was another factor associated with overweight and obesity based on logistic regression, which is inconsistent with Patel et al.'s systematic review study (Patel, 2008). One of the probable mechanisms of this inverse correlation is that sleep deprivation may lead to increased energy intake. Also, hunger and appetite center is stimulated by sleep deprivation, leading to increased ghrelin and decreased leptin in the blood. Further, increasing duration of wakefulness makes opportunities for eating. Another mechanism is that insomnia can lead to fatigue and reduction of physical activity, thus leading to increased obesity. Human studies have also shown that

sleep deprivation reduces body temperature and thermogenesis, thus reducing the energy expenditure (Patel, 2008).

This study did not show any significant relationship between BMI and other dietary components based on a logistic regression model. However, a number of studies have reported a meaningful and inverse correlation between dairy consumption and obesity, this relationship was not significant in our study (Azadbakht L, 2007). It can be explained that dairy consumption in most people was lower than the daily recommendation intake that requires more detailed investigations for judgment.

Previous studies indicated that people who have obese parents are more prone to obesity than others (Sarshar N, 2006). However, in the present study, due to application of subjective evaluation of parental obesity, this relationship was not significant. Furthermore, no significant association was observed between depression and smoking with BMI in our study; this is in contrast with a few other studies (Sarshar and Khajavi 2006). Therefore, further investigation is needed in this area.

Conclusions

Increase in age, number of pregnancies and family member, low physical activity, menopause, high calorie intake, and probably sleep deprivation are the factors associated with overweight and obesity in adult women who referred to health centers of Shiraz. It can be mentioned that despite extensive programs of public education that have been conducted in previous years, the prevalence of general and central obesity is still high. It seems that although many people are aware about the hazards of obesity; they still do not apply their knowledge practically. Consequently, the required backgrounds should be planned for people to transform their knowledge to attitude and behavior.

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Author contributions

Nikookar S and Eftekhari MH (as corresponding author) designed research; Nikookar S, Ranjbar Zahedani M and masoumi SJ conducted research; Nikookar S, Eftekhari MH, Ranjbar Zahedani M wrote the paper; Tabatabaei HR and S. Nikookar S analyzed data; Eftekhari MH had primary responsibility for final content. All authors read and approved the final manuscript.

Conflict of Interest

Authors declare no conflict of interest.

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