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Obesity and Related Factors in Iran: The STEPS Survey, 2011

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Background: To date, no study has addressed the association between race/ethnicity and obesity considering other sociodemographic and lifestyle factors in Iran.
Objectives: The current study aimed to study lifestyle and the environmental factors affecting obesity in the Iranian subjects of the STEPS Survey, 2011.
Patients and Methods: The study was conducted on 8639 subjects (aged ≥ 20 years) in the STEPS Survey 2011 in Iran under supervision of the World Health Organization (WHO). Height and body weight were measured following the standardized procedures. Generalized Estimating Equations (GEE) method was used to examine factors associated with obesity. The examined variables were age, gender, race/ethnicity, place of residence, employment status, physical activity, smoking status, and educational level.
Results: Overall, 22.3% of the subjects were obese. In a GEE model, a healthy weight status among adults was associated with being younger, male, in a rural residence, employees, spending more time engaged in physical activity, being a smoker and having a moderate or high level of education. These associations were statistically significant after adjusting for other variables.
Conclusions: The study results suggest a need for targeted interventions and continued surveillance for the Iranian adults.

Keywords: Obesity; Race; Ethnic Groups; Smoking

1. Background

Obesity is a major public-health problem worldwide (1). It has emerged as an epidemic, accompanied by a variety of health disorders, including cardiovascular diseases (2), diabetes (3), asthma (4), arthritis (5), chronic pain (6), Alzheimer's disease (7) and functional impairment (8). The obesity prevalence had increased to 35.7% among U.S. adults by 2009 - 2010 (9). In 2012, no state had a prevalence of obesity less than 20% (10). According to the World Health Organization (WHO) report, the number of obese adults worldwide is projected to reach 700 million by 2015.

Because of multifactorial nature of obesity, researchers focus on both medical and nonmedical factors such as age, gender, race/ethnicity, annual household income, educational attainment, and lifestyle factors. Apart from age and gender, which has shown a relation with obesity (11-13), the potential confounder of this association in adults include the socioeconomic status (14, 15). Some studies reported that obesity prevalence varies substantially by occupation (16, 17). Many studies analyzed the association of obesity with smoking (11, 18).

Several studies suggest a strong association between low levels of Physical Activity (PA) and obesity (19, 20).

Previous studies suggested a complex relationship between Body Mass Index (BMI) and race/ethnicity. For example, Kim et al. (21) demonstrated that BMI is not associated with race/ethnicity or place of birth. The results of studies show that the effect of gender on weight gain is ethnic specific (22, 23). Le et al. compared the regional and state-level prevalence of obesity from multiple sources in the U.S, and also demonstrated that the regions relative ranking of obesity prevalence differs substantially between self-reported and directly measured height and weight (24).

Another study examined the association between sociodemographic (except ethnicity and educational level) and lifestyle factors with obesity in Iran, based on data collected for the 2009 Survey (11).

2. Objectives

The current study aimed to investigate the relation-

ship between obesity and age, gender, race/ethnicity, place of residence, PA level, employment status, smoking status and educational level using data from the sixth round survey (2011) based on the WHO STEPwise guidelines.

3. Patients and Methods

3.1. Sample

Data analyzed in the current study came from the sixth round of the National Surveillance, a population-based survey of risk factors of non-communicable diseases among adults aged ≥ 15 years in all provinces, in Iran. The survey was conducted under the supervision of WHO with the financial support of the Iranian Ministry of Health and Medical Education, and was approved by the Ethics Committee of the Center for Disease Management of Iran. This cross-sectional study was conducted in 2011 by Iranian Center for Disease Control. A cluster sampling design was used to obtain data representing age range in Iran. The survey design, sampling methods and weights are described by the other study (25). Data were collected by personal face-to-face interviews. The participants completed a health questionnaire covering sociodemographic, behavioral, and health status characteristics. Height and weight were measured rather than self-reported. The study complied with the ethical standards of the country. After excluding pregnant women from the analyses, 8639 subjects aged ≥ 20 years remained in the study.

3.2. Response Variable

Subjects were weighted during the interview by a calibrated digital scale, on a firm surface, to the nearest 0.1 kg, subject had on light indoor clothes with emptied pockets, and no shoes. To measure the height, subjects stood bare footed on a fixed stadiometer calibrated in centimeter and to the nearest 5 mm. The scales were also calibrated on a daily basis. Obesity was defined as a body mass index (BMI = weight in kilograms divided by height in meters squared) of 30 or higher (26).

3.3. Covariates

Race/ethnicity: When responding to questionnaire item, respondents specify their occupational groups. The coding system consists of 11 specific occupational categories for people, arranged into 3 major employment status. For this analysis, ethnicity was analyzed as three categorical variables (Fars/Turk-Gilak-Lor-Turkmen (TGLT)/ other Iranian ethnicities).

PA: Physical activity was a composition measure of different activities as queried in the questionnaire, and participants were stratified into three groups (low/moderate/vigorous).

Smoking: The respondents were categorized into three groups: current smokers (subjects who smoked any tobacco products including cigarettes, pipes and hubble-bubbles), ex-smokers (subjects who used to smoke any tobacco products earlier), vs. nonsmokers (others).

Education level: Education was defined as the total number of years of education. The respondents were categorized into three groups: those with low (0-8 years), moderate (9-12 years) or high (more than 12 years) education.

Employment status: The original questionnaire included 11 response categories. For this analysis, occupational class was analyzed as three categorical variables (public employed / private employed / other (student, retired, homemaker, unable to work, soldier and others)).

3.4. Statistical Analyses

Since the responses of the members of each cluster are correlated, the Generalized Estimating Equations (GEE) model with exchangeable correlation structure was used to model the relationship between odds of obesity and race/ethnicity, age, gender, place of residence, employment status, PA, smoking and education level. No interaction was found between gender and any other variables; therefore, all analyses were performed jointly for male and female subjects. The results are presented as the odds ratios and their 95% CI's. All analyses were carried out by R software.

4. Results

The analyzed data in the study belonged to 8639 subjects from the sixth round Surveillance (2011) in Iran. Overall, 22.3% of the subjects were obese. Among all racial/ethnic groups, the highest prevalence value was observed in TGLT group (25.5%). In contrast, 21.5% and 16.9 % of people with Fars and the other Iranian ethnicities, respectively, were categorized as obese. Table 1 displays the prevalence of obesity per race/ethnicity groups stratified by other factors.

After fully adjusting all variables, the estimates of the odds of obesity associated with factors are presented in Table 2. For most variables, different groups showed a statistically significant difference in obesity. An association between age and obesity was observed. Using the 20 - 30 years old subjects as the reference group, the obesity odds ratios were 2.11 (95% CI, 1.78 - 2.50), 3.12 (95% CI, 2.59 - 3.77), 2.90 (95% CI, 2.42 - 3.48) and 2.40 (95% CI, 1.94 - 2.99) for age groups 30 - 40, 40 - 50, 50 - 60 and + 60 years, respectively.

Obesity was significantly lower in males than females. The odds ratio for females was 1.47 (95% CI, 1.26 - 1.72). A statistically significant association was found between race/ethnicity and obesity. Using Fars as the reference group, the obesity odds ratios for TLGT group and the other Iranian ethnicities were 1.28 (95% CI. 1.12-1.46) and 0.77 (95% CI. 0.70-0.94), respectively.

Table 1. Descriptive Prevalence of Obesity Across the Study Variable Levels Per Race/Ethnicity Groups [a,b]

Variable	Race/Ethnicity			Total
	Fars	TGLT	Other Iranian	
Age, y				
20 - 30	129 (10.3)	95 (10.5)	43 (10.6)	267 (10.4)
30 - 40	166 (20.8)	157 (24.6)	42 (15.2)	365 (21.3)
40 - 50	193 (28.8)	198 (37.4)	37 (19.7)	428 (30.8)
50 - 60	290 (28.8)	257 (33.4)	64 (22.5)	611 (29.7)
60 >	121 (26.6)	99 (31.2)	33 (23.6)	253 (27.7)
Gender				
Male	257 (14.7)	209 (16.0)	62 (11.4)	528 (14.7)
Female	642 (26.3)	597 (32.3)	157 (21.0)	1396 (27.7)
Place of residence				
Urban	703 (22.5)	603 (27.1)	146 (19.9)	1452 (23.9)
Rural	196 (18.4)	203 (21.8)	73 (13.0)	472 (18.4)
Employment status				
Public employed	76 (10.0)	73 (13.6)	20 (10.1)	169 (11.3)
Private employed	176 (15.8)	131 (15.2)	40 (10.5)	347 (14.7)
Other [c]	647 (28.0)	602 (34.2)	159 (22.2)	1408 (29.4)
Physical activity				
Low	505 (23.2)	428 (30.4)	119 (20.2)	1052 (25.2)
Moderate	222 (21.5)	182 (25.8)	51 (16.2)	455 (22.2)
Vigorous	172 (17.6)	196 (18.8)	49 (12.5)	417 (17.3)
Smoking status				
Nonsmoker	832 (22.7)	734 (27.6)	205 (18.5)	1771 (23.8)
Current Smoker	49 (12.2)	51 (12.7)	8 (5.8)	108 (11.5)
Ex-smoker	18 (14.2)	21 (21.0)	6 (13.3)	45 (16.5)
Education				
Low	446 (28.2)	515 (33.0)	150 (19.7)	1111 (28.5)
Moderate	351 (19.3)	230 (19.9)	50 (12.6)	631 (18.7)
High	102 (13.0)	61 (13.9)	19 (14.3)	182 (13.4)

[a] Abbreviations: TGLT, Tork-Gilak-Lor-Torkmen.
[b] Data are presented as No. (%).
[c] student, retired, homemaker, unable to work, soldier and others.

Adults living in the urban areas were more likely to be obese, compared with adults living in rural areas. The obesity odds ratio for urban adults was 1.54 (95% CI, 1.31 - 1.80). Occupation was significantly associated with the prevalence of obesity. Obesity odds ratios for public and private sector employees were 0.62 (95% CI, 0.49 - 0.77) and 0.80 (95% CI, 0.67 - 0.94) respectively. Although increases in physical activity were associated with lower gains in BMI, but this association was inversely and statistically significant only in the vigorous group. Obesity odds ratios for the moderate and vigorous groups were 0.90 (95% CI, 0.78 - 1.03) and 0.82 (95% CI, 0.71 - 0.95) respectively, compared with low level. Smoking status and obesity were inversely related. Obesity odds ratios for smokers and ex-smokers were 0.50 (95% CI, 0.40 - 0.63) and 0.68 (95% CI, 0.50 - 1.002) respectively, compared with nonsmokers.

There was a significant overall trend of lower odds of obesity with increased education. Using low level as the reference level, obesity odds ratios for moderate and high levels were 0.82 (95% CI, 0.72 - 0.93) and 0.68 (95% CI, 0.53 - 0.81), respectively.

Table 2. Adjusted Odds Ratios for Obesity Among Iranian Adults [a]

Variable	OR [b]	95% CI [c]
Age, y		
20 - 30	1.00	
30 - 40	2.11	1.78 - 2.50
40 - 50	3.12	2.59 - 3.77
50 - 60	2.90	2.42 - 3.48
60 >	2.40	1.94 - 2.99
Gender		
Male	1.00	
Female	1.47	1.26 - 1.72
Race/ethnicity		
Fars	1.00	
TGLT	1.28	1.12 - 1.46
Other Iranian ethnicities	0.77	0.70 - 0.94
Place of residence		
Rural	1.00	
Urban	1.54	1.31 - 1.80
Employment status		
Public employed	0.62	0.49 - 0.77
Private employed	0.80	0.67 - 0.94
Other [d]	1.00	
Physical activity		
Low	1.00	
Moderate	0.90	0.78 - 1.03
Vigorous	0.82	0.71 - 0.95
Smoking status		
Nonsmoker	1.00	
Ex-smoker	0.68	0.50 - 1.002
Current Smoker	0.50	0.40 - 0.63
Education level		
Low	1.00	
Moderate	0.82	0.72 - 0.93
High	0.68	0.53 - 0.81

[a] Adjusted for all other variables in the table.
[b] Odds ratios.
[c] Confidence Interval.
[d] student, retired, homemaker, unable to work, soldier and others.

5. Discussion

In the cross-sectional analyses of the data obtained from the WHO STEPwise approach, including more than 8600 males and females, an association was observed between race/ethnicity and obesity in the Iranian adults. This association was independent of age, gender, place of residence, employment status, physical activity, smoking status and educational level. The obtained results revealed that TGLT group tended to be heavier throughout life than did the Fars people. In contrast, other Iranians had the lowest levels of obesity and were the least likely to increase their weight.

Although several potential confounders were controlled, unmeasured confounders such as dietary intake and genetic variation may have influenced the observations. It is also possible that cultural differences regarding the desired ideal weight and body image may lead the Fars people to restrict caloric intake, whether with a healthy diet or an eating disorder, more than their TLGT counterparts. The Persians are mainly found in the central provinces, Fars province and coastal areas of Persian Gulf and TLGT group mainly live in the northern and northwestern provinces of Iran. Other environmental factors involved in weight gain should be explored, since they may give important clues regarding the causes of obesity. Psychosocial factors may also explain the racial differences in obesity. The current study results regarding race/ethnicity differences in susceptibility to obesity are basically in line with the findings of most studies in the developed and developing countries (22, 23).

Overall, among the adults aged 20 - 49 years, the odds ratio of obesity went up with increasing age and then it decreased for the subjects above 50 years. Changes in food intake, energy expenditure, appetite and body composition that occurs with ageing may be effective. It is possible that aging-related factors such as organ atrophy, cachexia, sarcopenia, and bone-mineral-density loss lead to the weight loss of older people (27). Adams et al. (28) showed that among the elderly people, above 50 years, the relationship between risk of death with weight loss is higher than that of weight gain.

In the current study, gender was significantly associated with obesity. It may include physiological mechanisms in the females, especially after pregnancy. The degree to which weight loss is associated with the metabolic improvements in males and females can also operate as a biological factor on obesity in females. The current study results are consistent with the findings of some other studies (29, 30).

The current study showed that rural residents had lower BMI values than the urban ones. The environment can influence access to healthy food, lifestyle behaviors such as the trend toward 'eating out', lack of sidewalks and accessible recreation areas. The association between unemployment and depression symptoms was observed in some studies (31). Zhao et al. showed that depression and anxiety were associated with BMI independent of disease status or other psychosocial or lifestyle factors (32).

Employed adults had lower obesity prevalence than unemployed ones, likely attributable to the occupational physical activities. Bonauto et al. showed that workers with physically demanding occupational physical activ-

ity had significantly lower prevalence of obesity compared with the ones with non-physically demanding jobs (17). Obesity may be more acceptable among unemployed people. There is possibly more discrimination against the obese; or obese people may end up in lower status jobs through stronger selective processes in Iran (11). The study also found that adults with high and moderate levels of education were significantly less likely to be obese compared with the ones with low level. Higher education may provide knowledge or resource influences on the obesity.

Other mechanisms can be attributed to these differences. For example, low-income families will select more energy-dense foods to offer the most dietary energy at the lowest cost. Pickett et al. also found income inequality to be positively related to the prevalence of obesity among both males and females, using data from 21 developed countries (33).

The current study findings regarding an inverse relationship between PA and obesity were consistent with those of most other studies. It is not elucidated clearly whether obesity is a cause or a consequence of PA. The imbalance between energy intake and expenditure is the main underlying cause of weight gain, and low levels of physical activity may not necessarily lead to weight gain (19), as observed in the current study. Lack of PA and a hyper caloric nutrition are the main reasons of overweight and obesity. PA is useful to burn calories and keep the muscular mass and increase the PA again (34). In a randomized controlled trial, Catenacci and Wyatt (35) found that PA alone, without diet control, is associated with only modest weight reduction.

In the current study, prevalence of obesity was lower among smokers than nonsmokers, likely attributable to the nicotine-induced decreases in appetite. Gonseth et al. (36) found that tobacco industry adds some substances acting as appetite suppressants into cigarettes. The inverse association spotted between smoking and obesity should not be used to counteract the efforts undertaken against this habit. Some biologically plausible explanations as well as psychological factors could be related to the effect of smoking on obesity. For example, Loos entered a new era of gene discovery regarding obesity (37). The current study findings regarding an inverse relationship between smoking and obesity are consistent with the findings of most of the other studies (38, 39).

The current study was subject to limitations. Because of the study design (cross-sectional) it was not possible to infer a causal relationship between race/ethnicity and obesity, and further longitudinal studies are needed to confirm it. Although several variables were adjusted in the analyses, other factors associated with obesity such as marital status and family income were not included in the models ,since there was a lack of information on these variables in the study. Despite these limitations, there are several strengths to the study. The current study was unique, since it was the first to examine the relationship between race/ethnicity and obesity in Iran. It used a nationally representative sample, which allows generalizing the results to the Iranian adults. Second, information on a wide variety of potentially confounding behavioral and demographic variables was collected, which allowed to assess this relationship independent of these potential confounders. Third, height and weight were measured rather than self-reported. Estimates of obesity prevalence based on self-reported height and weight tend to be lower than the ones based on measured height and weight.

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Authors' Contributions

Study concept and design: Enayatollah Bakhshi; data acquisition: Jalil Koohpayehzadeh, Ali Rafei, Koorosh Etemad, Fereshteh Asgari; data analysis and interpretation: Enayatollah Bakhshi, Behjat Seifi; manuscript drafting: Enayatollah Bakhshi; critical revision of the manuscript for important intellectual content: Behjat Seifi; statistical analysis: Enayatollah Bakhshi, Akbar Biglarian, Razieh Bidhendi Yarandi; administrative, technical and material supports: Ali Rafei; study supervision: Enayatollah Bakhshi.

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