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Socioeconomic determinants of excess weight and central obesity among Iranian women: Application of information, motivation, and behavioral skills model

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Abstract:

INTRODUCTION: In developing countries, there is an increased risk of incidence of noncommunicable diseases due to general and abdominal obesity. Therefore, this study aimed to assess socioeconomic determinants of excess weight and central obesity among women in Tehran city based on information motivation behavioral skills model (IMB).

MATERIALS AND METHODS: A cross-sectional study was conducted among 260 women aged between 20 and 49 years old using cluster sampling. A skilled interviewer completed socioeconomic status (SES), food insecurity, and IMB questionnaires. Analysis of variance, Chi-square tests, and regression model were used for statistical analysis. The multiple logistic regression analysis was used to identify independent predictors of the excess weight and central obesity using SPSS 21.

RESULTS: The mean and standard deviation of participants' age was 34.7 (±7.59) years old. The prevalence of overweight and obesity in adult women was estimated 35% and 21.2%, respectively. The prevalence of abdominal obesity was 34.6%. Independent predictors of overweight/obesity in women were age (odds ratio [OR] =1.09, 95% confidence interval [CI] =1.03–1.14), educational level (OR = 2.35, 95% CI = 1.05–5.27), and total expenditure (OR = 3.14, 95% CI = 1.06–9.37). Whereas, independent predictors for increased the likelihood of central obesity were age (OR = 1.12, 95% CI = 1.06–1.18), marital status (OR = 6.44, 95% CI = 1.94–21.40), low education (OR = 0.38, 95% CI = 0.16–0.91), number of rooms (OR = 1.19, 95% CI 1.03–3.45), and self-regulation score (OR = 0.94, 95% CI = 0.88–1.00).

CONCLUSIONS: The socioeconomic determinants, especially age, level of education, and expenditure, as well as self-regulation, play an important role in excess weight and central obesity among women. Therefore, further research is needed to reach women in different SES groups with a variety of interventions through concurrent triangulation of longitudinal studies and qualitative research.

Keywords:

Central obesity, excess weight, information motivation behavioral skills model, socioeconomic determinants, women

Introduction

In most parts of the developing world, general and abdominal obesity become the major public health of the 21st century.[1] The increasing trend of the diseases resulted in increased morbidity and mortality of the noncommunicable diseases in developing countries.[2,3] Various studies revealed that the increased prevalence of abdominal obesity

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along with general obesity is the greatest concern in both high- and low-income countries.[4-6] Iran is an urbanized country passing nutrition transition in the Middle East Region.[7] A decade follow-up of Tehran lipid and glucose level (TLGS) indicated that the trends of obesity and abdominal obesity are increasing alarmingly in the adult population of the Tehran. The prevalence of abdominal obesity and obesity at baseline 47·9% and 23·1% is changed to 71·1% and 34·1% at the end of the follow-up, respectively.[8]

Besides to genetic and lifestyle factors, several sociodemographic and socioeconomic factors are closely related to obesity. A number of cross-sectional studies indicated that unequal prevalence of obesity in subgroups of age, gender, marital status, income, and educational level.[9] A significant relationship is also suggested in most studies assessing the temporal trends of obesity in different socio-economic groups.[10,11] There are some evidence indicating that behavioral factors can mediate the association between socioeconomic status (SES) and obesity.[12] Limited studies have simultaneously explored the direct and indirect associations of obesity with sociodemographic, behavioral factors, and food insecurity (FI), using a tested conceptual model like information motivation behavioral skills (IMB).[13-17]

The IMB model is proposed by Fisher (1992) to explain HIV-related behaviors by three constructs, namely, information, motivation, and behavioral skills.[18] Information, motivation, and behavioral skills are the three constructs reconsidered generalizable determinants of health behaviors. Thus, the IMB model has been used as a theoretical framework for behavioral intervention studies across a variety of health behaviors.[19,20] Therefore, the aim of this study was to assess socioeconomic determinants of excess weight and central obesity among women in Tehran City based on IMB model.

Materials and Methods

Study setting, design, and sample

A cross-sectional study was conducted in five areas of Tehran, capital of Iran Islamic Republic, among 260 reproductive age women source populations were all reproductive-age women in included areas of health houses. All 20–49 years aged women who were present during the study and tended to participate in the study, were included in the study. Exclusion criteria were considered as suffering from disease affecting individual's diet (e.g., diabetics, cardiovascular, renal, and hepatic disease). A cluster sampling method was used. The data collection was performed in the period of January 2016–2017.

The study was approved by the ethics committee of the Tehran University of Medical Sciences with Ethical Code Number: 8921108011-131264. The purpose of the present study was informed to participants and written informed consent was obtained.

Data collection and measurement

Data were collected by four-trained health professionals through face-to-face interview using structured questionnaires. The questionnaire comprised sociodemographic factors, socioeconomic determinants, FI Household FI access scale, and IMB questions. Participants were classified into three categories (low, middle, and high) according to the fertile based on their total expenditure. The food expenditure also categorized as adequate, intermediate, and inadequate.

Height, weight, and waist circumference (WC) of studied women were measured using standard protocols, and body mass index (BMI) was calculated accordingly.[20] Women's weight was classified based on the cutoff values recommended by the National Institute of Health and National Heart (underweight: BMI <18.5; normal weight: 18.5 < BMI <24.9; overweight: 25.0 < BMI <29.9; and obese: BMI $\geq$30 kg/m^2). WC cutoffs for the Iranian adult population was considered as follows: WC <90 (no risk for cardiovascular disease [CVD]), WC $\geq$90 cm (at risk for CVD risk factors); WC $\geq$95 cm (high risk for CVD events).[21]

To determine household FI, Household Food Security Survey Module was used. This module is used to calculate a statistically reliable and meaningful measure of FI in the US and has often been used for measuring FI in developing countries.[22,23] Based on the locally adapted version of the HFIAS questionnaire scores, households were categorized into four groups based on access to food; food secure (0–1 scores), mildly (2–7 scores), moderately (8–14 scores), and severely food insecure (15–27 scores).[24]

The preliminary information, motivation, and behavioral skills questionnaire was adapted from literature and developed by the research team. An expert panel reviewed initial items for understandability, readability, and content validity. Assessment of reliability was done using a test-retest method and was confirmed by a Cronbach's alpha value >0.8. The items with content validity ratio (CVR) >0.49 and content validity index (CVI) >0.79 were considered appropriate. Twelve items were used to assess aspects of information (between 0 and 32 scores), 10 items for personal motivation (between 10 and 50 scores), 9 items for social motivation (between 9 and 45 scores), 8 items for self-efficacy (between 8 and 40 scores), and 10 items for self-regulation (between 10 and 50 scores). Higher scores reflected higher amounts of accurate information, higher amounts of total motivation, and higher levels of behavioral skills.[25]

Data quality management, processing, and analysis

Training was given for data collectors and pretest was done on 5% of the similar participants. Data analysis performed Statistical Package for the Social Sciences software version 21 (SPSS Inc., Chicago, IL, USA) using analysis of variance and Chi-square tests to assess variables' association. Regression model was conducted to test the effects of SES, IMB components, and food security on BMI and WC. The multiple logistic regression analysis was done to identify independent predictors of excess weight and central obesity. Values of $P < 0.05$ considered statistically significant.

Results

Two hundred and sixty of respondents participated in the study with overall response rate of 100%. Table 1 shows the weight and waist status of studied women based on their SES in Tehran. Accordingly, >55% of women were overweight or obese and 34.6% were at risk or high risk for CVD. Majority of women were married, educated, housewife, and food secure. An increase in education level and women's employment decreases overweight and obesity. Weight and WC of women were significantly differed with marital status, educational level and their occupation. The mean age and standard deviation of women were 34.7 (±0.58) years old.

Table 2 presents mean (± standard error [SE]) of age, family size, number of children and rooms, area of the house, food, and total expenditure and components of IMB model based on weight and waist status group of women. Accordingly, in patients with WC <90 cm (n = 170), the cost of food and total expenditures was lower than those at risk or high risk for CVD (n = 90).

Twenty-six percent of women were suffering from different levels of FI. Food insecurity was not significantly associated with weight and WC status in adult women [Table 3].

Table 1: Frequency of different levels of weight and waist status of adult women based on socioeconomic variables in Tehran

Socioeconomic variables	Weight status				Waist status			Total
	Underweight	Normal weight	Overweight	Obese	Normal	At risk	High risk	
Area								
North	3 (5.7)*	28 (52.8)	15 (28.3)	7 (13.2)	38 (71.7)	6 (11.3)	9 (17.0)	53 (100.0)
South	1 (1.9)	20 (38.5)	18 (34.6)	13 (25.0)	33 (63.5)	6 (11.5)	13 (25.0)	52 (100.0)
East	4 (7.5)	20 (37.7)	16 (30.2)	13 (24.5)	37 (69.8)	6 (11.3)	10 (18.9)	53 (100.0)
West	4 (7.7)	17 (32.7)	25 (48.1)	6 (11.5)	34 (65.4)	11 (21.2)	7 (13.5)	52 (100.0)
Center	1 (2.0)	16 (32.0)	17 (34.0)	16 (32.0)	28 (56.0)	9 (18.0)	13 (26.0)	50 (100.0)
Marital status								
Married	7 (3.3)†	77 (36.3)	78 (36.8)	50 (23.6)	128 (60.4)†	35 (16.5)	49 (23.1)	212 (100.0)
Divorcee	0 (0.0)	4 (66.7)	2 (33.3)	0 (0.0)	5 (83.3)	1 (16.7)	0 (0.0)	6 (100.0)
Single	6 (15.8)	19 (50.0)	9 (23.7)	4 (10.5)	34 (89.5)	2 (5.3)	2 (5.3)	38 (100.0)
Widow	0 (0.0)	1 (25.0)	2 (50.0)	1 (25.0)	3 (75.0)	0 (0.0)	1 (25.0)	4 (100.0)
Educational level								
Illiterate/primary	1 (5.6)†	3 (16.7)	8 (44.4)	6 (33.3)	8 (44.4)†	6 (33.3)	4 (22.2)	18 (100.0)
Secondary	1 (4.8)	7 (33.3)	9 (42.9)	4 (19.0)	11 (52.4)	3 (14.3)	7 (33.3)	21 (100.0)
High school diploma	2 (2.2)	31 (34.1)	29 (31.9)	29 (31.9)	56 (61.5)	9 (9.9)	26 (28.6)	91 (100.0)
Associate degree	0 (0.0)	6 (50.0)	5 (41.7)	1 (8.3)	10 (83.3)	2 (16.7)	0 (0.0)	12 (100.0)
B.Sc. degree	6 (7.4)	31 (38.3)	30 (37.0)	14 (17.3)	56 (69.1)	13 (16.0)	12 (14.8)	81 (100.0)
M.Sc. degree and higher	3 (8.1)	23 (62.2)	10 (27.0)	1 (2.7)	29 (78.4)	5 (13.5)	3 (8.1)	37 (100.0)
Occupation								
Unemployed	1 (8.3)‡	8 (66.7)	2 (16.7)	1 (8.3)	9 (75.0)†	2 (16.7)	1 (8.3)	12 (100.0)
Student	3 (30.0)	4 (40.0)	3 (30.0)	0 (0.0)	9 (90.0)	1 (10.0)	0 (00.0)	10 (100.0)
Housekeeper	2 (1.3)	60 (37.7)	60 (37.7)	37 (23.3)	99 (62.3)	24 (15.1)	36 (22.6)	159 (100.0)
Employee	5 (8.5)	24 (40.7)	19 (32.2)	11 (18.6)	41 (69.5)	11 (18.6)	7 (11.9)	59 (100.0)
Freelancer	2 (10.0)	5 (25.0)	7 (35.0)	6 (30.0)	12 (60.0)	0 (0.0)	8 (40.0)	20 (100.0)
Ethnicity								
Fars	8 (6.3)	52 (40.6)	47 (36.7)	21 (16.4)	93 (72.7)	14 (10.9)	21 (16.4)	128 (100.0)
Azeri	1 (1.0)	32 (33.3)	32 (33.3)	31 (32.3)	51 (53.1)	18 (18.8)	27 (28.1)	96 (100.0)
Kurd	1 (7.7)	4 (30.8)	6 (46.2)	2 (15.4)	8 (61.5)	2 (15.4)	3 (23.1)	13 (100.0)
Others	3 (13.1)	13 (56.5)	6 (26.1)	1 (4.3)	18 (78.3)	4 (17.4)	1 (4.3)	23 (100.0)
Total	13 (5.0)	101 (38.8)	91 (35.0)	55 (21.2)	170 (65.4)	38 (14.6)	52 (20.0)	260 (100.0)

*Figures in the parentheses are indicative of raw percent, †Significant difference between groups using the Chi-square test (P<0.05), ‡Significant difference between groups using Chi-square test (P<0.001)

Table 2: Analysis of sociodemographic characteristics and components of information-motivation-behavioral skills model based on weight and waist status group of women in Tehran

Variables (mean±SE)	Weight status					Waist status			
	Underweight (*n*=13)	Normal weight (*n*=101)	Overweight (*n*=91)	Obese (*n*=55)	Total (*n*=260)	Normal (*n*=170)	At risk (*n*=38)	High risk (*n*=52)	Total (*n*=260)
Age (years)	28.23±6.19*	32.70±6.84	36.30±7.45	37.18±7.76	3.92±1.84	33.20±7.20*	37.02±7.80	37.82±7.42	34.68±7.59
Family size	3.92±1.84	3.47±1.12	3.63±1.16	3.50±0.99	3.56±1.15	3.54±1.27	3.50±0.92	3.67±0.87	3.56±1.15
Number of children	0.53±0.87*	1.09±0.96	1.39±0.95	1.49±0.90	1.25±0.96	1.11±0.99*	1.36±0.81	1.65±0.83	1.25±0.96
Number of rooms	1.84±0.80	1.97±0.78	1.91±0.78	1.80±0.73	1.90±0.77	1.90±0.77	1.94±0.83	1.88±0.73	1.90±0.77
Floor area (square meter)	94.23±48.44	101.48±59.52	98.45±38.64	82.81±34.39	96.11±47.88	98.90±53.88	89.23±32.03	92.00±34.64	96.11±47.88
Food expenditure (thousands rials)	9250±8030	10,250±6340	12,700±1820	9890±6860	10,980±8410	10,330±670†	14,660±14,250	10,430±7170	10,980±8410
Total expenditure (thousands rials)	18,700±11,430	21,170±13,320	24,900±17,600	22,200±14,100	22,560±15,060	20,910±12,720*	30,500±22,120	22,140±14,310	22,250±15,060
Information	24.65±2.82	25.65±2.91	25.59±3.03	25.08±3.06	25.46±2.98	25.42±2.97	25.71±3.09	25.40±2.98	25.46±2.98
Attitude	37.92±4.51	40.50±4.17	40.67±6.04	40.25±3.99	40.38±4.90	40.14±5.11	40.42±5.07	41.13±3.98	40.38±4.90
Social support	36.23±6.08	33.56±6.31	32.86±6.07	32.03±7.00	33.13±6.40	33.41±6.06	31.89±6.58	33.11±7.33	33.13±6.40
Self-efficacy	33.53±5.15	33.79±4.60	33.91±4.96	34.29±4.60	33.92±4.73	33.86±4.93	33.31±5.16	34.57±3.63	33.92±4.73
Self-regulation	35.84±8.63	37.74±6.60	37.74±6.67	36.49±6.31	37.38±6.67	37.65±6.75	36.13±6.77	37.40±6.33	37.38±6.67

*Significant difference between groups using ANOVA (P<0.001), †Significant difference between groups using ANOVA (P<0.05). ANOVA=Analysis of variance, SE=Standard error

The score of FI in overweight and obese women was higher than normal and underweight ones and was significantly higher in at risk or high risk for CVD groups [Figure 1].

Table 4 presents the linear regression model for determinants of excess weight and abdominal obesity in reproductive age women of Tehran. Accordingly, unadjusted linear regression between food security and BMI was used, the regression coefficient was significant ($P < 0.05$, $\beta = 0.131$). Women's age, educational level, occupation, ethnicity of the households, floor area, and food expenditure were the main determinants of excess weight. It means that an increase one variable result increased women's BMI. However, weight status was not significantly related to food security by the Chi-square ($P < 0.05$, $\beta = -0.154$). In the same way, age, floor area, and food expenditures were the main determinants of WC.

Multiple regression analysis showed that the most important determinants of overweight/obesity in women were age (odds ratio [OR] =1.09, 95% confidence interval [CI] =1.03–1.14), educational level (OR for illiterate/primary versus higher than diploma = 2.35, 95% CI = 1.05–5.27), and total expenditure (OR for high vs. low = 3.14, 95% CI = 1.06–9.37). Moreover, age (OR = 1.12, 95% CI = 1.06–1.18), marital status (OR for married vs. single = 6.44, 95% CI = 1.94–21.40), education (OR for illiterate/primary = 2.56, 95% CI = 1.02–6.43 and OR for secondary/high-school diploma = 4.89, 95% CI = 1.10–21.68), unemployment vs. employed (OR = 0.38, 95% CI = 0.16–0.91), number of rooms (OR = 1.19, 95% CI = 1.03–3.45), and self-regulation score (OR = 0.94, 95% CI = 0.88–1.00) significantly increased the likelihood of central obesity [Table 5].

Discussion

This study aimed to assess socioeconomic determinants of excess weight and central obesity among women in Tehran city based on IMB model. According to IMB, individuals' exposure to information leads to motivation

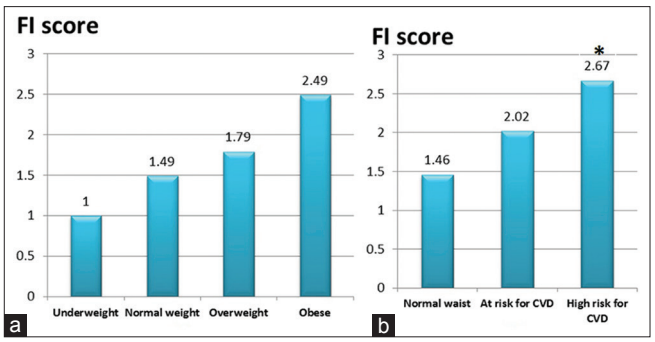

Figure 1: Food insecurity score in different (a) weight and (b) waist status group of women in Tehran. *: Significant difference with normal waist group ($P < 0.05$)

that is a baseline to perform behavior (through behavior skills) that averts disease condition through the effective method disease prevention.

In this study, the rate of overweight and obesity in adult women of Tehran was estimated as 35% and 21.2%, respectively. The prevalence of abdominal obesity in the same group was 34.6%. This is similar to the review, conducted in Iran until 2007, and had shown the rate of obesity among women >18 was 27.3%.[26] Another similar study of Steghamati and others in 2005, in females aged from 25 to 64 years, the overweight and obesity rate were estimated at 35.1% and 30.6%, respectively. Furthermore, the prevalence of central obesity was 73.4%.[27] Similar to this study, in a review conducted in Iran (1995–2011) by Rahmani *et al*., the percentage of women with obesity was 25.2 (19.8–30.4). Overall, the reported obesity rate in the previous studies varied between 1.1% and 67%.[5]

In 10 years, follow-up of TLGS, the rate of obesity in women >20 years old has increased from 29.5% (Phase I) to 42% (Phase IV). The prevalence of abdominal obesity in women was 44.4% in Phase I to 66.1% in Phase IV ($P < 0.001$).[8,28,29]

According to data from the World Health Organization, obesity rates among adults are exceptionally high in the Middle East region (>37% in the UAE, almost 40% in Kuwait and >42% in Qatar). The prevalence rate is significantly higher in women than men[30] which may be associated with the increased CVD. Cutoff points used for obesity and abdominal obesity in these studies were as follows: BMI ≥30 and WC ≥80 cm for Iranian women >20 years. Therefore, different obesity rates can be partly attributed to the variation of the age range in studied women, which were >20 years old in other studies and are between 20 and 49 years in the present study. Our results are compatible with obesity rates for 20 and 39 years old in the TLGS.

This study showed that the association of women's overweight/obesity with age, occupation, education, ethnicity, floor area, food, and total expenditure. Moreover, it revealed association between WC and age,

Table 3: Frequency of different levels of weight and waist circumference status of adult women based on Food Insecurity levels in Tehran

Variables	Levels of weight				Waist circumference			
	Underweight	Normal weight	Overweight	Obese	Normal	At risk	High risk	Total
Food secure	10 (5.2)*	82 (42.5)	65 (33.7)	36 (18.7)	133 (68.9)†	26 (13.5)	34 (17.6)	193 (74.2)
Mild food insecurity	3 (6.5)	11 (23.9)	20 (43.5)	12 (26.1)	26 (56.5)	9 (19.6)	11 (23.9)	46 (17.7)
Moderate food insecurity	0 (0.0)	6 (40.0)	5 (33.3)	4 (26.7)	9 (60.0)	2 (13.3)	4 (26.7)	15 (5.8)
Severe food insecurity	0 (0.0)	2 (33.3)	1 (16.7)	3 (50.0)	2 (33.3)	1 (16.7)	3 (50.0)	6 (2.3)
Total	13 (5.0)	101 (38.8)	91 (35.0)	55 (21.2)	170 (65.4)	38 (14.6)	52 (20.0)	260 (100.0)

*Figures in the parentheses are indicative of raw percent except for the last columns. †Significant difference between groups using the Chi-square test ($P<0.05$)

Table 4: Linear regression model for determinants of excess weight and abdominal obesity in adult women of Tehran

Variables	BMI				Waist circumference			
	Unstandardized coefficients		Standardized coefficients		Unstandardized coefficients		Standardized coefficients	
	B	SE	β	*P*	*B*	SE	β	*P*
Age (years)	0.130	0.047	0.209	0.006*	0.379	0.116	0.227	0.001*
Education	−0.697	0.332	−0.226	0.037†	−0.950	0.719	−0.110	0.188
Occupation	0.627	0.240	0.186	0.010*	0.869	0.533	0.100	0.104
Ethnicity	−0.400	0.180	−0.154	0.028†	−0.780	0.415	0.008	0.061
Family size	0.061	0.354	0.014	0.862	0.088	0.708	0.008	0.902
Number of children	0.114	0.507	0.022	0.823	1.498	0.054	0.114	0.156
Number of rooms	0.579	0.600	0.094	0.336	1.467	1.383	0.089	0.290
Floor area	−0.025	0.009	−0.243	0.005*	−0.065	0.021	−0.245	0.002*
Food expenditure	−0.009	0.000	0.362	0.002*	−0.001	0.000	−0.101	0.304
Total expenditure	0.001	0.000	−0.186	0.100	0.002	0.000	0.254	0.012†
Information	0.003	0.106	0.002	0.977	0.068	0.267	0.016	0.798
Attitude	0.007	0.068	0.007	0.924	0.197	0.164	0.076	0.229
Social support	−0.022	0.049	−0.031	0.660	−0.170	0.123	−0.086	0.168
Self-efficacy	0.033	0.078	0.035	0.671	−0.117	0.194	−0.044	0.547
Self-regulation	−0.058	0.057	−0.087	0.311	0.023	0.143	0.012	0.873
FI score	0.064	0.088	0.056	0.471	0.131	0.184	0.045	0.476

*Significant difference between groups using ANOVA ($P<0.01$), †Significant difference between groups using ANOVA ($P<0.05$). ANOVA=Analysis of variance, BMI=Body mass index, SE=Standard error, FI=Food insecurity

Table 5: Determinants of excess weight and central obesity in in adult women obtained from multivariate logistic regression analysis

Determinants	Overweight/obesity*		Central obesity	
	Adjusted OR (95% CI)	*P*	Adjusted OR (95% CI)	*P*
Age (years)	1.09 (1.03-1.14)	0.001	1.12 (1.06-1.18)	<0.001
Marital status				
Single	1.00 (reference)		1.00 (reference)	
Married	2.32 (0.92-5.92)	0.076	6.44 (1.94-21.40)	0.002
Education				
Higher than diploma	1.00 (reference)		1.00 (reference)	
Secondary/high-school diploma	4.27 (0.88-20.79)	0.072	4.89 (1.10-21.68)	0.037
Illiterate/primary	2.35 (1.05-5.27)	0.037	2.56 (1.02-6.43)	0.046
Occupation				
Employed	1.00 (reference)		1.00 (reference)	
Unemployed	0.53 (0.24-1.16)	0.111	0.38 (0.16-0.91)	0.030
Student	2.18 (0.36-13.23)	0.397	1.00 (0.09-10.87)	0.998
Housewife	0.30 (0.06-1.46)	0.135	0.67 (0.95-4.74)	0.689
Number of children	0.86 (0.55-1.35)	0.517	0.77 (0.47-1.27)	0.306
Number of rooms	1.09 (0.67-1.78)	0.734	1.19 (1.03-3.45)	0.040
Floor area per person (m^2/p)	0.99 (0.97-1.01)	0.338	0.97 (0.94-1.00)	0.061
Food expenditure				
Inadequate	1.00 (reference)		1.00 (reference)	
Intermediate	0.56 (0.24-1.41)	0.227	0.84 (0.33-2.16)	0.722
Adequate	0.46 (0.16-1.34)	0.153	0.41 (0.13-1.27)	0.122
Total expenditure				
Low	1.00 (reference)		1.00 (reference)	
Middle	2.29 (0.89-5.92)	0.087	0.67 (0.24-1.86)	0.438
High	3.14 (1.06-9.37)	0.040	3.15 (0.96-10.26)	0.057
Information	1.00 (0.90-1.11)	0.997	1.05 (0.94-1.17)	0.424
Attitude	0.98 (0.92-1.05)	0.616	1.04 (0.96-1.12)	0.357
Social-support	0.99 (0.94-1.04)	0.564	1.02 (0.97-1.08)	0.475
Self-efficacy	1.01 (0.94-1.09)	0.738	0.99 (0.92-1.08)	0.880
Self-regulation	0.98 (0.93-1.04)	0.468	0.94 (0.88-1.00)	0.040
Food insecurity status				
Food secure	1.00 (reference)		1.00 (reference)	
Mild food insecurity	2.31 (0.98-5.45)	0.056	1.67 (0.73-3.84)	0.228
Moderate food insecurity	1.10 (0.32-3.76)	0.875	0.99 (0.27-3.71)	0.990
Severe food insecurity	1.08 (0.14-8.61)	0.954	1.12 (0.12-10.65)	0.921

*Underweight subjects deleted from analysis. OR=Odds ratio, CI=Confidence interval

floor area, total expenditure, marital status, level of education, type of occupation, number of rooms, and self-regulation score which may be associated with the increased CVD. The TLGS study found a conceptual model of direct associations of age, marital status, and level of education with overweight and central obesity among adult women of Tehran.[13]

In this study, a number of children were not a significant predictor of women's central obesity in multivariate analysis. However, Malaysian study showed that overweight and abdominal obesity among the women were associated with the occupation of women (as housewives), having more children, larger family size, FI, shorter time spent in economic activities, longer time spent in leisure activities, and lower food variety.[31] A study in the Kingdom of Saudi Arabia, the prevalence of obesity was 43%, whereas educational level, employment status, and family income were a significant predictor of obesity.[32]

In the present study, obesity was lower in Kurds than Fars and Azeris. However, the number of Kurds in our sample was relatively low. However, in Rezazadeh *et al*.'s study, the findings showed that the association between moderate-to-severe FI and risk of general/central obesity varies in Azeris as compared to Kurds.[33]

In this study, the findings (using the HFIAS) revealed that the prevalence of mild, moderate, and severe households' FI was 46%, 15%, and 6%, respectively. Similar to this study, the findings in Tehran showed that urban obese women have higher FI scores than normal weight women. Some studies in women of

developed countries have shown associations between FI and obesity.[34,35] The study by Mohammadi *et al*. in Tehran showed that severe, moderate, and mild FI was observed in 11.5, 14.7, and 17.8%, respectively. No causal relationship was found between FI and weight status by structural equation models.[17]

According to a study in 2016 by Esfarjani *et al*., 29%, 12%, and 3%, of the studied households were mildly, moderately, and severely food insecure, respectively.[36] Other studies in Yazd, Shiraz, Tabriz, and the North-East of Iran showed 32.9%, 44%, 59.3%, and 40.9% of FI, respectively.[37-40]

In this study, participants with a higher score of self-regulation had shown lower WC, and there was no significant relationship with BMI. However, in Annesi and Gorjala study, changes in self-regulation were associated with BMI change.[41]

As high BMI and central obesity can be two important factors to be at risk in chronic diseases or conditions, application of this model or relevant model with similar constructs recommended to tailor appropriate theory-based intervention as Razavi *et al*. study.[42] This innovative understanding help health policymakers to empower women as an important part of society.[43]

In this study, before introducing the other factors, there was a significant relationship between food security and BMI and central obesity. In the present study, the IMB model was used as a conceptual framework of obesity in a group of women for the first time. Moreover, socioeconomic determinants affecting women's obesity were identified. Given the influence of some factors including individual, demographic, environmental, international, and educational factors on the epidemiology of obesity, governmental and nongovernmental health agencies, public health institutes, and all segments of the society should make an effort to have active roles in the prevention and control of obesity.

Since the study designed as a cross-sectional one, it is difficult to identify the causal relationship between variables. Nutrition and physical activity are also two important factors which were not among the goals of this study. These factors might influence the relationship between socioeconomic factors and weight status of women.

Conclusion

These study findings revealed socioeconomic determinants, especially age, education, and expenditure as well as self-regulation play an important role in excess weight and central obesity among women (20–49 years old). Therefore, recognizing these factors will contribute to better educational planning to decrease obesity in women through effective nutrition education and health promotion programs on obesity. The study results can be considered as a significant pathway to tailor the practical educational theory-based intervention to health policy makers among at-risk individuals.

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Conflicts of interest

There are no conflicts of interest.

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