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Relationship between Diet Quality and Quality of Life among Overweight and Obese Women

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ABSTRACT

Background: The prevalence of overweight and obesity is increasing among women. Since diet quality and quality of life are two indicators of healthy lifestyle, we conducted this study to examine the relationship between these two indicators among overweight and obese women**. Methods:** This study was carried out among a sample of 111 overweight and obese women, aged 35-60 years in the west of Tehran, Iran. Dietary data were collected using a 168-item food frequency questionnaire and the Nutrient-Rich Food index (NRF9.3) algorithms were used to estimate the nutrient density. The quality of life was measured using 26-item WHOQOL-BREF questionnaire . The SPSS 24 was run for statistical analysis. **Results:** We found that the participants' quality of life had a significant relationship with their occupational, marital, and educational status, but no significant association was observed between the quality of life and diet quality (P = 0.50). Pearson correlation showed that NRF9.3 score was positively associated with body mass index (P = 0.01), but no difference was found between obese and overweight women regarding quality of life. **Conclusion:** The NRF9.3 index was not associated with WHOQOL-BREF questionnaire's score, while job, marriage, and education were significantly associated with the quality of life. Further studies are needed to clarify the relationship between quality of life and diet quality among overweight and obese women.

Keywords: *Quality of life; Diet quality; NRF9.3 index score; Obesity; Overweight; Women*

Introduction

Overweight and obesity are defined as abnormal or excessive fat accumulation that can cause health damage. Overweight and obesity are the result of an imbalance between the number of calories consumed and those expended. This imbalance has been deepened by the change in feeding patterns, characterized by more processed foods, rich in sugars and added fats and simultaneously by reducing physical activity due to increasing urbanization, mechanization of work

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and motorization of transport (Sun *et al.*, 2014, Swinburn *et al.*, 2011). According to the statistics from 1980 to 2013, the number of overweight and obese people doubled from 921 million to 2.1 billion , affecting more than a third of the world's population (Ng *et al.*, 2014). In 2008, the prevalence of obesity and overweight was 42.8% in Iranian population. Furthermore, overweight, obesity, and morbid obesity were observed in 28.6%, 10.8%, and 3.4% of the population (Kelishadi *et al.*, 2008).

Quality of life refers to how well a person functions and to his or her perception of well-being in the physical, mental, and social domains of life–all distinct areas influenced by the person's experiences, beliefs, and expectations (Amarantos *et al.*, 2001). Quality of life is in relation with diet quality. A cross-sectional study in Europe implicated diet quality in depression and anxiety (Jacka *et al.*, 2011). Moreover, a 10-year study over 2200 Europeans aged 70– 75 years showed that adherence to a Mediterranean diet was not related to maintenance of health status or physical function (Haveman-Nies *et al.*, 2003). In contrast, a cross-sectional study among 4000 men and women in Hong Kong showed that diet quality assessed by the Diet Quality Index-International was associated with physical and mental health and frailty (Woo *et al.*, 2010). A few studies investigated this relationship specifically among women (Kim *et al.*, 2016). Therefore, we decided to assess both diet quality and quality of life in this vulnerable and important gender group using new tools and indices.

Over the years, several approaches and methods have been proposed to assess food and diet quality, including diet quality indices and various nutrient profiling methods. Some diet quality indices such as the US dietary guidelines (My Plate), healthy eating index (HEI), and alternative healthy eating index (AHEI) have been improved to measure the adaptation of individuals and population groups to the international and national dietary guidelines and recommendations (Guenther *et al.*, 2013). One of these indices is nutrient rich food index. The nutrient-rich food (NRF) family of indices was based on a variable number of qualifying nutrients (from six to fifteen) and on three disqualifying nutrients based on nutrient density (Drewnowski, 2017). Nutrient density is the ratio of the nutrient composition of a food to the nutrient requirements of the human consumer (Drewnowski, 2009). The reason we chose NRF9.3 as a diet quality indicator was the fact that it simultaneously examines the positive and negative aspects of the diet, covers most key components of the diet, and shows the correct quality of individual's diet.

We selected the World Health Organization's quality of life scale (WHOQOL-BREF) to measure quality of life. This index measures physical, psychological, social, environmental, and total health separately and is a validated questionnaire.

Women's health is of high importance that guarantees a healthy family as today's woman is sharing her responsibilities in the household and at the workplace equally. Hence, in this study, the relationship between diet quality and quality of life was investigated among Iranian overweight and obese women using new measurement tools for the first time.

Materials and Methods

Study design and Participants: To conduct the clinic-based cross-sectional study, three clinics were selected in west of Tehran through convenience sampling: Taghiniya, Olympic, and Nemat-Abad health centers. Overweight and obese women aged 35-60 years who were living in the west of Tehran and were not pregnant or breastfeeding were included in the study. The exclusion criteria included suffering from metabolic disorders such as hyperthyroidism, using medication that affects weight, and smoking or alcohol consumption. The data were collected by trained interviewers over a period of two and half months from April to June 2017. A total of 111 women who met our inclusion criteria were asked to sign informed consents. Followed by the

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interviews and data analyses, the participants were provided with the final findings.

Measurements: The briefed version of WHOQOL-BREF was administered to assess the quality of life in the present study. This questionnaire contained 26 questions covering the following four dimensions: physical health (questions no. 3, 4, 10, 15, 16, 17, 18), psychological health (questions no. 5, 6, 7, 11, 19, 26), social health (questions no. 20, 21, 22), and environmental health (questions no. 8, 9, 12, 13, 14, 23, 24, 25). Each statement was scored from 1 to 5. Questions no. 3 and 4 were scored reversely. Facets incorporated within the domains included: physical health (activities of daily living, dependence on medicinal substances and medical aids, energy and fatigue, mobility, pain and discomfort, sleep and rest, and work capacity); psychological health (body image and appearance, negative feelings, positive feelings, self-esteem, spirituality/ religion/personal beliefs, thinking, learning, memory, and concentration); social health (personal relationships, social support, and sexual activity), as well as environmental health (financial resources, freedom, physical safety and security, health and social care accessibility and quality of home environment, opportunities for acquiring new information and skills, participation in and opportunities for recreation/leisure, physical environment (pollution/ noise/ traffic/climate), and transport). Questions 1 and 2 were related to quality of life (QoL) and satisfaction with the health status analyzed separately as recommended by WHOQOL-BREF (1996). These two questions included five-point response categories for WHOQOL: "very poor", "poor", "neither poor nor good", "good", and "very good". Regarding satisfaction with health, the following choices were considered: "very dissatisfied", "dissatisfied", "neither satisfied nor dissatisfied", "satisfied", and "very satisfied". The scores ranged from 0 to 100 for this questionnaire. Reliability and validity of this scale were also assessed in 2008 (Nedjat *et al.*, 2008).

Diet quality was assessed using food frequency questionnaire (168-item) over the past year. The information was collected through a face-to-face individual interview with eligible women. In the case of any under or over estimation of food intake, the data were not used in statistical analysis. Reliability and validity of this questionnaire was assessed in 2012 (Asghari *et al.*, 2012).

Anthropometric measurements were obtained during the interview using validated standardized methods. Weight measurement was recorded to the nearest 0.5 kg using a seca (Germany, SECA) 761 medically approved flat mechanical scales. Height was recorded to the nearest millimeter using a Leicester portable height stick. Participants' BMI was classified according to the World Health Organization (WHO) classifications as overweight ($\geq$ 25 and < 29.9 kg/m^2) or obese ($\geq$ 30 kg/m^2) (World Health Organization, 2000).

Information on age, marital status, smoking, education, career, nationality, and residence were obtained via interview using a personal information questionnaire. Education was categorized into under diploma, diploma, and upper diploma. Marital status was defined as single or married. Women were categorized as 'housewife' or 'employed' according to their reported job status. Women's physical activity was measured using the International Physical Activity Questionnaire (Moghaddam *et al.*, 2012) and then the participants were categorized into low or moderate activity groups.

Calculation of the Nutrient Rich Food index scores: The NRF index consisted of two components: (i) the nutrient-rich (NR) component, which is based on a variable number of beneficial nutrients and (ii) the limiting nutrients (LIM) component. The NRF9.3 score was based on the sum of the percentage of reference daily values (DVs) for nine beneficial nutrients - protein, dietary fiber, vitamin A, vitamin C, vitamin E, calcium, magnesium, iron and potassium - minus the sum of the percentage of maximum DVs for three nutrients to limit - saturated fat, total sugar, i.e., mono- and disaccharides, and sodium (Abdollahi *et al.*, 2016). This index was used as follows. First, all foods

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consumed by each individual were scored using the NRF9.3 algorithms based on Drewnowski's method (Backstrand, 2003). This resulted in a NRF9.3 score (per 100 kcal) for every food item; i.e., a NRF9.3 food score. The recommended daily allowances, set by the Institute of Medicine (IOM) of the National Academies (Dietary Reference Intake (DRI), were used as the reference DVs (Alkerwi, 2014, Miller *et al.*, 2009). The percentage of reference DV for each nutrient was capped at 100% DV to avoid overvaluing of food items that provide very large amounts of a single nutrient. Second, the NRF9.3 food scores were converted to individual NRF9.3 index scores by multiplying the consumed amount of each food item (in 100-kcal units) by the NRF9.3 food scores. Later, these scores were summed for each person. Third, the NRF9.3 index scores were divided by the number of 100-kcal units of the participant's total energy intake to provide a 'weighted average' diet quality score. Higher NRF9.3 index scores indicated higher nutrient density per 100 kcal. Thus, participants with a high NRF9.3 index score were considered to have a healthier dietary pattern than those with a low NRF9.3 index score.

Ethical considerations: the study protechol was approved by the Ethics Committee of Iran University of Medical Sciences (IR.IUMS.REC 1395.95-04-193-30331.03/02/2017).

Data analysis: The Statistical Package for Social Sciences (SPSS), version 24, (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Descriptive statistics were carried out to describe demographic data. Categorical variables are reported through frequencies (percentages) and continuous variables were presented as mean (±SD). For inferential statistical methods, Pearson correlation coefficient and independent t-test were performed.

Results

One hundred and eleven women were included in the final analysis; 91 (82%) women were married. The mean score for NR9 and LIM3 are shown in **Table 1**.

The participants' mean age and BMI were 46.06 years and 31.95 kg/m^2, respectively. Furthermore, 71.2% of them had low physical activity and no one had high physical activity. Other participants' characteristics are presented in **Table 2**.

Considering the definition and scores of the questionnaires, all the study variables were measured for all participants. The mean score for total health and NRF9.3 index were 63.95 ± 18.14 and 69.93 ± 47.11, respectively. **Table 3** shows the mean scores of the study variables for the participants.

To compare the NRF9.3 index score and health dimensions between the single and married women and also between housewives and employed women, normality assumption was checked and the results were reported in **Table 4**. Findings showed that the total health status varried significantly in different educational levels (P = 0.009), occupational and marital status of the participants (P = 0.005 and P = 0.011, respectively). In other words, the single employed participants with higher educational level had better health status. The NRF9.3 index score was positively associated with weight category of the participants (P = 0.01).

The difference in social and physical health status were statistically significant in different levels of job categories (P =0.03, P = 0.002, respectively) and physical health status was associated with marital status (P = 0.007). Environmental health significantly varried in different levels of education (P = 0.02), job, and marital status of the participants (P = 0.001 and P = 0.001, respectively). Pairwise comparison based on Tukey statistic indicated that the participants' total health was statistically different between upper diploma and under diploma groups with regard to education levels (P = 0.006). Furthermore, a statistically significant environmental health difference was found between upper and under diploma and also between under diploma and diploma groups (P = 0.04, P = 0.03 respectively).

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The correlation between health dimensions (Physical, Psychological, Social, Environmental, and Total health) and NRF9.3 index indicated a strong significant correlation between the health dimensions as expected, but no significant correlation was found between the quality of life and the diet quality represented by the NRF index (**Table 5**).

Table1. Nutrient-rich food index and its components

Models	Algorithm	Mean
Nutrient-Rich $(NR9)_{100\ kcal}$	$\Sigma_{i=1-9}(Nutrient_i/RDV_i) \times 100$	51.39
limiting nutrients $(LIM3)_{100\ kcal}$	$\Sigma_{i=1-3}(Nutrient_i/MDV_i) \times 100$	18.54
Nutrient-Rich Food index $(NRF)9.3_{100\ kcal}$	NR9 - LIM3	69.93

RDV: Reference daily value; MDV: maximum daily value

Table 2. Characteristics of participants

Quantitative variables	**Mean ± SD**
Age (y)	46.06 ± 12.75
Height (m)	1.59 ± 0.56
Weight (kg)	81.23 ± 13.28
Body mass index (kg/m^2)	31.95 ± 4.54
Qualitative variables	**N (%)**
Education	
Under diploma	30 (27.0)
Diploma	44 (39.6)
Upper diploma	37 (33.3)
Marriage	
Single	20 (18.0)
Married	91 (82.0)
Physical activity	
Low	79 (71.2)
Moderate or high	32 (28.8)
Job	
Housewife	71 (64.0)
Employed	40 (36.0)
Weight status	
Overweight	43 (38.7)
Obese	68 (61.3)

Table 3. Mean (±SD) score of health components and Nutrient-rich food index

Physical health	61.74 ± 16.83
Psychological health	59.94 ± 15.32
Social health	63.66 ± 19.55
Environmental health	63.85 ± 14.26
Total health	63.95 ± 18.14
Nutrient-Rich Food index (NRF)9.3	69.93 ± 47.11

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Table 4. Association between demographic variables and health components with Nutrient-rich food (NRF) index scores

Variables	Physical health	Psychological health	Social health	Environmental health	Total health	NRF9.3
Education level						
Under diploma	56.42 (18.69)	59.16 (16.42)	60.55 (22.63)	57.70 (14.01)	55.41 (22.18)	59.19 (30.32)
Diploma	61.76 (17.77)	59.75 (16.04)	65.53 (17.93)	66.19 (14.33)	63.06 (16.82)	72.58 (49.25)
Upper diploma	66.02 (12.83)	60.81 (13.83)	63.96 (18.94)	66.04 (13.22)	68.91 (13.69)	75.49 (58.84)
P-value	0.06	0.90	0.56	0.02	0.009	0.33
Marriage status						
Single	70.89 (14.76)	62.29 (12.05)	70.00 (16.75)	73.59 (11.62)	70.62 (12.99)	72.97 (42.26)
Married	59.73 (16.66)	59.43 (15.96)	62.27 (19.92)	61.71 (13.94)	61.26 (18.73)	69.26 (48.30)
P-value	0.007	0.45	0.11	0.001	0.01	0.75
Physical activity						
Low	61.48 (16.71)	59.81 (16.09)	63.18 (19.68)	63.76 (14.12)	62.81 (18.12)	67.06 (40.28)
Moderate or high	62.38 (17.37)	60.28 (13.46)	64.84 (19.48)	64.06 (14.82)	63.28 (18.49)	77.02 (60.99)
P-value	0.79	0.83	0.68	0.92	0.90	0.31
Job						
Housewife	58.09 (16.83)	58.68 (16.07)	60.79 (20.43)	60.60 (12.91)	59.33 (18.38)	72.59 (55.51)
Employed	68.21 (14.95)	62.18 (13.81)	68.75 (16.95)	69.60 (14.87)	69.37 (16.00)	65.22 (26.32)
P-value	0.002	0.25	0.03	0.001	0.005	0.43
Weight status						
Overweight	61.37 (18.06)	58.52 (16.98)	63.17 (19.35)	61.19 (16.53)	62.50 (18.70)	58.27 (15.69)
Obese	61.97 (16.14)	60.84 (14.23)	63.97 (19.71)	65.53 (12.45)	63.23 (17.92)	77.31 (57.85)
P-value	0.857	0.440	0.836	0.119	0.836	0.012
Body mass index[a]	-0.12	0.008	0.011	0.058	- 0.052	0.100
P-value	0.19	0.93	0.91	0.54	0.58	0.29

Data are presented by mean (%); [a]: Pearson correlation coefficient.

Table 5. Correlation between health dimensions with Nutrient-rich food index.

Quality of life	Correlation coefficient	P-value
Physical health	0.068	0.480
Psychological health	0.001	0.995
Social health	0.029	0.761
Environmental health	-0.043	0.655
Total health	0.064	0.506

Discussion

To the best of our knowledge, this was the first study over the relationship between diet quality using NRF9.3 index score and quality of life using WHOQOL-BREF questionnaire among obese and overweight women in the west of Tehran. According to our findings, a significant relationship was observed between the environmental and total health status and the participants' education level. Participants with higher education had higher quality of life, which is confirmed by many studies (Neely *et al.*, 2000, Weitzman, 2017). We also found that housewives had lower physical, environmental, social, and total health status compared to the employed participants. Although work place, payment, and job satisfaction could affect the health status (Henseke, 2017), our findings can be explained by the effect of interpersonal relationship among employed participants. A study in Taiwan showed that the women who worked and had the chance to socialize with their colleagues had higher mental health (Chu, 2017). Single women also showed better quality of life in comparison to the married women. This finding is against many studies and marriage is associated with lower disease risk and fewer

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functional limitations (Newton *et al.*, 2014). However, our study participants were selected from four public clinics in west of Tehran, where women have access to free health services and are mostly from low-income families. Therefore, it is understandable if married participants have lower quality of life due to more economic hardships. No significant association was found in demographic characteristics between obese and overweight participants.

Unlike some previous studies (Russell *et al.*, 2016, Zervaki *et al.*, 2017), we found no significant relationship between the participants' quality of life and the diet quality. Bolton, K.A. et al. (Bolton *et al.*, 2016) and Ford, D.W. et al (Ford *et al.*, 2014) observed significant association between diet quality and quality of life . A positive effect of healthy diets on psychosocial quality of life was reported by a recent meta-analysis (Wu *et al.*, 2019). The different results are mainly due to the methodological differences, larger sample size including both genders in the analysis, and using different tools to measure quality of life and diet.

Our condarictory findings can be due to the data dispersion. Considering the wide standard deviation for NRF9.3 index scores, the data dispersion can justify the observed significant relationship between the quality of life and NRF9.3.

Another reason is that we administered the WHOQOL-BREF questionnaire as a tool to measure quality of life. The original version of this scale has 26 items mostly used in the case of diseases or impairments. Regarding our study's circumstances, this questionnaire may not have been the most appropriate tool to assess the quality of life, but it was the most accessible one; there has been no questionnaire or criteria to measure the quality of life for Iranian population. Besides, many other factors may affect quality of life as well as diet quality, such as psychosocial and economic determinants, which were not assessed in the present study due to time, financial, and ethical limitations.

We were also faced with limitations in using NRF9.3 Index score as an indicator of diet quality. The NRF score can predict the choice of RDA robustly using added or total sugar and means or sums of scores (Sluik *et al.*, 2015). In addition, sodium, as added salt during cooking or at the table, was not taken into account in the NRF9.3 calculations. We also found that the NRF9.3 index score was significantly associated with weight category and obese participants showed higher NRF9.3 index score beside the fact that all data were adjusted for energy before analysis. We chose this index as a measure of diet quality in our study despite its flaws, since it is a novel index and our results can be compared to similar studies in which different indexes such as HEI or Diet Quality Index-international (DQI-I) score was used in the same population (Kim *et al.*, 2016).

One of the strengths of this study is that it evaluated the relationship between NRF9.3 index score and quality of life among obese and overweight women for the first time. All questionnaires were completed by trained interviewers in personal interviews with each participant. We also had some limitations. Initially, we did not take into account the preparation and cooking methods of fruits and vegetables; so, cooked fruits and vegetables were generally counted in the fruit and vegetable categories. Regarding the validity of our measurements, we note that there may have been bias using FFQ to gather the participants' nutritional information such as energy and nutrient misreporting and selective reporting of foods. Our study population is representative of a group of residents in the west of Tehran with low income; thus, it is not possible to generalize the findings to a larger population in Iran.

Conclusion

According to the findings of this research, a significant relationship was found between the participants' quality of life and socio-demographic variables; however, no significant association was observed between the quality of life and diet quality. We suggest carrying out the same study in larger population using other tools to measure diet quality and quality of life. Moreover, other confounders should be controlled such as socio-economic status, which

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would illustrate the relationship between the diet quality and quality of life among overweight and obese women. As a result, we can set better plans and policies to improve women's lifestyle. In addition, inferring causality is impossible in cross-sectional studies; so, we suggest future researchers to study the participants' quality of life and diet in cohort studies to clarify the effect of quality of life.

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Conflict of Interest

The authors declare no conflict of interest.

Authors' contributions

All authors were involved in developing the idea and design of this study. Sajadi Hezaveh Z, Hamidi Z, Yavari M, Ebrahimi Z, and Hadidi M cooperated in data collection. Khalighi Sikaroudi M and Tanha K performed data analysis. Vafa MR and Sadat Bahtami L were involved in interpreting the results and drafting the manuscript. All authors were involved in critical revision and final approval of the article.

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