

ORIGINAL ARTICLE

Dietary Diversity and Abdominal Obesity among Female Students of Shiraz University of Medical Sciences, Shiraz, Iran

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ABSTRACT

Background: Obesity and overweight are the main risk factors for several chronic diseases with a rising trend in recent years. Obesity is multifactorial and is related to nutritional status of people and is correlated with the dietary diversity. This study investigated the relationship between dietary diversity score (DDS) and abdominal obesity among female students.

Methods: In this cross-sectional study, 120 female students of Shiraz University of Medical Sciences, Shiraz, Iran were enrolled. Weight, height, waist circumference (WC) were measured according to standard procedures, and body mass index (BMI) was calculated. Also, their dietary intake was recorded using a 24-hour diet recall questionnaires. DDS was calculated using food grouping based on the food pyramid guide. The relationship between DDS and anthropometric indicators was statistically assessed.

Results: BMI was shown to be 21.94 ± 4.66 kg/m² and the WC was 79 ± 11 cm. The DDS ranged from 1.7 to 9.4. BMI and waist circumference were significantly different between DDS quartiles; compared to the highest DDS quartile, subjects with the lowest DDS quartile had higher BMI and WC. The prevalence of obesity and overweight was less among participants with higher DDS.

Conclusion: Overweight, obesity as well as abdominal obesity were demonstrated to be inversely correlated to DDS, so that with an increase in DDS, overweight, and obesity as well as abdominal obesity decreased.

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Introduction

Overweight and obesity are defined as abnormal or excessive fat accumulation that can be considered as risk factors for chronic diseases (1). Obesity is a health issue with an increasing trend in the last century in many countries (2). The World Health

Organization estimated that around 1.3 billion adults worldwide are suffering from obesity and overweight (3), while the United States, Mexico, and New Zealand have showed the highest rates (4). The metabolic diseases have dramatically increased among adults in the Eastern Mediterranean Region,

with the highest rates of overweight and obesity in Egypt, Bahrain, Jordan, Kuwait, Saudi Arabia, and the United Arab Emirates, while the prevalence of overweight and obesity in these countries ranged from 74% to 86% among women and 69% to 77% in men (5).

In Iran, about 60% of the urban population are overweight or obese (6). In almost all studies conducted in Iran, the frequency of overweight and obesity at different ages in the females has been reported more than the males (7). Body mass index (BMI) is the most popular criteria for obesity in a population. Overweight and obesity are the main risk factors for several chronic diseases, including diabetes, high blood pressure/hypertension, cardiovascular diseases, and cancer (1, 8). The distribution of fat in the body is more important than obesity. Moreover, central obesity is the main component of metabolic syndrome. It is a more important indicator for the prediction of chronic diseases (9, 10). In Iran, 67% of women and 33% of men were reported to have abdominal obesity (11).

As obesity is a multifactorial disease, it is affected by various factors such as sedentary lifestyle, excessive alcohol consumption, taking certain medications, increasing calorie intake, and biological factors such as genetics, age, and sex (3). Unhealthy eating habits are among the main risk factors for obesity and related chronic diseases (12). Since the effects of individual eating habits may be too small to examine the relationship between the patterns of multiple eating habits and obesity, it seems better to use a general approach to identify the effects of all these factors (13). Although a positive relationship was illustrated between dietary diversity and nutritional status (14) and metabolic syndrome (15), however, the role of dietary diversity in the development of the chronic disease is still unclear. Some studies suggested that dietary diversity helps to consume more energy and increases the incidence of metabolic syndrome, but other studies indicated that dietary diversity is associated with adequate nutrient intake and reduces the incidence of disease (16). Therefore, this study was conducted to investigate the association of dietary diversity with obesity and abdominal obesity in students living in the dormitory of Shiraz University of Medical Sciences, Shiraz, Iran.

Materials and Methods

This cross-sectional study was conducted on 116 female students of Shiraz University of Medical Sciences residing in dormitories in Shiraz, Iran. Sample size was determined based on BMI with consideration of $\alpha=0.05$ and power of 95% to

be 116 ± 16 . Finally, 120 people were enrolled in the present study. Individuals were selected using cluster random sampling method. The inclusion criteria were having no specific diet or specific food allergies, no illness and medication use, and the exclusion criteria were non-cooperation of participants and those with calorie intake outside the range of 4200-800 calories per day. The participants' age range was 18-25 years and a written informed consent was signed by each participant.

Food intake was assessed using a 24-hour recall questionnaire for 3 days (two days in the middle of the week and one day off). In this questionnaire, all types and amounts of consumed food were recorded for one day. The questionnaires were completed by a nutritionist in an interview. To determine Dietary Diversity Score (DDS), food groups were divided according to food pyramid definitions, using 5 groups including cereals, vegetables, fruits, meats, and dairy products. The groups were subdivided into 23 subgroups. In this way, cereals and their products were in 7 subgroups such as white bread, biscuits, pasta, whole wheat bread, popcorn, rice, and white flours. The vegetables were in 7 subgroups including green leafy vegetables, potatoes, tomatoes, starchy vegetables, yellow and orange vegetables, etc. Fruits were in two subgroups of fruits and juices, dairy products were in 3 subgroups of different types of milk, yogurt, and cheese, and meat were in 4 subgroups consisted of different types of red meat, poultry, fish, and eggs. All 23 subgroups were selected to include diversity among all food items of the food pyramid guide groups. Each consumer was considered as a subset of each food group, when she consumed at least half of the serving food item according to the definitions of the quantitative indicators of the food pyramid guide within the mentioned 3 days. The final DDS was defined as 10, and each of the 5 main groups had a maximum of 2 points out of a total of 10 points of food diversity. The method of calculating the main groups denoted to the percentage of the maximum possible score. For example, a person who consumed at least half of the serving food from the 3 main subgroups of cereals received a score of $3:7*2=0.85$ in the cereal group. The scores for other groups were calculated identically, and the final score for the 5 main groups of the pyramid was determined to be 10. The higher the score obtained and the closer it was to 10, it was regarded as better observation of the principle of diversity in consumption of food items in accordance with the recommendations of the Food Pyramid Guide (17, 18).

In the first visit, anthropometric indices such as

weight with minimal coverage and without shoes were measured by a digital scale with an accuracy of 0.1 kg, the height was measured in standing position without shoes. The height assessments was with an accuracy of 0.1 cm, and the waist circumference by measuring the circumference on the iliac crest using a non-stretchable tape meter without applying any pressure to the body with an accuracy of 0.1 cm. The participants were evaluated according to standard guidelines by an experienced expert. BMI was calculated by dividing weight in kilograms by the square of the body height in meters. Based on BMI index, individuals were divided into three categories of obese (BMI>30), overweight (BMI=25-30), and normal weight (BMI=18.5-25). This classification was according to the US Centers for Disease Control and Prevention (CDC). Data analysis was performed using SPSS software (Version 22, Chicago, IL, USA). Data distribution was assessed using the Kolmogorov-Smirnov test. DDS score was classified and individuals were ranked based on their obtained scores. By using the Kruskal-Wallis test, BMI and WC were compared across the quartiles of DDS. Also, the prevalence of normal and above-normal body mass index among the quartiles was investigated using the Chi-Square test. The level of significance was set at P-value less than 0.05.

Results

Totally, 120 female students, aged between 25-18 years old, living in dormitories, whose fields of study were medicine and paramedical fields were enrolled. The median (inter quartile range) BMI of the participants was 21.94±4.66 kg/m² and the median WC was 79±11 cm. The DDS was in the range of 1.7-9.4. The range of the obtained quartile for the DDS was as follows: the first quartile was less than 5.8, the second quartile was 5.8-7.8, the third quartile was 7.8-8.6, and the fourth quartile was above 8.6. Anthropometric indices and their relationship with DDS were shown in Table 1. As demonstrated in Table 1, BMI as well as the WC were significantly different between DDS quartiles. Compared to the highest DDS quartile, people in

the lowest DDS quartile had higher BMI and WC. The prevalence of obesity and overweight was also lower among students with higher DDS.

Discussion

The present study was conducted on female dormitory students of Shiraz University of Medical Sciences, Shiraz, Iran to evaluate the association of DDS and abdominal obesity. It was previously shown that obesity in this age range is associated with increased risk of chronic diseases and also decreased quality of life (19). Central obesity as a major component of metabolic syndrome is an important indicator for predicting chronic diseases. Overweight and abdominal obesity were previously shown to be higher in the lower quartile groups (9, 10). Results of the present study revealed that overweight, obesity as well as abdominal obesity were demonstrated to be inversely correlated to DDS, so that with an increase in DDS, overweight, and obesity as well as abdominal obesity decreased.

The correlation between DDS and anthropometric indicators has been investigated by several researchers (19-21). In a study on female students, a negative relationship between DDS and abdominal obesity was observed. Higher DDS was shown to be associated with higher consumption of dairy products, whole grains, fruits, and vegetables (20). Similarly, in another study conducted on male students, with an increase in DDS, the ratio of the chance of abdominal obesity decreased (21). Another study reported that abdominal obesity was lower in people with higher DDS, and in particular, there was a negative relationship between the consumption of various vegetables with obesity and abdominal obesity (22). Many studies indicated that in Iran, higher DDS was associated with higher consumption of fruits and vegetables, which was associated with a reduced chance of obesity (20, 21). The variety in consumed items in different food groups was a useful indicator of the adequacy of specific nutrients. Therefore, to determine the adequacy of certain nutrients, the diversity of diet groups can be determined (18), and with the

Table 1: Association of BMI and waist circumference with DDS

Variable	DDS				P value**
	Quartile 1 (n=31)	Quartile 2 (n=32)	Quartile 3 (n=29)	Quartile 4 (n=28)	
BMI (kg/m ²)	26.02 (2)*	22.13 (3.36)	19.7 (2.04)	21.7 (2.73)	<0.001 ¹
Waist circumference (cm)	90 (3)	79 (4)	76 (5)	79 (3)	<0.001 ¹
BMI category					
BMI<25	7 (7.3%) ¹	32 (33.3%)	29 (30.2%)	28 (29.2%)	<0.001 ²
BMI>25	24 (100%)	0 (0%)	0 (0%)	0 (0%)	

DDS: Dietary Diversity Score, BMI: Body mass index *Data were presented as median (Inter Quartile Range), ¹ Data were presented as number (percent), **P value<0.05, 1.Kruskal-Wallis test, 2.Chi-Square test

reduction of DDS, the risk of insufficient food intake increases (16). In contrast, a study conducted in Ardabil found a positive association between DDS and obesity, so that people with higher food diversity scores were more obese. This study found that obese subjects had a more variation in diet, but their intake of fruits and vegetables was lower (23). In another study, obesity was directly linked to DDS (24). Various results can be due to the use of different methods to check dietary intake and to determine DDS, and differences in the input or output of certain food items that may likely affect the findings (3, 22).

It was shown that the relationship between DDS and obesity was dependent on the groups of consumed foods. If an increase in DDS happened, it was due to an increase in consumption of refined sweets, snacks, and carbohydrates, that it is positively associated with obesity. On the other hand, if DDS was associated with higher consumption of vegetables (except potatoes), it was inversely correlated with obesity and reduced the chances of obesity in people. Therefore, the proportion of consumed foods was the most important factor in predicting the effect of DDS on obesity (25).

The increase in DDS calculated in our study was shown to reflect the degree to which people adhere to the food guide pyramid. Since the food guide pyramid only reflects the balance of nutrients and is not a pattern for calorie control, an increase in access to a variety of foods will likely increase calorie intake. However, the results of the present study showed that if a varied and balanced diet is followed according to what the food guide pyramid recommends, the risk of overweight and obesity, especially abdominal obesity would decrease.

The present study has several limitations as it was a cross-sectional study. More prospective studies are needed to verify the correlations reported in this study. Moreover, the lack of control over distorting factors was another limitation of this study. In the present study, 24-hour three-day recalls were used to measure DDS. Furthermore, the method of calculating DDS was based on food guide pyramid grouping, which is considered as a strong point for this study.

Conclusion

Overweight, and obesity especially abdominal obesity were illustrated to be inversely correlated to DDS, so that with an increase in DDS, overweight, and obesity as well as abdominal obesity were shown to decrease. Hence, increasing dietary diversity can be considered as a possible solution in the control and treatment of obesity in future studies.

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Conflict of interest

None declared.

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