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Dietary Predictors of Overweight and Obesity in Iranian Adolescents

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Abstract

Background: Considering both diet and energy expenditures possess some influence on weight status, research into dietary determinants of obesity is challenging but essential to rational planning of well-organized interventions to avoid obesity.
Objectives: This study aimed to determine whether dietary factors were predictive of overweight and obesity in adolescents in the Iranian population.
Patients and Methods: A total of 840 students, ages 15 - 17, from six schools were enrolled in this cross-sectional study. A diet-patterns approach often has been used to describe the eating patterns in adolescents. Height, weight, and waist circumference anthropometric indices, physical activity, waist hip ratio, and BMI measurements were determined. Daily dietary data and weighed food records were collected in 2010 and 2011. Abdominal obesity was defined according to world health organization guidelines, and the relationship between dietary predictor variables and the measures of adiposity were determined by using linear regression. Usual dietary intakes were assessed in an experimental study of Esfahani students.
Results: In total, 38.5% of girls and 32.2% of boys had a Western dietary pattern as the more prevalent pattern. The diet quality of adolescents with the lowest score on each dietary pattern was compared with those recording the highest scores. Those with the Western dietary pattern score were less likely to exercise and had a higher prevalence of general obesity. Adolescents in the greater quartile of the Mediterranean dietary patterns had the lowest odds of being overweight (OR 0.50, 95%; CI 0.27 - 0.73) and obese (OR 0.48, 95%; CI 0.15 - 0.80) than those in the lower quartile, whereas those in the greater quartile of the Western dietary pattern had the highest odds of being overweight (OR 1.69, 95%; CI 1.10 - 2.04) and obese (OR 1.44, 95% CI 1.05 - 1.84). Higher consumption of a Western dietary pattern and a salty dietary pattern were associated significantly with obesity ($P < 0.05$). Intake of a Western dietary pattern and a salty–sweet dietary pattern were associated positively with measures of adiposity, namely body mass index and waist circumference.
Conclusions: This study showed significant associations between the seven dietary patterns and overweight and obesity among adolescents. Using dietary patterns within adolescents can provide important information on dietary consumption, and this approach is clearer and much easier to follow.

Keywords: Obesity, Food Habits, Adolescent, Dietary Patterns, Predictors, Overweight

1. Introduction

Nowadays, obesity is considered a common problem (1, 2) in both developed and developing countries. The prevalence of obesity is rising dramatically in Asian countries, including Iran (3). The world health organization reported that Iran is among the first seven countries in the world with regard to high prevalence of obesity in adolescents (4, 5). Based on the reports, 31% of youths ages 6 - 19 are overweight in Iran (2, 6). Obesity is a medical condition in which excessive body fat accumulates to the extent that it has an adverse impact on health, resulting in a reduced lifespan and increased health issues (3, 7), including among both children and adolescents (8, 9). The rising prevalence of obesity reflects the strong impact of lifestyle factors, including diet, in its etiology (10).

Rezaeipour et al. reported that, in Tehran, among subjects including 270 students selected from schools for girls, 87% had relatively good quality nutritional behaviors, and their average daily intake included cereals, bread, vegetables, and fats from the recommended range (11). Many of them had an inappropriate situation regarding body weight, and in relation to their utilization of the major food groups, the main percentage of unhealthy food consumed was related to fat, with most of the subjects taking fatty and salty snacks on a daily basis (11).

During the last few decades, the dietary plan quality of adolescents has declined with additional energy intake from takeout, salty and sweet snacks, and soft drinks, which has reduced the trends regarding fruit and vegetable intake. Although dietary factors happen to be implicated in the creation of obesity, the connection is complex and poorly understood.

Responding to the inconsistent results found so far with conventional methods of exiling single foods or nutrients, dietary pattern analysis continues to be suggested for additional research in nutritional epidemiology because this approach may provide further insight into this complex association.

Most of the data available in this regard are from developed countries (12, 13), and few data are available from developing countries (14, 15).

2. Objectives

The aim of the current study was to assess the relation of dietary patterns identified by factor analysis of obesity among adolescents and to design a strategy for a balanced diet to avoid obesity, which may cause irreversible damage to health.

3. Patients and Methods

This cross-sectional study was conducted in a representative sample of Iranian adolescents, ages 11 - 18, selected by a multistage cluster random-sampling method, who lived in Isfahan. The ethical committee of the Isfahan University of Medical Sciences approved the study. In the second phase, 840 students, ages 15 - 17, from six schools, were enrolled. Data collection was carried out from September 2010 - 2011. We excluded students who were remaining > 7 products clear on the food frequency questionnaire (FFQ), and those that noted an overall total everyday energy intake (EI) outside the range of 800 - 4200 kcal were excluded because it could cause bias. A signed knowledgeable consent form was acquired from each participant. Normal nutritional consumption was assessed via the 168-item semi-quantitative FFQ (10). The questionnaire was a direct interview. The FFQ contains a list of meals with standard portion sizes frequently consumed by adolescents. Individuals were asked to record their frequency of use of certain portions of each food throughout the last year on a regular (e.g., rice or bread), weekly (e.g., meat or whole grain), or monthly (e.g., seafood) basis. The reported frequency for each food object was transformed into a daily intake. Serving sizes of meals were changed into grams by utilizing family measures (16). Overall energy intake was based on summing the energy intake from all meals. Due to the large variety of food items in accordance with the quantity of individuals, we assigned each food item into one of the 31 described food teams. The basis for a food item to be placed into a food class was the likeness of nutrients. Some foods were considered independent food classes, as their nutrient profiles were unique. A prior validation study determined great correlations between dietary intakes assessed by the same method of FFQ during multiple 24-hour dietary recalls throughout a yearlong study (17) (such as coffee, tea, eggs, and margarine,), or their intake was considered to reveal a definite dietary pattern (such as broth, doogh, or garlic).

Subjects for this study were recruited from schools based on the following criteria: age 15 - 17 and a healthy resident of Esfahan city. Participants were excluded if any of the following was applicable to them: under medical treatment and receiving medications, physically disabled or receiving hormone therapy, and suffering from diseases such as cardiovascular disease and diabetes. In order to exclude subjects, their past medical history was obtained through the socio-demographic section of the questionnaire.

In order to calculate the sample size, the following formula was used: $n = (pqz^2)/E^2$ where n = sample size; z^2 = square of the confidence level in standard error units; p = the estimate of the proportion of normal dietary pattern; q = 1 - p, or the estimated proportion of failures; and E^2 = the square of the maximum allowance for error between the true proportion and the sample proportion. Assume the arbitrary test usually may display 60% of all people (p) and recognizes the normal dietary pattern. To assume with 95% confidence (Zs.i = 1.96) that the allowance for sampling error is not > 3.5% points (E), these values into the formulation will be:

$$n = (1.96)^2 (0.6) (0.4) / 0.0352$$
$$= (3.8416) (0.24) / 0.001225$$
$$= 0.922 / 0.001225$$
$$= 753$$

The test measurement was increased up to 15% as a result of attrition. The ultimate trial measurement was $753 + 753 \times 15 / 100 = 844$

3.1. Assessment of Anthropometric Measures

Weight was measured using digital scales (SECA Germany) while the participants were minimally clothed without shoes and recorded to the nearest 100 g. Height was assessed via the SECA stadiometer 206 (SECA Germany) measure while the subjects were standing, not wearing shoes, and had shoulders in a usual position. Body mass index (BMI) was determined as the weight (kg) divided by the square height (in m^2). Waist circumference (WC) was measured at the narrowest, and hip circumference was at the maximum level around light clothing, using an unstretchable tape measure, without any force to human body area. As the WC was taken over light clothing, individuals were requested to eliminate belts and tight or loose clothes intended to change the shape of the body, and the individual performing the test was requested to examine the tension of the tape on the subject's body to make sure that the tape had the proper pressure, namely, neither loose nor too tight. Even though, generally, in most individuals, the narrowest waist is simple to recognize, sometimes, measurement of the narrowest waist could not be done accurately due to a wide range of abdominal fat or serious thinness (18). In the present study, once the narrowest place of the waist was recognized (particularly in overweight participants), the measurements of the WC were taken straight under the end of the lowest rib, because generally in most individuals the narrowest waist is at the lowest rib. To reduce error, all measurements were taken by the same observer.

3.2. Statistical Analysis

The factor score for each pattern was considered by summing intakes of meal groups weighted by their factor loadings (19). Each adolescent obtained a factor score for each identified pattern, and we adjusted all models for BMI. All designs for BMI-categorized individuals were altered by quartile of dietary pattern scores. One of the ways of evaluation of difference with Tukey's post hoc evaluations was executed to differentiate substantial variations (such as age, anthropometry and physical exercise) across quartile kinds of dietary pattern ratings. The division of the qualitative variable across quartile was considered by using Pearson's chi-square tests. Age and energy were adjusted to mean values (namely, age, physical exercise, and overall EI) for overweight and obesity. First, we acquired age and gender-modified ORs, and then adjustments were made for WC and SES. We also adjusted for EI (kcal/d), physical activity, and sleeping time in the third model, and ultimately, we included BMI in the logistic regression model to study if the relationship was mediated by obesity. The Hansel chi-square test was employed to assess the overall trend of ORs across the increasing quartile of dietary pattern scores. The software SPSS (version 18; SPSS Inc., Chicago, IL) was utilized for all the statistical analyses. $P < 0.05$ was considered as the level of significance.

4. Results

Demographic data of our participants are described in Table 1. Seven major dietary patterns were extracted by using factor analysis. The Western dietary pattern was the most prevalent pattern among girls (38.5%) and boys (32.22%), whereas the Mediterranean dietary pattern was the least prevalent pattern, 3.94% among girls and 4.25% among boys. Factor-loading matrices for these dietary patterns can be found in Table 2. Partial correlation coefficients (r) for the association between dietary pattern scores and features of overweight and obesity among adolescents are presented in Table 3. The highest correlation was seen between sleeping time and low protein, which was followed by energy intake with Western, low-protein, and salty-sweet patterns ($P < 0.05$).

The diet quality of adolescents with the minimum score on each dietary pattern was compared with those recording maximum scores. As a result of the comparison among the participants in the lowest and highest quartiles, significant obesity trends were found among subjects presenting less physical activity. The Western dietary pattern presented a significantly higher BMI among subjects with significantly much less exercise coupled with a considerably greater incidence of obesity.

Individuals within the greater from the traditional dietary pattern had been a little more physically active, as well as significantly less probably be overweight compared to those within the minimum bracket.

Those with the Western dietary pattern score were less likely to exercise and had a higher prevalence of general obesity. Consumers of the Western dietary pattern intake had more energy and cholesterol and less fiber. In total, these factors explained 76.94% and 76.42% of the whole variance. Table 4 shows that participants in the maximum quartile of the Mediterranean dietary patterns had minimum odds of being overweight (OR 0.50, 95%; CI 0.27 - 0.73) and obese (OR 0.48, 95%; CI 0.15 - 0.80) than did those in the smallest quartile, whereas those in the uppermost quartile of the Western dietary pattern had higher odds of being overweight (OR 1.69, 95%; CI 1.10 - 2.04) and obese (OR 1.44, 95%; CI 1.05 - 1.84) than did those in the minimum quartile.

Subjects in the highest quartile of the Asian pattern (Table 5) had minimum odds of being overweight (OR0.77, 95%; CI 0.55 - 0.92) and obese (OR 0.67, 95%; CI 0.49 - 0.85) than did those in the smallest quartile, whereas those in the highest quartile of the low-protein dietary pattern (Table 6) had maximum odds of being overweight (OR 1.05, 95%; CI 0.81, 1.30) and obese (OR 1.39, 95%; CI 1.18 - 1.60) than did those in the minimum quartile.

Table 6 illustrates that those in the uppermost quartile of the sweet dietary pattern had the highest odds of being

Table 1. General Characteristics of Iranian Adolescents[a,b]

	Boys (n = 420)	Girls (n = 420)	P Value
Age, y	15.0 ± 2.1	15.4 ± 1.7	0.813
Weight, kg	51.8 ± 15.7	51.8 ± 10.5	0.472
Height, cm	160 ± 14	158 ± 8	0.614
BMI, Kg/m^2	19.9 ± 4.0	20.7 ± 3.5	0.187
WHR	0.7 ± 0.01	0.7 ± 0.01	0.441
Energy intake, kcal/d	2223 ± 1083	1903 ± 896	0.113
Weight status %			
Overweight	16.6 ± 0.3	11.9 ± 0.3	0.638
Obese	19.7 ± 0.4	15.1 ± 0.3	0.040
Sleeping duration, h/d	7.8 ± 1.2	7.5 ± 1.1	0.122
Physical activity, %			
Light	37.2	44.2	0.091
Moderate	46.7	44.5	0.741
Vigorous	16.1	11.3	0.062
Socioeconomic status, %			
Low	32.2	35.6	0.439
Middle	53.8	52.4	0.850
High	14	12	0.735

[a]Values are expressed as means ± SD or %.
[b]1 Kcal = 4.185 kj.

overweight (OR 1.00, 95%; CI 0.75 - 1.53) and obese (OR 1.37, 95%; CI 1.01 - 1.73) than those in the minimum quartile.

Participants in the uppermost quartile of the traditional pattern (Table 5) had lesser odds of being overweight (OR0.95, 95%; CI 0.82 - 0.12) and obese (OR 1.05, 95%; CI 0.0.90 - 1.19) as compared with individuals in the minimum quartile, while those in the highest quartile with the salty nutritional routine (Table 7) had a higher probability of being overweight (OR 1.04, 95%; CI 0.82, 1.29) and obese (OR 1.3, 95% CI 1.17 - 1.50) than those in the minimum quartile. Table 2 shows a factor-loading matrix for major dietary patterns of boys and girls. In this regard, seven major dietary patterns were extracted by using factor analysis.

5. Discussion

To our understanding, this is first study of Middle Eastern countries to record the relationship associated with significant dietary patterns and obesity. Our results revealed that the Mediterranean and Asian dietary patterns were associated with lower risks of obesity, whereas the Western dietary pattern was associated with higher risks of obesity. We identified no substantial association involving the traditional diet pattern with obesity. Almost all associations were independent of various other lifestyle factors. It is our understanding that this is the first study by which major dietary patterns have been related by factor analysis directly to obesity. Additionally, we indicated that a dietary pattern characterized by high use of legumes, vegetables, fruit, and poultry is related to a reduced threat of obesity.

In comparison, a dietary pattern with high levels of red meat, processed meat, refined grains, butter, and high-fat milk products and low levels of vegetables and fruit is connected with a greater threat of obesity. Studies that have recognized dietary patterns in developing countries are rare. The patterns extracted within our study were just like those found in earlier studies on adult populations (20). Two main dietary patterns were identified known as “prudent” (including veggies, fresh fruits, beans, whole grain products, as well as fish) and “Western” (including highly processed meats, steak, butter, high-fat milk products, eggs, and white grain).

Comparable dietary patterns were based on the nurses’ health study (21, 22), which investigated individuals with the Swedish Mammography Cohort and documented three major dietary patterns described as balanced (veg-

Table 2. Food Grouping Used in the Dietary Pattern Analyses

Food Groups	Food Items
Processed meats	Sausages, pizza
Red meats, organ meats	Beef, hamburger, lamb, beef liver
Fish	Canned tuna fish, other fish
Poultry	Chicken with or without skin, eggs
Butter, margarine	Butter, margarine
Low-fat dairy products	Skim or low-fat milk, low-fat yogurt
High-fat dairy products	High-fat milk, whole milk, chocolate milk, high-fat yogurt, cream cheeses, ice cream
Tea, coffee	Tea, coffee
Fruit	Bananas, cantaloupe, pears, apricots, cherries, apples, raisins or grapes, watermelon, oranges, grapefruit, kiwi, strawberries, peaches, nectarine, tangerine, mulberry, plums, persimmons, pomegranates, lemons, pineapples, fresh figs and dates
Fruit juices	Apple juice, orange juice, grapefruit juice, other fruit juices
Cruciferous vegetables Starch vegetables	Cabbage, cauliflower, Brussels sprouts, kale Carrots
Tomatoes	Tomatoes, tomato sauce, tomato pasta
Green leafy vegetables	Spinach, lettuce
Other vegetables	Cucumber, mixed vegetables, eggplant, celery, green peas, green beans, green pepper, turnip, corn, squash, mushrooms, onions
Legumes	Beans, peas, lima beans, broad beans, lentils, soy
Garlic	Garlic
French fries	French fried potatoes
Whole grains	Dark breads, barley bread, popcorn, cornflakes, wheat germ, bulgur
Refined grains	White breads (lavash, baguettes), noodles, pasta, rice, toasted bread, sweet bread, white flour, starch, biscuits
Snacks	Potato chips, corn puffs, crackers, popcorn
Nuts	Peanuts, almonds, pistachios, hazelnuts, roasted seeds, walnuts
Mayonnaise	Mayonnaise
Dried fruit	Dried figs, dried dates, dried mulberries, other dried fruit
Olives	Olives
Sweets and desserts	Chocolates, cookies, cakes, confections
Hydrogenated fats	Hydrogenated fats, animal fats
Vegetable oils	Vegetable oils
Sugars, condiments	Sugars, candies, gaz, jam, jelly, honey
Soft drinks, yogurt	Soft drinks, doogh (an Iranian yogurt preparation with a consistency similar to that of whole milk)
Broth	Broth

gies, fresh fruits, seafood, domestic fowl, tomato, grain, and low-fat dairy products), Western (processed animal meat products, various meats, processed grains, desserts, and deep-fried potatoes), and drinker (beer, wine beverages, hard liquor, and snacks).

The MD and Western patterns within this research tend to be much like the actual prudent and Western patterns described by Kim and Mueller (19), therefore, is similar to the healthy and Western patterns described by Hu et al. (20). Determining the actual relationship between dietary patterns and obesity is new. Nevertheless, it is recommended in order to see what types of dietary patterns can be found all over the world and to extent these types of patterns are based on the actual obesity epidemic. Within these studies, we identified a great opposite intimate relationship between the MD and Asian dietary pattern and the threat associated with obesity. This is in line with earlier described American (23) and European (24) studies. Various scientific studies determined that a dietary pattern seen as low-fat dairy, whole grains, and fresh fruit was involved inversely in alterations in BMI and WC in females (14, 22).

Inverse associations also have been reported between major dietary patterns characterized by whole grains, fruits, and vegetables with BMI and weight gain (25, 26). On the other hand, numerous studies have recorded no significant association (P = 0.49) between a healthy dietary pattern and BMI (27). This could be related to the self-reported weight and height within these studies. The Western dietary pattern appeared to be favorably related to the improved probability associated with common and central obesity. Both cross-sectional (28, 29) and prospective studies (30, 31) have indicated same findings previously. A fabulous “meat products” dietary pattern acquired with factor evaluation within a group of Hawaiian females was linked with a greater BMI (28). An optimistic relationship regarding the Western dietary pattern and being overweight was

Table 3. Partial Correlation Coefficients (r) for the Association Between Dietary Pattern Scores and Features of Overweight and Obesity Among Adolescents

	Western Pattern Score		Low Protein Score		Asian Pattern Score		Salty Pattern Score		Sweet Pattern Score		Traditional Pattern Score		Mediterranean Pattern Score	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p
Without BMI Adjustment														
Waist circum-ference	0.29	0.01	0.30	0.01	0.40	0.02	0.28	0.01	0.27	0.03	0.41	0.01	-0.33	< 0.001
Age/Sex	0.28	0.02	0.29	0.02	0.79	0.01	0.26	0.02	0.24	0.01	0.69	0.01	-0.18	0.01
Energy intake	0.47	0.006	0.54	0.006	-0.53	0.05	0.45	0.005	0.43	0.003	0.43	0.05	-0.47	< 0.001
Physical activity	0.25	0.02	0.26	0.02	-0.66	0.04	0.25	0.03	0.22	0.04	-0.56	0.04	-0.43	0.005
Sleeping time	0.52	< 0.001	0.51	0.005	0.43	0.08	0.53	0.001	0.55	0.005	0.40	0.06	-0.38	< 0.001
With BMI Adjustment														
Waist circum-ference	0.08	0.37	0.39	0.06	0.008	0.07	0.07	0.05	0.29	0.06	0.009	0.15	-0.23	0.01
Age/Sex	0.10	0.22	0.29	0.11	0.007	0.09	0.20	0.13	0.30	0.10	0.006	0.21	-0.11	0.09
Energy intake	0.28	0.03	0.45	0.01	0.05	0.06	0.27	0.02	0.40	0.07	0.04	0.16	-0.34	0.01
Physical activity	0.38	0.01	0.17	0.05	-0.05	0.04	0.35	0.01	0.22	0.02	0.04	0.11	-0.29	0.01
Sleeping time	0.18	0.04	0.16	0.03	0.07	0.14	0.16	0.04	0.43	0.001	0.06	0.13	-0.30	0.01

Table 4. Multivariate Adjusted Odds Ratio (95% CIs) for Overweight and Obesity Across Quartile (Q) Categories of Mediterranean Pattern Scores[a]

Mediterranean Pattern	Q2	Q4	P Value for Trend
Overweight			
Model I	0.92 (0.64, 1.20)	0.50 (0.27, 0.73)	< 0.01
Model II	0.97 (0.70, 1.23)	0.55 (0.29, 0.81)	< 0.01
Model III	0.98 (0.71, 1.25)	0.61 (0.31, 0.80)	< 0.01
Model IV	0.99 (0.72, 1.22)	0.65 (0.37, 0.93)	< 0.01
Obesity			
Model I	0.94 (0.54, 1.34)	0.48 (0.15, 0.80)	< 0.01
Model II	0.94 (0.59, 1.30)	0.57 (0.20, 0.82)	< 0.01
Model III	0.96 (0.62, 1.29)	0.53 (0.23, 0.82)	< 0.01
Model IV	0.97 (0.70, 1.23)	0.56 (0.27, 0.84)	< 0.01

[a] Model I, adjusted for age and sex; model II, further adjusted for waist circumference and SES; model III, additionally adjusted for energy, physical activity, and sleeping time; model IV, additionally adjusted for BMI; overweight defined as $\geq$ 85th percentile; obesity defined as $\geq$ 95th percentile.

documented specifically by Slattery et al. (29).

Within an eight-year prospective study among more than 50,000 adult women, the nurses' health study (31) recorded that adoption of the Western dietary pattern is associated with greater weight gain. Higher intakes of meat and sweets, as seen within the Western pattern, were related to gaining weight on a two-year follow-up period among males and females within the European Prospective Investigation into Cancer (32, 33) and nutrition-potsdam study (30, 34). Generally, these results underscore the significance of a Westernized diet as well as a nutrition changeover within the challenging prevalence of obesity within developing countries.

The actual Iranian dietary pattern identified within this research was linked persistently with being overweight. Iranian eating habits, as they were obvious within our study, are extremely loaded with processed grains (white rice as well as bread), tea, potatoes, and hydrogenated fats. With one of these ingredients, one could assume to find an optimistic connection among this kind of dietary pattern and risk associated with obesity. Nevertheless, some food groupings such as legumes and whole fiber items have been further loaded within this dietary pattern that could interact with various food products within the

Table 5. Multivariate Adjusted Odds Ratio (95% CIs) for Overweight and Obesity Across Quartile (Q) Categories of Asian and Traditional Pattern Scores[a]

	Asian Pattern			Traditional Pattern		
	Q2	**Q4**	**P Value for Trend**	**Q2**	**Q4**	**P Value for Trend**
			Overweight			
Model I	0.76 (0.53, 0.90)	0.77 (0.55, 0.92)	< 0.03	1.03 (0.78, 1.28)	0.95 (0.82, 1.12)	< 0.05
Model II	0.94 (0.81, 1.11)	0.98 (0.84, 1.12)	0.18	1.06 (0.82, 1.20)	1.00 (0.89, 1.07)	0.16
Model III	0.89 (0.71, 0.98)	0.86 (0.72, 0.99)	0.07	1.08 (0.84, 1.18)	1.01 (0.90, 1.13)	0.09
Model IV	0.98 (0.90, 1.31)	1.2 (0.91, 1.40)	0.11	1.12 (0.88, 131)	1.02 (0.92, 1.11)	0.14
			Obesity			
Model I	0.61 (0.46, 0.83)	0.67 (0.49, 0.85)	< 0.03	0.99 (0.62, 1.18)	1.05 (0.90, 1.19)	< 0.04
Model II	0.78 (0.60, 0.91)	0.81 (0.65, 0.94)	0.31	1.02 (0.66, 1.16)	1.09 (0.98, 1.20)	0.34
Model III	0.50 (0.22, 0.64)	0.55 (0.25, 0.66)	0.47	1.02 (0.68, 1.16)	1.04 (0.96, 1.14)	0.5
Model IV	0.83 (0.49, 0.97)	0.74 (0.48, 0.99)	0.22	1.03 (0.70, 1.12)	1.20 (1.04, 1.49)	0.33

[a]Model I, adjusted for age and sex; model II, further adjusted for waist circumference and SES; model III, additionally adjusted for energy, physical activity, and sleeping time; model IV, additionally adjusted for BMI; overweight defined as ≥ 85th percentile; obesity defined as ≥ 95th percentile.

Table 6. Multivariate Adjusted Odds Ratio (95% CIs) for Overweight and Obesity Across Quartile (Q) Categories of Sweet and Low-Protein Pattern Scores[a]

	Sweet Pattern			Low-Protein Pattern		
	Q2	**Q4**	**P Value for Trend**	**Q2**	**Q4**	**P Value for Trend**
			Overweight			
Model I	1.04 (0.79, 1.30)	1.00 (0.75, 1.53)	< 0.01	1.19 (0.19, 1.32)	1.05 (0.81, 1.30)	< 0.05
Model II	1.06 (0.61, 1.84)	1.07 (0.67, 1.49)	< 0.01	1.28 (1.05, 1.42)	1.17 (0.95, 1.40)	0.15
Model III	1.08 (0.87, 1.30)	1.19 (0.85, 1.66)	< 0.01	1.70 (1.43, 1.94)	1.61 (1.42, 1.80)	0.08
Model IV	1.09 (0.85, 1.39)	1.30 (1.00, 1.70)	< 0.01	1.07 (0.86, 1.28)	1.08 (0.87, 1.3)	0.12
			Obesity			
Model I	1.15 (0.71, 1.87)	1.37 (1.01, 1.73)	< 0.01	1.34 (1.16, 1.58)	1.39 (1.18, 1.6)	< 0.05
Model II	1.12 (0.42, 2.95)	1.4 (1.05, 1.84)	< 0.01	1.20 (0.94, 1.46)	1.23 (0.95, 1.5)	0.33
Model III	1.25 (0.56, 2.80)	1.5 (1.04, 1.90)	< 0.01	1.83 (1.61, 1.99)	1.85 (1.65, 1.88)	0.44
Model IV	1.48 (0.61, 3.59)	1.6 (1.06, 1.89)	< 0.01	2.17 (1.96, 2.42)	2.10 (1.94, 2.22)	0.27

[a]Model I, adjusted for age and sex; model II, further adjusted for waist circumference and SES; model III, additionally adjusted for energy, physical activity, and sleeping time; model IV, additionally adjusted for BMI; overweight defined as ≥ 85th percentile; obesity defined as ≥ 95th percentile.

pattern in order to counteract their impact on obesity.

The dietary pattern approach is complementary to analyses using individual foods or nutrients, which are limited by biologic interactions and co-linearity among nutrients. The logic behind the dietary pattern approach is that foods and nutrients are not eaten separately, but are eaten in the form of specified dietary patterns. However, all statistical methods that have been used for data reduction have limitations. For example, using factor analysis for dietary data reduction has been criticized for its subjectivity in nature and for the difficulty of replicating the results in other populations (35). However, similar dietary patterns based on thorough factor analysis have been noticed in different populations. It seems that the dietary patterns identified in this Iranian populace resemble those in Western populations. This is actually unsurprising, due to the fact that, in the past several years, Iran has encountered a socioeconomic changeover paired with Westernization in eating habits as well as lifestyle (36-38).

Alizadeh et al. in a study in northern Iran, suggested that, among the six major dietary patterns, Asian-like food was the healthiest one (39). Bahreynian et al. found three important nutritional patterns in Iran: healthy, Western, and sweet-dairy (40). The study revealed that significant as-

Table 7. Multivariate Adjusted Odds Ratio (95% CIs) for Overweight and Obesity Across Quartile (Q) Categories of Western and Salty Pattern Scores[a]

	Western Pattern			Salty Pattern		
	Q2	**Q4**	**P Value for Trend**	**Q2**	**Q4**	**P Value for Trend**
			Overweight			
Model I	1.15 (0.91, 1.40)	1.69 (1.10, 2.04)	< 0.01	1.28 (0.90, 1.65)	1.04 (0.82, 1.29)	< 0.01
Model II	1.09 (0.85, 1.39)	1.68 (1.08, 1.97)	< 0.01	1.25 (0.93, 1.57)	1.40 (0.95, 1.80)	< 0.01
Model III	1.08 (0.86, 1.36)	1.67 (1.06, 1.89)	< 0.01	1.27 (0.94, 1.59)	1.41 (1.42, 1.40)	< 0.01
Model IV	1.07 (0.89, 1.32)	1.50 (1.04, 1.90)	< 0.01	1.33 (0.96, 1.7)	1.09 (0.88, 1.3)	< 0.01
			Obesity			
Model I	1.30 (0.88, 1.67)	1.44 (1.05,1.84)	< 0.01	1.14 (0.81, 1.39)	1.34 (1.17, 1.5)	< 0.01
Model II	1.24 (0.90, 1.55)	1.37 (1.01, 1.73)	< 0.01	1.08 (0.84, 1.39)	1.27 (0.94, 1.6)	< 0.01
Model III	1.22 (0.91, 1.57)	1.35 (1.00, 1.70)	< 0.01	1.07 (0.86, 1.35)	1.88 (1.66, 1.89)	< 0.01
Model IV	1.18 (0.87, 1.50)	1.28 (0.90, 1.66)	< 0.01	1.01 (0.89, 1.33)	2.11 (1.93, 2.3)	< 0.01

[a]Model I, adjusted for age and sex; model II, further adjusted for waist circumference and SES; model III, additionally adjusted for energy, physical activity, and sleeping time; model IV, additionally adjusted for BMI; overweight defined as ≥ 85th percentile; obesity defined as ≥ 95th percentile.

sociations exist between the three dietary patterns among girls. The limitation of the sweet pattern, salty pattern, low-protein pattern, and Western pattern needs to be incorporated in a complex strategy for prevention of obesity.

There is an agreement between the findings of this study and numerous studies conducted on similar factors. Numerous limits should be regarded as within the presentation in our findings. We evaluated dietary patterns by using food consumption information only, even though the inclusion of consuming behaviors of, for instance, food as well as snack food habits within dietary pattern evaluation have been suggested (41). Furthermore, the limits of this FFQ affect dietary pattern analyses that depend on dietary information obtained with this method. One other issue in our research is its cross-sectional nature. Therefore, the actual relationship between these types of dietary patterns as well as being overweight or obese continues as being verified within prospective analyses.

5.1. Conclusions

Dietary pattern evaluation among teenagers provides essential information on dietary consumption within this populace. In addition, suggestions designed using this strategy tend to be clearer as well as much easier to follow. Longitudinal investigation can provide even further understanding of the actual aspect associated with modifying dietary patterns during teenagers' changeover from adolescence to adulthood. Critical zones with regard to long-term investigation incorporate prospective evaluation of the connection among dietary patterns and obesity.

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Footnote

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