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Association of Major Dietary Patterns and Overweight/Obesity in Female Adolescents Living in North West of Iran

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Abstract

Background: Obesity and overweight is a great concern in adolescence that would have impact on adulthood. This study was conducted to identify major dietary patterns and their relation with overweight/obesity of female adolescents living in Northwest of Iran.

Materials and Methods: The design of the study was cross-sectional conducted on 350 female students aged 16-18 years in Urmia city, Iran. Height and weight were measured using standard techniques and weight status was defined by World Health Organization (WHO) and Center for Disease Control (CDC) cut-offs. Dietary intake information was collected by a validated 169-item semi-quantitative food frequency questionnaire via face-to-face interview. Dietary patterns were identified through principle component analysis. Demographic and socio-economic confounding factors were obtained by a questionnaire. Logistic regression was used to assess the relationship between overweight/obesity and dietary patterns.

Results: About one third of participants (n=115, 32.9%) were overweight or obese. Three major dietary patterns were extracted: "high vegetable-high dairy", "high protein", and "traditional dishes". Parental educational level, house assets and household size were associated with dietary patterns. After adjusting for confounders, adolescents in upper quartile of "high vegetable-high dairy" pattern (OR=3.17, 95% CI=1.50-6.70; P_{trend}=0.010), and "high protein" pattern (OR=2.01, 95% CI=0.96-4.19; P_{trend}=0.006) had a greater risk of being overweight/obese. However, traditional dietary pattern was not related to overweight/obesity (P_{trend}=0.70).

Conclusion: Findings suggest that the chance of overweight/obesity was increased in adolescents that had higher adherence to "high vegetable-high dairy" and "high protein "dietary patterns. On the other hand, the socioeconomic status of household was an important factor influencing tendency of adolescents to a special dietary pattern.

Key Words: Adolescence, Dietary Pattern, Iran, Obesity.

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1- INTRODUCTION

Prevalence of obesity and overweight has increased all around the world (1, 2). In this regard, obesity and overweight in adolescence, as multifactorial health problems, are a great public health concern. It is shown that overweight and obesity in this age group may lead to various health outcomes, including cardiovascular diseases (CVD), diabetes and pulmonary disorders during lifespan (3, 4). According to previous studies, it is estimated that up to 57.8% of the world's population would be overweight or obese by 2030 (5). Based on a recent study conducted on 14274 Iranian students by Ejtehad et al. in 2015, 11.4% of participants (12.5% of boys and 10.3% of girls) and 9.4% (8.7% of boys and 10.2% of girls) were obese and overweight (6).

Various factors from genetic to environmental (socioeconomic, culture and behavior) are shown to be involved in obesity incidence (4, 7). Among the environmental factors, urbanization and nutrition transition in middle income countries, including Iran, has been identified as an important drive to the increase in obesity prevalence and its related health outcomes (1, 8). Changes in food patterns and increased intake of fast foods and calorie-dense snacks are among the factors which have led to overweight and obesity, specifically in adolescents (9, 10). Healthy dietary pattern along with other aspects of healthy lifestyle are known as effective factors in prevention of overweight/obesity and other chronic diseases (11-13). Adherence to a specific dietary pattern is influenced by various factors, including socioeconomic status (SES), ethnicity, culture, gender and age (11, 12). Overall, the prevalence of obesity or malnutrition varies across regions or ethnicities, which may be due to genetics, socioeconomic status or lifestyle differences (14, 15). In Iran, as a multiethnic country, prevalence of obesity differs in different provinces. West Azerbaijan is a province in the northwest of Iran where the trend of overweight and obesity of school children and adolescents is shown to be on the rise in recent years (16). Recent interest in studying dietary patterns rather than single food groups or nutrients has provided the opportunity to assess the possible interactive effects of different nutrients in food groups (17-19). Monitoring dietary pattern(s) during childhood and adolescence can be beneficial for implementing policies or interventions for reducing problems such as obesity (9). Therefore, this study aimed to investigate major dietary patterns in adolescent girls living in Urmia city, North West of Iran and its association with overweight/obesity.

2- MATERIALS AND METHODS

This cross-sectional study was conducted on female students aged 16-18 years (late adolescence), living in Urmia, West Azerbaijan province in the North West of Iran. The North and North West of Iran has the highest rate of general obesity prevalence by maximum prevalence rate of 18.3% (20), and also has high ethnic diversity. Particular ethnical structure and the special dietary patterns of this province has drawn attention toward the possible effect of culture on weight status (7), which was the main incentive in adolescents in this region.

2-1. Sampling

The sample size calculation in the study was based on body mass index (BMI) as the main dependent variable. Sample size was calculated using the following equation:

$$N = \left(\frac{Z\alpha + Z\beta\sqrt{1-r^2}}{r}\right) + 2$$

It was assumed that if r=0.3, α = 0.05, β=0.10, the correlation coefficient would be significant. Thus the estimated sample size was calculated as 114. Taking into

account the design effect, and in order to increase the precision of the study, the total sample size was considered 350. The sampling method was multistage stratified cluster random method. Thirteen girls' schools (9 public and 4 private schools) were selected across all four stratified municipality zones of Urmia city. Students were selected using stratified random method from all the three grades of junior high schools. 152 tenth grade, 123 eleventh grade and 75 twelfth grade students were selected according to population weight. Eligible girl students aged 16-18 years were randomly selected from the students list of each selected class.

2-2. Data Collection

2-2-1. Assessment of demographic and socioeconomic characteristics: General characteristics, including demographic (age, menarche age, education level, family size, and number of children) and socioeconomic status (SES) [parental educational status, parental job, house ownership, house size, and household's assets] of the sample were collected by a questionnaire through interview. Parents' occupation and educational level were categorized based on the predefined job categories (11), and house assets were scored in order to determine the total asset score (AS).

2-2-2. Physical activity Assessment: Physical activity was assessed by a self-reported questionnaire (21) previously validated for Iranian adolescents by Kelishadi et al. in 2001 (22). The questionnaire included nine questions for the activities and ranged from 0.9 (for sleep/rest) to >6 (for high-intensity) metabolic equivalents (METs). In order to define total metabolic equivalents, hours per day of the time spent on each activity were recorded and multiplied to its metabolic equivalents (METs). All the calculated METs*hours were then summed up.

2-2-3. Dietary intake assessment

Dietary intake was assessed by a validated semi-quantitative 169-item food frequency questionnaire (FFQ) (11), previously modified and confirmed on a validated FFQ for the capital city, Tehran by Mirmiran et al in 2010 (23) considering common foods consumed in Urmia (11). The traditional foods and dishes were added through this modification, including walnut and carrot halva (traditional sweet), herbal beverages (pussy willow and lemon balm), ash (a thick soup), dolma (stuffed grape or cabbage leaves), kofte (local meat-balls), and khagineh (traditional pancake). A portion size was provided for each food/dish item and frequency intake of each was asked over 1-year period. Participants were requested to report the frequency intake for each item on a daily, weekly, monthly, or yearly basis. Reported dietary intake of each food item was then converted to grams per day by applying the Iranian household measures guide. Food items were categorized into 27 predefined food groups similar to previous studies (11, 24). The participants' energy intake was estimated taking into account the portion size, the frequency of intake of each food item, and their weighted mean energy value (25). In order to eliminate under-reporting or over-reporting of energy, participants who reported daily energy intake of mean±3 SD were excluded from the study.

2-2-4. Anthropometric Assessment

Anthropometric measurements were obtained using standard techniques and tools and were conducted by a trained dietitian (26). Weight was measured by a digital scale (Seca, 807 digital scale, United States) (to the nearest 100 grams), and height was assessed using a strip meter (SUZA, China) fixed on the wall (to the nearest 0.1 centimeters). The weight scale was calibrated by a 5 kg standard scale. Students were asked to be dressed minimally and without shoes during

anthropometric measurements. Body Mass Index (BMI) was calculated by dividing weight (in kilograms) by the square of height (in meter). BMI-for-age z- score (BAZ) was calculated by Anthro Plus software (27).

2-3. Ethical consideration

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures were approved by the Ethics Committee of the National Nutrition and Food Technology Research Institute of Iran (IR.SBMU.nnftri.Rec.1396.131). Written informed consent was obtained from all adolescents and their parents.

2-4. Statistical Analysis

In order to extract major dietary patterns of participants, food groups were adjusted for energy by residual method and then deducted by principal component analysis (PCA). Of the derived factors, three interpretable factors were retained based on the Scree test; an orthogonal rotation procedure, the Varimax rotation, was then applied to simplify the factor structure and render it more easily interpretable. The derived factors were labeled on the basis of interpretation of the data and of the earlier literature. The factor score for each pattern was found by summing intakes of food groups weighted by factor loading, and individuals received a factor score for each identified pattern (28). Score of each derived pattern was categorized as Quartiles. Chi-square and independent-samples t-test were used to compare qualitative and quantitative data across quartiles of dietary patterns, respectively. To analyze the relationship between BMI/BAZ and general data, linear regression was used and the odds ratio (OR), and 95% Confidence interval (95% CI) for overweight/obesity according to quartile of dietary patterns were assessed by logistic regression. Data were analyzed in three models: model I, crude data, model II, data adjusted for age, menarche age and physical activity (but not for energy, because all food groups were previously adjusted for energy intake), and model III, data adjusted for ethnicity, socioeconomic status (parental education, parental job and house assets) and school type in addition to the previous factors mentioned in model II. SPSS software, version 14.0 was used for analyzing data. $P < 0.05$ was considered as significant.

3- RESULTS

Three major dietary patterns were extracted: "high vegetable-high dairy" (high consumption of cruciferous vegetables, green-leafy vegetables, other vegetables, fruits and dried fruits, egg, potato, low-fat dairy), "high-protein" (high in whole grains, red meats, legumes, pickles), and "traditional dishes" (high consumption of *dolme*, *khagine*, *khoresh*, Abgoosht, herbal beverages). About 20% of the total variance was explained by these three dietary patterns (**Table.1**). Demographic and socioeconomic characteristics of the participants across the quartile categories of the three dietary patterns are presented in **Table.2**. Adherence to high vegetable-high dairy dietary pattern was increased as students' age and educational level increased and as menarche age decreased. Also, students in the top quartile of high vegetable-high dairy pattern belonged to households with significantly larger size and higher number of children compared to those in the first quartile. Those placed in the upper quartile of high protein pattern had parents with higher educational level and lived in households with higher assets score and smaller household size and number of children compared to students in the first quartile. Instead, students with lower maternal educational level were located in the upper quartile of traditional dishes pattern. Anthropometric characteristics of participants across the quartile categories of the three dietary patterns are presented

in **Table. 3**. Those in the highest quartile of high protein dietary pattern had higher mean of BMI, BAZ with higher percentage of obese adolescents. The relation of BMI and BAZ with dietary patterns is presented in **Table. 4**. In the crude model the high protein pattern was positively associated BMI and BAZ. After adjusting for confounders (model II and III), high vegetable-high dairy pattern also had significant positive association with BAZ. There was no association between traditional dishes pattern and BMI or BAZ across all 3 models. Odds ratios (OR 95% CI) for general overweight/obesity across quartiles of dietary pattern scores are shown in **Table.5**. After adjustment for confounders, participants in the top quartile of high vegetable-high dairy pattern (OR=3.17, 95% CI=1.50-6.70; P_{trend}=0.010), and high protein pattern (OR=2.01, 95% CI=0.96-4.19; P_{trend}=0.006) were more likely to be overweight/obese, generally. Traditional dishes pattern was not related to overweight/obesity (P_{trend}=0.70).

Table-1: Factor loading matrix for the major dietary patterns identified by using F.F.Q. data among 350 female adolescents living in Urmia city[1, 2]

Food groups	High vegetable, high dairy pattern	High protein pattern	Traditional dishes pattern
Salty snacks and fast-foods and salt	-.517		-.253
Vegetables	.501	.309	
Sweets and sweet drinks	-.457		
Liquid oil	-.400		
Egg	.392		
Potato	.349		
Fruits and dried-fruits	.320		
Low-fat dairy	.305		
Coffee and tea	.289		
High-fat dairy	-.284		
Dressings (ketchup and mayonnaise)	-.283		
Animal and Hydrogenated fat	.238		
Kofte (meatballs)	-.226		
Whole grains		.708	
Refined grains		-.704	
Red meat	-.291	.462	
Legumes		.419	.255
Pickles		.289	
Dolma (stuffed grape, cabbage or other vegetable leaves)			.690
Khagineh (traditional pancake)			.642
Abgoosht(a traditional stew)			.412
Khoresh		.248	.407
Poultry and fish		.221	-.268
Herbal beverages (pussy willow and lemon balm)			.259
Nuts			
Olives			
Ash (traditional thick soup)			

[1] Values < 0.20 were excluded for simplicity. [2] The first factor explained 7.10 % of the total variance, and the second and third factor explained 6.88 % and 6.33% of the total variance,respectively.

Table-2: General characteristics of study participants according to quartiles of dietary patterns [1]

Variables	High vegetable, high dairy dietary pattern					High protein dietary pattern					Traditional dishes dietary pattern				
	Q1		Q4			Q1		Q4			Q1		Q4		
	N	(%)	N	(%)	P-value	N	(%)	N	(%)	P-value	N	(%)	N	(%)	P-value
School grade															
Tenth	45	29.6	35	23.0	0.04*	42	27.6	37	24.3	0.18	42	27.6	32	21.1	0.73
Eleventh	32	26.0	26	21.1		31	25.2	25	20.3		27	22.0	35	28.5	
Pre-university	10	13.3	27	36.0		15	20.0	26	34.7		19	25.3	20	26.7	
Ethnicity															
Azeri	56	25.6	51	23.3	0.71	38	17.4	70	32.0	0.000*	55	25.1	59	26.9	0.28
Kurd	31	23.7	37	28.2		50	38.2	18	13.7		33	25.2	28	21.4	
Father's education															
Illiterate or primary school	11	14.3	27	35.1	0.09	28	36.4	8	10.4	0.005*	12	15.6	18	23.4	0.12
Middle or high school	19	24.4	16	20.5		14	17.9	20	25.6		20	25.6	23	29.5	
Diploma	34	32.7	22	21.2		24	23.1	30	28.8		31	29.8	27	26.0	
University educations	23	25.3	23	25.3		22	24.2	30	33.0		25	27.5	19	20.9	
Mother's education															
Illiterate or primary school	22	17.9	38	30.9	0.14	43	35.0	17	13.8	0.002*	20	16.3	34	27.6	0.02*
Middle or high school	21	30.4	12	17.4		15	21.7	17	24.6		20	29.0	14	20.3	
Diploma and university education	44	27.8	38	24.1		30	19.0	54	34.2		48	30.4	39	24.7	
Father's Occupation															
Unemployed	2	13.3	6	40.0	0.64	3	20.0	3	20.0	0.68	3	20.0	1	6.7	0.66
Category 1	28	23.0	33	27.0		29	23.8	24	19.7		27	22.1	32	26.2	
Category 2	44	24.6	43	24.0		48	26.8	52	29.1		47	26.3	46	25.7	
Category 3	13	38.2	6	17.6		8	23.5	9	26.5		11	32.4	8	23.5	
Mother's Occupation															
Unemployed, housewife	72	24.1	75	25.1	0.91	79	26.4	71	23.7	0.54	73	24.4	78	26.1	0.73
Category 1	2	25.0	3	37.5		2	25.0	2	25.0		3	37.5	1	12.5	
Category 2	13	30.2	10	23.3		7	16.3	15	34.9		12	27.9	8	18.6	
	Mean	SD	Mean	SD	P-value	Mean	SD	Mean	SD	P-value	Mean	SD	Mean	SD	P-value
Age(year)	16.6	0.6	16.9	0.8	0.008*	16.6	0.7	16.8	0.8	0.13	16.7	0.7	16.8	0.7	0.29
Menarche age(year)	13.2	1.1	12.8	1.0	0.03*	13.1	1.1	12.9	0.9	0.12	13.0	1.0	12.7	1.2	0.19
Household size(no. of persons)	4.5	1.1	5.1	1.6	0.01*	5.4	1.6	4.6	1.2	0.0001*	4.7	1.2	4.9	1.4	0.36
Number of children	2.7	1.2	3.3	1.8	0.01*	3.5	1.7	2.7	1.1	0.001*	2.9	1.2	3.0	1.3	0.52
House assets	43.24	5.4	41.6	6.0	0.07	41.9	5.5	43.7	5.1	0.02*	42.8	5.8	41.2	6.2	0.08

[1] Data are presented as n (%) or mean (standard deviation). * Means are significantly different: P< 0.05. Q: Quartile, SD: standard deviation.

Table-3: Anthropometric characteristics of participants [1]

Variables	High vegetable, high dairy dietary pattern					High protein dietary pattern					Traditional dishes dietary pattern				
	Q1		Q4			Q1		Q4			Q1		Q4		
	Mean	SD	Mean	SD	P-value	Mean	SD	Mean	SD	P-value	Mean	SD	Mean	SD	P-value
Weight(Kg)	57.2	11.4	61.3	13.4	0.14	55.8	10.9	61.7	14.5	0.002*	57.9	13.0	61.3	12.2	0.12
Height(cm)	161.0	5.8	160.5	7.0	0.01*	160.2	6.2	161.8	6.3	0.10	160.1	6.8	161.9	5.3	0.18
BMI	22.0	3.94	23.7	4.8	0.06	21.7	4.0	23.5	5.1	0.008*	22.5	4.5	23.3	4.5	0.32
BAZ	0.1	1.1	0.5	1.2	0.13	0.05	1.1	0.4	1.4	0.01*	0.2	1.3	0.5	1.2	0.25
CDC cut-off															
Underweight	7	36.8	3	15.8	0.40	8	42.1	7	36.8	0.06	6	31.6	6	31.6	0.68
Normal	61	27.9	49	22.4	0.22	60	27.4	47	21.5	0.01*	54	24.7	49	22.4	0.46
Overweight	8	16.3	15	30.6	0.48	12	24.5	8	16.3	0.08	15	30.6	12	24.5	0.76
Obese	11	17.5	21	33.3	0.28	8	12.7	26	41.3	0.003*	13	20.6	20	31.7	0.50
WHO cut-off															
Underweight	3	3.4	0	0.0	0.37	4	50.0	3	37.5	0.16	3	37.5	4	50.0	0.16
Normal	65	28.6	51	22.5	0.12	64	28.2	51	22.5	0.01*	57	25.1	51	22.5	0.52
Overweight	13	16.0	26	32.1	0.06	15	18.5	19	23.5	0.06	19	23.5	24	29.6	0.73
Obese	6	17.6	11	32.4	0.18	5	14.7	15	44.1	0.03*	9	26.5	8	23.5	0.98

[1] Data are presented as n (%) or mean (standard deviation). Q: Quartile, * Means are significantly different: P< 0.05.

Table-4: The assosiation of BMI and BAZ with the adherence to major dietary patterns among 350 female adolescents aged 16-18 years-old.

Model	BMI		BAZ	
Dietary patterns	b[1]	CI[2]	b[1]	CI[2]
High vegetable, high dairy				
Model I[3]	0.10	-0.02to 0.91	0.08	-0.03to 0.22
Model II [4]	0.08	-0.09to 0.85	0.06	-0.04to 0.21
Model III [5]	0.13*	0.12 to 1.10	0.09	-0.01to 0.26
High protein				
Model I[3]	0.19*	0.41 to 1.33	0.17*	0.08 to 0.33
Model II [4]	0.16*	0.35 to 1.25	0.16*	0.06 to 0.32
Model III [5]	0.16*	0.24 to 1.19	0.14*	0.05 to 0.31
Traditional dishes				
Model I[3]	0.00	-0.46 to 0.47	0.11	-0.15 to 0.11
Model II[4]	-0.21	-0.56 to 0.37	0.08	-0.15 to 0.11
Model III[5]	-0.01	-0.52 to 0.43	0.09	-0.15 to 0.11

[1] b= Regression coefficient
[2] CI= Confidence interval.
BMI: Body Mass Index BAZ: BMI-for-age z- score.
[3] Model I: Crude model.
[4] Model II: Adjusted for age, menarche age, ethnicity and physical activity.
[5] Model III: Additionally, adjusted for parental education score and parental job score. House assets and school type.
* Means are significantly different: P< 0.05.

Table 5- Multivariate adjusted odds ratios for general overweight/obesity across quartiles of dietary pattern scores among 350 female adolescents living in Urmia aged 16-18 years-old [1]

	Quartiles of high vegetable, high dairy dietary pattern				
	Q1	Q2	Q3	Q4	P_{trend}
Overweight/obesity[2]					
Model I[3]	1.00	1.85(0.94-3.62)	1.78(0.91-3.51)	2.59*(1.34-5.03)	0.008*
Model II[4]	1.00	1.46(0.71-2.98)	1.22(0.58-2.57)	2.29*(1.13-4.62)	0.034*
Model III[5]	1.00	1.69(0.80-3.56)	1.50(0.69-3.26)	3.17*(1.50-6.70)	0.010*
	Quartiles of high protein dietary pattern				
	1	2	3	4	
Overweight/obesity[2]					
Model I[3]	1.00	1.22(0.61-2.43)	2.63*(1.37-5.07)	2.14*(1.10-4.13)	0.004*
Model II[4]	1.00	1.00(0.48-2.08)	2.59*(1.28-5.23)	2.37*(1.18-4.75)	0.001*
Model III[5]	1.00	1.01(0.47-2.16)	2.47*(1.17-5.23)	2.01(0.96-4.19)	0.006*
	Quartiles of traditional dishes dietary pattern				
	1	2	3	4	
Overweight/obesity[2]					
Model I[3]	1.00	1.01(0.53-1.91)	0.94(0.50-1.91)	1.24(0.66-2.33)	0.55
Model II[4]	1.00	0.76(0.38-1.52)	0.66(0.32-1.32)	1.00(0.51-1.96)	0.98
Model III[5]	1.00	0.83(0.40-1.70)	0.83(0.39-1.74)	1.14(0.57-2.29)	0.70

[1]Values are OR (95% CI).
[2] Categorized based on WHO cut-off. Q: Quartile.
[3] Model I: Crude model.
[4] Model II: Adjusted for age, menarche age, ethnicity and physical activity.
[5] Model III: Additionally, adjusted for parental education score and parental job score, house assets and school type.
* P-trend is significantly different: P< 0.05.

4- DISCUSSION

This study was conducted to investigate major dietary patterns and their relation with overweight/obesity of female adolescents living in the North West of Iran. Through this study, three distinct dietary patterns were extracted: "high vegetable-high dairy", "high protein", and "traditional dishes". Adhering to "high vegetable-high dairy" and "high protein" dietary patterns were significantly associated with higher possibility of overweight/obesity in adolescent girls in Urmia city, while no association was found between overweight/obesity and having a Traditional dietary pattern. This explains the nutrition transition occurring among this age group. The extracted dietary patterns in the present study are not exactly comparable with those derived by the majority of previous studies. Previous studies on dietary patterns have commonly reported two major patterns: "prudent or healthy dietary pattern" usually loaded with fruits, vegetables, legumes, low-fat dairy, fish, and whole grains and " western or unhealthy dietary pattern" that is mainly composed of red meat, processed meat, snacks, fast-foods, refined grains and sweets (29-33). Although our findings did not exactly match these two dietary patterns, there were many commonalities between the first two extracted patterns ("high vegetable-high dairy" and "high protein"). For instance, high loading of vegetables, fruits and low-fat dairy in the first dietary pattern, and high loading of red meat in the second pattern are similar to prudent and unhealthy dietary patterns, corresponding with those of healthy and unhealthy dietary patterns, respectively (18, 34). High vegetable-high dairy dietary pattern explained the greatest percentage of total variance. Age and school type were two important factors associated with adhering to this dietary pattern. Also, those who were older and at higher school grade, had higher probability of adhering to this healthy pattern. Surprisingly, most overweight/obese students were categorized in this dietary pattern, and there is a possibility that overweight/obese adolescents may have had a tendency to underreport intake of unhealthy foods or over report healthier food items such as fruit and vegetables (35, 36). High protein dietary pattern, with high red meat, kebab, organ meat, legumes and whole grains was mostly consumed by students from households with higher socio-economic status. Adherence to high protein dietary pattern was positively associated with overweight/obesity. The main sources of protein in this dietary pattern were red meats (factor loading=0.46) as compared to white meats (poultry and fish [factor loading=0.22]). This can explain its association with high SES, as red meats are often identified as food items with high income elasticity and are highly dependent on the purchase ability of the household (37). In the other hand, consumption of red meat is shown to be related with higher intake of fat and higher risk of overweight/obesity and metabolic syndrome (38-40). The third dietary pattern labeled as "traditional dishes" was highly loaded for traditional dishes and herbal beverages. In the previous study conducted in Urmia city on Azeri and Kurdish men and women aged 20-59 years, two different types of traditional dietary pattern were reported: "traditional high SES" (highly loaded for healthy food items and dishes), and "traditional low SES" (highly loaded for low quality traditional dishes and herbal drinks) (11), and the household SES of participants had an important role on adhering to each traditional pattern. The "Traditional dishes" dietary pattern of our study was relatively different. However, the extent of accordance with the traditional pattern in this study was not associated with SES. Several studies have been conducted to analyze the association of dietary patterns and anthropometric indices. A protective

effect for prudent dietary pattern against obesity has been shown in most investigations (41), although in a few studies inverse association has been reported (42). Naja et al. in 2008-2009 indicated that "western dietary pattern" characterized by high consumption of poultry and egg, red meat, mayonnaise, fast food, was associated with a higher risk of overweight in Lebanese adolescents (43). In another study, Esfahani et al. in 2010-1011 extracted seven major dietary patterns, declaring "Mediterranean" and "Western" dietary patterns to be similar to "healthy"and "Western" dietary patterns proposed by Hu et al. (10, 44). Esfahani et al. indicated that Western dietary pattern increased the risk of obesity while Mediterranean dietary pattern was associated with lower risk of obesity (10). Further, Nyholm et al. in 2002-2006 demonstrated a surprising relation "between fruit and vegetable dietary pattern" and increased incidence of obesity in women (42). As Newby et al. in 2004 declared, these inconsistencies can be partially due to differences in age or sex of the subjects (41). Likewise, there is a possibility that overweight or obese adolescents tended to report healthy dietary pattern (social desirability) to state their intake in a socially acceptable trait (45, 46) or may already have modified their diet to lose weight (36, 42). Dietary intake misreporting is shown to be associated with age, sex, BAZ, household size and income. And, under-reporting is positively correlated with BMI-for-age Z score (BAZ). Also, the risk of under-reporting is shown to be higher in participants with low/middle income families (35). Besides, family SES itself can affect dietary pattern disparities in adolescents (47). Adolescents from households with lower SES have a higher chance of following a dietary pattern with poorer quality and in this regard parental educational level is a major associated factor (47-49). As indicated in the previous study conducted in Urmia city, Kurds are immigrant population (minority) from Kurdistan and usually have lower SES compared to Azeris (11). In the present study, those with higher house assets score and parental education had higher tendency to have the higher score of high protein pattern and increased probability of being overweight or obese. Previous study in Urmia, has shown higher BMI and BAZ in adult men and women with higher economic status in comparison with those with lower economic status (7). The present findings on Urmia adolescents are in accordance with previous studies indicating higher risk of obesity in individuals with higher socio-economic status compared to those with lower SES (50, 51). However, studies in developed countries have reported higher risk of obesity in lower-income participants (50, 52). To our knowledge, this is the first study conducted to investigate major dietary patterns and its relation to overweight/obesity in female adolescents in Iran.

4-1. Study Limitations

Studying only girl adolescents due to social restrictions, limited our judgment about major dietary patterns in adolescents from both genders. Also, the cross-sectional nature of the study makes it impossible to indicate any causality between the studied factors. The FFQ used was not previously validated for adolescents and may have misreporting problems. Future studies on this age group will benefit from development and validation of an FFQ for adolescents.

5- CONCLUSION

Findings revealed notable chance of overweight/obesity in the studied adolescents among those of higher adherence with high-protein and/or high vegetable-high dairy dietary patterns. On the other hand, the socioeconomic status of household was an important factor

influencing dietary pattern. So, socioeconomic factors should be addressed in design and administration of interventions to promote adoption of healthier dietary choices in order to lower the risk of overweight/obesity.

6- CONFLICT OF INTEREST: None.

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