



The Association Between Dietary Pattern and Weight Status in School-Aged Children: A Cross-Sectional Study

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Abstract

Background: considering the increasing incidence of overweightness and obesity along with underweight among children, the investigation of the association between weight status and dietary pattern could provide valuable information about health of children. The aim of the present study was to assess the association between dietary pattern and weight status of rural school-aged children in Bijar County, Iran.

Methods: This cross-sectional study consisted of 255 rural school-aged children (aged 7 to 12 years) from Bijar county that were selected through simple random sampling. Dietary data were obtained by a semi-quantitative food frequency questionnaire. Also, assessment of anthropometric indices, physical activity, and demographic information was performed using standard procedures. Major dietary patterns were determined through the use of principal components analysis, and their association with child weight status was also investigated.

Results: Three dietary patterns, including traditional, modern, and mixed were identified. After adjustment based on age, physical activity, and energy intakes, P trend was significant and showed an upward trend for the chances of being overweight and obese in the quartile of the traditional dietary pattern (p for trend = 0.04). The risk of thinness and severe thinness significantly increased when "modern" dietary pattern was greatly followed (p for trend = 0.04).

Conclusions: Modern and mixed dietary patterns next to the traditional dietary pattern could be found among rural children. The current findings show that the traditional dietary pattern is associated with an increased risk of obesity; however, the modern dietary pattern leads to thinness in rural areas.

Keywords: Children, Dietary Pattern, Rural, Weight Status

1. Background

Traditional examination of nutritional epidemiology, concerning the relationship between diet and disease, focused more on one or a few nutrients only. This traditional approach is faced with limitations, among which lack of interactions between food and micronutrients can be noted. In the recent years, the use of the method of analysis of dietary patterns has gained much attention. In this method, nutritional data is summarized, and an overall picture of the whole diet and complex nutritional habits, including the potential effects of synergistic effective nu-

trients for individual's health, is obtained (1, 2). It is clear that dietary patterns are influenced by socio-economic factors and lifestyle characteristics (3).

Over the last few decades, nutritional transition in developing countries through changing dietary patterns and physical activity of children, has caused excessive overweightness and obesity, which can increase the risk of chronic diseases, such as type 2 diabetes, hypertension, and cardiovascular disease in adulthood (4, 5). However, it is important to mention that in some parts of the world, high prevalence of underweight cases exists alongside with increasing prevalence of overweightness and obesity

(6). In Iran, the prevalence of obesity and overweightness in children and young adults was reported to be 5.1 and 10.8%, respectively, which shows an increase of trend in the recent years (7). Nevertheless, the prevalence of underweight children and adolescents was reported to be 13.9% based on the Caspian national study in 2007 (8).

Regarding household income level, education, and socio-economic status, the nutritional status of children in a rural environment could be different when compared with an urban environment (9). As a result of differences in lifestyle, some differences exist in the dietary patterns and habits as well as physical activity pattern of children and adolescents living in cities and villages (10, 11). Investigations have been carried out on different population groups in Iran over the past decade concerning the major dietary patterns; however, most of these studies have been carried out on urban populations, and mainly on the adult age group, among which some of these studies have examined the relationship between major dietary patterns and weight status (12-16). Therefore, the purpose of this study was to identify major dietary patterns in rural school-aged children and to evaluate their relationship with weight status in this group.

2. Methods

The present study was conducted in Bijar county, Iran, between August 2014 and February 2015. In this cross-sectional study, 275 students were randomly invited among 1820 rural school-aged students in Bijar county and 265 people were willing to cooperate. Of these 265 participants, 10 were excluded for not filling more than 70 items on the food frequency questionnaire ($n = 7$) or reporting energy intake of less or more than 3 standard deviations from the average energy intake ($n = 3$). Finally, data on the remaining 255 (133 males and 122 females) rural school-aged students (7 to 12 years old) were analyzed. The ethics committee of Tehran University of Medical Sciences approved the study and informed consent was obtained from the participants' mothers.

General information about socio-economic variables as well as information on health status were gathered through face to face interviews and distribution of a general information questionnaire to the children's mothers.

A classified questionnaire on physical activity based on Metabolic Equivalent (MET) data, including 9 levels of activity from sleep and rest (METs 0.9) to vigorous activity (more than 6 METs) was used in order to evaluate the students' level of physical activity. Validity and reliability of the questionnaire have been previously confirmed in Iran (17, 18).

Dietary intake of children for the past year was assessed using the semi-quantitative food frequency questionnaire (FFQ), including 168 food items with standard serving size of each nutrient. These food items were chosen according to the most frequently consumed items in the national food consumption survey in Iran. The FFQ was based on food items rather than dishes, e.g. beans, different meats and oils, and rice, because different recipes are used for food preparation. Moreover, the validity and reliability of the questionnaire was previously evaluated in Iran (19, 20). Frequency of consumption of each food item was questioned and recorded by a trained dietitian from the students' mothers, according to its value based on consumption pattern per day, week, month, or year over the past year. Using manual for household measures (21), the consumed food portion sizes were converted to grams. In order to identify the dietary patterns and perform principal component analysis, due to the large number of items on the FFQ, the food items were first categorized to 24 food groups, based on the similarity of their nutrients and researchers' opinions, as well as on previous studies (Appendix 1. In Supplementary File) (2, 22).

All measurements were done based on standard methods and by trained researchers. Weight of each sample was measured with an accuracy of 0.1 kg and least amount of clothing. Furthermore, height of each participant was measured using a tape measure with an accuracy of 1.0 cm in standing posture next to the wall and on barefoot. Nutritional status of these children were classified to 3 categories as underweight and severely underweight (< -2 SD), normal (≥ -2 SD, $\leq +1$ SD), and overweight or obese ($> +1$ SD) by using Anthro plus software and world health organization guidelines, according to body mass index (BMI)-for-age z score (23).

Statistical analysis was conducted on the data mainly by using the SPSS version 16 software (SPSS Inc., Chicago, Illinois). Moreover, the Stata software version 12 was used in order to calculate P for trend of continuous variables among different categories of dietary pattern. Major dietary patterns were determined on 24 food groups using principal components analysis (PCA) with Varimax rotation. By taking relevant criteria into consideration, such as changing process of the scree plot, the percentage of attended variance and the ability of the identified factors to be interpreted by 3 main factors out of 9 factors that had an Eigen value greater than 1 was identified as the major dietary patterns (24). Each participant's score was obtained based on consumption value and load factor of 24 different food groups for each of the 3 major dietary patterns (20). Individuals were classified based on quartiles of dietary patterns and general characteristics for participants under study among the quartiles of dietary patterns were

compared using One Way analysis of variance (ANOVA) for quantitative variables and Chi-square test for qualitative variables. Tukey's Honest significant difference (HSD) test was used for 2 by 2 comparisons of the groups in ways that one way ANOVA was significantly meaningful. Logistic regression was used to calculate the odds ratio of thinness as well as overweightness or obesity as the dependent variable in relation to different dietary patterns as independent variables. In model 1, changing effect of age, model 2, age and physical activity, and in model 3, age, physical activity and energy intake, were adjusted. When the first quartile of the dietary patterns was considered as the reference, the odds ratios of the outcomes were determined with 95% confidence interval.

3. Results

Three dietary patterns that include "traditional" dietary pattern (high consumption of hydrogenated fats, fruits, vegetables, organ meats, tea and coffee, red meat, refined grains, dairy products, pickles, and poultry), "modern" dietary pattern (high consumption of artificial juice, processed meats, snacks, sweets and desserts, salt as well as low consumption of legumes) and "mixed" dietary pattern (fish, vegetable oils, dried fruits, nuts, French fries, baked potato, whole grains, and eggs), were identified after performing the principal components analysis (Table 1). In total, these 3 factors explained 29.3% of the total variance.

Characteristics of the children under study were shown based on the quartile of dietary patterns (Table 2). Individuals in the highest quartile as compared to those in the lowest quartile of traditional dietary pattern, were older and also had older mothers, had larger families and parents with lower education and weight, and body mass index and prevalence of overweightness or obesity were also higher in this group (P value < 0.05). Moreover, height showed an upward trend during quartiles for traditional dietary patterns (P value for trend of < 0.05). With regards to the modern dietary pattern, the likelihood of higher education of parents was lower and economic status showed an upward trend for people in the highest quartile when compared with the lowest quartile of dietary pattern score. In addition, regarding mixed dietary pattern, individuals, who followed this dietary pattern, as compared to individuals in the first quartile, had parents with higher education as well as greater weight and height; however, no significant relationship was observed regarding body mass index.

During the quartiles of mixed dietary patterns, from the first quartile toward the fourth quartile, older age and higher education of parents together with better economic status were observed, and weight and height ben-

Table 1. Factor Loading Matrix for the Three Dietary Patterns Identified in the Study Population^{a,b}

Food Groups	Dietary Patterns		
	Traditional	Modern	Mixed
Hydrogenated fats	0.59	0.19	-0.25
Fruits	0.57	0.03	0.05
Vegetables	0.56	-0.09	0.23
Organ meats	0.50	0.00	0.38
Tea and Coffee	0.48	0.35	-0.25
Red meats	0.44	-0.23	0.09
Refined grains	0.35	0.00	0.28
dairy products	0.34	-0.03	0.10
Pickles	0.30	0.23	0.14
Poultry	0.23	-0.02	0.16
Artificial juice	-0.09	0.63	0.24
Processed meats	-0.09	0.56	0.14
Snacks	-0.21	0.55	0.12
Sweets and desserts	0.38	0.52	-0.03
Salt	0.16	0.48	0.02
Legumes	0.31	0.38	0.33
Fish	0.10	0.18	0.53
Vegetable oils	-0.28	0.34	0.52
Dried fruits	0.22	0.06	0.47
Nuts	0.10	0.37	0.46
French fries	-0.28	0.16	0.46
baked potato	0.17	0.11	0.44
Whole grains	0.09	-0.02	0.33
Eggs	0.08	0.00	0.23
Percentage variance explained by each pattern	10.64	9.44	9.23

^aTotal variance explained by all of the patterns is 29.3%.

^bLoadings > 0.4 are given in bold.

efited an upward trend and the prevalence of severe and medium thinness also showed a downward trend. In the studied population, the prevalence of severe or medium thinness, overweightness and obesity was 13.3%, 10.2% and 1.6%, respectively.

Table 3 shows the odds ratios for severe or medium thinness and overweightness or obese. Chance of severe thinness or thinness in the modern dietary pattern in the third model showed an upward trend ($0.04 = P$ for trend) after adjustment for age, physical activity, and energy intake. In the case of mixed dietary pattern, the trend in the unadjusted model and model 2 showed a downward trend.

Table 2. Characteristics of the Study Participants Across Quartile Categories of the Dietary Pattern Scores^a

Variables	Quartiles of "Traditional" Dietary Pattern ^b					Quartiles of "Modern" Dietary Pattern ^b					Quartiles of "Mixed" Dietary Pattern ^b				
	Q1	Q2	Q3	Q4	p ^{c,d}	Q1	Q2	Q3	Q4	p ^{c,d}	Q1	Q2	Q3	Q4	p ^{c,d}
Girl, %	47.6	51.6	51.6	40.6	0.56	57.1	50.0	40.6	43.8	0.25	47.6	40.6	50.0	53.1	0.54
Age, y	8.7 ± 1.7	9.3 ± 1.7	9.2 ± 1.7	9.5 ± 1.6	0.05 ^e	9.1 ± 1.8	9.3 ± 1.8	9.1 ± 1.6	9.2 ± 1.6	0.92	8.9 ± 1.6	9.0 ± 1.6	9.5 ± 1.7	9.4 ± 1.6	0.17 ^e
Age of mother, y	34.4 ± 5.9	35.0 ± 5.4	35.7 ± 6.8	37.6 ± 5.9a	0.02 ^f	35.4 ± 6.0	35.0 ± 6.6	36.0 ± 6.6	36.2 ± 5.4	0.56	37.2 ± 7.0	35.2 ± 5.9	35.2 ± 5.5	35.0 ± 5.9	0.17
Family size > 4 persons, %	33.3	43.8	50.0	60.9	0.02 ^f	46.0	46.9	48.4	46.9	0.99	54.0	51.6	42.2	40.6	0.33
Education of parents															
Lo %	22.6	32.3	42.9	50.0		36.1	30.2	42.9	39.1		51.6	41.3	30.2	25.4	
Medium, %	37.1	37.1	33.3	34.4		18.0	39.7	41.3	42.2		33.9	34.9	38.1	34.9	
Hi %	40.3	30.6	23.8	15.6	0.02 ^f	45.9	30.2	15.9	18.8	< 0.01 ^e	14.5	23.8	31.7	39.7	0.02 ^f
Economic status															
Lo %	27.4	25.0	21.9	18.8		32.3	21.9	26.6	12.5		33.3	21.9	18.8	19.0	
Medium, %	59.7	53.1	57.8	57.8		54.8	57.8	57.8	57.8		55.6	59.4	59.4	54.0	
Hi %	12.9	21.9	20.3	23.4	0.74	12.9	20.3	15.6	29.7	0.09 ^f	11.1	18.8	21.9	27.0	0.21 ^e
Physical activity, MET.hour, d	39.1 ± 5.6	39.6 ± 5.4	40.1 ± 5.9	40.9 ± 6.6	0.28	40.2 ± 6.4	39.6 ± 6.2	40.0 ± 5.5	40.0 ± 5.9	0.34	39.6 ± 4.7	39.4 ± 5.6	41.3 ± 6.7	39.4 ± 6.6	0.17
BMI of mother, kg/m ²	26.5 ± 4.4	27.2 ± 5.0	26.5 ± 4.9	27.4 ± 4.9	0.68	26.8 ± 4.6	26.9 ± 4.9	27.1 ± 5.0	26.8 ± 4.8	0.98	27.7 ± 4.9	27.0 ± 4.3	25.4 ± 4.7b	27.5 ± 5.0	0.03
History of obesity, %	58.7	53.1	56.2	70.3	0.21	60.3	59.4	57.8	60.9	0.99	61.9	51.6	57.8	67.2	0.32
Weight, kg	25.4 ± 6.1	27.6 ± 7.9	27.6 ± 7.2	29.2 ± 7.4 b	0.03 ^f	27.1 ± 7.1	28.0 ± 7.6	27.9 ± 7.8	27.0 ± 6.7	0.63	26.1 ± 6.9	26.5 ± 7.4	27.9 ± 6.6	29.4 ± 7.8 b	0.03 ^f
Height, cm	129.2 ± 8.9	131.3 ± 10.5	132.1 ± 10.8	133.2 ± 9.1	0.14 ^e	130.8 ± 11.6	132.7 ± 10.6	131.3 ± 9.4	131.1 ± 7.7	0.69	129.3 ± 8.8	130.3 ± 11.0	132.2 ± 9.9	133.9 ± 9.3b	0.04 ^f
BMI, kg/m ²	15.0 ± 2.2	15.7 ± 2.5	15.6 ± 2.3	16.2 ± 2.7b	0.04 ^f	15.6 ± 2.2	15.6 ± 2.3	15.9 ± 2.8	15.5 ± 2.4	0.82	15.4 ± 2.7	15.3 ± 2.3	15.8 ± 2.2	16.1 ± 2.6	0.18
Severe thinness or thinness, % ^g	19.0	12.5	14.1	7.8	0.32	12.7	10.9	12.5	17.2	0.75	19.0	15.6	10.9	7.8	0.25 ^e
Overweight or obesity, % ^g	4.8	9.4	12.5	20.3	0.04 ^f	7.9	10.9	14.1	14.1	0.66	14.3	7.8	9.4	15.6	0.45

^a Values are means ± SD unless indicated. Letters indicate differences within a pattern: a vs. other quintiles, P < 0.05, b vs. quintile 1, P < 0.05.

^b Quartiles of the dietary patterns: Q1 first quartile, Q2 second quartile, Q3 third quartile, Q4 fourth quartile.

^c ANOVA for quantitative variables and chi-square for qualitative variables.

^d P value for trend.

^e P < 0.05.

^f P < 0.001.

^g Severe thinness or thinness: BMI for age z score < -2SD, Overweight or obesity: BMI for age z score > +1.

There was no significant adjusted relationship between overweightness or obesity and identified dietary patterns. Regarding the risk of overweightness or obesity in the unadjusted model (OR: 5.1, P < 0.01), model 1 (OR: 4.17, P =

0.021), and model 2 (OR: 4.33, P = 0.01), children in the highest quartile of the traditional dietary pattern were significantly more likely to be obese and overweight. This likelihood did not remain significant in the third model, after

age, physical activity, and energy intake were adjusted, yet P trend was significant and showed an upward trend for the chances of overweightness and obesity in the quartile of the traditional dietary pattern in the unadjusted model, model 1, model 2, and model 3 ($0.04 = P$ for trend).

4. Discussion

In this study, the major dietary patterns among the participants were identified to be traditional dietary pattern, modern dietary pattern, and mixed dietary pattern. The likelihood of obesity or overweightness among those, who were following a traditional dietary pattern was higher. There will be an increasing chance for severe thinness or thinness when the modern dietary pattern is followed.

Three dietary patterns were observed among rural students in this study. Since no study has been carried out on identifying dietary patterns in rural areas of Iran, it was impossible to compare the results of this study with studies of other rural areas. However, the dietary patterns detected in this study are comparable with the findings of other studies on this age group in urban areas. Azadbakht et al. (2012) identified 4 dietary patterns (namely sweet, fast food, western, and healthy) among school-aged children in Tehran (25). Fast food dietary pattern in this study was similar to modern dietary pattern with a high intake of processed meats, industrial fruit juices, snacks, and drinks. Bahreynian et al. (16), in their study aimed at identifying the dietary patterns among 7- to 11-year-old children living in Isfahan. In this study, 3 dietary patterns (namely healthy, unhealthy, and sweets, and dairy products) were identified. Healthy dietary pattern was largely the same as the mixed dietary pattern (with a high intake of fish, vegetable oils, nuts, and whole grains) in the present study. Age group was found to be the reason for such similarities in the present study and the aforementioned studies. Age group could be an influential factor for the major dietary patterns among children and adolescents (26). The cause of differences other than similarities mentioned in the identified dietary patterns could be reported as differences between rural and urban environments, such as access to food, employment, and household income situation (27). Morris and Northstone (28) reported that rural children follow more traditional and healthier dietary patterns, while urban children follow more "fast and processed foods" dietary patterns in their study on a 10-year-old Cohort in the UK. This claim was also confirmed by mixed and traditional dietary patterns in the present study. Considering the nutritional transition that rapidly took place over the past few years in Iran (29), identifying food patterns, such as modern food patterns, in the rural areas of Iran is not unexpected.

The prevalence of overweightness in the studied population (10.2%) was almost equal to the national statistics for the same age, while the prevalence of obesity (1.6%) was less (7). Although, it is expected for the prevalence of being underweight among children to have declined over the past few years (30), the prevalence of severe or medium thinness among the studied participants (13.3%) remained almost unchanged when compared with the national statistics in 2007 (13.9%) (8). The high prevalence of underweight children on one hand and overweightness and obesity on the other hand indicate a rapid nutritional transition as a result of lifestyle changes and access to food (31). The positive relationship between traditional dietary pattern and the chances of overweightness and obesity could be a result of the high intake of animal fat and refined grains in the traditional dietary pattern. High fat intake is known as an obesity risk factor (32) and refined grains with a high glycemic index may increase hunger and are effective in stimulating overeating (33). On the other hand, it should be added that children following traditional dietary pattern in this study were older and had older maternal age, larger family, and lower parental education. These factors are all risk factors for overweightness and obesity in children (34-36). This positive relationship between traditional dietary pattern and increased body mass index and obesity among adults was also observed in a study by Falahi et al. (37). Kochakpour et al. (22) revealed that unhealthy dietary pattern among adolescents increased body mass index and waist circumference in their study; this is similar to the traditional dietary pattern in the present study with high intake of refined grains, red meat, solid fat, high-fat dairy products, tea, and coffee. Azadbakht et al. stated in their study, that "sweet food" dietary pattern containing a high proportion of refined grains and sugary drinks and "western" dietary pattern with a high intake of animal fats and red meat had similar effects among children in Tehran (25). It was expected that similar to Azadbakht et al.'s "sweet food" dietary pattern, modern dietary patterns, including a high intake of sugary snacks, beverages and fast food should be accompanied with increase in overweightness and obesity among children. However, a negative correlation was observed with weight and body mass index, and the chances of severe and medium thinness increased among children under study when they followed this pattern. The results of the study of Craig et al. (26) on "snack" dietary pattern with high intake of processed meats and soft drinks, snacks, and sugar among 5- to 11-year-old boys was similar to that of this study and showed an inverse correlation with obesity. "Salty and sweet snacks" dietary pattern among adolescents was associated with a lower risk of overweightness and obesity in the study of Cutler et al. (38). Since no study has addressed the dietary patterns and

Table 3. Odds Ratios for Severe and Medium Thinness and Overweightness or Obesity^{a,b}

		Quartiles of "Traditional" Dietary Pattern ^c				P ^d	Quartiles of "Modern" Dietary Pattern ^c				P ^d	Quartiles of "Mixed" Dietary Pattern ^c				P ^d
		Q1	Q2	Q3	Q4		Q1	Q2	Q3	Q4		Q1	Q2	Q3	Q4	
Severe thinness or thinness ^e	Crud	1	0.61 (0.23 - 1.60)	0.70 (0.27 - 1.79)	0.36 (0.12 - 1.09)	0.10	1	0.84 (0.29 - 2.49)	0.98 (0.34 - 2.80)	1.43 (0.53 - 3.82)	0.43	1	0.79 (0.31 - 1.98)	0.52 (0.19 - 1.43)	0.36 (0.20 - 1.09)	0.04
	Model 1a	1	0.72 (0.27 - 1.93)	0.79 (0.03 - 2.06)	0.44 (0.14 - 1.38)	0.20	1	0.87 (0.29 - 2.60)	0.98 (0.34 - 2.85)	1.51 (0.55 - 4.13)	0.39	1	0.80 (0.31 - 2.05)	0.60 (0.21 - 1.66)	0.39 (0.13 - 1.21)	0.08
	Model 2b	1	0.76 (0.28 - 2.10)	0.84 (0.32 - 2.25)	0.47 (0.15 - 1.49)	0.26	1	0.99 (0.31 - 3.05)	1.19 (0.37 - 3.34)	1.71 (0.61 - 4.84)	0.28	1	0.80 (0.31 - 2.04)	0.59 (0.21 - 1.64)	0.32 (0.10 - 1.06)	0.04
	Model 3c	1	0.87 (0.31 - 2.47)	1.03 (0.39 - 2.86)	0.67 (0.19 - 2.41)	0.68	1	1.26 (0.40 - 4.01)	1.68 (0.53 - 5.30)	3.24 (0.99 - 10.55)	0.04	1	0.85 (0.33 - 2.21)	0.66 (0.23 - 1.87)	0.39 (0.11 - 1.42)	0.14
Overweight or obesity ^e	Crude	1	2.07 (0.49 - 8.66)	2.86 (0.72 - 11.31)	5.10 (1.38 - 18.89)	< 0.01	1	1.42 (0.43 - 4.75)	1.90 (0.60 - 6.02)	1.90 (0.60 - 6.02)	0.24	1	0.51 (0.16 - 1.61)	0.62 (0.21 - 1.86)	1.11 (0.42 - 2.95)	0.75
	Model 1a	1	1.68 (0.39 - 7.20)	2.47 (0.61 - 9.90)	4.17 (1.11 - 15.71)	0.02	1	1.36 (0.40 - 4.61)	2.03 (0.63 - 6.50)	1.92 (0.60 - 6.21)	0.21	1	0.48 (0.15 - 1.56)	0.49 (0.16 - 1.51)	0.92 (0.34 - 2.52)	0.92
	Model 2b	1	1.68 (0.39 - 7.20)	2.52 (0.62 - 10.20)	4.33 (1.14 - 16.46)	0.01	1	1.33 (0.39 - 4.53)	2.00 (0.62 - 6.46)	1.91 (0.59 - 6.16)	0.22	1	0.48 (0.15 - 1.56)	0.50 (0.16 - 1.57)	0.93 (0.34 - 2.56)	0.96
	Model 3c	1	1.57 (0.36 - 6.76)	2.11 (0.51 - 8.80)	2.97 (0.69 - 12.69)	0.04	1	1.05 (0.30 - 3.68)	1.36 (0.39 - 4.73)	1.18 (0.34 - 4.18)	0.73	1	0.47 (0.14 - 1.54)	0.40 (0.12 - 1.31)	0.62 (0.21 - 1.82)	0.41

^a Values are OR (95% confidence interval).

^b A Adjusted for age. b Adjusted for age and physical activity. c Adjusted for age, physical activity and energy intakes.

^c Quartiles of the dietary patterns: Q1 first quartile, Q2 second quartile, Q3 third quartile, Q4 fourth quartile.

^d P value for trend of odds ratios across quartiles of dietary patterns.

^e Severe thinness or thinness: BMI for age z score < -2SD, Overweight or obesity: BMI for age z score > +1.

risk of thinness among children, the results should be interpreted with caution. Despite the fact that mixed dietary pattern, including high intake of fish, dried fruits, liquid oils, nuts, and eggs as well as fried and baked potatoes, has a positive relationship with weight and decreases weight loss, it does not increase obesity. It seems that consuming relatively high amounts of micro nutrients and macro nutrients in this dietary pattern as compared to other patterns brings about a healthier pattern for the target population. Healthy dietary pattern in the study of Bahreynian et al. (16), which is similar to the mixed dietary pattern used in the current study, involves high intake of fish, vegetable oils, and whole grains. This pattern is inversely associated with body mass index, and risk of obesity and overweightness, and the girls following this dietary pattern had lower body mass index and lower risk of overweightness and obesity unlike the present study. However, beside the similarities mentioned earlier, the healthy dietary pattern in the study of Bahrainian et al. unlike the mixed dietary pattern used in the present study, includes high consumption of vegetables, fruits, and beans. These can be associated with low glycemic index (GI), high-fiber, low energy density, and reduced appetite and food intake (39, 40).

The cross-sectional nature of the current study should be considered as a limitation, since the causal relationship cannot be checked. Furthermore, some socio-economic factors, including parental education, maternal age, and family size could affect the association between children's dietary patterns and their weight status (41). However, in this study, intervening variables were not taken into account due to limited sample size. On the other hand, using an FFQ, its limitations, including reliance on memory and the possibility of under-reporting and over-reporting, should also be considered (19).

Despite the aforementioned limitations, this sociological study was the first conducted in a rural community in order to identify the relationship between children's dietary patterns and their weight status. In addition, investigating the relationship between major dietary patterns and wasting among children along with overweightness and obesity is regarded as an advantage of the present study.

Due to geographic, economic, and cultural differences between urban and rural children, another study is recommended to compare the dietary patterns among children in rural and urban areas and to identify similarities and differences in their major dietary patterns and the rela-

tionship between these patterns and the children's weight. Consequently, appropriate interventions and recommendations should be designed. Conclusively, the present study revealed that the 3 dietary patterns could be identified among rural children. While following the traditional dietary pattern is probably associated with an increased risk of obesity, modern dietary pattern leads to thinness in rural areas. The mixed dietary pattern is healthier when compared with other dietary patterns. Modifications and greater emphasis on a healthy dietary pattern could lead to better health in rural children.

Supplementary Material

Supplementary material(s) is available [here](#) [To read supplementary materials, please refer to the journal website and open PDF/HTML].

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Footnotes

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