Progress in Nutrition 2019; Vol. 21, Supplement 2: 229-237 DOI: 10.23751/pn.v21i2-S.6538

Original article

Dietary patterns and socioeconomic status in Iranian adolescent girls, 2015

Lida Daeie-Farshbaf[1], Parvin Sarbakhsh[2], Mehrangiz Ebrahimi-Mameghani[3], Ali Tarighat-Esfanjani[3]

[1]Student Research Committee, School of Nutrition and Food Sciences, Tabriz University of Medical Sciences,Tabriz, I.R. Iran; [2]Department of Statistics and Epidemiology, School of Public Health, Tabriz, I.R. Iran; [3]Nutrition Research Center, School of Nutrition and Food Sciences, Tabriz University of Medical Sciences, Tabriz, I.R. Iran - E-mail: Tarighata@tbzmed.ac.ir

Summary. *Objective:* Identifying major dietary patterns (DP) and their association with socioeconomic factors among adolescent girls, Tabriz, Iran. *Methods:* The present cross-sectional study was conducted among 725 girls aged 14-18 years, selected by multistage random sampling from 5 districts of Tabriz high schools. Participant's socioeconomic characteristics and food intake was gathered via suitable questionnaires. Height and weight were measured and body mass index (BMI) was calculated. Dietary patterns were identified using factor analysis. Additionally, the relationship between DPs and socioeconomic factors was evaluated using generalized linear models. *Results:* Three major DPs were identified and labeled as western, traditional and healthy and a total variation rate of 25.84% was detected. According to the univariate model, the healthy DP was in correlation with BMI< 85th percentile (P=0.04). A significant positive association between household size less than 4 members and western (P= 0.007) and traditional (P=0.01) DPs was observed. Healthy DP had a significant association with family income ≥ 1000$ (P=0.05) and parent's smoking situation had a significant association with Western DP (P=0.008). However after regression model analyzes, the association was only observed for family income ≥ 1000$ (β=0.6, CI=0.21-0.99, P=0.002). Excessive usage of internet and cell phone was in correlation with the Western DP (β=0.13, CI=0.07-0.19, P<0.001). *Conclusions and Implications:* According to the results of the current study, behavioral and family related factors that may influence DPs should be considered as critical points for interventional programs among adolescent girls.

Key words: dietary pattern, adolescent girls, socio-economic status

Introduction

Adolescence is as a critical growth period for the development of behavioral patterns and lifestyle (1). According to the results of years of research, dietary patterns (DP) are mainly formed during this period, thus adolescence's nutritional requirements can be deeply affected (2). Since nutritional behaviors are followed from adolescence into adulthood, it is crucial to emphasize on nutritional needs and dietary patterns of adolescents (3). This group tends to skip meals, consume junk foods and easy to cook meals, follow diets and irrational regimes to lose weight (4).

Nowadays in epidemiological nutrition studies, assessing DP rather than studying single food items or nutrients are widely accepted. Assessing individual's total diet can present useful data regarding the association between diet and health outcomes. Thus, assessing DP can provide concise information in nutritional interventions. The American Dietetic Association claims that healthy eating messages for people should emphasize on DPs rather than food items or meals (5-6).

Several epidemiological studies have supported the association between socioeconomic status (SES) and health and especially health-related behaviors in both developed and developing countries (7-10). Many stud-

ies have revealed the potential effects of socio-economic and behavioral characteristics on adolescent's DPs. In this regards, Kafeshani et al. claimed a positive correlation between urbanization and abundant consumption of fast foods, and also between rural lifestyle and vegetable dietary pattern (11). In another study, higher parental education increased the odds of having healthy diet and consuming more dairy products in adolescents (12).Since adolescent girls are more intense with their weight and body shape, poor dietary habits (insufficient consumption of essential nutrients) are highly reported (13). Consequently, poor dietary habits can cause early signs of adverse nutrition-related conditions, including cardiovascular disease, type 2 diabetes mellitus and obesity (14). Therefore, upgrading healthy nutritional habits during adolescence has the potential to confer significant long-term health benefits (15).

Due to the limited number of studies investigating adolescent's DPs, particularly in developing countries (11, 16); the present study aimed to investigate the major DPs of adolescent girls and their association with Socio-economic status in Tabriz, Iran.

Methods

Participants and procedures

This cross-sectional study was carried out among 725 female adolescents in Tabriz during September-October 2015. The study subjects were randomly selected using multistage sampling from five districts of Tabriz. The exclusion criteria were: suffering from any chronic disease (diabetes, heart-coronary illnesses, etc.) and adherence to specific diets. All the subjects in this study were healthy adolescent girls aged 14-18 years who were resident for at least one year in Tabriz.

Measurements

The purpose of the study and instructions required for completing the questionnaires were explained to all the students in a specific training session. Age was calculated based on date of birth. Height was measured following a standardized protocol (17) using a calibrated instrument (Stadiometer SECA model 213, SECA Corp., Hamburg, Germany, 2008) with 0.1cm accuracy. Weight was measured using a standard weighing instrument with 0.1kg accuracy (beurer scale, model GS 202, Beurer GmbH., Germany, 2015). Body Mass Index (BMI) was calculated by dividing weight (kg) to the square of height (m^2). The cut-off points of the Center for Disease Control and Prevention (CDC) association were used for classifying subjects BMI and weight. Cut-offs between the 85th and 95th percentile were classified as overweight and above 95th percentile as obese (18).

The present trial was approved by the ethical committee of Tabriz University of Medical Sciences (Ethical Code: TBZMED.REC.1394.593). Socioeconomic information such as parent's smoking condition, watching cabled television or using internet and cell phones (screen time) and settlement status were gathered by a precise author-designed questionnaire. Socioeconomic status was assessed by gathering data regarding parents' educational and occupational situation, number of family members and type of school was categorized into *"low", "moderate"*and*"high"* subgroups. Subject's usual dietary intake was assessed using a validated 132-item semi-quantitative food frequency questionnaire (SFFQ) (19). Participants were asked to record their usual dietary intake during the last year. The selected food frequency category for each item was converted into weekly intake. Then the portion size of each consumed food item was converted to grams using household measures. A total of 132 food items were grouped into 28 food subgroups (Table 1) on the basis of nutrient profiles and culinary usage. Food items that did not match any of the groups or represented distinctive dietary behaviors were categorized as an independent food group.

Statistical analysis

Results of demographic characteristics were expressed as means ± SD for continuous variables and as frequency and percent for categorical variables. The data normality was checked using the kolmogorov-smirnov test. Dietary patterns were extracted by exploratory factor analysis using principal component analysis (PCA), based on correlation matrix and direct oblimin rotation. Kaiser Meyer Olkin (KMO) index was calculated for sampling adequacy and was reported as 0.79, which was in the acceptable range. The result of the Bartlet test was significant which confirmed data occasion for performing factor analysis

Table 1. Food groups used in dietary pattern analysis

Sub groups	Food items
Traditional breads and cereals	Sanghak, lavash, shyrmal bread, barbari, wheat germ, oat bread, samanou, rice, oat, maize, grout, noodles, pasta, wheat flour
Industrial breads and cereals	Short cake, toasted flour, toasted bread, baguette, popcorn, pizza dough
High fat dairies	High fat milk, high fat yogurt, cream cheese, pasteurized ice cream, traditional ice cream, cream, and lighvan cheese
Low fat dairies	Low fat milk, low fat yogurt, dough, pasteurized cheese, curd, cocoa milk, chocolate milk
Fruits	Apple, citrus, banana, melon and water melon, peach, berry, lemon, kiwi, cherry, grape, plum, persimmon, pineapple, fig, date, compotes, drupelet, strips, pomegranate, blueberries
Fruit juices	Natural and commercial juice, fruit syrup
Condiments	Verjuice, lemon juice, pomegranate Sauce, ketchup, salt
Vegetables	Carrot, cabbage, spinach, green peppers, lettuce, stewed vegetables, cucumber, garlic, onion, eggplant, okra, celery, green bean, turnip, squash, mushroom, tomato
Potato	Potato
Pizza	Pizza
Legumes	Beans, pea, lentil, soy, split pea
Processed meats	Sausage, hamburger, canned tuna fish
Red meat	Beef, mutton
Organ meat	Liver, tongue
Chicken	Chicken, eg
Fish	Fish
Nuts	Almond, peanut, pistachio, hazelnut, roasted seeds, walnut
Olive	Olives, olive oil
Mayonnaise	Mayonnaise
Saturated fats	Butter, animal fats, ghee
Unsaturated fats	Vegetable oils (except for olive oil)
Sweets and desserts	Sugar, candies, jam, honey, jelly, cookies, cake, creamy cake, chocolate, cream-caramel, halva, gaz, cotton candy, baklava, zoolbia, grape juice, shole-zard, donuts
Tea and coffee	Tea, coffee
Pickles	Pickles
Drinks	Carbonated drinks, non-alcoholic beer, diet drinks
Broth	Broth
Snacks	Crackers, gums, wafers, puffs, biscuits
Chips	Potato chips ,French fries

(χ^2=2323.02, df= 378, P<0.001). Eigen value greater than 1.3 and visual inspection of the scree plot were applied for identifying the number of patterns to retain. In order to assess the suitability of respondent data for factor analysis, KMO was used for measuring sampling adequacy along with the Bartlett's test of Sphericity. Exploratory factor analysis was used for assessing the magnitude of loading food groups, and each pattern was named based on loadings more or equal than ±0.1. Additionally, dietary pattern score, standardized to a mean of zero and standard deviation of one, was calculated for each subject as a function of the contribution ("loading") that each food item attained to the pattern. The factor score represents how an individual follows a particular dietary pattern. In order to compare the socio–economic variables between quartile 1 (Q1) and quartile 4 (Q4) of each dietary pattern, generalized linear model was used and the results for differences between Q1 and Q4 for continues variables was reported. For categorical variables, result of model

for Q1 rather than Q4 from multinomial regression, was reported. The sampling method in this study was stratified sampling. Therefore, in order consider the effect of sampling method, variables such as district and type of school (as strata) was adjusted in all the models. The software Statistical Package for the Social Science SPSS version 23.0, IBM, Corp., US (2016) was used for statistical analysis. P-value less than 0.05 was considered as statistically significant.

Results

Dietary patterns

A total of 725 adolescent girls from nineteen high schools of 5 education districts completed the FFQ. As shown in Table 2, three major DPs were labeled: western diet (high intake of processed meat, chips, pizza, drinks, mayonnaise, snacks, high-fat dairies, industrial bread and cereals), traditional diet (high intake of traditional bread and cereals, legumes, red meat, organ meat, unsaturated fats, fish, sweets and desserts, saturated fats, poultry, condiments and broth) and healthy diet (high intake of fruits, vegetables, fruit juice, pickles, nuts, low-fat dairies, tea and coffee, olive, and potato). Assignment of food items to each DP was based on high loading value. The DPs presented 14.19, 6.56, and 5.08 variation rate for food intake, respectively.

Table 3 indicates the distribution of socioeconomic characteristics according to the quartiles of the three major DPs. Participant's mean age was 15.81±0.97 years. There were no differences observed for DPs according to age. Based on BMI/Age percentiles, adolescents in the lowest quartiles of healthy diet were underweight compared to those in the highest quartile (p=0.04). No associations were found between parents' education level and occupation status and SES with each type of DP. In comparison to the lowest quartile, individuals in the highest quartile of traditional diet were mainly urban citizens (p<0.02). There were significant associations between household size less than 4 members and Western DP as well as traditional DP. Only the healthy DP was associated with family income ≥ 1000$ (p=0.05). This finding indicates that higher income could provide healthy food consumption. The frequency of western diet was more in the highest quartile compared to the lowest quartile in adolescents with one smoking parent (P<0.01). Less than 2 hours watching cabled TV was associated with western/healthy DPs (p<0.05). Adolescents with 2-5 hours using the internet and cell phone had western diet especially in the highest quartile (P =0.001).

In order to identify behavioral and socioeconomic factors influencing DPs according to linear regression model, the variables that had P-value less than

Table 2. Factor loading matrix for major dietary patterns in adolescence girls (retaining factor loadings ≥ 0.1 or ≤ - 0.1)

Food sub groups	Component		
	Western	**Traditional**	**Healthy**
Processed meat	**0.617**	-	-
Chips	**0.533**	-	0.180
Pizza	**0.522**	0.261	-
Drinks	**0.501**	-	0.285
Mayonnaise	**0.434**	0.391	-
Snack	**0.405**	0.394	-
High-fat dairies	**0.381**	-	0.288
Industrial bread and cereals	**0.378**	-	0.246
Traditional breads and cereals	0.191	**0.633**	0.255
Legumes	-0.136	**0.582**	0.163
Red meat	0.170	**0.502**	0.152
Organ meats	-	**0.479**	0.356
Unsaturated fats	-	**0.477**	-
Fishes	-	**0.424**	0.124
Sweets and desserts	0.373	**0.419**	0.364
Saturated fats	-	**0.370**	-
Poultry	0.107	**0.337**	-
Condiments	0.227	**0.312**	0.209
Broth	-0.238	**0.265**	0.159
Fruits	0.164	0.204	**0.648**
Vegetables	0.193	0.280	**0.600**
Fruit juice	0.459	-	**0.494**
Pickles	0.200	-	**0.478**
Nuts	-	-	**0.421**
Low-fat dairies	0.222	-	**0.408**
Tea and coffee	-0.129	0.219	**0.354**
Olive	-	0.181	**0.296**
Potato	-	0.133	**0.150**
Variance (%)	14.19	6.56	5.08

Table 3. Distribution of socioeconomic characteristics according to quartiles of identified dietary patterns (n=725)

Characteristic	**Western n=256 (35.3%)**			**Traditional n=208 (28.7%)**			**Healthy n=261 (36%)**		
	Q1 100% (n=182)	Q4 100% (n=181)	*P	Q1 100% (n=181)	Q4 100% (n=181)	P	Q1 100% (n=181)	Q4 100% (n=182)	P
Age (year)									
Total=15.81±9.9	15.8 ± .97	15.76 ± 1.06	**0.64**	15.73 ±. 99	15.92 ± 1.01	**0.72**	15.89 ± 1.01	15.75 ± 1.03	**0.99**
BMI /Age*									
<85th	81.9(149)	85.7(155)	**0.1**	78.4(142)	85.1(154)	**0.76**	87.6(159)	83.5(152)	**0.04**
85-95th	11(20)	11(20)	**0.17**	16(29)	9.9(18)	**0.42**	10.5(19)	10.4(19)	**0.07**
≥95th	7.1(13)	3.3(6)	*ref*	5.5(10)	5(9)	*ref*	1.7(3)	6(11)	*ref*
Father's education									
University degree	17(31)	13.8(25)	**0.27**	13.8(25)	21(38)	**0.13**	15.5(28)	18.1(33)	**0.31**
Diploma	39(71)	44.8(81)	**0.38**	43.1(78)	40.9(74)	**0.97**	39.2(71)	43.4(79)	**0.16**
Elementary and illiterate	44(80)	41.4(75)	*ref*	43.1(78)	38.1(69)	*ref*	45.3(82)	38.5(70)	*ref*
Mother's education									
University degree	9.9(18)	14.4(26)	**0.32**	7.2(13)	16.6(30)	**0.32**	7.2(13)	12.1(22)	**0.12**
Diploma	40.7(74)	46.4(84)	**0.2**	46.4(84)	45.9(83)	**0.82**	48.1(87)	49.5(90)	**0.4**
Elementary and illiterate	49.5(90)	39.2(71)	*ref*	46.4(84)	37.6(68)	*ref*	44.8(81)	38.5(70)	*ref*
Mother's occupation									
Housewives	90.7(165)	87.3(158)	**0.37**	89.4(161)	85.1(154)	**0.85**	91.2(165)	89.6(163)	**0.51**
Retired	0.5(1)	1.1(2)	**0.94**	0.6(1)	1.1(2)	**0.59**	1.7(3)	1.1(2)	**0.37**
Employee	4.9(9)	5(9)	**0.4**	3.9(7)	8.3(15)	**0.28**	3.9(7)	4.4(8)	**0.77**
Self-employed	3.8(7)	6.6(12)	*ref*	6.1(11)	5.5(10)	*ref*	3.3(6)	4.9(9)	*ref*
Location									
City town	15.9(29)	16(29)	**0.25**	12.7(23)	19.9(36)	**0.02**	16(29)	19.2(35)	**0.89**
Tabriz	84.1(153)	84(152)	*ref*	87.3(158)	80.1(145)	*ref*	84(152)	80.8(147)	*ref*
Household size									
<4									
≥4	17(31)	8.8(16)	**0.007**	18.2(33)	9.4(17)	**0.01**	9.4(17)	15.9(29)	**0.07**
	83(151)	91.2(165)	*ref*	81.8(148)	90.6(164)	*ref*	90.6(164)	84.1(153)	*ref*
Family income									
≥1000$	80.2(146)	84.5(153)	**0.48**	80.1(145)	88.4(160)	**0.69**	79(143)	90.7(165)	**0.05**
<1000$	19.8(36)	15.5(28)	*ref*	19.9(36)	11.6(21)	*ref*	21(38)	9.3(17)	*ref*
Parent smokes									
Yes	18.1(33)	30.4(55)	**0.008**	23.2(42)	23.8(43)	**0.68**	18.8(34)	24.7(45)	**0.18**
No	81.9(149)	69.6(126)	*ref*	76.8(139)	76.2(138)	*ref*	81.2(147)	75.3(137)	*ref*
Cabled TV channels watching on a day									
No use	64.8(118)	34.8(63)	**0.001**	48.6(88)	51.4(93)	**0.15**	57.5(104)	42.3(77)	**0.04**
<2 h	24.7(45)	24.9(45)	**0.004**	30.9(56)	22.1(40)	**0.04**	22.7(41)	25.3(46)	**0.26**
2-5h	9.3(17)	29.3(53)	**0.138**	16.6(30)	19.3(35)	**0.37**	15.5(28)	22.5(41)	**0.42**
>5h	1.1(2)	11(20)	*ref*	3.9(7)	7.2(13)	*ref*	4.4(8)	9.9(18)	*ref*
Use of Internet and cell phone on a day									
No use	30.8(56)	15.5(28)	**0. 1**	21(38)	18.2(33)	**0.26**	22.1(40)	19.2(35)	**0.42**
<2 h	48.9(89)	34.3(62)	**0. 1**	45.3(82)	40.9(74)	**0.21**	42.5(77)	41.8(76)	**0.57**
2-5h	17.6(32)	26(47)	**0.001**	22.7(41)	26(47)	**0.55**	23.8(43)	23.1(42)	**0.45**
>5h	2.7(5)	24.3(44)	*ref*	11(20)	14.9(27)	*ref*	12.6(21)	15.9(29)	*ref*
SES									
Low	15.4(28)	19.3(35)	**0.99**	12.2(22)	19.3(35)	**0.49**	16(29)	17.6(32)	**0.62**
Middle	74.7(136)	67.4(122)	**0.31**	77.3(140)	69.1(125)	**0.52**	76.2(138)	71.4(130)	**0.26**
High	9.9(18)	13.3(24)	*ref*	10.5(19)	11.6(21)	*ref*	7.7(14)	11(20)	*ref*

*BMI, Body Mass Index / ref. reference; *P< 0.05; Comparisons between Q_1 and Q_4 were performed for quantitative variables with contrast of general linear model and for qualitative variables by multinomial regression model; 1th and 4th Quartiles of dietary pattern score are indicated by Q1 and Q4; ˙Adjusted for district and type of school; ¨According to U.S. Centers for Disease and Prevention*

Table 4. Linear regression of major dietary patterns with demographic and socio-economic factors (n=725)

	Western (R^2 =0.132)		Traditional (R^2=0.056)		Healthier (R^2 =0.068)	
	ß (95 % CI)	*P	ß (95% CI)	P	ß (95% CI)	P
BMI /Age*						
<85th	0.58 (-0.02, 1.1)	0.06	0.003 (-0.73,0.74)	0.99	-0.28 (-0.9,0.33)	0.36
85-95th	0.47 (-0.25, 1.1)	0.2	-0.47 (-1.3,0.4)	0.29	-0.24 (-0.98,0.48)	0.5
≥95th	*Ref*		*ref*		*ref*	
Father's education						
University degree	-0.31(-0.81,0.18)	0.22	0.08 (-0.52,0.68)	0.79	0.14 (-0.35,0.65)	0.57
Diploma	-0.12 (-0.47,0.22)	0.48	-0.12 (-0.55, 0.29)	0.5	0.05 (-0.29, 0.41)	0.74
Elementary and illiterate	*ref*		*ref*		*ref*	
Mother's education						
University degree	0.49 (-0.08, 1.07)	0.09	1 (0.29,1.7)	0.005	0.39 (-0.19,0.99)	0.18
Diploma	0.28(-0.07,0.64)	0.12	0.27 (-0.15, 0.71)	0.21	-0.03(-0.39, 0.33)	0.85
Elementary and illiterate	*ref*		*ref*		*ref*	
Household size						
<4	-0.07 (-0.36, 0.22)	0.63	0.18 (-0.18, 0.54)	0.32	0.25 (-0.04, 0.55)	0.09
≥4	*ref*		*ref*		*ref*	
Family income						
≥1000$	0.23 (-0.15, 0.61)	0.24	0.17 (-0.29, 0.64)	0.46	0.6 (0.21, 0.99)	0.002
<1000$	*ref*		*ref*		*ref*	
Location						
City town	0.3 (-0.18, 0.8)	0.2	0.7 (0.08, 1.3)	0.02	-0.09 (-0.6 ,0.44)	0.7
Tabriz	*ref*		*ref*		*ref*	
Parent smokes						
Yes	0.24 (-0.08, 0.56)	0.15	0.35 (-0.04,0.75)	0.08	0.3 (-0.02, 0.64)	0.06
No	*ref*		*ref*		*ref*	
Cabled TV channels watching (h/d)	0.18 (0.1,0.25)	<0.001	0.04(-0.04,0.14)	0.3	0.12(0.05,0.2)	0.41
Use of Internet and cell phone (h/d)	0.13 (0.07,0.19)	<0.001	-0.01 (-0.08, 0.06)	0.77	-0.02 (-0.08,0.03)	0.41

*BMI, Body Mass Index / CI, Confidence Interval / ref, reference. Multivariate analysis was used. *P < 0.05; ‡Adjusted for district and type of school. ¶According to U.S. Centers for Disease and Prevention.*

0.1 atleast in one of the patterns were entered into the multivariate analysis (Table.4). Higher maternal education was related to traditional diet (β=1, CI=0.29-1.7, P=0.005) and family income ≥1000$ was associated with healthy diet (β=0.6, CI=0.21-0.99, P=0.002). Living in city was associated with traditional diet (β=0.7, CI=0.08-1.3, P=0.02). Watching cabled TV was positively correlated with western and healthy diet (β=0.18, CI=0.1-0.25, P=0.0 / β=0.12, CI=0.05-0.2, P=0.001), whereas using the internet and cell phone had a positive relationship with western diet (β=0.13, CI= -0.18-0.8, P= 0.0).

Discussion

In this study three major DPs were identified: Western, traditional and healthy DPs. The western diet was defined as high intake of junk foods, processed meat, carbonated drinks, mayonnaise and snack which was in consistent with the fast food DP identified by kafeshani et al. (11) as well as " junk food pattern" with high intake of soda, fried foods, rice recognized by de moraes et al. (20) and Western-like DP introduced by Kiefte- de Jong et al. (21), characterized by high consumption of refined bread and cereals, sauces, snacks, sugar containing beverages. The healthy DP with high intake of fruits and vegetables, potato and vegetable oils (olive) was similar to health conscious DP recognized by Kiefte- de Jong et al.(21) and healthy food pattern by De Moraes et al. (20) and the prudent diet characterized by higher consumption of fruits, vegetables, nuts, potato, fruit juices and pickles (11). The traditional diet had few similarities with the animal fat diet with high intake of animal fat, organ meats and hydrogenated oils and protein food pattern mentioned by De Moraes et al. (20) with high consumption of beans, meats and eggs.

The present study highlights the potential role of SES and behavioral factors on DPs. In this study there significant differences between DPs based on age, however, in Kafeshani et al.'s study the prudent and animal fat diets had an inverse association, while the fast food diet had a positive association with age (10). Also in a study by Mc Naughton et al., an inverse association between healthy diet and age was mentioned (17).

According to the univariate model, adolescents with BMI <85th percentile had healthy diet; this could mainly be due to adolescent girl's obsession with their body shapes, thus they intend to eat healthier foods. In a study among Portuguese adolescents, BMI was inversely associated with dairy products, fast foods and the sweet group. Also BMI> 95th percentile was related with lower intake pattern (12). The positive association was observed between household size less than 4 members and western and traditional diets was in consistent with Pouraram et al.'s study (23) which reported a negative correlation between family size and intake of fat per week. This finding indicates that in crowded families, less fat is consumed.

Our findings also indicated that adolescents, who were passive smokers in the family, were more likely to have Western DP which was in consistent with Ambrosini et al.'s (22) and Kiefte de jong et al (21) studies. In these studies adolescents with parental smoking had significantly higher Western DP score.

According to multivariate model analysis, no significant differences were observed between BMI, family income, parental smoking and DPs. These results were in line with Ambrosini et al's study which did not find any relationship between the DPs and BMI (22).

Unexpectedly, in this study we did not find any correlation between parental education and occupation and any of the DPs, but based on multivariate model, an association between maternal education and traditional DP was observed. This might be due to the fact that mothers with high education tend to prepare foods that are rich in protein because of their concerns regarding their adolescent's growth needs (24). In an Australian study, there was an inverse association between mother's education and snack pattern. In this regards, adolescents with higher maternal education had healthy diet pattern (22).

The correlation between living in city and having traditional diet could be explained by the fact that despite changes in life styles and nutritional changes in the recent years, these areas have still saved their traditional life styles. This finding is in accordance with McNaughton et al's study which claimed that vegetable DP is positively associated with rural residency (17).

We also observed that family income can affect family's access to healthy foods. This was in line with Mohammadabad et al's study. They observed that high-income individuals had a higher tendency to follow Mediterranean diet, featured as a healthy diet pattern (25).

Based on the linear regression model, using internet and cell phones was related with Western DP. Also adolescents who spent more hours watching TV had Western and healthy DP. Other studies claimed that spending several hours watching TV is associated with higher consumption of soft drinks and fried foods (26-30).

In this study we did not observe any differences between DPs based on SES score which was inconsistent with previous studies. Araujo et al reported that families with weak socio-economic status had more tendencies to eat unhealthy foods (12). In a study on healthy American adults, Kerver *et al.* reported that individuals with strong socio-economic status are more likely to have vegetable diets (31).

Study strengths and limitations

This cross-sectional study was accomplished on a large population of adolescent girls recruited from all districts of Tabriz. The FFQ used for dietary data collection consisted of 132 items frequently consumed by the population. Since the statistical technique exploratory factor analysis (EFA), requires arbitrary decisions and subjective interpretation of factors, we used a criteria similar to previous studies in order to enable comparisons. Another limitation to this study was that male adolescents were not included so we were unable to compare results based on gender; also we did not assess physical activity which is an affective factor on DPs.

Conclusion

In this study only about one third (36%) of the study population had healthy diet. Therefore, this study suggests that behavioral and family related factors such as maternal education, family income, cabled TV and internet and parental smoking, are effective factors on DPs and are considered as critical points to interventional programs in this field of nutritional studies.

Acknowledgment

The authors are grateful for the financial support of the Nutrition Research Center, Tabriz University of Medical Sciences. The authors also are deeply indebted with all the subjects who participated in this study. This article was written based on the data set of Mrs. Lida Daeie-Farshbaf's MSc thesis registered in Tabriz university of Medical sciences.

References

1. Spear B.A. Adolescent growth and development. *J Academy of Nutr and Dietetics* 2002; 23.
2. Dehghan M, Akhtar-Danesh N, Merchant AT. Childhood obesity, prevalence and prevention. *Nutr* 2005; 4(1):24 (Persian).
3. Lake AA, Mathers JC, Rugg-Gunn AJ, Adamson AJ. Longitudinal change in food habits between adolescence (11–12 years) and adulthood (32–33 years): the ASH30 Study. *J Public Health* 2006; 28(1):10-6.
4. Weinsier RL, Morgan SL, Perrin VG.*Fundamentals of Clinical Nutrition*. 2nd ed. Missouri: Mosby 1998; 17: 96-101.
5. Esmaillzadeh A, Azadbakht L, Kimiaghar M. "Analysis based on dietary patterns: a new approach in evaluating the relationship between nutrition and disease". *Iran J Nutr Sci Food Technol* 2007; 2: 71-80 (Persian).
6. Tarighat-Esfanjani A, Ebrahimi-Mameghani M, Asghari-Jafarabadi M, Jafari-Vayghan H, Saleh Ghadimi S. Identification of Major Dietary Patterns in Tabriz Adults. *Med J Tabriz Univ Med Sci and Health Services* 2016; 38(2):48-55.
7. Sugisawa H, T Nomura, and M Tomonaga. Psychosocial mediators between socioeconomic status and dietary habits among Japanese older adults. *J nutr, health & aging* 2015; 19(2):130-6.
8. Arruda SPM, Moura da Silva AA, Kac G, Goldani MZ, Bettiol H, Barbieri M. Socioeconomic and demographic factors are associated with dietary patterns in a cohort of young Brazilian adults. *BMC public health* 2014; 14(1):654.
9. Nédó E, Paulik E. Association of smoking, physical activity, and dietary habits with socioeconomic variables: a cross-sectional study in adults on both sides of the Hungarian-Romanian border. *BMC public health* 2012; 12(1):60.
10. Lyerly JE, Reeve CL. Evaluating the unique effects of cognitive ability and parental socioeconomic status on adult dietary behaviors and receipt of preventive health services. *Intelligence* 2014; 47:113-21.
11. Kafeshani O, Sarrafzadegan N, Nouri F, Mohammadifard N. Major dietary patterns in Iranian adolescents: Isfahan Healthy Heart Program, Iran. *ARYA athero* 2015; 11(1):61.
12. Araújo J, Teixeira J, Gaio AR, Lopes C, Ramos E. Dietary patterns among 13-y-old Portuguese adolescents.*Nutr* 2015; 31(1):148-54.
13. Fallah H, Hosseini M, Keshavarz SA. A Study of the Height, Weight, Body Mass Index (BMI) and Intake of Nutrients Among 11-14 Years-Old Adolescent of Non-profit Schools in Damghan City. *J school public health, Yazd* 2006; 5(3):20-9 (Persian).
14. Diet N. the Prevention of Chronic Diseases. Report of a joint WHO/FAO expert consultation. Geneva. World Health Organ Tech Rep Ser 2003; 916.
15. McNaughton SA, Ball K, Mishra GD, Crawford DA. Dietary patterns of adolescents and risk of obesity and hypertension. *J nutr* 2008; 138(2):364-70.
16. Roustaee R, Djazayery A, Hajifaraji M, Djazayery Sh , Mehrabi Y. Assessing the Major Dietary Patterns and Their Relation with Eating Disorders in Female Adolescents of Tehran. *Iran J Nutr Sci & amp; Food Technol* 2014; 9(3):21-31.
17. Organization WH. *Measuring obesity—classification and description of anthropometric data. Report on a WHO consultation of the epidemiology of obesity*. Warsaw 21-23 October 1987. Copenhagen: WHO, 1989. Nutrition Unit document, EUR/ICP/NUT 1987;123.
18. Centers for Disease Control and Prevention. CDC growth charts. 2000. http: //www.cdc.gov/growthcharts/. Accessed 31 Jan 2010.
19. Ebrahimi-Mameghani M, Behroozi-Fared-Mogaddam A, Asghari-Jafarabadi M. Assessing the reliability and reproducibility of food frequency questionnaire and identify major dietary patterns in overweight and obese adults in Tabriz, Iran. *J Mazand Univ Med Sci* 2014; 23(2):46-57. (Persian).
20. de Moraes ACF, Adami F, Falcão MC. Understanding the correlates of adolescents' dietary intake patterns. A multivariate analysis. *Appetite* 2012; 58(3):1057-62.
21. Kiefte-de Jong JC, de Vries JH, Bleeker SE, Jaddoe VW, Hofman A, Raat H, et al. Socio-demographic and lifestyle determinants of 'Western-like and 'Health conscious' dietary patterns in toddlers. *BRT J Nutr* 2013; 109(1):137-47.
22. Ambrosini, GL, Oddy WH, Robinson M, O'Sullivan TA, Hands BP, de Klerk NH, et al. Adolescent dietary patterns are associated with lifestyle and family psycho-social factors. *Public Health Nutr* 2009; 12(10):1807-15.
23. Pouraram H, Abtahi M, Djazayeri A, Eshraghian MR, Khodadadi E. Dietary pattern of adolescent girls in relation to socio-economic factors; A comparison between North

and South Tehran. *J Paramed Sci* 2013; 4(4):3-10.
24. Patrick H, Theresa A. A Review of Family and Social Determinants of Children's Eating Patterns and Diet Quality. *J American College of Nutr* 2005; 24(2): 83-92.
25. Mohammadifard N, Sarrafzadegan N, Nouri F, Sajjadi F, Alikhasi H, Maghroun M, et al. Using factor analysis to identify dietary patterns in Iranian adults: Isfahan Healthy Heart Program. *Int j public health* 2012; 57(1):235-41.
26. ArancetaJ,Pérez-Rodrigo C, Ribas L, Serra-Majem L. Sociodemographic and lifestyle determinants of food patterns in Spanish children and adolescents: the enKid study. *EUR J Clin Nutr* 2003; 57: 40-4.
27. Utter J, Neumark-Sztainer D, Jeffery R, Story M. Couch potatoes or French fries: are sedentary behaviors associated with body mass index, physical activity, and dietary behaviors among adolescents? *J Am Dietetic Assoc* 2003; 103(10):1298-305.
28. van Kooten M, de Ridder D, Vollebergh W, van Dorsselaer S. What's so special about eating? Examining unhealthy diet of adolescents in the context of other health-related behaviours and emotional distress. *Appetite* 2007; 48(3):325-32.
29. Kourlaba G, Panagiotakos DB, Mihas K, Alevizos A, Marayiannis K, Mariolis A, et al. Dietary patterns in relation to socio-economic and lifestyle characteristics among Greek adolescents: a multivariate analysis. *Public health nutr* 2009; 12(9):1366-72.
30. Richter A, Heidemann C, Schulze MB, Roosen J, Thiele S, Mensink GB. Dietary patterns of adolescents in Germany-Associations with nutrient intake and other health related lifestyle characteristics. *BMC pediatrics* 2012; 12(1):35.
31. Kerver JM, Yang EJ, Bianchi L, Song WO. Dietary patterns associated with risk factors for cardiovascular disease in healthy US adults. *Am J clin nutr* 2003; 78(6):1103-10.

Correspondence:
Ali Tarighat-Esfanjani, Ph.D.
Nutrition Research Center,
School of Nutrition and Food Sciences
Tabriz University of Medical Sciences
Attar Nishabouri St., Tabriz, I. R. Iran
Postal code: 5166614711, P.O. Box 14711
Tel: 0098-41-33357582, Fax: 0098-41-33340634
E-mail: Tarighata@tbzmed.ac.ir