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Diet Quality of Adolescents in Shiraz, Southern Iran Needs Moderate to Severe Improvement

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ABSTRACT

Background: The importance of healthy eating habits increases in adolescence therefore, healthy eating index (HEI) and diet diversity score (DDS) are embedded in order to evaluate them. This study was undertaken to assess the diet quality of high school students in Shiraz, southern Iran.

Methods: This cross-sectional study enrolled 696, fourteen to twenty years old teenage boys and girls in Shiraz, southern Iran. Anthropometric indices including weight, height and waist circumference (WC) were measured. A 168-item food frequency questionnaire (FFQ) was used to estimate usual dietary intakes, then HEI and DDS were calculated. Two physical activity questionnaires, one related to sitting activities and another about other activities were completed by participants.

Results: Among 341 boys and 355 girls, 51.4%, 31.2% and 17.4% had were normal, underweight, and overweight or obese, respectively. Mean WC of participants was 71.7±10.71 cm. The mean of HEI score was 57.6±6.8. Only 0.2% of students had a good diet. The mean of DD Score was 6.4±1.3. About 23.5% of participants had highly diverse diet. A statistically significant higher HEI score (girls: 58.8±7.0, boys: 56.4±6.4) and lower DDS score (6.7±1.3 vs 6.1±1.2) were noticed in girls compared to boys. A positive association was seen between fruits and vegetables diversity score and negative relation between breads/grains, meat and dairies diversity scores with HEI.

Conclusion: Dietary habits of most of junior and senior high school students in Shiraz needed moderate to severe improvements. So it is necessary to promote adolescents' nutritional knowledge and attitudes.

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Introduction

Nutrition is one of the most important part of lifestyle which has an undeniable effect on growth, development, recovery from illness and health

maintenance (1). The importance of nutrition increases in adolescence, because as a result of a growth spurt nutrients requirements change in this stage. Also poor nutrition in adolescence can induce a wide range of nutrition related perturbation, as many non-communicable diseases, which have long-lasting consequences into adulthood (2). On the other hand, most of the chronic diseases which have a huge financial burden on the healthcare system can be prevented by proper nutrition (3).

To adopt a healthy nutrition style, some dietary guidelines have been defined by health institutes (4) and some evaluator systems embedded; one of them is Healthy Eating Index (HEI) (5). Different studies which assessed HEI in different populations found reverse relations between HEI scores and Body Mass Index (BMI), lipid profile (6), risk of chronic diseases (7), all-cause, CVD, cancer mortality risk (8), and Chronic Obstructive Pulmonary Disease (COPD) (9). Another evaluator system is Dietary Diversity Score (DDS). Based on body's physiological needs, diet should be a combination of all food groups to meet requirements for different nutrients. Actually monotonous diet can cause poor nutrition status that followed by health problems (10).

Nutrition scientists believe that the more diverse a diet is, the healthier it is likely to be. Studies in the field of nutrition sufficiency showed that DDS can be a good predictor index of nutrients adequacy (11). On the other hand, some studies showed better health status in populations who had higher DDS score. For example, higher blood antioxidant markers and reduced oxidative stress (12), less obesity and abdominal adiposity (13) and lower cardiovascular risk factors were related to higher DDS (14). Since in the past decades, Iran had experienced accelerated industrialization followed by diet alteration especially among adolescence, so we aimed to assess nutritional status of junior and senior high school students in Shiraz, southern Iran using HEI and DDS.

Materials and Methods

This cross-sectional descriptive analytical study was done on 14 to 20 years old teenage boys and girls in Shiraz, southern Iran. Participants were recruited by multi-stage random cluster sampling; for this purpose, schools were selected randomly in each area, then in each school, classes were selected randomly and in each class table of random numbers were used to choose participants. Anthropometric indices including weight, height and Waist Circumference (WC) were measured. Height was measured to the nearest 0.1 cm using an un-stretchable tape measure. Using a digital scale (Glamor BS-801, Hitachi, China), weight was measured to the nearest 100 g without shoes in minimal clothes. After each 10 measurements, the scale was calibrated using a standard load. Body Mass Index (BMI) was calculated as weight in kilogram divided by squared height in meter. WC was measured at the narrowest part of the waist, then it was compared to center of disease control and prevention (CDC) 2009 percentiles to determine central obesity. CDC 2000 percentile curves of BMI, weight and height based on age and sex, were used to determine the nutritional status.

A 168-item Food Frequency Questionnaire (FFQ) was used to estimating usual dietary intakes, then HEI and DDS were calculated. HEI consists of 12 components; each reflects an important aspect of diet quality. First nine components focus on adequacy (total fruits, whole fruits, total vegetables, greens and beans, whole grains, diaries, total protein foods, seafood and plant proteins and fatty acids). For calculating fatty acids score, the [Poly unsaturated fatty acids (PUFAs)+Mono Unsaturated Fatty Acids (MUFAs)]/Saturated Fatty Acids (SFAs) equation was considered.

Three other components focus on moderation (refined grains, sodium and empty calories). Intakes based on the recommended amounts (the best possible) were awarded the maximum score (5, 10 or 20 points depending on the component), whereas amounts that did not meet the recommendations were awarded fewer points proportionally, with zero being the minimum score (15). Finally, total score was calculated as the sum of the scores of ten subgroups with 100 being the maximum score. Then based on Bahreini *et al.*'s study (4), score<50 was defined as "poor diet", 51-80 was considered as "needs improvements" and HEI score>80 was regarded as "good diet".

In order to calculate DDS, based on Food Guide Pyramid, 5 main groups including bread-grains, vegetables, fruits, meat, dairy and their substitutions were considered (16). According to Haines *et al.*'s study (17), each main group was divided into subgroups to show the within groups diversity. Bread-grain group was expanded into 7 subgroups (refined breads, biscuits, macaroni, whole breads, corn flakes, rice and refined flour), vegetables group was divided into 7 subgroups (starchy vegetables, potatoes, legumes, salad vegetables, tomatoes, yellow vegetables and green vegetables), fruits group into 2 subgroups (fruits and fruit juices, berries and citrus), meat group to 4 subgroups (egg, read meat, poultry and fish) and dairy group into 3 subgroups

(milk, yogurt, chees). Each of the 5 broad food categories received a maximum diversity score of 2. To calculate the diversity score of each group, if a person consumed at least one serving from 3 possible diary categories (1/3×2=0.66), it was diversity of dairy group. Finally total score was the sum of the scores of five main groups with 10 being the maximum score.

Two physical activity questionnaires, one related to sitting activities (watching television, working with computer, doing homework, reading books, transporting by vehicle, doing artworks and talking) and another about other activities were completed by participants. Nutritionist 4 was used to estimate nutrients intakes and SPSS software (version 22, Chicago, IL, USA) was used for statistical analysis. Since the sample size was large enough, normality assumption could be considered for all variables. For reporting variables frequencies, descriptive analyses were used. To assess the association between HEI/DDS and quantitative variables, correlation coefficient was applied. Regression analysis determined the association between HEI/DDS and qualitative variables. At first, univariate linear regression was used for each variable, then to eliminate confounder effects, variables with p values<0.2 were entered into

Table 1: Demographic and socio-economic characteristics of junior and senior high school students in Shiraz.

Variables	Min-Max	Mean±SD	Frequency	
			Number	Percent
Age (years)	12-19	14.9±1.50		
Family size (number)	2-10	4.5±1.09		
Sex				
Male			341	49
Female			355	51
Pocket money/day (Rials)	0-2000000	12049.7±107743.05		
Pocket money spent on food (Rials)	0-700000	4389.6±35553.08		
FAS:				
Low			173	24.9
Moderate			301	43.2
High			198	28.4
Father education:				
Illiterate			9	1.3
primary school			51	7.3
Guidance school			104	14.9
High school			226	32.5
Diploma-bachelor			248	35.6
MA-PHD			44	6.3
Mother education:				
Illiterate			10	1.4
Primary school			51	7.3
Guidance school			122	17.5
High school			220	31.6
Diploma-bachelor			251	36.1
MA-PHD			34	4.9
Father job:				
Jobless			106	15.2
Worker/Employee			128	18.4
Senior clerk/Military			89	12.8
Manager/Doctor/Professor			59	8.5
Retired			47	6.8
Self-employee			250	35.9
Mother job:				
Housewife			457	65.7
Worker/Employee			91	13.1
Senior clerk/Military			24	3.4
Manager/Doctor/Professor			23	3.3
Retired			20	2.9
Self-employee			76	10.9

FAS: family affluent scale

adjusted regression models. *P* value less than 0.05 was considered as significant.

Results

A total of 696 students including 341 boys (49%) and 355 girls (51%) in age range of 12 to 19 years participated in this study. Socio-economic characteristics of the participants and their parents were shown in Table 1. Based on Family Affluent Scale (FAS), 24.9%, 43.2% and 28.4% of families had low, medium and high socio-economic status, respectively. The mean pocket money per day for students was 12049.7±107743 Rials; and the mean pocket money which students spent on snacks in a day was 4389.6±35553 Rials.

According to Table 2, the mean BMI of participants was 21.2±4.4 kg/m^2; 51.4% had normal weight, 31.2% were underweight and 17.4% were overweight or obese. Mean WC of participants was 71.7±10.71 cm. It was also shown that the mean of HEI score was 57.6±6.8 (Total score=100). Based on the classification of HEI score, only 0.2% of students had a good diet (HEI≥80), 86.8% moderate quality diet (50<HEI<80) and 13% had a poor diet (HEI≤50). The mean of DD Score was 6.4±1.3 (Total score=10). Only 23.5% of participants had highly diverse diet.

Results of regression analysis showed a statistically significant higher HEI score (girls: 58.8±7.0, boys: 56.4±6.4, $p<0.001$) and lower DDS score (6.7±1.3 Vs 6.1±1.2, $p<0.001$) in girls compared to boys. We did not find any significant relations between parent's job and/or income with students' dietary indices in final regression model (Table 3). Results of analysis of the relationship between each of the 5 food group diversity and HEI were shown in Table 4. There was a positive association between fruits and vegetables diversity score with HEI, while negative relation were found between breads/grains, meat and diaries diversity scores with HEI.

Discussion

Results of our study demonstrated that the junior and senior high school students had poor compliance with global dietary recommendations and dietary

Table 2: Anthropometry and diet quality indices of junior and senior high school students in Shiraz.

Variables	Min-Max	Mean±SD	Frequency	
			Number	Percent
BMI (Kg/m2):	12.98-47.88	21.2 ± 4.4		
Underweight (<18.5)			212	31.2
Normal weight (18.5-24.9)			354	51.4
Overweight (25-29.9)			88	12.5
Obese (>30)			33	4.9
Waist circumference (cm)	42-159	71.7±10.7		
HEI (Total score=100):	36-82	57.6±6.8		
≤50			77	13
50-80			513	86.8
≥80			1	0.2
DDS quartiles (Total score=10):	1.71-9.43	6.4±1.3		
<5.6			163	24
5.61-6.7			171	25.2
6.71-7.5			185	27.3
>7.51			159	23.5

BMI: Body Mass Index; HEI: Healthy Eating Index; DDS: Dietary Diversity Score

Table 3: Prediction of diet quality indices based on socio-economic factors in junior and senior high school students in Shiraz.

	HEI			DDS		
	β*	SE**	p++	β	SE	p++
Age	-0.060	0.201	0.203	--	--	--
sex	0.168	0.677	0.001	-0.163	0.091	0.001>
Father job	0.017	0.183	0.738	-0.069	0.024	0.148
Mother job	-0.029	0.202	0.566	-0.240	0.027	0.614
Breakfast/week	0.086	0.110	0.062	0.049	0.015	0.256
Family size	--	--	--	-0.011	0.042	0.793

*Regression coefficient; **Standard error; ++Linear regression; DDS: Dietary diversity score; HEI: Healthy eating index

Table 4: Association between food group diversity score and HEI.

Diversity score	HEI	
	Pearson correlation	*p*-value*
Bread/grain	-0.170	<0.001
Fruit	0.117	0.005
Vegetables	0.103	0.013
Meat	-0.086	0.037
Diaries	-0.084	0.040

HEI: Healthy Eating Index; *Correlation

habits of most of them needed moderate to severe improvements. These findings are consistent with the results of 2 other studies among adolescents in other cites of Iran; one of those studies conducted on adolescents in Isfahan (18), and the other in Tehran (19), found mean HEI scores of 63.90 and 64.8, respectively.

International health recommendations are in order to promote people health and many studies have indicated that HEI would be a proper tool for evaluating food habits, also it has negative correlation with (20-22) chronic diseases (7, 8). So these low HEI scores among Iranian adolescents could be an alarm of having a huge burden of health problems in our future adult population. Our results showed a significant higher HEI score and lower diversity score among female participants. Girls especially in their puberty period, are more concerned about their body image and more likely to perceive lower weight as ideal (23, 24), which can affect their food choices.

Despite some studies on different nation population which have claimed that diet quality are often affected by socio-economic factors like age, education and income level (20), we found no association between any of socioeconomic factors and dietary indices. Some researchers (25, 26) have reported that higher education was associated with higher nutritional knowledge also better dietary pattern. Also surveys which was conducted on American population reported that higher education of parents could result in having higher income (25, 27), so the family have wider food choices and can buy healthy foods which usually are more expensive than unhealthy ones (e.g. fruit and vegetables, low fat dairies, whole breads, etc.). But regarding our results, we assume that adolescents' diets are mainly affected by their attitudes toward healthy eating.

While we did not find any association between adolescents' pocket money and diet quality, others concluded that the girls who had more pocket money, bought more salty snaks and fast foods (28). Snaks and fast foods are just one of the HEI scoring components, and are not included in DDS, which could be the reson of our null findings. Different studies indicated that DDS is positively associated with nutrient adequacy and nutritional status, and some studies claimed that also HEI could be a suitable tool for assessing diet variety (4, 10).

Nevertheless in our study, DDS and HEI score was not in line and we did not find any significant correlation between them. As the majority of our participants were in the lowest category of DDS and middle category of HEI, while there was no participant in the highest categories of these two indices, we assume that although diversity is a part of healthy diet, having a diverse diet necessarily does not mean a healthy one, and this diversity may be resulted from eating unhealthy foodstuffs; because the word "variety" might be confusing and many individuals may think by mistake that eating low-nutrient- dense food items can make variety in their diet (29).

Further analysis of our participants' food habits showed an inverse relation between breads and grains diversity score and HEI that might be due to the diverse kind of refined grains products like biscuits, cakes and refined breads which increase grains diversity score, but are not healthy and have negative points in HEI scoring system. Besides our analysis showed a positive relation between fruits and vegetables diversity score and HEI, which could be due to the divers kinds of fruits and vegetables and all are healthy and have positive points in HEI scoring system. Although all the nutrients that human body needs are not found in limited food sources, it is consequential to get them from which sources to have a healthy diverse diet. It is very momentous to keep these diversity while staying within energy needs in order to avoid overweight and obesity (29, 30), so having a divers diet alone is not enough and it must be according to healthy eating guidelines.

Conclusion

All these findings on Iranian populations have a common point that Iranian population, specially adolescents have experienced undesirable changes based on world alteration in lifestyle and dietary patterns. Our study showed that the adolescent population in Shiraz the same as teenagers of other cities of Iran have poor dietary patterns. As

inappropriate diet imposes huge economic costs on the health system of the country by making large range of health problems, it is necessary to improve adolescents' nutritional knowledge and attitudes.

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Conflict of Interest

None declared.

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