

# Food Group Consumption Pattern of School-aged Children and Adolescents Inside and Outside the School Setting: a Cross-sectional Study of a Community in North-eastern Iran

Mohsen Naserirad<sup>a\*</sup>, Hamed Akbari<sup>b</sup>

<sup>a</sup>Department of Sociology, Faculty of Social Sciences, University of Tehran, Tehran, Iran.

<sup>b</sup>Department of Social Development Studies, Faculty of Social Sciences, University of Tehran, Tehran, Iran.

## ABSTRACT

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### Keywords:

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**Background:** The objective of this study is to describe the food group consumption pattern of school-aged children and adolescents inside and outside the school setting.

**Methods:** This was a cross-sectional, descriptive study of 384 primary and secondary school students, and enrolled in 1th to 12th grade in schools of the province of North Khorasan, Iran. Food intake and dietary pattern were assessed using a validated Food Frequency Questionnaire (FFQ) and 24-hour diet recalls (24HRs), through a self-reported three-day dietary record. The 24HRs were collected by trained interviewers between March and May 2019. The frequency of consumption of foods or food groups was summarized by a single value for each school student, according to the recommendations provided by the Department of Community Nutrition in Iranian Ministry of the Health and Medical Education.

**Results:** Most of the primary and secondary school students were eating fewer than the optimum recommended servings of milk and milk products (39.8%), fruits and natural juices (63.8%) and vegetables and tubers (47.1%), the optimum recommended servings of meats and eggs (49.0%), and more than the optimum recommended servings of bread and cereals (47.1%) and legumes and nuts (46.4%). According to the mean of 24-hour recalls, there were significant differences in the consumption of food groups between the tertiles of the dietary pattern ( $p < 0.05$ ).

**Conclusion:** There is evidence that school-aged children and adolescents are in food insecurity. The study reinforces the importance of nutrition education actions and more effective public policies for promoting healthier food choices in childhood and adolescence.

### Introduction

Malnutrition (over- and under-nutrition) and the non-communicable diseases related to it constitute one of the biggest challenges that public health is currently facing [1-3]. Children and adolescents are the group most vulnerable to the effects of malnutrition [4].

In the past decades, transitions in dietary intake among children and adolescents have been observed [5]. These changes in food intake have had a major impact upon the development of children and adolescents malnutrition [6].

Undernutrition is common and prevalent in developing countries [7], where one in five children is thought to suffer from undernutrition [8]. On the other hand, overnutrition is less widespread in developing countries but rates are increasing [9].

According to estimates by the United Nations Children's Fund (UNICEF), the Middle East and North Africa (MENA) region is witnessing a double burden of child malnutrition concomitant with a state of nutrition transition [10]. Most MENA countries are experiencing alarming rates

\*Corresponding author.

E-mail address: naserirad@ut.ac.ir

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of childhood and adolescence malnutrition, both over- and under-nutrition [11]. Contrary to widely held notions that malnutrition is due to poverty, evidence suggests that this may be caused by children and adolescents choosing to eat the incorrect types of food, rather than a lack of what to eat [12]. Undernutrition makes children much more susceptible to disease [13]. On the other hand, childhood overnutrition is associated with an increased risk of adult-onset diseases such as type 2 diabetes, cancers, cardiovascular disease, hypertension and polycystic ovarian syndrome [14-16].

Interest on food consumption in childhood and adolescence is increasing [17], considering that the formation of eating habits occurs in the early years of life [18]. In addition, it is during childhood and adolescence that children acquire eating habits that persist through adulthood [19]. Dietary pattern is related to cognitive, behavioral and developmental outcomes that are important in childhood and adolescence for health and well-being, as well as for school life [20-21]. Schools provide an environment for learning skills, and for development of intelligence that can be utilized by students to attain their goals in life [22]. The foods children and adolescents eat have the potential to impact on school engagement and consequent achievement [23]. Furthermore, academic performance in school is affected by diet and eating pattern [24].

Children and adolescents around the world have adopted different types of dietary patterns for their survival [25]. Mediterranean Diet (MD) model is also decreasing for multifactorial influences, particularly lifestyles changes, food globalization, economic, and sociocultural factors [26]. The national survey suggest an unhealthy dietary pattern and inappropriate eating habits in primary and secondary school students from 23 provinces of Iran [27]. Other nationwide studies show the dietary pattern of primary and secondary school students is not promising in Iran [28-29].

Understanding the influence of location is a big challenge for dietary patterns researchers [30]. Eating habits and dietary pattern of school students are affected by many environmental factors, particularly home and school [31]. School students consume between one-third to one-half of meals at school, making this a critical setting for interventions that alter the food environment [32-33]. However, the study of nutritional status in school students should not be performed without understanding the family

and social context in which the school student is inserted. Parents influence the formation of the school student's eating habits through the food available in the family [34]. Also, beliefs, attitudes and practices of parents determine school students' eating habits [35]. From a sociological perspective, socialization in school-aged children and adolescents occurs at school and family and develops there during a large part of their day. So, any description of their dietary pattern must include the study of the food on offer to school students in the educational and family environments.

Therefore, describing the dietary pattern experienced by school students inside and outside the school setting is essential to guide public policies and educational actions in respect of health and nutrition in the early stages of life. Results from studies of dietary pattern in school students may more easily be translated into diet recommendations and school health interventions. Despite the availability of reports from provinces of Iran pointing to the unhealthy dietary pattern in school students, the dietary pattern and eating habits of school students in North Khorasan have not received sufficient attention. Providing information on nutrition and the eating habits of school-aged children and adolescents in North Khorasan is important in order to change risky and unhealthy behavior in this age group.

Considering the importance of knowing the dietary pattern of different environments, the objective of the present study was to describe the food group consumption pattern of school-aged children and adolescents inside and outside the school setting.

## **Subjects and methods**

### *Study design and participants*

This was a cross-sectional, descriptive study of primary and secondary school students, and enrolled in 1th to 12th grade in schools of the province of North Khorasan, Iran. North Khorasan is a province located in northeastern Iran. The schools were selected from 14 out of 1898 non-governmental and governmental schools by random proportional stratified sampling. The total population of school students was 167,459 and sample size of 384 was determined using a standard formula. Inclusion criteria for participants consisted of regular school attendance at the first time of data collection. Exclusion criteria included genetic syndromes associated with obesity or other diseases, pregnancy, and children with special needs.

*Data collection and instruments*

Food intake and dietary pattern were assessed using a validated Food Frequency Questionnaire (FFQ) and 24-hour diet recalls (24HRs), through a self-reported three-day dietary record. FFQ is a semi-quantitative tool that provides consumption choices for 94 foods. The twenty-four-hour dietary recalls were collected by trained interviewers between March and May 2019. The advantage of twenty-four-hour dietary recalls is that they employ probes to ensure that foods are not forgotten and checks to verify questionable responses. The questionnaire was first reviewed by a panel consisted of three experts on dietary intake assessment methods. The respondents were asked to report the number of times that they consumed food from each of the food groups listed in the FFQ. Interviews were conducted in private or semi-private spaces. To minimize problems due to reading level, the questions were read aloud to the students in the first and second grades by trained interviewers. The frequency of consumption of foods or food groups was summarized by a single value for each school student, according to the recommendations provided by the Department of Community Nutrition in Iranian Ministry of the Health and Medical Education [36]. To assess servings, as the basic unit of consumption, per day of six food groups, according to the food pyramid recommended, the frequency of consumption of each of the 15 bread and cereal items, 12 meat and egg items, 13 legume and nut items, 9 milk and milk product items, 26 fruit and natural juice items and the 19 vegetable and tuber items was summed. All twenty-four-hour dietary recalls were reviewed by staff nutritionists before being analysed. Dietary pattern was shown as a discrete variable, which was obtained by the sum of the frequencies of consumption of foods contained in dietary pattern. The dietary pattern tertiles were the underfed, the optimum and the overfed. A pre-tested, interviewer-administered questionnaire was used to collect data on the socio-demographic characteristics of the respondents.

*Statistical analyses*

Descriptive statistics were used to characterize the sample according to food consumption, and one-way analysis of variance (ANOVA) with linear term and the post-hoc test adjusted for multiple comparisons (Bonferroni test) were used to test for the differences in the mean of the food group consumption between the tertiles of

the dietary pattern. All statistical analyses were performed using Microsoft Office Excel 2016 and IBM SPSS Statistics 24 (IBM Corp., Armonk, New York, USA) for Windows. Confidence Intervals (CI) were set at 95% and  $p < 0.05$  was considered statistically significant.

**Results**

(Table 1) shows the details of the socio-demographic characteristics of the participants. Nearly half of all participants were aged 10–13 years (51%). Most school students were a girl (65%). There was almost disparate participation of school students according to their grades (1-3: 29%; 4-6: 46%; 7-9: 11%; 10-12: 12%). Most fathers of the participants finished the secondary education (47%). Similarly, most mothers of the participants finished the secondary education (45%). A total of 74% school students rated their household economic status as low. Most parents of the participants (father: 54%; mother: 77%) were farmer, worker or self-employed. Participation was fairly equally distributed between urban and rural residents (49%; 49%, respectively). The majority had a Kurdish ethnic background (41%).

(Table 2) presents the frequency of dietary intake for each of the food groups in the dietary pattern tertiles. Most of primary school students were eating fewer than the optimum recommended servings of legumes and nuts (45.3%), fruits and natural juices (70.0%) and vegetables and tubers (51.1%), and had the optimum recommended servings of bread and cereals (49.1%), meats and eggs (54.6%) and milk and milk products (44.7%). Among the school secondary students who completed a 24-hour dietary recall, majority were eating fewer than the optimum recommended servings of milk and milk products (39.6%), fruits and natural juices (44.0%), and more than the optimum recommended servings of bread and cereals (63.7%), meats and eggs (46.2%), legumes and nuts (67.0%), and vegetables and tubers (35.2%). In total, most of primary and secondary school students were eating fewer than the optimum recommended servings of milk and milk products (39.8%), fruits and natural juices (63.8%) and vegetables and tubers (47.1%), the optimum recommended servings of meats and eggs (49.0%), and more than the optimum recommended servings of bread and cereals (47.1%) and legumes and nuts (46.4%).

Table 3 reports the mean consumption of food groups in the dietary pattern tertiles. According

to the mean of 24-hour recalls, there were food groups between the tertiles of the dietary significant differences in the consumption of pattern ( $p < 0.05$ ).

**Table 1. Socio-demographic characteristics of participants (n=384).**

Characteristics	N	%
<b>Age, years</b>		
6-9	103	26.8
10-13	198	51.6
14-17	77	20.1
≥18	6	1.6
<b>Sex</b>		
Boy	134	34.9
Girl	250	65.1
<b>Grade</b>		
1-3	115	29.9
4-6	178	46.4
7-9	43	11.2
10-12	48	12.5
<b>Father's education</b>		
illiterate	28	7.3
Primary	104	27.1
Secondary	183	47.6
Supérieur	69	18.0
<b>Mother's education</b>		
illiterate	35	9.1
Primary	98	25.5
Secondary	175	45.6
Supérieur	76	19.8
<b>Monthly household income</b>		
Low	286	74.5
High	98	25.5
<b>Father's occupation</b>		
Farmer/worker/self-employed	208	54.2
Business/service person	105	27.3
Teacher/governmental/professional	45	11.7
Other	26	6.8
<b>Mother's occupation</b>		
Farmer/worker/self-employed	298	77.1
Business/service person	16	4.2
Teacher/governmental/professional	25	6.5
Other	47	12.2
<b>Residence</b>		
Urban	191	49.7
Rural	190	49.5
Other	3	0.8
<b>Ethnicity</b>		
Persian	105	27.3
Turkic	64	16.7
Turkmen	158	41.1
Kurdish	10	2.6
Tat	45	11.7
Other	2	0.5

**Table 2. Frequency of dietary intake for each of the food groups by the dietary pattern tertiles**

Food groups	Primary School (n=293)			Secondary School (n=91)			Total (n=384)		
	1	2	3	1	2	3	1	2	3
	Under n (%)	Optimum n (%)	Over n (%)	Under n (%)	Optimum n (%)	Over n (%)	Under n (%)	Optimum n (%)	Over n (%)
Bread and cereals	26 (8.9)	144 (49.1)	123 (42.0)	6 (6.6)	27 (29.7)	58 (63.7)	32 (8.3)	171 (44.5)	181 (47.1)
Meats and eggs	84 (28.7)	160 (54.6)	49 (16.7)	21 (23.1)	28 (30.8)	42 (46.2)	105 (27.3)	188 (49.0)	91 (23.7)
Legumes and nuts	133 (45.3)	43 (14.7)	117 (40.0)	26 (28.6)	4 (4.4)	61 (67.0)	159 (41.4)	47 (12.2)	178 (46.4)
Milk and milk products	117 (39.9)	131 (44.7)	45 (15.4)	36 (39.6)	20 (22.0)	35 (38.5)	153 (39.8)	151 (39.3)	80 (20.8)
Fruits and natural juices	205 (70.0)	80 (27.3)	8 (2.7)	40 (44.0)	23 (25.3)	28 (30.8)	245 (63.8)	103 (26.8)	36 (9.4)

Vegetables and tubers	150 (51.1)	110 (37.5)	33 (11.3)	31 (34.1)	28 (30.4)	32 (35.2)	181 (47.1)	138 (35.9)	65 (16.9)
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**Table 3. Mean consumption of food groups by the dietary pattern tertiles**

Food groups	Primary School				Secondary School				Total			
	1	2	3	P value	1	2	3	P value	1	2	3	P value
	Under	Optimum	Over		Under	Optimum	Over		Under	Optimum	Over	
M±SD	M±SD	M±SD	M±SD	M±SD	M±SD	M±SD	M±SD	M±SD	M±SD	M±SD	M±SD	
Bread and cereals	4.2±1.3	8.8±1.3	13.9±2.7	0.010	4.7±0.9	8.7±1.6	17.2±5.1	0.048	4.3±1.3	8.8±1.4	14.9±3.9	0.007
Meats and eggs	0.4±0.3	1.4±0.3	2.6±0.6	0.032	0.4±0.3	1.4±0.3	4.0±2.1	0.021	0.4±0.3	1.4±0.3	3.3±1.6	0.009
Legumes and nuts	0.3±0.2	1.0±0.0	1.9±0.9	0.001	0.2±0.2	1.0±0.0	4.8±4.3	0.001	0.3±0.2	1.0±0.0	2.9±2.9	0.001
Milk and milk products	1.2±0.4	2.3±0.3	3.6±0.5	0.005	1.2±0.4	2.3±0.3	4.5±1.4	0.001	1.2±0.4	2.3±0.3	4.0±1.1	0.005
Fruits and natural juices	0.9±0.5	2.6±0.6	4.9±0.6	0.000	0.5±0.5	2.7±0.6	8.2±5.2	0.000	0.9±2.5	2.8±0.7	7.5±4.8	0.000
Vegetables and tubers	1.7±0.7	3.8±0.5	6.0±0.7	0.000	1.5±0.7	3.9±0.7	8.6±2.4	0.001	1.7±0.7	3.8±0.6	7.3±2.2	0.000

**Discussion**

This study aimed to describe the dietary patterns emerging from food consumption data school-aged children and adolescents in North Khorasan, Iran. To our knowledge, this is the first study to describe dietary patterns in the diets of school-aged children and adolescents inside and outside the school setting in North Khorasan, Iran.

The findings suggest that the consumption of some macronutrients in students did not meet standard recommendations. The meats and eggs group met the standard recommendation of FDA, whereas bread and cereals and legumes and nuts intakes were higher than recommended daily amounts. Also, milk and milk products fruits and natural juices and vegetables and tubers intakes were lower than recommended daily amounts. Both primary and secondary students had low consumption of milk and milk products, fruits and natural juices and vegetables and tubers, though fruits and natural juices and vegetables and tubers consumption was considerably lower in primary students. Fruits and vegetables are considered as sources of vitamins, minerals and antioxidants which are called protective foods. These foods are sources of nutrients whose adequate intake can help promote bone growth and development, as well as prevent a number of non-communicable diseases [37-39].

The United Nations (UN) has recognized the Right to Food in the Declaration of Human Rights in 1948, and has since noted that it is vital

for the enjoyment of all other rights [40]. The 1996 World Summit on Food Security declared that food should not be used as an instrument for political and economic pressure. Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life [41]. However, there is evidence that school-aged children and adolescents in North Khorasan are in a food insecurity.

One of the basic principles of rational nutrition is regular consumption of meals with adequate nutritional value. It is especially important during childhood and adolescence because it allows developing proper eating habits in adulthood. Skills training and self-efficacy are particularly important as students take on greater responsibility for meal preparation and food selection at home, in school, and at stores [42]. Health professionals and stakeholders must work with children and adolescents, parents/guardians, and educators to promote initiatives that increase food group consumption. The school plays a key role in the dietary intake of children, by creating opportunities to them to expand the repertoire of foods consumed and create a reference of healthy eating, as they are exposed to a wide variety of nutrient-rich foods at school meals. In addition, schools support the nutrition education and public policies for ensuring food group consumption [5]. However, interventions targeting the home, school, and neighborhood environments appear to be effective in increasing children's food group consumption [43-44].

Efforts will be more effective when undertaken by a core action group representative of the broader school community [45]. The group should consist of representatives of teachers, parents, pupils, caterers, local retailers as well as health professionals and representatives from the school's governing body. The school environment can be improved by providing healthy meals, breakfast clubs, subscription schemes for fruit, vegetables and milk, healthy options in vending machines and snack bars and water. The establishment of a school health service can also contribute to a healthy environment. To improve children's nutritional behavior patterns and knowledge, the community must also be involved in health promotion. The best way to achieve community participation is to collaborate with different sectors and stakeholders. Parents and caregivers are important stakeholders and need to be involved if school-based initiatives are to be sustainable and have a lasting effect on pupils' health [46]. The necessity of developing nutritional interventions and education strategies aiming the promotion of healthy eating habits in school-aged children and adolescents is indispensable.

The environment has been shown to be a key factor in the development of healthy eating patterns and has proved critical to the development of healthy nutrition habits in childhood and adolescence. Dietary patterns can vary depending on cultural, geographic, and economic circumstances. Thus, although different studies consider a dietary pattern with the same name, it does not mean that the food items of a certain pattern that represents in each context are the same. It is therefore indispensable for each country, authority or school to decide which of the suggestions for school nutrition and food policy are most appropriate and applicable to their circumstances.

One limitation of the current study was that the food categories might not capture all possible foods consumed by school-aged children and adolescents inside and outside the school setting. However, efforts were made to be the most representative of the typical Iranian diet. Another limitation of the current study was that the exact quantity of the foods categories consumed by school-aged children and adolescents could not be ascertained. It was nearly impossible for them to provide this detail for all foods categories eaten. This difficulty is

due to the possibility of foods categories to be masked when cooked in a composite meal.

## Conclusion

There is evidence that school-aged children and adolescents in North Khorasan are not meeting the food consumption recommendations provided by the Department of Community Nutrition in the Iranian Ministry of the Health and Medical Education. Students are so susceptible to be influenced by food consumption pattern inside and outside the school setting. School-Aged children and adolescents have an imbalanced diet, which is considerably low in several essential food groups. The study reinforces the importance of nutrition education actions and more effective public policies for promoting healthier food choices in childhood and adolescence.

## Conflict of interest

None of authors have conflict of interests.

## Funding

None.

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