

Nutritional Assessment for Primary School Children in Tehran: An Evaluation of Dietary Pattern with Emphasis on Snacks and Meals Consumption

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ABSTRACT

Background: In order to provide better advice for prevention of obesity and eating disorders among children, there is a need to have more knowledge of their dietary patterns. This study examined meal and snacking patterns of primary school children in Tehran.

Methods: A total of 761 male and female primary school children from all educational areas in Tehran were recruited in a cross-sectional survey. The data was collected by interviewing the students and their mothers or caregivers. Information on food consumption patterns was collected by one 24-h-recall and one snack-oriented food frequency questionnaire which covered a period of 1 month. Means, standard deviations, frequencies, percentages, energy and nutrient analyzes and nutrient densities were reported.

Results: All of the students snacked at least once on the day of the survey. Snacks provided 38% of total energy intake by the students. Fruits and sweet snacks were consumed by almost all of the students during a week. Energy and most nutrient intakes from meals were greater than those consumed from snacks. Snacks had a higher density of fiber, carbohydrate, calcium, iron, vitamin C, riboflavin and thiamin and had a lower density of protein, fat and niacin, compared with main meals. Salty snacks such as extruded cheese curls (Cheetos) and chips were not consumed so often.

Conclusions: Results provide detailed information about dietary patterns, which in turn enable development of targeted messages and/or interventions to improve nutritional status of school children.

Keywords: Children, nutritional value, primary school, snacking pattern

INTRODUCTION

In order to provide better advice for prevention of eating disorders and designing health programs for children there is a need to have more knowledge of their food intakes and dietary

patterns. It seems that snacking is extremely prevalent among children and snacks play a vital role in fulfilling children's dietary requirements.^[1] Whereas the term "snack" may remind us of foods which are not eaten at regular times and make a minor contribution to the daily intake,^[2] recent studies reveals that snacks play a vital role in provision of energy and nutrients needs.^[1,3] In a recent study, 13% of energy was provided by after school snacks.^[4] A study showed the majority of children snacked at least once daily.^[5] In other studies 25, 22 and 21% of daily energy requirements of children was provided by snacks, respectively.^[6-8] In another word the part snacks play in dietary intake seems to be more important than providing only "empty calories" and therefore needs to be studied precisely. In Iran data on the snacking pattern of school children, as a vulnerable age group, is limited to studies most of which did not measure actual contribution of snacks to the dietary intake of children.^[9-14] The aim of our study was to investigate evaluation of dietary pattern with emphasis on snacks and meals consumption of primary school children in Tehran.

METHODS

In this cross-sectional survey a sample of primary school children was recruited through a two-stage random sampling from December 2003 to October 2004. In the first stage, 46 schools (private and public) were selected randomly as clusters among all primary schools in 19 educational districts in Tehran. In the second stage, among each cluster 23 children from 1st to 5th grades were randomly selected. Due to probable differences in food consumption pattern and reporting in the first grade pupils, their sample size was taken as twice as that of other grades. Initially a letter of invitation was sent to mothers or caregivers. They were invited for an interview at the schools, on the following. Information on food intake and snacking pattern was obtained using a 24-h food recall questionnaire and a semi-quantitative snack-oriented food frequency questionnaire (FFQ). Content of the questionnaire was evaluated by a nutritionist who was expert in designing of FFQ and an epidemiologist with experience in similar issues. The 24-h food recall was designed to collect all eating occasions. The name of each eating occasion

was self-reported and distinguished from other occasions with a unique time and was classified as main meals (breakfast, lunch and dinner) and snacks (morning, afternoon and evening) according to the interviewee's concept. The FFQ included 111-123 food items based on seasonal variations. As the study lasted more than an academic year, it covered 4 seasons of the year. It included food items usually consumed as snacks by Iranian children and provided information on frequency and the amount of foods consumed during the previous month. The interviewers were nutritionist and participated in an intensive training program before the study. The 24-h recalls were completed through interviewing the mothers/caregivers. All the foods and beverages consumed at previous 24 h (no weekends) were reported by mothers and rechecked with the children. For filling the FFQ, children of grades 3rd-5th, were interviewed directly. For younger children (1st and 2nd grade children) the FFQ was completed by interviewing their mothers/caregivers. Interviewers reviewed all the recalls and FFQs for completeness and clarification, then the foods were coded and household measurements were converted to gram weights for all food items by existing source.^[15] The data were cleaned, then master database were produced. The food intakes were subjected to a special MS ACCESS database, which was designed for data entry. The intake of energy and 11 nutrients were calculated based on modified Iranian food composition table.^[16] Adequacy of diet was evaluated by comparison of mean intake of energy and nutrients to Food and Agriculture Organization (FAO)/World Health Organization recommended daily intakes.^[17]

Descriptive data of quantitative variables including means, standard deviations, frequencies, percentages, energy and nutrient analyses and nutrient densities were reported. Differences were considered to be statistically significant if $P < 0.05$. Independent-samples *t*-test was used to compare means of food consumption among boys and girls and two groups of students. Data was analyzed by SPSS version 11.5 (SPSS Inc., Chicago, IL, USA) and MS ACCESS, 2000. The study protocol was approved by the Research Council at the National Nutrition and Food Technology Institute affiliated with Shahid Beheshti University of Medical Sciences and Health Services.

RESULT

At first, 976 primary school children were recruited in the study. Due to some mothers' absence (participation rate 83%) for an interview and after omission of energy intake outliers (energy intake ≤ 800 and/or ≥ 3000 kcal or ratio of energy intake to energy requirement ≥ 1.7), a total of 761 primary school children entered the analysis. Sample size was more or less equally distributed between boys and girls. As it was supposed that first graders were different in quality and quantity of food intake from other graders, reported data are reported based on two groups. Distribution of sex, age and family size of the first and other grades students are displayed in Table 1.

Types and frequency of snacks consumption

All of the children snacked at least once a day and 32% of them had consumed all snack occasions (morning, afternoon and evening) and meals on the day of the survey. The most and the least eating occasions were lunch (377;98%) and after dinner snack (168;44%), respectively.

Breakfast was skipped by 19% of the participants. The mean daily per capita food consumption and number of servings, number and percentage of consumers are shown in Table 2. Fruits, sweet snacks and dairy products were eaten more frequently compared with other food groups of snacks.

Mean daily intake of food groups of snacks is determined for boys and girls, separately. Mean intake of dairy products and fruits among female first-graders were more than male students. Mean intake of dairy products among females students in other grades was significantly higher than male students ($P < 0.05$).

Energy and nutrient intakes from snacks

The average daily nutritional input from the total amount of snacks consumed and comparison between two groups and sexes are presented in Table 3. Data on food and nutrients intake was analyzed by food composition table of Iran, which was modified by USDA and FAO databases.^[18,19]

Table 1: General characteristic of primary school children in Tehran

General characteristic	Mean \pm SD					
	First grade			Other grades 2 nd -5 th		
	Boys (N=183)	Girls (N=195)	Total (N=378)	Boys (N=197)	Girls (N=186)	Total (N=383)
Age (year)	6.4 \pm 0.71	6.4 \pm 0.6	6.4 \pm 0.6	8.9 \pm 1.2	8.9 \pm 1.3	8.9 \pm 1.2
Family size (number)	4.2 \pm 1.3	4.0 \pm 0.8	4.1 \pm 1.1	4.3 \pm 1.1	4.3 \pm 1.3	4.3 \pm 1.2

SD=Standard deviation

Table 2: Means and SD of the consumed snack items (gram and serving) and number (%) of the consumers among primary school children in Tehran

Snack items	First grade*			Other grades		
	Mean \pm SD (g/day)	Servings mean \pm SD	N (%)	Mean \pm SD (g/day)	Servings mean \pm SD	N (%)
Bread and cereals	59 \pm 58	1.9 \pm 1.9	196 (51)	66 \pm 51	2.2 \pm 1.7	193 (50)
Vegetables	143 \pm 100	2.3 \pm 1.6	171 (45)	151 \pm 139	2.5 \pm 2.3	183 (47)
Fruits	388 \pm 284	2.9 \pm 2.1	314 (83)	429 \pm 227	3.3 \pm 2.1	317 (82)
Dairy products	221 \pm 164	0.8 \pm 0.6	269 (71)	207 \pm 164	0.7 \pm 0.6	245 (63)
Nuts and dried fruits	26 \pm 30	0.7 \pm 0.8	96 (25)	37 \pm 41	1.0 \pm 1.1	100 (26)
Sweet snacks	73 \pm 57	2.0 \pm 1.6	316 (83)	66 \pm 44	1.8 \pm 1.2	304 (79)
Ice creams	81 \pm 41	0.9 \pm 0.4	93 (24)	80 \pm 46	0.9 \pm 0.5	97 (25)
Beverages	242 \pm 126	0.9 \pm 0.4	184 (48)	228 \pm 109	0.8 \pm 0.4	181 (47)
Salty snacks	34 \pm 23	1.3 \pm 0.9	74 (19)	35 \pm 25	1.4 \pm 1.0	67 (17)

*There was no significant differences between two groups. SD=Standard deviation

Table 3: Comparison of energy and nutrients intake between two groups of male and female primary school children

Nutrients	First grade (mean±SD)		Other grades (mean±SD)		Total (mean±SD)	
	Boy N=184	Girl N=195	Boy N=196	Girl N=186	Boy N=380	Girl N=381
Energy (kcal)	1824±524*	1995±563	1958±489 ^Δ	2075±585	1893±510**	2034±574
Protein (g)	60±22*	68±24	65±21	71±24	63±22**	70±24
Calcium (mg)	882±436*	1011±436	959±462	989±437	922±451**	1000±443
Iron (mg)	11±5*	12±5	13±5	13±5	12±5	12±5
Vitamin A (IU)	1119±1158	1102±1318	1253±1341	1104±1135	1188±1256	1103±1231
Vitamin C (mg)	145±108*	171±108	179±131	169±121	162±121	170±130
Vitamin B2 (mg)	1.5±0.6*	1.8±0.7	1.6±0.7	1.7±0.7	1.6±0.7**	1.7±0.7
Thiamin (mg)	1.2±0.5*	1.3±0.5	1.3±0.5	1.4±0.6	1.3±0.5**	1.4±0.5
Niacin (mg)	14.8±7*	17±7	16±7 ^Δ	18±7	16±7**	17±7

*There was significant differences between boys and girls in the first grade, $P<0.05$. ^ΔThere was significant differences between boys and girls in the other grades, $P<0.05$. **There was significant differences between boys and girls in the total students, $P<0.05$. SD=Standard deviation

Means and SD of Nutrient density (per 1000 KCAL) of snacks and meals in primary school children is presented in Table 4. Snacks had a higher density (per 1000 Kcal) of calcium, vitamin A in first-graders. Meals had a higher density (per 1000 Kcal) of fat, carbohydrate and vitamin A in other grades of students.

Contribution of snacks and meals to daily dietary intake is presented in Figure 1.

DISCUSSION

In our study snacks provided as much as 38% of total energy intake of the children. In other words, in the present study overall contribution of snacks to total energy intake of the children was even higher than that of main meals such as lunch. Other data on the part of snacks in fulfilling the daily energy intake of children indicate percentages such as 1%, 16%, 20%, 23% and 25%.^[20-23] A study in Canada snacks provided 597 out of 2624 kcal of total energy.^[24] In another study in Scotland only among high snackers, snacks had provided about 35% of daily energy intake.^[2] Based on our findings the role of snacks in supplying daily energy is much (almost twice) higher than other studies. Hereby, the importance of snacks as food items which provide about 40% of energy intake in primary school children is confirmed. However, it should be taken into consideration that in our study dietary habits of the children on holidays was not surveyed which may have been different from ordinary days. One possible difference can be due to the presence of family members on holidays for eating

Table 4: Means and SD of nutrient density (per 1000 kcal) of snacks and meals in primary school children

Density of nutrients per 1000 kcal	Mean±SD			
	First grade		Other grades	
	Meals	Snacks	Meals	Snacks
Protein (g)	38±20	25±15	37±19	24±13
Fat (g)	35±16	30±24	37±18	29±23
Carbohydrate (g)	135±48	185±67	140±42	189±65
Fiber (g)	4±4	8±12	4±6	8±10
Calcium (mg)	463±464	691±562	458±432	661±593
Iron (mg)	5±4	6±6	6±4	6±5
Vitamin A (IU)	601±1651	799±3148	632±1521	609±1694
Vitamin C (mg)	43±89	186±310	46±78	203±343
Vitamin B2 (mg)	0.9±0.8	1±0.7	0.8±0.6	0.9±0.2
Thiamin (mg)	0.6±0.3	0.8±0.5	0.6±0.3	0.8±0.5
Niacin (mg)	9±7	6±4	9±6	6±4

SD=Standard deviation

occasions. On holidays, most children are at home and may eat with their families. They specially gather together for main meals, consequently meals skipping and occasions of snacking can be decreased. There is no report on the part of snacks in fulfilling the daily energy intake of Iranian primary school children. Therefore, any judgment about the trend of snacks' role in covering the daily energy intake among Iranian school children is impossible. The most common snacks consumed by children in the study were fruits and sweet snacks which consisted of chocolate, cookies, cakes, biscuits and traditional sweets.

On the day of survey, consumption of fruits and sweet snacks by the children were 83% and

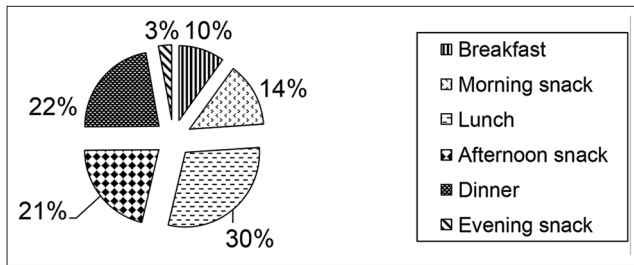


Figure 1: Percentage contribution of snacks and meals to overall energy intake in primary school children

80%, respectively. Almost all of children had fruits and sweet snacks during the week and their mean intake was also higher than that of other food groups. Mean daily intake of fruits was more than 400 g which fulfill daily recommendation.^[25]

Nutritional quality of the students can be evaluated in perspective of dietary guidelines for this age group. Compared with “My Plate”^[26] all fruit servings, half of vegetable servings and almost one-third of grains and dairy servings was provided by snacks [Table 2].

Among food categories fruits and sweet snacks ranked the highest food consumed daily in both groups of students. Our data are in agreement with “sweet tooth hypothesis” which states that many people have a strong liking for sweet tastes and a consequence of this may be that people who frequently eat sweet snacks may also frequently eat fruits.^[27]

Although in some Iranian and other studies^[9-14,28,29] intake of salty, fatty or sweet snacks such as carbonated beverages, salty extruded cheese curls (Cheetos) and chips were reported to be high, in our study these food items were not consumed often. Mean daily intake of chips, salty extruded cheese curls (Cheetos) and carbonated beverages was 40 g (less than half medium package), 34 g (about one small package) and 242 g (one cup) only among 7%, 7% and 2% of the children, respectively; compared with weekly intakes which were 114, 58 and 280 g among 91%, 71% and 33.5% of the children, respectively. As mentioned before,^[30] extruded cheese curls (Cheetos) are a kind of salty, energy dense and crunchy snack made from corn flour which in other studies were reported to be commonly taken by children. In recent years, there has been a fight between marketers and health workers because of high advertised brands of this product. In a recent study it was the most frequent TV food advertisement and the children remembered it more than other advertisements.^[31] This contradiction can be explained by this fact that nowadays, there are

strong regulations on school shops that do not permit sales of some items such as extruded cheese curls and carbonated drinks so that they are not available for the children. Data are consistent with the idea that availability may be a stronger determinant of the type of snack consumed than preferences.^[32]

Similarly, the most consumed sandwiches were homemade ones including cheese, croquette, butter and jam with different kinds of breads.

Mean contribution of snacks to intake of the children shows the importance of snacks in fulfillment of energy and nutrients in this age group. Whereas in other studies snacks did not have a significant role in energy and nutrients supply.^[2]

Quality of diets is mainly reported as nutrient density. Compared with main meals each 1000 kcal of snacks provided fibers and vitamin C more than 2-4 times. In a study nutrient density of main meals for all of nutrients was higher except for carbohydrate, sugar, starch and fat which were higher in snacks.^[2] In another study snacks provided a large part of the total fruit portions with orange juice (one of the contributors) having high content of vitamin C.^[3]

In a study snacks provided more energy, carbohydrate, total fat, saturated fat, dietary fiber and sodium than what did breakfast.^[24]

CONCLUSIONS

Snacks constitute a large portion of children’s total energy intake. Snacking enhances the intake of calcium, iron, vitamins A, C, riboflavin, thiamin and fiber and increases the likelihood of meeting fruit recommendations. Understanding how dietary patterns are associated with food and nutrient intake provides valuable information for designing effective nutrition education strategies to improve children’s diets. Future studies on the relationship between dietary patterns and health outcomes of the children are recommended.

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