

Dietary habits of Palestinian adolescents and associated sociodemographic characteristics in Ramallah, Nablus and Hebron governorates

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Submitted 5 June 2009; Accepted 24 February 2010; First published online 4 May 2010

Abstract

Objective: To describe food habits and associated sociodemographic factors.

Design: Cross-sectional survey in 2005.

Setting: Ninety-six school classes in Ramallah, Nablus and Hebron governorates, Occupied Palestinian Territory.

Subjects: Grade 8 and 9 students aged 13–15 years (*n* 2952).

Methods: Self-administered student and parent questionnaires.

Results: High standard of living (STL) index and residence in Ramallah were positively associated with intake of animal foods, Western-style foods, dairy products, fruits and vegetables, sweets and salty snacks. Only 26.1% of the students ate three main meals daily; 26.2% of the boys and 51.0% of the girls had breakfast one to two times per week or less often ($P < 0.001$). Only one-quarter of students drank milk daily (32.9% of boys and 18.3% of girls, $P < 0.001$). The majority of students, boys and girls in similar proportions, consumed vegetables daily (72.8% *v.* 73.8%, respectively). Daily fruit consumption was also equally common among boys and girls (58.9% *v.* 55.2%, respectively), but with clear differences by STL, region and parents' education. Daily intake of sweets and salty snacks was common among girls, and daily intake of soft drinks was common among boys.

Conclusions: Irregular meal patterns were common among Palestinian adolescents. High STL and residence in Ramallah were associated with frequent intake of foods high in sugar and fat, but also with frequent intake of fruits and vegetables. Effective interventions are needed to establish healthy dietary habits.

Keywords
Dietary habits
Palestinian adolescents
Nutrition
Sociodemographic factors

Adolescents' eating habits affect their risk of developing health and cognitive problems, including obesity, type 2 diabetes, poor bone mineralisation and poor academic performance⁽¹⁾. Evidence suggests that adolescents' dietary behaviours track into adulthood⁽²⁾. Currently, the main features of adolescents' food habits include breakfast skipping, snacking and low consumption of fruits and vegetables⁽³⁾. Breakfast skipping has been linked to inadequate diet, increased risk of obesity, lack of attention and impaired memory in schoolchildren^(4,5). In the international report of the Health Behaviour in School-aged Children (HBSC) survey in 2005–2006, the proportion of young people eating breakfast daily varied between countries within a range of 40–50%⁽³⁾. In the same survey, approximately 30–41% and 30–34% of adolescents in different countries reported daily consumption of fruits and vegetables, respectively⁽³⁾. Diets rich in fruits have been shown to be protective against a

number of childhood illnesses^(6,7) and some adult cancers⁽⁸⁾. Eating habits vary by socio-economic status, education, gender and age^(9,10).

Palestinian society is undergoing nutrition transition⁽¹¹⁾. A high prevalence of nutrition-related chronic diseases such as diabetes and obesity has been found in studies of Palestinian adults⁽¹²⁾. Food consumption patterns among Palestinians have changed to a more Westernised diet with increased intake of refined modern foods, such as white commercial bread, soft drinks and sweets, and decreased intake of traditional foods, such as legumes and bread made from brown flour⁽¹³⁾. On the other hand, severe restrictions on movement of people and goods affect households' economies and their access to and ability to purchase food, leading to food insecurity⁽¹⁴⁾. Approximately 34% of the West Bank (WB) population was found to be food insecure in 2006⁽¹⁴⁾.

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Palestinian adolescents (10–19 years) comprise 24% of the population⁽¹⁵⁾. Their dietary habits are important, yet understudied. To our knowledge, adolescent dietary habits in the WB have only been studied as part of the 2004 HBSC survey conducted in the WB and Gaza Strip. The survey identified such problems as breakfast skipping, especially among girls, and low-frequency intake of milk, fruits and vegetables⁽¹⁶⁾. The objectives of the present study were to describe food habits among Palestinian adolescents in three main governorates (administrative divisions of the Occupied Palestinian Territory) in the WB (Ramallah, Nablus and Hebron) and to investigate the relationship between food habits and sociodemographic factors (region, gender, urban/rural residence, standard of living (STL) index and parents' education).

Subjects and methods

Study design and population

A cross-sectional survey was conducted in urban and rural schools in Ramallah, Hebron and Nablus governorates between March and May 2005. Ramallah is located in the middle of the WB, with 279 730 inhabitants in 2007⁽¹⁵⁾. Hebron is situated in the southern part and Nablus in the northern part, with 552 164 and 320 830 inhabitants, respectively, in 2007⁽¹⁵⁾. In a comparison of demographic and lifestyle characteristics such as age of women at marriage, types of employment and availability of modern household amenities, Ramallah and Hebron cities represent two distinctive modes of urban life, with Ramallah being more modernised and having a higher standard of living. With respect to these indicators, Nablus is in an intermediate position⁽¹⁷⁾.

Sample selection

The sample was selected to be representative of students attending 8th and 9th grade classes in the three governorates. A list including the number of students per classroom in 2004–2005 was provided by the Palestinian Ministry of Education and Higher Education. The total number of 8th and 9th grade students was 13 011 in Ramallah, 15 315 in Nablus and 26 681 in Hebron. The classes were divided into nine strata by gender (boys', girls' and coeducational schools) and school type (public, United Nation Relief and Works Agency (UNRWA) and private). The sample was selected using single-stage probability proportional-to-size sampling from each of the nine strata within each governorate, with the class as the primary sampling unit. A sample size of 1000 students in each governorate was set for a maximum margin of error of 2.9% in the prevalence estimates of overweight/obesity as reported previously⁽¹⁸⁾. Ninety-six classes were selected: thirty-four in Ramallah, thirty-one in Hebron and thirty-one in Nablus. All students in the selected classes were invited to participate in the study.

Data collection procedures

Self-administered questionnaires were used to collect information from students and parents. The researcher and trained fieldworkers gave students standardised instructions on filling in their questionnaires, which were completed in the classroom in 1.5–2 h. Fieldworkers were present during administration of the questionnaires to clarify questions when needed. The students' questionnaire contained questions about age, residence, household amenities and meal and food frequency lists. The parents' questionnaires included household information such as family size and parents' education. It was taken home by students and returned to school the following day. Both students' and parents' questionnaires were piloted in Ramallah with forty girls and twenty-two boys and their parents in two classes (8th and 9th grades) and corrections were made accordingly. The students' questionnaire was also tested for reliability (1 week test-retest) for a different sample of 115 students (sixty-three girls and fifty-two boys) in two 8th grade and two 9th grade classes in four schools (two urban and two rural) in Ramallah governorate.

Ethical consideration

Informed consent was obtained from parents, students and school principals. Respondents were informed that answering the anonymous questionnaire was voluntary and that information would be treated confidentially. Moreover, the class teacher was not present during administration of the questionnaires. The study was a collaboration between the Institute of General Practice and Community Medicine at the University of Oslo and the Institute of Community and Public Health at Birzeit University. The protocol was approved by both institutes and by the Palestinian Ministry of Education and Higher Education, the UNRWA Office of Education and the Regional Ethical Committee of Norway.

Measures

Food and meal frequency lists

The students' questionnaire contained a frequency list of forty-two food items without portion sizes. Thirty-two items in this list were based on 24 h dietary recalls carried out for twelve adolescents (nine girls and three boys) in the same age range before the study. More items were added based on a previous study of Palestinian adults⁽¹³⁾ and thorough local knowledge of Palestinian food habits. The food and beverage question was 'How often do you drink/eat the following items?' The response categories were converted to frequencies in times/week (in parentheses) and these were more than four times per day (35), three to four times per day (24.5), one to two times per day (10.5), four to six times per week (5), two to three times per week (2.5), once a week (1), one to three times per month (0.5) and seldom/never (0).

The meal/snack pattern question was 'How often do you eat the following meal/snack?' The response categories were daily, three to four times per week, one to two times per week and seldom/never.

The following food scores were constructed from the food frequency list:

- Animal food score: including meat from beef or lamb, chicken, liver, kidney, *shawarma* (dish made from beef or lamb or chicken), sausage, hamburger, fish, canned fish, cold cuts and eggs.
- Dairy products score: including milk, flavoured milk, yoghurt, *labaneh* (partially dehydrated yoghurt), white cheese and yellow cheese.
- Fruit and vegetables score: including fresh fruits, fresh fruit juice, cucumber, tomatoes, other fresh vegetables, cooked vegetables and green leafy vegetables (spinach and others).
- Western food score: including pasta, pizza, hamburger, cornflakes, fried potatoes, hot dogs, and soft drinks (regular and diet).
- Sweets and salty snacks score: including sweets and chocolates, salty snacks, fruit nectar and soft drinks (regular and diet).

The five scores were constructed by the sum of recorded responses to weekly frequency intakes of food items divided by the number of items in each score. The 1-week test-retest reliability of the scores had a Spearman correlation from $r = 0.53$ to 0.73 .

Sociodemographic factors

The *household STL* was based on household possessions. Ownership of central heating, family car, family mobile phone, personal mobile phone, indoor bathroom, water pipes, refrigerator, full automatic washing machine, colour television, satellite, video, computer, dish washer, microwave oven, vacuum cleaner and Internet connection were summed; each item was given a value of 1. Three categories were constructed: 'low', ≤ 6 ; 'medium', $7-10$; and 'high', $11-16$. The 1-week test-retest of ownership of these amenities showed consistent answers ranging between 86.1% and 99.1% . The Spearman correlation coefficient between STL and parents' education was 0.38 ($P < 0.001$).

Parents' education was based on mother's and father's education; three categories were constructed: 'low' if both parents had less than secondary education; 'medium' if both parents had completed secondary education or if one had completed secondary education or had college or university degree and the other had less than secondary education; and 'high' if both parents had college or university degree or if one had college or university degree and the other had completed secondary education.

Urban/rural classification was based on Palestinian Central Bureau of Statistics (PCBS) classification, which is based on services and population size⁽¹⁹⁾.

Family was defined as family members living together in the same household.

Statistical analysis

Statistical analysis was performed using the Stata 10 statistical software package (Stata Corporation, College Station, TX, USA) and adjusted for design effect; the sample was weighted according to sample and population size in each governorate (inverse of sampling probability) and the analysis was adjusted for possible dependencies due to cluster design. Statistical significance was set at $P < 0.05$. The χ^2 test was used to compare frequencies, and the *t* test or ANOVA was used to compare means. Multivariate linear regression analysis was performed to model the association between food scores and sociodemographic characteristics. The following tests were conducted in regression analysis: (i) linearity effects of the covariates, (ii) normality of residuals, (iii) homoscedasticity of variance and (iv) points of high influence. Plausible interactions among the independent variables in the regression models were investigated.

Results

Response rates and sample characteristics

Two schools in Ramallah refused to participate and were replaced by schools from the same stratum of the sampling frame. Of the 3271 students in the invited sample, 3071 (93.9%) consented to participate. Only students aged 13–15 years were included in the present analyses, thus excluding 119 students outside these age groups⁽¹⁸⁾. The final sample consisted of 2952 students (96.1% of those participating). In total, 2846 (96.4%) parents completed their questionnaires. Of the 106 non-responding parents, no difference was found in STL, urban/rural residence or age categories of students compared to responding parents. However, of the non-responding parents, 17.9% were from Ramallah, 56.6% were from Hebron and 25.5% were from Nablus ($P < 0.05$) and 72.6% had male children ($P < 0.05$).

Table 1 shows that approximately equal proportions of students were from Ramallah, Hebron and Nablus governorates, with slightly more girls in all the three governorates. The students generally came from large families, with the largest mean family size in Hebron (8.9 *v.* 8.1 in Ramallah and 7.5 in Nablus). Hebron also had the highest proportion of families with more than eight members (49.8%, 37.7% and 25.4% for Hebron, Ramallah and Nablus, respectively). Ramallah governorate had the highest mean STL index (9.2 *v.* 9.0 in Nablus and 8.0 in Hebron) and the highest proportion of families in the high-STL category (32.7% *v.* 29.5% in Nablus and 18.0% in Hebron).

Meal pattern

Only 26.1% of the students reported having three main daily meals (breakfast, lunch and dinner). This proportion

Table 1 Sociodemographic characteristics of the study population (*n* 2952)

	Ramallah governorate (<i>n</i> 940)		Nablus governorate (<i>n</i> 1003)		Hebron governorate (<i>n</i> 1009)		<i>P</i> value†
	% or mean	<i>n</i> or <i>SD</i>	% or mean	<i>n</i> or <i>SD</i>	% or mean	<i>n</i> or <i>SD</i>	
Gender							
Boys	46.6	438	46.7	468	45.4	458	0.990
Girls	53.4	502	53.3	535	54.6	551	
Age groups (years)							
13–13.9	41.3	388	33.8	339	32.9	332	0.540
14–14.9	44.4	417	48.8	489	48.1	485	
15–15.9	14.3	135	17.4	175	19.0	192	
Residence							
Urban	41.0	375	59.3	585	67.9	665	0.094
Rural	59.0	540	40.7	402	32.1	315	
Parents' education‡							
Low	54.4	495	46.9	453	60.3	567	0.036
Medium	30.0	273	34.1	329	27.6	260	
High	15.6	142	19.0	183	12.1	114	
Family size, mean and <i>SD</i>	8.1	2.4	7.5	2.0	8.9	2.5	<0.001
1–6 persons	27.8	242	29.9	291	12.6	119	<0.001
7–8 persons	34.5	301	44.7	435	37.6	356	
>8 persons	37.7	329	25.4	247	49.8	472	
Household STL index§, mean and <i>SD</i>	9.2	2.9	9.0	2.8	8.0	2.8	0.004
Low (0–6)	18.2	156	19.3	191	29.5	292	0.003
Medium (7–10)	49.1	422	51.2	508	52.5	520	
High (11–16)	32.7	281	29.5	293	18.0	179	

STL, standard of living index.

†*P* value for the comparison between governorates using χ^2 test for categorical variables and ANOVA for means.

‡Parents' education based on mother's and father's education; three categories were constructed: 'low' if both parents had less than secondary education, 'medium' if both parents had completed secondary education or if one had completed secondary education or had college or university degree and the other had less than secondary education, 'high' if both parents had college or university degree or if one had college or university degree and the other had completed secondary education.

§Household STL based on the possession of sixteen household amenities; each item given a value of 1.

was significantly higher among boys than girls (34.5% *v.* 18.9%) and was positively associated with STL (22.1%, 25.3% and 31.0% for low, medium and high STL, respectively, $P \leq 0.011$; data not shown). The percentage of students who had daily lunch and dinner plus morning school snack was 38.6. This proportion was positively associated with STL and parents' education and was significantly higher among boys and among those from Nablus (data not shown).

Tables (2a and 2b), show that more boys than girls had breakfast and dinner daily. Almost half of the girls reported having breakfast one to two times or less per week, while this was the case with only 26.2% of the boys. Breakfast skipping was lowest among girls with high parents' education (38.5%) and among boys from Hebron (18.8%). Students who skipped breakfast were more likely to skip lunch ($P < 0.05$) and dinner ($P < 0.001$; data not shown).

Lunch was the most frequently eaten meal, with 80.7% of boys and 83.7% of girls reporting having daily lunch. Daily lunch was positively associated with STL, parents' education and residence in Nablus. Approximately 70% of the students had a morning school snack; this was positively associated with STL and parents' education and negatively associated with residence in Hebron. Rural/urban residence was not associated with any differences in meal pattern (data not shown).

Food frequency intake

Only one-quarter of the students reported drinking milk daily, with a significant difference between boys and girls (32.9% *v.* 18.3%, $P < 0.001$; Tables 2a and 2b). The percentage of students who seldom or never drank milk was 34.2 (22.9% and 43.8% for boys and girls, respectively, $P < 0.001$). Approximately 47% of the girls with low STL and 46% of the girls with low parents' education seldom or never drank milk. More students from Ramallah drank milk daily than students from Nablus or Hebron (29.9% *v.* 25.4% and 22.4%, $P < 0.05$; data not shown). Daily intake of other dairy products was more common among students having high STL and high parents' education.

The proportion of adolescents consuming any kind of vegetables at least once a day was high and almost equal for boys and girls (72.8% for boys and 73.8% for girls); this concerned mainly intake of fresh cucumber and tomatoes. Boys from Hebron had the lowest proportion of daily consumption of vegetables (68.4%). Approximately one-third of the students with low STL consumed vegetables less than once a day. Daily fruit consumption was less common than daily consumption of vegetables, and was similar for boys and girls (58.9% for boys and 55.2% for girls). Fruit intake was positively associated with residence in Ramallah, high parents' education and high STL. Only 39.0% of boys and 37.7% of girls from low-STL families ate fruits daily, compared to 73.0% of

Table 2a Meal pattern and food frequency intake (%) of boys by sociodemographic characteristics (n 1364)

	Total§ (n 1364)	Governorate			STL†			Parents' education‡		
		Ramallah (n 438)	Nablus (n 468)	Hebron (n 458)	Low (n 245)	Medium (n 656)	High (n 412)	Low (n 688)	Medium (n 373)	High (n 213)
Meal pattern										
Breakfast daily	56.9***	54.1	49.5	62.7**	56.8	54.7	61.6	59.6	53.2	55.7
Lunch daily	80.7	83.5	85.0	76.8*	70.8	82.3	85.5***	78.8	80.6	89.4*
Dinner daily	65.6***	65.0	62.8	67.6	63.1	67.3	64.2	67.7	67.4	60.4
Breakfast ≤ 1–2 times/week	26.2***	29.6	35.8	18.8***	24.8	26.4	25.3	24.5	27.5	28.8
School snack daily	71.7	81.9	77.5	63.2***	52.9	70.7	85.5***	68.1	73.4	82.2**
Food intake on daily basis										
Yoghurt	31.8	37.6	32.3	28.8	28.3	31.6	34.2	29.9	32.1	34.9
White cheese	25.5	28.1	39.7	15.9***	12.1	22.1	40.1***	20.5	27.0	36.5***
Yellow cheese	12.9	18.6	14.0	9.6*	3.9	11.2	21.1***	9.0	13.8	20.9***
Labanehi	36.4	33.2	45.1	33.0	24.1	34.1	49.3***	30.6	40.4	49.8***
Milk	32.9***	39.5	33.8	29.0*	26.1	30.7	40.6**	29.9	32.8	41.1**
Flavoured milk	23.3***	30.4	22.2	20.5*	15.4	20.5	33.0***	22.3	23.6	23.5
Eggs	43.7***	38.8	47.9	43.7	38.2	46.4	43.3	43.6	45.5	43.0
Cold cuts	40.2***	56.7	47.6	27.8***	29.1	36.5	53.7***	36.5	44.2	47.7*
Meat	11.4	17.2	10.9	9.0**	6.8	10.2	15.9**	9.4	14.9	12.1*
Chicken	11.9	19.3	7.9	10.7**	7.5	11.4	15.0	11.0	14.0	11.7
Fruits	58.9	72.9	64.7	48.6***	39.0	57.9	73.0***	54.3	62.1	71.3***
Any kind of vegetables	72.8	81.4	73.1	68.4***	64.2	73.2	77.8**	73.8	71.8	74.6
Tomatoes	56.3	64.5	54.3	53.4**	52.1	56.6	58.7	57.2	56.1	56.7
Cucumber	61.6	70.6	60.7	57.6***	53.7	61.2	67.2**	63.2	60.5	61.9
Other fresh vegetables	35.9	48.7	35.0	29.8***	24.2	35.4	43.8***	35.3	35.9	37.9
Cooked vegetables	8.1*	10.4	6.0	8.1	6.8	8.3	8.9	9.0	7.1	6.2
Falafel¶	19.3*	16.1	20.5	20.1	13.8	20.4	21.1	18.2	22.3	16.8
Chick peas	13.1	16.7	15.8	9.6**	9.8	12.9	15.4	12.8	13.8	9.3
Salty snacks	50.3**	61.1	55.8	41.7***	32.2	52.3	58.6***	46.5	48.7	65.6**
Sweets	42.3	55.2	45.5	34.1***	26.9	41.9	54.1***	39.3	44.9	50.9*
Tea	81.2	73.4	78.4	86.7**	81.7	84.4	75.3*	82.3	80.1	76.1
Regular soft drinks	39.6***	54.8	41.9	30.6***	28.1	37.7	50.0***	36.1	43.3	46.0
Diet soft drinks	16.6	22.9	16.3	13.8**	14.2	15.4	20.7	16.1	18.9	14.3
Fresh juice	32.8	39.5	37.4	26.6**	20.2	30.4	44.9***	29.0	36.9	36.7**
Fruit nectar	27.2	41.2	24.2	22.1***	21.0	25.2	33.9*	25.9	31.8	23.9
Fried potatoes	20.5	25.2	19.1	19.1	22.1	23.1	15.0*	23.3	18.5	13.4**
Corn flakes	4.9	9.2	6.4	1.8**	1.2	2.3	11.1***	3.3	4.2	11.5***

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

†Household standard of living index (STL) based on the possession of sixteen household amenities; each item given a value of 1.

‡Parents' education based on mother's and father's education; three categories were constructed: 'low' if both parents had less than secondary education, 'medium' if both parents had completed secondary education or if one had completed secondary education or had college or university degree and the other had less than secondary education, 'high' if both parents had college or university degree or if one had college or university degree and the other had completed secondary education.

§ P value is for the difference between genders.

||Partially homogenised milk.

¶Fried broad beans.

boys and 68.9% of girls from high-STL families. Daily vegetable and fruit intakes did not differ between urban and rural residents (data not shown).

The intakes of soft drinks, salty snacks, sweets and cornflakes were positively associated with residence in Ramallah and high STL. The percentage of boys who reported eating salty snacks daily was 50.3 compared to 61.5% of the girls ($P < 0.01$), while for regular soft drinks the corresponding figures were 39.6% for boys and 28.4% for girls ($P < 0.001$). Daily intake of fried potatoes was negatively associated with STL and parents' education. Frequency of eating fish was quite low; 36.1% of the adolescents reported consuming fish one to three times per month and 24.8% reported that they never consumed fish (data not shown).

Food scores

Grouping the different food items in five scores (Table 3) revealed significant differences between genders. Boys, in comparison with the girls, had a significantly higher animal food score, dairy products score and Western food score, but this was not the case for the fruit and vegetable score. The mean fruit and vegetable score was 6.5 times per week for boys and 6.1 times per week for girls ($P = 0.088$). Significant differences were also found among regions and STL categories in all five scores. Residents of Ramallah and those with high STL had higher scores. High parents' education was positively associated with dairy products score. Students from large families (more than eight persons) had lower food scores.

Table 2b Meal pattern and food frequency intake (%) of girls by sociodemographic characteristics (*n* 1588)

	Total§ (<i>n</i> 1588)	Governorate			STL†			Parents' education‡		
		Ramallah (<i>n</i> 503)	Nablus (<i>n</i> 535)	Hebron (<i>n</i> 551)	Low (<i>n</i> 394)	Medium (<i>n</i> 794)	High (<i>n</i> 341)	Low (<i>n</i> 827)	Medium (<i>n</i> 489)	High (<i>n</i> 226)
Meal pattern										
Breakfast daily	34.7***	37.3	30.1	35.9	34.5	34.0	36.2	31.2	37.8	44.4**
Lunch daily	83.7	85.2	89.7	79.6**	76.9	83.7	92.9***	80.1	87.3	93.3***
Dinner daily	49.6***	47.1	55.5	47.4	44.8	50.4	52.6	48.1	51.5	52.8
Breakfast ≤ 1–2 times/week	51.0***	48.1	56.3	49.4	53.3	51.4	47.2	54.3	49.1	38.5**
School snack daily	72.6	81.0	81.1	63.7***	56.0	74.1	91.0***	67.1	78.2	84.0***
Food intake on daily basis										
Yoghurt	28.3	30.4	28.6	27.2	22.6	30.5	29.9*	26.5	30.1	32.0
White cheese	27.9	27.8	51.4	14.7***	22.8	26.2	39.9***	25.4	30.6	35.0*
Yellow cheese	10.8	17.2	12.0	7.1***	6.2	9.0	20.4***	7.5	14.1	16.7***
Labaneh	36.2	39.6	44.3	30.1**	24.7	37.3	49.1***	30.7	39.9	51.9***
Milk	18.3***	21.5	18.0	16.9	15.3	17.2	24.6**	17.0	19.3	23.2
Flavoured milk	16.0***	22.7	17.2	12.2***	7.8	15.2	27.8***	13.2	19.8	19.4**
Eggs	30.2***	25.7	31.2	31.8	32.6	31.6	23.2	31.9	31.6	23.4
Cold cuts	28.0***	35.9	36.1	19.8***	21.3	27.8	35.8***	24.7	32.2	35.2**
Meat	10.7	13.5	11.4	8.9	7.9	10.5	13.1	9.8	11.5	12.0
Chicken	12.2	17.7	11.2	10.2*	10.5	12.9	11.7	12.7	12.1	13.4
Fruits	55.2	66.5	60.6	46.8***	37.7	58.4	68.9***	49.8	58.7	69.7***
Any kind of vegetables	73.8	80.8	76.6	68.9**	64.8	76.9	75.9**	73.8	74.0	76.6
Tomatoes	56.6	64.9	59.6	50.9**	46.4	58.2	60.3***	55.1	59.0	61.0
Cucumber	59.9	64.9	64.9	54.7*	51.5	62.0	64.8**	59.2	60.2	65.9
Other fresh vegetables	35.3	47.2	35.1	29.9***	26.9	35.3	44.7***	33.8	35.9	43.0
Cooked vegetables	11.3*	13.4	10.8	10.5	12.8	10.2	10.8	10.1	13.8	9.1
Falafeh¶	13.8*	15.4	16.1	11.8	13.6	14.2	13.3	14.9	15.9	7.0***
Chickpeas	11.1	12.1	14.2	8.9	10.1	11.4	10.3	10.4	14.0	8.0*
Salty snacks	61.5**	72.3	71.2	50.8***	47.5	63.8	73.3***	56.2	70.8	65.3***
Sweets	49.2	58.2	56.1	41.2***	38.2	49.3	63.7***	44.9	55.7	55.5**
Tea	68.2	60.4	68.0	71.9*	72.9	69.7	58.2**	70.1	70.3	56.3
Regular soft drinks	28.4***	36.7	25.8	26.0*	19.1	29.1	38.1***	26.2	33.1	27.2
Diet soft drinks	14.3	19.6	10.7	13.8**	11.1	14.3	18.4	14.1	14.9	13.7
Fresh juice	28.4	32.9	33.8	23.1*	19.4	29.6	37.9***	26.5	31.0	31.1
Fruit nectar	24.5	29.8	24.7	21.8	14.9	25.8	32.7***	23.0	25.9	26.0
Fried potatoes	23.8	7.3	23.2	22.6	28.7	24.1	15.9**	26.0	24.2	14.3**
Corn flakes	3.8	9.0	3.2	1.6***	1.2	1.6	12.3***	1.4	4.7	10.6***

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

†Household standard of living index (STL) based on the possession of sixteen household amenities; each item given a value of 1.

‡Parents' education based on mother's and father's education; three categories were constructed: 'low' if both parents had less than secondary education, 'medium' if both parents had completed secondary education or if one had completed secondary education or had college or university degree and the other had less than secondary education, 'high' if both parents had college or university degree or if one had college or university degree and the other had completed secondary education.

§ P value is for the difference between genders.

||Partially homogenised milk.

¶Fried broad beans.

Determinants of food intake

Table 4a shows the results of multivariate linear regression models of animal food score, dairy products score, Western food score and sweets and salty snacks score by different sociodemographic characteristics. Region and STL were significant independent determinants in all these scores. Gender (boys) was positively associated with animal food score and dairy products score. Parents' education was negatively associated with Western food score and sweets and salty snacks score. In the fruit and vegetable score model, we found significant interaction between STL index and high parents' education, and thus this model is presented in a separate table (Table 4b). High education of parents was positively associated with fruit and vegetable score in the lowest STL spectrum, but this was not the case in the highest STL level. Region

was a significant independent determinant in this score as well.

The data met the assumptions for linear regression models except for some detected heteroscedasticity. To resolve this, the results were compared with robust clustering models and no significant changes were detected (except in the Western food score model where gender (girls) was significant ($P \leq 0.01$) in the model with robust clustering).

Discussion

The findings show that only one-quarter of the students had three main meals daily and that breakfast skipping was common among girls. Frequency intake of animal

Table 3 Food scores (mean times per week and SE) in a sample of Palestinian adolescents in Ramallah, Hebron and Nablus governorates (*n* 2952)

	Animal food score†			Dairy products score‡			Fruits and vegetables score§			Western food score			Sweets and salty snacks score¶		
	Mean	SE	<i>P</i> ††	Mean	SE	<i>P</i> ††	Mean	SE	<i>P</i> ††	Mean	SE	<i>P</i> ††	Mean	SE	<i>P</i> ††
Gender															
Boys	2.2	0.1	<0.001	5.1	0.3	0.003	6.5	0.2	0.088	2.4	0.1	0.024	7.2	0.4	0.835
Girls	1.8	0.1		4.0	0.2		6.1	0.2		2.0	0.1		7.1	0.3	
Region															
Ramallah	2.3	0.1		5.4	0.2		7.4	0.2		3.1	0.1		9.4	0.3	
Nablus	2.0	0.1	0.001	5.3	0.2	<0.001	6.5	0.1	<0.001	2.1	0.1	<0.001	7.3	0.3	<0.001
Hebron	1.8	0.1		3.7	0.2		5.6	0.2		1.8	0.1		5.9	0.3	
Parents' education†††															
Low	1.9	0.1		4.0	0.2		6.2	0.2		2.1	0.1		6.8	0.3	
Medium	2.1	0.1	0.091	4.8	0.2	<0.001	6.5	0.2	0.232	2.3	0.1	0.152	7.7	0.3	0.006
High	2.1	0.1		5.6	0.3		6.3	0.2		2.3	0.1		7.2	0.4	
Family size															
1–6 persons	2.0	0.1		5.1	0.2		6.5	0.2		2.4	0.1		7.7	0.4	
7–8 persons	2.1	0.1	0.024	4.8	0.2	<0.001	6.4	0.2	0.169	2.2	0.1	0.013	7.3	0.3	0.012
>8 persons	1.9	0.1		3.8	0.2		6.0	0.2		2.0	0.1		6.5	0.3	
Household STL§§															
Low	1.7	0.1		3.3	0.2		5.2	0.3		1.7	0.1		5.3	0.4	
Medium	2.0	0.1	<0.001	4.3	0.2	<0.001	6.3	0.1	<0.001	2.1	0.1	<0.001	7.0	0.2	<0.001
High	2.2	0.1		5.9	0.2		7.0	0.2		2.8	0.1		9.0	0.3	

STL, standard of living.

†Animal food score includes meat from beef or lamb, chicken, liver and kidney, *shawerma*, sausage, hamburger, fish, canned fish, cold cuts and eggs.

‡Dairy products score includes milk, flavoured milk, yoghurt, *labaneh*, white cheese and yellow cheese.

§Fruit and vegetables score includes fresh fruits, fresh fruit juice, cucumber, tomato, other fresh vegetables, cooked vegetables and green leafy vegetables (spinach and others).

||Western food score includes pasta, pizza, hamburger, cornflakes, fried potatoes, hot dogs and soft drinks.

¶Sweets and salty snacks score includes sweets and chocolates, salty snacks, fruit nectar and soft drinks.

††*P* value for comparison of mean food scores between groups using *t* test or ANOVA.

†††Parents' education based on mother's and father's education; three categories were constructed: 'low' if both parents had less than secondary education, 'medium' if both parents had completed secondary education or if one had completed secondary education or had college or university degree and the other had less than secondary education, 'high' if both parents had college or university degree or if one had college or university degree and the other had completed secondary education.

§§Household index STL based on the possession of sixteen household amenities; each item given a value of 1.

Table 4a Multivariate linear regression models of the relationship between sociodemographic characteristics and food scores in a sample of Palestinian adolescents in Ramallah, Nablus and Hebron governorates (*n* 2952)[†]

	Animal food score‡			Dairy products score§			Western food score			Sweets and salty snacks score¶		
	β coefficient	SE	<i>P</i>	β coefficient	SE	<i>P</i>	β coefficient	SE	<i>P</i>	β coefficient	SE	<i>P</i>
Region												
Ramallah	0.00			0.00			0.00			0.00		
Nablus	-0.22	0.10	0.024	-0.05	0.27	0.842	-0.87	0.13	<0.001	-1.94	0.36	<0.001
Hebron	-0.37	0.12	0.002	-1.26	0.26	<0.001	-1.00	0.16	<0.001	-2.75	0.44	<0.001
Gender												
Boys	0.00			0.00			0.00			0.00		
Girls	-0.41	0.10	<0.001	-0.64	0.25	0.011	-0.24	0.14	0.086	0.37	0.38	0.337
Parents' education††												
Low	0.00			0.00			0.00			0.00		
Medium	0.09	0.07	0.233	0.44	0.20	0.027	0.00	0.09	0.999	0.29	0.29	0.316
High	-0.05	0.09	0.550	0.53	0.29	0.067	-0.34	0.13	0.012	-1.38	0.41	0.001
Household STL‡‡	0.05	0.02	0.001	0.25	0.04	<0.001	0.14	0.02	<0.001	0.52	0.06	<0.001
Family size	0.00	0.01	0.956	-0.02	0.04	0.635	-0.01	0.02	0.402	-0.05	0.05	0.326
Constant§§	2.43	0.10	<0.001	5.21	0.24	<0.001	3.08	0.14	<0.001	8.87	0.39	<0.001

STL, standard of living.

†The regression models are age adjusted.

‡Animal food score includes meat from beef or lamb, chicken, liver and kidney, *shawerma*, sausage, hamburger, fish, canned fish, cold cuts and eggs.§Dairy products score includes milk, flavoured milk, yoghurt, *labaneh*, white cheese and yellow cheese.

||Western food score includes pasta, pizza, hamburger, cornflakes, fried potatoes, hot dogs and soft drinks.

¶Sweets and salty snacks score includes sweets and chocolates, salty snacks, fruit nectar and soft drinks.

††Parents' education based on mother's and father's education; three categories were constructed: 'low' if both parents had less than secondary education, 'medium' if both parents had completed secondary education or if one had completed secondary education or had college or university degree and the other had less than secondary education, 'high' if both parents had college or university degree or if one had college or university degree and the other had completed secondary education.

‡‡Household STL index based on the possession of sixteen household amenities; each item given a value of 1.

§§Constant term: interpreted at family size = 8.32 (weighted mean family size), household STL = 8.56 (weighted mean STL) and age = 14.31 (weighted mean age).

Table 4b Multivariate linear regression models of the relationship between sociodemographic characteristics and fruits and vegetable score in a sample of Palestinian adolescents in Ramallah, Nablus and Hebron governorates (*n* 2952)[†]

	Fruits and vegetables score‡		
	β coefficient	SE	<i>P</i>
Region			
Ramallah	0.00		
Nablus	-0.81	0.27	0.003
Hebron	-1.53	0.30	<0.001
Gender			
Boys	0.00		
Girls	-0.18	0.23	0.428
Parents' education§			
Low/medium education of parents at STL index = 1.56	0.00		
High education of parents at STL index = 1.56	1.42	0.70	0.045
Low/medium, education of parents at STL index = 15.56	0.00		
High education of parents at STL index = 15.56	-1.88	0.47	<0.001
Household STL			
1 U increase of STL in low/medium education of parents	0.26	0.05	<0.001
1 U increase of STL in high education of parents	0.02	0.06	0.681
Family size	-0.03	0.04	0.486
Constant¶	7.50	0.27	<0.001

STL, standard of living.

†The regression models are age adjusted.

‡Fruits and vegetables score includes fresh fruits, fresh fruit juice, cucumber, tomato, other fresh vegetables, cooked vegetables, and green leafy vegetables (spinach and others).

§Parents' education based on mother's and father's education; three categories were constructed: 'low' if both parents had less than secondary education, 'medium' if both parents had completed secondary education or if one had completed secondary education or had college or university degree and the other had less than secondary education, 'high' if both parents had college or university degree or if one had college or university degree and the other had completed secondary education.

||Household STL index based on the possession of sixteen household amenities; each item given a value of 1.

¶Constant term: interpreted at family size = 8.32 (weighted mean family size), household STL = 8.56 (weighted mean STL) and age = 14.31 (weighted mean age).

foods, dairy products, fruits and vegetables, Western food, sweets and salty snacks was highest in Ramallah and was positively associated with STL. Few adolescents drank milk daily, and girls did so less than boys. Similar proportions of boys and girls reported daily intake of fruits and vegetables.

The STL index used to measure family affluence in the present study is amenities based, and is similar to what has been used in other surveys on adolescents^(20–22). It has been proven to be useful in this age group as many adolescents are unable to provide information on their parents' occupation and income⁽²³⁾. The amenities

included are culture specific for Palestinians and have been used (except for microwave oven) by PCBS for assessment of material STL⁽²⁴⁾. The weak correlation with parents' education indicates that these variables measure different aspects of family socio-economic status.

Irregular meal patterns have been associated with poor nutrient intake⁽⁵⁾. Skipping breakfast is a worldwide problem among adolescents and is usually higher among girls^(25,26). This was also common in the present study, especially among girls, as approximately half of the girls reported having breakfast one to two times or less per week. Omitting breakfast among adolescents has been related to lower consumption of the other main meals^(5,27), which was also the case in the present study.

Lunch was the main meal consumed among the adolescents. This is in accordance with the general food habits among Palestinians. The lunch meal often includes chicken or red meat, rice or potatoes and vegetables. Bread is usually consumed with every meal⁽¹³⁾.

Significant differences in food habits were found between boys and girls. More boys consumed animal foods, milk and soft drinks daily, while more girls consumed salty snacks and sweets. This is similar to findings from the Palestinian HBSC survey in 2004⁽¹⁶⁾. However, the proportion of adolescents reporting daily consumption of fruits and vegetables was higher than what was reported in the Palestinian HBSC survey⁽¹⁶⁾ and in the HBSC survey of 2005–2006⁽³⁾. This could be due to the fact that HBSC survey used one general question about the intake of vegetables, while in the present study several questions about different types of vegetables were included. Among these were questions about tomatoes and cucumber, which are frequently consumed by Palestinians as part of a salad or with bread at breakfast and dinner. Another difference found was that equal proportions of boys and girls reported consuming fruits and vegetables daily, while other studies have shown that in general girls are more likely than boys to eat fruits^(3,28) and vegetables daily^(3,9,28).

The mean frequency consumption of fruits and vegetables in the present study was 6.5 and 6.1 times per week for boys and girls, respectively. This means that the majority of the adolescents did not achieve the dietary recommendation of the WHO of five servings of fruits and vegetables per day⁽²⁹⁾. This could imply an insufficient intake of essential micronutrients and fibre that would protect against chronic disease later in life⁽²⁹⁾. Despite the deteriorating financial situation of Palestinian families⁽³⁰⁾, some vegetables and fruits are available in the local market at low prices. Thus, launching a campaign to encourage the community to consume more fruits and vegetable could be effective.

Milk and dairy products were not consumed on a daily basis by most of the adolescents. Children and adolescents are recommended to consume calcium-rich foods to develop adequate bone mass⁽³¹⁾. Adolescents with low

STL and those from large families had lower animal food scores. Zinc and iron, which are available in animal foods, are both essential for growth, neural development and immune system function^(32,33). Fish frequency consumption was very low among adolescents, and this was comparable to findings from another study among Palestinian adults⁽¹³⁾. Fish is an important source of high-quality protein, minerals and *n-3* fatty acids essential for growth and development and for protection against chronic diseases⁽²⁹⁾. Low consumption of milk, animal food and fish should be seen in relation to micronutrient deficiencies. Iron deficiency anaemia, iodine deficiency and vitamin A and D deficiencies have been reported as public health problems among Palestinians⁽¹⁴⁾. Insufficient intake of food rich in protein and micronutrients has also been associated with unfavourable school performance⁽³⁴⁾.

Regional differences in food consumption patterns were found: residents of Ramallah consumed animal foods, dairy products, fruits and vegetables, Western foods, sweets and salty snacks more often. These differences remained significant in the regression model after adjusting for other variables including STL. The persistence of these differences may be due to a more Westernised lifestyle in Ramallah compared to the other governorates⁽¹⁷⁾. Moreover, food security analysis in 2006 showed that 32.1% of the population in Ramallah was either food insecure or marginally food insecure *v.* 48.6% in Nablus and 46.7% in Hebron, probably due to the closure regimes⁽¹⁴⁾. Regional differences in overweight/obesity and stunting among the same adolescents have also been reported previously. The overweight/obesity prevalence was higher among adolescents from Ramallah, while the prevalence of stunting was higher among adolescents from Hebron⁽¹²⁾. The association between food patterns and nutritional status of adolescents in these regions needs to be investigated further.

High parents' education is associated with healthy eating⁽³⁵⁾. Similar findings were obtained in the present study, as parents' education was negatively associated with Western food score, sweet and salty snacks score. Similarly, parents' education has been found to be positively associated with fruit and vegetable intake^(36,37). In the present study, high education of parents in the low-STL category was associated with high fruit and vegetable score.

Several studies have shown that family socio-economic status influence the food habits of adolescents^(3,38,39). The multivariate analysis of food scores revealed that household STL was a significant independent determinant of all the scores; adolescents with high STL reported higher frequency consumption of animal foods, Western food and salty snacks and sweets, thus indicating less healthy food choices. Such findings have been obtained in countries in nutrition transition, such as China⁽³⁸⁾. In contrast, low family affluence in Western and Northern Europe has been found to be positively associated with soft drinks consumption⁽³⁾. A study on food consumption

patterns among Palestinian adults showed that the consumption of animal food products was highest among the wealthiest households⁽¹³⁾. It is thus reasonable to assume that Palestine is in a stage of nutrition transition similar to low-income economies where the intake of a diet high in fat and sugar is more common among the more affluent sections of the society⁽⁴⁰⁾.

Limitations and strengths

The study has certain limitations, such as its cross-sectional design, which limits the ability to establish causality. Another limitation is using self-reported responses, which might affect validity and reliability. The food frequency list was not validated, but the food items were based on 24 h dietary recalls with adolescents in the same age group and study area and thorough knowledge of food habits in the WB. The association between food frequencies and STL index yielded expected results. The 1-week test–retest reliability of the different food scores and the household amenities in the STL index was good. Strengths of the study included its relatively large sample size, the single-stage cluster sampling design, the urban/rural distribution and the high response rates.

Conclusion

Irregular meal patterns were common among adolescents, especially girls. Residence in Ramallah and high STL index were positively associated with intake of high-sugar and high-fat foods. Consumption of foods rich in micronutrients such as fruits, vegetables and dairy products was low among adolescents, especially those with low STL. Research using improved methods for assessing food intake is needed to support these conclusions. Effective and context-appropriate nutrition interventions are needed that promote healthy eating habits in schools and communities. Such interventions should take into consideration socio-economic and other constraints that make access to such foods very difficult.

Acknowledgements

The present study is a collaboration between Birzeit University and the University of Oslo supported by a grant from the Norwegian Programme for Development, Research and Education (NUFU) PRO X1 50/2002. The authors declare no conflict of interest. N.M., H.F.A. and G.H.O. contributed to the conception, design, analysis and interpretation of data, and drafting of the manuscript, and approved the final version for publication. N.M. contributed to data collection. Z.S. contributed to analysis and interpretation of the data, commented on the manuscript and approved the final version for publication. The authors thank the participating schools, the

Palestinian Ministry of Education and Higher Education and the UNRWA Office of Education for facilitating fieldwork. They are grateful to Alpha International for Research, Polling and Informatics for conducting fieldwork and for statistical support.

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