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Socioeconomic differences in selected dietary habits among Norwegian 13–14 year-olds: a cross-sectional study

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Abstract

Background: Social inequalities in health are a major and even growing problem in all European countries.
Objective: The aim of the present study was to describe 1) differences in dietary habits among Norwegian adolescents by gender and socioeconomic status; 2) differences in self-reported knowledge of dietary guidelines among their parents according to socioeconomic status.
Design: In 2012, a cross-sectional study where students filled in a web-based food frequency questionnaire at school was conducted in nine lower secondary schools in Vest-Agder County, Norway. Socioeconomic status (SES) and knowledge of dietary guidelines were obtained from the parents using a web-based questionnaire. In total, 517 ninth-grade students (mean age 13.9) out of 742 invited students participated in the study, giving a participation rate of 69.7%. The total number of dyads with information on both parents and students was 308 (41.5%).
Results: The findings indicate that there is a tendency for girls to have a healthier diet than boys, with greater intake of fruits and vegetables (girls intake in median 3.5 units per day and boys 2.9 units per day), and lower intake of soft drinks (girls 0.25 l in median versus boys 0.5 l per week). Students from families with higher SES reported a significant higher intake of vegetables and fish, and lower intake of soft drinks and fast food than those from lower SES. Parents with higher SES reported a significantly better knowledge of dietary guidelines compared to those with lower SES.
Conclusions: Differences in dietary habits were found between groups of students by gender and SES. Differences were also found in parents' self-reported knowledge of dietary guidelines. This social patterning should be recognized in public health interventions.

Keywords: *dietary habits*; *socioeconomic status*; *nutrition knowledge*; *adolescents*; *soft drinks*; *fruits and vegetables*

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Social inequalities in health are a major and ever-growing problem in all European countries (1). Despite the fact that Norway is a welfare state and the health of the Norwegians is generally good (2), there are large social inequalities in health (3). Results from an international study (4) have shown that Norway has greater social inequalities in health than many other Western countries at least in relative terms. Socioeconomic inequalities in health may involve several factors (1), some of these differences may be attributed to differences in health behavior and diet (5, 6). Diet is an extensively investigated risk factor for major health problems, that is, as cardiovascular diseases, type 2 diabetes, obesity, development of metabolic syndrome, and some forms of cancers (7, 8). The World Health Organization (9) states that 7 of the 10 main causes of health problems and lifestyle diseases today may be related to diet. Adolescence is a period of marked social and biological changes as part of the transition from childhood to adulthood characterized by an increase in consumption of unhealthy foods and marked declines in physical activity (10–12). Adolescence has been regarded as one of the most important periods for establishing food preferences and it is likely that healthy eating habits in adolescence will be maintained into adulthood (13, 14). Although adolescence has been considered as a period of social cohesion (15), recent studies have shown a correlation between socioeconomic status and health during adolescence (12, 16, 17) and later in adulthood (10, 18, 19). Socioeconomic status and diet among adolescents has received more attention in

recent years in Norway. However, studies among adolescents that focus on socioeconomic differences in food habits are limited.

In general, diet among adults with higher socioeconomic status is associated with higher consumption of healthy foods than those with lower SES (20). Some of these differences in diet may be attributed to differences in knowledge of diet (21). According to a study by Wardle et al. (21) greater knowledge of diet is associated with a higher intake of healthy foods, especially for fruit and vegetables. A main goal for the health authorities is to change the diet in line with recommended dietary guidelines (22). One of the strategies to improve diet is to reach out to the entire population with clear, easily understood information on diet and nutrition. This information shall be tailored to different target groups with respect to use of inducements and channels and thus will help to reduce social inequalities in health (22).

The aim of this present study is to describe differences in dietary habits among Norwegian adolescents by gender and socioeconomic status, and describe differences in knowledge of dietary guidelines among their parents according to socioeconomic status.

Methods

Study design, procedure, and sample

A cross-sectional study of ninth grade students (aged 13–14) from lower secondary schools in Vest-Agder County, Norway, was performed from September to November 2012. All secondary schools (grades 8–10) in five communities were invited to participate in the study. Of the 15 invited schools, nine (60%) agreed to participate in the study. All schools found the project interesting, and the main reason for non-participation was lack of time. In total, 742 children were invited to participate in the study. Information about the study was given through several information channels; oral information was given to the students on an information day at school, two information letters were given to the students, one for themselves and one that for their parents. The schools also informed the parents through students' weekly plans and via SMS. Parents gave written consent on the projects website. In total, 531 students were given permission to participate, which represented 71.6% of the invited ninth-grade students. Of these, 517 completed the food frequency questionnaire, giving a participation rate of 69.7%. Non-responses among students were due to absence on the day the survey was administered. All classes who participated in the study received a gift of 1,000 NOK. An ID number, given to both parents and students, was used to link the questionnaires. The number of parents who responded to the questionnaire was 335, a response rate of 45.1%. The total number of dyads with registered information on both parents and students was 308, giving a response rate of 41.5% of the invited participants and 59.6% of the students who filled out the questionnaire. These 308 dyads, including 131 boys, 177 girls and their parents, represent the total sample in this study. This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by The Norwegian Social Science Data Services. Written consent was obtained from the parents of all participating adolescents and the adolescents themselves.

Study population

The students' main characteristics are shown in Table 1. The students' mean age was 13.9 years and 11.6% of the students were classified as overweight according to Cole et al.'s classification (24). A sociodemographic description of the parents is shown in Table 2. Of the participating parents in the study 12.3% were single parents, 23.1% had a lower family income than 600,000 NOK of those 86.8% single parents, and 76.9% had a higher family income than 600,000 NOK. Lower education ($\leq$12 years of education) was reported by 41.6% of the mothers and 48.7% of the fathers, and higher education was reported by 58.4% of the mothers and 51.3% of the fathers. More girls than boys (63.4% vs. 51.5%, $p = 0.037$) had mothers with high education. There were no such differences for fathers' education. Ethnic origin was not used in the analysis as the vast majority of respondents were of Norwegian origin (92.8%).

Measures

Both questionnaires, for parents and students, were pretested for clarity and length among a small sample of parents and students in the same age group and in the same part of Norway prior to the main study. These were not participants in the main study.

Table 1. Characteristics of the students' age, height and weight status

	Boys ($n = 131$)		Girls ($n = 177$)		Total ($n = 308$)	
	Mean	SD*	Mean	SD*	Mean	SD*
Age (years)	13.9	0.27	13.9	0.33	13.9	0.30
Height and weight status[a]						
Height (cm)	171.4	7.99	164.7	6.82	167.5	8.03
Weight (kg)	58.0	11.19	53.9	8.76	55.7	10.05
BMI (kg/m^2)	19.65	2.83	19.85	2.75	19.77	2.78
	n (%)		*n* (%)		*n* (%)	
Overweight *n* (%)[b]	16 (12.5)		19 (11)		35 (11.6)	

*Standard deviation.

[a]Self-reported data.

[b]Weight status classified using sex-and-age-specified cutoff points at age 13 and 14 years using Coles' standard definition (23).

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Table 2. Sociodemographic description of the parents

	n (%)
Parents in household	308
1	38 (12.3)
≥2	270 (87.7)
Family income[a]	307
< 600,000 NOK	71 (23.1)
> 600,000 NOK	236 (76.9)
Parental education[b]	
Mother	305
Lower	127 (41.6)
Higher	178 (58.4)
Father	298
Lower	145 (48.7)
Higher	153 (51.3)

[a]Family income before taxes.
[b]Lower education ≤12 years of education at the elementary, high school, or vocational school.
Higher education: having attended college or university.

FFQ – food frequency questionnaire

The food and drink intake of the students was reported by the student themselves using a validated web-based retrospective food frequency questionnaire (25, 26). The questionnaire was completed at school, in the presence of two project workers. It took about 45 min to complete the questionnaire. Respondents indicated how frequently they had consumed 112 food items and 20 types of drinks during the last 4 weeks. The FFQ measured one item for each question. The present analyses are based on a subset of 30 items from the FFQ, which were categorized into six food groups: fruit (f), vegetables (v), total fruits and vegetables, sugar-sweetened soft drinks, fish and fast food. These were selected based on current dietary recommendations and due to their importance to health. Examined fruit variables contained apples, pears, banana, orange/tangerine/grapefruit, nectarine/peach/plum, dried fruit, melon, kiwi, pineapple, fresh/frozen berries, grapes, and raisins. Vegetables overall contained broccoli, cauliflower, onion/garlic/leek, avocado, corn, mushrooms, peas, mixed lettuce, peppers, carrots, and cucumbers. Fish for dinner contained the variables fatty fish, lean fish, and other fish products such as fish balls, fishcakes, fish sticks, and puddings. Fast food contained the variables sausages/frankfurters, hamburgers, pizza and French fries. The response categories for fruit and vegetables were 'never', '1–3 times a month', 'once a week', '2–3 times a week', '4–6 times a week', and '1 or more times a day'. Before merging into new variables all fruit and vegetables items were re-coded to reflect consumption in times per week (0, 0.5, 1, 2.5, 5, 10). After merging the variables, it was divided by seven to reflect consumption of times per day. The seven response categories for consuming a bottle (0.5 l; standard portion) of sugar-sweetened soft drinks were 'never', '1–3 bottles a month', '1 bottle a week', '2–6 bottles a week', '1 bottle a day' and '2–3 bottles a day', 'more than 3 bottles a day'. The response categories were re-coded to reflect consumption in times per week (0, 0.5, 1, 4, 7, 17.5, 25). To reflect consumption in liters per week the variable was divided by two. Fish and fast food variables were given the alternative frequencies 'never', '1–3 times a month', 'once a week', '2–4 times a week', 'more than three times a week'. To reflect consumption per week, these variables were re-coded into 0, 0.5, 1, 3, 5. Furthermore, the questionnaire also included questions about background information such as gender, age, ethnicity, residential area, height, and weight. To classify the students' weight status, Coles' standard definition of sex- and age-specific cutoff points similar to the widely used 25 kg/m^2 for overweight in adults (24), for children aged 13 and 14, were used. These cutoffs are 21.91 and 22.58 kg/m^2 for 13-year-old boys and girls, respectively, and 22.62 and 23.34 kg/m^2 for 14-year-old boys and girls, respectively.

Socioeconomic status

To assess socioeconomic information, the parents filled in a web-based questionnaire at the website of the project. SES was determined using family income and parental education. Income is measured as the total income of the family before taxes, not adjusted for number of adults or children living in the household. Income was given five response categories: <NOK 300,000; NOK 300–600,000; NOK 600,000–800,000; NOK 800,000–1,000,000; >NOK 1,000,000. Family income was dichotomized using NOK 600,000 as a cutoff for lower respective higher income. Parental education, both mother and father, is measured as respondents' total years of education and was grouped as a four-category classification: 'primary school' (9 years or less); 'upper secondary education or vocational school' (3 years of secondary education); 'university or university college' (4 years or less); and 'university or university college' (more than 4 years). In analysis, the four parental levels of education were dichotomized into 'equal or less' than 12 years of education' and 'completed college or university education'.

Knowledge of dietary guidelines

Parents reported their knowledge of dietary guidelines by the question 'Do you know the dietary guidelines from the Norwegian Directorate of Health?' This question had three response categories: 'yes, to a large extent', 'yes, little/some extent' and 'no'. In analysis, these categories were presented as two categories where 'good' includes 'yes, to a large extent', and 'less or no' knowledge includes the two last categories.

Data analysis and statistics

All statistical analyses were performed with SPSS statistical software package version 19.0 (IBM Corporation, Armonk, NY, USA). The description of participants and their diet are presented as median with interquartile range or percentages using descriptive statistics. Given the skewed nature of the data, analyses of between group differences in dietary habits were conducted using non-parametric statistics, Mann Whitney U-tests. Pearson's Chi-square tests, χ^2, were used when analyzing the differences between categorical variables, knowledge of dietary guidelines and SES. A p-value of ≤ 0.05 was considered to be statistically significant. All respondents were included in the analysis. Only a few missing were registered in the questionnaires, and these were treated as missing in the analysis using exclude cases listwise.

Results

Differences by gender in intake of fruit, vegetables, total fruits and vegetables, sugar-sweetened soft drinks, fish, and fast food are shown in Table 3. In general, girls reported a higher consumption of healthy foods and a lower consumption of unhealthy foods than boys. Significant differences occurred between genders with a higher intake of vegetables among girls and higher intake of soft drinks, fish and fast food among boys. The gender differences were particularly evident regarding drinking soft drinks and intake of vegetables and fast food. Girls reported an intake of 1.79 vegetables versus boys 1.29 vegetables per day, 0.25 l versus 0.5 l soft drinks per week and girls consumed fast food 1.5 times versus boys two times per week.

Students from families with lower income and lower levels of education reported an overall higher consumption of sugar-sweetened soft drinks and fast food, and less consumption of fish and vegetables than those from higher SES (Table 3). Differences in diet by maternal education were especially pronounced in intake of soft drinks and fish. Students with least educated mothers reported an intake of 0.5 l soft drinks per week, fish once a week. Students with higher maternal education reported 0.25 l of soft drinks per week and fish 1.5 times per week. Significant differences in diet were even more pronounced and measured by paternal education, as seen in Table 3. Significant differences in intake of vegetables, fish and fast food also occurred between those with lower and higher income, even though not as distinct. Differences also occurred in fruit intake between groups, although not significant differences.

Table 4 presents the differences in parents' knowledge of dietary guidelines according to SES. In total, 40.9% of the parents reported good knowledge of dietary guidelines. Significant differences in parents' knowledge of dietary guidelines were shown between groups by income ($p = 0.001$), and maternal ($p = 0.001$) respective paternal education ($p = 0.018$). Parents with higher income and higher education reported significantly greater knowledge of dietary guidelines than those with lower income and

Table 3. Differences in students' dietary intake by gender, parental income, and education presented in median (inter quartile range)

		Fruit Units per day		Vegetables Units per day		Total fruit & vegetables Units per day		Sugar-sweetened soft drinks Liters per week		Fish Times per week		Fast food Times per week	
	N	Median (IQR)	*p**	Median (IQR)	*p**	Median (IQR)	*p**	Median (IQR)	*p**	Median (IQR)	*p**	Median (IQR)	*p**
Gender	306												
Girl	175	1.50 (1.64)		1.79 (1.93)		3.50 (3.21)		0.25 (0.25)		1.50 (1.00)		1.50 (1.00)	
Boy	131	1.39 (1.50)	0.181	1.29 (1.93)	0.004	2.89 (3.00)	0.014	0.50 (1.75)	0.000	1.50 (2.00)	0.010	2.00 (1.00)	0.000
Family income[a]	305												
<600,000 NOK	69	1.25 (1.38)		1.21 (1.66)		2.46 (2.43)		0.50 (1.75)		1.00 (1.00)		2.00 (1.00)	
>600,000 NOK	236	1.50 (1.68)	0.072	1.71 (1.86)	0.042	3.50 (3.21)	0.037	0.50 (1.75)	0.717	1.50 (1.50)	0.022	1.50 (1.50)	0.029
Mothers' education[b]	303												
Lower	125	1.43 (1.61)		1.29 (2.04)		2.86 (3.68)		0.50 (1.75)		1.00 (1.50)		2.00 (1.00)	
Higher	178	1.50 (1.68)	0.746	1.71 (1.75)	0.023	3.46 (2.91)	0.128	0.25 (0.25)	0.002	1.50 (1.50)	0.002	1.50 (1.00)	0.040
Fathers' education[b]	296												
Lower	145	1.36 (1.66)		1.29 (1.64)		2.86 (3.13)		0.50 (1.75)		1.25 (1.50)		2.00 (1.00)	
Higher	153	1.50 (1.57)	0.261	1.79 (1.86)	0.004	3.43 (3.07)	0.037	0.25 (0.25)	0.000	1.50 (1.50)	0.005	1.50 (1.00)	0.001

*Analyzed using non-parametric independent samples tests. *P*-value = 0.05 was used.

[a]Family income before taxes.

[b]Lower education: ≤12 years of education at the elementary, high school, or vocational school. Higher education: having attended college or university education.

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Table 4. Differences in parents' knowledge of dietary guidelines according to family income and parental education[a]

	No or less knowledge, *n* (%)	Good knowledge, *n* (%)	*p**
In total	181 (59.0)	126 (41.0)	
Family income[b]			
<600,000 NOK	55 (30.4)	16 (12.7)	0.000
>600,000 NOK	126 (69.6)	110 (87.3)	
Mothers' education[c]			
Lower	88 (49.2)	39 (31)	0.001
Higher	91 (50.8)	87 (69)	
Fathers' education[c]			
Lower	95 (54.6)	50 (40.7)	0.018
Higher	79 (45.4)	73 (59.3)	

*Analyzed using Pearson's Chi-square test (χ^2). *P*-value = 0.05 was used.

[a]Based on the question 'Do you know the nutritional recommendations from the Health Directorate?'

[b]Family income before taxes.

[c]Lower education: ≤12 years of education at the elementary, high school, or vocational school. Higher education: having attended college or university.

education. Good knowledge of dietary guidelines were reported by 69% of parents with higher levels of maternal education, 59.3% of parents with higher levels of paternal education, and 87.3% of those with higher income.

Discussion

The aim of this present study was to describe differences in dietary habits among Norwegian adolescents by gender and socioeconomic status, and investigate differences in knowledge of dietary guidelines among their parents according to socioeconomic status.

Our results indicate that there are significant differences according to gender and socioeconomic status in the selected dietary habits. There are also differences in parents' knowledge of dietary guidelines according to socioeconomic status.

With regard to gender differences, we found that girls generally reported a more frequent consumption of healthy food items (total F&V); in contrast, boys reported a higher consumption of unhealthy food items as soft drinks and fast food. There are more girls than boys with highly educated mothers, which might influence these results. However, these differences between gender and examined food items are well documented among both children and adolescents (13, 27–29). There are a number of hypotheses on gender differences in diet. Wardle et al. (29) suggest that females are more concerned about health considerations, have stronger beliefs in the importance of healthy foods, have a stronger desire to look after one's appearance and are more likely to translate their attitudes to action. Another explanation could be boys' having higher energy requirements and thus control their food preferences toward more energy-efficient dense foods (30). A Norwegian study by Bere et al. (31) found that preferences in taste were the strongest mediator of the difference in intake of fruit and vegetables between boys and girls.

Adolescents do not have an independent socioeconomic status, and thus the study of social inequality in diet among adolescents is a question about the extent to which parents and home conditions affect diet. This study demonstrates that adolescents from families with lower SES consume less healthy foods as vegetables and fish, and more fast food and soft drinks than those of higher SES. These findings are consistent with existing studies of diet among adolescents and SES undertaken in Norway (13, 28, 32, 33). In opposition to other previous studies, our results do not show significant differences in fruit intake between groups. Dietary habits among adolescents are influenced by multiple sociodemographic and socioenvironmental factors as from peers, leisure activities and school environment (34). In this study we have chosen to focus on parents' socioeconomic status, and the results must be interpreted with that in mind. However, parents and the socioeconomic status is of great importance in dietary habits among adolescents, through knowledge, attitudes, availability, food choices, preferences, and values attached to diet and health (12, 34–36). According to a study by Mirowsky and Roos (37) educated parents inspire a healthy lifestyle in their children.

Socioeconomic factors influence the availability of healthy foods at home, with a decrease in the availability in groups with lower socioeconomic status (38). Differences in the availability of healthy foods may be mediated by knowledge of diet (21) and possibly food prices (36). Economic circumstances may influence the families' opportunity to buy healthy foods (38). Results in the present study demonstrates that adolescents growing up in families with lower financial resources have lower consumption of a healthy diet, which may reflect the relative high cost of fish, fruit and vegetables in Norway. A study by French (39), demonstrate that price reduction is an effective strategy to increase the purchase of more healthy foods. However, with respect to healthy food choices, economic factors is not enough for healthy eating, norms and values are of great importance (40). In a study by Wardle et al. (21), knowledge of diet is significantly associated with healthy eating, especially for fruit and vegetables. Wardle et al. (21) emphasize that there is lack of nutrition knowledge in lower SES groups, which may be a potential explanation for differences in dietary habits in the present study. Parents with high SES, both high education and high income, report that they have more knowledge of dietary guidelines than those with lower SES.

Education tells you something about a person's general knowledge that may influence diet through increased sense of personal control and ability to utilize health-related information (41), and income is partly related to educational level. Thereby, it has been assumed that some health promotion strategies, like propaganda and media, may be particularly effective in groups with higher education (42). However, knowledge of diet may not necessarily be sufficient enough to initiate a healthy diet, and structural measures are of great importance especially in terms of reducing social inequalities in diet (2, 7, 22).

Despite the fact that a nationwide diet survey (32) already in 2,000 reported socioeconomic inequalities in diet among adolescents and initiated actions and strategies to prevent socioeconomic inequalities in health, the present study demonstrates that differences in diet still exist among Norwegian adolescents. To reduce social inequalities in diet, public measures have been initiated, that is, use of price measures, efforts to improve access to healthy foods in kindergarten, school, work and leisure, labeling of food and interaction with stakeholders in the private and voluntary sectors (22). Among these, a free fruit program for all schools with lower secondary classes should be mentioned. This program has been implemented nationwide since 2007, and has led to an increase in students' consumption of fruit among all groups (43). In the present study, there were no differences in intake of fruit between SES groups or gender, which may reflect the effectiveness of the free fruit program. However, effective measures to reduce social inequalities in diet are generally limited.

Strengths and limitations

Among the strengths of the present study is that we have reports from two different sources, that is, from both students and parents. That the parents report information of SES gives us more reliable data and less missing data, than if the students themselves had reported this (44). At baseline, the study has a relative high response rates and large sample sizes of schools and students, which minimized the risk of selection bias. Another strength is that the FFQ used in this study has been recognized as a valid instrument in epidemiological studies ranking adolescents according to their usual food intake (25, 26). Another advantage of this study is few missing data on diet and SES, partly due to design of questionnaires. A possible strength of our study is that socioeconomic status is presented as two parameters, that is, parental education and income. Research on diet and socioeconomic inequalities most often include education as an indicator of SES (45). However, education and income cover different areas of social stratification (45) and both are important to include. The relation between education and dietary and health habits (45) are most often explained by the person's general knowledge which may influence dietary choices. Income is partly related to education level however also include the person's social position (46). Marmot argue that there are two ways income may be related to health, through a direct effect on the material conditions necessary for biological survival (e.g. food), and through an effect on social participation and opportunity to control life circumstances (47). Our study only presents relations between diet and income; however, future studies could further explore if there are causal relations between income and dietary habits.

Several methodological limitations of this study must be considered. Despite a high response rate among students, selection bias may have been introduced as a consequence of lower parental response rates. The reason for lower participation of parents is uncertain and may be due to many factors. Because we were unable to determine parental socioeconomic status among the non-respondents, the absence of many parents may influence the study's ability to generalize to the population. A disadvantage of this study is that information and questionnaires only were available in Norwegian, which may have influenced the inclusion of all social groups, especially those with foreign backgrounds. Although the study population represents different socioeconomic groups, it may not be representative of the population. According to findings from a study by Turrell et al. (48), there is reason to expect that parents not participating in studies like this represent lower socioeconomic groups. In this study, the proportion of total parents with higher education is 54.7%, which is significantly higher than in Vest-Agder County in total (26.1%) and nationwide (29.1%). It must be taken into account that this statistics are for all adults over 16 years, while the majority (68%) of the parents in this study are aged between 40 and 50. The proportion of higher education in the same age group nationwide is 35.1% (49). The fact that the study is non-representative may affect the validity of the study. However, because of the medium size study population and diverse study population, the tendency of the results can be seen.

Although the FFQ has been validated, the validity of reported food intake is of concern. The dietary data are based on self-reports and may be over- or underestimated depending on social desirability bias and recall bias. We cannot exclude the possibility of misreporting in dietary intake due to under- and overestimating of self-reported data. A well-known phenomenon in studies like this is that obviously unhealthy foods are underestimated, while healthy foods are overestimated (23). Similarly, some parents may have overreported personal information such as income. To reduce social desirability bias among the students, we introduced the survey by telling them that

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it was not an exam and that there is no right or wrong answers. Students were encouraged to answer the questions as honestly as possible. Furthermore, adolescents may have had difficulties in recalling past dietary intake for the last 4 weeks (50). It must also be considered that students may have been unfocused when filling out the questionnaire (51), which may have resulted in misreporting of intake. However, this was not a major problem in the study, as most students in the study were focused and positive to answer the survey.

The parental knowledge about dietary guidelines was assessed with only one question. We did not do any performance test to assess actual knowledge, the results only reflects the parents' perceived knowledge. This is a limitation with our study. It may also be that there is a social desirability influencing the results of this question and it should be investigated further.

These are factors that must be taken into consideration in all studies of this kind.

Conclusion

The findings in this study provide an indication that special considerations should be given to adolescence in lower socioeconomic positions and in boys. In future, research factors influencing eating behaviors of adolescents need to be better understood to develop effective nutrition interventions to change eating behaviors. Given the differences in knowledge of dietary guidelines among the parents, it is important to develop appropriate and effective health promotion strategies to reach out to the entire population. Improving diet in less privileged groups can be an effective prevention strategy to reduce social inequalities, which in turn can improve public health. A possible arena to influence young people's diet regardless of gender and socioeconomic status is school. Another strategy is to increase availability by reducing prices on healthy foods implemented through policy initiatives.

Authors' contributions

NCØ conceived the study and all authors contributed to the design of the study. MS drafted the paper, performed the analyses. MS, AMSA, and NCØ interpreted the results. IMW and MS carried out the data collection. AMSA and NCØ counseled through the whole process and AMSA, IMW, and NCØ critically commented on and revised the paper. All authors have seen and approved the contents of the submitted manuscript.

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Conflict of interest and funding

All authors declare that they have no competing interests.

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