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Adolescents' health-related dietary patterns by parental socio-economic position, The Nord-Trøndelag Health Study (HUNT)

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Background: Nutrition is among the important determinants of diseases, and the social patterning of early eating habits may offer keys to prevention. We studied associations between selected indicators of adolescents' health-related dietary habits (daily intake of candy, soft drinks, fruit and vegetables) and parental socio-economic position (education, social class and income). **Methods:** The material consisted of participants in the adolescent part (Young-HUNT) of the Nord-Trøndelag Health Study during the period 1995–97, 8817 girls and boys aged 13–19 years (89% of all students in junior high schools and high schools in a Norwegian county). Data on parental socio-economic position was available from the adult part of HUNT and Statistics Norway. Cross-sectional data analyses were performed using cross-tables and binary logistic regression. **Results:** Of the indicators of socio-economic position used, the parent's educational level, in particular the mother's education, showed the highest impact on adolescents' health-related dietary habits. Girls with the least educated mothers had a prevalence odds ratio of 2.5 (1.8–3.3) for drinking soft drinks daily and 0.6 (0.5–0.8) for eating vegetables daily as compared to girls with the most educated mothers. The corresponding numbers for boys were 1.9 (1.5–2.4) and 0.6 (0.5–0.8). Parental social class also showed gradients in adolescents' health-related dietary habits, but there was virtually no gradient by income. **Conclusion:** Higher levels of parental education, in particular the mother's education, are clearly associated with healthier dietary habits among adolescents. This social patterning should be recognized in public health interventions.

Keywords: adolescents, diet, health-related behaviour, parental socio-economic position, social inequalities.

Introduction

An optimal diet during adolescence is important to support normal growth and development.[1] Dietary habits developed in adolescence may contribute to form adult dietary habits. Both early circumstances and adult life circumstances may in turn influence disease risk.[2] On the population level, nutrition plays an important role in the development of many diseases, in particular non-communicable chronic diseases.[3,4] Morbidity and mortality from such chronic diseases, like cardiovascular diseases, some cancers, type 2 diabetes and obesity, have higher prevalence and incidence in groups of lower socio-economic position.[5–7]

A recent WHO report[8] recommended, among other things, a diet with less saturated fat, sugar and salt and an abundance of fruits and vegetables to combat non-communicable chronic diseases. Since fruits and vegetables contribute to cardiovascular health due to the variety of phytonutrients, potassium and fibre they contain,[8] an intake of at least 400 g of fruit and vegetables a day are recommended to reduce the risk of coronary heart disease, stroke and high blood pressure. A reduced intake of sugar-sweetened drinks among children has also been shown to be important in weight management.[8,9]

Social inequalities in health can be understood as a result of the prolonged processes that start several years before the effects are displayed.[2,10] Socio-economic position can affect health at any point, from birth or even during foetal life until death, and the effect of social inequalities may accumulate over time.[11] Also, there may be critical periods when the impact of socio-economic position has greater effect on health and lifestyle. Adolescence as a critical period for socio-economic inequalities in health has been challenged by studies who found almost no gradients in health among adolescents, which suggests that schooling and peer influences may lead to greater homogenization.[12] However, socio-economic inequalities in adolescents' lifestyle factors, such as dietary habits, may contribute to inequalities in health and disease in later life. In particular, this could be true for morbidity and mortality from non-communicable chronic diseases.[10,11]

The main objective of this study was to examine associations between selected indicators of adolescents' health-related dietary habits (daily intake of candy, soft drinks, fruit and vegetables) and parental socio-economic position (education, social class and income). We also wanted to study if using indicators of socio-economic position determined by mother's and father's position separately would give different results.

Methods

The HUNT study

The county of Nord-Trøndelag in Norway has a stable and homogenous population with ~127 000 inhabitants. The sex and age distribution is similar to Norway as a whole. The same is true for geography, industry and for sources of income and economy. The county lacks large cities, and the level of average income is somewhat lower than the average of Norway.[13] In 1995–97, all inhabitants aged 13 years and older were invited to the Nord-Trøndelag Health Study (HUNT 2). Students in junior high schools and high schools, 13–19 years old, were

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invited to the adolescent part of HUNT, Young-HUNT. The students filled in questionnaires and were screened for a number of health measures. Information on the adolescents' health-related dietary habits from Young-HUNT (1995–97) was merged with information on parental socio-economic position from the adult part of HUNT 2 and register data from Statistics Norway via the Norwegian Family Registry. The present study included 8817 adolescents, accounting for 89% of students in junior high schools and high schools in the county, and their parents. Information on parental social class, Erikson Goldthorpe and Portocarero (EGP),[14] was available from parental participation and self reporting of occupational categories in HUNT 2. This gave a larger proportion of missing data due to parents not participating in the HUNT 2 study and incompletely filled in questionnaires. Information on parental educational level and income was available from the national register data, and therefore also for parents not participating in the HUNT 2 study.

All participants and parents of children under the age of 16 years signed a written consent to take part in the study. The study was approved by the Regional Committee for Medical Research Ethics and the Norwegian Data Inspectorate Board.

Measuring health-related dietary habits

Adolescents' health-related dietary habits were measured using questionnaires with the question: 'How often do you drink or eat the things listed below?' We studied the intake of candy, chocolate and other sweets (candy), cola, soda or other soft drinks (soft drinks), fruit and vegetables. The answers were reclassified into daily consumption (more than once a day and once a day) and not daily consumption (every week but not every day, seldom and never). We selected the four dietary variables listed above because they could clearly be categorized as healthy or unhealthy. Other dietary variables that could also have been categorized as healthy or unhealthy were not used in these analyses because there was little variation in the answer categories. The health-related dietary variables in Young-HUNT (1995–97) were the same as in the well established cross-national WHO study[15] on Health Behaviour of School-aged Children (HBSC).[16] A Belgian study indicates sufficient reliability and validity of the HBSC food-frequency questionnaire for correlation analyses.[17] Beginning around the age of 10, the cognitive processes of children and adolescents become more similar to those of adults,[17,18] which further supports the use of food-frequency questionnaires in the relevant age group (13–19 years).

Parental socio-economic position

Data on parental education and income was made available by Statistics Norway and EGP social class information from parental participation and self-reporting of occupational categories in HUNT 2. Education was measured as the highest level of education attained. We reclassified the educational data into three levels: primary education ($\leq$9 years), secondary education (10–12 years) and tertiary education ($\geq$13 years). Data on income was based on pensionable income in 1995. We calculated parental income in quartiles by mother's income, father's income and by adding together the income of the mother and the father. The EGP social class scheme was approximated with a reclassification of 10 original self reported occupational categories.[13] A comparison of this approximation and a standard procedure based on separate occupational codes has shown the applicability of this reclassification.[19] The respondents were asked to classify their last held or present occupation. We merged class I (higher administrators and professionals) and II (lower administrators and professionals) into upper class, III (routine non-manual workers) and IV (self-employed, farmers and fishermen) into middle class and V+VI (skilled manual workers) and VII (unskilled manual workers) into lower class. Adolescents with parents who reported that they had 'never been economically active' were treated as missing for EGP social class.

Statistics

The prevalence was adjusted for age by direct standardization. The standard population consisted of girls and boys 13–19 years old as of 1 January 1999 in the Nord-Trøndelag county. The odds ratios (ORs) were obtained by logistic regression. Age was adjusted by including a continuous variable representing age in years. The analyses were carried out separately for girls and boys and by maternal and paternal socio-economic position. All statistical analyses were performed using the statistical software SPSS for Windows, version 15.0.

Results

Out of the 8817 adolescents who were eligible for analyses, there were 4384 girls and 4433 boys. The results showed that the girls tended to consume more fruit and vegetables and less candy and soft drinks than the boys (figure 1 available online as supplementary data). The gender difference was particularly evident regarding drinking soft drinks daily (15% girls and 29% boys).

Table 1 shows prevalence and prevalence ORs in the girls' health-related dietary habits by maternal and paternal level of education. Higher levels of parental education were consistently associated with healthier food habits: more frequent intake of fruit and vegetables and less frequent intake of candy and soft drinks. This association was more pronounced when maternal educational level was measured. Girls with the least educated mothers had a prevalence OR of 2.5 (1.8–3.3) for drinking soft drinks daily and 0.6 (0.5–0.8) for eating vegetables daily when compared with girls with the most educated mothers. The educational gradient was less pronounced in daily intake of candy in comparison with soft drinks, fruit and vegetables.

Table 2 shows prevalence and prevalence ORs in the boys' health-related dietary habits by maternal and paternal level of education. The trend of the boys was similar to that of the girls, although the inequalities were somewhat less pronounced among the boys. Boys with the least educated mothers had a prevalence OR of 1.9 (1.5–2.4) for drinking soft drinks daily and 0.6 (0.5–0.8) for eating vegetables daily when compared to boys with the most educated mothers.

Table 3 shows prevalence and prevalence ORs in the girls' health-related dietary habits by maternal and paternal EGP social class. Higher EGP parental social class was associated with more frequent intake of fruit and vegetables and less frequent intake of soft drinks. There seemed to be no clear gradient by maternal or paternal EGP social class for the reporting of eating candy daily.

Table 4 shows prevalence and prevalence ORs in the boys' health-related dietary habits by maternal and paternal EGP social class. Higher parental EGP social class was associated with a more frequent consumption of fruit and vegetables. However, the gradient by maternal and paternal EGP social class was indistinct for daily consumption of candy and soft drinks among the boys. The exception was in drinking soft drinks daily by paternal EGP social class, where the boys with fathers in EGP social class III + IV had a prevalence

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Table 1 Prevalence and prevalence ORs of health-related dietary habits by parental educational level in the Nord-Trøndelag Health Study (1995–97), girls 13–19 years old

Level of education	Candy daily				Soft drinks daily				Fruit daily				Vegetables daily			
	Total	No	Prev.[a]	OR[b] (95% CI)	Total	No	Prev.[a]	OR[b] (95% CI)	Total	No	Prev.[a]	OR[b] (95% CI)	Total	No	Prev.[a]	OR[b] (95% CI)
Maternal education																
Tertiary	900	72	8	1	901	96	11	1	903	491	53	1	903	418	46	1
Secondary	2716	255	9	1.2 (0.9–1.6)	2723	391	16	1.4 (1.1–1.8)	2718	1315	47	0.8 (0.7–0.9)	2716	1002	36	0.7 (0.6–0.8)
Primary	572	75	13	1.8 (1.3–2.5)	576	133	24	2.5 (1.8–3.3)	573	255	44	0.7 (0.6–0.9)	573	193	34	0.6 (0.5–0.8)
Total classified	4188				4200				4194				4192			
Missing	196				184				190				192			
Total	4384				4384				4384				4384			
Paternal education																
Tertiary	927	72	8	1	930	93	11	1	928	519	54	1	929	423	44	1
Secondary	2539	251	10	1.3 (1.0–1.7)	2545	392	17	1.7 (1.3–2.1)	2538	1217	47	0.7 (0.6–0.8)	2537	942	36	0.7 (0.6–0.8)
Primary	628	63	10	1.3 (0.9–1.9)	629	116	20	2.0 (1.5–2.7)	632	279	44	0.6 (0.5–0.8)	631	211	32	0.6 (0.5–0.8)
Total classified	4094				4104				4098				4097			
Missing	290				280				286				287			
Total	4384				4384				4384				4384			

a: Prevalence of dietary habits by parental educational level. Adjusted for age by direct standardization, girls 13–19 years old in Nord-Trøndelag as of 1 January 1999
b: Prevalence ORs. Adjusted for age by including a continuous variable representing age in years in the logistic regression model

Table 2 Prevalence and prevalence ORs of health-related dietary habits by parental educational level in the Nord-Trøndelag Health Study (1995–97), boys 13–19 years old

Level of education	Candy daily				Soft drinks daily				Fruit daily				Vegetables daily			
	Total	No	Prev.[a]	OR[b] (95% CI)	Total	No	Prev.[a]	OR[b] (95% CI)	Total	No	Prev.[a]	OR[b] (95% CI)	Total	No	Prev.[a]	OR[b] (95% CI)
Maternal education																
Tertiary	955	107	11	1	959	221	25	1	953	406	41	1	956	381	37	1
Secondary	2693	384	14	1.3 (1.1–1.7)	2694	794	32	1.4 (1.2–1.7)	2675	995	35	0.8 (0.7–0.9)	2677	884	33	0.7 (0.6–0.9)
Primary	555	89	16	1.5 (1.1–2.1)	556	206	38	1.9 (1.5–2.4)	550	198	35	0.8 (0.7–1.0)	552	154	28	0.6 (0.5–0.8)
Total classified	4203				4209				4178				4185			
Missing	230				224				255				248			
Total	4433				4433				4433				4433			
Paternal education																
Tertiary	953	119	11	1	955	225	24	1	949	403	40	1	951	391	38	1
Secondary	2515	341	14	1.1 (0.9–1.4)	2519	758	32	1.4 (1.8-1.7)	2504	918	35	0.8 (0.7–0.9)	2505	800	32	0.7 (0.6–0.8)
Primary	631	100	14	1.3 (1.0–1.8)	632	201	34	1.5 (1.2–1.9)	623	233	37	0.8 (0.7–1.0)	627	189	30	0.6 (0.5–0.8)
Total classified	4099				4106				4076				4083			
Missing	334				327				357				350			
Total	4433				4433				4433				4433			

a: Prevalence of dietary habits by parental educational level. Adjusted for age by direct standardization, boys 13-19 years old in Nord-Trøndelag as of 1 January 1999
b: Prevalence ORs. Adjusted for age by including a continuous variable representing age in years in the logistic regression model

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Table 3 Prevalence and prevalence ORs of health-related dietary habits by parental EGP social class in the Nord-Trøndelag Health Study (1995–97), girls 13–19 years old

EGP social class	Candy daily				Soft drinks daily				Fruit daily				Vegetables daily			
	Total	No	Prev.[a]	OR[b] (95% CI)	Total	No	Prev.[a]	OR[b] (95% CI)	Total	No	Prev.[a]	OR[b] (95% CI)	Total	No	Prev.[a]	OR[b] (95% CI)
Maternal social class[c]																
I + II	898	70	8	1	898	106	13	1	898	475	53	1	896	402	45	1
III + IV	1176	111	10	1.2 (0.9–1.7)	1180	159	14	1.1 (0.9–1.5)	1180	602	50	0.9 (0.8–1.1)	1176	445	37	0.8 (0.6–0.9)
V + VI + VII	561	44	7	1.0 (0.7–1.5)	560	97	18	1.6 (1.2–2.1)	559	243	40	0.7 (0.6–0.9)	560	180	30	0.6 (0.5–0.7)
Total classified	2635				2638				2637				2632			
Missing[d]	1749				1746				1747				1752			
Total	4384				4384				4384				4384			
Paternal social class[c]																
I + II	825	67	8	1	826	85	11	1	828	446	53	1	828	359	43	1
III + IV	760	57	8	0.9 (0.6–1.3)	761	85	12	1.1 (0.8–1.5)	757	386	51	0.9 (0.7–1.1)	757	313	41	0.9 (0.8–1.1)
V + VI + VII	756	69	9	1.1 (0.8–1.6)	757	133	19	1.9 (1.4–2.5)	757	343	45	0.7 (0.6–0.9)	755	242	32	0.6 (0.5–0.8)
Total classified	2341				2344				2342				2340			
Missing[e]	2043				2040				2042				2044			
Total	4384				4384				4384				4384			

a: Prevalence of dietary habits by parental educational level. Adjusted for age by direct standardization, girls 13-19 years old in Nord-Trøndelag as of 1 January 1999
b: Prevalence ORs. Adjusted for age by including a continuous variable representing age in years in the logistic regression model
c: I = higher administrators and professionals, II = lower administrators and professionals, III = routine non- manual workers, IV = self-employed, farmers and fishermen, V + VI = skilled manual workers, VII = unskilled manual workers
d: Out of 4384 girls, 796 were missing due to mother not participating in the HUNT 2 study
e: Out of 4384 girls, 1393 were missing due to father not participating in the HUNT 2 study

Table 4 Prevalence and prevalence ORs of health-related dietary habits by parental EGP social class in the Nord-Trøndelag Health Study (1995–97), boys 13–19 years old

EGP social	Candy daily				Soft drinks daily				Fruit daily				Vegetables daily			
	Total	No	Prev.[a]	OR[b] (95% CI)	Total	No	Prev.[a]	OR[b] (95% CI)	Total	No	Prev.[a]	OR[b] (95% CI)	Total	No	Prev.[a]	OR[b] (95% CI)
Maternal social class[c]																
I + II	895	103	12	1	898	222	28	1	889	372	39	1	892	356	37	1
III + IV	1112	150	13	1.2 (0.9–1.6)	1112	327	32	1.3 (1.0–1.5)	1106	401	34	0.8 (0.7–1.0)	1107	353	31	0.7 (0.6–0.9)
V + VI + VII	589	90	14	1.4 (1.0–1.9)	589	170	30	1.2 (1.0–1.5)	584	208	34	0.8 (0.6–1.0)	585	182	29	0.7 (0.6–0.9)
Total classified	2595				2599				2579				2584			
Missing[d]	1838				1834				1854				1849			
Total	4433				4433				4433				4433			
Paternal social class[c]																
I + II	828	110	13	1	830	187	24	1	823	345	39	1	827	324	37	1
III + IV	755	73	9	0.7 (0.5–1.0)	757	204	29	1.3 (1.0–1.6)	753	263	32	0.7 (0.6–0.9)	753	244	31	0.8 (0.6–0.9)
V + VI + VII	789	110	14	1.1 (0.8–1.4)	789	234	33	1.4 (1.1-1.8)	783	285	34	0.8 (0.7–1.0)	782	238	30	0.7 (0.6–0.8)
Total classified	2372				2376				2359				2362			
Missing[e]	2061				2057				2074				2071			
Total	4433				4433				4433				4433			

a: Prevalence of dietary habits by parental educational level. Adjusted for age by direct standardization, boys 13–19 years old in Nord-Trøndelag as of 1 January 1999
b: Prevalence ORs. Adjusted for age by including a continuous variable representing age in years in the logistic regression model
c: I = higher administrators and professionals, II = lower administrators and professionals, III = routine non- manual workers, IV = self-employed, farmers and fishermen, V + VI = skilled manual workers, VII = unskilled manual workers
d: Out of 4433 boys, 877 were missing due to mother not participating in the HUNT 2 study
e: Out of 4433 boys, 1382 were missing due to father not participating in the HUNT 2 study

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odds ratio of 1.3 (1.0–1.6) and boys with fathers in EGP social class V + VI + VII had a prevalence odds ratio of 1.4 (1.1–1.8) compared with boys with fathers in EGP social class I + II. Also by EGP social class, we found that the inequalities were somewhat less pronounced among boys compared to girls.

We found virtually no income gradients for fruit and vegetables by all three income measures (tables 5 and 6 available online as supplementary data).

Discussion

We found a clear association between parental socio-economic position and adolescents' health-related dietary habits. However, income showed virtually no gradients. Parental educational level, in particular the mothers, showed the highest impact on the adolescents' health-related dietary habits. The inequalities in education and EGP social class were somewhat more pronounced in the girls than in the boys. In general, girls tended to eat fruit and vegetables more frequently and consume candy and soft drinks less frequently than the boys.

Socio-economic inequalities in health in children and adults are well established, but in adolescents this correlation has been debated. West *et al.*[12] found almost no gradients in health among adolescents in the West of Scotland and suggest an equalization in youth due to homogenization through schooling and peer influences. However, previous studies have shown a fairly consistent pattern where adolescents from families in a high socio-economic position eat more fruit and vegetables than adolescents from families in a lower socio-economic position.[20–24] This pattern was observed within a large number of operationalizations of socio-economic position, also in our data. However, parental income showed virtually no gradients in adolescents' health-related dietary habits. It may be that education and social class are more stably correlated to healthy eating habits than income. Education could provide important socio-economic influence on health-related behaviour as it may increase a sense of personal control[11,25] and ability to grasp and utilize health-related information.[26]

We found that maternal educational level showed the highest impact on the adolescents' health-related dietary habits. It is likely that women, wives and mothers tend to have a stronger influence on the family's health-related behaviours by providing meals, spending more time in the household and organizing the household. A woman's educational level may influence the household more than a man's educational level: it may affect men's health-related behaviours[27] and may have the most influence on dietary habits.[28] Our finding of a strong association between maternal educational level and adolescents' dietary habits could be a result of such circumstances; since wives influence health behaviours of their husbands, we can assume this influence extends to their children and other family members.

More than half of the adolescents did not meet the recommended intake of 400 g of fruit and vegetables a day,[8] as they did not eat fruit and/or vegetables daily. We found that the girls ate healthier and more in line with dietary guidelines than the boys. Both of these findings are in line with other studies on food consumption in adolescents.[1,20,21,29–31]

The strength of this study is that it covers a population of 8817 adolescents, with a total participation rate of 89%. We also had almost complete register data on the adolescents' parental educational level and income, measured by both the mother and the father. However, there were more missing values in the data on parental EGP social class for three reasons: some parents chose not to participate in the HUNT 2 study, some did not complete their questionnaires and some reported never having been economically active. Since missing values could have lead to biased estimates, we analysed the association between missing values due to missing data on parental EGP social class and parental educational level. We found that the prevalence of missing values was significantly larger with a lower parental educational level. This may have introduced an underestimation of differences in the adolescents' health-related dietary habits by parental EGP social class. This finding coincides with a study on the socio-economic patterning of survey participation and non-response error.[32]

The generalizability from Nord-Trøndelag to Norway has been considered good because the region has representative geography, demography and average socio-economic mortality.[33] However, the county lacks large cities, and the level of average income is somewhat lower than the average of Norway as a whole. As big cities usually demonstrate greater inequalities than rural areas, Nord-Trøndelag may be more egalitarian than Norway as a whole,[13] in which case social inequalities may be underestimated. On the other hand, one might think that accessibility to large supermarkets, which offer a large range of foods and fresh foods at low prices, may be more restricted in rural areas. Discussions in the literature suggest that access to shops, as well as quality and price, play an important role for the consumption of fruit and vegetables.[34] There is no evidence to suggest that the food distribution is more restricted in Nord-Trøndelag than elsewhere. Furthermore, recent studies from the Netherlands, the UK and Australia have shown that food shopping environment may not contribute to health-related dietary habits and socio-economic inequalities in food choice.[34–36]

There have been some nutritional changes since the data were collected. The use of sugar has declined over the last decade while the consumption of fruit and vegetables has increased.[37] However, a satisfactory consumption level of these foods has not been reached yet. The sales of soft drinks are still very high, and the consumption of candy has increased. From 2007, free fruit and vegetables are offered to pupils in junior high schools nationwide. Providing this for free for all pupils could contribute to reducing social inequalities in fruit and vegetable consumption, since charges seem to increase social inequalities in fruit and vegetable intake.[38] Furthermore, the Norwegian government increased charges on sweetened beverages from 2009 to promote a reduction in the consumption.

Based on the assumption that socio-economic position is ascribed rather than achieved among adolescents, researchers have used indicators based on parental occupation, education and income.[12] These indicators of socio-economic position are used to classify individuals in groups of similar status or prestige, power, knowledge and resources.[39] Each indicator has a unique contribution in capturing aspects of socio-economic position, even though the indicators typically are shown to be weakly to moderately correlated.[40] By using more than one measure of socio-economic position separately, we have not taken into account the covariance between different measures. However, it is important to describe observed behavioural patterns in different concrete socio-economic groups in the population to use in the development of new hypotheses of causal mechanisms, in further and more analytical studies as a basis for public health strategies.

As part of a strategy to prevent many diseases, particularly non-communicable chronic diseases, we should aim at initiatives to improve adolescents' dietary habits. Special considerations should be given to groups in lower socio-economic positions and boys. A more analytical approach is needed to investigate why higher levels of socio-economic

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position and higher levels of education (particularly maternal education) seem to be associated with healthy dietary habits among adolescents. Regardless of such explanations, the social patterning of adolescents' eating habits clearly have public health implications.

Supplementary data

Supplementary data are available at *EURPUB* online.

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Conflicts of interest: None declared.

Key points

This population-based study examines health-related dietary habits in adolescents by parental education, social class and income stratified by gender and by maternal and paternal socio-economic position.

Though the girls ate healthier and more in line with dietary guidelines, more than half of both girls and boys did not meet WHO recommendations on intake of fruit and vegetables.

We found that higher parental socio-economic position was associated with more healthy dietary habits among adolescents, but there was virtually no gradient by income.

Parental educational level, in particular the mother's education level, showed the highest impact on adolescents' health-related dietary habits.

Any public health interventions with regard to dietary habits in adolescents should recognize this social patterning.

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