

¹ Department of Public Health, Ghent University, Ghent, Belgium

² Department of Health Sciences, Vesalius – Hogeschool Ghent, Ghent, Belgium

³ Department of Agricultural Economics, Ghent University, Ghent, Belgium

Adolescents' education and their diet recorded by 7-day food records

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Summary

Objectives: To investigate associations between dietary habits and socio-economic status in adolescents (Ghent, Belgium).

Methods: A random sample of 341 adolescents (13–18 years) participated in a dietary survey using a 7-day dietary record. Respondents' educational training (general/vocational) and parental education were used as indicators of socio-economic status.

Results: In girls, the prevalence of overweight is higher when following vocational training or having a low parental education; the energy and micronutrient intake was higher in respondents with a general training and in those with a high parental education. Girls following a general training have significantly higher intake of fruit, vegetables, breakfast cereals, cheese and milk & milk products, while their intake was significantly lower for soft drinks. Girls with a high parental education have a higher intake of cake, biscuits, milk & milk products. In boys, small differences in micronutrient and food intake were found between different educational levels. In both sexes, the diet of general trained adolescents was more diversified.

Conclusion: The results demonstrate trends which highlight the need for continued efforts to improve the adolescents' diet, particularly in lower social groups.

Keywords: Education – Parental education – Food intake – Nutrient intake.

Differences in educational training underlie many health disparities. Inequalities in education are associated not only with diverging patterns in mortality and morbidity (Mackenbach et al. 2000) but also with the main determinants of health, such

as the quality of the environment and health-related behaviours, such as nutrition (World Health Organisation (WHO) 2002). Dietary intakes are considered to play a significant role in the development of chronic diseases (Bolton-Smith et al. 1991; Smith & Brunner 1997). Differences in dietary intake may be partly responsible for socioeconomic inequalities in the occurrence of these diseases (James et al. 1997; Smith & Brunner 1997). Previous studies have shown that the consumption of some food items is socially patterned among adolescents (Hoglund et al. 1998; Roos et al. 2001; Sweeting et al. 1994). In general, less educated groups appear to consume a less healthy diet.

In 2000, the Belgian Science Policy launched a call for proposals on the topic of social cohesion in the society. The aim of the call was to contribute to the consolidation of knowledge potential in support of the federal socioeconomic policy. The call was an invitation to use existing databases for answering some of the remaining questions. It is in the context of this programme that the current study is fulfilled.

The objective of this study is to analyse the relation between adolescents' personal and parental educational training, and the adolescents' dietary habits. This is one of the remaining questions mentioned in the call.

Material and methods

For the purpose of analysing the relation between adolescents' personal and parental education and the adolescents' dietary habits a dietary survey from 1997 (March–May), in which a random sample of adolescent residents of Ghent participated, was used. The study sample consisted of 656 adolescents (13–18 years) randomly selected on the basis of a multistage cluster sampling technique. The design and methodology have been described in more detail elsewhere (Matthys et al. 2003). In brief, local private and public secondary schools (n

= 5) were randomly selected. They all agreed to participate. In Belgium, two major trajectories can roughly be distinguished in the educational system. One route consists of mainly theoretical courses, further called 'general' education. A second type of education focuses more intensively on the adoption of practical skills, further called 'vocational' education. Within each school, classes were selected in such a way that a uniform distribution over the age range of 13–18 years was obtained. All students from the selected classes were asked to participate in the study. Of 656 adolescents (39.6% boys and 60.4% girls), 565 were considered eligible. Non-eligible students ($n = 91$) were on sickness leave or had moved to other schools. Of the 565 eligible students, 411 (72.7%) actually participated. Because of missing data in the food diaries (see below), 70 students – of the 411 who actually participated – were excluded. Hence, results are reported for 341 of the 565 eligible students (60.3%). In this paper, results are given separately for boys ($n = 129$) and girls ($n = 212$).

Information letters were sent to directors, parents and the adolescents, who were all asked to give their written consent. The recruitment and the fieldwork were carried out in collaboration with the local Medical School Services.

A 7-day (consecutive) estimated food record method (semi-structured diary) was used to quantify food and nutrient intake. Information on the type (including brand names) and amount of food consumed was collected through an open entry format. The amount of food consumed was estimated using household measures (e.g. coffee spoon, cup, ...) and standard portions (e.g. pieces, slices, ...). Instructions for the completion of the diary (special attention was given to the issue of estimation of portion sizes of food items and this was demonstrated with a number of standardised examples) and regular checks (every 2 days) for quality and completeness of the diaries were carried out by experienced dietitians. After completion, the diaries were processed into food quantities and codes by experienced dietitians on the basis of a standard protocol, including a Belgian standard manual on food portions and household measures. The storage of data on intake of individual food items was very detailed and contained altogether 745 different food items. Calculations of nutrient intake were done on the basis of the Dutch Food Composition Table (NEVO 1993) and the Belgian Food Composition Tables (NUBEL 1992; NUBEL 1995) by means of a nutritional software package (BECCEL-software packet) developed by the Unilever company. Average energy intake, nutrient intakes and intake of food items were calculated as the mean of the 7-day intake period.

A Variety Score (VS) was developed and is defined as the number of different food items that were consumed over the 7-day period and so reflect the respondents' food spectrum

(Drewnowski et al. 1997). Both a "total Variety Score" and a "food group specific Variety Score" were used. For this purpose, the food items were classified into groups according to the Dutch Food Composition Table (NEVO 1993).

Height and weight of the respondents were measured according to the standardised method proposed by the World Health Organization (WHO 1995). Data on measured heights and weights were completed during the same period (1 week) as the food diary. The body mass index (BMI) was computed as weight (kg) divided by the square of height (m^2). Internationally accepted age and sex-related cut-off points for body mass index related to overweight and obesity in children and adolescents developed by Cole and co-workers (Cole et al. 2000) were used.

In the general questionnaire, adolescents were asked about their place of residence (rural versus urban), the number of brothers and/or sisters, the educational level of both parents, the country of birth of both parents (born in Belgium or abroad) and the family status (parents living together or apart).

Socio-economic status is based on two indicators. The first indicator was based on the current educational level of the respondents. This variable distinguishes two levels, a 'general' education (mainly theoretical courses) and a 'vocational' training (focused on practical skills).

The second indicator of socio-economic status was based on the highest level of education that has been completed successfully by each parent of the respondents and is considered as a proxy measure of parental education. Parental education was categorised into high, medium and low. The first category was labelled high and represents the respondents whose parents both have a college education or university degree. The second category (medium) represents the respondents with only one parent having a college education or university degree. The last category (low) represents all respondents with no higher educated parent.

Both indicators were analysed by gender. A sub-analysis in girls was done on the basis of a combination of both indicators. The nutrient and food habits of girls following a general education with a high parental education were compared with girls following a vocational education with a low parental education.

Statistical analyses were performed using the SPSS software, version 12.0 (SPSS, Inc., Chicago, IL, USA). Descriptive statistics used means and standard deviations for continuous data. Kolmogorov-Smirnov test was performed to test for normality. Student's *t*-tests were used to compare the means of the different groups. Mann-Whitney and Kruskal-Wallis tests were used when variables were not normally distributed. Chi-square test was used to compare proportions. The associations

between respondents' educational training, parental education and nutrient intake were investigated using generalised linear models. The following covariates were entered together: age, family status, place of residence, the number of brothers and/or sisters and the country of birth of both parents. Given the multitude of statistical tests, a P-value of <0.01 was chosen in order to reduce the probability of false-positive findings.

The study was approved by the Ethical Committee of the Faculty of Medicine and Health Sciences of the Ghent University Hospital.

Results

The characteristics of the survey population by respondents' educational level and parental education are shown in Table 1. In boys, respondents with a vocational background are less represented. In both boys and girls, the drop-out of subjects (due to non-participation or incomplete diary) was significantly higher in students from vocational education as compared to students from general education (data not shown). High parental education is proportionally most represented in boys while low parental education has the highest proportion in girls.

Table 1 also shows the proportion of overweight adolescents. In boys there are no differences between both educational levels. A higher proportion of overweight girls is found in the vocational educational level class in comparison with female adolescents with a general educational level. In a similar way, in the low parental educational level class, more overweight girls are found in comparison to girls with a high parental educational level.

In Table 2, the mean energy and macronutrient intake (expressed as a percentage of the total energy intake) are shown according to gender and educational level. In general, boys

have a higher energy intake than girls. The differences between boys and girls in terms of macronutrient intake, expressed as a proportion of energy, are small. The overall picture of energy contribution from macronutrients is very similar in boys and girls from both educational levels. Protein contributed on average 14.5 % to the energy intake, fat 36 % and carbohydrates 49 %. Girls with a general education have a significantly higher energy intake than girls following a vocational training. No other significant differences were found between 'general' and 'vocational' adolescents. Girls with a high parental education have a significantly higher energy intake. In male adolescents there were no significant differences between different parental education groups.

Table 3 shows the mean intake of selected micronutrients per day by gender and educational level. In male adolescents, no significant differences were found. Girls from a general educational level have significantly higher intakes of calcium, phosphorus, iron, magnesium, vitamin B1 and B2. Girls with a high parental education have a significantly higher relative intake of calcium, phosphorus, iron, magnesium, vitamin B1 and B2. When the relative intake of micronutrients (mg/1 000 kcal) is considered, boys from a general education level have a significantly higher intake of iron than their counterparts. Based on relative intake, girls from a general educational level have significantly higher relative intakes of calcium, phosphorus, magnesium, vitamin B1 and B2. Girls with a high parental education have a significant higher relative intake of calcium, phosphorus and vitamin B2 (data not shown).

Based on the generalised linear models, the associations between respondents' educational training, parental education and nutrient intake were investigated. Results from the univariate analyses were all confirmed (data not shown).

The daily intake of food groups, expressed in grams, for the total group of adolescents according to gender, respondents'

Table 1 Distribution of respondents' educational training and parental educational level of the study sample according to sex and percentage of overweight adolescents (boys n = 129, girls n = 212)

	Boys			Girls		
	n	Age (mean)	% excess weight ^b (%obese)	n	Age (mean)	% excess weight ^b (%obese)
Educational training respondent						
General	112	15.1	6.3 (0.0)	101	15.4	7.1 ^a (0.0)
Vocational	17	16.2	11.8 (0.0)	111	16.0	22.1 ^a (8.3)
Educational level parents ^c						
High	47	15.1	2.1 (0.0)	59	15.6	3.4 (1.7)
Medium	30	14.9	10.0 (0.0)	32	15.9	12.5 (3.1)
Low	30	15.2	10.0 (0.0)	72	15.9	26.4 (8.3)

a: Missing data from two persons

b: Percentage of respondents with a BMI higher than 25, corresponding to the sex and age specific cut off points (Cole et al, 2000)

c: Missing data due to no information about the educational level of mothers or fathers or both

Table 2 Mean (S.D.) energy intake (kcal), mean (S.D.) intake of macronutrients (in energy %) by gender, respondents' and parental education

	Educational level respondent			Parental education			
	General Mean (S.D.)	Vocational Mean (S.D.)	P – value	Low Mean (S.D.)	Medium Mean (S.D.)	High Mean (S.D.)	P – value ^a
<i>Boys (n)</i>	112	17		30	30	47	
Energy (kcal)	2634 (485.6)	2780 (689.9)	0.611	2571 (533.0)	2586 (510.5)	2650 (426.7)	0.615
Protein (E %)	14.5 (1.9)	13.3 (2.2)	0.025	14.4 (2.1)	15.0 (2.2)	14.3 (1.8)	0.259
Total Carbohydrates (E %)	48.8 (4.9)	48.1 (5.2)	0.407	49.8 (5.2)	47.8 (5.4)	49.2 (4.4)	0.235
Mono and disaccharides (E %)	23.7 (5.6)	24.6 (5.9)	0.775	25.6 (4.5)	22.8 (6.6)	23.6 (4.9)	0.064
Complex Carbohydrates (E %)	25.1 (4.3)	23.4 (3.3)	0.093	24.2 (3.8)	24.9 (4.6)	25.5 (4.4)	0.492
Total Fat (E %)	36.1 (4.5)	36.9 (4.6)	0.274	35.5 (5.1)	36.4 (4.7)	36.0 (4.0)	0.785
SFA (E %)	15.5 (2.5)	15.6 (2.6)	0.765	15.1 (2.7)	15.6 (2.3)	15.7 (2.5)	0.849
MUFA (E %)	14.6 (2.2)	14.9 (1.9)	0.323	14.2 (2.3)	14.5 (2.2)	14.6 (2.2)	0.762
PUFA (E %)	6.1 (1.6)	6.5 (1.1)	0.100	6.2 (1.4)	6.2 (1.7)	5.8 (1.5)	0.281
Alcohol (E %)	0.6 (1.5)	1.6 (3.2)	0.851	0.3 (0.9)	0.9 (2.1)	0.6 (1.2)	0.342
<i>Girls (n)</i>	101	111		72	32	59	
Energy (kcal)	2080 (369.4)	1870.2 (494.9)	0.001	1862 (462.2)	1927 (387.6)	2190 (359.3)	<0.001
Protein (E %)	15.1 (2.5)	14.7 (2.7)	0.228	14.9 (2.6)	14.6 (2.7)	15.2 (2.9)	0.601
Total Carbohydrates (E %)	49.2 (4.9)	49.2 (5.9)	0.951	48.7 (6.1)	49.8 (6.2)	49.9 (4.8)	0.311
Mono and disaccharides (E %)	24.2 (4.8)	23.9 (6.9)	0.669	23.2 (5.9)	25.2 (7.6)	25.2 (5.7)	0.221
Complex Carbohydrates (E %)	24.9 (4.5)	25.4 (4.7)	0.531	25.5 (5.2)	24.6 (4.7)	24.8 (4.3)	0.790
Total Fat (E %)	35.3 (4.6)	35.6 (5.3)	0.732	35.8 (5.6)	35.3 (5.6)	34.5 (4.2)	0.195
SFA (E %)	15.7 (2.4)	15.1 (2.4)	0.079	15.2 (2.6)	15.4 (2.4)	15.3 (2.2)	0.868
MUFA (E %)	13.9 (2.3)	14.4 (2.7)	0.128	14.6 (2.7)	14.1 (2.9)	13.4 (2.1)	0.011
PUFA (E %)	5.8 (1.3)	6.1 (1.6)	0.133	6.0 (1.5)	5.8 (1.7)	5.8 (1.3)	0.695
Alcohol (E %)	0.4 (1.0)	0.6 (1.3)	0.987	0.6 (1.5)	0.4 (0.6)	0.4 (0.7)	0.952

E % = energy percentage; SFA = Saturated Fatty Acids; MUFA = Monounsaturated Fatty Acids; PUFA = Polyunsaturated Fatty Acids
a: Difference between low, medium and high

and parental education is presented in Table 4. In male adolescents, boys with a general educational level have a significantly higher intake of water. No differences were observed when boys of different parental education groups were compared. In all different sub-groups, the intakes of fruit, vegetables and water were below the recommendation of respectively 250 g/day, 300 g/day and 1500 ml/day, while the intake of meat was above the recommended 100 g/day.

In girls, the differences were even more pronounced. Girls with a general educational level have a higher intake of fruit, vegetables, breakfast cereals, cheese and milk and dairy products, while their intake is significantly lower for soft drinks. Girls with a high parental education have a higher intake of cake and biscuits as well as milk and dairy products. The same analyses were executed based on users only. In boys, no significant differences were observed. In girls with a general educational level a significantly higher intake of fruit, vegeta-

bles, milk and dairy products and a significantly lower intake of soft drinks was found. In the consumer only analyses in female adolescents according to parental education, girls with a high parental education have a significant higher intake of bread, cake and biscuits and milk and dairy products.

In comparison with the recommendations a similar trend as for boys was found.

The total Variety Score was higher in boys following a general educational training. On food group level, the Variety Score was not significantly different. Based on the parental education, there is no significant difference in boys. The total Variety Score was higher in girls following a general educational training. Girls with a general educational training have a significantly higher Variety Score for fruit, vegetables, breakfast cereals, cheese, milk and dairy products, cake and biscuits, sugar and confectionery and a significantly lower Variety Score for soft drinks. Girls with a high parental educa-

Table 3 Mean micronutrient intake (S.D.) (in mg) by gender, respondents' and parental educational level, Belgian recommendations are shown for comparison

Belgian Recommend Daily Allowance	Educational level respondent			Parental education			P – value ^a
	General	Vocational	P – value	Low	Medium	High	
	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)	
<i>Boys (n)</i>	112	17	30	30	30	47	
Calcium	912.50 (337.53)	919.30 (431.17)	831.36 (333.72)	943.62 (335.35)	956.06 (355.17)	0.231	
Phosphorus	1479.03 (349.60)	1431.08 (417.77)	1387.33 (333.11)	1465.69 (344.62)	1512.89 (340.76)	0.453	
Total Iron	13.61 (2.92)	12.32 (2.66)	12.98 (2.97)	13.03 (2.67)	13.92 (3.03)	0.392	
Magnesium	272.44 (68.97)	263.42 (76.30)	256.10 (63.38)	265.85 (75.14)	286.73 (67.09)	0.135	
Vitamin B1	1.50 (0.60)	1.69 (1.48)	1.43 (0.50)	1.59 (0.93)	1.64 (0.92)	0.711	
Vitamin B2	1.69 (0.55)	1.51 (0.61)	1.68 (0.68)	1.66 (0.49)	1.71 (0.49)	0.630	
Vitamin C	81.46 (48.05)	90.61 (55.54)	84.38 (41.10)	77.13 (35.73)	87.53 (58.69)	0.804	
<i>Girls (n)</i>	101	111	72	32	59		
Calcium	947.23 (358.03)	675.62 (290.79)	692.42 (327.82)	824.40 (339.78)	1017.51 (358.78)	< 0.001	
Phosphorus	1300.80 (367.31)	1032.98 (330.18)	1048.55 (352.61)	1102.93 (276.92)	1417.76 (374.89)	< 0.001	
Total Iron	10.75 (2.66)	9.41 (2.76)	9.52 (2.50)	9.85 (3.09)	11.29 (2.61)	< 0.001	
Magnesium	237.96 (64.47)	192.74 (60.46)	195.40 (63.72)	206.11 (53.02)	254.59 (56.99)	< 0.001	
Vitamin B1	1.35 (1.13)	1.01 (0.60)	1.02 (0.52)	1.13 (0.70)	1.41 (1.22)	< 0.001	
Vitamin B2	1.51 (0.57)	1.16 (0.55)	1.15 (0.58)	1.34 (0.53)	1.63 (0.55)	< 0.001	
Vitamin C	84.36 (44.71)	72.69 (47.40)	72.49 (40.67)	86.03 (49.29)	88.29 (51.79)	0.136	

a: Difference between low, medium and high

tion have a significantly higher total Variety Score and food group specific Variety Score for cake and biscuits and milk and dairy products (data not shown).

Table 5 shows energy, macro-, micronutrient and food group intake of female adolescents according to the combination of their own education and the parental education. Girls following a general educational training with a high parental education have a significantly higher intake of energy, calcium, phosphorus, magnesium, vitamin B1 and B2, bread, cake and biscuits, breakfast cereals, milk and dairy products and sugar and confectionery compared to girls following a vocational educational training with a low parental education. More detailed data show that girls from a general education with a high parental education consume significantly more low-fat milk products, skimmed milk products and low-fat fresh fish than their counterparts. Girls from a vocational education with a low parental education consume significantly more high-fat meat (data not shown in table).

Discussion

This study provides data on estimated nutrient and food intake in a sample of Belgian adolescents, allowing an examination of social variations in the dietary habits. It is – to our knowledge – for the first time that a quantification of nutrient and food intake in different social groups in Belgian adolescents has been undertaken. However, an important disadvantage of the present study is its reliance on an existing database which was initially not established to analyse the dietary habits in relation to social differences. Particularly, the limited number of boys in vocational education causes a lack of power in the analyses. The originally selected sample size contained only 56 boys who follow a vocational education. This is explained by the study design where schools with vocational education were less well represented. It is not clear in what way this may have affected the results of the study but it does not infringe on the value of the

Table 4 The median intake of food groups (in grams) of the total group of adolescents according to gender, respondents' and parental education (Between brackets percentage users per sub-group)

	Educational level respondent		P-value	Parental education			P-value ^a
	General	Vocational		Low	Medium	High	
<i>Boys (n)</i>	112	17		30	30	47	
Fruit	68.93 (92)	34.29 (94)	0.097	82.79 (93)	59.79 (93)	63.86 (89)	0.493
Vegetables	118.11 (100)	106.29 (100)	0.179	109.46 (100)	113.93 (100)	132.14 (100)	0.263
Potatoes	137.29 (100)	111.14 (100)	0.533	143.00 (100)	133.79 (100)	117.86 (100)	0.205
Bread	190.00 (100)	167.86 (100)	0.554	154.29 (100)	191.57 (100)	195.00 (100)	0.058
Fruit juices	83.57 (76)	28.57 (59)	0.635	103.57 (80)	108.57 (73)	81.43 (75)	0.990
Soft drinks	403.57 (92)	466.69 (94)	0.423	459.06 (93)	378.21 (97)	328.57 (87)	0.233
Water	392.11 (96)	47.43 (71)	0.003	220.36 (83)	445.57 (97)	360.14 (98)	0.215
Cake & biscuits	33.29 (93)	19.29 (71)	0.166	32.29 (87)	30.79 (97)	35.57 (94)	0.974
Poultry	21.43 (75)	28.57 (88)	0.242	23.21 (73)	22.86 (70)	21.43 (81)	0.967
Breakfast cereals	4.29 (57)	.00 (29)	0.061	4.29 (57)	.21 (50)	7.14 (62)	0.597
Cheese	18.14 (92)	19.00 (88)	0.681	13.39 (90)	27.75 (90)	19.00 (94)	0.351
Milk & milk products	234.64 (99)	226.71 (94)	0.232	267.54 (100)	230.29 (100)	234.29 (98)	0.882
Fish	14.29 (65)	2.14 (53)	0.050	14.29 (70)	7.07 (53)	19.29 (68)	0.584
Meat & meat products	139.43 (100)	148.93 (100)	0.931	146.96 (100)	158.32 (100)	120.71 (100)	0.036
Sugar, confectionery, sweet fillings and sweet sauces	36.75 (99)	39.43 (100)	0.582	31.82 (100)	27.11 (100)	47.86 (100)	0.028
Fats, oils and savoury sauces	45.57 (100)	57.57 (100)	0.048	48.36 (100)	46.93 (100)	42.36 (100)	0.798
<i>Girls (n)</i>	101	111		72	32	59	
Fruit	110.07 (97)	77.43 (93)	0.002	79.82 (93)	95.18 (100)	117.14 (97)	0.149
Vegetables	106.14 (100)	80.43 (100)	0.007	91.25 (100)	102.89 (100)	104.71 (100)	0.156
Potatoes	94.00 (100)	90.00 (98)	0.976	96.43 (100)	90.89 (100)	93.14 (100)	0.718
Bread	144.43 (100)	139.00 (99)	0.083	134.71 (99)	137.64 (100)	158.21 (100)	0.013
Fruit juices	121.43 (83)	82.14 (72)	0.031	94.00 (83)	108.57 (72)	121.43 (81)	0.763
Soft drinks	92.86 (77)	204.29 (93)	<0.001	166.43 (92)	161.79 (88)	142.86 (76)	0.128
Water	482.14 (98)	371.43 (97)	0.014	351.43 (99)	432.25 (100)	441.36 (95)	0.429
Cake & biscuits	27.14 (93)	22.71 (89)	0.014	21.07 (92)	25.00 (94)	36.86 (95)	0.003
Poultry	18.86 (72)	17.86 (64)	0.646	17.61 (61)	17.14 (63)	19.71 (81)	0.370
Breakfast cereals	4.29 (55)	.00 (30)	<0.001	.00 (33)	.89 (53)	4.29 (54)	0.017
Cheese	29.29 (97)	17.86 (90)	0.005	17.86 (93)	24.57 (97)	30.00 (95)	0.116
Milk & milk products	245.36 (99)	124.43 (93)	<0.001	117.50 (93)	151.54 (94)	352.86 (100)	<0.001
Fish	7.29 (63)	10.71 (66)	0.804	8.14 (65)	8.36 (69)	17.07 (66)	0.415
Meat & meat products	83.21 (97)	98.79 (100)	0.301	102.50 (100)	83.54 (100)	78.50 (97)	0.119
Sugar, confectionery, sweet fillings and sweet sauces	27.86 (100)	25.29 (99)	0.069	23.57 (100)	26.64 (100)	32.86 (100)	0.012
Fats, oils and savoury sauces	31.57 (100)	32.79 (100)	0.579	32.18 (100)	31.39 (100)	34.64 (100)	0.618

a: Difference between low, medium and high

within-girl analyses. On the other hand, the strength of the study is the use of a 7-day estimated food record.

In this study, the social stratification within the adolescent population is based on two indicators, namely the respondents' educational training and the parental education. The classification of the respondents' educational level was based on the school register. In the current study there could be a selection bias induced because of the higher drop-out rate of male subjects from the category 'vocational'. Therefore, the conclusions are focussed on the female adolescents. The parental education was reported by the adolescents. The validity

of the adolescents' report of parental education can be questioned. A Norwegian study found that the strength of agreements between adolescents' and parents' reports of parental education was rather weak (Lien et al. 2001). This could be a limitation of the study. Nevertheless, cross-study comparisons are difficult, owing to differences in the measurement of lifestyle behaviours, differences in classification of the different European education systems, differences in the dietary assessment methods or differences in the study samples. Based on the anthropometrical data the overall nutritional status could be determined. The proportion of overweight

Table 5 Mean energy intake (kcal), mean contribution to energy of macronutrients (E %), relative micronutrient intake (mg/1000 kcal) and mean food group intake in female adolescents according to the respondents' education and parental education

	Educational level respondent and parental education		P – value
	General educational level and high parental education	Vocational educational level and low parental education	
	Mean (S.D.)	Mean (S.D.)	
<i>N</i>	47	56	
Energy (kcal)	2210 (370.2)	1807 (485.5)	<0.001
Protein (E %)	15.2 (2.4)	14.8 (2.5)	0.292
Total Carbohydrates (E %)	50.2 (4.3)	49.2 (6.2)	0.255
Mono-disaccharides (E %)	25.2 (4.9)	23.1 (6.1)	0.045
Complex Carbohydrates (E %)	24.9 (4.3)	26.2 (4.9)	0.311
Total fat (E %)	34.5 (3.9)	35.4 (5.8)	0.181
SFA (E %)	15.4 (2.2)	14.9 (2.7)	0.560
MUFA (E %)	13.3 (1.9)	14.4 (2.9)	0.012
PUFA (E %)	5.8 (1.2)	6.0 (1.4)	0.408
Calcium (mg/1000 kcal)	481.83 (154.23)	349.86 (124.54)	<0.001
Phosphorus (mg/1000 kcal)	670.20 (183.59)	551.11 (114.91)	<0.001
Total Iron (mg/1000 kcal)	5.35 (1.29)	5.40 (1.41)	0.832
Magnesium (mg/1000 kcal)	120.43 (26.05)	106.96 (24.38)	0.005
Vitamin B1 (mg/1000 kcal)	0.71 (0.70)	0.52 (0.19)	0.010
Vitamin B2 (mg/1000 kcal)	0.79 (0.27)	0.59 (0.20)	<0.001
Vitamin C (mg/1000 kcal)	40.93 (24.95)	41.63 (24.99)	0.952
Fruit	133.02 (105.78)	97.87 (83.57)	0.083
Vegetables	121.53 (61.82)	100.10 (55.39)	0.062
Potatoes	104.56 (60.68)	106.36 (59.55)	0.830
Bread	168.19 (51.23)	135.33 (50.72)	0.004
Fruit juices	165.60 (166.46)	126.04 (145.76)	0.322
Soft drinks	164.53 (208.63)	251.14 (224.17)	0.019
Water	520.23 (362.17)	410.53 (337.09)	0.095
Cake & biscuits	42.38 (29.03)	24.20 (19.99)	<0.001
Poultry	24.99 (20.62)	24.89 (26.13)	0.553
Breakfast cereals	9.78 (14.45)	3.96 (7.84)	0.001
Cheese	29.09 (21.17)	21.07 (19.40)	0.026
Milk & milk products	403.91 (273.78)	154.60 (187.49)	<0.001
Fish	17.95 (19.45)	14.02 (15.40)	0.463
Meat & meat products	86.29 (46.49)	95.06 (50.05)	0.219
Sugar, confectionery, sweet fillings and sweet sauces	40.91 (28.53)	26.76 (17.45)	0.004
Fats, oils and savoury sauces	36.43 (17.45)	33.60 (17.45)	0.433

and obese adolescents is higher in girls with a vocational educational level and in girls with a low parental education. No differences were found in boys. The higher prevalence of obesity in subjects with a lower social status is in line with other Belgian studies (De Spiegelaere et al. 1998; Stam-Moraga et al. 1999). Based on school health files of 2607 children, social inequality – based on parents' professions and the status of their activity – in the prevalence of obesity in Belgian girls was found (De Spiegelaere et al. 1998). A similar conclusion was found in adults, based on the Belgian Interuniversity Research on Nutrition and Health. Stam-

Moraga and co-workers found that compared to the lowest educated women, the proportion of obese was significantly lower in higher education groups. Results from neighbouring countries confirm that the prevalence of obesity is highest in lower social classes (Hulshof et al. 2003; Klein-Platat et al. 2003; Smith & Brunner 1997).

Based on the findings about energy intake and macronutrient intake almost no differences were found between subjects according to their social status. In boys, with the exception of significant differences in protein intake according to the respondents' educational level, no differences were found. In

girls, differences in monounsaturated fatty acids and energy intake were found. One could raise the question whether the observed difference in energy intake is real or whether it is the consequence of underreporting. The mechanism of under- and overreporting could play a role in our study but due to the lack of complementary data (e.g. physical activity degree) and the unavailability of a valid indicator to detect adolescent under- and over-reporters, it remains difficult to deal with this issue. However, in the current study the lowest mean ratio of energy intake to estimated basal metabolic rate was observed in girls with a lower educational level (EI/BMR 1.28 for girls with a low educational level versus 1.44–1.52 for girls with a high educational level). The current results indicate that the influence of underreporting might be overrepresented in girls belonging to the low social class. In boys, no differences were found.

Some studies concluded that there is not much evidence of energy and macronutrient differences. Low social classes have been described as efficient purchasers of calories and nutrients per unit cost. Nevertheless, the intake of micronutrients is usually much lower in the less advantaged (Dowler et al. 1997; Nelson 2000). The current study found that girls who follow a vocational education and/or with a low parental education were associated with a lower intake of most minerals and vitamins both in absolute amounts and expressed per 1000kcal. Total iron intake is an exception on the above finding. Similar results were found in British and Spanish adolescents, mainly in girls (Nelson 2000; Tur et al. 2004). These observations are directly related to health outcomes, according to British data that pointed out that micronutrient and antioxidant intakes have the most likely nutritional influences on health inequalities (Smith & Brunner 1997).

In the current study social class differences were more pronounced on the food level than on the nutrient level. The findings about the higher consumption of cheese in subjects with a higher educational level are in line with the conclusions of a systematic review of social differences in food habits in Europe (Sanchez-Villegas et al. 2003). There was not enough evidence to support that milk intake is different according to educational levels (Sanchez-Villegas et al. 2003). A survey from the Netherlands confirmed the current results about cheese and milk and dairy products intake (Hulshof et al. 1991). In our study, the consumption of soft drinks is higher in subjects with a low educational level or a low parental education. These findings are supported by other surveys (Sweeting et al. 1994; Vereecken et al. 2004). The average consumption of fruit and vegetables was higher in our subjects belonging to the higher educational groups. Previous studies have shown that the intakes of fruit and vegetables are significantly associated with the educational level (Hulshof et al. 2003; Tur et al. 2004; Vereecken et al. 2004). A systematic review of

socioeconomic differences in food habits in Europe showed that, particularly in Northern and Western European countries, a higher social status is associated with a higher consumption of fruit and vegetables (Irala-Estevez et al. 2000). The current results are in agreement with these previous studies, mainly in girls. Subjects with a higher educational level tend to be more aware of the characteristics of a healthy diet (Margetts et al. 1997) and have more knowledge about food items which are healthier (Hjartaker & Lund 1998; Margetts et al. 1997; Martinez-Gonzalez et al. 1998). To the extent that better awareness and knowledge are translated into healthier dietary habits, this might partly explain the differences in food consumption between social classes. On the other hand, poverty and lower income also may restrict access to healthy food (Dowler & Dobson 1997; James et al. 1997). Nevertheless, the intake of fruit and vegetables of the total population, irrespective of social class, is below the national recommendations (Vlaams Instituut voor Gezondheidspromotie 2003).

Studies have shown that dietary variety is associated with increased consumption of fruit and vegetables (Drewnowski et al. 1997) and decreased cardiovascular risk factors (Hsu-Hage & Wahlqvist 1996); dietary variety has been found to be inversely associated with age-adjusted risk of mortality (Kant et al. 1995). Based on the results of the Variety Score, girls from the general educational level consume a larger variety of more healthy food groups (fruit, vegetables), although they consume also a greater variety of cake and biscuits, sugar and confectionery but less of soft drinks. Similar results were found when parental education was used as indicator. Based on the current findings girls with a higher educational level consume a more varied diet that can favourably affect health. In this study, as in others (Dynesen et al. 2003; Friel et al. 2003; Hjartaker & Lund 1998), respondents' educational training seems to be a relevant indicator of social status explaining differences in dietary habits. Adolescents following a general educational training or with a high parental education consume more healthy foods, have a higher intake of micronutrients and a higher Variety Score. Based on these findings, baseline data is now provided for health promotion campaigns. More specific, it is known that nutritional education is important in all different educational options in secondary schools (American Dietetic Association 2003; Perez-Rodrigo & Aranceta 2001). But at the same time the results of the current study show that segmenting and targeting is important in health promotion. Different educational options need another approach and message content to deal with health promotion.

In general, one could establish that the total population does not reach the national recommendations (Nationale Raad voor de Voeding 1996; Vlaams Instituut voor Gezondheidspromotie

tie 2003), but the situation is worst in lower social classes. Although the sample is small, these findings demonstrate trends which highlight the need for continued health promotion efforts to improve the diet of adolescents in all social classes in Belgium but particularly in lower social groups. Therefore public authorities trying to minimise social inequalities in health need regularly updated information about the social differentiation of health-related lifestyles. Social differences in dietary habits change over time (Prättälä et al. 1992) and it is important to be aware not only of the current differences but also of any subsequent change in the future.

Conflict of interest

The authors state that there are no conflicts of interest.

Zusammenfassung

Bildung und Ernährungsmuster Adoleszenter, gemessen anhand von siebentägigen Ernährungsprotokollen

Fragestellung: Diese Studie untersuchte die Beziehungen zwischen Ernährungsgewohnheiten und sozio-ökonomischer Schicht bei Adoleszenten (in Gent, Belgien).

Methodik: Die Stichprobe bestand aus zufällig ausgewählten Adoleszenten (13–18 Jahre), die teilgenommen hatten an Ernährungsuntersuchungen unter Benützung eines sieben-tägigen geschätzten Ernährungsprotokolls. Als Indikatoren des sozio-ökonomischen Status wurde die Ausbildung der Befragten (allgemeine/berufliche) und die Ausbildung der Eltern (niedrig/mittel/hoch) gebraucht.

Ergebnisse: Bei den Mädchen kommt Übergewicht öfter vor, wenn sie selbst eine Berufsausbildung oder ihre Eltern eine einfache Ausbildung genossen haben. Bei Mädchen mit einer allgemeinen Ausbildung, deren Eltern eine hohe Ausbildung haben, war die Energie- und Mikronährstoffeinnahme höher. Die Mädchen mit einer allgemeinen Ausbildung haben eine wesentlich höhere Obst-, Gemüse-, Getreide-, Käse- und Milcheinnahme, während sie erheblich weniger Softgetränke konsumieren. Mädchen, deren Eltern eine hohe Ausbildung haben, konsumieren mehr Kuchen und Gebäck und mehr Milch und Milchprodukte. Bei den Jungen mit verschiedenen Ausbildungsniveaus waren nur kleine Unterschiede in Mikronährstoff- und Nahrungseinnahme zu finden. Bei den Adoleszenten mit einer allgemeinen Ausbildung beiderlei Geschlechts war die Diät abwechslungsreicher.

Schlussfolgerungen: Die Resultate machen Tendenzen sichtbar, die die Notwendigkeit unablässiger Anstrengungen für eine bessere Diät von Adoleszenten, insbesondere bei niedrigem sozio-ökonomischem Status unterstreichen.

Matthys C, De Henauw S, Maes L, et al.
Adolescents' education and their diet recorded by 7-day food records

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Résumé

Objectif: Analyser les liens entre le niveau socio-économique et les habitudes alimentaires des adolescents (Gand, Belgique).

Méthodes: Une enquête alimentaire a été menée auprès d'un échantillon aléatoire de 341 adolescents (13–18 ans) à l'aide d'un relevé alimentaire sur 7 jours. Le type d'enseignement (général/professionnel) suivi par les adolescents et le niveau d'éducation de leurs parents ont été utilisés comme indicateurs du statut socio-économique.

Résultats: La prévalence de la surcharge pondérale est plus élevée chez les adolescentes qui suivent une filière professionnelle ou dont les parents ont un niveau d'éducation bas. La consommation énergétique et de micronutriments est plus élevée chez les filles de l'enseignement général et chez celles dont les parents ont un niveau d'éducation élevé. La consommation de fruits de légumes, de céréales, de fromages, de lait et de produits laitiers est significativement plus élevée chez les filles issues de l'enseignement général. De plus, ces dernières consomment significativement moins de boissons sucrées. Les filles dont les parents ont un niveau d'éducation élevé consomment davantage de biscuits, de laits et de produits laitiers. Chez les garçons, la consommation de micronutriments et d'aliments diffère peu selon des niveaux d'éducation. Chez les deux sexes, l'alimentation des adolescents suivant l'enseignement général est plus diversifiée.

Conclusion: Les résultats présentent des tendances qui soulignent la nécessité d'efforts persistants afin d'améliorer l'alimentation des adolescents, et ce plus particulièrement dans les couches socio-économiques faibles.

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Address for correspondence

Christophe Matthys, MSc
Department of Public Health
Ghent University
UZ – 2 Blok A
De Pintelaan 185
B-9000 Ghent
Belgium
Tel.: +32 9 240 37 18
Fax: +32 9 240 49 94
e-mail: Christophe.Matthys@UGent.be



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