



# Dietary habits during adolescence—results of the Belgian Adolux Study

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**Objective of the present study:** To analyse the usual dietary habits of Belgian adolescents from a high cardiovascular risk population.

**Methods:** A food frequency questionnaire (57 items) was administered to the whole sample. Complementary questions specified some types of food (eg fat content). A subgroup of 234 adolescents gave detailed information on portion size (picture book and food samples).

**Setting:** Twenty-four secondary schools in the Belgian province of Luxembourg.

**Subjects:** A total of 1526 adolescents (12–17 y) selected by a multiclustered stage sampling (participation: 83.6%).

**Results:** Respectively 46% and 60% of the adolescents did not eat fruit and vegetables daily. Most of the adolescents (72%) consumed at least one dairy product daily. The frequent consumption of chocolate and French fries indicated the strong cultural influence on dietary habits while imported foods (like hamburgers) had little success. One-third of the adolescents (33%,  $n = 509$ ) drank alcohol at least once a week and this proportion rose to 57% in the oldest age group. Boys and girls differed significantly in their diet, with girls choosing healthier foods. Dietary habits, in particular drinking habits, differed also significantly between education levels, assessed by the learning option of the participants. The semi-quantitative questionnaire showed that two-thirds of the adolescents had a lipid intake (mainly saturated fatty acids) which exceeded 35% of the total caloric intake. Complex carbohydrates represented less than half of the total carbohydrates intake.

**Conclusion:** The study of the diet of Belgian adolescents confirmed the strong influence of tradition, in particular on the consumption of high fat content foods. The promotion of healthy diet in adolescents should consider the cultural influence, even for this young age group.

**Descriptors:** adolescence; diet; food habits

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## Introduction

Cardiovascular risk factors have been considered for a long time as a specific adult health problem. However, adult dietary habits are determined by familial and cultural factors rooted in childhood and adolescence. Moreover, the detection of atherosclerotic lesions early in life and their relationship with the pre-mortem cardiovascular risk factors level have been demonstrated (Strong *et al*, 1994). Both elements explain the relevance of research on the usual diet of adolescents from a high cardiovascular risk area. In this regard, the Belgian province of Luxembourg has a high incidence of cardiovascular deaths and was selected as a collaborative MONICA centre (MONItoring of trends in CARdiovascular diseases; Brohet *et al*, 1988;

Institut National Belge des Statistiques, 1993). Consequently, this province was likewise chosen to conduct a study of cardiovascular risk factors in adolescents. The present paper describes their usual dietary habits.

## Subjects and methods

### Survey population

The survey was conducted in the Belgian province of Luxembourg. This rural area has a population of 240 000, with 7.8% aged 12–17 y ( $n = 18 800$ ). The sample was recruited by a multiclustered sampling technique, for logistical reasons and to increase the participation of the adolescents. First, 24 secondary schools of the province were randomly selected (out of 48 schools). Secondly, a stratification according to the learning option ascertained that all social backgrounds were represented. Belgian students have the choice between classical learning options (ie mainly theoretical lessons) or technical ones (ie from 25% to 75% practical lessons). A learning option was therefore allocated to each school with probability

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proportional to the distribution registered in the province. Finally, classes were randomly selected as final cluster units. Information letters were sent to directors, parents and adolescents. The directors, the students and the parents were asked to give their written consent. Written consents were obtained for all participants. In case of refusal (from the adolescent or his parents), a short questionnaire was completed in order to compare the refusers' characteristics with the participants' ones. The inclusion criteria were based on age (12–17 y) and on the eligibility criteria for MONICA studies, ie Belgian nationality and residence in the province. Older and foreign adolescents could participate to encourage the participation in the classes and to avoid adverse reactions against the study. Their questionnaires were thereafter excluded from the analysis.

The eligible population included 1825 subjects. A response rate of 83.6% resulted in a total of 1526 participants—784 girls and 742 boys (Table 1). The age distribution of the sample was homogeneous in the middle age groups with fewer participants in the youngest and oldest ones. Detailed information on portion sizes was recorded by interview in a random subgroup of 234 adolescents. More boys than girls were interviewed but the age distribution was similar to the sample one (Table 1). Three-hundred eligible subjects did not take part in the study. One-third ( $n=108$ ) were not at school during the survey and 192 subjects refused to collaborate. The non-participants' gender distribution was balanced and their age distribution was similar to that of the participants. The size of the middle age group was the biggest and this distribution was strongly influenced by a grouping of refusers in some classes. There was a balance between boys and girls and the lowest non-participation rate was found in the youngest age group. Their reasons for refusing were mainly a recent medical examination ( $n=31$ ), missing the appointment ( $n=24$ ), and a refusal from the parents ( $n=19$ ). Ethical approval was secured beforehand.

### Methods

Six interviewers collected the data in the schools. Five of them were graduated from high school (medical option) and the last one had a university degree. Three manuals guaranteed the standardisation of the data collection, ie a methodology manual, a coding manual and a manual specifically designed for the interviewers (including the

description of the survey, the field organisation and the data collection procedures). The interviewers attended training sessions at the beginning and in the middle of the survey to ensure the standardisation of the data collection.

Information on the usual dietary habits was collected from January to May 1995 with an auto-administered food frequency questionnaire. The practicability, reproducibility and ability of this instrument to assess the usual intakes guided the choice of this method (Franck *et al*, 1992; Jain *et al*, 1996). The questionnaire included 57 items representative of the usual diet in Belgian adolescents. Most foods were selected using the consumer panel published by the Belgian Institut Economique Agricole (1991), eg meat, fish, delicatessen meats, cheese, fruits and vegetables. The choice of the other items was determined with the help of a dietician. Eight frequencies were possible for each food, ie 'seldom or never', 'once a month', 'twice or three times a month', 'once a week', 'twice to five times a week', 'once a day', 'twice or three times a day', 'four times a day'. Complementary questions detailed some food types, mainly for their fat content. The questionnaire was tested and adapted after a pilot study with adolescents ( $n=23$ ). Quantitative information on portion sizes was collected in a subsample of respondents using a standard picture book and food samplings.

Three food composition tables were used, ie the table from Souci *et al* (1994), the Belgian table from the Paul Lambin Institute (1995) and the Belgian food composition table NUBEL (1995) (for cooked preparations). The analysis focused on energy, proteins, carbohydrates, fibre, alcohol and lipids (ie cholesterol, saturated, monounsaturated and polyunsaturated fatty acids).

### Statistical analyses

Statistical analyses were performed using the SAS<sup>®</sup> statistical package (SAS Institute Inc., 1994). Descriptive statistics used means and standard deviations for continuous data. Tests for normality were performed and skewed values were mathematically transformed to fulfill the normality assumption. Qualitative data were summarised using frequencies and illustrated by histograms. *t*-Tests were applied afterwards for comparing means of two subgroups, whereas an analysis of variance was used for the comparison of more than two subgroups. Chi-squared tests tested the association between categorical variables.

**Table 1** Participants and non participants: age and gender distribution (number and percentage)

Age	Participants		Non-participants		Subgroup interviewed on portion sizes	
	Boys	Girls	Boys	Girls	Boys	Girls
12 y	86 (12%)	96 (13%)	12 (8%)	5 (3.5%)	17 (13%)	11 (11%)
13 y	155 (21%)	145 (18.5%)	21 (14%)	17 (11.5%)	24 (19%)	22 (21%)
14 y	138 (18.5%)	119 (15%)	35 (24%)	26 (17%)	27 (21%)	16 (15%)
15 y	130 (17%)	147 (18.5%)	22 (15%)	33 (22%)	25 (19%)	24 (23%)
16 y	139 (18.5%)	139 (17.5%)	41 (28%)	41 (27%)	20 (15.5%)	17 (16%)
17 y	94 (13%)	138 (17.5%)	17 (11%)	29 (19%)	16 (12.5%)	15 (14%)
All	742 (100%)	784 (100%)	148 (100%)	151 (100%)	129 (100%)	105 (100%)

## Results

### *Dietary habits of the whole population: results of the food frequency questionnaire*

The consumption of fruit, vegetables and cereals was first analysed. Some 59% ( $n = 903$ ) of the adolescents did not eat vegetables (raw or cooked) daily and 17% ( $n = 258$ ) of the participants ate vegetables less than once a week. Fruit consumption was more frequent with 54% of the population ( $n = 825$ ) eating at least one fresh fruit a day. However, 10% of the adolescents ( $n = 148$ ) consumed fruit less than once a week. A quarter of the adolescents ate cereals daily (28%,  $n = 425$ ). A similar proportion of participants (28%,  $n = 425$ ) never ate them.

The analysis of the dairy products consumption focused on their frequency but also on their fat content (Table 2). Seventy-two percent of the adolescents (72%,  $n = 1099$ ) reported the daily consumption of at least one dairy product. Milk (or drinking chocolate), yoghurt and cheese were consumed daily, respectively by 56.3%, 23.2% and 32.9% of the respondents. Half-skimmed milk was the first

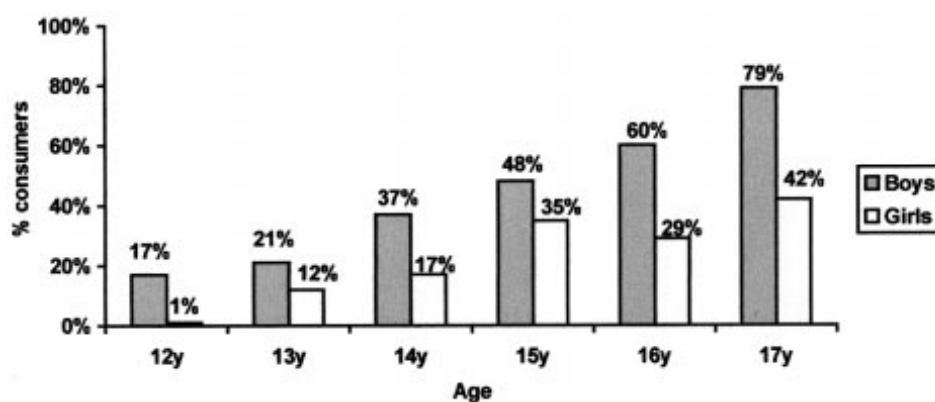
variety chosen by the participants (45%,  $n = 690$ ). Thirty-five percent ( $n = 533$ ) preferred full-cream milk and skimmed milk was seldom consumed (by 2.5% of the respondents,  $n = 39$ ). Twelve percent ( $n = 194$ ) never drank milk and 4.5% ( $n = 70$ ) did not know the type they usually drink. The distribution was reversed for yoghurt varieties. Half of the adolescents (48%,  $n = 717$ ) preferred full-cream products whereas one-third of the participants ( $n = 466$ ) chose skimmed products. The preferred spread on bread was butter (36%,  $n = 550$ ). Fifteen percent usually consumed standard margarine (15%,  $n = 238$ ), the same proportion used low-fat margarine ( $n = 226$ ) and 25% of adolescents ( $n = 384$ ) did not spread any fat on bread. The gender differences in the consumption of skimmed products were also analysed. The type of milk was similar in both genders. Differences appeared for yoghurt, with 57% of the boys ( $n = 421$ ) and only 40% of the girls ( $n = 296$ ) choosing full-cream varieties. Butter consumption was higher for boys (39%,  $n = 289$  vs 33%,  $n = 261$  for girls). Girls chose low-fat margarine twice as often (20%,  $n = 152$  vs 10% for boys,  $n = 74$ ).

The consumption of meat and eggs was studied in relation with the cardiovascular risk profile. Two-thirds of the adolescents (66%,  $n = 1011$ ) ate meat at least once a day, without any significant difference between boys and girls. Only 1.1% ( $n = 17$ ) of the respondents were vegetarians. Beef was the most frequently consumed meat, followed by pork (including sausages) and poultry. One-third of the sample (32.2%,  $n = 490$ ) ate fish weekly. The mean weekly consumption of eggs was moderate, respectively equal to 2.1 units for boys and 1.5 units for girls.

Consumption of potato chips, hamburgers and French fries was studied in particular, as they are high fat-content foods usually appreciated by young consumers (Table 2). Belgian tastes influence the adolescents' diet as three-quarters of the sample consumed French fries at least once a week (77%,  $n = 1171$ ). However, 'imported tastes' such as hamburgers, chips and crisps had much less success. Four out of five adolescents ate hamburgers less than once a week (82%,  $n = 1246$ ). Chocolate is also a

**Table 2** Consumption of selected items: differences between gender

Food (frequency)	Boys	Girls	P-value for the difference
Dairy products (daily)	73% (543)	71% (556)	> 0.05
Milk (daily)	60% (447)	53% (412)	0.001
Cheese (daily)	31% (229)	35% (273)	> 0.05
Yoghurt (daily)	22% (163)	24% (191)	> 0.05
Fruit (daily)	47% (346)	61% (479)	< 0.001
Vegetables (daily)	35% (258)	46% (365)	< 0.001
Cereals (daily)	29% (214)	27% (211)	> 0.05
Meat (daily)	69% (500)	66% (511)	> 0.05
Fish (weekly)	31% (227)	34% (263)	> 0.05
Eggs (mean $n$ /weekly)	2.1	1.5	< 0.001
French fries (weekly)	80% (596)	73% (575)	0.001
Hamburgers (weekly)	20% (147)	17% (133)	> 0.05
Chocolate (daily)	28% (212)	21% (166)	0.001
Sweetmeats (daily)	21% (158)	19% (147)	> 0.05
Lemonade (daily)	43% (317)	25% (199)	< 0.001



**Figure 1** Consumption of alcohol: % adolescents who drink alcohol at least once a week.

well-established Belgian tradition. A quarter of the respondents ate it daily (25%,  $n=378$ ), while other popular sweets (eg Mars<sup>®</sup>, Raider<sup>®</sup>) were picked less often.

The analysis of drinking habits showed that lemonade had the same success as fruit juice. The daily consumption of both drinks was similar, 34% of the sample. The consumption of alcohol was studied in detail as it is a growing problem in youths. One-third of the adolescents consumed alcohol, mainly beer, at least once a week (33%,  $n=509$ ). The trend with age showed that the proportion of teenagers who drank alcohol weekly increased steadily to reach 57% ( $n=133$ ) in the 17-y-old group (Figure 1). Boys and girls showed marked differences in their alcohol habits. Forty-three percent of the boys (43%,  $n=319$ ) and 24% of the girls ( $n=190$ ) drank at least once a week, all ages combined.

Boys and girls exhibited also a different eating pattern for the consumption of healthy or unhealthy foods. Table 2 shows the difference between boys and girls for the consumption of representative frequently consumed foods, ie dairy products, fruit, vegetables, cereals, meat, fish, eggs, French fries, hamburgers, chocolate, sweets and lemonade. All but one difference was significant (at the  $P=0.05$  level), showing that girls pay more attention to the quality of their diet. This observation was confirmed by a higher prevalence of butter consumers in the group of boys (39% vs 33% for girls,  $P$  for the difference = 0.02). The consumption of full-cream milk showed the same trend but the results were non-significant (37% for boys vs 33% for girls,  $P > 0.05$ ). The pattern of consumption was also studied according to age for the main categories of foods described above. The daily consumption of dairy products did not change significantly between 12 and 17y except for the daily consumption of milk, which decreased significantly between these age groups (ie from 46% to 41%,  $P < 0.05$ ). The consumption of fruits and vegetables showed the same trend, in particular for the last category (respectively from 55% to 52% and from 44% to 35%,  $P < 0.01$ ). The pattern of consumption for the other foods did not change significantly with age even if some trends were observed (eg and increase in lemonade consumption).

Differences in dietary habits were also studied in relation with social class, ie the participants' learning option (either classical or technical curriculum). Table 3 shows the consumption of some foods mentioned above. In general, the students from technical options reported a less healthy diet than the students from the classical curriculum, except for a higher consumption of dairy products. However, they had a marked preference for full-cream milk (41% chose this type vs 31% in the classical curriculum). The frequency of traditional foods such as French fries and chocolate was similar between the learning options. The biggest difference was observed for alcohol intake. A quarter (25%) of the students from the classical curriculum reported drinking alcohol weekly vs 39% in the technical learning options. The differences between genders were also analysed in the classical and in the technical curriculum. Results were similar to the differences recorded in the whole sample.

**Table 3** Consumption of selected items: differences between learning options

Food (frequency)	Classical curriculum	Technical curriculum	P-value for the difference
Dairy products (daily)	75% (685)	67% (414)	0.001
Fruit (daily)	58% (525)	49% (300)	0.001
Vegetables (daily)	45% (410)	35% (213)	0.001
French fries (weekly)	75% (689)	78% (482)	> 0.05
Chocolate (daily)	26% (238)	23% (140)	> 0.05
Lemonades (daily)	30% (273)	40% (245)	0.001
Alcohol (weekly)	25% (226)	39% (241)	0.001

These analyses confirmed the trend for healthier food choices in girls. Results were found significant for their higher consumption of fruit and vegetables in both learning options ( $P < 0.01$  for both foods in both learning options). Their lemonade and alcohol consumption were also significantly lower than the boys' one in both learning options. However, the most striking difference was observed for alcohol consumption in the technical curriculum where the prevalence of weekly alcohol drinkers was equal to 55 and 23% for boys and girls, respectively.

*Results of the semi-quantitative food frequency questionnaire*

Complete, valid and detailed dietary information was obtained from 234 participants. Their mean daily energy and nutrient intakes are presented in Table 4 for both genders. In spite of a higher energy intake for boys, the composition of diet was similar in both genders—47% carbohydrates, 38% lipids, 13% proteins and 2% alcohol. Two-thirds of the adolescents consumed lipids as more than 35% of their diet (66%,  $n=154$ ). Mean cholesterol intakes for boys and girls were 511 and 400 mg/day, respectively ( $P$  for the difference  $< 0.001$ ). The fatty acids consumed were mainly represented by saturated fats, 18% of the total energy intake. Monounsaturated fatty acids and polyunsaturated fatty acids represented 13% and 7% of the total energy intake, respectively. The types of fatty acids consumed were similar for boys and girls. Carbohydrate consumption was characterized by a high consumption of sucrose and free sugars (24% of the caloric intake). Gender difference was statistically significant for the type of

**Table 4** Mean ( $\pm$  s.d.) daily energy and nutrient intakes (g)

	Boys	Girls
Energy intake	3592 ( $\pm$ 1480) kcal	2542 ( $\pm$ 1279) kcal
Proteins	110 ( $\pm$ 50)	79 ( $\pm$ 36)
Lipids	152 ( $\pm$ 74)	107 ( $\pm$ 60)
Carbohydrates	427 ( $\pm$ 192)	302 ( $\pm$ 163)
Cholesterol (mg)	602 ( $\pm$ 298)	400 ( $\pm$ 163)
Saturated FA	70 ( $\pm$ 39)	46 ( $\pm$ 27)
Monounsaturated FA	53 ( $\pm$ 26)	36 ( $\pm$ 22)
Polyunsaturated FA	23 ( $\pm$ 11)	19 ( $\pm$ 12)
Complex carbohydrates	207 ( $\pm$ 118)	132 ( $\pm$ 90)
Sucrose and free sugars	212 ( $\pm$ 123)	164 ( $\pm$ 105)

carbohydrates consumed. Boys consumed a higher percentage of complex carbohydrates than girls, as a proportion of total energy intake (23% vs 21%,  $P$  for the difference  $< 0.05$ ).

## Discussion

The present study analysed the everyday diet of a population of Belgian adolescents. The sample was representative of the adolescents from the province of Luxembourg, as the 1526 respondents represented 8% of the population aged 12–17 y. Moreover, the gender ratio, the residence and the learning option of the study population were similar to the distribution observed in the province. The participation rate (83.6%) was high for a study conducted in adolescents.

Report biases could have influenced the answers of the dietary questionnaire (Salvini *et al*, 1989). In this study, boys tended, in particular, to overestimate some well-liked foods (eg pizza, pie, sweets and beer). However, the over-reports of socially accepted foods and the under-reports of socially proscribed items were not noticed in the answers of the whole sample, as described in adult studies (Hebert *et al*, 1995). The day-to-day variation in the participants' diet and the seasonal influence were minimized by the use of a food frequency questionnaire (Subar *et al*, 1994). This method was therefore selected to collect information about the dietary habits of this adolescent population.

The results give an interesting picture of the dietary choices of a sample of European adolescents. The daily consumption of fruits and vegetables and the choice of low fat-content dairy products have been proposed as indicators of a healthy diet (Laitinen *et al*, 1995). The first point yielded disappointing results as respectively 60% and 46% of the adolescents did not eat vegetables or fruit even once a day. These results are in accordance with the low fruit and vegetable consumption recorded in a sample of Swiss adolescents (Cavadini *et al*, 1999). Spanish authors also found that people aged 16–20 y disliked vegetables (Farré Rovira *et al*, 1999). However, their results showed that fresh fruit was eaten almost daily by the majority of young Spanish people. Among dairy products the adolescents chose half-skimmed milk for drinking and butter to spread on their bread. These results are in accordance with the latest figures published by the Belgian Institut Economique Agricole, which found a rise in the purchase of half-skimmed milk coupled with a decline in consumption of the full-cream one and a very low consumption of skimmed milk (Institut Economique Agricole, 1991). The consumption of butter was also declining according to this institute, but it was still the preferred spread used on bread in Wallonie. Therefore, the present study confirmed the trend for healthier food choices with the consumption of lower-fat-content products. However, taste and tradition are still important as more than one-third of the adolescents prefer to eat butter and high-fat-content dairy products. In line with this traditional diet, French fries and chocolate consumption were representative of Belgian respondents. A

quarter of the sample ate French fries at least twice a week and another quarter ate chocolate at least once a day. The taste but also products' availability in this rural region explained these high frequencies, as well as the low consumption of 'imported' foods (eg hamburgers).

Girls reported healthier food choices than boys, ie more fruit and vegetables and less high-fat-content foods (eg dairy products, potato chips and chocolate). Their preference for skimmed products and light meals (eg apple, yoghurt) has seldom been studied, but it has been described in two Belgian studies (Pierson, 1996; PROMES, 1991). Girls also reported half the alcohol consumption of boys, but this might be related to an under-reporting of their actual consumption (Hebert *et al*, 1995). Male drinking is indeed better socially accepted than women drinking as drinking habits are sometimes considered as an attribute of 'manhood'. The food choices did not change much with age. However, some markers of a healthy diet (ie milk, fruit and vegetables) showed a worsening of the diet between 12 and 17 y of age. Moreover, alcohol consumption increased markedly from the youngest to the oldest age group. Forty-one percent of 15-y-olds drank alcohol at least once a week, in comparison with 21% of 15-y-old participants in a British sample (Hughes *et al*, 1997). The Finnish Cohort Study reported a mean daily ethanol intake less than 1 g in this age group (Åkerblom *et al*, 1985). Social and psychological roots of this problem have been studied by qualitative research (Hughes *et al*, 1997). At 12–13 y, adolescents try any drink to have new experiences. At age 14–15, sweet strong alcohol allows them to test their limits and later drinking habits are more related to a wish to belong to adulthood by drinking more conventional alcohol like beer.

The influence of social class on diet was also clear in this study. The learning option was selected as the indicator of the adolescents' social class level. In adolescence, neither education level nor profession is available to determine social class. However, learning option is an indicator of the future education level of the participant. In that way, the negative influence of low education was similar to the findings of the Finnish study (Laitinen *et al*, 1995). The Finnish adolescents from high social class also consumed less high-fat-content foods and more fruit and vegetables than those from low social class. Moreover, the present study has observed that alcohol drinking was more frequent in the technical course than in the classical one. The adolescent dietary habits are therefore influenced by their social environment early on.

The daily intake of a random subgroup of adolescents was determined using two different techniques, be a standardised picture book and food sampling (Haraldsdottir *et al*, 1994). Only added fat used for cooking was a non-measurable source of lipids in this dietary analysis. The results of this semi-quantitative food frequency questionnaire showed high mean energy and nutrient intakes in comparison with the recommended or published values for other populations (Dupin & Cuq, 1992; Samuelson *et al*, 1996; Torun *et al*, 1996). Methodological and epidemiological data explain, at least partly, these high values. First,

a methodological hypothesis is the tendency of the food frequency questionnaire to overestimate quantities, as found in some comparison studies (Martin-Moreno *et al*, 1993; Thompson & Margetts, 1993). However, authors have concluded that the nutrients expressed as percentages of total caloric intake are similar between dietary questionnaires (Jain *et al*, 1996). Secondly, studies conducted in the province of Luxembourg on cardiovascular risk factors have found a particularly high prevalence of obesity in all age groups, ie children, adolescents and adults (Brohet *et al*, 1988; Guillaume, 1994; Paulus *et al*, 1999). In particular, 27% of the adolescent boys and 24% of the girls had a higher BMI than the 90th percentile of the French distribution. A comparison with the British percentiles showed similar results, ie 20% of the present study population exceeded the 90th British percentile. The high energy intake recorded in this adolescent population is therefore explained by a real excess of energy intake coupled with a possible overestimate of it.

In the present study, diet composition mainly showed high lipid and saturated fatty acid consumption (respectively 38% and 17% of caloric intake). This excess was coupled with low carbohydrate consumption (47% vs 55%–70% recommended) with low proportion of complex carbohydrates (22% vs 50% recommended). These high lipid and low (complex) carbohydrate consumption are in the line with the findings of other studies conducted in young populations from Europe and from the USA (Aguilera *et al*, 1996; Ginot *et al*, 1997; Guillaume, 1994; McPherson *et al*, 1990; Newell *et al*, 1988; Pierson, 1996).

The detailed dietary interview found significantly higher mean energy intake in boys than in girls but the dietary patterns were similar in both genders, eg high lipid and saturated fat intake and low complex carbohydrate consumption. These results were in contrast to the healthier food choices reported by girls in the general questionnaire. Two hypotheses might explain this discrepancy. The food items proposed as healthy diet markers might be misleading, or the girls specifically might overreport specific socially desirable foods (Hebert *et al*, 1995).

## Conclusion

The present research has analysed the usual diet of a sample of Belgian adolescents. The characteristic features of their diet are a high lipid and low carbohydrate consumption, few fruit and vegetables, a taste for traditional products and a bent for alcohol drinking, especially in the oldest age group.

These results are in accordance with the findings of other European studies in youths. The worrying point is that the dietary habits of young populations predict those of tomorrow's adults. In addition, the prevention of cardiovascular risk factors are faced with major barriers in adults. In particular, this is true for the promotion of healthy diet, given its deep family, traditional and cultural influences. New directions must be investigated to tackle the problem

effectively before adulthood. Health promotion initiatives must rely on a sound knowledge of the interests and health beliefs of the young (Krowchuk *et al*, 1999; Muscari *et al*, 1999; Neumark Sztainer *et al*, 1999). Moreover, specific initiatives must target the adult environment responsible for the food availability, for family habits and education (eg attitude towards advertising). Effective actions during the first years of life are the best way to improving the health of future adult Europeans.

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## References

- Aguilera F, Lupianez L, Magana D, Planells E, Mataise FJ & Llopis J (1996): Lipid status in a population of Spanish schoolchildren. *Eur. J. Epidemiol.* **12**, 135–140.
- Åkerblom HK, Viikari JS, Uhari M & Rasanen L (1985): Atherosclerosis precursors in Finnish children and adolescents. *Acta Paediatr. Scand.* **318S**, 49–203.
- Brohet C, Janssens D, Beck D, Hannut R, Kulbertus H, Lavenne F *et al* (1988): Cardiovascular Risk factors in a sample of a rural Belgian population: the Bellux MONICA Study. *Acta Med. Scand.* **728**, 129–136.
- Cavadini C, Decarli B, Dirren H, Caudey M & Narring F (1999): Assessment of adolescent food habits in Switzerland. *Appetite* **32**, 97–106.
- Dupin H & Cuq JL (1992): Besoins nutritionnels dans l'enfance et l'adolescence. In *Alimentation et Nutrition Humaines*, pp 484–487. Paris: ESF Eds.
- Farré Rovira R, Frascuet Pons I & Martínez Martínez I (1999): The usual diet of a group of adolescents from Valencia. *Nutr. Hosp.* **14**, 223–230.
- Frank G, Nicklas T, Webber L, Major C, Miller J & Berenson G (1992): A food frequency questionnaire for adolescents: defining eating patterns. *J. Am. Diet. Assoc.* **92**, 313–318.
- Ginot L, Ait-Bouali N & Peyr C (1997): Habitudes alimentaires et bilan nutritionnel chez les collégiens: une étude en banlieue parisienne. *Rev. Epidémiol. Santé. Publique* **45**(Suppl 1), 78.
- Guillaume M (1994): Children in the province of Luxembourg: an epidemiological study of the cardiovascular risk factors and their determinants. Dissertation, UCL School of Public Health, Brussels.
- Haraldsdottir J, Tjønneland A & Overvad K (1994): Validity of individual portion size estimates in a food frequency questionnaire. *Int. J. Epidemiol.* **23**, 787–796.
- Hebert JR, Clemow L, Pbert L, Ockene IS & Ockene JK (1995): Social desirability bias in dietary self-report may compromise the validity of dietary intake measures. *Int. J. Epidemiol.* **24**, 389–398.
- Hughes K, Macintosh AM, Hastings G, Wheeler C, Watson J & Inglis J (1997): Young people, alcohol and designer drinks: quantitative and qualitative study. *Br Med. J.* **314**, 414–418.
- Institut Economique Agricole (1991): *Panel de consommation*, Report no 315. Brussels: Institut Economique Agricole.
- Institut National Belge des Statistiques (1993): *Initial cause of deaths by gender, province, region*. Brussels: Institut National des Statistiques.
- Institut Paul Lambin (1995): *Table de composition des aliments*. Brussels: Institut Paul Lambin, Haute Ecole Léonard de Vinci.
- Jain M, Howe GR & Rohan T (1996): Dietary assessment in epidemiology: comparison of a food frequency and a diet history questionnaire with a 7-day food record. *Am. J. Epidemiol.* **143**, 953–960.
- Krowchuk DP, Kreiter SR, Woods CR & Sinal SH (1999): Problem dieting behaviors in young adolescents. *Arch. Pediatr. Adolesc. Med.* **152**, 884–888.
- Laitinen S, Rasanen L, Viikari JS & Åkerblom HK (1995): Diet of Finnish children in relation to the family's socio-economic status. *Scand. J. Soc. Med.* **23**, 88–94.

- Martin-Moreno JM, Boyle P, Gorgojo L, Maisonneuve P, Fernandez-Rodríguez JC, Salvini S & Willett WC (1993): Development and validation of a food frequency questionnaire in Spain. *Int. J. Epidemiol.* **22**, 512–519.
- McPherson RS, Nichaman MZ, Kohl HW, Reed DB & Labarthe DR (1990): Intakes and food sources of dietary fat among schoolchildren in the Woodlands, Texas. *Pediatrics* **86**, 520–526.
- Muscari ME (1999): Prevention: are we really reaching today's teens? *Am. J. Mat. Child. Nurs.* **24**, 87–91.
- Newell G, Borrud L, McPherson S, Nichaman M & Pillow P (1988): Nutrient intakes of Whites, Blacks and Mexican Americans in Southeast Texas. *Prev. Med.* **17**, 622–633.
- Neumark Sztainer D, Story M, Perry C & Casey MA (1999): Factors influencing food choices of adolescents: findings of focus-group discussions with adolescents. *J. Am. Diet. Assoc.* **99**, 929–937.
- NUBEL (1995): *Table de composition des aliments*, 3rd edn. Brussels: Ministère de la Santé Publique.
- Paulus D, Saint-Remy A & Jeanjean M (1999): Blood pressure during adolescence: a study among Belgian adolescents selected from a high cardiovascular risk population. *Eur. J. Epidemiol.* **15**, 783–790.
- Pierson A (1996): L'alimentation de l'étudiant en première année d'enseignement supérieur. Dissertation, Institut Paul Lambin, Brussels.
- PROMES (1991): Les comportements alimentaires des jeunes de la Communauté Française. *Santé Pluriel*. **4**, 1–34.
- Salvini S, Hunter DJ, Sampson L, Stampfer MJ, Graham AC, Rosner B & Willett WC (1989): Food-based validation of a dietary questionnaire: the effects of week-to-week variation in food consumption. *Int. J. Epidemiol.* **18**, 858–867.
- Samuelson G, Bratteby LE, Enghardt H & Hedgren M (1996): Food habits and energy and nutrient intake in Swedish adolescents approaching the year 2000. *Acta Paediatr.* **S415**, 1–20.
- SAS Institute Inc. (1994): *SAS<sup>®</sup> Software: Abridged Reference*, version 6, 1st edn. SAS Institute Inc.
- Souci S, Fachmann W & Kraut H (1994): *Food Composition and Nutrition Tables*, 5th edn. Medpharm Publishers.
- Strong JP, Oalman MC & Malcolm GT (1994): Atherosclerosis in youth: relationship of risk factors to arterial lesions. In *Prevention of Atherosclerosis and Hypertension Beginning in Youth*, eds LJ Filer, RM Lauer, RV Luepker, pp 13–18. Philadelphia, PA: Lea and Febiger.
- Subar AF, Frey CM, Harlan LC & Kahle L (1994): Differences in reported food frequency by season of questionnaire administration. *Epidemiology* **5**, 226–233.
- Thompson RL & Margetts BM (1993): Comparison of a food frequency questionnaire with a 10-day weighted record in cigarette smokers. *Int. J. Epidemiol.* **22**, 824–833.
- Torun B, Davies P, Livingstone M, Paolisso M, Sackett R & Spurr G (1996): Energy requirements and dietary energy recommendations for children and adolescents 1 to 18 y old. *Eur. J. Clin. Nutr.* **50**, S37–S81.