

Breakfast habits among European adolescents and their association with sociodemographic factors: the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) study

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Abstract

Objective: To describe breakfast habits at food group level in European adolescents and to investigate the associations between these habits and sociodemographic factors.

Design: Cross-sectional study.

Setting: Secondary schools from nine European cities participating in the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) Study. Breakfast habits were assessed twice using a computer-based 24h dietary recall. Adolescents who consumed breakfast on at least one recall day were classified as 'breakfast consumers' and adolescents who did not have anything for breakfast on either of the two recall days were considered 'breakfast skippers'. A 'breakfast quality index' to describe breakfast quality was created based on the consumption or non-consumption of cereals/cereal products, dairy products and fruits/vegetables. The sociodemographic factors studied were sex, age, region of Europe, maternal and paternal education, family structure and family affluence.

Subjects: Adolescents (*n* 2672, 53% girls) aged 12–17 years.

Results: The majority of the adolescents reported a breakfast that scored poorly on the breakfast quality index. Older adolescents, adolescents from the southern part of Europe and adolescents from families with low socio-economic status were more likely to consume a low-quality breakfast.

Conclusions: The study highlights the need to promote the consumption of a high-quality breakfast among adolescents, particularly in older adolescents, adolescents from southern Europe and adolescents from families with low socio-economic status, in order to improve public health.

Keywords
Food groups
Dietary habits
Socio-economic
Teenager

Breakfast consumption is an important part of a healthy lifestyle⁽¹⁾. Regular breakfast consumption among adolescents has been associated with better diet quality^(2–4), better cognitive performance⁽⁵⁾ and reduced risk of

becoming overweight or obese⁽⁶⁾. Nevertheless, breakfast skipping is a common behaviour among European adolescents, with a prevalence ranging from 3%⁽⁷⁾ to 34%⁽¹⁾.

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A 'good-quality' breakfast can impact favourably on adolescent mental health⁽⁸⁾ and cognitive performance⁽⁹⁾ and improve the overall diet quality^(3,10). Preferably, breakfast should include products from each of the dairy, cereal and fruit groups⁽¹¹⁾. However, these three food groups were found to be consumed for breakfast by only 10% of adolescents in studies from Belgium⁽³⁾ and The Netherlands⁽¹⁰⁾ and by 5% of adolescents in a study from Spain⁽¹²⁾. Milk and cereal are commonly consumed at breakfast in many child and adolescent populations in Western countries⁽¹⁾, while fruit is less common^(10,12).

Previous studies in European adolescents have focused mainly on breakfast consumption *v.* skipping^(6,13). These studies have shown that daily breakfast consumption decreases with age^(10,13,14), and is associated with sex – girls were less likely to be daily breakfast consumers than boys^(10,13–16) – and socio-economic factors^(13,15,16). Studies on breakfast quality and sociodemographic factors at European level among adolescents are, however, scarce. Low levels of breakfast consumption can be considered a public health issue but in order to be able to promote breakfast consumption it is first crucial to understand potential differences in breakfast habits among European adolescents, by sex, socio-economic factors and geographical factors.

The aim of the present study was therefore to describe the breakfast habits (in terms of both frequency and quality) at food group level in European adolescents. Additionally we wanted to investigate associations between these habits and sociodemographic factors such as sex, age, region in Europe, parental education, family structure and family affluence.

Methods

Study design and sampling

The HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) Study is a school-based multi-centre study, designed to obtain reliable and valid data on nutrition and health-related factors from a sample of 3528 adolescents (52% girls) aged 12·50–17·49 years in ten European cities⁽¹⁷⁾. The selected cities are Athens (Greece), Dortmund (Germany), Ghent (Belgium), Heraklion (Greece), Lille (France), Pecs (Hungary), Rome (Italy), Vienna (Austria), Stockholm/Västerås (Sweden) and Zaragoza (Spain).

The selection of the European cities was primarily a practical one. As it was not realistic to include a random sample of all European adolescents, it was decided to study a city-based sample, striving for representativeness of adolescents living in European cities. Within these cities, schools were randomly selected, but stratified for geographical location. Within the participating schools, classes were randomly selected, stratified by grade. In all countries it was compulsory to go to school at these ages and our aim was to reach a sub-sample from the whole population in these ages.

All pupils of the selected classes were invited to participate. A class was considered eligible if the participation rate was at least 70%. The final database included only those participants who met the following criteria: they were between 12·50 and 17·49 years of age, they and their parents had provided written informed consent, and their weight and height had been measured. Participants were excluded if they were participating simultaneously in another clinical trial or had had an acute infection less than one week before the study. The adolescents completed in-class surveys, two non-consecutive computer-based 24 h dietary recalls and physical tests during the 2006–2007 academic year. A more detailed description of the study design, sampling and procedure has previously been published⁽¹⁷⁾. Both parents and adolescents gave written informed consent, and the HELENA study protocol was approved by the national or local independent ethical committee from the relevant European city⁽¹⁸⁾.

The present paper includes data of 2672 adolescents from nine cities (53% girls), with a mean age of 14·8 (SD 1·2) years. Data from Heraklion (Greece) are not used in the present analysis because only one 24 h dietary recall was collected in the majority of adolescents.

Sociodemographic measurements

Socio-economic factors were assessed, during the in-class surveys, via the questionnaire 'Your Living Environment'⁽¹⁹⁾. This questionnaire gathered general information about the education level of parents, family structure and family affluence. This latter variable was measured using a modified version of the family affluence scale (FAS), a scale developed by the WHO collaborative Health Behaviour in School-aged Children (HBSC) Study⁽²⁰⁾. A sum score of the following items was used: whether the adolescent had his/her own bedroom, the number of cars in the family, the number of computers and the presence of an Internet connection at home. The FAS was dichotomized to 'low family affluence' (FAS score ≤ 3) *v.* 'high family affluence' (FAS score ≥ 4).

Maternal and paternal education level was dichotomized into 'low/medium education' (elementary, lower secondary, higher secondary education) and 'high education' (university education). The family structure variable was derived from the question 'With whom do you principally stay?'. Adolescents who chose 'with both of your parents', 'with your mother and her partner' or 'with your father and his partner' were considered to have a 'traditional' family structure. Adolescents who chose 'with your mother', 'with your father', 'with your mother half of the time and your father half of the time', 'with your grandparents or other relatives', 'with your foster or adoptive parents' or 'in an orphanage or somewhere else' were considered to have a 'single-parent/shared-care' family structure.

Data on sex, age and study centre were collected by a physician. Age was dichotomized to younger or older than 15 years of age. The variable 'study centre' was

dichotomized into northern/central (Dortmund, Ghent, Lille, Pecs, Vienna and Stockholm/Västerås) and southern (Athens, Rome and Zaragoza).

All of the questionnaires included in the study were discussed and approved by the HELENA partners. After consensus was reached, the questionnaires were translated and back-translated into the native language of the participants⁽¹⁹⁾.

Dietary survey

Dietary intake data were obtained using a dietary assessment tool named HELENA-DIAT, which was based on a self-administered, computerized 24 h dietary recall program called Young Adolescents' Nutrition Assessment on Computer (YANA-C)^(21,22). The program contains questions related to six meal occasions (i.e. breakfast, morning snacks, lunch, afternoon snacks, evening meal, evening snacks) with questions designed to prompt the adolescents to remember what they ate. The first two questions asked about the time they got up the previous day and if they had breakfast. If they responded no, they were prompted with an additional question 'You didn't have anything, however small, to eat or drink for breakfast?'. If the adolescents had breakfast, a drink or something small, they were asked 'Where and with whom did you have breakfast, yesterday?' and 'Around what time was that?'. Then, adolescents selected the food items consumed from a culturally adapted list and further described the quantity consumed. Pictures and measurement units helped the adolescents to give quantitatively detailed information^(21,22). Two computerized 24 h recalls were performed on two non-consecutive days within the space of two weeks. The HELENA-DIAT was filled in by the adolescents at school, and it took about 10–30 min to complete.

Breakfast patterns

Based on reported breakfast consumption the adolescent was classified as a 'breakfast consumer' (i.e. they consumed breakfast on at least one recall day) or a 'breakfast skipper' (i.e. they did not consume breakfast on either of the two recall days). According to one previous study⁽²³⁾, a breakfast meal should weigh more than 15 g to be considered a meal. In our study five breakfast meals weighed less than 15 g and were excluded. The computer program initially categorized foods into twenty-seven food groups (Table 1), but because many of the food groups were infrequently consumed for breakfast we merged similar groups and reduced this number to seventeen (Tables 2 to 4). All food items were classified as being consumed (on one or both of the recall days) or not consumed (not on either of the two recall days). For the purpose of the study, breakfast quality was related to the presence (irrespective of amount) of food items from three specific food groups: cereal products ('bread' and 'breakfast cereals'), dairy products ('milk and yoghurt' and 'cheese') and fruit/vegetables ('fruit & vegetables' and 'fruit juice'). Additionally, a 'breakfast quality index' was created

in which 1 point was awarded for consuming a breakfast and an extra 1 point was awarded for each of the three food groups (hereafter called 'target food groups') consumed (i.e. 1 to 3 extra points), resulting in a possible score of 0 to 8 across both days. Adolescents consuming a breakfast that scored highly (≥ 6 points) were considered to have a 'high quality breakfast' while those who scored lowly (< 4 points) were considered to have a 'low quality breakfast'.

Statistical analyses

All analyses were performed using the statistical software package IBM SPSS Statistics version 19.0 for Windows (IBM SPSS Inc., Chicago, IL, USA), and the level of significance was set at 5%. We used percentage, median and 25th and 75th percentiles for describing breakfast consumers and the total quantity of each food group consumed for breakfast (g/d).

Multiple logistic regression analyses were used to investigate the associations with breakfast consumption and food groups for breakfast (dependent variables) according to sociodemographic variables (independent variables). All multiple logistic regression models included sex (boy *v.* girl), age (< 15 years *v.* ≥ 15 years), region (southern *v.* northern/central), maternal and paternal education level (low/medium *v.* high), family structure (traditional *v.* single parent/shared care) and FAS score (low *v.* high) as independent variables.

Multiple linear regression analyses were performed to evaluate associations between the breakfast quality index (continuous) and sex, age (in years, continuous), region, maternal and paternal education level, family structure and FAS score as independent variables. All analyses were adjusted by a weighting factor to balance the sample according to the age and sex distribution of the theoretical sample, to guarantee representation of each of the stratified groups.

Results

Population characteristics

Table 2 shows that 53% of the population were girls, 56% were under 15 years of age and 29% came from the southern part of Europe. One-third of the adolescents had highly educated mothers, one-third had highly educated fathers and 80% were living in a traditional family structure. Three-quarters (77%) indicated that their family was affluent, as defined by the FAS.

Breakfast consumption according to sociodemographic factors

We observed that 7% of the adolescents were 'breakfast skippers' (Fig. 1). Breakfast consumption, on both recall days, was reported among 77% of the adolescents (data not shown). Younger adolescents (< 15 years of age) reported more often than older adolescents that they

Table 1 Percentage of adolescents consuming twenty-seven food groups and the median (P25–P75) consumption on the days the food was consumed (observed sample): adolescents (*n* 2672) aged 12–17 years from nine European cities participating in the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) Study

Food group	% of consumers		g consumed*	
	One day only	Both days	Median	P25–P75
Beverages				
Tea & coffee	11.0	8.8	214	112–225
Water	16.0	7.3	200	175–275
Fruit juice	15.0	9.7	200	200–265
Soft drinks	5.9	1.4	250	200–425
Dairy				
Milk	23.0	28.0	225	150–262
Soya drink	0.1	0.3	200	148–244
Sugared milk	11.0	5.2	225	200–236
Yoghurt	5.7	1.7	169	125–225
Cheese	13.0	4.8	30	20–44
Other milk productst	1.0	0.1	62	7.5–200
Meat, fish, eggs and their products				
Meat & products	14.0	5.1	33	22.5–50
Fish & products	0.6	0.1	21	14–33
Eggs	3.6	0.4	50	50–100
Fruit & vegetables				
Fruits	9.7	3.7	130	100–184
Vegetables	5.5	1.1	30	10–61
Other vegetables‡	1.5	0.1	38	20–88
Cereals				
Bread	26.0	22.0	60	36–80
Breakfast cereals	14.0	9.3	40	28–58
Other cereals§	0.4	0	68	45–73
Cakes & sweets				
Cakes/pies/biscuits	19.0	8.8	68	48–100
Snacks	0.7	0.1	55	30–80
Added sugar	13.0	6.8	20	12–38
Sweets	14.0	8.0	30	15–60
Added fat/oil				
Vegetable fat	8.4	3.3	16	8.1–24
Butter	11.0	5.9	15	9.0–24
Miscellaneous				
Pasta, soup, etc.	2.0	0.1	60	2.7–150
Sauce	1.9	0.2	41	20–74

P25, 25th percentile; P75, 75th percentile.

*Gram consumed on consumption days.

†Milk-based dessert and cream.

‡Potatoes, pulses, etc.

§Oats and rice.

were 'breakfast consumers' (OR = 1.66; 95% CI 1.17, 2.35). Fewer adolescents with a low/medium maternal education level indicated that they were 'breakfast consumers' compared with adolescents with a high maternal education level (OR = 0.61; 95% CI 0.38, 0.98). There were no significant differences in breakfast consumption ('consumer' *v.* 'skipper') by sex, region, paternal education, family structure and FAS (Tables 3 and 4).

Breakfast quality according to sociodemographic factors

We found that 4% of the sample consumed all three of the target food groups on both recall days (Fig. 1). Figure 1 also shows that 53% of the adolescents consumed products from two or fewer of the target food groups.

Breakfast quality was higher in adolescents from the northern and central part of Europe ($\beta = 0.142$, $P < 0.001$), in those whose mothers had a high education level

($\beta = 0.129$, $P < 0.001$), in those reporting higher family affluence ($\beta = 0.068$, $P = 0.002$) and in those coming from a traditional family structure ($\beta = 0.055$, $P = 0.006$). Breakfast quality was lower among older adolescents than among younger ($\beta = -0.063$, $P = 0.001$). There was no association between breakfast quality and sex or paternal education (Table 5).

Food groups consumed at breakfast according to sociodemographic factors

Table 3 shows that girls were more likely to consume 'tea and coffee' and 'butter' but less likely to consume 'meat, fish and eggs' (all $P < 0.05$) for breakfast than boys. Younger adolescents (<15 years of age) were more likely to consume 'other milk products' ($P < 0.001$) and less likely to consume 'tea and coffee', 'water' and 'added sugar' (all $P < 0.05$) than older adolescents. Adolescents from northern/central parts of Europe were more likely to

Table 2 Percentage of consumers of breakfast and of seventeen food groups for breakfast by sociodemographic factors (observed sample): adolescents (*n* 2672) aged 12–17 years from nine European cities participating in the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) Study

	Sex*		Age* (years)		Region*		Maternal education*		Paternal education*		Family structure*		FAS*	
	Boy	Girl	<15	≥15	North/central	South	Low/medium	High	Low/medium	High	Single parent/ shared care	Traditional	Low	High
<i>n</i> 2672	1245	1427	1496	1179	1904	768	1642	901	1573	885	530	2069	559	1880
% 100	47	53	56	44	71	29	65	35	64	36	20	80	23	77
Breakfast consumer†	93	93	95	91	93	92	92	96	92	96	92	93	91	94
Beverages														
Tea & coffee	18	22	17	23	21	16	21	17	21	18	18	21	21	19
Water	22	24	21	25	24	20	24	21	23	22	24	21	22	23
Fruit juice	24	26	25	25	29	16	20	32	22	30	26	22	17	28
Soft drinks	8	6	8	7	10	1	10	2	9	5	7	9	7	7
Dairy														
Milk & yoghurt	58	52	57	52	49	50	50	64	51	63	55	53	50	56
Cheese	19	18	18	19	23	6	16	20	18	18	18	19	17	19
Other milk products‡	17	17	20	14	19	11	17	18	17	18	17	18	19	17
Meat, fish, eggs & their products														
Meat, fish & eggs	24	20	21	23	28	7	23	20	24	19	21	25	24	22
Fruit & vegetables														
Fruit & Vegetables	19	21	20	19	25	8	18	24	19	23	21	18	16	20
Cereals														
Bread	46	49	56	48	58	20	45	52	44	50	48	47	41	49
Cereals§	27	24	25	24	26	21	21	30	21	30	26	23	16	28
Cakes & sweets														
Cakes, pies, biscuits & snacks	28	30	30	26	23	41	29	29	28	30	29	27	32	28
Added sugar	21	20	18	22	18	26	21	20	21	21	21	19	20	22
Sweets including chocolate	22	23	23	22	21	27	22	24	21	25	24	16	17	24
Added fat/oil														
Vegetable fat	11	12	11	13	15	3	11	12	12	12	12	10	14	11
Butter	16	18	17	17	22	4	15	20	15	19	17	19	10	19
Miscellaneous														
Pasta, soup, sauce, etc.	4	3	2	2	2	1	2	1	2	1	2	2	2	2

FAS, family affluence scale.

*The proportion of adolescents who consumed the different food items (on one or both days).

†Breakfast consumption on at least one day.

‡Milk-based dessert, sugared milk and cream.

§Breakfast cereals and other cereals.

Table 3 Results of multivariate logistic regression analyses with consumption of breakfast and of food groups as dependent variables and sociodemographic factors as independent variables: adolescents (*n* 2672) aged 12–17 years from nine European cities participating in the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) Study

	Girls			<15 years of age			Northern/central Europe		
	OR	95% CI	<i>P</i>	OR	95% CI	<i>P</i>	OR	95% CI	<i>P</i>
Breakfast consumer*	1.09	0.78, 1.53	0.613	1.66	1.17, 2.35	0.005	1.08	0.74, 1.57	0.707
Beverages									
Tea & coffee	1.33	1.07, 1.64	0.009	0.57	0.46, 0.70	<0.001	1.45	1.13, 1.87	0.004
Water	1.16	0.96, 1.42	0.133	0.81	0.66, 0.99	0.037	1.25	0.99, 1.57	0.060
Fruit juice	1.17	0.96, 1.43	0.116	1.10	0.90, 1.34	0.363	1.85	1.45, 2.36	<0.001
Soft drinks	0.77	0.55, 1.08	0.125	1.32	0.94, 1.84	0.109	8.75	4.16, 18.39	<0.001
Dairy									
Milk & yoghurt	0.87	0.73, 1.03	0.111	1.15	0.97, 1.37	0.113	0.34	0.28, 0.42	<0.001
Cheese	1.05	0.84, 1.31	0.674	1.07	0.85, 1.33	0.567	4.50	3.18, 6.38	<0.001
Other milk product [†]	1.00	0.80, 1.26	0.973	1.72	1.37, 2.17	<0.001	2.34	1.74, 3.14	<0.001
Meat, fish, eggs & their products									
Meat, fish & eggs	0.79	0.64, 0.98	0.028	0.96	0.78, 1.18	0.678	5.77	4.12, 8.08	<0.001
Fruit & vegetables									
Fruit & vegetables	1.22	0.98, 1.51	0.072	1.11	0.90, 1.38	0.331	4.39	3.17, 6.08	<0.001
Cereals									
Bread	1.19	0.99, 1.42	0.061	1.06	0.88, 1.26	0.550	5.92	4.71, 7.44	<0.001
Cereals [‡]	0.89	0.73, 1.08	0.240	1.15	0.94, 1.39	0.173	1.23	0.98, 1.54	0.080
Cakes and sweets									
Cakes, pies, biscuits & snacks	1.06	0.88, 1.28	0.517	1.04	0.86, 1.25	0.695	0.42	0.35, 0.52	<0.001
Added sugar	1.06	0.87, 1.30	0.564	0.70	0.57, 0.86	0.001	0.61	0.49, 0.77	<0.001
Sweets including chocolate	1.02	0.84, 1.25	0.816	0.94	0.77, 1.15	0.569	0.63	0.50, 0.78	<0.001
Added fat/oil									
Vegetable fat	1.06	0.81, 1.37	0.685	0.99	0.76, 1.29	0.929	7.64	4.63, 12.61	<0.001
Butter	1.35	1.07, 1.70	0.013	1.07	0.85, 1.35	0.561	8.47	5.28, 13.59	<0.001
Miscellaneous									
Pasta, soup, sauce, etc.	0.80	0.52, 1.21	0.289	0.68	0.44, 1.05	0.082	3.30	1.72, 6.36	<0.001

Odds ratios and 95% confidence intervals weighted for age and sex. Reference categories: boys, ≥ 15 years of age and southern Europe.

*Breakfast consumed on one or both of the recall days.

[†]Milk-based dessert, sugared milk and cream.

[‡]Breakfast cereals and other cereals.

consume a drink (tea, coffee, fruit juice and soft drink; all $P < 0.001$) for breakfast compared with those from the southern part of Europe. They were also more likely to consume 'cheese', 'other milk products', 'meat, fish and eggs', 'fruit and vegetables', 'bread', 'cereals' and 'added fat or oil' and less likely to consume 'milk and yoghurt', 'cakes', 'sweets' and 'added sugar' (all $P < 0.001$) for breakfast compared with their counterparts from southern Europe.

Adolescents whose mothers had a low/medium education level were less likely to consume 'fruit juice' and 'milk and yoghurt' and more likely to consume 'soft drinks' (all $P < 0.001$) and 'fruit and vegetables' and 'bread' (both $P < 0.05$) for breakfast compared with those whose mothers had a high education level (Table 4). Adolescents from single-parent/shared-care families were less likely to consume 'sweets' ($P < 0.01$) for breakfast compared with those from traditional families. Adolescents who reported lower family affluence were less likely to consume 'fruit juice' and 'milk and yoghurt' (both $P < 0.01$) and to consume 'cereals' and 'sweets' (both $P < 0.001$); they were also more likely to consume 'other milk products' ($P < 0.01$), 'meat, fish and eggs' and 'vegetable fat' (both $P < 0.001$) for breakfast compared

with those who reported greater family affluence. There were no significant differences in food groups consumed for breakfast by level of paternal education (Table 4).

Discussion

The aim of the present study was to describe breakfast habits (in terms of both frequency and quality) at food group level in European adolescents. Additionally we wanted to investigate the associations between these habits and sociodemographic factors such as sex, age, region in Europe, parental education, family structure and family affluence.

The main findings of the study are that the majority of the adolescents studied consumed some form of breakfast, but that the quality was rather low. We also found that breakfast habits were associated with age, region in Europe, maternal education, family structure and family affluence. Breakfast skipping (not consuming breakfast on any of the two recall days) was reported by 7% of the adolescents, a figure which is in agreement with other studies among European adolescents^(1,13). With regard to breakfast quality, our study shows that the majority of the

Table 4 Results of multivariate logistic regression analyses with consumption of breakfast and of food groups as dependent variables and sociodemographic factors as independent variables: adolescents (*n* 2672) aged 12–17 years from nine European cities participating in the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) Study

	Low/medium maternal education			Low/medium paternal education			Single-parent/shared-care family structure			Low FAS		
	OR	95% CI	<i>P</i>	OR	95% CI	<i>P</i>	OR	95% CI	<i>P</i>	OR	95% CI	<i>P</i>
Breakfast consumer*	0.61	0.38, 0.98	0.040	0.80	0.51, 1.27	0.351	1.04	0.67, 1.60	0.874	0.73	0.49, 1.08	0.118
Beverages												
Tea & coffee	1.09	0.83, 1.42	0.548	1.09	0.83, 1.43	0.533	1.10	0.84, 1.42	0.490	1.14	0.88, 1.48	0.328
Water	1.05	0.82, 1.35	0.713	1.02	0.79, 1.31	0.895	0.86	0.67, 1.12	0.269	1.08	0.84, 1.38	0.566
Fruit juice	0.63	0.49, 0.80	<0.001	0.88	0.69, 1.12	0.292	0.81	0.62, 1.05	0.107	0.64	0.48, 0.85	0.002
Soft drinks	3.83	2.23, 6.56	<0.001	1.09	0.69, 1.74	0.71	1.18	0.79, 1.76	0.408	0.92	0.60, 1.40	0.687
Dairy												
Milk & yoghurt	0.62	0.50, 0.77	<0.001	0.81	0.65, 1.02	0.067	1.05	0.84, 1.31	0.661	0.70	0.56, 0.88	0.002
Cheese	0.78	0.59, 1.03	0.084	1.03	0.78, 1.37	0.835	1.01	0.76, 1.33	0.960	1.29	0.97, 1.73	0.081
Other milk products†	1.04	0.78, 1.39	0.797	0.80	0.60, 1.07	0.126	1.02	0.77, 1.36	0.892	1.50	1.23, 1.98	0.005
Meat, fish, eggs & their products												
Meat, fish & eggs	0.93	0.71, 1.22	0.593	1.27	0.96, 1.67	0.090	1.04	0.81, 1.35	0.749	1.58	1.21, 2.06	0.001
Fruit & vegetables												
Fruit & vegetables	0.75	0.57, 0.99	0.039	0.91	0.69, 1.20	0.503	0.76	0.57, 1.01	0.057	1.13	0.85, 1.51	0.396
Cereals												
Bread	0.79	0.63, 0.99	0.043	0.83	0.66, 1.04	0.104	0.86	0.69, 1.08	0.208	1.15	0.91, 1.45	0.232
Cereals‡	0.85	0.67, 1.08	0.183	0.76	0.60, 0.96	0.024	0.94	0.73, 1.21	0.615	0.54	0.41, 0.72	<0.001
Cakes and sweets												
Cakes, pies, biscuits & snacks	0.98	0.77, 1.24	0.867	0.89	0.70, 1.13	0.342	1.00	0.79, 1.28	0.970	1.02	0.80, 1.29	0.900
Added sugar	1.05	0.81, 1.36	0.711	0.94	0.73, 1.21	0.634	0.84	0.64, 1.10	0.209	0.84	0.65, 1.10	0.210
Sweets including chocolate	1.10	0.85, 1.41	0.468	0.72	0.56, 0.93	0.010	0.68	0.52, 0.90	0.007	0.57	0.43, 0.76	<0.001
Added fat/oil												
Vegetable fat	1.13	0.80, 1.60	0.495	0.77	0.55, 1.09	0.138	0.73	0.51, 1.03	0.077	2.12	1.54, 2.92	<0.001
Butter	0.78	0.58, 1.04	0.092	0.83	0.62, 1.11	0.214	1.11	0.84, 1.49	0.454	0.73	0.52, 1.03	0.075
Miscellaneous												
Pasta, soup, sauce, etc.	1.20	0.68, 2.12	0.533	1.35	0.76, 2.40	0.314	0.80	0.46, 1.39	0.426	1.55	0.94, 2.56	0.083

FAS, family affluence scale.

Odds ratios and 95% confidence intervals weighted for age and sex. Reference categories: high maternal education, high paternal education, traditional family structure and high FAS.

*Breakfast consumed on one or both recall days.

†Milk-based dessert, sugared milk and cream.

‡Breakfast cereals and other cereals.

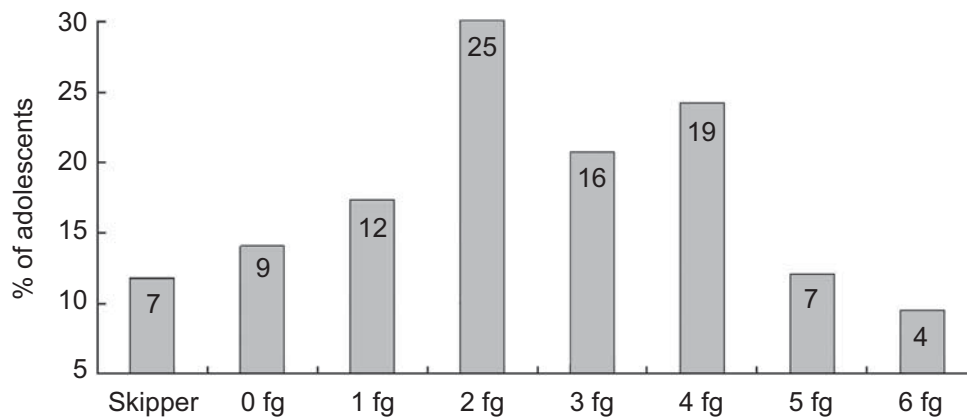


Fig. 1 Breakfast skippers and total number of target food groups (fg) consumed at breakfast over both recall days (maximum: three per day) in the study population: adolescents (n 2672) aged 12–17 years from nine European cities participating in the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) Study

Table 5 Multiple regression analyses exploring the association between breakfast quality index* and sociodemographic factors: adolescents (n 2672) aged 12–17 years from nine European cities participating in the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) Study

	β	P
Girls	0.012	0.536
Age (years)†	−0.063	0.001
Northern/central Europe	0.142	<0.001
High maternal education	0.129	<0.001
High paternal education	0.031	0.208
Traditional family structure	0.055	0.006
High FAS	0.068	0.002

FAS, family affluence scale.

*Breakfast quality index score has nine categories from skipper (score of 0) to three target food groups consumed on both days (score of 8).

†Age is a continuous variable.

adolescents (96%) did not consume a breakfast including foods from all three of the target food groups on both recall days. Additionally, half of the adolescents consumed products from no more than two of the target food groups together during both the recall days. Similar results were reported in a Dutch study⁽¹⁰⁾ and in Spanish children and adolescents⁽¹²⁾.

Sex differences in breakfast consumption have been reported in other studies^(1,13); however, we found no differences between boys and girls in either frequency of breakfast consumption or breakfast quality. We did observe that girls were more likely to drink/eat ‘tea and coffee’ and ‘butter’ and less likely to eat ‘meat, fish and eggs’ for breakfast than boys, which concurs with results from other studies^(10,24).

Adolescents under the age of 15 years were more likely to be breakfast consumers and to consume more of the target food groups for breakfast than older adolescents. Aranceta *et al.* reported similar results in Spanish adolescents⁽¹²⁾. Other authors have also shown that younger European adolescents consume breakfast more

often than their older counterparts^(1,10,13). More autonomy and independence in regard to food choices among older adolescents could explain the age decline in breakfast consumption⁽²⁵⁾. Younger adolescents were also more likely to drink ‘other milk products’ and less likely to consume ‘tea and coffee’, ‘water’ or ‘added sugar’ in comparison to older adolescents. This is in contrast to Raaijmakers *et al.* who showed that higher consumption from the liquid group was more common among older adolescents⁽¹⁰⁾.

Adolescents from northern and central parts of Europe were more likely to score more highly on the breakfast quality index and were more likely to consume the target food groups than those from southern Europe. Risvas *et al.* suggested that Greek students have learnt to categorize food as ‘healthier but less tasty’ and ‘appealing but unhealthy’⁽²⁶⁾, while Finnish adolescents perceived e.g. healthy bread as pleasant and very acceptable⁽²⁷⁾. These attitudinal differences to healthy food between countries might explain why we saw a higher score on the breakfast quality index among adolescents in the northern and central part of Europe.

We did not find significant differences in breakfast consumption *v.* skipping between the two regions in Europe. Vereecken *et al.* reported differences in the frequency of breakfast consumption among different countries in Europe; in the southern region daily breakfast consumption varied from 33% (Greek girls) to 72% (Spanish boys), while in the northern/central region the daily breakfast consumption ranged from 42% (Hungarian girls) to 73% (Swedish boys)⁽¹³⁾. Differences in breakfast consumption have also been reported between Greece and Finland⁽²⁸⁾. It could be that many inter-country differences are even more pronounced than inter-regional differences, which may explain why we did not observe any differences in breakfast consumption between our two regions, but further studies are required to confirm this theory.

Socio-economic status seems to be associated with dietary habits among adolescents but not to the same extent as in adults⁽²⁹⁾. One reason for this could be that peers influence the adolescent's behaviour even more than does the family's socio-economic status. In our study, the only socio-economic variable that was associated with breakfast consumption was maternal education level; adolescents whose mothers had a high education level were more likely to be breakfast consumers compared with adolescents whose mothers had a low/medium education level. Similar results have been found in Norway⁽¹⁵⁾ and the USA^(30,31). Additionally, our study shows that adolescents whose mothers had a high education level were more likely to consume a breakfast of higher quality, to consume the target food groups and were less likely to consume 'soft drinks' for breakfast. Similar patterns have been shown in Norway⁽³²⁾. Mothers have a strong influence on the dietary habits of their families and influence the family food environment, and mothers who are more educated may be more likely to consider health in their choice of foods^(29,33).

Adolescents reporting higher family affluence were more likely to consume a breakfast of higher quality, to consume the target food groups and to consume 'sweets', but less likely to consume 'other milk products', 'meat, fish and eggs' and 'vegetable fat' for breakfast in comparison to those reporting low family affluence. The HBSC Study showed an association between a high score on the FAS and breakfast consumption in five of the countries included in HELENA (Belgium, France, Germany, Hungary and Sweden)⁽¹³⁾. Higher fruit consumption among the more affluent adolescents has also been shown in the HBSC Study⁽³⁴⁾. Less affluent families might have less money to spend on food⁽³⁵⁾ and when cost is a barrier families might be less likely to consider health in their choice of food.

Finally, adolescents from a 'traditional' family structure were more likely to report a high-quality breakfast and were also more likely to eat 'sweets' for breakfast compared with those from single-parent/shared-care families. A similar association between breakfast consumption and this family structure were observed in the HBSC Study, among the countries included in HELENA, with the exception of Greece⁽¹³⁾. Family cohesion has been found to be associated with breakfast consumption and decreased soda intake in a population of girls in the USA⁽³⁰⁾. One possible explanation for the higher quality of breakfast in adolescents from traditional families could be that these adolescents could be more likely to comply with their parents' wishes regarding breakfast consumption and the family may be more likely to consume breakfast together.

Strengths and limitations

The strengths of our study include the large sample of adolescents. Our aim was to reach a sub-sample within each country that was representative of the whole

population of adolescents in Europe regarding sex, age and socio-economic status. As it was compulsory in all countries for this age group to attend school and as we collected the data in large cities, we assert that the sample will be representative of large cities in Europe. The standardized and harmonized methodology is also a study strength. The computerized 24h recall method provides both frequency and quality data about the breakfast and two non-consecutive 24h recalls have shown to be a relatively reproducible estimate of the mean usual intake of a group⁽³⁶⁾.

Some limitations of the current study include the fact that there is no accepted definition of breakfast in the literature; although the issue has been discussed at length⁽¹¹⁾, no consensus has been reached. For the purpose of our study we defined high and low breakfast quality based on a relatively simple index that considered both breakfast consumption and consumption of three desirable target food groups. The index does not allow for other food groups that may also be considered nutritious, nor can it take into account whether undesirable food groups were also consumed and in what quantities. The fact that the study population comes only from urban areas could mean that the sociodemographic distribution is not representative of the total population of the nine countries studied. The inability to compare the results between the different countries in Europe⁽¹⁷⁾ is also a limitation as heterogeneity in breakfast habits between European countries has been reported⁽¹³⁾. The 24h recall was collected during school time on weekdays, so there are no Fridays and Saturdays in the dietary recall database; this could influence the results as differences in dietary intakes between weekdays and weekends have been reported⁽³⁶⁾.

Implications for further research

The public health implications of poor breakfast consumption habits are considerable and our finding that only 4% of European adolescents consumed a high-quality breakfast highlights the need to promote breakfast, especially a high-quality breakfast, among adolescents. Particular attention should be paid to older adolescents, adolescents from the southern part of Europe and adolescents from families with low socio-economic status.

More specific information about the breakfast habits among European adolescents in larger country samples is needed to facilitate inter-country comparisons.

Conclusions

The majority of the adolescents consumed a 'low-quality' breakfast. Older adolescents, adolescents from the southern part of Europe (Greece, Italy and Spain) and adolescents from families with low socio-economic status were more likely to consume a 'low-quality' breakfast.

The study highlights the need to promote 'high-quality' breakfast among adolescents, particularly to older adolescents, adolescents from southern Europe and adolescents from families with low socio-economic status.

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