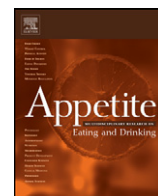




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Research report

Breakfast habits and factors influencing food choices at breakfast in relation to socio-demographic and family factors among European adolescents. The HELENA Study[☆]Lena Hallström^{a,b,1,*}, Carine A. Vereecken^{c,d,1}, Jonatan R. Ruiz^{b,e,1}, Emma Patterson^{b,1}, Chantal C. Gilbert^{f,1}, Giovina Catasta^{g,1}, Ligia-Esperanza Díaz^{h,1}, Sonia Gómez-Martínez^{h,1}, Marcela González Gross^{i,1}, Frédéric Gottrand^{j,1}, Adrienn Hegyi^{k,1}, Claire Lehoux^{l,1}, Theodora Mouratidou^{m,1}, Kurt Widham^{n,1}, Annika Åström^{o,1}, Luis A. Moreno^{m,1}, Michael Sjöström^{b,1}^a School of Health, Care and Social Welfare, Mälardalens University, Västerås, Sweden^b Unit for Preventive Nutrition, Department of Biosciences and Nutrition, Karolinska Institute, Huddinge, Sweden^c Research Foundation – Flanders, Belgium^d Ghent University, Department of Public Health, University Hospital, Ghent, Belgium^e Department of Physical Activity and Sport, School of Physical Activity and Sport Sciences, University of Granada, Granada, Spain^f Campden BRI, Gloucestershire, UK^g National Institute for Food and Nutrition Research, Italy^h Department of Metabolism and Nutrition, Institute of Food Science, Technology and Nutrition (ICTAN), Instituto del Frío, Spanish National Research Council, Spainⁱ Facultad de Ciencias de la Actividad Física y del Deporte, Universidad Politécnica de Madrid, Madrid, Spain^j Faculté de Médecine, Université de Lille, France^k Campden BRI Magyarország, Budapest, Hungary^l Meurice Research and Development asbl, Brussels, Belgium^m Escuela Universitaria de Ciencias de la Salud, Universidad de Zaragoza, Zaragoza, Spainⁿ Division of Clinical Nutrition and Prevention, Department of Pediatrics, Medical University of Vienna, Vienna, Austria^o The Swedish Institute for Food and Biotechnology, Göteborg, Sweden

ARTICLE INFO

Article history:

Received 16 July 2010

Received in revised form 22 February 2011

Accepted 23 February 2011

Keywords:

Socioeconomic factors

Parents

Siblings

Diet surveys

Breakfast

ABSTRACT

Breakfast consumption has been shown to be an important indicator of a healthy lifestyle. Little is known however about factors influencing breakfast consumption and food choices at breakfast in adolescents. The aim of the present study was therefore to describe breakfast habits, and factors influencing food choices at breakfast within the framework of the EU-funded HELENA Study, in 3528 adolescents from ten European cities. Additionally, socio-demographic differences in breakfast habits and in influencing factors were investigated. Half of the adolescents (and fewer girls than boys) indicated being regular breakfast consumers. Girls with mothers with a high level of education, boys from 'traditional' families and boys who perceived low family affluence were positively associated with breakfast consumption. Boys whose parents gave encouragement and girls whose peers ate healthily were more likely to be regular breakfast consumers. 'Hunger', 'taste', 'health concerns' and 'parents or guardian' were the most important influences on the adolescents' food choices at breakfast. Adolescents from southern Europe and girls reported to be more influenced by personal and socio-environmental factors. Socio-demographic differences, in particular regional and gender differences, need to be considered in discussions surrounding the development of nutritional intervention programs intended for adolescents.

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[☆] **Acknowledgements:** The authors thank all the adolescents who took part in the HELENA Study. The HELENA Study took place with the financial support of the European Community Sixth RTD Framework Program (Contract FOOD-CT-2005-007034), the Swedish Council for Working Life and Social Research (FAS), the Research Foundation – Flanders (FWO, CV), and the Spanish Ministry of Science and Innovation (RYC-2010-05957). The content of this article reflect only the authors' views and the European Community is not liable for any use that may be made of the information contained therein. The writing group takes sole responsibility for the content of this article.

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Introduction

Breakfast consumption has been shown to be an important indicator of a healthy lifestyle (Rampersaud, Pereira, Girard, Adams, & Metz, 2005). Adolescents who are regular breakfast consumers have reported better exercise patterns (Keski-Rahkonen, Kaprio, Rissanen, Virkkunen, & Rose, 2003) and cognitive performance (Hoyland, Dye, & Lawton, 2009). In addition, regular breakfast consumption is associated with a reduced risk of becoming overweight or obese among adolescents in Europe (Szajewska & Ruszczynski, 2010). A good-quality breakfast can impact favorably on adolescents' mental health (O'sullivan et al., 2009) and improve overall diet quality (Matthys, De Henauw, Bellemans, De Maeyer, & De Backer, 2007; Raaijmakers, Bessems, Kremers, & Van Assema, 2010). Despite the importance of daily breakfast consumption, breakfast skipping is common among many adolescents in Western countries with prevalences of breakfast skipping varying between 3% (Dialektakou & Vranas, 2008) and 34% (Rampersaud et al., 2005). Moreover, a good quality breakfast is consumed among just 10% or fewer of adolescents from Belgium (Matthys et al., 2007) and the Netherlands (Raaijmakers et al., 2010). Additionally interventions to promote breakfast have met with mixed success (Rampersaud et al., 2005). A better understanding of factors influencing adolescents' breakfast habits may help to develop more efficient interventions.

Previous studies indicate that breakfast habits are related to socio-demographic characteristics and regions (Vereecken, Dupuy, et al., 2009). Breakfast skipping is more common among girls, older adolescents and those from low socioeconomic groups (Vereecken, Dupuy, et al., 2009, Johansen, 2006 #3906; Keski-Rahkonen et al., 2003). A direct association between parents and offspring has been shown in Finland; if the parents consume breakfast regularly, the adolescents consume breakfast regularly as well (Keski-Rahkonen et al., 2003). North American adolescents who consume breakfast regularly report consuming meals with their families more often (Videon & Manning, 2003) and the whole home food environment seems to be associated with breakfast consumption (Boutelle, Birkeland, Hannan, Story, & Neumark-Sztainer, 2007; Videon & Manning, 2003). Hunger, taste, time and convenience are the strongest factors influencing adolescents' food choices, in general, among North American adolescents (Neumark-Sztainer, Story, Perry, & Casey, 1999). Studies investigating influences on food choices for breakfast in European adolescents are however lacking.

The aim of this study was therefore to investigate factors influencing the food European adolescents choose for breakfast. Additionally, associations with socio-environmental variables were investigated so that better tailored interventions to promote breakfast could be developed in future.

Methods

Study design and sampling

The HELENA 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 approximately 3000 adolescents aged 13.00–16.99 years in 10 European cities (Moreno et al., 2008). The selected cities were Athens (Greece), Dortmund (Germany), Ghent (Belgium), Heraklion (Greece), Lille (France), Pecs (Hungary), Rome (Italy), Vienna (Austria), Stockholm (Sweden) and Zaragoza (Spain).

The selection of the European cities was first of all 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. 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: were aged between 12.5 and 17.49 years, had informed consent signed by both parents and adolescents, had at least weight and height measured and completed at least 75% of the tests and questionnaires. Participants were excluded if they were participating simultaneously in another clinical trial or had an acute infection less than one week before the study.

The adolescents completed in-class surveys and tests during the 2006–2007 academic year. A more detailed description of the study design, sampling and procedure has previously been published (Moreno et al., 2008). The present study comprises a total of 3528 adolescents (52% girls), with a mean age of 14.7 years (SD 1.2).

The study was approved by the national or local independent ethics committee from the relevant European city (Beghin et al., 2008).

Measures

For this study, a selection of questions from three questionnaires was used: 'Food Choices and Preferences' (Gilbert et al., 2008), 'Healthy Diet Determinants' (Vereecken, De Henauw, et al., 2009) and 'Your Living Environment' (Iliescu et al., 2008). The questions and response options used are described in Table 1.

The 'Food Choices and Preferences' (FCP) questionnaire was developed based on the results of 44 focus groups (with 304 adolescents) (Gilbert et al., 2010) which explored attitudes and issues of concern among adolescents regarding food choices, preferences, healthy eating and lifestyles. The focus groups were conducted in five European countries (Belgium, Hungary, Spain, Sweden and UK) and did not include any of the HELENA adolescents. Information was gathered regarding eating habits at various meal occasions; factors that influence food choice; favorite foods, healthy foods and traditional foods; healthy lifestyle and physical activity; sources of information on healthy eating and lifestyle; and exploration of ideas for new product development. This provided insight into aspects such as snacking, the perceived importance of 'health' in influencing choices, and barriers to healthy eating (Gilbert et al., 2008).

Breakfast consumption was assessed based on agreement with the statement: "I often skip breakfast" with 7 answer categories ranging from strongly disagree to strongly agree. The potential factors influencing choice of foods at breakfast included personal (hunger, taste, health, daily routine, ease of preparation, medical reason and price) and socio-environmental factors (parents or guardian, availability, friends and school environment), with answer categories ranging from no and slight influence to moderate, strong and very strong influence.

Assessments about socio-environmental factors (e.g. 'how healthy are your parents'/peers eating habits' and 'how often do your parents'/peers encourage you to eat healthily') were derived from the 'Healthy Diet Determinants' questionnaire (Table 1) (Vereecken, De Henauw, et al., 2009). For the purpose of the questionnaire, a 'healthy diet' was defined for the adolescents as: 'a well balanced diet which contains a lot of fruit, vegetables and dairy products, a good portion of starchy foods like bread, potatoes and pasta, a moderate portion of meat or fish, and not too much fat and sugar. Also the intake of a large amount of fluid is very important in a healthy diet. The energy content of a healthy diet is in accordance with the needs of the human body' (Vereecken, De Henauw, et al., 2009).

The 'Your Living Environment' (YLE) questionnaire was designed to assess socio-demographic status and gathered general

Table 1
Questionnaires and answer categories used in this paper.

Question and statements	Dichotomized answer categories	
Food Choices and Preference (FCP) (Gilbert et al., 2008, 2010) Dependent variables (Tables 3, 4A and 4B)		
• I often skip breakfast. Dependent variables (Table 3) Answer categories: Strongly disagree 1 to strongly agree 7	Breakfast consumer (1–3 = 1)	Breakfast skipper (5–7 = 0)
• How strong of an influence do the following factors have on your choice of foods at breakfast? Dependent variables (Tables 4A and 4B). Table 4A: Personal factors (How hungry you are, the taste of the food, concern for your health , your habits or daily routine , the food is easy to prepare , medical reason) Table 4B: Socio-environmental factors (Parents or guardian, the food is readily available , others , price of the food, school environment and friends) Answer categories: No influence 1 to very strong influence 5	No influence (1–2 = 0)	Influence (3–5 = 1)
Healthy diet determinants (HE) (Vereecken, De Henauw, et al., 2009) Independent variables (Table 3)		
• How healthily does your father/mother/brother/sister/best friend eat? Parents behaviour (father/mother) and peers behaviour (brother/sister/best friend) Answer categories: Very unhealthy 1 to very health 5	Unhealthy (1–3)	Healthy ^a (4–5)
• How often does your father/mother/brother/sister/best friend encourage you to eat a healthy diet? Parents encourage (father/mother) and peers encourage (brother/sister/best friend) Answer categories: Not at all 1 to very often 5	Never encourages (1–3)	Often encourages ^a (4–5)
Your Living Environment (YLE) (Iliescu et al., 2008) Socio-demographical factors Independent variables (Tables 3, 4A and 4B)		
• Parents education level: Education mother and Education father Low/medium education: elementary-, lower secondary-, higher secondary education High education: postgraduate studies	Low/medium education	High education ^a
• Parental occupations based on the International Standard Classification of Occupation (ISCO) Occupation mother and Occupation father	High – ISCO ^a 1–2 Medium – ISCO 3–5 Both working ^a	Low – ISCO 6–9 Undefined – ISCO 10–12 At least one at home
• Which of the following applies to your father/mother? Parents employment status Working: working full-time, working part-time, Not working: housewife, retired or being on the sick-list, trainee/student looking for work, pensioner, temporarily unemployed (e.g. maternity leave)		
• With whom do you principally stay with? Family structure Traditional family: with both of your parents, with your mother and her partner, with your father and his partner Single-parent/shared-care families: with your mother, with your father, with your mother half time and your father half time, with your grandparents or other relatives, with your foster or/adoptive parents, in an orphanage or somewhere else	Traditional family ^a	Single/shared-care
• How well off is your family? How well off Answer categories: very well off 1 to not well off 5	Well off ^a (1–2)	Not well off (3–5)
• Family affluence index FAS : own bedroom, how many cars, how many computers and internet connection at home	≤3 items	≥4 items ^a

The words in bold type are the names of the variables in Tables 3, 4A and 4B.

^a Reference value in the logistic regression.

information about the education and occupation level of both parents, parental employment status, family structure, number of siblings, how ‘well off’ the family was (the adolescent’s perception of the family’s affluence), and actual family affluence. This latter variable was measured using the family affluence scale (FAS), an index of the following items: whether the adolescent has his/her own bedroom, number of cars in the family, number of computers, and internet connection at home. The FAS was developed by the WHO collaborative Health Behaviour in School-aged Children (HBSC) Study (Boyce, Torsheim, Currie, & Zambon, 2006) and a modified version was used in this paper. The family structure variables were combined and a distinction was made between those living in one home with two parents (parents and/or step-parents), and those living in single-parent families (either lone parent household or ‘shared-care’ between parents). Those living in other family structures (e.g. in a foster home or with grandparents) were categorized into the single-parent/shared-care families.

Data on sex, age and study centre were collected in the case report form, completed by a physician. Age was dichotomized to younger or older than fifteen years of age. Centre was, according to the core group decision, dichotomized into northern/central (Dortmund, Ghent, Lille, Pecs, Vienna and Stockholm) and southern (Athens, Heraklion, Rome and Zaragoza).

All of the questionnaires included in the study were discussed and approved by the HELENA partners (Iliescu et al., 2008). After consensus was reached, the questionnaires were translated and

back-translated into the native language of the participants (Iliescu et al., 2008).

Test–retest stability of the questionnaire

The test–retest stability of the breakfast question from the FCP questionnaire (Gilbert et al., 2010) used in this paper (Table 1), was measured in 73 adolescents (55% girls) in Belgium (not included in the HELENA Study), with a mean age of 13.2 years (SD 0.8). Kappa values were calculated. The dichotomized breakfast statement “I often skip breakfast” showed good agreement between the test and retest (0.91) and the kappa values of the dichotomized factors (socio-environment and personal factors) from the FCP questionnaire (Table 1), ranged from medium to good agreement (0.35–0.75, $p < 0.01$ for the lowest correlation) with an average of 0.51.

The test–retest stability of the questions from the HE questionnaire used in this paper was measured in 55 adolescents (44% girls), with a mean age of 14.6 (SD 1.1) years. The test–retest stability of the socio-environmental factors from the HE questionnaire was poor to good (0.31–0.89) with Cronbach’s α (peers behaviour 0.31, peers encouragement 0.67, parents’ behaviour 0.72 and parents’ encouragement 0.89). Spearman’s rank correlations were calculated between the socio-environmental factors (peers’ behaviour, peers’ encouragement, parents’ behaviour and parents’ encouragement) and the subjects’ consumption of food groups: fruit, vegetables, soft drinks, snacks, non-sweetened milk.

The correlations were good between parents' perceived behaviour and milk consumption ($r = 0.31$) and between peers' perceived behaviour and fruit ($r = 0.27$), vegetables ($r = 0.35$), snacks ($r = -0.28$) and soft drink consumption ($r = -0.30$) (Vereecken, De Henauw, et al., 2009) but non-significant for the remaining associations.

Statistical analyses

Logistic regression analyses were used to investigate associations of breakfast consumption and choices of food at breakfast with individual and socio-environmental factors. All the logistic regressions included age, sex, study centre and socio-demographical factors (parental education and occupation, parents' employment status, living situation, siblings, perception of being 'well off', and the FAS score) as independent factors. Before the multivariate analyses, univariate analyses were done between the dependent and independent variables, resulting in significant associations between most of the variables.

Because of non-normality of the data, all questions, except parental occupation and siblings, were dichotomized (Table 1). To compare breakfast consumers and breakfast skippers, respondents indicating 'neither agree nor disagree' for the statement 'I often skip breakfast' (8%, $n = 235$) were excluded from the regression analysis; "strongly", "moderately" and "slightly disagree" were recorded into regular "breakfast consumer" while slightly, moderately and strongly agree were recorded into irregularly breakfast consumer from now on called "breakfast skipper". For the influencing factors, "no" and "slight" influence were recorded into "no influence", while "moderate", "strong" and "very strong" influence were recorded into "influence".

In all analyses a weighting factor for age and sex was used in order to adjust for imbalances in age in the observed group sample sizes. Separate analyses were performed for boys and girls in the analysis between breakfast consumers versus skipper, as breakfast habits often differ between the sexes (Rampersaud et al., 2005; Timlin, Pereira, Story, & Neumark-Sztainer, 2008). Descriptive statistics of the different socio-environmental and personal variables among factors influencing the choice of food for breakfast are presented for breakfast consumers only, including both sexes ($n = 1587$). The R^2 coefficient, a measure of the strength of association used in this study, was Nagelkerker R^2 . Analyses were performed in IBM SPSS version 19.0 and the level of significance was set at 5%.

Results

More than half (54%) of the adolescents were regular breakfast consumers (Fig. 1 and Table 2).

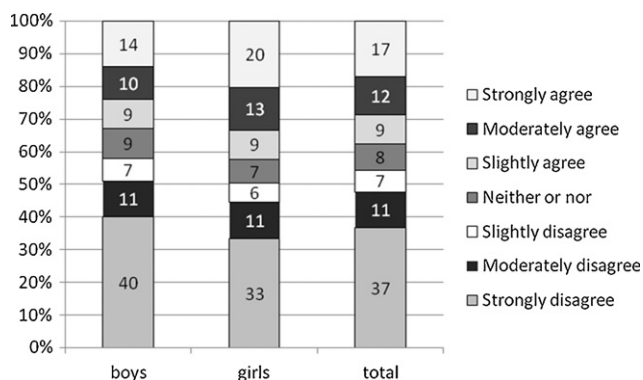


Fig. 1. Percentage of the statement "I often skip breakfast".

Table 2
Population categorization (observed sample).

	Boys (n = 1683)		Girls (n = 1845)		Answers	
	n	%	n	%	n	%
"I often skip breakfast"						
Breakfast consumer	793	58	792	51	2929	83
Neither or nor	125	9	110	7		
Breakfast skipper	452	33	657	42		
Age						
≥15 years ^a	744	44	769	42	3528	100
<15 years	936	56	1076	58		
Centre						
Northern/central	1082	64	1155	63	3528	100
Southern	601	36	690	37		
Education of mother						
High	533	34	584	33	3315	94
Low/medium	1032	66	1166	67		
Education of father						
High	536	35	567	34	3202	91
Low/medium	993	65	1106	66		
Occupation mother						
High	292	18	285	16	3341	95
Medium	578	37	688	39		
Low	240	15	289	16		
Undefined	468	30	501	28		
Occupation father						
High	462	30	446	26	3247	92
Medium	441	28	472	28		
Low	380	24	501	30		
Undefined	269	17	276	16		
Parents' employment status						
Both working	1020	70	1128	71	3058	87
At least one at home	442	30	468	29		
Family structure						
Traditional	1264	79	1392	79	3360	95
Single/shared-care	340	21	364	21		
Number of siblings						
0 siblings	281	18	302	17	3351	95
1 sibling	787	49	831	47		
≥2 siblings	528	33	622	35		
How well off						
Well off	895	55	895	50	3410	97
Not well off	728	45	892	50		
FAS (internet, pc, cars own room)						
High (≥4 items)	1141	78	1220	73	3135	89
Low (≤3 items)	321	22	453	27		
Parents' behaviour						
Healthy	980	62	972	53	3375	96
Unhealthy	614	38	809	44		
Parents encourage						
Often encourage	878	55	1000	56	3366	95
Do not encourage	711	45	779	44		
Peers behaviour						
Healthy	823	52	902	51	3341	95
Unhealthy	747	48	869	49		
Peers encourage						
Often encourage	757	49	1030	56	3312	94
Do not encourage	791	51	734	40		

Fewer girls indicated that they were breakfast consumers compared to boys (OR, 0.77; 95% CI, 0.64–0.94, $p < 0.05$).

Boys from single-parent/shared-care families, were less likely to be regular breakfast consumers (OR, 0.55, 95% CI, 0.38–0.81, $p < 0.01$) compared to boys from traditional families (Table 3). Boys who perceived that the family was 'not well off' were more likely to be regular breakfast consumers (OR, 1.55, 95% CI, 1.13–2.13, $p < 0.01$) compared to boys who perceived that the family was 'well off'. Girls who had a low FAS score were less likely to be regular breakfast consumers compared to their counterparts with high FAS scores. Girls whose mothers had a low/medium education level were less likely to be regular breakfast consumers (OR, 0.52, 95% CI, 0.37–0.74, $p < 0.001$) compared to girls with mothers with a high education level. The remaining socio-demographical factors

Table 3

Results of multivariate logistic regression analyses with breakfast consumption as dependent variable and socio-demographic and socio-environmental factors as independent variables: (OR, 95% CI) weighted for age.

	Boys (n = 829)			Girls (n = 1006)		
	OR	95% CI	p ^a	OR	95% CI	p ^a
Age (≥ 15 years ^b)						
<15 years	1.35	0.99–1.83		1.06	0.82–1.39	
Centre (northern/central ^b)						
Southern	0.92	0.65–1.29		0.84	0.62–1.13	
Education of mother (high ^b)						
Low/medium	0.72	0.48–1.08		0.52	0.37–0.74	***
Education of father (high ^b)						
Low/medium	0.76	0.51–1.14		0.86	0.60–1.22	
Occupation of mother (high ^b)						
Medium ISCO	1.32	0.84–2.08		1.31	0.87–1.97	
Low ISCO	1.33	0.73–2.42		1.21	0.71–2.06	
Undefined ISCO	1.36	0.77–2.41		1.50	0.89–2.54	
Occupation of father (high ^b)						
Medium ISCO	0.74	0.49–1.13		0.90	0.62–1.32	
Low ISCO	0.73	0.45–1.20		1.02	0.67–1.55	
Undefined ISCO	0.71	0.44–1.16		0.97	0.61–1.56	
Parents' employment status (both working ^b)						
At least one at home	1.03	0.67–1.60		1.12	0.75–1.68	
Family structure (traditional ^b)						
Single/shared-care	0.55	0.38–0.81	**	1.00	0.69–1.46	
Number siblings (0 siblings ^b)						
1 sibling	0.81	0.53–1.24		1.04	0.71–1.51	
≥ 2 siblings	0.89	0.56–1.42		0.73	0.49–1.09	
How well off (well off ^b)						
Not well off	1.55	1.13–2.13	**	1.14	0.87–1.49	
FAS (internet, pc, cars, own room) (≥ 4 items ^b)						
≤ 3 items	0.90	0.60–1.36		0.70	0.50–0.98	*
Parent behaviour (healthy ^b)						
Unhealthy	0.70	0.50–0.96	*	0.91	0.68–1.21	
Parent encourage (often encourage ^b)						
Do not encourage	0.59	0.43–0.81	**	1.00	0.75–1.34	
Peers behaviour (healthy ^b)						
Unhealthy	0.76	0.54–1.05		0.69	0.52–0.91	**
Peers encourage (often encourage ^b)						
Do not encourage	1.44	1.04–2.00	*	1.25	0.94–1.64	
Nagelkerker R ²	0.107			0.079		

^a * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

^b Reference value.

(centre, father's education, parental occupation, parents' employment status and siblings) did not differ significantly in either boys or girls between the breakfast consumption groups.

Boys whose parents gave low or no encouragement to eat a healthy diet were less likely to be regular breakfast consumers (OR, 0.59, 95% CI, 0.43–0.81, $p < 0.01$) compared to boys whose parents often gave encouragement to eat a healthy diet. Girls whose peers ate unhealthily were less likely to be regular breakfast consumers (OR, 0.69, 95% CI, 0.52–0.91, $p < 0.01$) compared to those whose peers ate healthily. Boys whose parents ate unhealthily were less likely to be regular breakfast consumers compared to those whose parents ate healthily. Boys whose peers gave low or no encouragement to eat a healthy diet were more likely to be regular breakfast consumers compared to adolescents whose peers often gave encouragement to eat a healthy diet.

The variation explained in the regression was 0.11 for boys and 0.08 for girls, estimated with Nagelkerker R² (Table 3).

The personal factors 'hunger', 'taste of the food' and 'concern for health' and the socio-environmental factor 'parents or guardian' were the most important influences on adolescents' food choices at breakfast. Between 44% and 59% of respondents believed these factors to have a strong or very strong influence. The factor 'price of the food', 'the school environment' and 'friends' had much less influence, between 11% and 14% reported that these factors had a strong or very strong influence (Fig. 2). The pattern was similar for boys and girls (data not shown).

Table 4A shows the socio-demographical associations among the personal factors ('hunger', 'concerns for health', 'daily routine', 'ease of preparation' and 'medical reasons') influencing food choices for breakfast. The factors 'concern for health' (OR, 2.14, 95% CI, 1.61–2.83, $p < 0.001$) and 'daily routine' (OR, 1.67, 95% CI, 1.30–2.15, $p < 0.001$) influenced the girls more than the boys in their choice of food for breakfast. Adolescents younger than 15 years of age were more influenced by 'medical reasons' and less influenced by 'ease of preparation' in comparison to the older adolescents in their choice of food for breakfast. Adolescents from southern Europe were more influenced by 'concern for health' (OR, 2.26, 95% CI, 1.60–3.19, $p < 0.001$), 'medical reasons' (OR, 1.80, 95% CI, 1.33–2.42, $p < 0.001$) and less influenced by 'hunger' (OR, 0.61, 95% CI, 0.43–0.86, $p < 0.01$) and 'ease of preparation' in their choices of food for breakfast compared to adolescents from the northern and central part of Europe. For those adolescents whose mothers had a low/medium education level, the factor 'concern for health' and 'daily routine' had a larger influence on food choices at breakfast compared to those whose mothers had a high education level. Among those adolescents whose fathers had a high education level, the 'daily routine' (OR, 0.61, 95% CI, 0.44–0.86, $p < 0.01$) had a larger influence on food choices at breakfast compared to those whose fathers had a low/medium education level.

There were no socio-demographic differences seen for the personal factor 'taste of the food' (data not shown).

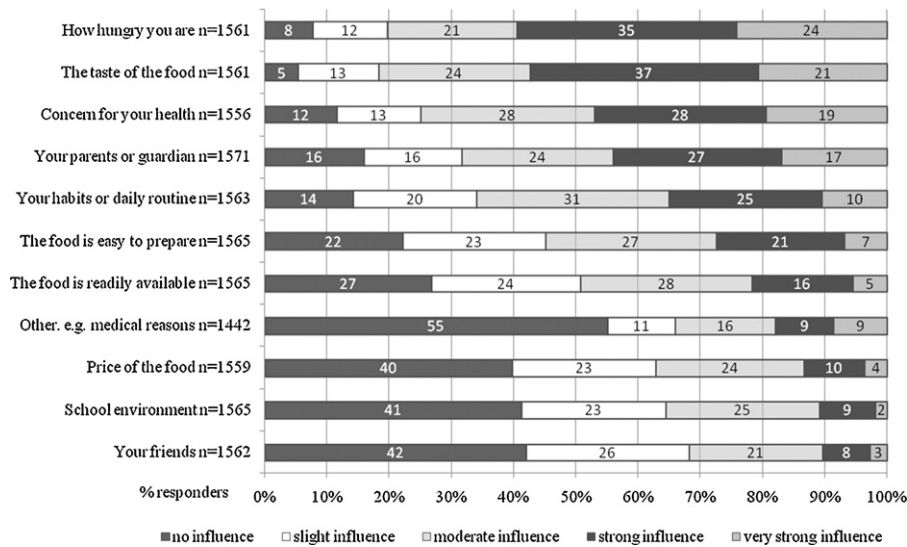


Fig. 2. Percentage of factors influence on adolescents' choice of foods to breakfast.

Table 4B shows the socio-demographical distribution among the socio-environmental factors ('parents or guardian', 'the food is readily available', 'price of the food', 'the school environment' and 'friends') influencing food choices for breakfast. Girls were more influenced by their 'parents or guardian' and less influenced by whether 'the food is readily available' in their choices of food for breakfast compared to boys. Adolescents younger than 15 years of age were more influenced by 'parents and guardians' (OR, 1.54, 95% CI, 1.18–2.01, $p < 0.01$) in comparison to the older adolescents in their choice of food for breakfast. Adolescents from southern Europe were more influenced by 'parents or guardian' (OR, 2.59, 95% CI, 1.88–3.59, $p < 0.001$) 'school environment' (OR, 1.88, 95%

CI, 1.42–2.50, $p < 0.001$) and 'friends' (OR, 1.51, 95% CI, 1.12–2.02, $p < 0.01$) and less influenced by whether 'the food is readily available' (OR, 0.66, 95% CI, 0.50–0.87, $p < 0.01$) in their choices of food for breakfast compare to adolescents from the northern and central part of Europe. For those adolescents whose mothers had a low/medium education level, 'price of the food' (OR, 1.75, 95% CI, 1.26–2.43, $p < 0.01$) had a larger influence on food choices at breakfast compared to those whose mothers had a high education level. For those adolescents whose fathers had a low/medium education level, the 'parents or guardian' had less influence on food choices at breakfast compared to those whose fathers had a high education level. Finally, adolescents who perceived themselves as

Table 4A

Results logistic regression analysis with personal factors (hunger, health, daily routine, ease of preparation and medical reason) influencing choices of food for breakfast as dependent variables and socio-demographics as independent, for breakfast consumers only. Weighted for age and sex.

	Hunger (n = 1151)			Health (n = 1152)			Daily routine (n = 1155)			Prepare (n = 1157)			Medical (n = 1062)		
	OR	95% CI	p^a	OR	95% CI	p^a	OR	95% CI	p^a	OR	95% CI	p^a	OR	95% CI	p^a
Age (≥ 15 years ^b)															
<15 years	0.80	0.58–1.09		1.13	0.85–1.50		0.86	0.66–1.11		0.78	0.61–1.00	*	1.38	1.05–1.81	*
Sex (boys ^b)															
Girls	0.94	0.69–1.28		2.14	1.61–2.83	***	1.67	1.30–2.15	***	0.91	0.72–1.15		0.77	0.59–1.00	
Centre (northern/central ^a)															
Southern	0.61	0.43–0.86	**	2.26	1.60–3.19	***	1.12	0.83–1.49		0.76	0.58–1.00	*	1.80	1.33–2.42	***
Education of mother (high ^b)															
Low/medium	0.87	0.58–1.31		1.51	1.05–2.16	*	1.40	1.00–1.95	*	1.22	0.90–1.66		1.11	0.78–1.57	
Education of father (high ^b)															
Low/medium	1.30	0.86–1.98		1.28	0.88–1.85		0.61	0.44–0.86	**	1.22	0.89–1.68		1.37	0.95–1.98	
Occupation of mother (high ^b)															
Medium ISCO	1.34	0.85–2.12		0.63	0.42–0.95	*	0.90	0.61–1.32		0.80	0.56–1.14		0.88	0.59–1.31	
Low ISCO	1.23	0.66–2.31		0.68	0.38–1.23		0.55	0.33–0.93	*	0.63	0.38–1.03		0.69	0.40–1.20	
Undefined ISCO	0.83	0.47–1.45		0.79	0.47–1.34		0.69	0.43–1.11		0.73	0.46–1.14		0.89	0.54–1.49	
Occupation of father (high ^b)															
Medium ISCO	1.00	0.64–1.56		0.67	0.46–0.99	*	1.11	0.78–1.59		1.06	0.76–1.48		1.40	0.96–2.05	
Low ISCO	0.62	0.38–1.02		0.74	0.45–1.12		1.14	0.76–1.72		1.05	0.72–1.54		1.48	0.96–2.28	
Undefined ISCO	0.68	0.41–1.13		0.95	0.59–1.52		0.87	0.57–1.32		1.20	0.80–1.79		1.10	0.70–1.74	
Number of siblings (0 siblings ^b)															
1 sibling	1.60	1.06–2.40	*	1.24	0.84–1.83		1.33	0.94–1.88		1.23	0.88–1.71		1.23	0.85–1.77	
≥ 2 siblings	1.24	0.79–1.94		1.22	0.80–1.86		1.01	0.69–1.48		1.20	0.83–1.73		1.18	0.78–1.78	
How well off (well off ^b)															
Not well off	1.14	0.83–1.56		0.82	0.62–1.09		1.08	0.83–1.40		0.80	0.63–1.02		0.97	0.74–1.27	
Nagelkerker R^2	0.044			0.102			0.055			0.031			0.067		

The regression include also parents employment status, living situation, and FAS score.

^a $p < 0.05$, ^{**} $p < 0.01$, ^{***} $p < 0.001$.

^b Reference value.

Table 4B

Results of logistic regression analysis with socio-environmental factors (parents, available, price, school and friends) influencing choices of food for breakfast as dependent variables and socio-demographics as independent, for breakfast consumers only. Weighted for age and sex.

	Parents (n = 1161)			Available (n = 1153)			Price (n = 1150)			School (n = 1155)			Friends (n = 1155)		
	OR	95% CI	p ^a	OR	95% CI	p ^a	OR	95% CI	p ^a	OR	95% CI	p ^a	OR	95% CI	p ^a
Age (≥ 15 years ^b)															
<15 years	1.54	1.18–2.01	**	0.82	0.64–1.05		1.14	0.88–1.46		1.20	0.93–1.54		0.93	0.72–1.21	
Sex (boys ^b)															
Girls	1.36	1.05–1.77	*	0.78	0.62–1.00	*	0.98	0.76–1.25		1.18	0.92–1.51		1.12	0.86–1.44	
Centre (north/central ^b)															
South	2.59	1.88–3.59	***	0.66	0.50–0.87	**	0.78	0.58–1.04		1.88	1.42–2.50	***	1.51	1.12–2.02	**
Education mother (high ^b)															
Low/medium	0.96	0.68–1.36		1.25	0.91–1.71		1.75	1.26–2.43	**	0.90	0.65–1.25		1.00	0.72–1.40	
Education father (high ^b)															
Low/medium	0.69	0.48–0.99	*	1.14	0.83–1.58		1.03	0.74–1.44		0.95	0.68–1.33		1.33	0.94–1.88	
Occupation mother (high ^b)															
Medium ISCO	1.23	0.83–1.83		1.08	0.76–1.53		0.80	0.55–1.16		0.86	0.59–1.25		0.76	0.52–1.11	
Low ISCO	0.89	0.52–1.53		1.05	0.64–1.73		0.91	0.55–1.52		0.93	0.55–1.56		0.52	0.30–0.90	*
Undefined ISCO	0.91	0.56–1.49		1.02	0.65–1.61		0.94	0.59–1.50		0.95	0.59–1.53		0.85	0.52–1.38	
Occupation father (high ^b)															
Medium ISCO	1.15	0.80–1.67		1.22	0.88–1.71		0.90	0.64–1.28		1.41	0.99–2.00		1.34	0.94–1.92	
Low ISCO	1.00	0.66–1.52		1.19	0.81–1.75		1.15	0.77–1.71		1.52	1.01–2.28	*	1.46	0.97–2.20	
Undefined ISCO	0.91	0.59–1.40		1.07	0.72–1.60		0.97	0.64–1.48		1.08	0.70–1.66		0.94	0.61–1.46	
Number siblings (0 siblings ^b)															
1 sibling	1.08	0.75–1.56		1.14	0.81–1.58		1.30	0.92–1.86		1.08	0.76–1.53		1.35	0.93–1.95	
≥ 2 siblings	0.99	0.67–1.48		1.32	0.92–1.91		1.37	0.93–2.02		1.10	0.75–1.62		1.61	1.08–2.42	*
How well off (well off ^b)															
Not well off	0.77	0.59–1.01		0.58	0.45–0.74		1.20	0.93–1.55		0.75	0.58–0.97	*	0.64	0.49–0.84	**
Nagelkerker R ²	0.091			0.053			0.042			0.054			0.051		

The regression include also parents employment status, living situation, and FAS score.

^a * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

^b Reference value.

being 'not well off' were less influenced by the 'school environment' and 'friends' (OR, 0.64, 95% CI, 0.49–0.84, $p < 0.01$) in comparison to those who perceived themselves as being 'well off' in their choices of food for breakfast. There were no significant differences for the socio-demographical variables 'parents' employment status', 'family structure' and 'FAS' for any of the personal and socio-environmental factors (data not shown). The variation explained in the regressions varied between 0.03 and 0.10 estimated with Nagelkerker R² (Tables 4A and 4B).

Discussion

The main finding of this study was that European adolescents' breakfast consumption and choice of food for breakfast was associated with region in Europe; sex; socio-environmental factors (parents) and personal factors (hunger, taste and health) are inappreciably associated with socio-demographical factors.

Breakfast habits

The frequency of regular breakfast consumption among adolescents in our study is in agreement with other European studies in adolescents, indicating that many do not have appropriate breakfast habits (Aranceta, Serra-Majem, Ribas, & Perez-Rodrigo, 2001; Bruno-Ambrosius, Swanholm, & Twetman, 2005; Keski-Rahkonen et al., 2003; Lien, 2007; Matthys et al., 2007; Sjöberg, Hallberg, Höglund, & Hulthen, 2003; Vereecken, Dupuy, et al., 2009).

Additionally, this study presents data on a neglected area of research, namely the influence of personal and socio-environmental factors on food choice at breakfast among European adolescents. Our study shows that the personal factors 'hunger', 'taste of the food', 'concern for health' and the socio-environmental factor 'parents or guardian' were the most important influences on the adolescents' choice of food at breakfast. Similar findings have been

shown in studies from the USA (Neumark-Sztainer et al., 1999; Story, Neumark-Sztainer, & French, 2002), from Sweden (Berg, Jonsson, Conner, & Lissner, 2003) and from Australia (O'Dea, 2003). Quality, price, taste, health and family have been shown to influence a European adolescent/adult population most in their choice of food, where taste was the most important factor in the youngest group (15–34 year) (Lennernas et al., 1997). Our results support principles described in social cognitive theory (Ball et al., 2009; Baranowski, Cullen, & Baranowski, 1999), briefly, the social cognitive theory is to take into consideration the interplay between socio-environmental, personal and behavioural factors.

Breakfast consumption and socio-demographic factors

In our study, boys were more likely to be regular breakfast consumers compared with girls, which is supported by previous findings (Lien, 2007; Matthys et al., 2007; Sjöberg et al., 2003), although not consistently (Aranceta et al., 2001). One reason for the sex differences in breakfast consumption could be that girls skip breakfast to control their weight (Lattimore & Halford, 2003; Timlin et al., 2008). Girls reported also that they were more influenced in their choices of food for breakfast by their 'parents', by 'concern for health' and 'daily routine' compared to boys. Similar results have been reported elsewhere (Boutelle et al., 2007).

Although we did not observe any age differences in breakfast consumption for either sex, other studies have shown that older adolescents skip breakfast more often than their younger counterparts (Rampersaud et al., 2005; Vereecken, Dupuy, et al., 2009). In our study, younger adolescents reported that they were more influenced by their 'parents or guardian' in their choices of food for breakfast compared to older adolescents. This could reflect the adolescent's increasing autonomy with age, and indeed older adolescents report consuming more food outside the home compared to younger adolescents (Story et al., 2002).

We did not find a significant difference in breakfast consumption between the two regions of Europe. However looking at the factors influencing food choices for breakfast, significant differences were found between the two regions for most factors. Adolescents from the south of Europe reported that they were more influenced by their parents, concern for their health, medical reasons, the school and friends while northern and central European adolescents were more influenced by hunger, ease of preparation and availability in their choices of food for breakfast. Lennernas et al. (1997) show in a European population (15 years and upward) no regional differences among factors influencing food choices. It is likely that the socio-cultural norms are different between southern Europe and the northern/central part. To our knowledge, there are no studies investigating differences on food choices in adolescents from southern and northern/central Europe. Further research is needed on a regional or national level to better understand the determinants of food choices in adolescents living in different parts of Europe.

Boys who lived in traditional families were more likely to be breakfast consumers than boys who lived in single-parent/shared-care families. Similar results have been seen in adolescents (Lien, 2007), with the exception of those from Eastern Europe, in the HBSC Study (Vereecken, Dupuy, et al., 2009). The association between family structures and breakfast habits may be explained by the social and contextual factors that are associated with exposure to single parenthood (Fergusson, Boden, & Horwood, 2007). Nonetheless, factors influencing food choices did not differ by family structure.

Our study showed that girls were more likely to be breakfast consumers if they had a mother with a high education level compared to girls with mothers with a low/medium education level. Similar results have been found both in Europe (Lien, 2007; Pearson, Macfarlane, Crawford, & Biddle, 2009) and in the United States (Timlin et al., 2008). Studies finding no association between parental education and breakfast consumption have also been reported, in Australia (Shaw, 1998), China (Shi, Lien, Kumar, & Holmboe-Ottesen, 2005) and Taiwan (Yang, Wang, Hsieh, & Chen, 2006). In addition our study showed that adolescents with a mother with a low education level were more influenced, by 'concern for their health', 'the daily routine' and 'the price of food' in their choices of food for breakfast, compared to adolescents with a mother with a high education level. If the adolescents had a father with high education level they were more influenced by the 'parents' and 'daily routine' in their choice of food for breakfast.

Boys were more likely to be breakfast consumer if they perceived themselves as being 'well off' and for girls a positive association was found between regular breakfast consumption and FAS, similarly results have previously been shown (Vereecken, Dupuy, et al., 2009). Adolescents who perceived themselves to be 'well off' report that they were more influenced by 'school environment' and 'friends' in their choices of food for breakfast compared to those who perceived themselves to be 'not well off'.

Mother's and father's occupation level as indicators for socio-demographic status did not differ between breakfast consumers and breakfast skippers in our study. The literature shows that having parents with a high-level occupation is associated with regular breakfast consumption (Keski-Rahkonen et al., 2003; Sjöberg et al., 2003). Instead there was an association between if 'concern for their health' influenced the adolescent's choices of food for breakfast and if the mother and father had a high occupational level. A study by Vereecken et al. found that mothers of preschool children had a lower health-attitude score if they had a low-level occupation and education (Vereecken & Maes, 2010).

Breakfast consumption and socio-environmental (parents'/peers' eating behaviour and encourage) factors

Regular breakfast consumption among girls was associated with the socio-environmental factor 'peers' behaviour' and for boys there was a positive association between breakfast and parents' behaviour. Adolescent breakfast consumption has been reported, in Finland, to be associated with parental breakfast consumption (Keski-Rahkonen et al., 2003) and with frequency of family meals in North America (Utter, Scragg, Schaaf, & Mhurchu, 2008; Videon & Manning, 2003). Keski-Rahkonen et al. (2003) suggested that the best way to influence adolescents' breakfast habits is to create a family and peer atmosphere that endorses general health-conscious behaviour.

Boys were more likely to be regular breakfast consumers if they received encouragement from their parents to eat healthily. No such association was seen in girls. Boutelle et al. (2007) showed that adolescents' perception of their mothers' attitudes is associated with their own behaviour and attitudes. Our results together with the literature highlight the importance of adolescents' perceptions of their parents and the impact of these perceptions on adolescent attitudes and behaviour. Boys reported consuming breakfast less often when peers encouraged them to eat healthily. This was in contrast to the influence of peers on younger children's food preferences (Taylor, Evers, & Mckenna, 2005). Story et al. (2002) has raised the question that adolescents are seeking autonomy and may not believe that their behaviour is influenced by others and if they are influenced, by peers, it may be indirect rather than direct.

School breakfast programs are considered to be useful (Aranceta et al., 2001; Gassin, 2001), but opinions differ regarding efficiency (Belderson et al., 2003). Studies have indicated the family to be a good arena for breakfast programs (Keski-Rahkonen et al., 2003; Matthys et al., 2007), but very few studies involving families have been done with adolescents (Mihás et al., 2009; Neumark-Sztainer, Flattum, Story, Feldman, & Petrich, 2008).

Strengths and limitations

The strengths of our study include the fact that the geographical distribution of HELENA partners, as well as the large sample of adolescents in the study population, gives a fair approximation of the average picture of the situation in European cities (Moreno et al., 2008). Another strength is the standardized and harmonized methodology (Beghin et al., 2008; Iliescu et al., 2008; Moreno et al., 2008) and the use of reliable and validated questionnaires (Vereecken, De Henauw, et al., 2009). The limitations of the current study include the cluster selection, sampling from urban areas only, the lack of possibility to compare the results between the different countries in Europe (Moreno et al., 2008) and the use of self-reported data (Gilbert et al., 2008; Iliescu et al., 2008; Vereecken, De Henauw, et al., 2009). The skipping breakfast variable was based on the adolescents' perception of how often they skipped breakfast, and therefore not based on real frequencies or food intake. No specific definition for the term 'breakfast' was provided in this study.

The factors studied explained only a very low proportion of the variance in breakfast consumption (the Nagelkerker R^2 was 0.11 for boys and 0.08 for girls and the socio-environmental and personal factors varied between 0.03 and 0.10).

In this study, the findings were presented for two regions in Europe, but heterogeneity in breakfast habits between European countries have been reported (Vereecken, Dupuy, et al., 2009). To get more specific information about the breakfast habits among European adolescents it is recommended to do investigations in larger country samples. The studies should focus on the association

of factors influencing breakfast habits with factors such as parents, taste, hunger, health aspects and sex.

Conclusion

The main finding in this study was that European adolescents' breakfast consumption and choice of food for breakfast was associated with region in Europe; sex; socio-environmental factors (parents) and personal factors (hunger, taste and health) are appreciably associated to socio-demographical factors. These factors should be taken into consideration when discussing and planning for breakfast intervention programs for adolescents.

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