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## Breakfast consumption and its socio-demographic and lifestyle correlates in schoolchildren in 41 countries participating in the HBSC study

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### Abstract

**Objective**—To investigate associations of daily breakfast consumption (DBC) with demographic and lifestyle factors in 41 countries.

**Methods**—Design: Survey including nationally representative samples of 11–15 year olds (n = 204,534) (HBSC 2005–2006). Statistics: Multilevel logistic regression analyses

**Results**—DBC varied from 33 % (Greek girls) to 75 % (Portuguese boys).

In most countries, lower DBC was noticed in girls, older adolescents, those with lower family affluence and those living in single-parent families. DBC was positively associated with healthy lifestyle behaviours and negatively with unhealthy lifestyle behaviours.

**Conclusion**—Breakfast skipping deserves attention in preventive programs. It is common among adolescents, especially girls, older adolescents and those from disadvantaged families.

The results indicate that DBC can serve as an indicator to identify children at risk for unhealthy lifestyle behaviours.

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## Keywords

Breakfast; Schoolchildren; Adolescents

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## Introduction

Breakfast is often considered the most important meal of the day and children can benefit from breakfast consumption in several ways. Several studies have consistently shown that regular breakfast consumption is associated with higher in-takes of micronutrients, and a better diet quality in school-aged children<sup>1-4</sup>. In addition, many cross-sectional studies across the world suggest an inverse relationship between breakfast consumption and BMI or overweight<sup>2-7</sup>. This finding has also been noted in the cross-sectional analysis of data from 41 countries participating in the Health Behaviour in School-aged Children study (HBSC)<sup>8</sup>. Prospective studies have confirmed this association in adolescents<sup>2,9</sup>.

It is well known that parents play an important role in what children consume. The main body of literature on the association between social economic status (SES) and breakfast habits almost consistently concludes that being a child or adolescent of low SES is associated with irregular breakfast habits and this relationship exists for a range of different SES indicators (e. g. parental education<sup>2,10,11</sup>, parental occupation<sup>5</sup>, and area level indicators<sup>6</sup>). Only rarely, no association between SES and adolescent breakfast habits has been observed<sup>12</sup>. However most studies of the association between SES and adolescent breakfast habits have included US populations<sup>2,10</sup> or Northern European populations<sup>5,11</sup>. Knowledge on the relevance of SES for the breakfast habits of children and adolescents in other European regions are lacking.

Health-compromising behaviours such as alcohol consumption, smoking, and sedentary lifestyle are also important determinants of energy balance and energy metabolism, and therefore need to be considered in the perspective of overweight prevention. Breakfast consumption is usually negatively associated with risk behaviours. Although, the relationship of breakfast consumption with these lifestyle factors has been examined in only a few studies<sup>5,7</sup>, to our knowledge, such data are lacking from a large cross-country comparative study perspective.

The purpose of the present study was to describe daily breakfast consumption (DBC) patterns of children across 41 countries participating in the HBSC (2005/06) survey and to identify its socio-demographic (gender, age, family affluence and family structure) and lifestyle correlates (smoking and drinking practices, physical activity, television viewing, eating habits including fruit, vegetable, soft-drink consumption, and dieting behaviour). Consistent patterns across the HBSC countries can make an important contribution to screening strategies and development of health promotion programs.

## Methods

### Subjects and study design

The data presented here were obtained from the 2005/06 World Health Organization collaborative HBSC study, which comprises of an international network of research teams across Europe and North America with the aim to gain insight into adolescents' health and health behaviours.

Each country followed the standardized international research protocol to ensure consistency in survey instruments, data collection and processing procedures. Participants were selected

using a clustered sampling design, where the initial sampling unit was either the school class or school. Questionnaires were administered in school classrooms by trained personnel, teachers, or school nurses. The time frame for filling out the questionnaires was one school period. Participants could freely choose to participate and anonymity and confidentiality was ensured at all stages of the study. Each country respected ethical and legal requirements in their countries for this type of survey.

The population selected for sampling was 11, 13 and 15 years old attending school with the desired mean age for the three age groups being 11.5, 13.5 and 15.5 respectively. Participating countries were required to include a minimum of 95 % of the eligible target population within their sample frame. In the majority of countries, national representative samples were drawn and samples were stratified to ensure representation by, for example, geography, ethnic group and school type. The recommended sample size for each of the three age groups was approximately 1,500 students, assuming a 95 % confidence interval of  $\pm 3$  percent around a proportion of 50 per cent and allowing for the clustered nature of the samples.

In total, 204,534 adolescents from 41 countries or regions, were included in the 2005–06 final datafile. More detailed information about the study is provided elsewhere<sup>13,14</sup>.

## Measures

To assess DBC, adolescents were asked to indicate how many days in a week and in a weekend they had breakfast (defined as having more than a glass of milk or fruit juice). Response categories were “never” to “five days” for the week, and “never” to “two days” for the weekend. The number of weekdays and weekend days were summed and dichotomized into “daily breakfast consumption” versus “less than daily”.

As a measure of the adolescents' socioeconomic position, family affluence was measured by a sum score (Family Affluence Scale: FAS) of four items: Does your family own a car, van or truck? (0–2 points). Do you have your own bedroom for yourself? (0–1 points). During the past twelve months, how many times did you travel away on holiday (vacation) with your family? (0–2 points); and how many computers does your family own? (0–2). Due to international differences in variation and mean of FAS, and the fact that we wanted to study the associations within each country rather than between countries, the FAS sum score was divided into tertiles within each country.

Some young people live in one or two parent households, while others may have more complex living arrangements. In the questions about family structure the child was asked to indicate on a checklist with whom he/she lived most of the time and if he/she also had a second home. The checklist included father, mother, stepfather, stepmother, siblings, extended family, living with other adults, or living in a foster home or children's home. The variables were combined and a distinction was made between those living with two parents (parents and/or stepparents) and those living with a single parent in the main home. Missings and those living in other family structures (e. g. in a foster home or with grand parents) were categorized into a third category to avoid losing these cases in further analyses.

To study the associations of DBC with health risk behaviours, questions on different aspects of lifestyle were included: substance use (smoking, drunkenness), physical activity, television viewing, eating habits (fruit, vegetable and soft drink consumption) and dieting practises. For each, a dichotomous variable was constructed.

Smoking status was defined based on the question “How often do you smoke tobacco at present?” Possible responses were: “every day”, “at least once a week, but not every day”,

“less than once a week” or “never”, recoded into “smokers” and “non-smokers”. Alcohol (mis)use was measured with the question “How often have you been drunk?”, with the response options “never”, “once”, “2–3 times”, “4–10 times” and “more than 10 times”, recoded into “less than twice”, versus “twice or more”.

Moderate to vigorous physical activity was measured based on the question: “How many days in the past week were you physically active for 60 minutes or more. Response categories were “0 days” up to “7 days”, recoded into “< 5 days a week”; “ 5 days a week”.

Television viewing was assessed by “About how many hours a day do you usually watch television (including videos and DVDs) in your free time?” on weekdays and again on the weekend. The nine possible responses were “none at all”, “about half an hour a day”, “about 1 hour a day”, “about 2 hours a day” up to “about 7 or more hours a day”. Both responses were combined and recoded into “ 2 hours a day” versus “> 2 hours a day”.

Adolescents were asked how many times a week they usually consume fruit, vegetables, and soft drinks. The response options were “never”, “less than once a week”, “about once a week”, “two to four days a week”, “five to six days a week”, “once a day, every day”, “every day, more than once”. All three items were dichotomised into “daily” vs. “less than daily”.

Concerning dieting, adolescents were asked: “At present are you on a diet or doing something else to lose weight?” Response categories were: “no, my weight is fine”, “no, but I need to lose weight”, “no, I need to put on weight” and “yes”, dichotomised into “dieters (= the last option)” and “non-dieters.”

Respondents with missing data on age, gender, family affluence or DBC were excluded from the analyses.

## Analyses

Frequencies of DBC by gender were produced for all participating countries and for descriptive sake are presented by region as defined by the United Nations<sup>15</sup>.

Multilevel logistic regression analyses were conducted for each country separately, with adolescents nested within schools (two-level random intercept model). In a first set of models, the dependent variable was DBC and the independent variables were age, gender, family affluence and family structure. In a second set of analyses, we analysed for each health risk behaviour (independent) separately, the association with DBC (dependent), controlling for socio-demographic factors.

The MLwin2.1 software package with second order predictive quasi-likelihood estimation procedures was used to perform the analyses. All independent variables are presented as dummy indicator variables, contrasted against a base category. P-values < 0.05 were considered significant.

## Results

Data on 190,635 adolescents were included for the present analyses. Across all countries, 7.4 % of the respondents were excluded due to missing values on key variables: DBC (3.6 %), family affluence (3.7 %), and/or age (0.7 %). In eight countries > 10 % individuals were excluded due to missing values: Greenland (28.6 %), Israel (18.9 %), Luxembourg (16.8 %), Malta (14.9 %), Belgium-Fr (14.5 %), Italy (13.6 %), Ireland (11.8 %), and Turkey (11.3 %).

Socio-demographic characteristics of the study population are shown in Tab. 1.

When DBC patterns by countries and gender were examined (Fig. 1) regional tendencies were noted. The majority of Central European, Southern European, and Northern European countries had > 50 % children reporting DBC (highest DBC was noted in the Netherlands, Portugal, Denmark and Sweden). In half of the Eastern European and two of the three non-European countries, less than 50 % of children had breakfast every day.

In most countries a general trend of lower DBC by girls (Tab. 2 and Fig. 1; exception Iceland), and a consistent trend of lower DBC in older age groups was noted, irrespective of region. Socio-economic position as measured by FAS, was associated with DBC in most Northern European and Central European countries; children from families with low FAS were less likely to have breakfast every day. However, a negative association between FAS and DBC was noted in three countries (Latvia, Bulgaria, Turkey). With regard to family structure, living in a two-parent family was associated with DBC in the majority of countries across regions with the exception of Eastern European countries.

The adjusted odds for DBC were lower in smokers in all countries, except Malta (Tab. 3). A negative association was also noted between DBC and being drunk in the majority of countries except in Southern European countries, where the association was less evident.

In the majority of countries, being physically active was positively, while watching > 2 hr/day of television was negatively associated with DBC. Most countries showed a strong positive relation between daily fruit or vegetable consumption and DBC. In addition, in most countries soft drink consumption and dieting were negatively associated with DBC.

## Discussion

Despite the recommendations encouraging breakfast consumption<sup>4</sup>, breakfast skipping by children was noted consistently across all regions. In only four countries (Netherlands, Portugal, Denmark, and Sweden) 70 % or more children reported eating breakfast daily. This is consistent with the findings indicating that breakfast skipping is highly prevalent in Europe and the United States, ranging from 10 to 30 %<sup>4</sup>. Variations in DBC were noted across regions. Disparities in breakfast consumption across countries may be explained by differences in cultural practices, socio-economic factors and availability of school-breakfast programs.

DBC was related to all socio-demographic factors examined. Girls showed lower prevalences of DBC than boys in most countries. DBC was less common in older children, and in children from families with lower family affluence, and in those living with a single parent. In addition, DBC correlated positively with healthy lifestyle- and negatively with unhealthy lifestyle-behaviours.

The finding of girls eating breakfast less often than boys has been reported previously<sup>5,6,12,16</sup>. It is likely that girls are more weight and/or image-conscious and are more likely to practice weight control behaviours including breakfast skipping<sup>17</sup>. In fact, dieting related negatively to DBC in the current study (adjusted OR ranged between 0.44 and 0.91) consistent with the findings of Timlin et al.<sup>2</sup>. Our finding of lower DBC in older children compared to 11 year olds is also consistent with previous studies<sup>6,9</sup>. This age-related decline in DBC could be explained by important changes that accompany adolescence including greater autonomy and independence in food choices, decreased frequency of family meals and time considerations<sup>3,18</sup> but also increased dieting, especially among girls. Previous studies on the association between SES and breakfast habits in US populations<sup>2,10</sup> and Northern European populations<sup>5,11</sup> indicate a positive association

between SES and regular breakfast consumption. However, the present study indicates that the association of SES, operationalised as family affluence, with DBC shows regional differences that could reflect differences in socio-cultural norms regarding breakfast consumption.

Literature on the association between family structure and breakfast habits of children and adolescents is limited<sup>11,16</sup>. Our findings that irregular breakfast habits occur more often among children of single-parent families compared to two-parent family constellations, generally fit well with those reported previously<sup>11,16</sup>. This finding was consistent across regions except for countries from the Eastern European region, where sociocultural norms may be different. However, whether family structure is the direct cause of adverse life outcomes has been disputed<sup>19</sup>. It is likely that single parent families may represent a cluster of several social and contextual factors that may be mediating its association with negative outcomes<sup>20</sup>.

Adolescence is often characterized by increased risk behaviour and experimentation with alcohol, tobacco and other drugs. In the current study, DBC was negatively correlated with smoking in all but one country, illustrating the consistency of this association across socio-economic, cultural, and regional differences. This finding is in agreement with other reports showing a consistent inverse association between breakfast consumption and smoking<sup>2,5</sup>. A plausible link between smoking and skipping breakfast may be that smoking diminishes appetite<sup>5</sup>; another explanation might be the clustering of unhealthy behaviours. Alcohol consumption has also been associated with skipping breakfast in adolescents<sup>2,5</sup>. In the current study children who reported being drunk at least twice in their life had decreased odds of DBC in the majority of countries except in Southern European countries where this association was less evident.

Few studies have examined the association between breakfast consumption and physical activity: congruent with our findings, most reported a positive association<sup>2,5,7</sup> while one study<sup>6</sup> involving younger children (5–14 y) found no relation. Our results on the association of DBC with sedentary behaviour fit well with our findings on DBC and physical activity: children who consumed breakfast daily were also less likely to watch > 2 hours/day of television. To our knowledge this is the first study to report on the association between breakfast consumption and television viewing, although television use has often been related to overweight in children and adolescents<sup>21</sup>.

In the current study, in most countries with the exception of some Northern European countries, both daily fruit and daily vegetable consumption were consistently associated with DBC whereas an inverse relationship was found for daily soft drink consumption in most countries. In two other studies comparable findings have been noted<sup>1,6</sup>.

Our study has certain limitations. The school response was low for some countries which might compromise the generalizability of the findings (i. e. < 60 % for Germany, the Netherlands, Belgium, the USA, and Wales; > 60 and < 75 % for Norway and Greenland; for 6 countries/regions the data was not available; > 75 % for the remaining 28 countries). Nevertheless, we have no reason to believe that their refusal to participate has an important influence on the results of our analyses as the reason for drop out is mainly that they already participate in one or several other studies. The pupil response was in general high, varying between 73 and 96 % for those countries of which information was available (n = 22). Additionally it must be said that it is difficult to compare the response rates between the countries because the available information on the gross population is very different from country to country.

The data were self-reported. Furthermore, DBC was based on frequency of breakfast during the week (defined as more than a glass of milk or fruit juice), however no further information on the quality of breakfast was gathered. Nonetheless the quality of breakfast could be important in determining its health effects<sup>1</sup>.

Taken together, the findings from this large, multi-national survey involving simultaneous assessment of several domains (socio-economic, demographic, and several health related lifestyle behaviours) in 11-, 13- and 15-year old children, indicate that a simple definition of breakfast consumption can serve as an indicator to identify children at risk for unhealthy lifestyle behaviours. These children could be targeted for interventions to improve overall lifestyle practises.

Another important message from this study is to promote breakfast consumption in children. Although some studies suggest that breakfast consumption 4–5 times a week is already associated with health benefits, others have shown that breakfast consumption has a dose-response effect on overweight<sup>2</sup>. Thus DBC should be encouraged as much as possible within the context of each country and family. Increased attention to DBC is necessary during the transition from childhood to adolescence, especially in girls and young persons from disadvantaged families. Breakfast provision in schools may offer a means to overcome social inequalities in DBC and could serve to yield health benefits associated with breakfast consumption.

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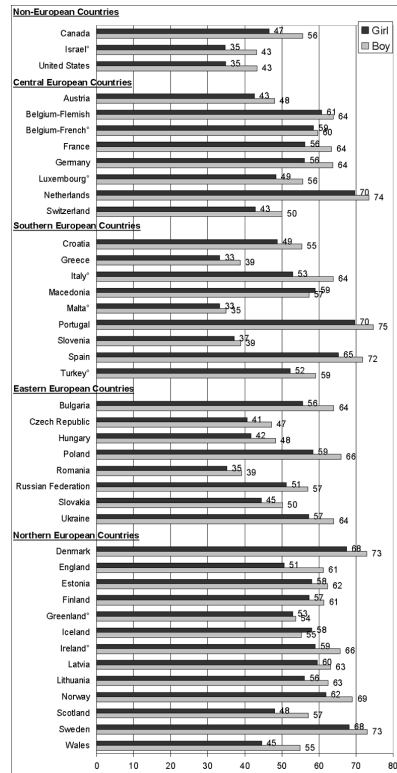
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**Figure 1. Daily breakfast consumption among 11-, 13- and 15-year olds by country and gender (%)**

\*countries with more than 10% missings for breakfast consumption, family affluence or age

Table 1

Socio-demographic characteristics of the study population.

	Gender(%)		Age (y) (%)					Family Affluence (%)			Family Structure (%)			N
	Boy	Girl	11	13	15	High	Medium	Low	2-parent	Single	Other			
<b>Non-European countries</b>														
Canada	47	53	24	35	40	23	55	23	78	18	5	5513		
Israel	39	61	29	32	39	36	41	23	86	9	4	4610		
United States	47	53	28	39	33	26	49	25	71	25	5	3769		
<b>Central European countries</b>														
Austria	48	52	34	33	33	42	27	31	82	14	4	4393		
Belgium-FI	50	50	31	32	37	21	51	28	81	13	6	3937		
Belgium-Fr	51	49	34	33	32	44	23	33	80	16	4	3829		
France	49	51	34	34	32	23	51	26	82	15	4	6688		
Germany	50	50	30	34	36	22	49	30	81	15	3	6876		
Luxembourg	48	52	29	36	36	31	29	40	83	14	3	3652		
Netherlands	50	50	32	35	32	23	55	22	86	12	1	4079		
Switzerland	49	51	32	35	33	19	55	26	84	12	3	4321		
<b>Southern European Countries</b>														
Croatia	48	52	33	34	34	22	48	30	90	8	1	4729		
Greece	47	53	29	32	39	28	47	25	87	11	2	3537		
Italy	48	52	30	35	35	34	25	41	89	8	3	3412		
Macedonia	49	51	31	33	36	37	24	40	92	6	2	5016		
Malta	47	53	37	37	27	38	27	35	65	35	1	1195		
Portugal	47	53	30	34	36	33	43	24	82	10	8	3705		
Slovenia	49	51	33	36	31	46	27	28	88	10	2	4841		
Spain	49	51	33	32	35	40	27	33	86	11	3	8612		
Turkey	51	49	37	33	31	31	38	31	79	10	12	5000		
<b>Eastern European countries</b>														
Bulgaria	49	51	33	32	35	43	25	32	83	13	4	4505		
Czech Republic	50	50	31	34	35	24	47	30	83	16	2	4647		
Hungary	48	52	31	35	34	25	47	28	82	16	2	3397		

	Gender(%)		Age (y) (%)					Family Affluence (%)				Family Structure (%)			
	Boy	Girl	11	13	15	High	Medium	Low	2-parent	Single	Other	N			
Poland	48	52	28	30	42	24	44	32	86	12	3	5295			
Romania	45	55	36	29	35	33	39	28	57	34	9	4350			
Russian Federation	47	53	33	33	34	29	45	26	64	19	18	7523			
Slovakia	46	54	33	35	33	32	44	25	87	12	1	3576			
Ukraine	46	54	29	34	37	44	25	32	78	18	4	4756			
<b>Northern European countries</b>															
Denmark	48	52	37	36	28	20	58	23	70	17	13	5280			
England	47	53	33	35	31	32	28	39	80	16	4	4325			
Estonia	49	51	32	32	36	25	44	32	80	19	2	4337			
Finland	47	53	34	33	33	42	28	31	82	16	3	5015			
Greenland	47	53	35	35	30	24	43	34	58	27	16	976			
Iceland	50	50	40	40	20	38	33	28	82	16	3	8986			
Ireland	50	51	29	36	35	20	56	23	83	12	5	4315			
Latvia	47	53	33	35	32	22	46	32	72	23	5	3970			
Lithuania	51	49	33	34	34	40	23	38	78	18	3	5362			
Norway	51	49	32	34	34	34	35	31	76	15	9	4461			
Scotland	49	51	28	36	36	44	24	32	78	19	3	5690			
Sweden	49	51	34	31	35	25	31	44	82	14	5	4172			
Wales	49	52	32	36	33	45	25	30	77	19	4	3983			

**Table 2**  
Associations of daily breakfast consumption with socio-demographic factors: OR (95 % CI).

	Gender		Age (y)			Family affluence			Family structure		
	girls	boys	13	15	15	low	medium	high	single	other	
<b>Non-European countries</b>											
Canada	<b>0.67 (0.60–0.75)</b>	<b>0.48 (0.41–0.56)</b>	<b>0.48 (0.41–0.56)</b>	<b>0.34 (0.28–0.41)</b>	0.94 (0.82–1.08)	0.84 (0.71–1.00)	<b>0.62 (0.54–0.73)</b>	1.06 (0.80–1.39)			
Israel	<b>0.73 (0.64–0.82)</b>	<b>0.71 (0.59–0.85)</b>	<b>0.51 (0.43–0.62)</b>	0.95 (0.83–1.09)	0.86 (0.73–1.02)	0.84 (0.68–1.04)	1.05 (0.77–1.43)				
United States	<b>0.69 (0.61–0.79)</b>	<b>0.61 (0.52–0.72)</b>	<b>0.50 (0.42–0.60)</b>	<b>0.78 (0.67–0.92)</b>	<b>0.61 (0.51–0.74)</b>	<b>0.77 (0.66–0.91)</b>	<b>0.67 (0.48–0.94)</b>				
<b>Central European countries</b>											
Austria	<b>0.82 (0.72–0.93)</b>	<b>0.64 (0.54–0.76)</b>	<b>0.47 (0.39–0.56)</b>	0.93 (0.08–1.09)	0.86 (0.75–1.00)	<b>0.79 (0.66–0.95)</b>	0.93 (0.66–1.31)				
Belgium-Flemish	0.89 (0.78–1.02)	<b>0.56 (0.45–0.68)</b>	<b>0.38 (0.31–0.47)</b>	<b>0.82 (0.68–0.98)</b>	<b>0.58 (0.48–0.71)</b>	<b>0.67 (0.55–0.81)</b>	<b>0.72 (0.54–0.96)</b>				
Belgium-French	0.96 (0.84–1.10)	<b>0.64 (0.52–0.78)</b>	<b>0.45 (0.36–0.56)</b>	<b>0.76 (0.64–0.90)</b>	<b>0.66 (0.56–0.77)</b>	<b>0.83 (0.69–0.99)</b>	1.06 (0.74–1.52)				
France	<b>0.74 (0.67–0.82)</b>	<b>0.62 (0.54–0.71)</b>	<b>0.42 (0.37–0.48)</b>	<b>0.86 (0.75–0.98)</b>	<b>0.64 (0.55–0.74)</b>	<b>0.79 (0.69–0.92)</b>	0.80 (0.61–1.04)				
Germany	<b>0.73 (0.66–0.81)</b>	<b>0.50 (0.44–0.57)</b>	<b>0.40 (0.35–0.45)</b>	<b>0.79 (0.69–0.91)</b>	<b>0.55 (0.47–0.64)</b>	<b>0.79 (0.68–0.91)</b>	<b>0.69 (0.52–0.91)</b>				
Luxembourg	<b>0.74 (0.65–0.85)</b>	<b>0.60 (0.50–0.72)</b>	<b>0.41 (0.34–0.50)</b>	0.93 (0.78–1.10)	<b>0.71 (0.60–0.84)</b>	<b>0.72 (0.59–0.87)</b>	0.83 (0.56–1.23)				
Netherlands	<b>0.83 (0.72–0.96)</b>	<b>0.51 (0.41–0.65)</b>	<b>0.30 (0.23–0.38)</b>	1.01 (0.84–1.22)	<b>0.77 (0.62–0.97)</b>	<b>0.64 (0.52–0.80)</b>	1.05 (0.58–1.91)				
Switzerland	<b>0.74 (0.66–0.84)</b>	<b>0.62 (0.52–0.74)</b>	<b>0.44 (0.37–0.52)</b>	0.92 (0.78–1.08)	<b>0.69 (0.57–0.83)</b>	<b>0.73 (0.60–0.88)</b>	0.84 (0.59–1.19)				
<b>Southern European Countries</b>											
Croatia	<b>0.78 (0.69–0.88)</b>	<b>0.67 (0.58–0.77)</b>	<b>0.59 (0.49–0.71)</b>	0.94 (0.81–1.10)	0.86 (0.73–1.02)	<b>0.70 (0.57–0.86)</b>	0.94 (0.55–1.58)				
Greece	<b>0.81 (0.70–0.93)</b>	<b>0.69 (0.56–0.85)</b>	<b>0.54 (0.44–0.66)</b>	0.91 (0.77–1.08)	0.89 (0.73–1.09)	0.90 (0.71–1.13)	1.29 (0.81–2.06)				
Italy	<b>0.63 (0.55–0.73)</b>	<b>0.72 (0.57–0.91)</b>	<b>0.54 (0.43–0.69)</b>	0.97 (0.80–1.17)	0.87 (0.73–1.03)	<b>0.70 (0.55–0.91)</b>	1.23 (0.80–1.90)				
Macedonia	1.06 (0.93–1.20)	1.07 (0.92–1.25)	0.81 (0.61–1.08)	<b>1.25 (1.06–1.47)</b>	1.00 (0.87–1.16)	0.88 (0.69–1.14)	<b>0.63 (0.41–0.96)</b>				
Malta <sup>o</sup>	0.88 (0.69–1.13)	0.79 (0.60–1.05)	<b>0.59 (0.43–0.81)</b>	<b>0.73 (0.53–0.99)</b>	0.96 (0.72–1.27)	<b>0.74 (0.57–0.96)</b>	0.91 (0.23–3.56)				
Portugal	<b>0.80 (0.69–0.93)</b>	<b>0.66 (0.54–0.82)</b>	<b>0.32 (0.26–0.39)</b>	1.11 (0.93–1.32)	0.96 (0.79–1.18)	<b>0.71 (0.56–0.9)</b>	<b>0.62 (0.48–0.81)</b>				
Slovenia	0.93 (0.82–1.05)	<b>0.53 (0.46–0.62)</b>	<b>0.54 (0.45–0.64)</b>	0.84 (0.73–0.97)	<b>0.80 (0.69–0.92)</b>	0.83 (0.68–1.02)	1.30 (0.86–1.96)				
Spain	<b>0.72 (0.65–0.79)</b>	<b>0.51 (0.45–0.58)</b>	<b>0.30 (0.26–0.34)</b>	<b>0.87 (0.78–0.99)</b>	<b>0.78 (0.70–0.88)</b>	<b>0.71 (0.61–0.82)</b>	1.01 (0.77–1.32)				
Turkey	<b>0.75 (0.67–0.85)</b>	<b>0.85 (0.74–0.98)</b>	<b>0.73 (0.61–0.88)</b>	<b>1.23 (1.07–1.42)</b>	<b>1.21 (1.04–1.41)</b>	<b>0.78 (0.64–0.95)</b>	<b>0.82 (0.69–0.99)</b>				
<b>Eastern European countries</b>											
Bulgaria	<b>0.73 (0.64–0.83)</b>	<b>0.63 (0.53–0.73)</b>	<b>0.40 (0.34–0.48)</b>	1.18 (1.01–1.39)	<b>1.30 (1.12–1.52)</b>	0.87 (0.72–1.05)	0.89 (0.65–1.22)				
Czech Republic	<b>0.76 (0.68–0.86)</b>	<b>0.74 (0.64–0.86)</b>	<b>0.66 (0.57–0.76)</b>	1.01 (0.87–1.17)	0.89 (0.76–1.06)	<b>0.78 (0.66–0.92)</b>	0.96 (0.59–1.56)				
Hungary	<b>0.77 (0.67–0.89)</b>	<b>0.67 (0.56–0.79)</b>	<b>0.46 (0.37–0.56)</b>	1.09 (0.91–1.29)	0.89 (0.73–1.09)	<b>0.80 (0.66–0.97)</b>	1.19 (0.74–1.91)				

	Gender	Age (y)			Family affluence			Family structure		
		girls	13	15	medium	low	single	other		
Poland		<b>0.73 (0.65–0.81)</b>	<b>0.71 (0.59–0.85)</b>	<b>0.62 (0.53–0.74)</b>	1.14 (0.98–1.32)	1.01 (0.86–1.18)	0.84 (0.70–1.00)	1.15 (0.79–1.69)		
Romania		0.88 (0.77–1.00)	<b>0.76 (0.63–0.91)</b>	<b>0.62 (0.51–0.75)</b>	0.93 (0.80–1.08)	<b>0.83 (0.70–0.99)</b>	0.90 (0.77–1.06)	0.84 (0.66–1.07)		
Russian Federation		<b>0.79 (0.72–0.87)</b>	<b>0.79 (0.71–0.89)</b>	<b>0.76 (0.68–0.86)</b>	1.06 (0.95–1.18)	1.10 (0.97–1.25)	0.92 (0.82–1.04)	1.07 (0.93–1.24)		
Slovakia <sup>o</sup>		<b>0.80 (0.70–0.92)</b>	<b>0.71 (0.60–0.83)</b>	<b>0.66 (0.56–0.77)</b>	1.06 (0.91–1.24)	0.91 (0.76–1.09)	0.83 (0.67–1.02)	<b>0.54 (0.29–0.99)</b>		
Ukraine		<b>0.74 (0.66–0.84)</b>	0.94 (0.79–1.14)	<b>0.69 (0.57–0.82)</b>	1.08 (0.92–1.25)	0.96 (0.83–1.11)	1.02 (0.86–1.19)	1.04 (0.76–1.43)		
<b>Northern European countries</b>										
Denmark		<b>0.76 (0.67–0.86)</b>	<b>0.57 (0.49–0.67)</b>	<b>0.38 (0.33–0.45)</b>	1.04 (0.88–1.22)	<b>0.82 (0.68–0.99)</b>	<b>0.64 (0.54–0.75)</b>	1.01 (0.84–1.22)		
England		<b>0.61 (0.53–0.70)</b>	<b>0.58 (0.50–0.68)</b>	<b>0.45 (0.38–0.53)</b>	0.93 (0.79–1.09)	<b>0.79 (0.68–0.92)</b>	<b>0.75 (0.63–0.89)</b>	<b>0.67 (0.48–0.92)</b>		
Estonia		<b>0.82 (0.73–0.93)</b>	<b>0.77 (0.66–0.90)</b>	<b>0.78 (0.67–0.91)</b>	1.11 (0.95–1.30)	1.05 (0.88–1.25)	0.90 (0.77–1.06)	0.94 (0.57–1.54)		
Finland		<b>0.84 (0.75–0.94)</b>	<b>0.56 (0.48–0.66)</b>	<b>0.43 (0.37–0.51)</b>	0.87 (0.75–1.00)	<b>0.75 (0.65–0.86)</b>	<b>0.68 (0.58–0.80)</b>	0.79 (0.55–1.15)		
Greenland		0.94 (0.72–1.24)	1.01 (0.73–1.41)	<b>0.41 (0.29–0.58)</b>	0.97 (0.68–1.39)	0.79 (0.53–1.17)	0.76 (0.55–1.05)	1.01 (0.68–1.50)		
Iceland		<b>1.14 (1.04–1.24)</b>	<b>0.53 (0.48–0.59)</b>	<b>0.31 (0.28–0.35)</b>	0.97 (0.87–1.07)	<b>0.76 (0.68–0.84)</b>	<b>0.71 (0.63–0.80)</b>	<b>0.76 (0.58–0.99)</b>		
Ireland		<b>0.70 (0.61–0.80)</b>	<b>0.59 (0.49–0.71)</b>	<b>0.43 (0.35–0.52)</b>	0.95 (0.80–1.12)	<b>0.70 (0.57–0.85)</b>	<b>0.68 (0.56–0.82)</b>	0.87 (0.65–1.16)		
Latvia		<b>0.85 (0.74–0.97)</b>	<b>0.82 (0.70–0.96)</b>	0.85 (0.73–1.00)	<b>1.22 (1.03–1.44)</b>	<b>1.33 (1.11–1.60)</b>	0.86 (0.74–1.01)	1.00 (0.73–1.36)		
Lithuania		<b>0.76 (0.68–0.85)</b>	<b>0.73 (0.63–0.83)</b>	<b>0.62 (0.54–0.71)</b>	1.09 (0.94–1.26)	0.96 (0.85–1.10)	<b>0.79 (0.68–0.91)</b>	1.26 (0.92–1.73)		
Norway		<b>0.69 (0.61–0.79)</b>	<b>0.52 (0.44–0.62)</b>	<b>0.33 (0.28–0.40)</b>	0.94 (0.81–1.10)	<b>0.69 (0.59–0.82)</b>	<b>0.66 (0.55–0.79)</b>	0.86 (0.68–1.08)		
Scotland		<b>0.66 (0.60–0.74)</b>	<b>0.40 (0.34–0.47)</b>	<b>0.30 (0.25–0.35)</b>	0.93 (0.81–1.07)	<b>0.83 (0.73–0.95)</b>	<b>0.66 (0.57–0.76)</b>	0.89 (0.65–1.22)		
Sweden		<b>0.79 (0.69–0.91)</b>	<b>0.46 (0.38–0.57)</b>	<b>0.31 (0.26–0.37)</b>	0.93 (0.77–1.13)	<b>0.78 (0.66–0.94)</b>	<b>0.75 (0.62–0.91)</b>	0.73 (0.53–1.01)		
Wales		<b>0.64 (0.56–0.72)</b>	<b>0.61 (0.52–0.71)</b>	<b>0.44 (0.37–0.52)</b>	0.90 (0.77–1.06)	<b>0.81 (0.69–0.94)</b>	<b>0.79 (0.66–0.93)</b>	<b>0.65 (0.47–0.91)</b>		

base category: boys, 11 year old, high family affluence, living with 2 parents

bold: significant OR

<sup>o</sup> no school variable was available, as a consequence the clustering in schools was not taken into account

Table 3

Associations of daily breakfast consumption with health-related behaviours: Adjusted OR (95 %CI).

	smokers	Alcohol misuse (been drunk 2 times)	Physical activity ( < 5 days 60 minutes)	Television viewing (> 2 hours)	daily fruit consumption	daily vegetables consumption	daily soft drinks consumption	on a diet
<b>Non-European countries</b>								
Canada	0.38 (0.31–0.47)	0.46 (0.39–0.54)	1.20 (1.07–1.35)	0.76 (0.67–0.85)	1.68 (1.49–1.89)	1.65 (1.47–1.86)	0.56 (0.47–0.66)	0.67 (0.57–0.79)
Israel	0.76 (0.60–0.97)	0.81 (0.62–1.05)	1.57 (1.37–1.80)	0.78 (0.68–0.90)	1.63 (1.49–1.79)	1.50 (1.33–1.70)	1.19 (1.05–1.35)	0.73 (0.61–0.88)
United States	0.49 (0.37–0.65)	0.70 (0.54–0.92)	1.33 (1.16–1.53)	0.69 (0.60–0.79)	1.49 (1.30–1.71)	1.61 (1.40–1.85)	0.72 (0.63–0.84)	0.65 (0.55–0.77)
<b>Central European countries</b>								
Austria	0.49 (0.41–0.59)	0.43 (0.35–0.53)	1.08 (0.95–1.22)	0.64 (0.56–0.72)	1.26 (1.10–1.43)	1.20 (1.02–1.42)	0.69 (0.59–0.81)	0.62 (0.53–0.74)
Belgium-Fl.	0.49 (0.40–0.61)	0.51 (0.41–0.62)	1.50 (1.30–1.74)	0.62 (0.54–0.71)	1.55 (1.34–1.79)	1.70 (1.48–1.95)	0.71 (0.62–0.81)	0.74 (0.60–0.91)
Belgium-Fr.	0.45 (0.35–0.57)	0.69 (0.56–0.85)	1.44 (1.25–1.65)	0.65 (0.56–0.74)	1.32 (1.16–1.51)	1.39 (1.21–1.60)	0.70 (0.61–0.81)	0.71 (0.59–0.85)
France	0.56 (0.48–0.66)	0.58 (0.49–0.69)	1.19 (1.06–1.33)	0.66 (0.60–0.73)	1.33 (1.19–1.49)	1.46 (1.31–1.62)	0.66 (0.59–0.74)	0.65 (0.55–0.76)
Germany	0.48 (0.41–0.56)	0.5 (0.43–0.59)	1.08 (0.97–1.20)	0.70 (0.63–0.78)	1.27 (1.14–1.42)	1.23 (1.09–1.39)	0.72 (0.63–0.81)	0.57 (0.49–0.67)
Luxembourg	0.51 (0.41–0.63)	0.54 (0.42–0.69)	1.15 (0.99–1.32)	0.75 (0.65–0.86)	1.15 (1.00–1.33)	1.24 (1.07–1.43)	0.67 (0.57–0.78)	0.52 (0.43–0.63)
Netherlands	0.37 (0.29–0.46)	0.45 (0.36–0.57)	1.39 (1.20–1.61)	0.84 (0.71–0.98)	1.41 (1.20–1.66)	1.51 (1.30–1.76)	0.72 (0.62–0.84)	0.72 (0.56–0.94)
Switzerland	0.50 (0.40–0.63)	0.51 (0.40–0.65)	1.29 (1.11–1.49)	0.61 (0.53–0.70)	1.28 (1.13–1.46)	1.39 (1.22–1.58)	0.67 (0.58–0.77)	0.56 (0.46–0.68)
<b>Southern European Countries</b>								
Croatia	0.61 (0.51–0.74)	0.61 (0.52–0.72)	1.41 (1.25–1.59)	0.88 (0.77–1.00)	1.50 (1.33–1.70)	1.27 (1.11–1.45)	0.93 (0.82–1.05)	0.56 (0.46–0.68)
Greece	0.71 (0.53–0.93)	0.78 (0.60–1.02)	1.54 (1.33–1.79)	0.83 (0.71–0.97)	1.58 (1.36–1.84)	1.52 (1.31–1.77)	0.74 (0.60–0.91)	0.87 (0.71–1.05)
Italy	0.59 (0.47–0.73)	0.89 (0.69–1.14)	0.95 (0.82–1.11)	0.84 (0.73–0.97)	1.30 (1.13–1.51)	1.45 (1.23–1.72)	0.88 (0.75–1.04)	0.60 (0.49–0.72)
Macedonia	0.72 (0.56–0.91)	1.01 (0.80–1.26)	1.35 (1.19–1.53)	1.18 (1.04–1.34)	1.28 (1.13–1.45)	1.41 (1.24–1.60)	1.12 (0.98–1.27)	0.48 (0.39–0.58)
Malta <sup>o</sup>	0.78 (0.53–1.14)	0.41 (0.22–0.74)	1.61 (1.24–2.08)	0.85 (0.73–0.99)	1.56 (1.21–1.99)	1.48 (1.05–2.11)	0.76 (0.59–0.98)	0.77 (0.57–1.04)
Portugal	0.61 (0.48–0.77)	0.78 (0.62–0.98)	1.14 (0.96–1.36)	0.83 (0.70–0.99)	1.65 (1.41–1.93)	1.69 (1.41–2.04)	0.78 (0.66–0.92)	0.63 (0.50–0.80)
Slovenia	0.54 (0.42–0.68)	0.64 (0.53–0.77)	1.40 (1.23–1.58)	0.72 (0.63–0.81)	1.14 (1.01–1.29)	1.36 (1.18–1.56)	0.87 (0.76–1.01)	0.67 (0.55–0.80)
Spain	0.51 (0.44–0.59)	0.56 (0.48–0.66)	1.21 (1.09–1.33)	0.73 (0.66–0.80)	1.37 (1.24–1.51)	1.20 (1.06–1.36)	0.65 (0.58–0.72)	0.48 (0.42–0.56)
Turkey	NA	NA	1.15 (1.02–1.30)	0.87 (0.77–0.98)	1.36 (1.20–1.54)	1.61 (1.40–1.84)	0.75 (0.64–0.87)	0.46 (0.35–0.61)
<b>Eastern European countries</b>								
Bulgaria	0.66 (0.55–0.78)	0.70 (0.60–0.82)	1.04 (0.91–1.19)	1.04 (0.90–1.21)	1.28 (1.11–1.46)	1.27 (1.11–1.45)	1.19 (1.05–1.35)	0.45 (0.37–0.54)
Czech Rep.	0.55 (0.46–0.66)	0.61 (0.51–0.73)	1.23 (1.09–1.39)	0.83 (0.74–0.94)	1.29 (1.14–1.46)	1.32 (1.16–1.51)	0.81 (0.71–0.92)	0.69 (0.59–0.82)
Hungary	0.63 (0.50–0.78)	0.56 (0.45–0.69)	1.26 (1.09–1.47)	0.77 (0.67–0.89)	1.47 (1.27–1.71)	1.80 (1.52–2.14)	0.89 (0.76–1.04)	0.78 (0.65–0.94)

	smokers	Alcohol misuse (been drunk 2 times)	Physical activity (< 5 days 60 minutes)	Television viewing (> 2 hours)	daily fruit consumption	daily vegetables consumption	daily soft drinks consumption	on a diet
Poland	<b>0.56 (0.47-0.67)</b>	<b>0.58 (0.50-0.68)</b>	<b>1.18 (1.05-1.33)</b>	<b>0.79 (0.70-0.89)</b>	<b>1.17 (1.04-1.33)</b>	<b>1.48 (1.30-1.69)</b>	<b>0.66 (0.58-0.75)</b>	<b>0.52 (0.44-0.60)</b>
Romania	<b>0.74 (0.58-0.95)</b>	<b>0.82 (0.67-0.99)</b>	<b>1.35 (1.17-1.55)</b>	0.89 (0.77-1.03)	<b>1.41 (1.24-1.61)</b>	<b>1.53 (1.33-1.76)</b>	<b>0.84 (0.74-0.96)</b>	<b>0.69 (0.55-0.85)</b>
Russian Fed.	<b>0.76 (0.67-0.86)</b>	<b>0.71 (0.63-0.80)</b>	<b>1.23 (1.11-1.36)</b>	0.92 (0.83-1.01)	<b>1.15 (1.04-1.27)</b>	<b>1.39 (1.26-1.54)</b>	0.91 (0.82-1.01)	<b>0.63 (0.55-0.72)</b>
Slovakia <sup>o</sup>	<b>0.58 (0.47-0.72)</b>	<b>0.59 (0.48-0.72)</b>	1.19 (0.99-1.30)	<b>0.85 (0.73-0.99)</b>	<b>1.12 (0.97-1.29)</b>	<b>1.34 (1.15-1.57)</b>	<b>0.79 (0.69-0.91)</b>	<b>0.60 (0.48-0.75)</b>
Ukraine	<b>0.84 (0.71-0.99)</b>	0.96 (0.82-1.13)	<b>1.29 (1.14-1.46)</b>	0.88 (0.76-1.01)	<b>1.22 (1.06-1.39)</b>	<b>1.35 (1.20-1.53)</b>	0.96 (0.84-1.09)	<b>0.61 (0.50-0.73)</b>
<b>Northern European countries</b>								
Denmark	<b>0.40 (0.33-0.48)</b>	<b>0.44 (0.37-0.52)</b>	<b>1.20 (1.06-1.36)</b>	<b>0.72 (0.63-0.82)</b>	<b>1.20 (1.06-1.37)</b>	<b>1.48 (1.30-1.69)</b>	<b>0.44 (0.36-0.54)</b>	<b>0.67 (0.58-0.78)</b>
England	<b>0.42 (0.34-0.52)</b>	<b>0.44 (0.37-0.52)</b>	<b>1.30 (1.14-1.48)</b>	<b>0.74 (0.65-0.84)</b>	<b>1.59 (1.39-1.81)</b>	<b>1.72 (1.51-1.97)</b>	<b>0.61 (0.52-0.71)</b>	<b>0.50 (0.42-0.60)</b>
Estonia	<b>0.66 (0.55-0.78)</b>	<b>0.70 (0.59-0.82)</b>	<b>1.52 (1.34-1.74)</b>	1.04 (0.91-1.19)	1.12 (0.97-1.28)	<b>1.35 (1.16-1.58)</b>	<b>0.77 (0.63-0.95)</b>	<b>0.65 (0.51-0.82)</b>
Finland	<b>0.41 (0.34-0.49)</b>	<b>0.43 (0.36-0.51)</b>	<b>1.34 (1.18-1.52)</b>	<b>0.72 (0.64-0.81)</b>	<b>1.28 (1.11-1.47)</b>	<b>1.63 (1.42-1.88)</b>	<b>0.48 (0.37-0.63)</b>	<b>0.77 (0.63-0.93)</b>
Greenland	<b>0.63 (0.44-0.90)</b>	0.76 (0.51-1.14)	<b>1.45 (1.10-1.92)</b>	0.99 (0.71-1.39)	0.89 (0.60-1.33)	1.10 (0.83-1.47)	<b>0.57 (0.42-0.78)</b>	0.91 (0.64-1.31)
Iceland	<b>0.32 (0.26-0.40)</b>	<b>0.40 (0.33-0.48)</b>	<b>1.60 (1.47-1.75)</b>	<b>0.71 (0.65-0.77)</b>	<b>1.43 (1.30-1.57)</b>	<b>1.66 (1.50-1.84)</b>	<b>0.45 (0.39-0.52)</b>	<b>0.62 (0.55-0.68)</b>
Ireland	<b>0.41 (0.33-0.50)</b>	<b>0.44 (0.36-0.53)</b>	<b>1.31 (1.14-1.50)</b>	<b>0.73 (0.64-0.83)</b>	<b>1.63 (1.42-1.88)</b>	1.06 (0.93-1.21)	<b>0.52 (0.45-0.61)</b>	<b>0.50 (0.41-0.61)</b>
Latvia	<b>0.60 (0.51-0.72)</b>	<b>0.62 (0.52-0.73)</b>	<b>1.19 (1.04-1.36)</b>	0.89 (0.78-1.03)	0.98 (0.83-1.14)	<b>1.24 (1.06-1.45)</b>	0.89 (0.73-1.08)	<b>0.64 (0.52-0.78)</b>
<b>Lithuania</b>	<b>0.72 (0.61-0.85)</b>	<b>0.69 (0.60-0.80)</b>	<b>1.20 (1.07-1.34)</b>	0.90 (0.80-1.02)	1.05 (0.92-1.20)	<b>1.28 (1.12-1.46)</b>	<b>0.76 (0.65-0.88)</b>	<b>0.45 (0.38-0.54)</b>
Norway	<b>0.34 (0.27-0.43)</b>	<b>0.43 (0.34-0.53)</b>	<b>1.40 (1.22-1.61)</b>	<b>0.69 (0.60-0.79)</b>	<b>1.48 (1.30-1.70)</b>	<b>1.54 (1.33-1.79)</b>	<b>0.41 (0.34-0.50)</b>	<b>0.52 (0.43-0.62)</b>
Scotland	<b>0.46 (0.38-0.56)</b>	<b>0.53 (0.46-0.61)</b>	<b>1.26 (1.13-1.41)</b>	<b>0.82 (0.74-0.92)</b>	<b>1.89 (1.69-2.13)</b>	<b>1.76 (1.57-1.98)</b>	<b>0.54 (0.48-0.62)</b>	<b>0.65 (0.56-0.75)</b>
Sweden	<b>0.28 (0.21-0.38)</b>	<b>0.37 (0.30-0.47)</b>	<b>1.28 (1.10-1.48)</b>	<b>0.75 (0.65-0.86)</b>	<b>1.43 (1.22-1.67)</b>	<b>1.39 (1.19-1.61)</b>	<b>0.37 (0.28-0.48)</b>	<b>0.44 (0.35-0.56)</b>
Wales	<b>0.46 (0.37-0.57)</b>	<b>0.52 (0.45-0.61)</b>	<b>1.38 (1.21-1.58)</b>	0.88 (0.77-1.01)	<b>1.58 (1.38-1.82)</b>	<b>1.66 (1.44-1.91)</b>	<b>0.61 (0.53-0.70)</b>	<b>0.70 (0.59-0.82)</b>

<sup>o</sup> no school variable was available, as a consequence the clustering in schools was not taken into account; NA = not available all analyses controlled for gender, age, family affluence and family structure  
bold = significant OR