Eating behaviour and its association with social living conditions and weight status among adolescent girls: results of the cross-sectional Berlin School Children's Cohort study

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Abstract

Objective: To capture a more holistic picture of eating behaviour by investigating the impact of the social living conditions and weight status of parents and daughters on food consumption frequency, the context of meals and daily portion sizes.
Design: Cross-sectional Berlin School Children's Cohort study.
Setting: A total of sixty-nine schools in Berlin (3 400 000 inhabitants, eastern Germany) participated in the present study.
Subjects: A total of 1519 girls aged 11–14 years were selected. Bi- and multivariate analyses were performed to examine the impact of age, migration background, socio-economic status (SES), parental education, family situation and the weight status of parents and daughters on three different eating behaviour scores according to nutritional recommendations.
Results: For the three dependent eating behaviour variables, different patterns of influencing factors emerged. Multivariate regression (model 1) revealed that low and middle SES, two-parent migration background and older age were significant risk factors. Meal context was also significantly influenced by living with a single parent. Similar results were obtained for the daily portion size scores and maternal overweight status was the most influential. Model 2 succeeded in showing that, within the composite variable of family SES, mothers' level of education was the dominant component.
Conclusions: SES as a whole, and especially the component of mothers' level of education and two-parent migration background, was the strongest risk factor for an unfavourable eating pattern among adolescent girls. The results clearly indicated preventive potential. Using three different measures of eating behaviour simultaneously provided an in-depth understanding of general patterns and potential risk factors.

The majority of Western citizens in the 21st century have all the prerequisites for leading a healthy life. However, non-communicable diseases partially caused by unhealthy eating behaviour are on the rise in industrialized nations[1]. Research on eating behaviour tends to focus on eating disorders and obesity. Much research exists on the genetics of obesity, but little on the environment and intermediary behaviours (e.g. eating behaviour) that promote childhood overweight[2]. Unhealthy eating behaviour is labelled as a modifiable risk factor[1,3] for non-communicable diseases and research on eating behaviour is crucial. Because of the vast number of variables, eating behaviour is one of the most complex

behaviours and thus hard to capture[4]. Nevertheless, much literature exists on the effect of consumption frequency, such as breakfast habits, in adults or of specific food items, such as fruit, vegetables and sweets, in adolescents' eating behaviour[5–7]. Research on eating behaviour in subpopulations and its influencing factors is also limited. Only a few studies exist on the eating behaviour of adolescent girls, especially those stratified by specific determinants such as socio-economic status (SES) and biological background. A report of the pan-European Health Behaviour in School-aged Children (HBSC) study acknowledges that 'research on SES differences in adolescent food habits is limited'[5]. Recent results can be

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found in the German part of the HBSC study[8], the German Health Interview and Examination Survey for Children and Adolescents (KiGGS) including the EsKiMo module (Nutrition Study as a KiGGS module)[4,9,10], the DOrtmund Nutritional and Anthropometric Longitudinally Designed Study (DONALD)[11] and, to a limited extent, in the Kiel Obesity Prevention Study (KOPS)[12]. The studies partially stratify for factors such as age, SES and weight status. During adolescence, girls may be especially susceptible to acquiring unhealthy eating habits and to disregarding nutritional recommendations[3,13]. Further, despite increased research interest in eating behaviour in children and adolescents, very few studies compare the determinants of different components of eating behaviour such as food frequency, meal context and portion size. All are crucial in the discussion of eating behaviour.

Against this background, the results of the present study add to the understanding of the impact of social factors (SES, parental education, family situation and weight status of parents and daughters) and weight status on eating behaviour. For the first time, different measures of eating behaviour are used to provide a comprehensive picture of this lifestyle component. The following hypotheses will be tested in bi- and multivariate analyses: the risk of unfavourable eating behaviour is increased with higher age, migration background, lower SES/education, living with one parent, being overweight or obese and/or having overweight parents.

Method

Design

The data set of the Berlin School Children's Cohort (BSCOC) of the Institute for Experimental Paediatric Endocrinology at the Charité Virchow Hospital in Berlin, Germany, was used. A cross-sectional BSCOC study was conducted between September 2006 and March 2007[14]. The survey group was randomly selected from primary and secondary schools. Of 160 schools approached, sixty-nine participated in the study. A total of 1840 (40·8 % response) girls within the age range of 9–15 years and of grades 5–8 were enrolled, of whom 11–14-year-olds (*n* 1519) were selected for the secondary analysis[15]. After being intensively pre-tested in the target group, a standardized questionnaire consisting of eighty questions was given to the girls, including a thirteen-item standardized questionnaire for the parents. During the assessment period in the classroom, three study assistants supported the completion of the questionnaire. Information about nutrition, eating behaviour, migration background (country of birth, language and ethnicity) and family situation was collected. The parental questionnaire asked about migration, social background, parents' weight and height and was completed by 91·3 % of the girls' parents. The present study was approved by the Charité Ethics Committee.

Eating behaviour

A comprehensive view was made possible for the first time by the use of three dependent variables of eating behaviour that provided information on the food items, portions and meal context. The 'food frequency score' was computed on the basis of data obtained through an FFQ enquiring into the frequency with which the respondents consumed twenty-eight food items (daily, multiple times per week, approximately once per week and less or never). The FFQ is adapted from the KOPS FFQ (twenty-six items)[16], which was validated against a 7 d dietary record in twenty-four children. The individual frequencies were coded as 0 = unfavourable, 1 = normal and 2 = optimal, according to the optimiX® recommendations of the Research Institute of Child Nutrition (Dortmund, Germany)[17,18] and the dietary index according to Winkler *et al.*[19]. The score is the sum of the individual frequencies; the higher the score the better the girls' eating behaviour. The maximal point value is 56. Scores ≥75th percentile (35–56 points) are deemed optimal, scores ≥25th percentile but <75th percentile (27–34 points) are deemed normal and those <25th percentile (0–26 points) are considered unfavourable.

The second variable 'meal context score' refers to eight questions on where and with whom the girls usually consume their meals. The location of breakfast, lunch and dinner was categorized as follows: at home, on the road, in school, usually skipped and I do not know. Company during mealtime was categorized as: with family or relatives, alone, with classmates and others. The snack behaviour variable counted the frequency of snacking between meals per day (≤1, 2, 3, >3 times/d and I do not know). The variable 'eating in front of the television' had the following response options: never, sometimes, often and I do not know. The aforementioned eight categories were used to create the aggregated meal variable, using the concept of Winkler's three-category index: optimal (2), normal (1) and unfavourable (0; see Table 1). The points were added, with the highest score attainable being 16 and the lowest 3. Scores ≥75th percentile (15–16 points) were coded as optimal; those ≥25th percentile but <75th percentile (12–14 points) were coded as normal; and those <25th percentile (0–11 points) were coded as unfavourable.

The third variable 'daily portion size' score consisted of fifteen food groups and the portions were measured according to the AID 'handmodell'[20]. The portions on the questionnaire were categorized as follows: not at all; 1 times one handful = one portion; 2 times one handful = two portions; 3–4 times one handful = three to four portions; and >4 times one handful = more than four portions. The responses to the beverage questions were categorized similarly, except that the word glass replaced the word handful. The students had to estimate their hand portions according to the size of their hand. The portion size score was coded according to the same pattern, whereby eating, for example, three to four portions of

Table 1 Construction of meal score on the basis of recommendations according to optimiX® [17,18] and Winkler et al. [19]

Meals	Location				
	At home	On the road	In school	Usually skipped	I do not know
Breakfast	2	1	1	0	0
Lunch	2	0	2	0	0
Dinner	2	0	1	0	0
	With whom				
	Family, relatives	Alone	With classmates	Others	
Breakfast	2	1	1	1	
Lunch	2	1	2	1	
Dinner	2	1	1	1	
Snacks	≤1 time/d	2 times/d	3 times/d	>3 times/d	I do not know
	2	1	0	0	0
Eat in front of the television/computer	Never	Sometimes	Often	I do not know	
	1	2	0	0	

bread or rolls was coded as optimal (2 points), two portions were coded as normal (1 point) and eating fewer portions, as well as more than four portions, was coded as unfavourable (no point); higher scores indicate better food portion patterns. The possible cumulative points range from 0 to 30. Students with scores ≥75th percentile (20–30 points) are categorized as having optimal portion scores. Scores ≥25th percentile but <75th percentile (15–19 points) are deemed normal. Scores <25th percentile (0–14 points) are assigned an unfavourable portion pattern.

The independent influencing factors were coded as follows. 'Age' was divided into four groups: 11-, 12-, 13- and 14-year-olds. 'Highest level of education' attained by parents was measured individually and integrated into the SES index. 'SES' was calculated using the definition of the Administration for Health, Environment and Consumer Protection of the Berlin Senate [21]. In this index, parental education was weighted twice to emphasize its importance and employment status was counted once. 'Migration background' was defined as suggested by Schenk et al. [22]: no, one-parent or two-parent migration background. If no information was available from parents but girls were born in Germany and had German nationality, the language spoken at home was chosen to categorize the migration background. 'Family situation' was coded as living with two adults or one parent. 'Height and weight of the parents' were self-reported. BMI was calculated as weight in kilograms divided by the square of height in metres (kg/m^2). The categorical BMI variable was categorized as underweight (BMI < $18\cdot0\,kg/m^2$), normal (BMI = $18\cdot0$–$24\cdot9\,kg/m^2$) and overweight or obese (BMI > $24\cdot9\,kg/m^2$) according to the WHO BMI classification [23]. The 'weight status of the girls' was categorized using the German reference definition [24]: <10th percentile was considered underweight and >90th percentile was considered overweight. One study nurse measured the girls' body weight and height.

The Kruskall–Wallis test was performed to examine differences in food frequency consumption, meal context and daily portion sizes according to age group, migration background, SES, parental education, family situation and weight status of parents and daughters (Table 1). To analyse the risk of unfavourable patterns with regard to food frequency consumption, meal context and daily portion sizes, we used multivariate logistic regression models. The reference categories in all analyses were optimal or normal patterns. As predictors, the following variables were included in the logistic regression models: age (continuous), SES, migration background, parental education, family situation and weight status of parents and girls. For all three dependent variables, two models were calculated on the basis of the measure of social status. 'Model 1' included SES; 'model 2' comprised mothers' and fathers' education as two separate variables. OR, 95% CI and statistical significance are documented in Tables 2 and 3. For all statistical tests, a level of significance of 5% was stated. All data analyses were performed using the Statistical Package for the Social Sciences statistical software package version 17·0 (SPSS Inc., Chicago, IL, USA).

Results

Study population

The distribution of the 1519 school girls stratified by age, migration background, SES, parental education, family situation and weight status of mother, father and daughter is shown in Table 2. The age groups were unequally distributed with more girls in older age groups. In all, 64·1% of the girls had no migration background (9·1% one-parent; 26·8% two-parent migration background). SES was distributed as follows: 25·2% low, 36·5% middle and 38·3% high SES, similarly in all age groups (not shown). Some 18·3% of both parents had less than tenth grade

Table 2 Frequency distribution of selected social and biological indicators (median, 25th and 75th percentiles) and association between eating behaviour and selected social and biological indicators among adolescent girls in Berlin

	Total		Food frequency score				Meal context score				Portion size score			
	n	%	25th	Median	75th	P	25th	Median	75th	P	25th	Median	75th	P
Age (years; n 1519)														
11	146	9·6	28	32	36	0·007	15	17	20	<0·001	13	14	15	0·653
12	330	21·7	28	32	35		15	18	20		13	14	15	
13	593	39·0	27	31	34		14	17	20		12	13	15	
14	450	29·6	27	31	35		14	17	20		11	13	14	
Migration background (n 1413)														
No	906	64·1	28	32	36	<0·001	12	14	15	<0·001	15	18	20	<0·001
One parent	128	9·1	29	33	36		12	14	15		16	18	21	
Two parents	379	26·8	25	29	33		11	13	14		13	16	19	
SES parents (n 1341)														
Low	338	25·2	25	28	32	<0·001	11	13	14	<0·001	14	16	18	<0·001
Middle	490	36·5	28	31	35		12	13	15		15	17	20	
High	513	38·3	30	33	37		13	14	15		16	19	21	
Mother's education (n 1344)														
Less than 10th grade	246	18·3	25	28	33	<0·001	11	13	14	<0·001	13	16	18	<0·001
10th grade	497	37·0	27	31	34		12	13	14		14	17	19	
13th grade (Arbitur) and higher (university)	601	44·7	29	33	36		12	14	15		16	19	21	
Father's education (n 1256)														
Less than 10th grade	237	18·9	25	29	32	<0·001	11	13	14	<0·001	14	16	18	<0·001
10th grade	418	33·3	28	31	34		12	13	14		14	17	19	
13th grade (Arbitur) and higher (university)	601	47·9	29	33	36		13	14	15		16	19	21	
Family situation (n 1519)														
With one parent	537	35·1	27	31	35	0·360	11	13	14	<0·001	14	17	19	0·004
With both parents	995	64·9	28	31	35		12	14	15		15	17	20	
BMI of mother (kg/m²; n 1250)														
Underweight	35	2·8	28	33	39	<0·001	12	14	15	0·019	15	19	21	0·002
Normal	826	66·1	28	32	35		12	14	15		15	18	20	
Overweight	389	31·1	26	30	34		12	13	15		14	17	19	
BMI of father (kg/m²; n 1106)														
Underweight	5	0·5	28	32	36	0·194	12	14	15	0·144	16	17	20	0·016
Normal	455	41·1	28	32	36		12	14	15		15	18	21	
Overweight	646	58·4	28	31	35		12	14	15		15	17	20	
Girls' weight status (n 1519)														
Underweight	113	7·4	26	31	35	0·013	12	14	15	0·030	13	16	19	0·025
Normal	1232	80·5	27	31	35		12	13	15		15	17	20	
Overweight	186	12·1	29	32	36		12	13	14		15	18	20	

25th, 25th percentile; 75th, 75th percentile; SES, socio-economic status.

school-leaving certificate (none or Hauptschulabschluss). Over one-third had a tenth grade school-leaving certificate (Mittlere Reife) and >45 % of the mothers and fathers held a university entrance diploma (Abitur or Hochschulreife) or a college or university degree (Fach or Hochschulabschluss). With regard to family situation, 35·1 % lived in single-parent households. The parental weight status indicates that just under one-third of mothers were overweight or obese; the proportion of fathers who were overweight or obese was considerably higher (58·4 %). Of the girls, 12·1 % were overweight or obese and 7·4 % were underweight.

The association between the median food frequency score, meal context score and portion size score and selected social and weight status indicators among adolescent girls is presented in Table 2. Statistically significant differences in food frequency scores were found according to age group, migration background, SES of parents, mothers' and fathers' education, mothers' BMI and girls' weight status. Family situation and fathers' BMI did not influence the food frequency score.

Age, migration background, SES of parents, mothers' and fathers' education, family situation and weight status of mothers and daughters were significantly related to differences in meal context scores, whereas fathers' BMI was not significant. Migration background, SES of parents, mothers' and fathers' education and BMI and daughters' weight status were significant determinants of portion size scores.

The multivariate results are organized by food frequency, meal context and portion size scores, each of which is calculated separately (Tables 3 and 4). In model 1 (Table 3), influencing factors regarding 'unfavourable food frequency scores' were: low SES (OR = 3·6), middle SES (OR = 1·9), two-parent migration background (OR = 2·3) and age (OR = 1·3). Overweight or obese status of the girls had a slightly protective influence (OR = 0·3) on the girls' food frequency score. Mothers' and fathers' BMI, family situation and being underweight

Table 3 Model 1: SES as risk factor among selected indicators for unfavourable eating behaviour (multivariate logistic regression)

Independent variable (reference)	Unfavourable food frequency (n 941)			Unfavourable meal context (n 1020)			Unfavourable portion size (n 1020)		
	OR	95 % CI	P	OR	95 % CI	P	OR	95 % CI	P
Age (years)	1·3	1·0, 1·9	0·019	1·5	1·2, 1·8	<0·001	1·2	1·0, 1·3	0·136
Migration background (no)									
One parent	1·4	0·8, 2·6	0·262	1·2	0·7, 2·1	0·463	0·5	0·3, 0·9	0·001
Two parents	2·3	1·5, 3·6	<0·001	1·6	1·1, 2·5	0·024	1·6	1·1, 2·4	0·002
Social status (high)									
Middle	1·9	1·2, 3·0	0·009	2·1	1·4, 3·2	0·001	1·9	1·3, 2·7	0·033
Low	3·6	2·1, 6·0	<0·001	2·3	1·4, 3·8	0·001	2·0	1·3, 3·2	0·013
Family (two adults)									
One parent	1·2	0·7, 1·8	0·569	0·6	0·4, 0·9	0·008	0·7	0·5, 1·1	0·099
Mother (normal)									
Overweight	1·3	0·9, 2·0	0·151	1·1	0·8, 1·6	0·530	1·5	1·1, 2·1	0·019
Underweight	0·6	0·1, 2·7	0·517	0·5	0·1, 2·4	0·409	0·9	0·3, 2·7	0·816
Father (normal)									
Overweight	1·2	0·8, 1·7	0·476	0·9	0·6, 1·3	0·675	1·0	0·8, 1·5	0·792
Underweight	–	–	–	1·1	0·1, 11·0	0·913	0·7	0·1, 6·4	0·735
Girls' BMI (kg/m^2; normal)									
Overweight	0·3	0·2, 0·7	0·002	1·1	0·6, 1·8	0·817	0·7	0·4, 1·2	0·242
Underweight	1·6	0·8, 3·2	0·141	0·6	0·3, 1·3	0·217	1·6	0·9, 2·8	0·094

SES, socio-economic status.

Table 4 Model 2: Mothers' and fathers' education as risk factors among selected indicators for unfavourable eating behaviour (multivariate logistic regression)

Independent variable (reference)	Unfavourable food frequency (n 924)			Unfavourable meal context (n 998)			Unfavourable portion size (n 998)		
	OR	95 % CI	P	OR	95 % CI	P	OR	95 % CI	P
Age (years)	1·2	1·0, 1·5	0·057	1·5	1·2, 1·8	<0·001	1·2	1·0, 1·4	0·087
Migration background (no)									
One parent	1·4	0·8, 2·7	0·238	1·0	0·6, 1·9	0·894	0·5	0·3, 1·0	0·066
Two parents	2·5	1·6, 3·0	<0·001	1·6	1·1, 2·6	0·026	1·8	1·2, 2·6	0·005
Mothers' education (up to tenth grade)									
Less than tenth grade	3·3	1·7, 6·2	<0·001	1·4	0·7, 2·6	0·312	1·6	0·9, 2·9	0·084
Tenth grade	1·9	1·2, 3·2	0·010	1·9	1·2, 2·9	0·009	1·5	1·0, 2·3	0·046
Fathers' education (up to tenth grade)									
Less than tenth grade	1·1	0·6, 2·0	0·703	1·6	0·9, 2·9	0·101	1·2	0·7, 2·0	0·515
Tenth grade	1·1	0·7, 1·7	0·820	1·6	1·0, 2·5	0·057	1·4	0·9, 2·2	0·085
Family (two adults)									
One parent	1·1	0·7, 1·7	0·781	0·6	0·4, 0·9	0·015	0·8	0·6, 1·2	0·280
Mother (normal)									
Overweight	1·4	0·9, 2·0	0·117	1·1	0·8, 1·6	0·633	1·4	1·0, 2·0	0·039
Underweight	0·7	0·2, 3·1	0·631	0·6	0·1, 2·6	0·475	0·9	0·3, 2·8	0·896
Father (normal)									
Overweight	1·3	0·8, 1·7	0·261	0·9	0·6, 1·3	0·611	1·0	0·7, 1·5	0·825
Underweight	–	–	–	1·2	0·1, 11·3	0·900	0·7	0·1, 6·8	0·772
Girls' BMI (normal; kg/m^2)									
Overweight	0·3	0·2, 0·6	<0·001	1·1	0·7, 1·9	0·640	0·8	0·5, 1·3	0·335
Underweight	1·8	0·9, 3·4	0·082	0·6	0·3, 1·4	0·241	1·8	1·1, 3·2	0·031

were not statistically significant influencing factors on the girls' food frequency score. Statistically significant risk factors for the 'meal context score' – arranged from the highest to the lowest risk – were low SES (OR = 2·3), middle SES (OR = 2·1), two-parent migration background (OR = 1·6), age (OR = 1·5) and living with one parent (OR = 0·6). Mothers' and fathers' BMI and the girls' weight status did not have a statistically significant influence on the meal score. Statistically significant risk factors for the

'portion size score' were: low SES (OR = 2·0), middle SES (OR = 1·9), overweight mothers (OR = 1·5) and migration background, both two-parent (OR = 1·6) and one-parent (OR = 0·5). Age, family situation, mothers' and fathers' BMI and the weight status of girls did not have a statistically significant influence on the portion score of the girls.

The results for model 2 (Table 4) follow the same structure as those for model 1. The statistically significant observations regarding the 'unfavourable food frequency

score' were: mothers with less than tenth grade school-leaving certificate (OR = 3·3), mothers with tenth grade school-leaving certificate (OR = 1·9) and girls with two-parent migration background (OR = 2·5). Overweight or obese status of the girls had a protective influence (OR = 0·3) on the girls' food frequency score. Fathers' education, family situation, mothers' and fathers' BMI and girls being underweight did not have a statistically significant influence on the food frequency score of the girls. Statistically significant influencing factors for the 'meal score' were: mothers with a tenth grade school-leaving certificate (OR = 1·9), two-parent migration background (OR = 1·6), living with one parent (OR = 0·6) and age (OR = 1·5). Mothers having less than tenth grade school-leaving certificate, fathers' education and mothers', fathers' and girls' BMI did not have a statistically significant influence on the meal score of the girls. Girls being underweight (OR = 1·8), two-parent migration background (OR = 1·8), mothers having tenth grade school-leaving certificate (OR = 1·5) and mothers being overweight (OR = 1·4) were risk factors for 'unfavourable portion score'. Age, family situation, mothers being underweight, fathers' BMI and girls being overweight did not have a statistically significant influence on the girls' portion score.

Discussion

Eating behaviour is an interesting field of study and is widely discussed at the national political level in Germany and Europe, in the scientific community and in popular literature. In particular, adolescents' eating behaviour is gaining new attention with the rise in obesity and nutrition-related chronic diseases. The objective of the present study was to investigate the impact of social living conditions and girls' and/or parents' weight status on food frequency, meal context and daily portion sizes among adolescent girls. Using three different measures of eating behaviour simultaneously provided an in-depth understanding of general patterns and potential risk factors.

The study population comprised adolescent girls from Berlin, of whom 9·6% were 11 years old, 21·7% were 12 years old, 39·0% were 13 years old and 29·6% were 14 years old. The age distribution of the study population is fairly representative. Slight differences exist regarding migration background (BSCOC: 36·6%; KiGGS: 14·0%[25]). This may be due to the relatively high number of immigrants in Berlin. The BSCOC SES distribution is similar to that of the Berlin Health Report, indicating that the BSCOC sample is representative for Berlin[21]. Given the different definitions of SES, a comparison with KiGGS and the HBSC study is hardly possible in this respect[8].

The bivariate analysis examined the results of nine relationships between either social factors or weight status and food behaviour measures. Almost all were statistically significant influencing factors, except for family situation and

fathers' BMI, which did not influence the food frequency score; fathers' BMI was not significant for the meal score, and age was not significant for the portion score.

Accordingly, the hypotheses that unfavourable eating behaviour is increased with (i) migration background, (ii) lower SES/education, (iii) higher age, (iv) living with one parent and (v) being overweight or obese and/or having overweight parents were confirmed by the study results (bi- and multivariate analyses) with only very few exceptions.

Migration background and SES were strongly linked with a less-favourable eating behaviour. These findings are confirmed by other studies[10,26]. Kleiser *et al.*[10] conclude that the food intakes of young people with a migration background living in Germany are subject to considerable variation. Food is that component of culture that is easiest to carry along when moving to another country. With access to basic foods, almost anybody can compose a familiar meal from their home country, which means that staple food components play a central role and are changed last[27]. Main dietary composition changes occur in complementary and accessory foods, which leads to an increased tendency towards consumption of non-recommended foods such as soft drinks, snacks and fast food. For example, in the present study, girls with a two-parent migration background consumed vegetables and salad more often, but they also consumed a lot more soft drinks and sweets in comparison with girls from a no-migration background. It has to be taken into account that adolescents with a migration background more often have parents with low SES and low education, which supports a less-favourable eating behaviour. SES and low education are independently associated with food intake[28]. In the present study, the greatest social gradient was found in the food frequency score. Throughout history and in different demographic groups, SES has been consistently associated with health[29]. Other studies have also found that lower SES groups consume unhealthier foods more frequently despite different definitions[11,30–32]. On the contrary, consumption of fruit and vegetables is higher in higher SES groups[5,8,29]. Our study showed a higher percentage of the low SES group having fewer regular meals, similar to the study by Hoglund *et al.*[33]. Owing to the nature of the cumulative outcome variables in the present study, it could not be established whether the number of daily meals or the meal context (with parents or on the way) influences the outcome of eating behaviour. However, this measure is factored into the score and thus may contribute to the findings that the low SES group has less-favourable meal context eating behaviour. 'Parental education' showed gender differences. Although mothers' educational level was a risk factor for all components of eating behaviour, fathers' educational level did not play a role at all. This is in agreement with the argument of Winkleby *et al.*[34], who stated that, specifically, mothers' education is the strongest predictor of health within the SES. Education

represents more than formal schooling and nutritional knowledge; rather, it includes lifestyles, attitudes and approaches. Mothers' education may be more important than fathers' education for adolescent girls' eating behaviour because mothers usually prepare meals, spend more time with the children and act as role models, especially for girls[35]. Elfhag and Linne[36] determine that eating pathology is shared by mothers and daughters, but not by sons. The employment status of parents had no influence on eating behaviour, as described by Würbach et al.[37].

Surprisingly, and contrary to the findings of other studies, we found a positive association only between age and unfavourable meal scores. Several other studies found an increase in unhealthy food consumption frequency, e.g. sweets, fast food[4,11] and soft drinks[5,38], and a decrease in the consumption of healthy food such as fruit and vegetables (S Bartsch, unpublished results) in older children. No cumulative meal scores are found in the literature; however, individual aspects of meal contexts support the findings of the present study. The frequency of eating breakfast with parents decreases with older age[8,38]. With the transition from childhood to adulthood, adolescents seek to claim their independence and eat less frequently with the family[30] or at home and may skip meals altogether. These are possible reasons why adolescents exhibit lower meal scores as they get older. The reasons why, in the BSCOC study, meal scores are associated with age, whereas the food frequency and portion scores are not, remain open to debate.

'Family situation' was associated with unfavourable meal scores, but not with food frequency or portion scores. The family still remains the dominant setting for meal consumption (S Bartsch, unpublished results). The National Longitudinal Study of Adolescent Health found that students in one-parent households have a higher risk of unfavourable eating behaviour 'such as skipping breakfast and lunch, eating fewer vegetables, [and] consuming more fast food'[39]. In further analyses, details of this interaction with the other measures of eating behaviour on one side and social factors on the other should be focused upon.

Interestingly, weight status was less important in girls' eating behaviour. 'Overweight in parents' was relevant only for mothers. Numerous studies have shown that overweight in parents influences the child's eating behaviour[2,40–45]. The fact becomes apparent that overweight parents influence the child's eating behaviour negatively[46–48]. Similar to parents' education, overweight mothers may have more of an influence than fathers because they spend more time with the girls and are more involved with food preparation in the household[35].

Our findings did not support 'overweight in girls' as a risk factor for unfavourable eating behaviour. Contrary to our hypothesis, being overweight was slightly protective for the food frequency score. Our finding has to be interpreted with caution, as social desirability among other factors could play a role. This is clearly opposed to the findings that obesity is correlated with unhealthy eating[10,49,50] and skipping breakfast[31,51–55]. With regard to the composite meal score, the findings are inconclusive[56,57], indicating the need for further research.

Benefit of using different measures of eating behaviour

Taking the multivariate results into account, two patterns are obvious. First, there are risk factors ubiquitously relevant for eating behaviour. Our results showed a consistent significance of SES or mothers' education and migration background in relation to the three selected components of eating behaviour. Second, the relevance of other risk factors is dependent on the measure of eating behaviour. For example, having an overweight mother and being an underweight girl are associated only with unfavourable portion sizes. With regard to the risk factors, the meal context score seems to be different compared with the other two components of eating behaviour. Rather than finding categorical influences, e.g. parental education, migration background or weight status, on the eating behaviour of adolescent girls in Berlin, gender differences in parental influence are observed.

Conclusion

Gender differences emerge as a central theme from the findings of the present study. The girls' eating behaviour is less affected by categorical influences than by the gender of their parents. The disaggregate SES component of mothers' education is clearly seminal in shaping the social gradient in relation to all three components of eating behaviour. Fathers' education on the other hand is not a significant factor in the multivariate analysis. Savage et al.[35] argue that mothers' education has such a strong influence on girls' eating behaviour because 'in most families, women still have primary responsibility for feeding children'. Campbell et al.[58] note that especially mothers influence the home food environment, which is crucial in 'determining adolescents' (…) eating'[36] and in establishing a link in eating behaviour between mothers and daughters, but not between the former and their sons. Interventions are needed at multiple levels. These can be successful only when preventive measures involve parents, children and adolescents. Specific interventions accounting for age, gender, migration background and the socio-economic background of the target group are necessary without stigmatizing groups that are already vulnerable[59,60].

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