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Associations between eating frequency, adiposity, diet, and activity in healthy weight and centrally obese children 9-10 years

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Abstract

The rising prevalence of childhood obesity is a key public health issue worldwide. Increased eating frequency (EF) is one aspect of diet that has been beneficially associated with obesity, although the mechanisms are unclear. The aims of the current study were to determine whether increased EF was associated with improved adiposity in children, and if this was due to differences in dietary and activity behaviours. Cross-sectional data from 1700 9-10-year-olds were analysed to examine associations between EF, estimated from diet diaries, measures of adiposity, and activity measured by accelerometer. Analyses were stratified by obesity status using waist-to-height ratio to define obesity as it has shown to be a good predictor of adverse health outcomes. Mean EF was 4.3 occasions/day and after adjustment for under-reporting, energy intake, and activity significant relative mean differences of -2.4% for body weight ($p=0.001$), -1.0% for BMI ($p=0.020$), -33% for BMI z-score ($p=0.014$), and -0.6% for waist circumference ($p=0.031$) per increase in eating occasion were found in healthy weight but not centrally obese children. Differences between the extreme quartiles of EF were observed for total fat intake at breakfast (-18%, $p<0.001$), fruit and vegetables from snacks (201% healthy weight and 209% centrally obese children, $p<0.01$), and for healthy weight children, vigorous activity (4%, $p=0.003$). Increased EF was favourably associated with adiposity, diet quality, and activity behaviours in healthy weight but not centrally obese children. Future obesity interventions should consider the mediating role of diet quality and activity in the relationship between EF and adiposity in children.

Introduction

Worldwide childhood obesity rates are reaching epidemic proportions with established health consequences that include both the presence of cardiovascular risk factors and strong links to adult morbidity and mortality (1). The distribution of body fat is also thought to predict cardiovascular disease risk with central (abdominal) obesity being more strongly related than total adiposity (2). Evidence also suggests that measures of central obesity, in particular waist-to-height ratio, predict adverse health outcomes including cardiovascular disease independently of BMI. Waist-to-height ratio is also associated with percentage body fat in children (5). Poor diet, next to lack of physical activity, has been implicated as a key determinant of obesity (1) but it is not clear which specific aspects of dietary behaviour, such as eating frequency, should be targeted to reduce obesity (6, 7). In order to develop effective strategies for obesity prevention it is critical to determine how different aspects of children's diets relate to body composition and body fat distribution to enable more specific guidance and intervention strategies in the future.

Eating frequency (number of eating occasions/meals per day) is one aspect of the diet that is thought to be associated with both weight status and with risk factors associated with

chronic diseases (8). Studies in adults have shown that increased eating frequency is associated with improved weight status, although the evidence is equivocal (9-13) perhaps due to the use of different methodologies (14), different definitions of intake occasions (14), under-reporting (15), or limited data on energy expenditure (9). The evidence in children is more consistent with four previous studies showing that eating frequency is associated with reduced obesity status (16-19). These studies however, have only used questionnaires to examine eating frequency and physical activity meaning they have been unable to concurrently examine distribution and content of meals and snacks and objectively measured physical activity throughout the course of the day. This data would allow us to examine if the mechanisms proposed to explain the association between increased eating frequency and improved weight status in adults, including elevated physical activity levels (9), and better adjustment of energy intake in response to preceding eating occasions (9, 16, 20) also act in children. To date it has been suggested that the specific distribution of meals and snacks may be important in the maintenance of body weight in children with data showing that increased snacking and breakfast consumption are associated with reduced risk of overweight and obesity (21, 22). However, studies have not investigated the composition of foods within eating occasions.

The aims of the current cross-sectional study were two-fold. First, to assess if, in a well-characterized population-based sample of children aged 9–10 years eating frequency was associated with objectively measured parameters of adiposity when children were stratified by central obesity status. . Secondly to examine if any observed associations might be attributable to differences in the composition of the diet or physical activity levels in an attempt to elucidate the potential mediating mechanisms whereby eating frequency might influence bodyweight. Since breakfast consumption and snacking have been highlighted as key meals in terms of weight control and energy regulation we chose to focus specifically on dietary intake at these meals (21-23). It was hypothesised that the children who ate more frequently would have more favourable adiposity status, dietary behaviours, and physical activity levels compared to children who ate less frequently.

Methods and procedure

Participants

Ninety-two schools in the county of Norfolk, United Kingdom, agreed to take part in the SPEEDY study (Sport, Physical activity and Eating behaviour: Environmental Determinants in Young people) which was designed to quantify dietary habits, physical activity and their correlates in a population based sample of 9-10 year old children. A total of 2064 children participated and detailed descriptions of the sampling strategy, participation rates and measurement procedures have been previously reported (24). Briefly, children aged 9-10 were recruited from schools during the 12-week summer term of 2007 (April to July). Trained researchers took anthropometric measurements, and instructed children on how to complete questionnaires and diaries, and how to use an accelerometer. The University of East Anglia local research ethics committee approved the study protocol and the written consent of all participating children and their parents was obtained.

Procedure

Assessment of dietary intake—Dietary intake was recorded using a four-day food and drink diary where children, with assistance from their parents, were asked to record everything they ate and drank over a four-day period (including two weekend days). This method has previously been used and validated with children aged 9-10 years (25). Estimated weights of portions were then calculated using published values, including those specific to children (26, 27), and mean nutrient intakes estimated using the WISP nutritional

analysis software version 3.0 (Tinuviel Software, Warrington, UK) using nutrient values from McCance and Widdowson's *The Composition of Foods*, 6th Edition (28).

Children were asked to record their food and drink consumption in pre-defined time periods (6am-9am, 9am-12pm, 12pm-2pm, 2pm-5pm, 5pm to 8pm, 8pm-10pm, 10pm to 6am). Daily eating frequency was defined as the number of time periods in which children reported consuming any food or drink. Breakfast was defined as consuming any food or drink during the first eating period (6am and 9am), a mid-day meal as any food or drink consumed in the third eating period (12pm and 2pm) and an evening meal as food and drink consumed in the fifth eating period (5pm and 8pm). A snack was defined as food or drink consumed at any other time.

Under-reporting of energy intake was assessed by calculating the ratio of reported energy intake (EI) to estimated energy requirements (EER), which were estimated using equations from the FOA/WHO/UNU Expert Consultation Report on Human Energy Requirements (29). A 95% confidence interval for the accuracy of EI:EER was calculated by taking into account the amount of variation inherent in the methods used to estimate EI and EER (30). For the SPEEDY data the 95% confidence interval for EI:EER was 0.71 to 1.30 and therefore reports of EI within 71% to 130% of EER were considered to be in the range of normal measurement. As excluding children who under-report can distort dietary intake data, energy reporting quality (ratio of EI:EER) was examined as a continuous variable in all statistical models (31).

Assessment of anthropometry variables—Portable Leicester height measures (Seca, Hamburg, Germany) were used to assess height to the nearest millimeter. A non segmental bio impedance scale (Tanita, type TBF-300A, Tanita Tokyo, Japan) was used to measure weight (to the nearest 0.1 kilogram) and impedance. Previously validated and published equations were used to calculate percentage body fat (32). Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared and transformed to standardized Z-scores using the LMS method and the 1990 British Growth Reference data (33). Waist circumference was measured twice to the nearest millimeter (or three times if a discrepancy of over 3 cm was observed) at the midpoint between the lower costal margin and the level of the anterior superior iliac crests, using a calibrated measuring tape (Seca, UK), a 0.5 cm correction was applied to account for clothing. Waist-to-height ratio was calculated as waist (cm) divided by height (cm) and used to classify children as centrally obese (>0.46 boys and >0.45 girls) or healthy weight (<0.46 boys and <0.45 girls) using recently developed age-appropriate cut-offs to define central obesity (5). We chose to use waist-to-height ratio as the measurement to define obesity in the current study for a number of reasons. Firstly, there is substantial evidence that abdominal obesity is a better predictor of cardiovascular risk than BMI in children (2-4). Secondly, waist-to-height ratio has benefits over waist circumference when defining central obesity as it is known that height influences observations of fat accumulation and distribution. Thirdly, the use of waist-to-height ratio has also been highlighted as a useful public health tool in that very similar cut-off values can be used in different age, gender and ethnic groups (34). A greater interest in and advocacy for the use of waist-to-height ratio to define obesity has therefore been observed in recent years (34).

Assessment of confounding variables—Information on highest parental education (in categories) was obtained from parental self-report. Free-living physical activity was assessed over one week with the ActiGraph activity monitor (GTIM, Actigraph LCC, Pensacola, US) using a recording epoch of 5 seconds. Children were fitted with the monitor on the measurement day at school and received both verbal and written instructions regarding its use. They were instructed to wear the monitor during all waking hours, except while

engaged in water-based activities. A special written programme (MAHUffe; www.mrc.epid.cam.ac.uk) was used for data cleaning, reduction and further analyses. Zero activity periods of 10 minutes or longer were interpreted as “not worn time” and these periods were removed from the summation of activity in line with previous research (35). Participants who did not manage to record valid data for at least 500 min per day for at least 3 days were excluded from further analyses. Physical activity was defined as mean daily activity counts per minute, an indicator of overall energy expenditure, and minutes in activity of moderate (2000-3999 counts·min⁻¹) and vigorous activity (>4000 counts·min⁻¹).

Statistical analysis

As overweight children have been shown to have different dietary and physical activity patterns to healthy weight children (36), and differences in meal frequencies have been shown between obese and healthy weight adults (37) we examined the relationships between eating frequency and adiposity separately in healthy weight and centrally obese children using stratified analyses. Independent sample t-tests and chi-squared test for categorical data were used to examine differences between characteristics of the healthy weight and centrally obese children. Associations between eating frequency and children's adiposity status were evaluated using multiple regression analysis after adjustment for relevant confounders. The distribution and nutritional composition of breakfast and snacks, and physical activity levels, were determined in quartile categories of eating frequency. Mean percentage differences, adjusted for relevant confounders, are presented between the highest and lowest quartile (Q4-Q1), with statistical comparisons made using ANCOVA. Potential confounders included gender, parental educational attainment, under-reporting (ratio of EI to EER), energy intake (kcal), and physical activity (counts per minute). Statistical analyses were performed using SPSS version 16.0 for windows (SPSS Inc., Chicago, IL, USA).

Results

Descriptive statistics for demographic and physical characteristics of the children are shown in Table 1. Of the 2064 children recruited for the SPEEDY study 1700 (82%) had adiposity measurements taken, completed diet diaries, provided valid physical activity data, and data on relevant confounders. All the children were aged between 9 and 10 years (10.3 ± 0.3 years) and 56% were girls. The included children did not differ in age to those who were excluded, although there were differences by gender (56% girls included sample v 50% girls excluded sample; $\chi^2=4.71$ $p=0.030$). Centrally obese children were more likely to be girls ($\chi^2=12.6$ $p<0.001$) and have parents with lower levels of education ($\chi^2=22.1$ $p=0.001$). As expected, the healthy weight children had significantly lower anthropometric measures (all $p<0.05$) and higher physical activity levels ($t=6.05$ $p<0.001$) than the centrally obese children. There were no clear differences in the nutrient intakes of the two groups although the healthy weight children consumed more energy from carbohydrate ($t=2.42$ $p=0.015$) and less energy from protein ($t=-2.31$ $p=0.021$), compared to the centrally obese children.

Mean eating frequency was 4.3 eating occasions per day (SD 0.8, range 2.3 to 6.0). There was no significant difference in reported frequency of meals and snacks between the healthy-weight and centrally obese children (4.4 eating occasions, SD 0.7, range 2.3 to 6.0 v 4.3 eating occasions, SD 0.7, range 2.5 to 6.0; $t=-0.31$ $p=0.308$), and the distribution of eating frequency in each sub-group were similar (Figure 1). The mean number of snacks reported was 1.6 per day in this sample (SD 0.68, range 0.0 to 3.0). The observed relationship between eating frequency and adiposity differed between the healthy weight children and the centrally obese children, Table 2. In healthy weight children increased eating frequency was associated favourably with adiposity; each unit increase in eating frequency was inversely associated with weight ($B=-0.78\text{kg}$; $p=0.001$), BMI ($B=-0.17\text{kg/}$

m^2 ; $p=0.020$), BMI z-score ($B=-0.10$; $p=0.014$), and waist circumference ($B=-0.38\text{cm}$; $p=0.031$). In centrally obese children each increase in eating occasion was positively associated with BMI z-score ($B=0.09$; $p=0.047$) and waist-to-height ratio ($B=0.005\text{cm}$; $p=0.036$).

Eating frequency was significantly associated with both the number of snacks consumed and the nutritional composition of the snacks. Compared to the least frequent eaters, the most frequent eaters consumed more snacks (healthy weight children 188% Q4-Q1, $p<0.001$; centrally obese children 200% Q4-Q1, $p<0.001$). Moreover, their snacks were lower in energy density (healthy weight children -35% Q4-Q1, $p<0.001$; centrally obese children -33% Q4-Q1, $p<0.001$) and higher in carbohydrate (healthy weight children 10% Q4-Q1, $p<0.001$; centrally obese children 15% Q4-Q1, $p<0.001$), fibre (healthy weight children 57% Q4-Q1, $p<0.001$; centrally obese children 62% Q4-Q1, $p<0.001$), and fruit and vegetables (healthy weight children 201% Q4-Q1, $p<0.001$; centrally obese children 209% Q4-Q1, $p<0.001$) (Figure 2).

Breakfast consumption was reported on an average of 89.2% of days (SD 18.0, range 0% to 100%). Eating frequency was associated with the number of days that breakfast consumption was reported with children in the highest quartile of eating frequency reporting breakfast consumption most frequently (healthy weight children 10% Q4-Q1, $p<0.001$; centrally obese children 9% Q4-Q1, $p<0.001$). The nutritional composition of food and drinks reported at breakfast time also differed by eating frequency. Compared to the least frequent eaters (quartile 1) the most frequent eaters (quartile 5) reported lower energy intake (healthy weight children -14% Q4-Q1, $p<0.001$; centrally obese children -10% Q4-Q1, $p=0.044$), lower total fat intake (healthy weight children -18% Q4-Q1, $p<0.001$; centrally obese children -18% Q4-Q1, $p<0.001$), and higher carbohydrate intake at breakfast (healthy weight children 9% Q4-Q1, $p<0.001$; centrally obese children 10% Q4-Q1, $p=0.001$), (Figure 2).

The percentage differences in energy intake between extreme eating frequency quartiles were similar for both healthy weight (1.5% Q4-Q1, $p<0.001$) and centrally obese children (1.1% Q4-Q1, $p=0.035$), as were differences in activity of moderate intensity (healthy weight children 6% Q4-Q1, $p=0.040$ and overweight children 6% Q4-Q1, $p=0.104$). The direction of differences in high intensity activity differed between the two groups however, with the healthy weight children who ate most frequently reporting significantly higher levels of vigorous activity than the children who ate least frequently (4% Q4-Q1, $p=0.033$), with the converse observed for overweight children, although this did not reach statistical significance (-2% Q4-Q1, $p=0.801$), (Figure 2).

Discussion

Using a large population-based sample of 9-10 year old children we observed that increased eating frequency was associated with improved body weight, BMI and waist circumference in healthy weight children with relative mean differences of -2.4% for body weight, -1.0% for BMI, -33% for BMI z-score, and -0.6% for waist circumference detected. Conversely increased eating frequency was associated with a higher BMI z-score and waist-to-height ratio in centrally obese children, with relative mean differences of 6% and 1% respectively. Increased eating frequency was also associated with the more favourable nutritional composition of breakfast and snacks in both groups, with children in the highest quartiles of eating frequency reporting improved fruit and vegetable, fat, fiber, and carbohydrate intakes at these meals, compared to the children in the lowest quartiles. Finally, an inverse association between high intensity physical activity and eating frequency was seen for the healthy weight, but not the centrally-obese children. These findings were all independent of

covariates known to be associated with obesity including gender, energy intake, physical activity, parental education, and under-reporting.

Despite the large amount of work examining associations between dietary intake and weight status in children, it is not entirely clear how different eating behaviours relate to measures of adiposity in children, or the mechanisms behind these associations. To our knowledge this is the first time a study has examined the behaviours that may be associated with eating frequency in a large cohort of children using food diaries and objectively measured physical activity. Previous studies in children have shown daily meal frequency to be associated with a lower prevalence of obesity in German children aged 5-6 years (16), lower BMI z-score in German children aged 7-14 years (17), and with lower BMI in Portuguese girls aged 13-17 years (18). Furthermore snacking frequency has shown to be associated with overweight status in the NHANES study (21). The current study builds on the results of this previous work by showing eating frequency to be differentially associated with adiposity in healthy weight and centrally obese children. The magnitude of our findings may have potential clinical relevance as reductions in BMI z-score similar to those observed in the current study have previously been associated with reductions in cardio-metabolic risk factors in children of a similar age. Specifically, a decrease in BMI z-score of 0.1 has been associated with significantly lower insulin (-19 pmol/L), and total (-0.1 mmol/L) and LDL cholesterol levels (-0.12 mmol/L) (38).

Our data also suggest that there may be a favourable impact of increased eating frequency on fruit and vegetable, fat, fiber, and carbohydrate intakes at the specific meal times examined in the current study. These food groups and nutrients are known to be important in terms of weight control in children and are the dietary components forming the basis of public health policy relating to the prevention and treatment of childhood obesity (39). We have also shown that intake of these foods and nutrients are improved at specific meals that have been highlighted as important in terms of reducing obesity in children (21, 22).

The positive relationship observed between eating frequency and adiposity in centrally obese children does not appear to have been reported previously in the literature. It is possible that the differences observed in the associations between eating frequency and adiposity between healthy weight and obese children were linked to disparities in how the children were compensating energy intake and energy expenditure as our data shows no association between physical activity and eating frequency in centrally obese children. This could indicate that centrally obese children who were eating more frequently were, unlike the healthy weight children, not compensating for their increased energy intake by being physically active. Previous studies have shown that children are generally good energy compensators, although this ability declines with age, and there is some evidence that overweight children compensate less well than children of a healthy weight (40). A further possibility is that some of the centrally-obese children were eating fewer meals as a strategy for weight loss which could make it appear that there were positive associations between frequency of eating and adiposity in this group.

Strengths of this study are robust methodologies that allowed us to collect data on eating frequency, the composition of the diet, and objectively measured physical activity concurrently. Unlike previous studies that have investigated eating frequency we were able to examine the composition of foods and nutrients within eating occasions. There was also a large sample recruited using a population-based sampling strategy. Under-reporting is common in nutritional studies, especially among those who are overweight or obese (31), by using under-reporting as a covariate we were able to control for the effect misreporting may have had on any reported associations.

The limitations include the cross-sectional design that means we cannot determine if reverse causality was a factor. Furthermore whilst our sample included children from a diverse range of urban and rural environments and areas of varying deprivation, Norfolk does not have large cities, and is culturally less varied than some parts of the country, as there are a low proportion of families from different ethnic backgrounds. Lower rates of overweight and obesity were also found in the current sample compared to national averages (24). We acknowledge that our findings would not be generalisable to more ethnically diverse populations and further work is needed to see if these findings are replicated in other samples. Finally although food diaries have been shown to provide a valid measure of food intake in this age group (25), under-reporting was accounted for in the present analysis and substantial assistance from parents was requested, we cannot entirely eliminate measurement error or the possibility of reporting bias by the children or parents. Furthermore, our definition of eating frequency was restrictive (to a maximum of six eating occasions), although more detailed than previous studies, and it is possible that some children consumed more than one meal or snack in the time periods we considered. This misclassification may have underestimated the magnitude of associations between eating frequency, measures of adiposity, diet, and physical activity in this sample. If eating frequency was more precisely defined the associations observed may have been of an even greater magnitude.

In conclusion, we found that increased eating frequency was favourably associated with body weight and adiposity measures in healthy weight children but not centrally obese children. The healthy-weight children who ate most frequently reported significantly higher physical activity levels and improved composition of snacks and breakfast in terms of fruit and vegetables, fat, fiber and carbohydrates, compared to the children who ate least frequently. In contrast, our data shows no association between objectively measured physical activity and eating frequency in centrally obese children. It is therefore important that public health messages supporting increased eating frequency in children, such as those that promote breakfast or snacking consumption, should focus on promoting dietary quality and the importance of physical activity in balancing energy intake. The findings of the current study suggest that future obesity interventions should consider the mediating role of physical activity and diet quality in the relationship between eating frequency and in children, however, further evidence from prospective studies is needed to confirm the findings of the current study.

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A: Healthy weight children (n=1034)

B: Centrally obese children (n=666)

Figure 1.
Distribution of eating frequency in 1700 9-10-year-old children

Figure 2.

Mean percentage differences in dietary intake at specified meals and physical activity by eating frequency (*categories were plotted on the secondary axis). Comparisons were made between the 4th and 1st quintile (Healthy weight children n=269 for Q1 and 273 for Q4; centrally obese children n=191 for Q1 and 155 for Q4). Values were adjusted for gender, parental education, under-reporting, physical activity, and †energy intake. %ES = percentage of total energy from snacks; %EB = percentage of total energy from breakfast. ‡The difference between the 4th and 1st quintile was significantly different $P<0.05$ (ANCOVA) in healthy weight and centrally obese children, or in §healthy weight children only.

Table 1Characteristics of 1700 healthy weight and centrally obese 9-10-year-old children from the SPEEDY study¹

	All children n=1700	Healthy weight children n=1034	Centrally obese children n=666
Gender (% girls)	56%	53%	62% *
Age	10.3 (0.3)	10.3 (0.3)	10.2 (0.3)
Parental education			
- None or school leaving certificate	7%	5%	9%
- GCSE (exams usually taken age 16)	51%	49%	55%
- A-level (exams usually taken at age 18)	25%	28%	21%
- University	17%	18%	15% *
Height (cm)	141 (6.6)	140 (6.3)	142 (6.9) *
Weight (kg)	36.6 (8.3)	32.7 (4.9)	42.7 (8.9) *
BMI (kg/m ²)	18.2 (3.1)	16.5 (1.4)	21.0 (3.1) *
BMI (z_score)	0.4 (1.1)	-0.3 (0.8)	1.4 (0.8) *
Waist (cm)	64.1 (8.1)	59.4 (3.6)	71.5 (7.7) *
Waist: height (cm)	0.454 (0.051)	0.422 (0.109)	0.504 (0.044) *
Body fat (%)	30.6 (7.9)	26.1 (4.9)	37.7 (6.1) *
Eating Occasions			
Eating frequency (occasions/day)	4.3 (0.8)	4.4 (0.7)	4.3 (0.7)
Snacking frequency (occasions/day)	1.57 (0.68)	1.58 (0.68)	1.56 (0.69)
Breakfast frequency (% days)	89.2 (18.0)	89.8 (17.6)	88.3 (18.7)
Composition of the diet			
Energy density (kcal/g)	1.97 (0.31)	1.98 (0.31)	1.97 (0.32)
Total fat (% energy/day)	37.0 (4.6)	36.9 (4.4)	37.2 (4.7)
Carbohydrate (% energy/day)	48.6 (5.1)	48.9 (5.0)	48.3 (5.1) *
Protein (% energy/day)	14.3 (2.3)	14.2 (2.3)	14.5 (2.3) *
Fiber (g/day)	9.7 (3.4)	9.7 (3.4)	9.7 (3.4)
Fruit and vegetable (g/day)	196 (115)	198 (115)	192 (115)
Physical activity			
Moderate activity (minutes/day)	48.3 (14.3)	49.2 (14.5)	47.0 (13.9) *
Vigorous activity (minutes/day)	25.0 (13.2)	26.9 (13.9)	22.0 (11.5) *
Total activity (counts per minute)	668 (218)	691 (227)	631 (197) *

¹Values are mean (SD) or %, n=1700.

* significant difference between healthy-weight and overweight children (p<0.05; independent sample t-test or chi-squared test for categorical data).

Table 2

Associations between eating frequency and adiposity in 1700 healthy weight and centrally obese 9-10-year-old children¹

	All children <i>n</i> =1700			Healthy weight children <i>n</i> =1034			Centrally obese children <i>n</i> =666		
	B	SE	P-value	B	SE	P-value	B	SE	P-value
Weight (kg)	−0.02	0.31	0.479	−0.78	0.24	0.001	0.64	0.52	0.220
BMI (kg/m ²)	0.02	0.12	0.867	−0.17	0.07	0.020	0.30	0.18	0.088
BMI (z_score)	−0.03	0.04	0.556	−0.10	0.04	0.014	0.09	0.05	0.047
Waist circumference (cm)	0.41	0.31	0.893	−0.38	0.17	0.031	0.71	0.45	0.118
Waist: height (cm)	0.002	0.002	0.313	0.000	0.001	0.849	0.005	0.003	0.036
Body fat (%)	−0.03	0.27	0.992	−0.20	0.21	0.347	0.40	0.33	0.226

¹Values are beta coefficients and SE for a one unit increase in eating frequency, multivariate linear regression adjusted for gender, parental education, under-reporting, energy intake and physical activity.