

Differences in Danish children's diet quality on weekdays v. weekend days

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Abstract

Objective: To compare differences in children's diet quality on weekdays (Monday–Thursday), Fridays and weekend days.

Design: A representative cross-sectional study in which participants completed a 7 d pre-coded food record. Mean intakes of energy, macronutrients and selected food items (g/10 MJ) as well as energy density were compared between weekdays, Fridays and weekend days for each gender in three age groups (4–6, 7–10 and 11–14 years) using Tobit analysis to account for zero intakes.

Setting: The Danish National Survey of Dietary Habits and Physical Activity 2003–2008.

Subjects: Children (*n* 784; 49.9% boys) aged 4–14 years.

Results: For both genders in all age groups ($P < 0.05$), energy intake was higher during weekends than on weekdays, and intakes of sugar-sweetened beverages and white bread were higher, whereas intake of rye bread was lower. This contributed to a higher percentage of energy from added sugars, a lower fibre content and a higher energy density on weekend days *v.* weekdays. In children aged 4–6 and 7–10 years, the diet on weekend days was also characterized by higher intakes of sweets and chocolate and lower intakes of fruit and vegetables. Overall, the diet on Fridays appeared as a mix of the diets on weekdays and weekend days.

Conclusions: Significant differences and distinct characteristic patterns were found in children's diet quality during weekdays, Fridays and weekend days. The present study suggests that in prevention of childhood overweight and obesity, more attention should be paid to the higher energy intake, especially from sugar-rich foods and beverages, on Fridays and weekend days.

Keywords
Dietary assessment
Food record
Week

Dietary intake plays an important role in the prevention of chronic diseases^(1,2) and the adverse effects of children's unhealthy eating behaviours, in particular the increasing prevalence of childhood overweight and obesity, have become a significant public health challenge⁽³⁾. Unfavourable diets in childhood may have long-term implications, especially as tracking of overweight from childhood to adulthood occurs, and thereby increase the risk of subsequent morbidity and mortality^(4,5). The evidence of consistency in relation to dietary habits in children is limited and most studies report only poor to moderate stability over time, indicating that the diets of children are potentially modifiable⁽⁶⁾.

Compared with food-based dietary guidelines and nutritional recommendations, many children generally consume too little fruit and vegetables, fish and fibre, and too much of

foods high in fat and sugar^(7,8). As improved nutrition is a key factor in promoting health, growth and development in children, there is an obvious need to address this issue.

It has been suggested that family factors and the nature of foods available at home, in schools and in fast-food establishments are some of the most significant determinants of the eating habits of children⁽⁹⁾. In this context, weekdays and weekend days differ in many ways, both structurally and culturally, which may influence dietary intake patterns, for example through more access to food and snacks, together with likely expectations of fewer restrictions on weekend days than during weekdays. Periods of holidays and summer vacations have been associated with increases in weight status in both children⁽¹⁰⁾ and adults⁽¹¹⁾, and similar differences may apply on a smaller scale to weekends.

Previous research in children has suggested that snacking and other daily eating patterns differ on weekdays compared with weekend days in a way that may have an impact on the overall diet quality on these days^(12,13). Moreover, Friday stands out as a weekday on which the diet may resemble both weekdays and weekend days in terms of diet quality. However, few studies have considered these issues of dietary intake. The objective of the present study was therefore to compare differences in diet quality on weekdays (Monday–Thursday), Fridays and weekend days in a simple random sample of Danish children.

Methods

Sample

Data for the present study were derived from the Danish National Survey of Dietary Habits and Physical Activity 2003–2008, which is a nationwide cross-sectional survey. The study population comprised a simple random sample of 4–14-year-old children, retrieved from the Central Office of Civil Registration. Participants received an invitation letter and were afterwards contacted by telephone. For the families who agreed to participate, written informed consent was obtained from a parent of each child prior to their participation. In comparison with census data from Statistics Denmark, the distribution of gender and age of the participants could be characterized as representative for the Danish population of children aged 4–14 years.

Assessment of dietary intake

Dietary intake was recorded every day for seven consecutive days in food records with pre-coded response categories, which included open answer options. Children and their parents were instructed in person by trained interviewers on how to complete the food records. The parents were responsible for completing the records and for deciding to what extent their children were capable of assisting. The food record was organized according to the typical Danish meal pattern (breakfast, lunch, dinner and in between meals). Each meal was divided into sections with headings such as beverages, bread, spreadable fats, meat and vegetables to make it easier to find and record the relevant foods, dishes and beverages. For food items not included in the pre-coded food record, the participants wrote the type of food and portion size eaten in open answer categories. The quantities of foods consumed were given in predefined household measures (cups, spoons, slices, etc.) or estimated from photographs in a picture book containing fourteen series of food photographs, each series showing four to six different portion sizes. As a supplement to the food record, participants also received a food recording booklet for the children to take to school or to other places outside their home on the days of assessment. Intakes of energy, nutrients and food items were calculated for each individual using the software

system GIES version 0.995a (developed at the National Food Institute, Technical University of Denmark, Søborg, Denmark) and the Danish Food Composition Databank version 7 (www.foodcomp.dk). Validation of the method for children and adults is described elsewhere^(14,15).

Besides energy intake and macronutrients, a number of food items were selected to give an indication of the diet quality. The selection of variables was based on the work of Sepp *et al.*⁽¹⁶⁾ and the Nordic Monitoring project⁽¹⁷⁾, which has shown that the intake of certain food groups explains a considerable part of the variation in the relative content of total fat, saturated fat, added sugars and dietary fibre in the diet. The intake of these food groups is therefore particularly useful in the assessment of overall nutritional quality of the diet. Energy density of the diet was calculated separately for (i) solid foods and liquids consumed as food (e.g. soups and yoghurt) and (ii) beverages, including both energy-containing and non-energy-containing beverages (e.g. milk/juice and water/tea, respectively) and presented as kJ/100 g. Furthermore, dietary intake based on the average intake during the week was compared with the nutritional recommendations for added sugars, saturated fat, fish and fruit and vegetables^(18,19).

Definition of weekdays and weekend days

Weekdays and weekend days were defined as Monday to Thursday and as Saturday and Sunday, respectively. Preliminary analysis showed that intakes on Friday differed from those on both Monday to Thursday and Saturday and Sunday. Therefore Friday was kept as a period of its own, instead of making a dichotomous weekday/weekend day variable.

Weight status

Information about the children's height and weight was obtained through a personal face-to-face interview with one of the parents, referred to as the 'responding parent', which was the mother in 87% of cases. Prevalence of overweight and obesity in the study sample was defined according to international age- and gender-specific BMI cut-off values for children and adolescents⁽²⁰⁾ corresponding to BMI values of ≥ 25 and ≥ 30 kg/m², respectively, for adults aged ≥ 18 years.

Parental education

The educational level of the responding parent was defined in four categories: (i) basic school (10 years or less of total education); (ii) vocational education, upper secondary school (10–12 years); (iii) short higher education (13–15 years, primarily theoretical); and (iv) long higher education (15 + years, primarily theoretical).

Definition of under-reporters and over-reporters

Prevalence of misreporters was assessed by evaluating the 95% confidence limits of agreement between recorded

energy intake and estimated BMR on the individual level. The Goldberg's cut-off 2 criterion was used⁽²¹⁾, which takes into account age- and gender-specific values for physical activity. Physical activity level values corresponding to light physical activity were used to define cut-off values for under-reporters and over-reporters, respectively⁽²²⁾. Estimates of BMR were calculated from equations based on age, gender, height and weight⁽²³⁾.

Statistical analyses

The main analyses were performed separately for the three age groups, 4–6 years, 7–10 years and 11–14, years due to the wide age range of children in the study population and associated different degree of parental influence on the diet and diet recording. Differences between gender regarding height, weight and BMI were analysed using Student's *t* test, whereas differences between age groups regarding height, weight and BMI were analysed using one-way ANOVA and Tukey's *post hoc* test. Differences regarding parental education and weight status were assessed between gender and between age groups using the χ^2 test and Fisher's exact test.

Differences in energy intake, macronutrient intake and energy density for weekdays *v.* weekend days, Fridays *v.* weekdays and Fridays *v.* weekend days were analysed using Student's *t* test. For some of the food items, especially sausages, full-fat cheese, fries and fried potatoes and rye bread, a high percentage of the children (up to 79% within the three age groups) had zero intakes during the week. To account for zero intakes, these variables were compared between weekdays, Fridays and weekend days using Tobit regression analysis, which includes the zero observations in the analysis by combining the binary information of

intake *v.* zero intake with the quantitative intake values for the non-zero cases. Mean values and standard deviations were used to describe the diet, because some of the medians were equal to or close to zero.

Data were analysed separately for boys and girls due to significant gender differences in dietary intake in the preliminary analyses. Since the dietary intake analyses included multiple tests, Bonferroni corrections with $k=3$ were performed. The unit g/10MJ was used to take differences in total energy intake into account and to assess the quality of the diet, rather than absolute intakes. Data were analysed with the SPSS for Windows statistical software package version 19.0 (SPSS Statistics, Inc., Chicago, IL, USA) and the R statistical software version 2.13.2 (2009; R Development Core Team, <http://www.r-project.org>) with a significance level of $P < 0.05$.

Results

Study population

A total of 1294 children were invited to participate and 1006 (78%) children accepted. After exclusion of incomplete dietary recordings, data from 784 (61%) children with seven consecutive days of dietary recording and information about BMI and parental educational level were available for analysis. The group of excluded children ($n=222$) comprised 27% 4–6-year-olds, 32% 7–10-year-olds and 41% 11–14-year-olds. Characteristics of the study population are presented for each age group in Table 1. Within each age group no gender differences were found regarding height, weight, BMI and parental education. Furthermore, no gender differences were observed with regard to weight status for the 7–10- and

Table 1 Characteristics of the study population: children aged 4–14 years, the Danish National Survey of Dietary Habits and Physical Activity 2003–2008

	4–6 years ($n=207$)		7–10 years ($n=287$)		11–14 years ($n=290$)		<i>P</i> value*
	Mean	SD	Mean	SD	Mean	SD	
Gender, boys/girls (%)	50/50		53/47		47/53		0.303
Height (cm)	118 ^c	9	139 ^b	9	161 ^a	10	<0.001
Weight (kg)	22.0 ^c	4.3	32.8 ^b	7.5	49.9 ^a	10.7	<0.001
BMI (kg/m ²)	15.6 ^c	1.9	16.8 ^b	2.6	19.1 ^a	3.0	<0.001
Weight status† (%)							
Normal weight, boys/girls	91.3/80.6		82.2/81.5		79.3/82.6		0.074/0.981
Overweight, boys/girls	8.7/15.5		13.8/14.1		17.8/14.2		
Obese, boys/girls	0/3.9		3.9/4.4		3.0/3.2		
Parental education‡ (%)							
Basic school	8.7		8.7		11.7		0.117
Vocational education	41.5		43.9		42.4		
Short higher education	8.2		10.1		14.5		
Long higher education	41.5		37.3		31.4		

^{a,b,c}Mean values within a row with unlike superscript letters were significantly different between age groups ($P < 0.001$).

*Differences between age groups tested using the χ^2 test for gender distribution and parental education, by one-way ANOVA for height, weight and BMI, and by Fisher's exact test for weight status.

†Weight status according to international cut off values⁽²⁰⁾. Weight status differed significantly between genders in the 4–6-year-old children ($P=0.034$), but not in the 7–10-year-olds ($P=0.975$) or in the 11–14-year-olds ($P=0.705$).

‡Parental educational level: basic school = 10 years or less of total education; vocational education, upper secondary school = 10–12 years; short higher education = 13–15 years (primarily theoretical); long higher education = 15+ years (primarily theoretical).

Table 2 Dietary content by gender on weekdays (Monday–Thursday), Fridays and weekend days (Saturday and Sunday): 4–6-year-old children, the Danish National Survey of Dietary Habits and Physical Activity 2003–2008

	Boys, 4–6 years (<i>n</i> 104)						Girls, 4–6 years (<i>n</i> 103)					
	Weekdays		Friday		Weekend days		Weekdays		Friday		Weekend days	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Energy and nutrients												
Energy (MJ/d)	7.5 ^b	1.8	8.3 ^a	2.6	8.4 ^a	2.7	6.6 ^b	1.4	7.2 ^a	2.1	7.4 ^a	1.7
Total fat (E%)	33 ^b	5	34 ^{a,b}	7	35 ^a	6	34 ^a	5	32 ^b	7	35 ^a	6
SFA (E%)	14	3	14	3	15	3	15	3	14	3	15	3
MUFA (E%)	11 ^b	2	12 ^{a,b}	3	12 ^a	2	11 ^a	2	11 ^b	3	12 ^a	3
PUFA (E%)	5	1	5	1	5	1	5 ^a	1	4 ^b	1	5 ^a	1
Carbohydrates (E%)	52	5	52	7	51	6	51 ^b	5	54 ^a	7	52 ^b	6
Added sugars (E%)	9 ^b	5	14 ^a	8	13 ^a	6	10 ^b	4	15 ^a	8	14 ^a	5
Fibre (g/10 MJ)	25 ^a	6	22 ^b	8	20 ^c	6	25 ^a	6	21 ^b	7	19 ^c	5
Protein (E%)	15 ^a	2	14 ^b	3	14 ^b	3	15 ^a	2	14 ^b	3	13 ^c	2
Foods (g/10 MJ)												
Vegetables	174 ^a	104	144 ^{a,b}	139	133 ^b	114	178 ^a	94	141 ^{a,b}	165	129 ^b	90
Fruit	276 ^a	163	255 ^{a,b}	262	189 ^b	171	273 ^a	164	218 ^{a,b}	184	205 ^b	198
Fish	18 ^a	21	14 ^b	33	18 ^{a,b}	27	19 ^a	23	14 ^b	42	14 ^{a,b}	2
Rye bread	101 ^a	49	83 ^b	58	62 ^c	46	86 ^a	46	86 ^a	63	55 ^b	41
White bread	46 ^b	40	38 ^c	50	69 ^a	53	44 ^a	40	49 ^a	64	69 ^b	47
Butter on bread	14	14	12	17	15	15	16	15	16	15	18	13
Full-fat cheese	4	8	6	13	4	10	6	11	5	13	4	10
French fried potatoes	11	21	22	44	19	34	18 ^a	27	18 ^b	44	29 ^a	44
Sausages	6	14	11	38	12	28	11 ^a	21	7 ^b	31	11 ^{a,b}	35
Sweets & chocolate	11 ^b	14	38 ^a	44	28 ^a	31	15 ^c	15	55 ^a	52	29 ^b	27
Cakes & biscuits	33	39	46	77	46	50	29 ^b	37	34 ^b	60	50 ^a	49
SSB	185 ^b	234	273 ^{a,b}	350	274 ^a	245	154 ^b	184	274 ^{a,b}	330	259 ^a	219
Energy density (kJ/100 g)												
Energy density, foods	704 ^b	127	794 ^a	220	844 ^a	197	712 ^b	140	826 ^a	229	864 ^a	204
Energy density, beverages	100 ^b	42	104 ^b	52	121 ^a	48	112 ^b	49	117 ^b	53	131 ^a	49

E%, percentage of energy intake; SSB, sugar-sweetened beverages.

^{a,b,c}For each gender group, mean values within a row with unlike superscript letters were significantly different ($P < 0.05$).

11–14-year-old children, but there were more overweight and obese girls than boys in the 4–6-year-old children ($P = 0.034$). Height, weight and BMI were all significantly different between age groups ($P < 0.001$), whereas there were no significant differences between age groups regarding gender distribution, weight status and parental education. The prevalence of identified under-reporters was 1.0% in the 4–6-year-olds, 3.8% in the 7–10-year-olds and 16.6% in the 11–14-year-olds. The number of under-reporters did not differ between genders.

Based on the average intake during the week, boys had a significantly higher total energy intake than girls in all three age groups (4–6 years: boys 7.87 (SD 1.87) MJ/d *v.* girls 6.91 (SD 1.34) MJ/d, $P < 0.001$; 7–10 years: boys 8.79 (SD 1.94) MJ/d *v.* girls 8.19 (SD 2.03) MJ/d, $P = 0.01$; 11–14 years: boys 9.57 (SD 2.83) MJ/d *v.* girls 7.74 (SD 1.99) MJ/d, $P < 0.001$).

A large proportion of the children did not meet the nutritional recommendations of keeping the percentage of energy from added sugars below 10% (66% of the children) and the percentage of energy from saturated fat below 10% (96% of the children)⁽¹⁸⁾. A total of 89% of the children did not reach the recommended intake of fish of at least 200 g/week, and the recommended intake of fruit and vegetables was not met by 66% of the

4–10-year-old children (recommended intake of 400 g/d) and by 91% of the 11–14-year-olds (recommended intake of 600 g/d)⁽¹⁹⁾.

Food and nutrient intakes

Mean intakes of energy, macronutrients, selected food items and energy density of the diet on weekdays, Fridays and weekend days are presented for each age group in Tables 2–4. The following results were all statistically significant at a significance level of $P < 0.05$.

Weekdays *v.* weekend days

For both boys and girls in all three age groups, energy intake was consistently higher on weekend days than on weekdays. Furthermore, the percentage of energy from added sugars was higher, whereas the fibre content and the percentage of energy from protein were lower on weekend days compared with weekdays. The diet also contained a higher amount of sugar-sweetened beverages (SSB) and white bread, and a lower amount of rye bread on weekend days *v.* weekdays. In addition, the energy density of foods as well as of beverages was higher on weekend days than on weekdays. Boys and girls aged 4–6 and 7–10 years also had higher intakes of sweets and chocolate and lower intakes of fruit and vegetables on weekend days compared with weekdays.

Table 3 Dietary content by gender on weekdays (Monday–Thursday), Fridays and weekend days (Saturday and Sunday): 7–10-year-old children, the Danish National Survey of Dietary Habits and Physical Activity 2003–2008

	Boys, 7–10 years (<i>n</i> 152)						Girls, 7–10 years (<i>n</i> 135)					
	Weekdays		Friday		Weekend days		Weekdays		Friday		Weekend days	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Energy and nutrients												
Energy (MJ/d)	8.4 ^c	1.9	9.8 ^a	3.3	9.0 ^b	2.7	7.8 ^b	2.4	9.0 ^a	2.9	8.6 ^a	2.3
Total fat (E%)	33 ^b	5	32 ^b	7	34 ^a	6	33	5	32	6	33	6
SFA (E%)	14 ^{a,b}	3	13 ^b	4	14 ^a	3	14 ^a	3	13 ^b	3	14 ^{a,b}	3
MUFA (E%)	11 ^b	2	11 ^b	3	12 ^a	3	11 ^{a,b}	2	11 ^b	3	11 ^a	2
PUFA (E%)	5	1	5	2	5	1	5	1	5	1	5	1
Carbohydrates (E%)	52 ^b	6	55 ^a	7	52 ^b	7	52 ^b	5	55 ^a	7	53 ^{a,b}	6
Added sugars (E%)	11 ^b	5	15 ^a	8	15 ^a	7	10 ^b	4	16 ^a	8	16 ^a	7
Fibre (g/10MJ)	23 ^a	7	21 ^b	8	18 ^c	6	24 ^a	6	21 ^b	7	18 ^c	5
Protein (E%)	15 ^a	2	14 ^b	3	14 ^b	3	15 ^a	2	13 ^b	3	13 ^b	3
Foods (g/10MJ)												
Vegetables	167 ^a	103	154 ^{a,b}	138	130 ^b	118	180 ^a	117	173 ^a	137	118 ^b	103
Fruit	260 ^a	204	197 ^b	235	157 ^b	151	274 ^a	200	215 ^b	221	184 ^b	173
Fish	13	17	16	44	19	39	12	17	17	47	14	22
Rye bread	72 ^a	55	60 ^b	64	46 ^b	45	73 ^a	50	60 ^b	58	44 ^b	42
White bread	54 ^b	48	57 ^b	72	78 ^a	62	61 ^b	47	56 ^b	61	77 ^a	48
Butter on bread	10	11	9	12	12	13	12	11	10	12	12	12
Full-fat cheese	5 ^a	10	3 ^b	10	6 ^a	12	3 ^a	7	3 ^b	10	4 ^{a,b}	11
French fried potatoes	18	28	23	52	27	43	15 ^{a,b}	23	16 ^b	45	21 ^a	35
Sausages	6 ^{a,b}	15	8 ^b	33	13 ^a	36	5	14	6	24	9	23
Sweets & chocolate	13 ^c	16	43 ^a	45	26 ^b	28	18 ^b	23	46 ^a	45	33 ^a	37
Cakes & biscuits	30 ^{a,b}	38	35 ^b	63	45 ^a	53	35	39	46	75	53	64
SSB	242 ^b	297	348 ^{a,b}	371	397 ^a	357	175 ^b	183	335 ^a	387	378 ^a	307
Energy density (kJ/100 g)												
Energy density, foods	727 ^b	149	841 ^a	223	879 ^a	191	713 ^c	152	804 ^b	215	859 ^a	182
Energy density, beverages	102 ^b	48	108 ^b	60	116 ^a	52	100 ^b	47	103 ^b	56	122 ^a	55

E%, percentage of energy intake; SSB, sugar-sweetened beverages.

^{a,b,c}For each gender group, mean values within a row with unlike superscript letters were significantly different ($P < 0.05$).

Fridays v. weekdays

Energy intake was higher on Fridays than on weekdays for both boys and girls in all three age groups. Differences that applied to all groups also included a higher percentage of energy from added sugars, a lower percentage of energy from protein and a lower fibre content of the diet on Fridays than on weekdays. In addition, the intake of fruit was lower for the 4–6-year-olds and the 11–14-year-old girls, and the intake of rye bread was lower for all groups except for the 4–6-year-olds and the 11–14-year-old girls. The diet contained significantly higher amounts of sweets and chocolate on Fridays than on weekdays for all groups, although this was not significant for the 11–14-year-olds. The energy density of foods was higher on Fridays than on weekdays for all age and gender groups, and the 11–14-year-old girls also had a higher energy density of beverages on Fridays compared with weekdays.

Fridays v. weekend days

Energy intake did not differ significantly between Fridays and weekend days, except for the 7–10-year-old boys, who had a higher energy intake on Fridays than on weekend days. For both boys and girls in all three age groups intake of white bread was lower on Fridays than on weekend days. The fibre content of the diet

was higher on Fridays compared with weekend days, although this was not significant for the 11–14-year-old boys, whereas intake of cakes and biscuits was lower for all groups, except for the 4–6-year-old boys and the 7–10-year-old girls. The energy density of foods was lower on Fridays than on weekend days in the 7–10-year-old girls, whereas the energy density of beverages was lower in the 4–6-year-olds and 7–10-year-old girls.

Discussion

Results from the present study showed that there were significant, distinct differences and characteristic patterns in the children's diet quality during weekdays, Fridays and weekend days. Results of the present study indicate that quality of the diet consumed during weekend days was lower than on weekdays, whereas the diet quality on Fridays appeared to be at an intermediate level. Furthermore, average energy intake and energy density were consistently higher on weekend days than on weekdays and intermediate on Fridays. The tendency of increasing energy density from weekdays to weekend days further supports the finding of decreasing diet quality from weekdays to weekend days, because higher energy density has previously been associated with lower

Table 4 Dietary content by gender on weekdays (Monday–Thursday), Fridays and weekend days (Saturday and Sunday): 11–14-year-old children: the Danish National Survey of Dietary Habits and Physical Activity 2003–2008

	Boys, 11–14 years (<i>n</i> 135)						Girls, 11–14 years (<i>n</i> 155)					
	Weekdays		Friday		Weekend days		Weekdays		Friday		Weekend days	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Energy and nutrients												
Energy (MJ/d)	9.0 ^b	2.8	10.5 ^a	4.6	10.3 ^a	3.8	7.4 ^b	2.0	8.1 ^a	3.4	8.2 ^a	2.5
Total fat (E%)	33	6	32	8	34	7	31	5	31	9	32	6
SFA (E%)	14	3	14	4	14	3	13	2	13	4	14	3
MUFA (E%)	11	2	11	3	12	3	11	2	11	4	11	3
PUFA (E%)	5 ^a	1	5 ^b	2	5 ^{a,b}	1	5	1	5	1	4	1
Carbohydrates (E%)	52 ^b	6	54 ^a	9	52 ^{a,b}	7	54	6	55	9	54	7
Added sugars (E%)	11 ^b	6	15 ^a	10	14 ^a	8	11 ^b	5	14 ^a	9	15 ^a	7
Fibre (g/10 MJ)	23 ^a	7	20 ^b	9	19 ^b	6	23 ^a	7	21 ^b	8	18 ^c	6
Protein (E%)	15 ^a	3	14 ^b	3	14 ^b	3	15 ^a	2	14 ^b	4	14 ^b	3
Foods (g/10 MJ)												
Vegetables	155	105	171	144	139	137	179 ^a	132	178 ^a	171	131 ^b	112
Fruit	200	209	164	246	164	188	244 ^a	190	159 ^b	186	177 ^b	161
Fish	12 ^a	20	14 ^b	43	15 ^a	32	12 ^a	21	11 ^b	32	12 ^a	24
Rye bread	67 ^a	61	53 ^b	67	46 ^b	78	54 ^a	54	50 ^{a,b}	67	36 ^b	44
White bread	57 ^b	53	45 ^c	56	79 ^a	66	71 ^b	63	76 ^b	89	88 ^a	66
Butter on bread	8	13	8	15	10	15	8	10	8	13	9	10
Full-fat cheese	4 ^a	10	3 ^{a,b}	10	7 ^a	16	3	6	4	11	4	13
French fried potatoes	22 ^a	32	22 ^b	55	27 ^{a,b}	47	19 ^a	33	32 ^a	79	23 ^a	42
Sausages	8 ^a	22	6 ^b	26	4 ^{a,b}	15	6	22	6	36	5	25
Sweets & chocolate	18	23	40	56	26	32	25	31	37	54	34	39
Cakes & biscuits	31 ^a	44	32 ^b	66	43 ^a	74	36 ^b	44	29 ^c	55	61 ^a	71
SSB	254 ^b	302	422 ^{a,b}	488	409 ^a	352	224 ^b	231	343 ^{a,b}	400	351 ^a	367
Energy density (kJ/100 g)												
Energy density, foods	775 ^b	167	854 ^a	244	868 ^a	217	734 ^b	165	840 ^a	236	864 ^a	236
Energy density, beverages	95 ^b	54	104 ^{a,b}	62	115 ^a	56	88 ^c	49	104 ^b	65	107 ^a	59

E%, percentage of energy intake; SSB, sugar-sweetened beverages.

^{a,b,c}For each gender group, mean values within a row with unlike superscript letters were significantly different ($P < 0.05$).

dietary quality in children⁽²⁴⁾. Moreover, a high intake of energy-dense foods has been convincingly identified as a factor promoting weight gain⁽²⁾.

The majority of the children did not meet the dietary recommendations for added sugars, saturated fat, fish and fruit and vegetables on a weekly basis. The present results therefore further emphasize the importance of considering the unfavourable dietary intake patterns during weekends and Fridays.

To the authors' knowledge, the present study is the first on the diet quality on weekdays *v.* weekend days in a representative sample of children in Europe. Although few studies have addressed this issue specifically in school-aged children, similar findings for certain key variables such as SSB and the percentage of energy from fat have been presented previously^(12,13). The tendency towards less healthy dietary habits during weekends compared with weekdays is also in accordance with other studies in pre-school children^(25–27). A Scottish study of 5–17-year-olds showed no significant differences in energy intake, total fat, saturated fat and non-milk extrinsic sugars between weekdays and weekend days⁽²⁸⁾; however, the overall findings suggested that the weekend is a period with less healthy dietary patterns compared with weekdays.

In the present study, the significantly higher energy intake on Fridays and weekend days compared with

weekdays stresses that not only did the children have less healthy dietary habits on Fridays and weekend days, they also consumed more in total rather than compensating by eating less amounts of more regular foods. This is of concern in the prevention of overweight in children because these dietary habits may promote positive energy balance, thereby increasing the risk of becoming overweight and obese. Furthermore, the finding that especially sugar-rich foods and beverages contributed more to the energy intake on Fridays and weekend days compared with weekdays is of concern. Findings from epidemiological studies clearly indicate that regular consumption of SSB may lead to weight gain and substantially increase the risk of developing chronic diseases⁽²⁹⁾. In addition, a high intake of added sugars may increase the risk of a nutritionally inadequate diet⁽³⁰⁾ and is found to be positively associated with multiple measures known to increase CVD risk in adolescents⁽³¹⁾.

Some general environmental and structural differences between schooldays and non-schooldays may in part explain the findings that the dietary quality is lower on weekend days. Schooldays may be more structured and supervised, while parents' attitudes towards healthy eating habits and the availability of different foods and beverages during weekends are most likely very important factors for the variation in dietary quality during the

week⁽⁹⁾. The perception that it is acceptable to lessen the restrictions during weekends on food groups that should be limited in the diet has been described in a combined qualitative and quantitative Danish study concerning parents' motives to give their children sugar-rich foods⁽³²⁾. The interviewed parents expressed the view that they felt capable of controlling their children's sugar intake. However, the dietary intake data revealed that the children had a considerably higher intake of added sugars than recommended. The parents also expressed the view that it has become a tradition to give children sugar-rich foods during weekends and that a 'culture of cosiness' is seen as a legitimized cause for this. The promotion of healthy eating habits might benefit from more focus on changing this attitude.

Weekends also include a tendency for children to be less physically active than on weekdays and spend more time in sedentary behaviours, including television viewing and other screen time^(33–35), thereby further increasing the risk for weight gain during weekend days. Moreover, extended periods spent watching television has been associated with generally having less healthy food preferences and food habits in school-aged children⁽³⁶⁾; thus these factors may act together in an undesirable direction.

In dietary assessment, Fridays are usually considered equal to other weekdays. However, results from the present study showed that the diet on Fridays appeared as a mix of the diet on weekdays and weekend days. Furthermore, according to the variables analysed in the present study, there were more significant differences between Fridays and weekdays than between Fridays and weekend days. This suggests that in assessment of dietary intake, the weekend is not necessarily limited to Saturdays and Sundays, but may include Fridays as well. The issue of whether dietary intake on Fridays should be considered as belonging to weekdays or weekend days needs to be addressed in future dietary assessment studies.

As for all dietary assessment studies, a limitation of the present study is that self-reported food recording may potentially be subject to misreporting. However, the degree of under-reporting seemed to be rather limited with the exception of the group of children aged 11–14 years, which is recognized as a particularly challenging age group when assessing dietary intake⁽³⁷⁾. While parents take the full responsibility for the dietary recording of younger children, older children often record their intakes with less parental assistance. This is reasonable from the point of view that older children may have more frequent snacking outside the home and less structured eating patterns, which the parents may not know in detail. However, this combination also means that food items or eating occasions may be more prone to be forgotten or missed out by the older children. In addition, sensitivity to social desirability and possibly decreased interest in dietary recording may increase the susceptibility to under-reporting among older children⁽³⁷⁾.

Acknowledging that dietary under-reporting is a well-recognized, ubiquitous concern in dietary assessment, we assessed the prevalence of under-reporters using the Goldberg method. Although this approach has some limitations in that it only identifies the most extreme misreporters and is considered to have a low specificity at the individual level⁽³⁸⁾, it is the most commonly used approach when the doubly labelled water method or other objective measurements of energy expenditure are not available.

One strength of the present study is the separate analyses of data for the three age groups to allow for different eating patterns and different challenges in dietary assessment represented by the age span of 4–14 years. Another major strength is the comprehensive dietary data amassed from daily recordings of dietary intake for seven consecutive days by each participant. These data enabled detailed analyses of the diet quality across the week, including specific distinction of the diet on Fridays. Other strengths include the nationwide character of the study and the wide age span of the sample that render the results more generalizable to children in the general population.

Conclusions

Significant differences and distinct characteristic patterns were found in children's diet quality during weekdays, Fridays and weekend days. The present study suggests that in the prevention of childhood overweight and obesity, more attention should be paid to the higher energy intake, especially from sugar-rich foods and beverages, on Fridays and weekend days.

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