

Breakfast trends in children and adolescents: frequency and quality

Ute Alexy*, Meike Wicher and Mathilde Kersting

Forschungsinstitut für Kinderernährung, Research Institute of Child Nutrition, Heinstueck 11, D-44225 Dortmund, Germany

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Abstract

Objective: Although breakfast is important for obesity prevention and dietary quality, breakfast skipping is a common behaviour. Knowledge of changes in breakfast habits may provide potential behaviour targets for intervention programmes. The present study describes the actual data on trends in breakfast habits and composition. **Design:** A total of 7800 3 d dietary records of 1081 participants aged 2–18 years collected between 1986 and 2007 in the DONALD (Dortmund Nutritional and Anthropometric Longitudinally Designed) Study were analysed using mixed linear models.

Results: Breakfast was eaten at 78% of all record days; regular breakfast (breakfast was eaten on all three recorded weekdays) was eaten in 75% of records. During the study period, the number of records with regular breakfast decreased significantly in 6–12- and 13–18-year-olds ($P=0.0084$ and 0.0350 , respectively). Of all breakfast meals, 62% were bread meals and 21% were ready-to-eat cereal (RTEC) meals. RTEC meals nearly doubled from the youngest to the oldest age group ($P<0.0001$). During the study period, the percentage of bread meals decreased, whereas the percentage of RTEC meals increased ($P<0.0001$). A higher percentage of RTEC meals than the bread meals was in accordance with the food-based guidelines (36% *v.* 20%, $P<0.0001$), i.e. a breakfast including grain, dairy and fruit/vegetables.

Conclusions: In the DONALD Study sample, a negative age and time trend in breakfast consumption was verified. Interventions regarding breakfast habits should be aimed at adolescents and should focus on fruit/vegetables.

Keywords
Breakfast
Trends
Children
Adolescents

Overweight and obesity in children and adolescents are an increasing problem in affluent countries⁽¹⁾. Besides genetic and lifestyle factors, several dietary factors are believed to be related to the development of overweight in the young^(2,3). One of these is an irregular meal pattern, especially breakfast skipping. Numerous epidemiological studies have shown a positive relationship between breakfast skipping and overweight/obesity in children and adolescents^(4–12), whereas only a small number of studies have failed to detect significant associations^(10,13).

Breakfast skipping is a widespread behaviour⁽¹⁴⁾, and the frequency of breakfast skipping has increased over time, at least in the United States⁽¹⁵⁾. Breakfast skipping may have an overall dietary impact, as breakfast skippers consume a lower mean number of servings of nutritious foods such as vegetables, grain products and milk products daily⁽¹¹⁾. In addition, composition of breakfast is important. In 2008, Giovannini *et al.*⁽¹⁶⁾ devised guidelines for a high-quality breakfast which are in accordance with other authors: breakfast should include grain (namely whole grain), fruit

(or juice) and (semi)skimmed milk products or other sources of calcium⁽¹⁷⁾. As in breakfast skipping, a low-quality breakfast can compromise overall dietary intake of nutrients^(5,7,16,18) and food levels^(16,19).

Intensive research has been concentrated on the quality of ready-to-eat cereal (RTEC) breakfasts and their impact on overall energy and nutrient intakes. These studies emphasise the low fat content and the high nutrient contents of RTEC breakfasts^(20–25). Other types of breakfast, e.g. bread meals ('continental breakfast'), have rarely been the subject of scientific analyses.

Eating habits are apparently changing with time due to societal changes as well as to changes in the range of offered foods and food marketing. In spite of the importance of breakfast in diet quality and prevention of obesity, the actual data on trends in breakfast habits are scarce. In the United States, a 5% decline in breakfast consumption was reported for pre-school children between 1965 and 1991⁽¹⁵⁾. Data from other countries are lacking. Therefore, we examined age and time trends in breakfast frequency and food pattern at breakfast in a

*Corresponding author: Email alexy@fke-do.de

sample of male and female children and adolescents in Germany using data from the DONALD (Dortmund Nutritional and Anthropometric Longitudinally Designed) Study. The DONALD Study provides 20-year longitudinal data from a sample covering childhood and adolescence with a yearly detailed dietary information from the 3 d weighed food records.

Methods

Study design

The DONALD Study is an ongoing, longitudinal (open cohort) study collecting detailed data on diet, growth, development and metabolism between infancy and adulthood since 1985. Details have been published elsewhere⁽²⁶⁾. In short, the starting study sample included infants, children and adolescents recruited from the cross-sectional studies conducted in schools and kindergartens (n 470). Since 1989, infants have been recruited and followed up longitudinally at least until the age of 18 years. Study participants are recruited in the city of Dortmund and surrounding communities via personal contacts, maternity wards or paediatric practices. The eligible are healthy German infants whose mothers and/or fathers are willing to participate in a long-term study and of whom at least one parent has sufficient knowledge of the German language. Dropout rates are low (3%). Actually, 580 individuals are participants of the DONALD Study.

The regular DONALD assessments include records of dietary intake and behaviour, anthropometry, urine sampling, interviews on lifestyle and health-related issues and medical examination once in a year per study participant ≥ 2 years of age⁽²⁶⁾. All examinations and assessments are performed with parental and/or participant's consent.

The DONALD Study, which is exclusively observational and non-invasive, has been approved by the International Scientific Committee of the Research Institute of Child Nutrition and the Ethic Commission of the University of Bonn.

Study sample

For the present evaluation, we analysed 3 d dietary records of participants aged 2–18 years in the study period (1986–2007). This selection resulted in 7800 records (23 400 record days) from 1081 participants (534 boys, 547 girls) from 797 families. Per participant, between one (n 132; 12% of the total sample) and seventeen (44, 4%), 3 d records were available and analysed (mean: 7.2 records per participant). A total of 1095 dietary records (14%) were available for the period 1986–1990; 1735 (22%) for 1991–1995; 1571 (20%) for 1996–1999; 1750 (22%) for 2000–2003; and 1649 (21%) for 2004–2007. Mean age at recording of these study periods was 7.0 (SD 4.2), 7.2 (SD 4.0), 8.3 (SD 4.3), 9.2 (SD 4.8) and 9.3 (SD 5.0) years. Percentages of records from boys were 51%, 50%,

49%, 49% and 50% in the respective study periods. Participants themselves choose the start of the 3 d recording period. Of the total, 7007 record days (30%) were collected at weekend days (Saturday and Sunday) in the present sample.

Dietary survey

Parents of younger or older participants themselves weighed and recorded all foods and beverages consumed using electronic food scales (± 1 g) on three consecutive days. In addition, medicines and supplements were recorded. Semi-quantitative recording (e.g. number of spoons and scoops) was allowed when weighing was not possible. Food collection details have been described elsewhere⁽²⁶⁾.

Energy and nutrient intakes were calculated using the in-house nutrient database LEFTAB. LEFTAB is based on standard nutrient tables, predominantly the German (48% of items) and the US (18% of items) tables⁽²⁷⁾. Energy and nutrient contents of commercial food products, e.g. RTEC, bread and convenience food, are calculated by recipe simulation using labelled nutrient contents and ingredients. For longitudinal analysis in the DONALD Study, LEFTAB is updated continuously with new foods recorded by the participants, if their composition is different from the existing labels. A new food or a commercial food product that already exists in the database but has undergone a change in composition (i.e. new ingredients and fortification) leads to a new entry⁽²⁷⁾. At present, LEFTAB contains about 6000 food items (15% staple foods, 77% composites and commercial products, including commercial infant food, and 8% special preparations, i.e. medicines and supplements).

For the present evaluation, dietary supplements and pharmaceuticals were excluded. All foods and beverages recorded were assigned to one of the nine food groups (Table 1) in accordance with the food groups of the US Mypyramid. We adopted this classification of interest in specific food groups eaten at breakfast by splitting the grain group into bread and RTEC. Both these food groups represent the two typical German types of breakfast. Fruit and vegetables had been aggregated. We added the food groups 'Beverages' and 'Miscellaneous', since we aimed to allocate all reported food items to a suitable food group.

Definition of breakfast and breakfast types

The time of every eating occasion is listed in the 3 d records. Participants themselves decide when a new eating occasion begins. Overall, 146 364 eating occasions were reported in the total sample. Here, breakfast has been defined as any eating occasion between 05.00 and 08.59 hours. A total of 21 183 eating occasions have been reported during this period. After summing the sets of eating occasions with <10 min between them into single eating occasions, 21 141 breakfast eating occasions remained.

Table 1 Definition of food groups

Dairy	Including milk, dairy products, e.g. yoghurt and cheese, infant formula
Meat/fish/egg	Including sausage, canned meat or fish
Fat/oil	Including butter, margarine, vegetable oils and mayonnaise
RTEC	Including breakfast cereals, mueslis and infant cereals
Bread	Including all sorts of bread, baguette and bread rolls
Sweets	Including jam, honey, confectionery and instant chocolate powder
Fruit/vegetables	Including fresh, frozen and canned products and 100% juices
Beverages	Including water, tea, coffee and sweetened drinks
Miscellaneous	Including all other foods and spices

RTEC, ready-to-eat cereals.

Table 2 Trends in breakfast habits in 23 400 record days from 1081 participants in the DONALD Study (2–18 years old) between 1986 and 2007

	Number of records <i>n</i>	With breakfast			
		Age group (<i>P</i> < 0.0001)*			
		2–5 years (%)	6–12 years (%)	13–18 years (%)	Total (%)
Study period (<i>P</i> < 0.0001)*					
1986–1990	3282	88.8	84.2	72.9	84.8
1991–1995	5208	89.3	80.7	76.2	83.7
1996–1999	4713	85.7	77.3	69.4	78.6
2000–2003	5250	85.8	70.2	57.4	71.0
2004–2007	4947	86.3	72.2	59.8	72.6
Weekdays (<i>P</i> < 0.0001)*					
Monday–Friday	16 393	91.8	85.3	73.8	84.8
Saturday–Sunday	7007	78.8	55.8	32.5	60.7

*Results of a general linear mixed model considering correlation of repeated measurements dependent on the absolute time interval of repeated measurements within the same participant; no significant gender differences (*P* = 0.0676).

For the calculation of breakfast frequency, a total food consumption at breakfast <15 g, normally a piece of candy or cracker, was not accepted as a breakfast (*n* 43 breakfast meals).

With respect to the grain component, breakfast meals were assigned to five meal types: bread meals, RTEC meals, meals with both bread and RTEC, meals with neither bread nor RTEC and beverage-only meals.

Statistical analysis

SAS® procedures (SAS statistical software package version 8.2; SAS Institute Inc., Cary, NC, USA) were used for data analysis. Food and nutrient intakes were calculated as individual means of the three record days.

To analyse the influence of effects on the outcome variables, a mixed linear model was used, in which the means of the data and the covariance structure (children of the family and repeated measurements) were modelled (PROC MIXED in SAS®). An exponential spatial structure of covariance was specified to consider correlation of repeated measurements dependent on the absolute time interval of repeated measurements within the same participant. For discrete variables (e.g. breakfast skipping, regularity of breakfast and meal types), the %GLIMMIX macro in SAS® was used to fit the general mixed linear model. In the models, age (in years), time (in years since the start of the study), gender, day of the week

(Monday–Friday *v.* Saturday–Sunday) and meal type (five types defined by the grain component) were included as potential effects. Regularity of breakfast has been defined as breakfast consumption every day during the 3 d record period on weekdays.

Results

Breakfast frequency

Overall, a breakfast was eaten on 18 163 record days (77.6% of all record days). The number of days with breakfast decreased significantly during the study period and with age (Table 2). These trends were significant within the age groups with the exception of the not significant time trend in the youngest (data not shown). Breakfast skipping was more frequent on weekend days than on weekdays (Table 2). No significant gender differences in breakfast frequencies were found.

For analysis of the regularity of breakfasting, only dietary records with three weekdays were selected (*n* 3529, 45% of all records). In 75% of these records, a breakfast was eaten on all 3 d (regular breakfast); in 11% of records, it was eaten on 2 d; and in 7% of records, it was eaten on 1 d. In 7% of records, breakfast was skipped on all days. During the study period, the number of records with breakfast on 3 d decreased significantly in the 6–12- and

13–18-year-olds ($P=0.0084$ and 0.0350 , respectively, Fig. 1), but not in the younger age group. A significant negative age trend was found only in 6–12-year-olds ($P=0.0120$). Gender differences were not significant.

Meal types

Overall, 11 254 breakfasts were bread meals (62%), 3743 were RTEC meals (21%); both bread and RTEC were eaten at 762 breakfast meals (4%), and neither bread nor RTEC was consumed at 2229 meals (12%). A total of 175 breakfast meals (1%) contained only beverages.

The distribution of meal types at breakfast changed significantly with age ($P<0.0001$, Table 3). The percentage of bread meals remained fairly constant, but RTEC meals nearly doubled from the youngest to the oldest age group. The percentage of meals with neither bread nor RTEC decreased.

Moreover, time trends were significant ($P<0.0001$) for breakfast type, as the percentage of bread meals decreased, but the percentage of RTEC meals increased.

Whereas no gender differences were found for meal types, the distribution of meal types differed between weekdays and weekend days, with a higher percentage

of bread meals and a lower percentage of RTEC meals on weekend days ($P<0.0001$).

Breakfast quality

In accordance with the recommendations on breakfast composition, only 24% of bread or RTEC meals included fruit/vegetables and dairy. During the study period, the percentage of breakfast meals, according to the guidelines^(16,17), increased from 22% in 1986–1999 to 26% in 2004–2007 ($P=0.0005$). With respect to age, there was a decrease from 29% in 2–5-year-olds to 23% in 13–18-year-olds ($P<0.0001$). A higher percentage of RTEC meals than of bread meals was in accordance with the breakfast composition guidelines (36% *v.* 20%, $P<0.0001$), i.e. a breakfast including grain, dairy and fruit/vegetables. According to the guidelines, the greatest difference between bread meals and RTEC meals was the consumption of dairy; only 74% of bread meals, but 99% of RTEC contained dairy. Fruit/vegetables were eaten at 32% of bread meals and 37% of RTEC meals; beverages were consumed at 39% of bread meals, but only 29% of RTEC meals. No significant differences in adherence to guidelines were found with respect to gender or weekend/weekdays.

Table 4 shows trends in the composition of the most common meal types, i.e. bread meals and RTEC meals. Overall, dairy accounts for approximately half of the breakfast intake followed by other beverages (approximately one-fifth). The overall portion size of fruit/vegetables at breakfast is small, comprising only 11% of the total food intake.

The total food intake and the intake of food groups at breakfast increased significantly with age ($P<0.0001$), with the exception of fruit/vegetable intake. The significant increase of total intake over time at breakfast was due to an increase in beverages, fruit/vegetables and grain intake, whereas the intakes of dairy, fat and sweets decreased ($P<0.0001$). Significant gender differences were found with boys having a higher total

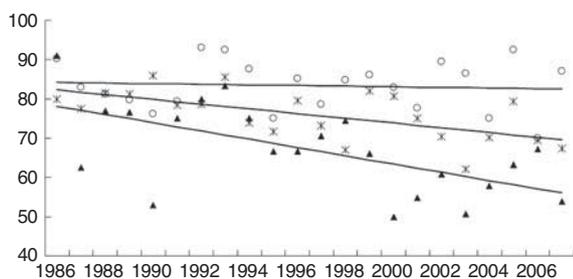


Fig. 1 Percentage of weekday records with regular breakfast (three times in 3 d) during the study period in participants aged 2–5 (○), 6–12 (×) and 13–18 (▲) years from the DONALD Study. Results of a general linear mixed model: 6–12 years old (n 1552, 3 d dietary records), $P=0.0084$; 13–18 years old (n 906), $P=0.0350$; 2–5 years old (n 1071), NS

Table 3 Trends in meal types at breakfast in 1081 participants in the DONALD Study (2–18 years old) between 1986 and 2007 (18 163 breakfast meals)

	Number of meals (n)	Breakfast meal types				
		Bread (%)	RTEC (%)	Both (%)	Neither (%)	Beverages (%)
Age ($P<0.0001$)*						
2–5 years	7108	62.9	14.1	5.8	16.4	0.7
6–12 years	7899	61.1	25.3	3.4	9.6	0.6
13–18 years	3156	62.1	23.4	2.5	9.6	2.5
Time ($P<0.0001$)*						
1986–1990	2786	67.1	16.9	4.1	11.5	0.5
1991–1995	4355	64.5	19.5	4.3	11.2	0.6
1996–1999	3703	59.3	23.3	4.1	12.2	1.1
2000–2003	3726	59.9	21.1	3.9	13.5	1.6
2004–2007	3593	59.8	21.5	4.6	13.1	1.0
Weekdays ($P<0.0001$)*						
Monday–Friday	13 897	59.6	23.5	4.2	11.8	0.9
Saturday–Sunday	4266	69.7	11.3	4.1	13.8	1.2

*Results of a general linear mixed model considering correlation of repeated measurements dependent on the absolute time interval of repeated measurements within the same participant; no significant gender differences ($P=0.8142$).

Table 4 Composition and trends* of bread meals (n 11 254) and RTEC meals (n 3743) for breakfast in 1081 participants in the DONALD Study (2–18 years old) between 1986 and 2007; results of PROC MIXED

	Overall intake per meal (g/meal)		Age (years)		Time (years)		Gender (boys v. girls)		Weekdays v. weekend days		Meal types (bread v. RTEC)	
	Mean	SD	β^*	P	β^*	P	β^*	P	β^*	P	β^*	P
Total intake†	303.4	152.8	9.05	<0.0001	2.19	<0.0001	44.37	<0.0001	-36.66	<0.0001	-5.34	0.0584
Total food intake	243	136	5.75	<0.0001	-0.34	NS	44.58	<0.0001	-31.01	<0.0001	-31.27	<0.0001
Bread	32.1	29.1	1.66	<0.0001	0.20	<0.0001	4.01	<0.0001	-8.19	<0.0001	42.71	<0.0001
RTEC	10.9	23.8	0.64	<0.0001	0.14	<0.0001	2.28	<0.0001	-0.63	0.0227	-41.76	<0.0001
Dairy	140.7	115.0	1.72	<0.0001	-1.5	<0.0001	30.86	<0.0001	-5.47	0.0045	-53.95	<0.0001
FV‡	34.5	68.9	0.34	NS	1.28	<0.0001	2.54	NS	-4.58	0.0004	-0.84	NS
Meat	7.0	16.9	0.17	<0.0001	-0.05	NS	-0.73	NS	-9.15	<0.0001	7.34	<0.0001
Fat	3.2	4.4	0.12	<0.0001	-0.14	<0.0001	0.37	0.0037	-0.70	<0.0001	4.17	<0.0001
Sweet	14.0	34.0	1.10	<0.0001	-0.38	<0.0001	2.97	0.0015	-2.20	0.0002	11.87	<0.0001
Beverages	60.3	101.6	3.33	<0.0001	2.49	<0.0001	-0.28	NS	-5.55	0.0032	25.85	<0.0001

RTEC, ready-to-eat cereals; FV, fruit and vegetables.

*Trend (weighted least square estimates).

†Food and beverages.

intake and higher intakes of all food groups with the exception of fruit/vegetables, meat and beverages. On weekdays (Monday–Friday), the food amount for breakfast was lower than that on weekend days. The comparison of bread meals and RTEC meals showed a lower intake of dairy at bread meals, but higher intakes of meat, fat, sweets and beverages.

Discussion

This investigation of breakfast habits in German children and adolescents in a descriptive epidemiological study during the last two decades found the following main results; (i) there was a positive age and time trend in breakfast skipping and a negative trend in regular breakfast eating; (ii) bread meals were the predominant meal type at breakfast, but the percentage of RTEC meals increased with time and age; (iii) the amount of food intake at breakfast remained constant, but the intake of beverages at breakfast increased; (iv) the breakfast quality, i.e. the accordance with food-based guidelines^(5,16,17), was low especially due to low intake of fruit/vegetables in general and dairy in bread meals.

In the present study, we focus on a food-based definition of breakfast quality. However, we do not consider the portion size or food selection within a food group in this definition. For example, breakfast guidelines demand intake of whole grain. Bread as well as RTEC can consist of whole grain, but on the other hand, bread and RTEC can consist of low fibre, high fat and high sugar. In our study, RTEC was a vehicle for intake of milk, but further analysis of energy and nutrient intakes of different types of breakfast is needed.

The frequency of breakfast in our study sample (approximately 75% of all record days) was lower than that in comparable populations. In a Portuguese sample of 13–17-year-olds, 87–94% ate breakfast⁽⁶⁾; in comparison, 97% of 9–11-year-old British children reported breakfast eating⁽²⁸⁾. In Canadian pre-school children, only one-tenth ate breakfast on <7 d/week⁽¹¹⁾. These differences in breakfast prevalence may result from different dietary habits, and also from varying definitions of breakfast in different study settings, which may have blurred the results. Some studies used participant definitions for the assessment of breakfast: ‘During the past week, how many days did you eat breakfast?’⁽⁵⁾ Breakfast skipping was defined as not eating a morning meal in combination with some boundaries, e.g. at home⁽²⁹⁾ or before school. Other studies defined breakfast as the first eating occasion involving a solid food or a (energetic) beverage that occurred after waking up^(16,22). In the DONALD Study, we used researcher-defined food consumption during the defined hours of the day as done by Utter *et al.*⁽⁷⁾ and Siega-Riz *et al.*⁽¹⁵⁾, which is more objective than to ask the study participants about the type of

meal. To define the 'first meal of the day' as breakfast may not be suitable, since in case of breakfast skipping, this first meal may occur in the middle of the day. In addition, our open recording in the DONALD Study shows that a lot of participants do not eat only 'meals' but snack repeatedly over the day, as well before 'breakfast'. Our definition also includes an apple or a piece of chocolate as breakfast. However, a food-based definition of breakfast would predispose our results of breakfast quality. Recent publications have revealed marked declines in the frequency of breakfast intake throughout adolescence^(4,10), which begins in childhood⁽⁷⁾. Moreover, the breakfast quality decreased in female adolescents, as indicated by an increased consumption of caffeine, sucrose and sodium and a decreased consumption of calcium⁽⁴⁾. A potential background of this change of breakfast habits during adolescence may be the known shift from morningness to eveningness during the age of puberty⁽³⁴⁾. The DONALD Study showed that not only did the frequency of breakfast decrease with age, but also the quality of breakfast decreased in accordance with the common guidelines.

Although our results on age trends are in accordance with others, we did not find a higher frequency of breakfast skipping in girls than in boys, as has been reported previously in the literature^(5-7,13,29).

With its exceptionally long study period of ≥ 20 years and close assessments, the Donald Study can examine relevant time trends. In the DONALD Study, we found a significant negative trend in breakfast frequency and regularity. There are only a small number of studies on time trends in breakfast consumption in children. A comparison of representative US samples over the last few decades showed a decline of breakfast consumption, particularly in older adolescents⁽¹⁵⁾ and adults⁽³⁰⁾. In the Bogalusa Heart Study, breakfast skipping increased from 8% to 30% in 10-year-old children from 1973 to 1994⁽³¹⁾. Comparable studies from European countries are lacking.

In affluent societies, eating breakfast daily was associated with higher socio-economic status (SES)^(5,7), and breakfast skipping was associated with low family SES in adults⁽³²⁾, children⁽³³⁾ and adolescent boys, but not in girls⁽²⁹⁾. In addition, breakfast quality was positively associated with SES⁽³²⁾. The association between breakfast skipping and lower SES can at least partly explain the higher prevalence of obesity in this population.

However, the increasing trends in breakfast skipping observed in the United States were independent of the population's changes in sociodemographic patterns⁽¹⁵⁾. Therefore, it is not surprising that we also found a negative trend in breakfast consumption in our study sample in which participants with higher education levels of parents were over-represented, which is indicative of a higher SES⁽²⁶⁾.

The DONALD Study is not able to provide possible reasons for the negative age and time trends. Weight-related concerns and perceptions are likely related to breakfast intake and may play a role in the frequency with

which breakfast is eaten⁽⁵⁾. However, familial or cultural factors should also be kept in view, as well as the increasing autonomy in making food choices during adolescence, which is in line with the widespread availability of pre-prepared foods and the trend towards two working parents.

In the DONALD Study, breakfast patterns are less healthy on weekends than weekdays. Also breakfast frequency was lower at weekends. However, this result may be affected by our time-centred definition. A shift in the intake of meals to later in the day on weekends has been reported previously⁽³⁴⁾. Differences in food consumption patterns between weekdays and weekend days, with higher intakes of energy and fat on weekend days, have been described previously^(8,35-37).

Breakfast quality is important for the maintenance of an adequate diet. The intake of milk products during breakfast supports the total daily intake of milk and calcium⁽¹⁹⁾. Children who usually eat breakfast are more likely to be frequent consumers of fruit, cereals and milk⁽⁷⁾. Consumers of a high-quality breakfast had better overall dietary patterns than those who consumed a low-quality breakfast⁽¹⁶⁾.

In Germany, the traditional breakfast consists of bread or a bakery item, spread and filling, in combination with a (warm) beverage. Such bread meals are still predominant today, in spite of the competition by RTEC. Similarly, in a Belgian study, less than half of the adolescents consumed an RTEC meal at breakfast⁽¹⁶⁾.

While in France RTEC consumption declined with age⁽²²⁾; in the DONALD Study, the portion size of RTEC increased with age and during the study period. Furthermore, the percentage of RTEC was higher in school-aged children and adolescents than in the pre-school age group.

RTEC are presumed to be a particularly healthy breakfast because of their low fat and high carbohydrate and vitamin content. RTEC are an important vehicle for milk intake. In our study, RTEC meals contained more dairy than bread meals. In the US population, RTEC at breakfast was associated with greater daily intake of both milk and calcium⁽³⁸⁾.

Food-based dietary guidelines recommend that a high-quality breakfast should contain three components: a grain product, fruit/vegetables and a dairy component or an alternative source of calcium^(5,16,17,39). For Germany, an additional beverage (i.e. water, tea and juice/water mixtures) is recommended for breakfast⁽³⁹⁾, since it is known that water intake in German children and adolescents is below the recommended amounts^(40,41). In the present evaluation, only a small percentage (30–40%) of breakfasts contained a beverage.

Our study has some strengths as well as some weaknesses in terms of population and methodology. An important strength is the longitudinal assessment, which is unique, as to our knowledge, there are no other studies with 20-year dietary data to document secular trends in dietary patterns. Our study sample was not intended to be representative⁽²⁶⁾. In the DONALD Study, 49% of mothers

and 56% of fathers have technical/high school education, but in the general population, only 29% of men and 36% of women⁽²⁶⁾ have technical/high school education. However, the results of other dietary evaluations in Germany are in accordance with those from our sample⁽⁴²⁾. Since breakfast habits are associated with SES, the results presented in the present study may not be generalisable to other SES groups of children and adolescents.

In our study, the same dietary assessment methodology has been used since the start of the study in 1985. These dietary records emphasise the detailed dietary information⁽²⁷⁾ verified by dietitians. However, it may be questioned whether an yearly 3 d record characterises an individual's typical eating habits.

Conclusions

The identification of changes in breakfast habits in the young may be seen as a potential starting point for intervention programmes. Currently, in Germany, breakfast promotion is focused on kindergartens and primary schools. However, as rates of breakfast consumption decrease throughout childhood and adolescence, more emphasis should be placed on breakfast consumption in older children in secondary schools. School breakfast programmes can significantly lower the number of children skipping breakfast⁽³¹⁾. In addition, families should be targeted, since during adolescence, family mealtimes are important for healthy dietary habits^(29,43). Interventions should be aimed at promoting a high-quality breakfast and should focus on including fruit/vegetables and beverages. Further research is needed to better understand the increasing trend towards breakfast skipping and the impact of different breakfast meal types on energy and nutrient intake.

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