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The difference in lifestyle between breastfed and non-breastfed children in the GECKO Drenthe birth cohort

Carolien Tigelaar

Author:	Carolien Tigelaar Student University College Groningen University of Groningen
Student number:	S2540460
First supervisor:	Dr. Ir. E. Corpeleijn University Medical Center Groningen Hanzeplein 1 9713 GZ Groningen
Second supervisor:	Dr. R. K. Chiu University College Groningen Hoendiepskade 23/24 9718 BG Groningen

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1. Abstract

Background: According to literature, lifestyle factors might affect the association between breastfeeding and obesity, which have been found in many studies.

Objective: We examined whether a difference in lifestyle in terms of physical activity and dietary patterns, is present between breastfed and non-breastfed children at the age of five.

Design: All children studied were participants in the GECKO Drenthe birth cohort. Physical activity was measured using the ActiGraph GT3x (at least 3 wearing days, more than 10 hours a day). To assess the dietary patterns among the children, for seven times a day dietary data was collected via a questionnaire, filled in by the parents at the child's age of five. Data on infant feeding was derived from parental questionnaires filled in at the age of 2 weeks, 1 month, 2 months and 3 months.

Results: The type of beverages consumed over the day contain more sugar by non-breastfed children than the type of beverages consumed over the day by breastfed children (3.97 ± 0.95 for breastfed children; 4.14 ± 0.91 for non-breastfed children, $p<0.001$). Breastfed children consume less refined bread at breakfast than non-breastfed children (3.00 ± 1.08 for breastfed children, 2.85 ± 1.03 for non-breastfed children, $p=0.027$). Although the consumption frequency of fruit does not differ between breastfed and non-breastfed children, the moment of consumption differs, with a higher consumption for breastfed children in the afternoon (N=362 (57.8%), 1.36 ± 1.32 for breastfed children; N=348 (50.0%), 1.10 ± 1.22 for non-breastfed children; $p<0.001$) and a higher consumption for non-breastfed children in the evening (N=144 (23.2%), 0.45 ± 0.92 for breastfed children; N=208 (30.3%), 0.68 ± 1.16 for non-breastfed children; $p=0.001$). Since fruit consumption is negatively correlated with the consumption of small biscuits or candy in the afternoon (Spearman $r=-0.161$, $p<0.001$), but positively correlated in the evening (Spearman $r=0.172$, $p<0.001$), non-breastfed children are more likely to consume small biscuits or candy on top of a piece of fruit. Higher consumption of fast-food among breastfed children was found. No differences in physical activity levels between breastfed and non-breastfed children were found.

Conclusion: In terms of lifestyle differences, some differences in dietary patterns between breastfed children and non-breastfed children could be observed. Physical activity levels between breastfed and non-breastfed children did not differ. Especially the consumption of beverages containing more sugar among non-breastfed children compared to breastfed children provide evidence for a healthier diet for breastfed children. This study provides enough evidence to conclude that dietary patterns differ between breastfed and non-breastfed children. Further research is needed to draw unified conclusions on the differences in terms of the healthiness of diets.

2. Introduction

2.1 Epidemic of childhood obesity

The rising prevalence of childhood obesity among the world population is one of the main challenges of the 21st century. Globally, a rise of 47.1% in the prevalence of combined childhood overweight and obesity has been observed between 1980 and 2013 (1). Similar to adult obesity, childhood obesity results in an increased risk of noncommunicable diseases such as cardiovascular disease and type 2 diabetes. Also increased risks of comorbidities associated with these diseases, such as high blood pressure, insulin resistance and dyslipidaemia are present (2). Moreover, being obese in childhood increases the likelihood of being obese in adulthood (2-4).

Risk factors for the development of childhood obesity

Childhood obesity can be considered as a complex condition, since many factors and the interaction between these factors contribute to the development of it. Already in the "first 1000 days", the period from conception to the age of 2, factors influencing childhood obesity can be identified (5). Children whose mothers smoked during pregnancy have a higher risk for becoming overweight than children whose mothers did not smoke during pregnancy, as reviewed by Oken et al. (6). Moreover, an overweight or obese mother increases the risk of developing obesity during childhood (7,8).

In addition, a higher birth weight is associated with an elevated risk for childhood obesity (7-9). However, a low birth weight might also result in an increased risk for obesity, since many infants with a low birth weight show a catch-up growth in the first 1-2 years of life (10). Children who display a catch-up growth are more likely to be heavier and taller at the age of five compared to other children. Also, a greater body mass index, a higher percentage body fat, and higher total fat mass can be observed (10). Therefore, catch-up growth is another risk factor which is associated with childhood obesity (7,10).

During the early postnatal months, nutrition is a factor influencing the risk on childhood obesity. In a birth cohort study of 881 infants from the UK, an association between higher total dietary intake for infants at the age of 4 months and greater weight gain between birth and 3 years among formula or mixed-fed infants was found (11). The association was not found for breastfed infants. In addition, higher protein intake during the early postnatal months has been associated with an increase in body size and adiposity as a result of higher plasma levels of insulin and insulin-like growth factor IGF-1 (12). Finally, research has shown that breastfeeding decreases the risk of childhood obesity (13-18). As a result, a lack of breastfeeding can be considered as a risk factor for the development of childhood obesity.

Next to risk factors during the "first 1000 days", other risk factors for the development of childhood obesity can also be identified. Shorter sleep duration (7,9), a lack

of physical activity (9,19) and the consumption of sugar-containing beverages (9,20-22) are among these risk factors.

Television watching is another factor which is taken into account by many studies focussing on risk factors for childhood obesity. It is an interesting variable, since it contains several components contributing to childhood obesity. Firstly, it results in lower levels of physical activity, resulting in lower energy expenditure (9,19). Also, television watching is thought to increase calorie intake, since children seem to passively consume energy dense foods while watching television. Furthermore, children are exposed to television commercials, including food commercials, most for fast food, soft drinks, sweets, sugar-sweetened breakfast cereal (23-25).

On top of that, genetics is an element which might influence the development of childhood obesity as well. Especially the complex interaction between genes which are associated with obesity seem to contribute to the development of obesity (26). Single gene defects can also contribute to the development of obesity, but this holds only for a small amount of people (27).

Finally, the measurement of social class is an important component in epidemiology, because the relation between social class and health status has been proven to be present (28). Therefore, the association between social class and childhood obesity should be considered. Research has shown that social status is inversely associated with childhood obesity for children at the age of 6 and older, in developed countries (29,30). The prevalence of childhood obesity is higher among lower-class children than children with a higher socioeconomic status.

2.2 Breastfeeding: a reduced risk of obesity

As mentioned earlier, research has shown that breastfeeding decreases the risk of childhood obesity (13-18). A systematic review by Arenz et al. (31) calculated an adjusted odds ratio of 0.78 (95% CI 0.71-0.85) for breastfeeding as a risk factor for childhood obesity. Nine studies were considered since only studies which adjusted for potential confounding factors were taken into consideration. Although the confounding variables adjusted for differed per study, maternal or parental overweight, birth weight, smoking during pregnancy, and social class or educational level were often considered.

Despite the fact that the mechanisms by which breastfeeding affects the risk of childhood obesity are still unclear, literature has made some suggestions about possible explanations. First of all, both energy and protein intake are lower in breastfed infants compared to formula-fed infants (21,32), providing a possible explanation of the association, since higher energy and protein intake during the early postnatal months increases the risk of

childhood obesity (11,12). However, the absence of sufficient evidence for a causal relationship makes that conclusions on this matter cannot be drawn (21).

Another possible explanation suggested by literature is that breastfed infants are able to regulate their milk consumption, thereby self-regulating their energy-intake (32). In contrast, infants who are formula-fed may be encouraged to finish a certain amount of milk, namely the amount present in the bottle. However, evidence supporting the statement that formula-fed infants are less able to self-regulate their intake than breastfed infants is lacking.

Even though most studies adjust for possible confounding factors, the association between breastfeeding and risk of childhood obesity might partly be explained by confounding factors for which adjustment did not take place. Dewey (32) suggests that especially child-feeding practices and parental control over feeding and the influence of physical activity are difficult to assess. It is proposed that parents who choose to breastfeed their child may have a higher socioeconomic status and a healthier lifestyle in general, particularly for parents who breastfeed for a long period. As a consequence, dietary patterns and physical activity levels may be more optimal in these families, explaining the link between breastfeeding and childhood obesity to some extent (32).

All in all, although several explanations are suggested by the available literature, conclusions on the mechanism behind the association between breastfeeding and childhood obesity cannot be drawn.

As mentioned previously, it is suggested that parents who choose to breastfeed their child may have a higher socioeconomic status and a healthier lifestyle in general, particularly for parents who breastfeed for a long period. As a consequence, dietary patterns and physical activity levels may be more optimal in these families, explaining the link between breastfeeding and childhood obesity to a certain extent (32). In order to determine if children who were breastfed as infants have a healthier lifestyle compared to children who were not breastfed as infants, this study will compare the lifestyles of both groups by examining dietary patterns and physical activity levels.

3. Methods

3.1 GECKO Drenthe

The GECKO Drenthe birth cohort has been designed to study the determinants of development of overweight in childhood. The GECKO Drenthe birth cohort study is a population-based birth-cohort study of children born within a period of one year in Drenthe, a northern province of the Netherlands.

All parents from children born between April 2006 and April 2007 in the province of Drenthe in the Netherlands were invited to participate in the study. Further details of the study design, recruitment and study procedures has been published elsewhere (33). Written informed consent was obtained from all parents. The study was approved by the Medical Ethics Committee of the University Medical Center Groningen and follows the declaration of Helsinki.

3.2 Infant feeding

For the information about infant feeding, data of parental questionnaires filled in at the age of 2 weeks, 1 month, 2 months, and 3 months was used. For the type of infant feeding, a distinction was made between children who were breastfed at the age of three months and children who were not breastfed at the age of three months. The category of breastfed children included the children who received exclusive breastfeeding, breastfeeding in combination with formula feeding, and children who received pumped breastmilk. The category of non-breastfed children included the children who received formula feeding exclusively at the age of 3 months. Since this study is searching for behavioural patterns, the distinction was made based on the efforts parents are willing to make to breastfed their child rather than the biological aspect of breastfeeding.

3.3 Dietary habits

For information on dietary habits we used data of parental questionnaires, filled in at the child's age of five. The questionnaire was based on the questionnaire used for ChecKid, a research focussing on the behaviour, health and living circumstances ofchildren living in Zwolle, a city in the Netherlands. To assess the dietary patterns among the children, for seven times a day dietary data was collected, namely breakfast, in the morning, lunch at school or lunch at home, in the afternoon, dinner, and in the evening. For every eating moment, parents could fill in what type of food items were chosen and how often a certain food item was consumed in an average week. The options were never, 0-1 times a week, 2-3 times a week, 4-5 times a week, or 6-7 times a week. In this way, data on the consumption frequency of food items and the moment of consumption could be collected. Since the focus of this study is on what kind of products are consumed rather than the amount of it, portion size was

not taken into account. In order to determine if one food item is preferred over the other in terms of a healthy diet, the definition and guidelines of a good diet of the Health Council of the Netherlands were followed (34).

For this study, a selection of food items was made based on their relevance for determining dietary habits at the age of five. The food items considered were bread, beverages, snacks, dinner, and dessert and are shown in **Table 3** and **Table 4**. In addition, vegetables or fruit on bread was also taken into account. Since eating vegetables and fruit is part of a healthy diet according to the Healthy Council (34), increasing this consumption in various ways might be a marker for a healthy diet. Vegetables or fruit on bread is one of the options by which vegetable or fruit consumption might be increased. The consumption of vegetables or fruit on bread was evaluated by the question what they ate on bread in an average week. Two groups were distinguished based on consuming vegetables or fruit on bread for at least one time a week. The consumption frequency was not taken into account.

On top of the snack consumption, fruit consumption was also considered separately as illustrated in **Figure 2**. For fruit consumption, the consumption frequency between the groups was compared. Also, the correlation between the consumption of fruit and small biscuits or candy was analysed.

Bread and beverages scores

For the consumption of bread and beverages, the categories could be organized ordinally in terms of a healthy diet. As a result, a five-scale score for bread and a six-scale score for beverages could be calculated. The scores are presented in **Table 3** and show the type of bread or beverage consumed.

For bread the categories were: white (>75%), brown + white (>75%), brown (>75%), brown + whole-wheat (>75%), and whole-wheat (>75%). To fall in a certain category, the total bread consumption of a study participant had to consist of more than 75% of that type of bread. The score ranges from 1 for white (>75%) to 5 for whole-wheat (>75%). A higher score represents a higher consumption of whole-wheat bread and thus healthier food choices regarding the type of bread.

For beverages, the score was calculated based on the amount of sugar a certain drink contained. The beverages categories were: no sugar-containing (>75%), satiating sugars + no-sugar containing (>75%), combination of all types of beverages (>75%), satiating sugars + empty sugars (>75%), satiating sugars and no-sugar containing (>75%), and empty sugars (>75%). No sugar-containing beverages included water, tea without milk/sugar and artificially sweetened beverages. Satiating sugars includes products containing lactose, and the category of empty sugars contains products such as sodas, juices, and lemonade. The score ranges from 1 for no sugar-containing (>75%) to 6 for empty sugars (>75%). Again, to

fall in a certain category, the total beverage consumption of a study participant had to consist of more than 75% of that type of beverage.

3.4 Physical activity

Physical activity in children was assessed using the ActiGraph GT3X (ActiGraph, Pensacola, FL). The ActiGraph was shown to be a reliable and valid device to measure PA volume and intensity in young children (35,36). The ActiGraph was worn by the child with an elastic belt. Parents were instructed to let their child wear the ActiGraph on the iliac crest on the right hip for four days, of which at least one weekend day, during all waking hours except while bathing or swimming (37,38). To be included in the analysis, the accelerometer had to be worn for at least 600 minutes/day for at least 3 days, regardless whether these were week or weekend days. Non-wearing time of the ActiGraph was classified as a minimum length of 90 minutes without any observed counts (39). Physical activity data from 1,475 children, 4 to 7 years of age, was obtained of which 1,135 children had valid data. Cut-off points recommended by Butte et al. were used to calculate time spent in sedentary vs light (240 counts per minute), light vs moderate PA (2120 counts per minute), and moderate vs vigorous PA (4450 counts per minute) (40). Collected data were analysed in 15-second epochs. Data were collected using a frequency of 30 Hz (41). All children with wearing time ≥ 840 min./day (14 h./day) were checked manually for sleeping time. Adherence to the Dutch healthy exercise norm (NNGB) was defined as ≥ 60 minutes of moderate to vigorous PA (MVPA) per day.

3.5 Statistical analysis

For statistical analysis, IBM SPSS 23 for Windows (SPSS, Chicago Illinois, USA) was used. The level of significance was set to 5%. For the basic characteristics of the study participants, data are presented as means with standard deviations or as rates in N and percentages. Depending on the characteristics of the data, either a Mann-Whitney U test or a Fisher's exact test was performed.

A comparison of the physical activity levels between non-breastfed and breastfed children was made by looking at the mean of sedentary behaviour, light PA, moderate PA, vigorous PA, and moderate-to-vigorous PA over 6 days. For both of the groups, the median with the 25^{th} and 75^{th} percentile are presented, since most physical activity variables were more or less skewed. For the same reason, a Mann-Whitney U test was performed to examine if there was a difference between breastfed and non-breastfed children. Data on adherence to the Dutch healthy exercise norm was presented as rates in N and percentages and was tested with a Fisher's exact test.

The type of beverages and bread consumed was analysed by performing a Mann-Whitney U test on the calculated beverage and bread score. Since the calculated scores were

categorical, presenting the data in median and 25th and 75th percentile did not show the differences which were present between the breastfed and non-breastfed groups. By presenting the data as means with standard deviations these differences could be displayed. The values can be found in **Table 3**.

For the other food items no score was calculated, but the consumption frequency in an average week of certain food items for each eating moment separately was taken into account. A Mann-Whitney U test was performed to examine the possible differences between breastfed and non-breastfed children. Since the consumption frequency score ranges from 0 for never to 4 for 6-7 times a week, the data is categorical. Again, presenting the data in median and 25th and 75th percentile did not show the differences observed between the two groups, while mean with standard deviations illustrated these differences clearly, as can be seen in **Table 4**. The mean has been calculated by including all participants of whom data was available. As a result, the mean is dependent on both the number of participants who are consuming a certain food item and the consumption frequency of these consumers. As a result, a low score can represent both a low consumption frequency among a large fraction of the participants or a high consumption frequency among a small fraction of the participants. To be able to interpret the mean, the number of participants who are consuming a food item at least 0-1 times a week, is displayed as rates in N and percentages. In case variables were checked for correlation, a Spearman's rho correlation test was performed, because of the non-normality of most data.

For the consumption of fruit or vegetables on bread, a Fisher's exact test was performed and the data was presented as rates in N and percentages.

4. Results

We studied 2310 children within the GECKO Drenthe cohort with information on dietary habits and physical activity at the age of five. Of the children studied, 44.7% received breastfeeding at the age of three months. Basic characteristics of the participants are shown in **Table 1**. A few characteristics differed between breastfed and non-breastfed children. First of all, the BMI z-score for non-breastfed children is higher than the BMI z-score for breastfed children. Furthermore, parents who choose to breastfeed their child tend to have a higher educational level, a higher income, and both parents are slightly older in age.

Physical activity

For physical activity, 967 children were included in the analysis, based on valid ActiGraph data. **Table 2** shows the physical activity levels and adherence to the Dutch healthy exercise norm (NNGB). For all levels of physical activity and adherence to the Dutch healthy exercise norm, the difference between non-breastfed and breastfed children was not significant.

Dietary patterns

Data on dietary patterns are presented in **Table 3** and **Table 4**. First of all, when looking at the consumption of bread in **Table 3**, children who were breastfed as an infant have a higher bread score than non-breastfed children at breakfast. A higher bread score represents a higher consumption of whole-wheat bread and a lower consumption of refined bread. For other eating moments during the day, a difference in bread score between breastfed and non-breastfed children could not be observed. When looking in more detail at the type of bread consumed per eating moment, small differences in the consumption of white bread, croissants and for the category “other” for some eating moments can be found. Detailed information on this can be found in Appendix A.

Table 3 shows the beverage score of all consumption moments separately and the total score over the day. Differences between non-breastfed and breastfed could be observed for the total beverage score, but also for the beverages score of all consumption moments separately, except for “in the morning”. **Figure 1** illustrates the consistency of the results regarding beverage consumption over the day.

To explain the difference in beverage score, the type of drinks has been considered into more detail, as can be seen in Appendix B. The difference in beverage score can mainly be explained by a lower consumption frequency of yoghurt drinks, juice, and tea with sugar and a higher consumption frequency of water, tea without sugar, and lemonade among breastfed children compared to non-breastfed children. Milk was more often consumed during lunch at home by breastfed children, but more often consumed by non-breastfed children during dinner.

For the variable concerning the consumption vegetables or fruit on bread, 94 children (14.9%) of the breastfed group and 93 children (13.1%) of the non-breastfed group ate vegetables or fruit on bread. No significant difference between breastfed and non-breastfed was found (p=0.385).

Snack consumption was analysed by using data on snack consumption in the morning, afternoon, and evening, as shown in **Table 4**. The consumption of gingerbread and neutral snacks differed significantly in the morning and afternoon. Having no snack at all was seen more frequently among breastfed children compared to non-breastfed children in the afternoon and evening. In the afternoon, fruits are eaten more frequently by breastfed children than non-breastfed children, as shown in **Figure 2**. For the evening, non-breastfed children eat fruit and small cookies or candy more frequently compared to their breastfed counterparts. The consumption of fruit and small biscuits or candy was negatively correlated in the morning and afternoon (Spearman r=-0.161, p<0.001 and -0.180, p<0.001 respectively), but positively correlated in het evening (Spearman r=0.172, p<0.001)).

When looking at the main dish of the day, only significant differences can be observed for a rice dish or fast-food. For both a rice dish and fast-food, higher consumption rates are seen among breastfed children than non-breastfed children. For a small amount of children the main dish is, always or occasionally, consumed at noon (N=17 (2.1%) for at school, N=161 (12.1%) for at home). For the group having the main dish at noon when they are at home, a significant difference between non-breastfed and breastfed children could be found in the consumption of a dish consisting of potatoes, vegetables and meat (p=0.040). Non-breastfed children seem to eat this meal more often than breastfed children at noon.

For the dessert, only a difference in the consumption of full fat yoghurt could be observed, with a higher consumption rate for breastfed children.

Table 1. Basic characteristics of study participants.

	N_{total}	Breastfed children	N_{total}	Non-breastfed children	P
Child characteristics & anthropometrics					
Age at PA measurement (years)	521	5.64 ± 0.78	446	5.66 ± 0.78	0.793
Age at dietary measurement (years)	472	5.86 ± 0.33	405	5.83 ± 0.33	0.200
Female gender, N (%)	521	253 (48.6%)	446	213 (47.8%)	0.846
BMI for age z-score at 5 years	450	0.17 ± 0.73	382	0.30 ± 0.83	**0.035**
Ethnicity (%)	498		422		0.085
Dutch		469 (94.2%)		408 (96.7%)	
Non-Dutch		29 (5.8%)		14 (3.3%)	
Parental characteristics					
Age father at birth (years)	945	33.94 ± 5.17	1151	32.94 ± 4.69	**<0.001**
Age mother at birth (years)	1020	31.25 ± 4.51	1268	30.31 ± 4.31	**<0.001**
Highest household income, N (%)	469		378		**0.002**
<€1150 / month		9 (1.9%)		16 (4.2%)	
€1151-3050 / month		287 (61.2%)		255 (67.5%)	
€3051-3500 / month		102 (21.7%)		70 (18.5%)	
€3501 or more / month		71 (15.1%)		37 (9.8%)	
Educational level father, N (%)	494		414		**<0.001**
Low/middle		292 (59.1%)		280 (67.6%)	
High ((applied) university)		202 (40.9%)		134 (32.4%)	
Educational level mother, N (%)	504		428		**0.009**
Low/middle		244 (48.4%)		287 (67.1%)	
High ((applied) university)		260 (51.6%)		141 (32.9%)	

Bold: p<0.05.

Table 2. Mean of measured physical activity over 6 days.

	Breastfed children	Non-breastfed children	P
Sedentary behaviour (hrs./day)	6.23 (5.61 – 6.84)	6.20 (5.55 – 6.81)	0.477
Light PA (hrs./day)	4.37 (3.98 – 4.81)	4.40 (4.00 – 4.84)	0.201
Moderate PA (min./day)	43.44 (34.67 – 54.41)	44.40 (35.58 – 56.16)	0.322
Vigorous PA (min./day)	16.44 (11.22 – 24.72)	17.156 (11.57 – 24.32)	0.881
Moderate to vigorous PA (min./day)	60.50 (48.15 – 79.89)	63.094 (48.42 – 81.70)	0.430
Adherence to Dutch healthy exercise norm, N (%)	267 (51.2%)	245 (54.9%)	0.272

For breastfed children N=521; for non-breastfed children N=446.

Table 3. Dietary scores

	N_{total}	Breastfed children	N_{total}	Non-breastfed children	P
Bread score					
Breakfast	466	3.00 ± 1.08	548	2.85 ± 1.03	**0.027**
Lunch at school	353	3.20 ± 1.08	370	3.30 ± 1.07	0.921
Lunch at home	491	3.00 ± 1.16	577	2.94 ± 1.08	0.061
Dinner	58	3.00 ± 1.22	74	2.88 ± 1.16	0.514
Beverage score					
Breakfast	627	3.81 ± 1.80	705	4.08 ± 1.71	**0.005**
In the morning	626	5.65 ± 0.92	703	5.68 ± 0.87	0.480
Lunch at school	403	4.41 ± 1.82	397	4.70 ± 1.66	**0.038**
Lunch at home	621	3.84 ± 1.72	698	4.33 ± 1.63	**<0.001**
In the afternoon	625	5.51 ± 0.93	695	5.58 ± 0.91	**0.047**
Dinner	592	3.30 ± 1.78	651	3.50 ± 1.67	**0.021**
In the evening	604	3.45 ± 1.72	678	3.91 ± 1.80	**<0.001**
Total	632	3.97 ± 0.95	709	4.14 ± 0.91	**<0.001**

Bold: p<0.05.

Table 4. Consumption frequency of food items

Food item	N_{yes} (%)	Breastfed children	N_{yes} (%)	Non-breastfed children	P
Snack in the morning					
Nothing	3 (0.5%)	0.01 ± 0.15	9 (1.27%)	0.02 ± 0.16	0.123
Fruit	584 (92.8%)	2.95 ± 0.84	656 (93.2%)	2.93 ± 1.06	0.683
Bread	96 (15.3%)	0.32 ± 0.84	104 (14.8%)	0.30 ± 0.81	0.761
Raisins	27 (4.3%)	0.05 ± 0.28	21 (3.0%)	0.04 ± 0.27	0.206
Raw vegetables	110 (17.5%)	0.29 ± 0.68	97 (13.8 %)	0.23 ± 0.62	0.062
Salty snack	7 (1.1%)	0.01 ± 0.15	11 (1.6%)	0.02 ± 0.14	0.479
Small biscuits or candy	199 (31.6%)	0.62 ± 1.02	199 (28.3%)	0.57 ± 1.00	0.227
Packed biscuits	212 (33.7%)	0.62 ± 0.99	235 (33.4%)	0.64 ± 1.00	0.937
Large cookies or cake	17 (2.7%)	0.03 ± 0.22	17 (2.4%)	0.03 ± 0.19	0.733
Gingerbread	153 (24.3%)	0.39 ± 0.29	203 (28.8%)	0.48 ± 0.83	**0.049**
Dairy products	13 (2.1%)	0.04 ± 0.29	11 (1.6%)	0.03 ± 0.30	0.494
Neutral snack	63 (10.0%)	0.18 ± 0.60	47 (6.7%)	0.11 ± 0.46	**0.025**
Snacks in the afternoon					
Nothing	33 (5.3%)	0.09 ± 0.41	21 (3.0%)	0.06 ± 0.37	**0.041**
Fruit	362 (57.8%)	1.36 ± 1.32	348 (50.0%)	1.10 ± 1.22	**<0.001**
Bread	68 (10.9%)	0.19 ± 0.60	93 (13.4%)	0.24 ± 0.69	0.143
Raisins	62 (9.9%)	0.13 ± 0.42	82 (11.8%)	0.15 ± 0.45	0.286
Raw vegetables	99 (15.8%)	0.32 ± 0.81	89 (12.8%)	0.21 ± 0.60	0.074
Salty snack	130 (20.8%)	0.28 ± 0.60	141 (20.3%)	0.27 ± 0.59	0.836
Small biscuits or candy	563 (89.9%)	2.58 ± 1.17	627 (90.1%)	2.52 ± 1.17	0.264
Packed biscuits	124 (19.8%)	0.34 ± 0.75	159 (22.8%)	0.40 ± 0.82	0.164
Large cookies or cake	57 (9.1%)	0.13 ± 0.46	63 (9.1%)	0.13 ± 0.45	0.970
Gingerbread	147 (23.5%)	0.38 ± 0.75	194 (27.9%)	0.47 ± 0.81	**0.046**
Dairy products	14 (2.2%)	0.04± 0.27	17 (2.4%)	0.04 ± 0.29	0.802
Neutral snack	144 (23.0%)	0.48± 0.96	126 (18.1%)	0.36 ± 0.84	**0.022**
Snacks in the evening					
Nothing	436 (70.3%)	2.52 ± 1.76	406 (59.1%)	2.01 ± 1.78	**<0.001**
Fruit	144 (23.2%)	0.45 ± 0.92	208 (30.3%)	0.68 ± 1.16	**0.001**
Bread	20 (3.2%)	0.05 ± 0.28	28 (4.1%)	0.07 ± 0.36	0.405
Raisins	5 (0.8%)	0.01 ± 0.16	8 (1.2%)	0.02 ± 0.17	0.517
Raw vegetables	17 (2.7%)	0.03 ± 0.21	27 (3.9%)	0.06 ± 0.33	0.227
Salty snack	110 (17.7%)	0.22 ± 0.51	123 (17.9%)	0.22 ± 0.50	0.946
Small biscuits or candy	123 (19.8%)	0.35 ± 0.81	168 (24.5%)	0.50 ± 1.02	**0.024**
Packed biscuits	9 (1.5%)	0.02 ± 0.17	17 (2.5%)	0.04 ± 0.25	0.182

Large cookies or cake	16 (2.6%)	0.03 ± 0.21	28 (4.1%)	0.06± 0.30	0.133
Gingerbread	13 (2.1%)	0.02 ± 0.17	27 (3.9%)	0.06 ± 0.32	0.052
Dairy products	58 (9.4%)	0.24 ± 0.81	76 (11.1%)	0.26 ± 0.82	0.349
Dinner					
Soup	250 (40.1%)	0.45 ± 0.59	245 (35.7%)	0.41 ± 0.60	0.075
Potatoes, vegetables, meat	605 (99.0%)	2.53 ± 0.65	674 (98.3%)	2.57 ± 0.69	0.233
Pasta	573 (93.4%)	1.43 ± 0.63	630 (91.8%)	1.37 ± 0.67	0.070
Rice	426 (69.7%)	0.89 ± 0.71	407 (59.3%)	0.75 ± 0.73	**<0.001**
Snacks	141 (23.1%)	0.24 ± 0.45	171 (24.9%)	0.27 ± 0.48	0.398
Pancakes	347 (56.8%)	0.57 ± 0.51	378 (55.1%)	0.56 ± 0.52	0.557
Fast-food	442 (72.3%)	0.74 ± 0.48	462 (67.3%)	0.69 ± 0.51	**0.048**
Ready meals	38 (6.2%)	0.07 ± 0.26	38 (5.5%)	0.06 ± 0.26	0.613
Desserts					
Skimmed dairy products	83 (25.9%)	0.65 ± 1.20	96 (30.2%)	0.76 ± 1.25	0.242
Semi-skimmed dairy products	124 (38.8%)	0.93 ± 1.30	124 (39.0%)	0.99 ± 1.34	0.720
Full fat yoghurt, quark or milk	59 (18.4%)	0.46 ± 1.03	28 (8.8%)	0.19 ± 0.70	**<0.001**
Skimmed fruit-yoghurt	92 (28.8%)	0.60 ± 1.03	92 (28.9%)	0.63 ± 1.05	0.810
Pudding, custard, full fat fruit-yoghurt	187 (58.4%)	1.31 ± 1.29	191 (60.1%)	1.45 ± 1.34	0.234
Fruit	67 (20.9%)	0.47 ± 1.02	52 (16.4%)	0.37 ± 0.93	0.144

For snacks and dinner, N for breastfed children varies from 611-629, for dessert N=320. For non-breastfed children N varies from 686-704 for snacks and dinner, and N=318 for dessert.

Bold: p<0.05.

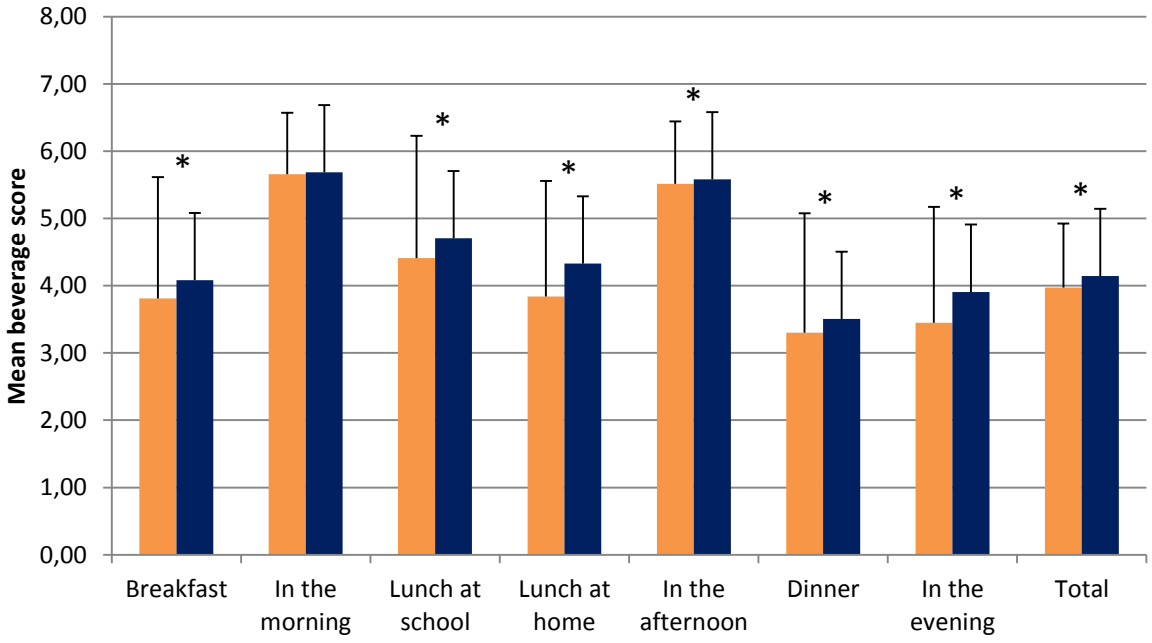

Figure 1 Mean beverage scores over the day. The beverage score is based on the consumption of the amount of sugar in drinks. A higher beverage score represents a higher sugar consumption in drinks. Breastfed children are displayed in the orange bars, non-breastfed children in the blue bars. For lunch at school N=403 for breastfed children and N=397 for non-breastfed children. For the other moments, N ranges from 592 to 632 for breastfed children and from 651 to 709 for non-breastfed children.
*p<0.05.

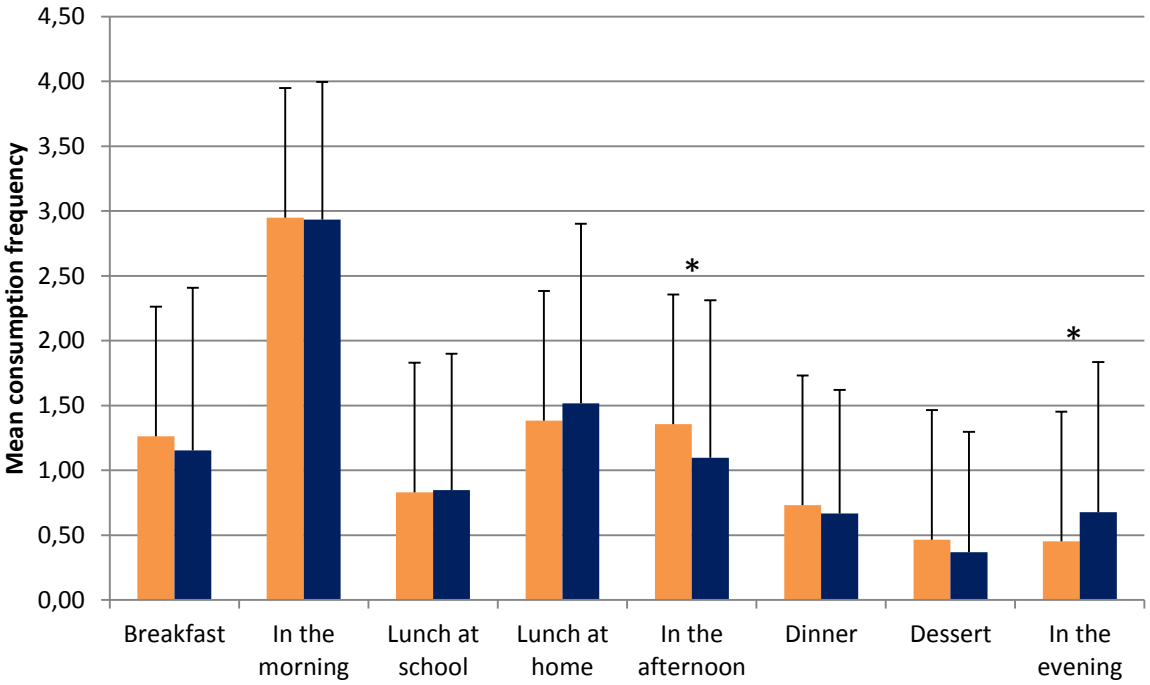

Figure 2 Mean consumption frequency of fruit over the day. The mean consumption frequency includes both information on the frequency of consumption and the number of consumers. Breastfed children are displayed in the orange bars, non-breastfed children in the blue bars. For breakfast, lunch, and dinner N ranged from 112 to 179 for breastfed children and from 118 to 209 for non-breastfed children. For in the morning, afternoon, and evening N ranged from 620 to 629 for breastfed children and from 687 to 704 for non-breastfed children. *$p<0.05$.

5. Discussion

This study showed that some differences in lifestyle are present between breastfed and non-breastfed children. The difference in lifestyle is explained by differences in dietary patterns and not in differences in physical activity between the groups. When looking at the dietary patterns, the most clear difference between breastfed and non-breastfed children can be found in the difference in beverage score.

Since literature suggests that parents who choose to breastfeed their child have a higher socioeconomic status in general, we would expect to find a higher educational level and income for parents who have choose to breastfeed their child in comparison to parents who have chosen not to. The parental differences found in educational level and income in this study supports this statement. The relevant question is if this is also represented in a healthier lifestyle in terms of physical activity and dietary patterns.

A first component of lifestyle which is taken into consideration is the dietary pattern. The most evident difference between breastfed and non-breastfed can be observed when looking at beverages. Considering the beverage consumption in general, non-breastfed children tend to drink more often “empty sugars” than breastfed children. Since the Health Council advices to avoid “empty sugars” as much as possible (34), breastfed children tend to have a healthier diet in terms of beverage consumption. The difference in beverage consumption based on the amount of sugar that beverages contain is an important finding, since it is one of the few food items which show consistent outcomes in research regarding the association between dietary factors and childhood obesity (9,20-22). Therefore, intervention to limit the consumption of sugar-containing beverages is beneficial to reduce childhood obesity. Since the beverages score is the highest in the morning, a promoting policy on the consumption of non-sugar containing drinks at primary schools or day-cares might be useful.

For the consumption of type of bread only a significant difference in bread score at breakfast can be observed. Breastfed children are scoring higher on bread at breakfast than non-breastfed children as a result of less white bread consumption and a higher whole-wheat consumption. A higher bread score reflects food choices which are in line with the recommendation of the Health Council (34), namely avoidance of refined products and more focus on whole-wheat products. This implies that in terms of type of bread eaten at breakfast, breastfed children have a healthier diet than non-breastfed children. The difference found in consumption of croissants and white bread at lunch supports this statement. However, since the bread score for lunch at school and at home and for dinner were not significantly different, the outcomes are not sufficient to conclude that in terms of type of bread breastfed and non-breastfed children have different or healthier dietary patterns. However, a study

concerning dietary patterns and breastfeeding in Australian children, reported that breastfed children were more likely to consume healthy foods, including whole-wheat bread (42).

When looking at snacks consumed over the day, small differences can be observed the consumption of gingerbread, neutral snacks, and small biscuits or candy, or having no snack at all. However, since the mean consumption frequency of these food items is low as a result of low consumption frequency or a low amount of consumers, unified conclusions on snack consumption cannot be drawn.

Considering fruit as a snack separately, some patterns can be observed, as shown in **Figure 2.** First of all, many children eat fruit in the morning. This is probably a result of the fruit-policy most primary schools and day-cares currently have. Of the 1333 children, only 93 children never eat fruit in the morning. In the afternoon, fruit consumption is higher for breastfed children, while in the evening fruit consumption is higher for non-breastfed children. When looking at overall fruit consumption, no difference can be observed. As a result, the timing of fruit consumption differs, but not the consumption frequency itself. Since in the afternoon the consumption of fruit and small biscuits or candy are negatively correlated, fruit can be considered as a replacement for small biscuits or candy. In the evening, the consumption of fruit and small biscuits or candy are positively correlated, implying that children who eat a piece of fruit in the evening are more likely to eat a small biscuit or candy besides it. A possible explanation for this positive correlation is that children who eat a piece of fruit are rewarded with a small biscuit or candy. This might be an indicator for a less healthier diet. Therefore, breastfed children are more likely to have a healthier diet compared to their non-breastfed counterparts, even though the total fruit consumption may not differ.

Although limited data on the exact content of the main dish was available, data showed that a higher consumption frequency of fast-food among breastfed children was found. This is in contrast with the results on beverages, bread in the morning and the fruit consumption which indicated a slightly healthier diet for breastfed children compared to non-breastfed children. Literature suggests a positive association between fast-food consumption and BMI score (43), but this was not found in this study. Therefore, fast-food consumption as found in this study might not be a good indicator for a healthy diet. This hypothesis is supported by a study which reported a positive association between a healthy dietary pattern and breastfeeding (42). This healthy dietary pattern had an inversely association with take-away food.

For desserts, only a difference in the consumption of the full fat dairy products could be observed. Since the consumption of other types of desserts does not differ, the conclusion that the dietary pattern in terms of desserts differ between breastfed and non-breastfed children cannot be drawn.

All in all, some differences in dietary patterns between breastfed children and non-breastfed children can be observed. Since a difference in BMI z-score between non-breastfed and breastfed children is present and no difference can be observed in physical activity levels, it is likely that the difference in BMI z-score is due to differences in dietary habits. The lower BMI z-score among breastfed children supports the statement that in terms of diet, breastfed children tend to have a slightly healthier diet than non-breastfed children. Especially the lower beverage score, representing a healthier diet, for breastfed children provides evidence for this. However, the higher consumption rate of fast-food in these children contradicts this statement. Therefore, future research will be needed to be able to draw definite conclusions on the differences in terms of a healthy diet.

A factor which might have influenced the outcomes of this study is the distinction regarding breastfeeding and non-breastfeeding which has been made. For this study two categories were made, namely breastfeeding, including infants who received exclusive breastfeeding, breastfeeding in combination with formula feeding and infants who received expressed breastmilk, and non-breastfeeding, including infants who received formula feeding exclusively. Making three categories, namely infants receiving exclusively breastfeeding, infants receiving a combination of breastfeeding and formula feeding, and infants receiving exclusively formula feeding, may have produced other results.

Also, we have chosen to make the breastfeeding and non-breastfeeding group based on the type of infant feeding at the age of three months. Since literature suggests that the positive association between socio-economic status and breastfeeding is particularly strong for parents who breastfeed for a long period, a period of three months might be a limitation to the study. However, performing the same tests on groups made based on the age of six months did show similar results, implying that the choice of three months does not result in limitations of this study.

A possible limitation of this study is that selection bias might be present. Although all parents from children born between April 2006 and April 2007 were invited to participate in the study, not all participated. This selection bias can be observed in the underrepresentation of ethnic minorities in the study. Also within the study a selection bias might be present, because not all parents filled in the questionnaire at the child's age of five although they were part of the GECKO Drenthe birth cohort.

Although data on neutral snacks was available for the morning and afternoon, this data was not available for the evening. As a result, it is not known if the difference in neutral snack consumption in the morning and afternoon would also have been observed in the evening, which is a limitation of this study.

Future research

Although some differences in diet have been found between breastfed and non-breastfed children are found, future research is needed to be able to draw unified conclusions, especially on the differences in dietary patterns in terms of a healthy diet. Future research on diet differences between breastfed and non-breastfed children may use principal component analysis, since this method can bring out patterns in diets which is crucial for the analysis of dietary habits.

As a result of the differences in dietary patterns found, future studies which focus on the association between breastfeeding and childhood obesity need to adjust for dietary patterns in order to conduct reliable research. Otherwise, a healthier dietary pattern might explain the association between breastfeeding and childhood obesity to a certain extent. Since no differences in physical activity are found, adjustment for physical activity does not seem required.

Conclusion

In terms of lifestyle differences, some differences in dietary patterns between breastfed children and non-breastfed children can be observed. Physical activity levels between breastfed and non-breastfed children did not differ. Especially the consumption of beverages containing more sugar among non-breastfed children compared to breastfed children provide suggestive evidence for a healthier diet for breastfed children. The type of bread consumed and the consumption of fruit in combination with small biscuits or candy support this statement, while fast-food consumption contradicts it. Therefore, future research will be needed to be able to draw definite conclusions on the differences in terms of a healthy diet. Despite this, this research provides enough evidence to conclude that the dietary patterns differ between breastfed and non-breastfed children, even though the direction is not clear yet.

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Appendix A: Type of bread

	N_{yes} (%)	Breastfed children	N_{yes} (%)	Non-breastfed children	P
Breakfast					
White bread	92 (15.4%)	0.27 ± 0.73	140 (20.8%)	0.39 ± 0.90	**0.009**
Brown bread	457 (76.5%)	2.52 ± 1.61	516 (76.8%)	2.55 ± 1.61	0.751
Whole-wheat bread	283 (47.4%)	1.36 ± 1.62	278 (41.4%)	1.22 ± 1.61	0.079
White brood with fibre	44 (7.4%)	0.14 ± 0.55	39 (5.8%)	0.12 ± 0.55	0.276
Croissants	154 (25.8%)	0.28 ± 0.50	162 (24.1%)	0.26 ± 0.48	0.514
Bread rolls	253 (42.4%)	0.50 ± 0.65	287 (42.7%)	0.52 ± 0.67	0.739
Pilot bread/rusk	188 (31.5%)	0.44 ± 0.77	194 (28.9%)	0.45 ± 0.83	0.568
Other	93 (15.6%)	0.27 ± 0.76	78 (11.6%)	0.18 ± 0.57	**0.033**
Lunch at school					
White bread	45 (11.2%)	0.17 ± 0.58	52 (12.9%)	0.16 ± 0.46	0.526
Brown bread	291 (72.4%)	1.35 ± 1.10	301 (74.7%)	1.47 ± 1.14	0.139
Whole-wheat bread	176 (43.8%)	0.81 ± 1.08	171 (42.4%)	0.85 ± 1.17	0.998
White brood with fibre	26 (6.5%)	0.10 ± 0.42	18 (4.5%)	0.06 ± 0.29	0.205
Croissants	17 (4.2%)	0.04 ± 0.22	35 (8.7%)	0.10 ± 0.37	**0.010**
Bread rolls	75 (18.7%)	0.22 ± 0.50	77 (19.1%)	0.23 ± 0.50	0.900
Pilot bread/rusk	33 (8.2%)	0.10 ± 0.37	28 (6.9%)	0.08 ± 0.35	0.477
Other	28 (7.0%)	0.12 ± 0.52	17 (4.2%)	0.06 ± 0.35	0.087
Lunch at home					
White bread	97 (15.9%)	0.26 ± 0.68	138 (20.1%)	0.36 ±0.85	**0.034**
Brown bread	443 (72.6%)	2.16 ± 1.53	514 (75.0%)	2.28 ± 1.53	0.116
Whole-wheat bread	279 (45.7%)	1.28 ± 1.54	283 (41.3%)	1.13 ± 1.50	0.083
White brood with fibre	38 (6.2%)	0.11 ± 0.47	38 (5.5%)	0.09 ± 0.44	0.604
Croissants	71 (11.6%)	0.12 ± 0.35	114 (16.6%)	0.19 ± 0.45	**0.009**
Bread rolls	203 (33.3%)	0.41 ± 0.64	222 (32.4%)	0.42 ± 0.69	0.876
Pilot bread/rusk	154 (25.2%)	0.38 ± 0.76	145 (21.2%)	0.33 ± 0.71	0.107
Other	78 (12.8%)	0.26 ± 0.78	55 (8.0%)	0.15 ± 0.57	**0.004**
Dinner					
White bread	11 (16.7%)	0.35 ± 0.94	15 (17.0%)	0.34 ± 0.91	0.973
Brown bread	41 (62.1%)	1.27 ± 1.37	57 (64.8%)	1.23 ± 1.19	0.932
Whole-wheat bread	26 (39.4%)	0.67 ± 1.06	34 (38.6%)	0.65 ± 1.00	0.992
White brood with fibre	4 (6.1%)	0.08 ± 0.32	5 (5.7%)	0.07 ± 0.30	0.918
Croissants	4 (6.1%)	0.08 ± 0.32	11 (12.5%)	0.13 ± 0.33	0.197
Bread rolls	18 (27.3%)	0.29 ± 0.49	28 (31.8%)	0.36 ± 0.57	0.481
Pilot bread/rusk	11 (16.7%)	0.20 ± 0.47	10 (11.4%)	0.15 ± 0.47	0.351
Other	5 (7.6%)	0.08 ± 0.27	8 (9.1%)	0.17 ± 0.61	0.669

For lunch at school N=403 for breastfed children and N=397 for non-breastfed children. For the other moments, N ranges from 592 to 632 for breastfed children and from 651 to 709 for non-breastfed children.

Bold: $p<0.05$

Appendix B: Type of drinks

	N_{yes} (%)	Breastfed children	N_{yes} (%)	Non-breastfed children	P
Breakfast					
Nothing	23 (3.7%)	0.10 ± 0.57	23 (3.3%)	0.09 ± 0.51	0.673
Water	75 (12.0%)	0.28 ± 0.87	71 (10.0%)	0.19 ± 0.66	0.202
Milk	362 (57.7%)	1.89 ± 1.78	393 (55.6%)	1.76 ± 1..73	0.127
Yoghurt drink	252 (40.2%)	1.04 ± 1.45	361 (51.1%)	1.39 ± 1.57	**<0.001**
Soda	4 (0.6%)	0.01 ± 0.13	6 (0.8%)	0.01 ± 0.16	0.655
Diet soda	1 (0.2%)	0.00 ± 0.08	2 (0.3%)	0.00 ± 0.05	0.636
Juice	112 (17.9%)	0.40 ± 0.98	115 (16.3%)	0.34 ± 0.88	0.387
Lemonade	119 (19.0%)	0.49 ± 1.13	154 (21.8%)	0.52 ± 1.11	0.289
Tea without sugar	91 (14.5%)	0.38 ± 1.04	77 (10.9%)	0.26 ± 0.85	**0.038**
Tea with sugar	52 (8.3%)	0.18 ± 0.68	75 ((10.6%)	0.22 ± 0.73	0.155
Tea with milk and sugar	33 (5.3%)	0.14 ± 0.64	37 (5.2%)	0.12 ± 0.60	0.964
In the morning					
Nothing	6 (1.0%)	0.02 ± 0.20	5 (0.6%)	0.01 0.15	0.620
Water	78 (12.5%)	0.28 ± 0.80	85 (12.1%)	0.27 ± 0.80	0.846
Milk	47 (7.5%)	0.18 ± 0.68	47 (6.7%)	0.16 ± 0.65	0.560
Yoghurt drink	66 (10.5%)	0.23 ± 0.75	96 (13.7%)	0.30 ± 0.82	0.087
Soda	15 (2.4%)	0.06 ± 0.43	15 (2.1%)	0.05 ± 0.36	0.736
Diet soda	5 (0.8%)	0.02 ± 0.22	10 (1.4%)	0.02 ± 0.15	0.288
Juice	151 (24.1%)	0.58 ± 1.12	231 (32.9%)	0.83 ± 1.29	**<0.001**
Lemonade	522 (83.4%)	2.81 ± 1.46	571 (81.2%)	2.61 ± 1.48	**0.002**
Tea without sugar	26 (4.2%)	0.08 ± 0.46	17 (2.4%)	0.04 ± 0.26	0.071
Tea with sugar	14 (2.2%)	0.05 ± 0.36	17 (2.4%)	0.04 ± 0.27	0.844
Tea with milk and sugar	5 (0.8%)	0.01 ± 0.15	6 (0.9%)	0.02 ± 0.21	0.911
Lunch at school					
Nothing	2 (0.5%)	0.01 ±0.11	3 (0.8%)	0.01 ± 0.09	0.646
Water	29 (7.2%)	0.11 ± 0.45	30 (7.5%)	0.11 ± 0.42	0.864
Milk	176 (43.7%)	0.82 ± 1.08	164 (41.2%)	0.77 ± 1.09	0.411
Yoghurt drink	177 (43.9%)	0.74 ± 0.98	218 (54.8%)	0.98 ± 1.09	**0.001**
Soda	6 (1.5%)	0.02 ± 0.19	7 (1.8%)	0.03 ± 0.24	0.759
Diet soda	2 (0.5%)	0.01 ± 0.11	1 (0.3%)	0.00 ± 0.05	0.570
Juice	71 (17.6%)	0.27 ± 0.65	77 (19.3%)	0.28 ± 0.63	0.532
Lemonade	99 (24.6%)	0.44 ± 0.87	110 (27.6%)	0.46 ± 0.87	0.429
Tea without sugar	19 (4.7%)	0.09 ± 0.46	7 (1.8%)	0.03 ± 0.24	**0.018**
Tea with sugar	8 (2.0%)	0.03 ± 0.24	16 (4.0%)	0.06 ± 0.30	0.094
Tea with milk and sugar	2 (0.5%)	0.01 ± 0.11	8 (2.0%)	0.03 ± 0.19	0.054
Lunch at home					
Nothing	8 (1.3%)	0.04 ± 0.36	9 (1.3%)	0.02 ± 0.23	0.989
Water	83 (13.4%)	0.28 ± 0.81	97 (13.9%)	0.29 ± 0.80	0.791
Milk	386 (62.2%)	1.82 ± 1.59	390 (55.9%)	1.57 ± 1.57	**0.005**
Yoghurt drink	303 (48.8%)	1.14 ± 1.36	412 (59.0%)	1.51 ± 1.47	**<0.001**
Soda	10 (1.6%)	0.03 ± 0.26	10 (1.4%)	0.04 ± 0.35	0.802
Diet soda	5 (0.8%)	0.02 ± 0.23	7 (1.0%)	0.02 ± 0.24	0.708
Juice	90 (14.5%)	0.29 ± 0.78	114 (16.3%)	0.33 ± 0.83	0.368
Lemonade	157 (25.3%)	0.62 ± 1.18	201 (28.8%)	0.70 ± 1.21	0.183
Tea without sugar	47 (7.6%)	0.15 ± 0.55	42 (6.0%)	0.12 ± 0.54	0.268
Tea with sugar	31 (5.0%)	0.10 ± 0.48	64 (9.2%)	0.18 ± 0.63	**0.003**
Tea with milk and sugar	12 (1.9%)	0.04 ± 0.33	25 (3.6%)	0.08 ± 0.46	0.070
In the afternoon					
Nothing	7 (1.1%)	0.02 ± 0.16	5 (0.7%)	0.01 ± 0.13	0.444
Water	161 (25.8%)	0.56 ± 1.06	159 (22.9%)	0.51 ± 1.04	0.245
Milk	38 (6.1%)	0.12 ± 0.51	40 (5.8%)	0.11 ± 0.47	0.785
Yoghurt drink	41 (6.6%)	0.11 ± 0.45	47 (6.8%)	0.13 ± 0.52	0.859
Soda	41 (6.6%)	0.12 ± 0.51	44 (6.3%)	0.13 ± 0.56	0.889
Diet soda	15 (2.4%)	0.04 ± 0.29	22 (3.2%)	0.05 ± 0.31	0.391

Juice	172 (27.5%)	0.60 ± 1.08	238 (34.2%)	0.75 ± 1.15	**0.007**
Lemonade	583 (93.3%)	3.07 ± 1.14	636 (91.5%)	2.92 ± 1.19	**0.012**
Tea without sugar	102 (16.3%)	0.33 ± 0.83	73 (10.5%)	0.22 ± 0.71	**0.002**
Tea with sugar	58 (9.3%)	0.19 ± 0.65	80 (11.5%)	0.21 ± 0.63	0.233
Tea with milk and sugar	25 (4.0%)	0.08 ± 0.42	38 (5.5%)	0.13 ± 0.58	0.193
Dinner					
Nothing	220 (35.6%)	1.10 ± 1.58	256 (37.2%)	1.16 ± 1.63	0.422
Water	327 (52.9%)	1.34 ± 1.50	302 (44.0%)	1.06 ± 1.39	**<0.001**
Milk	75 (12.1%)	0.30 ± 0.90	114 (16.6%)	0.42 ± 1.05	**0.021**
Yoghurt drink	30 (4.9%)	0.09 ± 0.48	69 (10.0%)	0.20 ± 0.67	**<0.001**
Soda	26 (4.2%)	0.06 ± 0.32	26 (3.8%)	0.08 ± 0.45	0.728
Diet soda	9 (1.5%)	0.02 ± 0.21	16 (2.3%)	0.03 ± 0.25	0.251
Juice	54 (8.7%)	0.18 ± 0.66	80 (11.6%)	0.23 ± 0.70	0.094
Lemonade	205 (33.2%)	0.90 ± 1.42	236 (34.4%)	0.84 ± 1.30	0.861
Tea without sugar	7 (1.1%)	0.01 ± 0.13	5 (0.7%)	0.01 ± 0.18	0.451
Tea with sugar	1 (0.2%)	0.00 ± 0.08	8 (1.2%)	0.02 ± 0.17	**0.029**
Tea with milk and sugar	0 (0.0%)	0.00 ± 0.00	4 (0.6%)	0.01 ± 0.137	0.058
In the evening					
Nothing	261 (42.1%)	1.42 ± 1.77	212 (30.6%)	1.00 ± 1.58	**<0.001**
Water	281 (45.3%)	1.10 ± 1.41	267 (38.5%)	0.93 ± 1.34	**0.020**
Milk	60 (9.7%)	0.25 ± 0.84	81 (11.7%)	0.31 ± 0.94	0.243
Yoghurt drink	17 (2.7%)	0.06 ± 0.40	63 (9.1%)	0.21 ± 0.73	**<0.001**
Soda	41 (6.6%)	0.11 ± 0.49	31 (4.5%)	0.08 ± 0.04	0.089
Diet soda	12 (1.9%)	0.03 ± 0.23	26 (3.8%)	0.06 ± 0.32	**0.048**
Juice	70 (11.3%)	0.22 ± 0.68	115 (16.6%)	0.34 ± 0.86	**0.005**
Lemonade	217 (35.0%)	0.82 ± 1.28	303 (43.7%)	1.10 ± 1.43	**<0.001**
Tea without sugar	27 (4.4%)	0.07 ± 0.38	24 (3.5%)	0.07 ± 0.40	0.414
Tea with sugar	18 (2.9%)	0.05 ± 0.35	29 (4.2%)	0.07 ± 0.37	0.216
Tea with milk and sugar	9 (1.5%)	0.04 ± 0.37	14 (2.0%)	0.05 ± 0.39	0.437

For breakfast, N=627 for breastfed children and N=707 for non-breastfed children. In the morning, N=626 for breastfed children and N=703 for non-breastfed children.

Bold: $p<0.05$