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Unfavourable food consumption is exacerbated by low socioeconomic status among children aged 1–5 years in the German nutrition survey KiESEL

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Abstract

Diet in the first years of life is a key determinant of lifelong disease risk and is highly affected by socioeconomic status (SES). However, the specific relation between SES and food consumption in toddlers and preschoolers is poorly understood. This study assesses SES-related differences in food consumption in 1–5-year-olds in Germany using weighed food records (3+1 days) of a subsample of 887 children from the cross-sectional Children's Nutrition Survey to Record Food Consumption (KiESEL) undertaken 2014–2017. Children were categorized as having a low, medium, or high SES depending on parental income, education, and occupation. A two-step generalized linear model corrected for age and sex was applied to assess differences in food consumption, using bootstrapping to address unequal group sizes. Differences between SES groups were found for unfavourable foods (and the subgroups sugar-sweetened beverages and confectionary/desserts), fruit, bread/cereals, and fats/oils ($p_{Boot} < 0.05$). Mean daily consumption in the low SES-group as compared to the high-SES group was 84 g lower for total fruit, 22 g lower for bread/cereals, and 3 g lower for fats/oils, while being 123 g higher for sugar-sweetened beverages and 158 g higher for unfavourable foods in total (based on bootstrap 95 % confidence intervals). In conclusion, this study suggests a social gradient in the diet of German toddlers and preschoolers, with lower SES linked to lower diet quality. To prevent adverse health trajectories, public health measures to improve early life nutrition should address all children, prioritizing those of lower SES.

Keywords: Food consumption, socioeconomic status, toddlers, preschoolers, nutrition survey

Abbreviations used: BfR, German Federal Institute for Risk Assessment *(Bundesinstitut für Risikobewertung)*; BLS, German Nutrient Database *(Bundeslebensmittelschlüssel)*; GLM, generalized linear model; KiESEL, Children's Nutrition Survey to Record Food Consumption *(Kinder-Ernährungsstudie zur Erfassung des Lebensmittelverzehrs)*; KiGGS, German Health Interview and Examination Survey for Children and Adolescents *(Studie zur Gesundheit von Kindern und Jugendlichen in Deutschland);* MRI, Max Rubner-Institut; OMD, Optimized Mixed Diet; P, percentile; RKI, Robert Koch Institute; SD, standard deviation; SES, socioeconomic status; SSB, sugar-sweetened beverage

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Introduction

Early childhood is a vulnerable period for growth and development, during which dietary behaviour and disease risk are shaped profoundly [(1)]. Socioeconomic factors may decisively affect this process, with ample evidence showing that exposure to low socioeconomic status (SES) is associated with a diet conducive to lifestyle-related diseases [(2)]. Unhealthy early childhood dietary practices may progress into adulthood [(3)] and result in obesity and related comorbidities [(4)]. This may increase an individual's lifelong risk of disease and premature mortality [(5)], which is already elevated due to SES disadvantages as such [(6)]. Addressing SES-related dietary shortcomings in the early life stages therefore is of paramount importance.

Previous representative studies from Germany demonstrate clear associations between SES and food consumption in both older children and adults. A cross-sectional analysis of 12–17-year-olds found that children with low SES consumed more soft drinks, with girls also consuming more meat and boys more juice compared to their higher SES peers [(7)]. Among adolescents and adults aged 14 to 80 years, lower SES was linked to higher consumption of meat, soft drinks, and beer, and lower intake of fruit, vegetables, fish, and water [(8)], indicating that higher SES is linked to better, albeit still incomplete adherence to dietary recommendations.

Although studies provide evidence linking socioeconomic characteristics to diet quality in preschool-aged children [(9-12)] , data on the relation between SES and early childhood diet are scarce [(13)]. Given the considerable impact of nutrition in this phase of life [(1)], the large amount of time spent in parental care, and the associated extent of exposure to the household SES environment, such as parental food choices [(13)], toddlerhood and preschool age are of particular relevance.

The objective of this analysis is therefore to assess SES differences in food consumption in children 1–5 years of age and to identify SES-related shortcomings in diet quality at this stage of life. Analyses are based on the most recent representative food consumption data for Germany, collected within the Children's Nutrition Survey to Record Food Consumption (*Kinder-Ernährungsstudie zur Erfassung des Lebensmittelverzehrs,* KiESEL) [(14)].

Subjects and methods

KiESEL is a cross-sectional study, carried out from 2014 to 2017 by the German Federal Institute for Risk Assessment (*Bundesinstitut für Risikobewertung*, BfR). The study is a module of the German Health Interview and Examination Survey for Children and Adolescents Wave 2 (*Studie zur Gesundheit von Kindern und Jugendlichen in Deutschland Welle 2*, KiGGS Wave 2), which is part of the national health monitoring by the Robert Koch Institute (RKI) [(14)]. KiESEL received approval from the Berlin Medical Association (Eth 28/13) and the German Federal Commissioner for Data Protection and Freedom of Information. For each child participating in the study, written informed consent was sought from the primary caregiver. To ensure compliance with quality standards in health research reporting, the STROBE-nut guidelines were followed during the writing of this manuscript [(15)] (**Table S1**).

The KiESEL sample was drawn at random from the gross sample of KiGGS Wave 2, which in turn was selected based on official residency registries of 167 representative German cities and municipalities [(16)]. The KiESEL sample comprises a total of n = 1104 children aged 0.5–5 years [(14)]. For the present analyses, a subsample of n = 887 children aged 1–5 years was used after applying the following exclusion criteria: no or less than 3 days of food record completed (n = 96), age < 1 year (n = 118), or missing SES data (n = 3) (see **Figure S1**). Note that the sample also includes n = 62 children 6 years of age, accounted for by the time lag between recruitment and the commencement of data collection. For the purpose of analysis, these children were considered as 5-year-olds. Details on the KiESEL study design are reported elsewhere [(14, 16)].

The present analysis is based on SES categories determined within KiGGS Wave 2. Briefly, a multidimensional SES index was calculated, comprising the three equally weighted dimensions of parental education, occupational status, and net household income (equivalized disposable income). First, each dimension was assigned a score from 1 (low) to 7 (high) [(17)]. Next, an index was calculated from the sum of these individual values, resulting in SES scores ranging from 3 to 21. If educational and occupational status differed among a child's parents, the higher-scoring parent was considered. The so-derived metric SES index was segmented into three categories: low SES (1st quintile), medium SES (2nd to 4th quintile), and high SES (5th quintile), referring to the total KiGGS Wave 2 sample [(17)]. For details on the index, see Lampert et al. [(17)].

Food consumption was assessed using a parent-performed food record, completed on three consecutive days and a fourth day scheduled 2 to 16 weeks thereafter. During a home visit, trained nutritionists provided instructions on how to document food consumption, and distributed kitchen scales and a journal with pre-printed log pages for further assistance. By default, food quantities were determined by weighing. If unfeasible, e.g., in the context of out-of-home consumption, quantities were estimated based on package labels, household measures, or a KiESEL customized picture book. For child day-care facilities, a simplified food record was applied. Following data collection, food records were screened for ambiguities and if identified, parents were contacted for clarification [(14)].

The foods consumed were classified into food groups using a modified version of the food classification scheme applied in the German food-based dietary guidelines for children and adolescents, referred to as the Optimized Mixed Diet (OMD) recommendations [(18)], drawing on work by Spiegler et al. [(19)]. For instance, food groups were expanded to include foods intended for infants and young children (e.g., human milk and commercial complementary foods). Besides, the food groups eggs and fish were not considered separately, but together with the food group meat/sausages for reasons related to linear model assumptions (high proportion of non-consumers). For similar reasons, nuts were classified as fruit and not considered as a separate food group. For more detailed information on the food classification scheme, see **Table S2**. Dishes composed of several food groups (e.g., lasagna, curries, or stews) were generally broken down into their ingredients, which were then grouped as such. An exception was made for sweet foods and dishes (e.g., cake, sweet semolina pudding, or pancakes), bread, bread rolls, pasta, potato products, as well as commercial complementary foods, all of which were assigned as a whole.

Data for SES were collected in KiGGS Wave 2, while body weight and height were assessed during the KiESEL home visit. Energy intake was calculated by linking the protocol entries with the German Nutrient Database (*Bundeslebensmittelschlüssel*, BLS) version 3.02 [(20)] or the database LEBTAB [(21)], the latter being a food composition database explicitly including foods intended for infants and young children.

Studies suggesting a relationship between low SES and higher rates of under-reporting [(22, 23)] prompted an assessment of energy misreporting. This was conducted using the Goldberg cut-off method as updated by Black, in which the ratio of reported energy intake to estimated basal metabolic rate is compared to predetermined cut-off values (**Table S3**) [(24)]. To avoid unknown bias, under- and over-reporters were not excluded.

Statistical analyses were performed using SAS version 9.4 (SAS Institute, Inc., Cary, NC, USA). Descriptive measures include arithmetic mean, standard deviation, and 5th and 95th percentiles (hereafter P5 and P95, respectively). Regarding the sample characteristics, significant differences for metric data were identified if the 95 % CIs of arithmetic means did not overlap. For categorical characteristics, Chi-square tests ($\alpha = 0.05$) were performed.

Data on food consumption were derived from individual values, computed as the arithmetic mean of all food record days per child. Non-consumers were not excluded from the analysis. To investigate differences in food consumption between the SES categories, a two-step generalized linear model (GLM) adjusted for age and sex was used: In the first step, a linear model on food consumption as a function of age was performed. To avoid masking possible sex effects, as found in previous KiESEL analysis on food consumption [19, 25], this was conducted separately for boys and girls. In a second step, a Welch one-way analysis of variance (Welch ANOVA) was performed to compare the means of the residuals (i.e., the difference between actual and predicted consumed amounts by age and sex) derived in the previous step.

Assumptions of normality of residuals and homogeneity of variances/heteroscedasticity were checked for each food group through visual inspections using QQ plots and Levene's test, respectively. The two food groups 'unfavourable foods' and its subgroup 'sugar-sweetened beverages' (SSBs) failed to meet the assumption of homogeneity of variances, which led to the choice of Welch ANOVA.

To account for the small number of children in the low SES category compared to the other SES categories, bootstrapping techniques were applied to enhance the robustness and reliability of the statistical inferences made. Bootstrap samples (n = 1000) were drawn by unrestricted random sampling, with sample sizes matching the original sample. For bootstrap hypothesis testing involving *p*-values, a second, fictitious SES variable with randomly assigned values was added to the bootstrap dataset to model a scenario in which the null hypothesis (H0) holds, stating that the mean values of food consumption do not differ across the three SES categories. The test statistics, i.e., the Welch ANOVA F tests and post-hoc tests were then calculated for each bootstrap sample. Next, the proportion of bootstrap samples was computed for which the test statistic was greater than or equal to the statistic in the original sample in the direction of the alternative hypothesis (H1). This proportion is reported as the bootstrap *p*-value (hereafter referred to as p_{Boot}). Significant differences in food consumption between SES categories were identified if the p_{Boot} was below the significance level set at

$\alpha = 0.05$, based on four decimal places. Throughout all analyses, Bonferroni correction for multiple testing was applied to prevent α-error inflation in post-hoc testing.

Results

The characteristics of the KiESEL sample are shown in **Table 1**. 6.0 % of the children were assigned to the low, 60.3 % to the medium, and 33.7 % to the high SES category. No significant differences were found between the SES categories for the characteristics displayed in Table 1.

Daily food consumption stratified by SES and the respective Welch ANOVA statistics are depicted in **Table 2**. The descriptive statistics are derived from the original sample, while the Welch ANOVA statistics display age- and sex-adjusted bootstrap values.

Differences in food consumption among the SES groups were found for total fruit and its subgroup plain fruit, bread/cereals, fats/oils, and the group of unfavourable foods and its subgroups SSBs and confectionary/desserts. However, only for the food groups plain fruit, bread/cereals, unfavourable foods, and SSBs, post-hoc tests revealed differences for all between-group comparisons (i.e., low vs. high, medium vs. high, and low vs. medium SES).

Regarding the direction of differences detected as significant, consumption of the group of unfavourable foods (as a whole as well as its subgroups SSBs and confectionary/desserts) was higher in the group with the respective lower SES. Conversely, consumption of the remaining food groups (i.e., total fruit, plain fruit, bread/cereals, and fats/oils) was higher in the group with the respective higher SES.

Figure 1 displays differences in mean consumption between the high- and the low-SES group: Among children in the low-SES group, mean daily food consumption was 84 g lower for total fruit, 69 g lower for plain fruit, 22 g lower for bread/cereals, and 3 g lower for fats/oils compared to their peers with high SES. On the other hand, children in the low-SES category on average consumed 158 g more unfavourable foods per day (thereof 123 g more SSBs) compared to the children in the high-SES category. An analysis of mean consumption differences between the low- and high-SES groups by age group revealed no significant differences between 1–2- and 3–5-year-olds (**Figure S2**).

Discussion

This study identified more adverse diets in toddlers and preschoolers with lower compared to higher SES in Germany, particularly characterized by a higher consumption of unfavourable foods – first and foremost SSBs – and a lower consumption of fruit.

Previous KiESEL analyses have highlighted non-attainment of OMD recommendations, particularly characterised by an excess consumption of unfavourable foods [(19)]. The present analysis shows that the extent of this overconsumption is even greater in children of lower SES background.

Having a considerable amount of unfavourable foods in children's diets not only promotes weight gain, obesity, and non-communicable diseases but may also result in healthier food options being displaced from the diet [(26, 27)]. Unfavourable foods may furthermore increase vulnerability to micronutrient deficiencies by decreasing overall nutrient density. This is of particular importance for young children due to their high nutrient requirements in relation to body weight [(28)].

In KiESEL, SSBs accounted for a substantial proportion of the unfavourable foods [(19)]. A body of literature links SSB consumption to overweight/obesity and dental caries in children [(29)]. A US longitudinal study, for instance, found a dose-dependent positive association between SSB consumption and BMI z-scores in a birth cohort followed over the course of 17 years, even after controlling for SES, overall diet quality, and energy intake [(30)]. An inverse relationship between soft drink consumption and SES among children and adolescents in Germany has been shown in a previous cross-sectional study of 12–17-year-olds [(7)] and a longitudinal study of 0–17-year-olds [(31)]. Looking across Europe, an analysis of nationally representative data from 23 countries in the WHO European region (COSI 2015/2017) found low parental education and family-perceived wealth, both potential pointers to low(er) SES, to be associated with a higher frequency of SSB consumption in children aged 6–9 years [(32)]. The present finding of high SSB consumption among KiESEL children in families with low SES is particularly worrisome considering that low SES is already a risk factor for both obesity and poor oral health irrespective of SSB consumption [(33-35)]. This is attributable to aspects such as restricted access to engage in regular physical activity [(33)] and diminished parental health literacy [(36)]. Moreover, in KiESEL children, SSB consumption adds to an already high sugar intake from confectionary/desserts. As for oral health, findings from

KiGGS Wave 2 point towards a positive relationship between SES and the frequency of brushing one's teeth and attendance of dental check-ups [37].

Also consistent with the present findings, a pooled-analysis of COSI 2015/2017 data further identified European children aged 6–9 years with lower parental education and lower family-perceived wealth as being more likely to not eat fresh fruit every day than their higher-SES peers [32]. However, in a German nationally representative survey of 6–17-year-olds, a difference in fruit consumption by SES was found solely among boys [38].

In contrast, the present data do not support a link between SES and vegetable consumption as previously described for children aged 5 years and above in COSI 2015/2017 and the Feel4Diabetes study, another Pan-European project [32, 39]. Apart from the notion that children generally prefer fruits over vegetables [40], one reason may be that fruits, rather than vegetables, serve as substitutes for unhealthy snack foods. Further, parents with higher SES prefer to offer fruits over unhealthy snack foods to their child [41], which is in line with the present data on fruit and unfavourable food intake.

According to the Global Burden of Disease Study in 2021, diets low in fruit and high in SSBs each accounted for 43.8 and 3.61 million disability-adjusted life years worldwide as well as 1.680.000 and 75.700 premature deaths, respectively [42, 43]. This highlights the overall importance of SES-related differences in consumption of these food groups and the need to counteract these adverse consumption patterns early on.

The finding that children with lower SES in KiESEL had lower consumption of bread/cereals and fats/oils might be related to differences in breakfast habits, as both cereals and bread are typical 'breakfast foods' in children in Germany [44], with bread being commonly served with butter or margarine. Possible explanations may include a higher rate of breakfast skipping associated with lower SES, as previously reported for German school children [45], and SES-related differences in breakfast quality, as observed in European adolescents [46]. However, the extent to which these aspects play a role in the age group of toddlers and preschoolers remains to be investigated.

The dynamics between SES and food consumption are multifaceted with various explanatory approaches likely to interact: SES is positively linked to health literacy and health consciousness [47, 48], which translates into parents' ability to understand health- and nutrition-related information such as package labels and act in a health-promoting manner [39]. Besides, higher parental education has been associated with better adherence to dietary guidelines and recommendations [39], and health promotion initiatives tend to achieve greater effectiveness in adults with higher SES [49]. Drewnowski and Darmon noted that foods of lower nutritional value and lower-quality diets generally cost less per calorie than more nutritious foods and higher quality diets [50]. Thus, it is likely that limited financial resources restrict the ability of lower-SES households to afford healthy diets. Underlining this, a modelling study on food expenses by Hohoff et al. found the German social welfare allowance rate for food insufficient to cover food costs of toddlers and preschoolers except for 1–3-year-olds who are female and/or vegetarian [51]. When non-food reward options (e.g., leisure activities, sports club memberships, books) are difficult to afford, parents may further turn to unfavourable foods as a relatively cheap compensatory measure to treat their child [52]. Furthermore, SES was found to be inversely related to screen time in preschoolers [53]. With increased screen time comes increased exposure to child-targeted food marketing and advertising campaigns, which in the vast majority of cases promote foods high in fat, sugar, or salt [54]. In addition, there are studies from the US and Sweden pointing towards a higher density of advertisements for unfavourable food in low-income neighbourhoods [55, 56]. Moreover, emotional and psychological hardship due to socioeconomic disadvantage may increase parental prevalence of ‘comfort eating’ to ease distress. Such coping mechanisms may eventually translate into unhealthy child feeding practices [57]. Lastly, with breastfeeding being linked to healthier diets in toddlers and preschoolers, possibly facilitated by early-on accustoming to a range of flavours through breast milk [58, 59], and breastfeeding rate and duration in Germany being higher with increasing SES [60], some of the differences may be attributable to differences in breastfeeding.

The key strength of this study is the high level of data accuracy provided through the application of weighed food records. Another strength is that the multidimensionality of SES is accounted for, as the SES categories used in this analysis capture not only parental education but also income and occupation. The small number of children in the low-SES group and the slightly differing age distribution between the SES groups do principally pose limitations, yet these were vastly attenuated by the statistical methodology. Although a weighting factor exists for the total KiESEL sample [19, 25], its use in the present analysis was contraindicated. Since the weighting factor incorporates SES dimensions, its application may introduce bias into analyses of SES-related differences. Furthermore, the statistical analyses conducted are primarily inferential. To control for age and sex differences within the SES groups, residuals were calculated and used in the model. Despite the attempts to improve generalizability, further studies are required to confirm the present results.

With regard to the dietary assessment method applied, weighed food records involve a considerable amount of effort on the part of respondents, possibly leading to changes in

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dietary behaviour [61], and they may be biased by social desirability [62]. Multiple testing was corrected for the SES comparisons but not for the number of food groups due to the lack of independence of food groups as well as the explorative nature of this study.

Even among the youngest, there is indication of a social gradient in diet: lower SES in children aged 1–5 years in Germany is linked to a lower diet quality, particularly characterized by high consumption of SSBs and low consumption of fruit. In view of the substantial repercussions of early-life diet on food preferences and lifelong risk of lifestyle-related diseases, the particularly high unfavourable food consumption observed among children with low SES ought to be addressed before adverse trajectories become entrenched. Considering the many ways in which a low SES may compromise healthy eating, a comprehensive set of structural prevention measures (e.g., taxation of SSBs and sugary foods, tax incentives to promote the purchase of fruit and vegetables, free provision of drinking water at day-care centres and schools, restrictions on advertisements of unfavourable foods, breastfeeding promotion [63]) is necessary. Further, engagement from various stakeholders is needed to effectively reach families affected by low SES. Given the high day-care attendance rates in Germany – over one-third of children under 3 years of age and more than 90 % of those aged 3 to 6 years [64] – mandatory preventive measures in day-care settings should be implemented to systematically improve diet quality for the majority of children. Lastly, more research is needed to determine the most effective strategies for improving diet quality of children, particularly those coming from socially disadvantaged families. Future research should also address how measures can be integrated into support systems commonly accessed by these families, such as early childhood support programs, routine paediatric health check-ups, or food banks.

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Authors' contribution to the manuscript

LB: Writing – original draft, Conceptualization, Methodology, Formal Analysis; CS: Writing – review & editing, Conceptualization, Methodology, Formal Analysis; MD: Writing –

review & editing, Methodology, Formal Analysis; AS, TH: Writing – review & editing, Conceptualization, Methodology, Project administration; SJ, A-KB, RE: Writing – review & editing; SSgB: Writing – review & editing, Conceptualization, Methodology, Supervision

Data availability

Data described in the manuscript (in aggregated form), code book, and analytic code will be made available upon request pending application and approval. Requests to access these datasets should be directed to Thorsten Heuer, thorsten.heuer@mri.bund.de.

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Declaration of Interests

The authors declare none.

Use of AI tools

During the preparation of this work, the authors used ChatGPT-4-Turbo (OpenAI, www.chatgpt.com) and DeepL (DeepL SE, www.deepl.com) in order to support the development of code for data analysis and to assist with English language refinement, particularly given the authors' non-native speaker status. After using these services, the authors reviewed and edited the content as needed and take full responsibility for all aspects of the publication.

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Table 1 Characteristics of KiESEL children (n = 887) aged 1–5 years stratified by SES

	Low SES (n = 53)	**Medium SES (n = 535)**	**High SES (n = 299)**
Sex (n, %)			
Male	27 (50.9)	262 (49.0)	163 (54.5)
Female	26 (49.1)	273 (51.0)	136 (45.5)
Age group (n, %)[1]			
1–2 years of age	19 (35.8)	205 (38.3)	130 (43.5)
3–5 years of age	34 (64.2)	330 (61.7)	169 (56.5)
Anthropometric measurements (mean ± SD)			
Body weight (kg)	15.9 ± 4.5	16.0 ± 4.5	15.7 ± 4.1
Body height (cm)	98.5 ± 13.6	99.3 ± 14.1	98.4 ± 13.8
BMI (kg/m^2)	16.2 ± 1.9	16.0 ± 1.5	16.0 ± 1.3
Dietary characteristics			
Food consumption (g/day, mean ± SD)	1413 ± 484	1448 ± 382	1417 ± 378
Energy intake (MJ/day, mean ± SD)	4.8 ± 1.3	4.8 ± 1.2	4.9 ± 1.2
Misreporting (n, %)			
Over-reporting	1 (1.9)	7 (1.3)	7 (2.3)
Under-reporting	3 (5.7)	25 (4.7)	8 (2.7)

Note that all age specifications refer to completed years of life, e.g., the age group ‘1–2 years’ refers to children aged 1.0 to 2.9 years. KiESEL, Children’s Nutrition Survey to Record Food Consumption; SD, standard deviation; SES, socioeconomic status

[1] Incl. 62 children 6 years of age

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Table 2 Daily food consumption in KiESEL children (n = 887) 1–5 years of age stratified by SES *(original sample descriptive statistics and age and sex adjusted bootstrap Welch ANOVA test statistics)*

	Low SES (n = 53)			**Medium SES (n = 535)**			**High SES (n = 299)**			**Welch-ANOVA**	
Food group (g/day)	**Mean**	**SD**	**P5, P95**	**Mean**	**SD**	**P5, P95**	**Mean**	**SD**	**P5, P95**	p_{Boot}	**Post-hoc p_{Boot} low – high, low – medium, medium – high**[1]
Beverages	426	373	50, 989	489	301	99, 1085	477	272	146, 1030	0.50	0.86 0.65 >0.99
Vegetables incl. legumes	68	64	8, 220	74	55	11, 186	77	49	13, 173	0.45	>0.99 >0.99 0.96
Total fruit	154	117	0, 342	216	147	33, 491	238	134	51, 505	**<0.001**	**<0.001** **<0.001** 0.07
Plain fruit	88	65	0, 208	133	91	18, 314	157	100	22, 345	**<0.001**	**<0.001** **<0.001** **0.009**

Fruit juices and smoothies	65	97	0, 300	82	120	0, 306	79	95	0, 289	0.45	0.77 0.67 >0.99
Potatoes, pasta, and rice	85	47	27, 185	79	47	18, 166	85	49	20, 180	0.15	>0.99 0.97 0.17
Bread and cereals	64	35	12, 135	79	51	20, 153	86	40	27, 156	**<0.001**	**<0.001** **0.006** **0.04**
Milk and milk products	198	167	7, 518	179	155	8, 476	198	160	18, 526	0.32	>0.99 >0.99 0.49
Meat, sausages, eggs, and fish	61	39	8, 146	60	38	8, 134	59	36	7, 122	0.99	>0.99 >0.99 >0.99
Meat and sausages	45	34	0, 118	45	32	2, 109	41	31	2, 103	0.28	>0.99 >0.99 0.32
Fats and oils	7	5	0, 15	9	7	1, 21	9	7	1, 21	**0.002**	**0.003** **<0.001** >0.99
Unfavourable	319	263	29, 829	238	204	45, 628	161	106	19, 365	**<0.001**	**<0.001**

foods											**0.05** **<0.001**
Sugar-sweetened beverages	151	203	0, 533	80	168	0, 365	28	60	0, 163	**<0.001**	**<0.001** **0.03** **<0.001**
Confectionary and desserts	87	67	0, 149	88	61	2, 144	81	56	0, 131	**<0.001**	0.32 >0.99 **<0.001**

Note: Significance was determined based on *p*-values rounded to four decimal places. As only selected subgroups are presented, the sum of subgroups does not necessarily correspond to the amount of the superordinate group.

The bootstrap confidence interval of the differences in means displayed in Figure 1 and the bootstrap *p*-values slightly differ in terms of the interpretation to be derived. This is due to the different methodological approaches required for bootstrapping.

KiESEL, Children's Nutrition Survey to Record Food Consumption; SD, standard deviation; P, percentile; SES, socioeconomic status

[1] Bonferroni corrected

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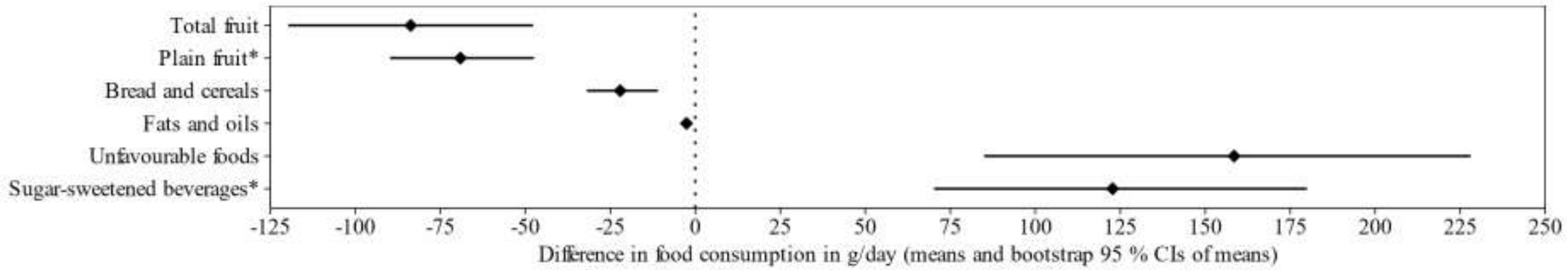

Note that subgroups are marked with an asterisk (*).

Figure 1 Differences in food consumption of 1–5-year-old children with low (n = 53) compared to high (n = 299) socioeconomic status (displaying difference of original mean values with bootstrap 95 % confidence intervals, positive differences indicate a higher consumption in the low-SES group, while negative differences indicate a higher consumption in the high-SES group). Differences are considered significant if the CIs of the means do not overlap with the null line.