

Exposure to sweeteners through soft drinks in Germany among 0.5 to <6-year-old children

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Background

The National Reduction and Innovation Strategy for Sugar, Fats and Salt in Processed Foods aims to achieve a balanced energy intake and improved nutrient supply for the German population. Reducing the use of sugar in processed products could lead to increased use of low-calorie sweeteners, for example in soft drinks. Low-calorie sweeteners are food additives whose use is regulated. The maximum permitted levels for individual sweeteners are intended to ensure that the Acceptable Daily Intake (ADI) set at European level is adhered to. There are soft drinks on the German market (energy-reduced or sugar-free) that use not only different sweeteners individually, but also in combination.

Methods

Representative data on soft drink consumption are available from the BfR Children's Nutrition Survey to Record Food Consumption (KIESEL). The food consumption of 1008 children in Germany aged between 0.5 and 5 years was recorded on a total of 4 days using a weighing/estimation protocol. Partially breastfed children were excluded from the analysis. The individual amounts of soft drinks consumed were summed and the mean value calculated over all the days of the protocol. The soft drinks included were cola, lemonade, iced tea, isotonic drinks and fruit juice drinks. As part of an extension of the "food additives" module of the BfR MEAL study, the sweetener content of market-relevant soft drinks was determined. Contrary to the normal approach in total diet studies, the analysis was carried out at the level of individual products and not as a pool sample. The sweeteners acesulfame K, aspartame, cyclamate, saccharin, sucralose and steviol glycosides were detected and the levels analysed using the lower-bound approach.

Consumption of soft drinks

Table 1: Consumption of soft drinks in g per day, broken down by age group and gender. Confidence intervals have been calculated by non-parametric bootstrap.

Group	N	Mean (CI-95%)	Median (CI-95%)	P95 (CI-95%)
All	363	122 (108 - 136)	84 (67 - 100)	398 (288 - 506)
0.5 - <1 y	2	73	83	98
1 - <2 y	23	93 (72 - 116)	100 (58 - 118)	211 (118 - 233)
2 - <3 y	47	144 (99 - 197)	94 (75 - 123)	402 (233 - 888)
3 - <6 y	291	122 (107 - 138)	82 (67 - 100)	398 (291 - 516)
Male	201	127 (110 - 146)	94 (75 - 100)	398 (258 - 516)
Female	162	117 (96 - 143)	65 (50 - 100)	377 (233 - 531)

Soft drink consumption is present in all age groups analysed. Children aged 3 to <6 years drink an average of 122 g/day. The confidence interval lies between 107 and 138 g/day. The P95 consumption for this age group is 398 g/day (CI-95%: 291 - 516 g/day). In relation to the total amount of drinks consumed per day, soft drinks account for 17% (girls) and 18% (boys). The calculation of the total amount of beverages consumed and the proportion of soft drinks is based on the main MEAL groups (Kolbaum et al., 20-22).

Presence of sweeteners in soft drinks

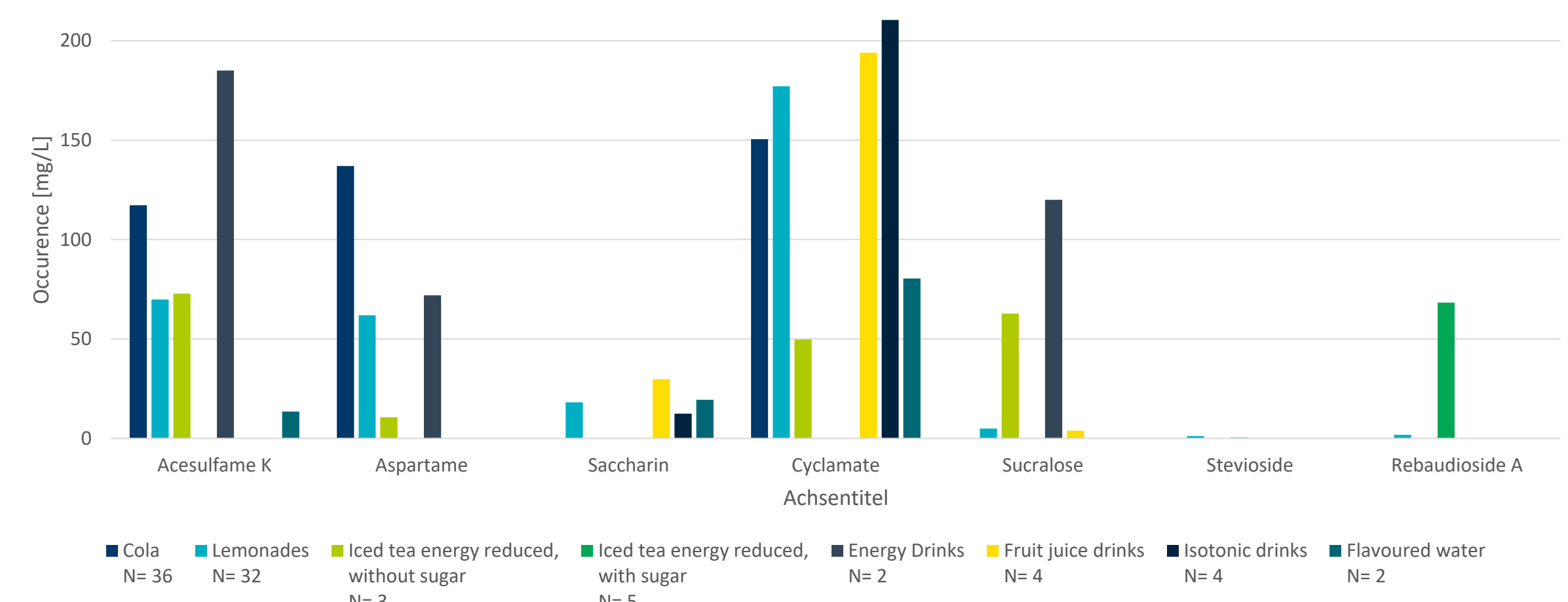


Figure 1: Levels (MW) of sweeteners in mg/L differentiated by soft drink group, N= number of analysed soft drinks per group. Only sweeteners for which concentrations above the limit of quantification (LOQ) were measured in the corresponding group are listed.

32 soft drinks were analysed, with the highest number of different sweeteners being 7. Lemonades showed the most different sweeteners. In 1 lemonade sample 5 different sweeteners were measured. The most common combination was 3-4 sweeteners per drink sample (data not shown). Cyclamate had the highest concentration among the sweeteners analysed in both soft drinks (MW 177 mg/L) and cola (MW 150 mg/L).

Children's exposure to sweeteners in soft drinks

Table 2: Exposure of children aged 0.5 - < 6 years to different sweeteners, assuming that 100% of the beverages consumed contain the average sweetener content from the BfR MEAL study.

Sweetener	N	P50 exposure (CI-95%) [$\mu\text{g} / (\text{kg d})$]	P95 exposure (CI-95%) [$\mu\text{g} / (\text{kg d})$]
Acesulfame K	180	291 (253 - 348)	1501 (1105 - 1629)
Aspartame	180	257 (207 - 301)	1326 (1163 - 1757)
Cyclamate	363	910 (791 - 1046)	3818 (3179 - 4124)
Saccharin	362	106 (92 - 116)	459 (362 - 613)
Sucralose	341	20 (16 - 22)	105 (81 - 206)
Steviolglycosides (Rebaudioside A and stevioside)	154	11 (9 - 13)	43 (28 - 64)

For calculating exposure it was assumed that all beverages consumed contained the levels shown in Figure 1. The highest median exposure is to cyclamate with an exposure of 910 $\mu\text{g}/(\text{kg d})$. This is followed by acesulfame K and aspartame with 291 $\mu\text{g}/(\text{kg d})$ and 257 $\mu\text{g}/(\text{kg d})$ respectively. Lower median values were found for saccharin (106 $\mu\text{g}/(\text{kg d})$) and sucralose (20 $\mu\text{g}/(\text{kg d})$). The steviol glycosides rebaudioside A and stevioside show a lower median exposure of 11 $\mu\text{g}/(\text{kg d})$. Furthermore, in a very conservative scenario, it was assumed that all soft drinks contain levels equal to the respective maximum levels for sweeteners (data not shown). In this scenario, the exposure is 2-20 times higher than the results in Table 2.

Conclusions

Children aged 0.5 - < 6 years consume soft drinks. Consumption accounts for 17-18% of total beverage consumption. Seven different sweeteners have been found in soft drinks. Simultaneous exposure to multiple sweeteners contained in the same drink could be demonstrated. Exposure to cyclamate is the highest compared to other sweeteners. Taking into account current consumption data from the KIESEL study and assuming average values from the BfR MEAL study, the ADI of the individual sweeteners analysed is not exceeded. When evaluating the individual sweeteners, the exposure estimate does not indicate an increased health risk for children aged 0.5 - < 6 years. However, other sources contribute to the intake of low-calorie sweeteners, which are not considered in this assessment.

References

Kolbaum A. E., Jaeger A., Ptok S., Sarvan I., Greiner M., Lindtner O. (2022). Collection of occurrence data in foods - The value of the BfR MEAL study in addition to the national monitoring for dietary exposure assessment. *Food Chem X* 13: 100240.