

Research Article

Interim Evaluation of Germany's Sugar Reduction Strategy for Soft Drinks: Commitments versus Actual Trends in Sugar Content and Sugar Sales from Soft Drinks

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1 **Abstract**

2

3 **Introduction:** A high intake of sugar, in particular from sugar-sweetened soft drinks, increases the
4 risk for obesity, type 2 diabetes mellitus and dental caries. Germany has pursued a national strategy
5 for sugar reduction in soft drinks based on voluntary commitments by industry since 2015, but its
6 effects are unclear.

7

8 **Methods:** We use aggregated annual sales data from Euromonitor International to assess trends in
9 mean sales-weighted sugar content of soft drinks and per capita sugar sales from soft drinks in
10 Germany from 2015-2021. We compare these trends to the reduction path set by Germany's
11 national sugar reduction strategy, and to data for the United Kingdom, which adopted a soft drinks
12 tax in 2017 and which we selected as best practice comparison country based on pre-defined criteria.

13

14 **Results:** Between 2015-2021, the mean sales-weighted sugar content of soft drinks sold in Germany
15 decreased by 2% from 5.3 to 5.2 g/100ml, falling short of an interim 9% reduction target and a 29%
16 reduction observed in the United Kingdom over the same period. Sugar sales from soft drinks in
17 Germany decreased from 22.4 to 21.6 g/capita/day (-4%) between 2015-2021, but remain high from
18 a public health perspective.

19

20 **Conclusions:** Reductions observed under Germany's sugar reduction strategy fall short of stated
21 targets and trends observed internationally under best practice conditions. Additional policy
22 measures may be needed to support sugar reduction in soft drinks in Germany.

23 Introduction

24

25 An increasing body of evidence links excess consumption of free sugars with a number of adverse
26 health outcomes [1, 2]. Sugar intake from beverages is of particular concern [2]. Evidence from
27 randomized controlled trials and observational studies shows that sugar-sweetened beverages can
28 contribute to weight gain and an increased risk for overweight and obesity [3-5], while observational
29 studies show positive associations with an increased risk for diabetes mellitus type 2, dental caries,
30 and overall mortality [6-8]. Sugar-sweetened soft drinks are therefore considered an important
31 driver of the global epidemic of obesity, type 2 diabetes mellitus, and other chronic diet-related
32 diseases [9, 10].

33

34 The World Health Organization (WHO) therefore recommends to limit intake of free sugars among
35 adults and children to no more than 10% of total energy intake, noting that additional health benefits
36 may be achieved by limiting it to no more than 5% [2]. Similarly, the European Food Safety Authority
37 (EFSA) concludes that due to the observed health risks, no safe upper level of intake can be set for
38 added and free sugars, and that intake should be as low as possible in the context of a nutritionally
39 adequate diet [11]. The German guidelines on sugar intake follow the WHO in recommending to limit
40 intake of free sugars to less than 10% of total energy intake, or approximately 50 g/day for an
41 average adult with a total energy intake of 2000 kcal/day [12]. Current sugar intake levels in
42 Germany are estimated to range from 13% to 19% of total energy intake, depending on gender and
43 age [12].

44

45 Sugar reduction in soft drinks is also a declared policy objective of the German government. As its
46 landmark nutrition policy act, it announced in 2015 a National Strategy for the Reduction of Sugar,
47 Fat and Salt in Processed Foods [13]. In the subsequent years, specific reduction targets were defined
48 through formal agreements between the government and food industry groups, including a
49 commitment to reduce the average sugar content of soft drinks sold in Germany by 15% between
50 2015 and 2025 [14-16]. In 2022, the newly elected German government announced that if the prior
51 approach based on voluntary commitments by the food industry proved insufficient, additional
52 measures (including a tax on sugar-sweetened beverages) would be considered as part of a new
53 national nutrition strategy to be developed until the end of 2023 [17, 18].

54

55 Against this backdrop, the present paper evaluates Germany's current sugar reduction strategy for
56 soft drinks by assessing trends in mean sales-weighted sugar content of soft drinks and per capita

57 sugar sales from soft drinks from 2011-2021. We compare these trends with the reduction path set
58 by Germany's national sugar reduction strategy, and with data for the United Kingdom (UK), which
59 adopted a soft drinks tax in line with international recommendations in 2017, and which we selected
60 as best practice comparison country based on pre-defined criteria.

61 **Methods**

62

63 ***Study design and setting***

64 This is a policy evaluation based on a repeat cross-sectional analysis of aggregated annual sales and
65 ingredient data provided by Euromonitor International, a market research company. The evaluation
66 is based on three comparisons: actual trends versus reduction targets; actual trends in Germany
67 versus trends in the UK; and actual trends before and after Germany's sugar reduction strategy was
68 announced. We chose the UK as international best practice comparison country based on the
69 following pre-defined criteria: geographical proximity and similarity in market size to Germany; and
70 implementation of a soft drinks tax aligned with WHO recommendations (including the use of a
71 tiered tax design to incentivize reformulation) [19]. A detailed description of our methodological
72 approach, including the steps taken to select the comparison country, is provided in the
73 supplementary material. Our study follows the STROBE reporting guideline [20].

74

75 ***Variables***

76 We assess the mean sales-weighted sugar content of soft drinks, the mean amount of sugar sold
77 through soft drinks per capita per day, and mean soft drinks sales per capita and day. In line with
78 common usage, we define soft drinks as non-alcoholic, non-dairy beverages with added sweeteners
79 (including sugar and other caloric sweeteners, as well as high-intensity, non-nutritive sweeteners
80 such as aspartame) [21]. Our definition of soft drinks therefore includes varieties with sugar as well
81 as sugar- and calorie-free varieties sweetened with non-nutritive sweeteners. Sugar is defined in line
82 with the WHO definition of free sugars [2].

83

84 ***Data sources and methods of assessment***

85 We use data from the Euromonitor Passport database collected and provided by Euromonitor
86 International. Euromonitor provides sales and ingredient data based on primary and secondary data
87 sources, including company reports, official statistics, store audits, product information (such as
88 ingredient and nutrient declarations), interviews with companies, and estimates by in-house experts
89 [22]. The Euromonitor Passport database is considered to be one of the most comprehensive and
90 reliable sources for such data, and has been used extensively in public health research, including

91 studies on soft drinks sales and composition [23-25]. For soft drinks, the database covers both off-
92 trade sales (i.e., sales through retail outlets) and on-trade sales (i.e., through hospitality and catering
93 outlets). Euromonitor uses an internationally standardised methodology, which allows for
94 comparisons between countries and over time [22].

95

96 We obtained sales and ingredient data for all beverage categories meeting our definition of soft
97 drinks, i.e. carbonates (including cola carbonates, lemonade and lime, ginger ale, tonic water and
98 other bitters, orange carbonates, and other non-cola carbonates), juice drinks (with up to 24% juice),
99 nectars (with more than 24% but less than 100% fruit), flavoured bottled water, functional bottled
100 water, energy drinks, sports drinks, and ready-to-drink tea. We included powder and liquid
101 concentrates in our calculation of per capita sugar sales from soft drinks, but not in the calculation of
102 the mean sales-weighted sugar content and per capita soft drink sales. We aggregated data for the
103 beverage and ingredient categories included in our definition of soft drinks and free sugars,
104 respectively, as listed in the supplementary material. For information on Germany's sugar reduction
105 strategy, we used official government publications [13, 26, 15, 16].

106

107 ***Analysis***

108 We descriptively plot the annual mean sales-weighted sugar content of soft drinks and per capita
109 sugar sales from soft drink sales from 2011 to 2021. To compare this trend to the targets of
110 Germany's national sugar reduction strategy, we calculated a linear reduction path based on the
111 observed value for the strategy's baseline year (2015) and the relative reduction target set by the
112 strategy for 2025. (The strategy does not define interim targets, but emphasizes that its reduction
113 targets will be achieved stepwise and gradually, justifying the assumption of a linear reduction path
114 [14, 15].) We then compare outcome trends in Germany to those over the same period in the UK.
115 Finally, we compare outcome trends in Germany before and after 2015. For this last comparison, we
116 calculate the compound annual reduction rate in the mean sales-weighted sugar content of soft
117 drinks in Germany for 2011-2015 and 2015-2021 respectively.

118

119 We use 2015 as the baseline for our analysis, as this is the baseline year to which the sugar reduction
120 targets, as stated in government and industry publications, refer [14, 15]. 2015 is also the year in
121 which the sugar reduction strategy was first publicly announced, even though the specific reduction
122 targets for soft drinks were published only in 2019 (according to industry sources, the earlier baseline
123 year of 2015 was chosen to account for sugar reductions achieved in the preceding years, i.e.
124 between the first announcement of the strategy in 2015 and the publication on the 15% reduction
125 target in 2019) [14]. We also report data for 2011-2014 to allow for a comparison of trends before

126 and after the strategy's baseline year. We chose 2011-2021 as the overall time frame of our analysis
127 as this was the time span for which comparable data was available from Euromonitor when we
128 conducted our analyses.

129

130 ***Study registration and protocol availability***

131 A protocol for this study was developed and prospectively registered with the Open Science
132 Framework (registration DOI 10.17605/OSF.IO/3WJ49) before data was analysed [27]. Differences
133 between protocol and manuscript are explained in the supplementary material.

134 **Results**

135

136 ***Trends in sugar content of soft drinks in Germany***

137 The mean sales-weighted sugar content of soft drinks sold in Germany decreased between 2011-
138 2021 (from 5.4 g/100ml to 5.2 g/100ml, -3%), as did mean per capita sugar sales from soft drinks
139 (from 24 g/capita/day to 22 g/capita/day, -10%) and mean soft drinks sales per capita (from 428
140 ml/capita/day to 389 ml/capita/day, -9%) (see Table 1 and Fig. 1-3).

141

142 ***Comparison of actual trends in Germany with reduction targets and with trends in the UK***

143 During the time period covered by Germany's national sugar reduction strategy for which data were
144 available (2015-2021), the mean sales weighted sugar-content of soft drinks sold in Germany
145 decreased by 2% (from 5.3 g/100ml to 5.2 g/100ml). This contrasts with a 9% interim reduction
146 target for the same time period implied by the sugar reduction strategy, as well as with a 29%
147 reduction (from 5.3 g/100ml in 2015 to 3.8 g/100ml in 2021) observed in the United Kingdom (see
148 Fig. 1). Sugar sales from soft drinks decreased in the UK in this time period from 21 g/capita/day in
149 2015 to 15 g/capita/day in 2021 (-28%), while total soft drink sales increased slightly from 288 to 290
150 ml/capita/day (+1%) (see Table 1).

151

152 ***Comparison of pre- and post-pledge trends***

153 The compound annual reduction rate of the mean sales-weighted sugar content of soft drinks in
154 Germany during the four years prior to the baseline of the sugar reduction strategy (2011-2015) was
155 0.2%, and increased slightly to 0.4% during the years covered by the strategy for which data were
156 available (2015-2021).

157 **Discussion**

158

159 ***Key findings and public health implications***

160 During the time period covered by Germany's current national sugar reduction strategy for which
161 data were available (2015-2021), the mean sales-weighted sugar content of soft drinks sold in
162 Germany decreased only slightly by 2%, which falls short of an interim 9% reduction target, as well as
163 of the 29% reduction achieved in the UK during the same time period. At the current pace, Germany
164 is therefore not on track for meeting the 15% reduction target it has set itself for 2025, which is
165 modest compared to the reductions achieved in the UK to date. The average annual reduction rate
166 increased slightly after the strategy was announced in 2015, from 0.2% per year in 2011-2015 to
167 0.4% per year in 2015-2021.

168
169 Per capita sugar sales from soft drinks in Germany decreased by 4% since the national sugar
170 reduction strategy was first announced in 2015, but still stood at 22 g/day/capita in 2021. For an
171 average adult with a daily energy requirement of 2000 kcal/day this corresponds to almost half the
172 recommended maximum intake of free sugars (10% of total energy intake, or 50 g/day) [2, 12].
173 Dietary surveys show that soft drink intake is highly unevenly distributed in the population, with
174 children, teenagers and young adults consuming two to three times more than older adults, and low
175 socioeconomic status groups consuming more than high socioeconomic status groups [28, 29]. This
176 suggests that young people and socioeconomically disadvantaged groups in Germany may exceed
177 the recommended maximum intake of free sugars through their soft drink intake alone. This
178 underlines the importance of reducing sugar intake from soft drinks.

179
180 Soft drinks sales per capita in Germany decreased during that same time period by 3.6% (from 404
181 ml/capita/day in 2015 to 389 ml/capita/day in 2021), but remain higher than recommended (due to
182 their demonstrated adverse health effects, dietary guidelines generally do not define a safe upper
183 limit for soft drinks, but recommend to avoid or limit their intake [30, 31]). Soft drink sales per capita
184 slightly increased in the UK (from 288 ml/capita/day in 2015 to 290 ml/capita/day in 2021, +0.7%),
185 suggesting that substantial sugar reductions do not necessarily result in lower total sales of soft
186 drinks.

187

188 ***Strengths and limitations***

189 To the best of our knowledge, our study is the most comprehensive assessment to date of recent
190 trends in sugar content, sales, and sugar sales from soft drinks in Germany. The only publicly
191 available recent assessments we are aware of were limited to comparisons between single years
192 (2016 and 2018, and 2018 and 2019 respectively), did not cover soft drink sales in the hospitality
193 sector, were based on non-representative samples, and were not sales-weighted [32-34]. The

194 Euromonitor Passport Database used for our analysis provides a comprehensive market coverage
195 and is based on a standardised methodology, which allows for comparisons between countries and
196 across time [22]. Our analysis is based on sales and ingredient data, which are, unlike self-reported
197 dietary survey data, not prone to recall and social desirability bias. Finally, we defined key aspects of
198 our methodology in an a priori protocol developed and published before data were analysed [27].
199

200 Our study also has a number of limitations. While sales figures can be considered reasonable proxies
201 for consumption, and may be more reliable than self-reported dietary intake data, they do not
202 account for food waste of the final consumer (i.e. drinks left over or discarded by consumers).
203 Besides, we did not include liquid and powder concentrates (which are diluted by the final consumer
204 before consumption) in our estimates for soft drink sales volumes and mean sugar content, as
205 dilution ratios may vary. We calculated sugar content based on the use of various types of added
206 sugars as ingredient, but were unable to account for the sugar content of fruit juices used as
207 ingredient in some types of soft drinks (such as nectars). Due to data limitations, we were also unable
208 to differentiate between regular and low-calorie soft drinks, and we did not assess trends in the use
209 of high-intensity sweeteners. We were also unable to assess trends for sub-populations (such as
210 children), as our data represents population-wide averages. Moreover, while Euromonitor is
211 generally considered a reliable source of sales and ingredient data, its data are partially based on
212 estimates by its technical and industry experts, and reported outcomes may therefore be different
213 from the true values [22]. Due to data limitations we were unable to quantify this uncertainty.
214 Finally, our analysis is descriptive, and we did not attempt to establish causal relationships between
215 the observed trends and factors that may have influenced them. In particular, reductions seen in
216 average sugar sales from soft drinks in Germany between 2015 and 2021 may reflect secular trends,
217 rather than effects of the sugar reduction strategy. Of note, dietary survey data from the DONALD
218 study suggests that among children and adolescents in Germany sugar intake from soft drinks
219 decreased between 1985 and 2016 [35].
220

221 ***Comparisons with other studies***

222 Data on the sugar content of soft drinks, and sugar sales from soft drinks in Germany is limited.
223 Following a mandate by Germany's Federal Ministry of Food and Agriculture (BMEL), the Federal
224 Research Institute for Nutrition and Food (Max-Rubner-Institut, or MRI) published two reports on the
225 sugar content of soft drinks on the German market in 2018 and 2020 [34, 36]. The second and more
226 comprehensive of these reports, published as an updated version in June 2020, reports data for two
227 main beverage categories: soft drinks ("Erfrischungsgetränke" in German) as well as sugar-
228 sweetened beverages ("gesüßte Erfrischungsgetränke" in German, including soft drinks with caloric

229 sweeteners, but excluding soft drinks sweetened exclusively with non-nutritive sweeteners) [36].
230 Data for specific sub-categories (such as lemonades) are also reported. Data collection covered
231 beverages sold through retail outlets, and followed a stepwise process including online research on
232 manufacturers' websites, enquiries with manufacturers as well as on-site research in grocery stores.
233 Results are not weighted by sales, but for the follow-up assessment in 2019, data on the mean sugar
234 content are presented separately for the full range of products included in the analysis, and for top-
235 selling products identified through household panel data from the market research company GfK. For
236 the full range of soft drinks, the median sugar content is reported as 6.2 g/100 ml in 2018, and 6.0
237 g/100 ml in 2019, a relative decrease of 3.2% [36]. For sugar-sweetened beverages, the median sugar
238 content of the full product range is reported as 6.5 g/100 ml in 2018, and 6.2 g/100 ml in 2019, a
239 relative decrease of 4.6% [36]. For top-selling products, the median sugar content for sugar-
240 sweetened beverages is reported as 5.9 g/100 ml in 2019. In our analysis, we found the average
241 sales-weighted sugar content of soft drinks to be 5.25 g/100 ml in 2018 and 5.23 g/100 ml in 2019, a
242 relative decrease of 0.20%. Our figures therefore show a lower absolute level of sugar content for
243 both years, and a smaller relative decrease between the two years. These differences may be
244 explained by the fact that our figures are weighted by sales, include the hospitality sector, and are
245 based on a slightly different definition of soft drinks (the MRI data set did not include nectars) and on
246 a different data source (Euromonitor data vs. the MRI's own sample of beverages). A comparison of
247 our results with further studies (including studies from the UK) is provided in the supplementary
248 material.

249 ***Policy Implications***

250 So far, the approach pursued by the German government to reduce sugar intake from soft drinks and
251 average sugar content of soft drinks sold in Germany has not fully achieved its stated objectives. This
252 suggests that additional policy measures may be needed. In 2020, the Scientific Advisory Council at
253 Germany's Federal Ministry of Food and Agriculture (WBAE) proposed a number of measures to
254 reduce the adverse health effects of soft drink consumption in Germany, including a levy on sugar-
255 sweetened beverages proportional to their content of free sugars [37]. Besides its intended effects
256 on sales and consumption of sugar, this could generate revenue of 1.0 to 1.9 billion € annually, which
257 could be used to partially fund a value added tax exemption for healthy foods including fruit and
258 vegetables [37]. This proposal has received renewed attention in light of recent increases in the price
259 of staple foods, as well as due to its potential environmental co-benefits [38]. Similar to the Sugary
260 Drinks Industry Levy in the UK, revenue could also be used to fund free, healthy school meals [37].
261 Further measures recommended by the WBAE include improvements to the availability of healthy
262 beverages in schools, kindergartens, hospitals and other public settings, and an action plan for the
263 promotion of drinking water (including a mandate that free drinking water must be available for

264 consumption in all foodservice establishments) [37]. These recommendations are in line with a
265 report of Germany's national nutrition research institute (the Max-Rubner-Institute), which
266 concluded in 2016 that regulatory and fiscal measures should be considered if the industry's
267 voluntary reformulation commitments proved insufficiently effective [39]. Additional measures
268 recommended by the institute include improved nutrition labelling and the regulation of marketing
269 of food with a high content of sugar [39]. In light of the findings of the present study, and the well-
270 established adverse health effects of sugar-sweetened soft drinks, these measures should be
271 considered as part of the new national nutrition strategy announced for 2023 [18].

272

273 **Statements**

274

275 **Acknowledgements**

276 We thank Mirela Kadic from Euromonitor International for her advice on using the Passport
277 database, from which we extracted the data for this study.

278

279 **Statement of Ethics**

280 No human subjects were involved in this research and no ethical clearance was required according to
281 the regulations of the Ethics Committee of Ludwig-Maximilians-Universität München (LMU Munich).

282

283 **Conflict of Interest Statement**

284 PVP has received research funding from Germany's Federal Ministries of Food and Agriculture
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289 Society (DDG) and the German Obesity Society (DAG), and has previously been an employee of
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298

299 **Author Contributions**

300 Conceptualization: PvP, OH, AL, DR, JB, KEF, SP, ML and ER; Methodology: PvP, OH, AL, DR, JB, KEF,
301 SP, ML and ER; Data Curation: PvP and AL; Formal Analysis: PvP and AL; Validation: AL; Writing –
302 Original Draft: PvP; Writing – Review and Editing: PvP, OH, AL, DR, AL, JB, KEF, SP, ML and ER; Funding
303 Acquisition: OH and PvP.

304

305 **Study registration and protocol availability**

306 This study is based on a protocol developed and prospectively registered through the Open Science
307 Framework (registration DOI 10.17605/OSF.IO/3WJ49) before data was analysed [27]. Differences
308 between the protocol and the manuscript are explained in the supplementary material.

309

310 **Data Availability Statement**

311 The Euromonitor International Passport data used in this research is proprietary data owned by
312 Euromonitor International, a market research company. Access to the database has to be acquired
313 from Euromonitor International, and is generally subject to a fee. Further enquiries can be directed
314 to the corresponding author.

315

316 **Supplementary material**

317 Additional information is provided in the supplementary material published online alongside this
318 article.

319

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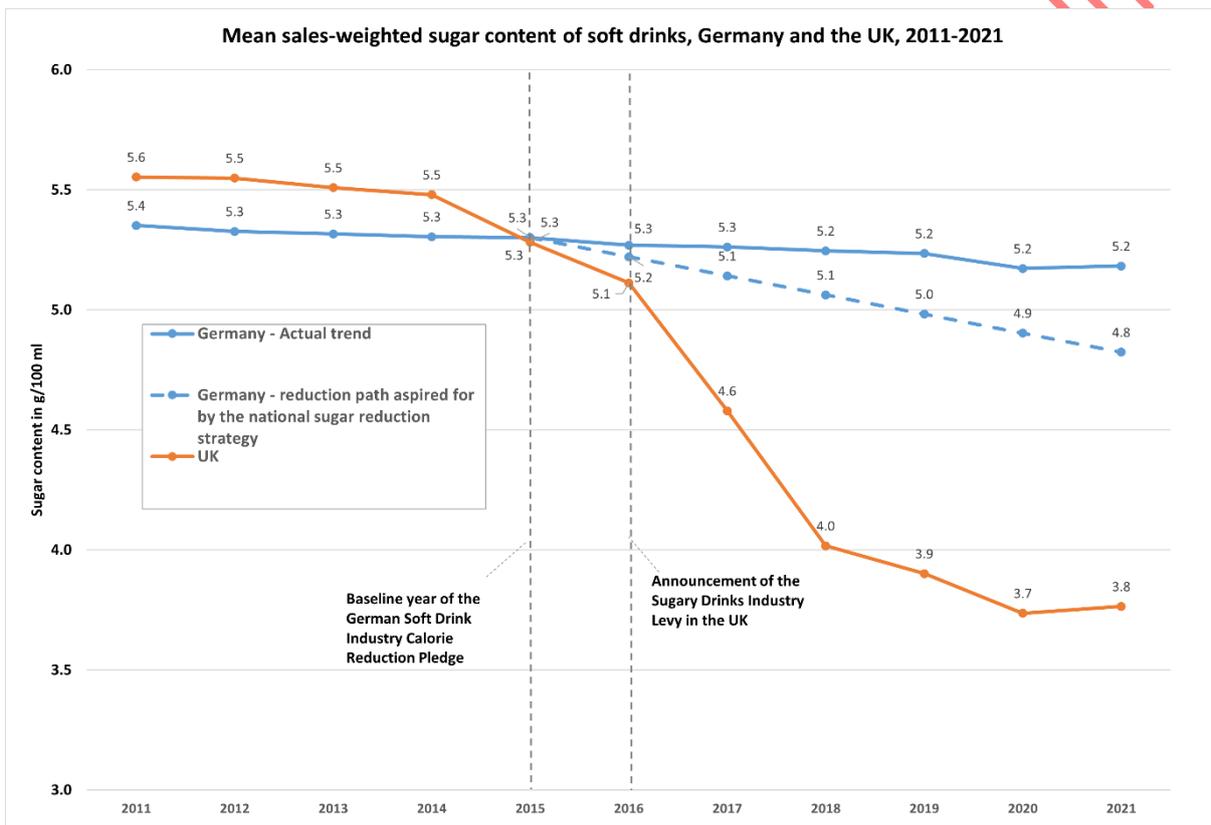
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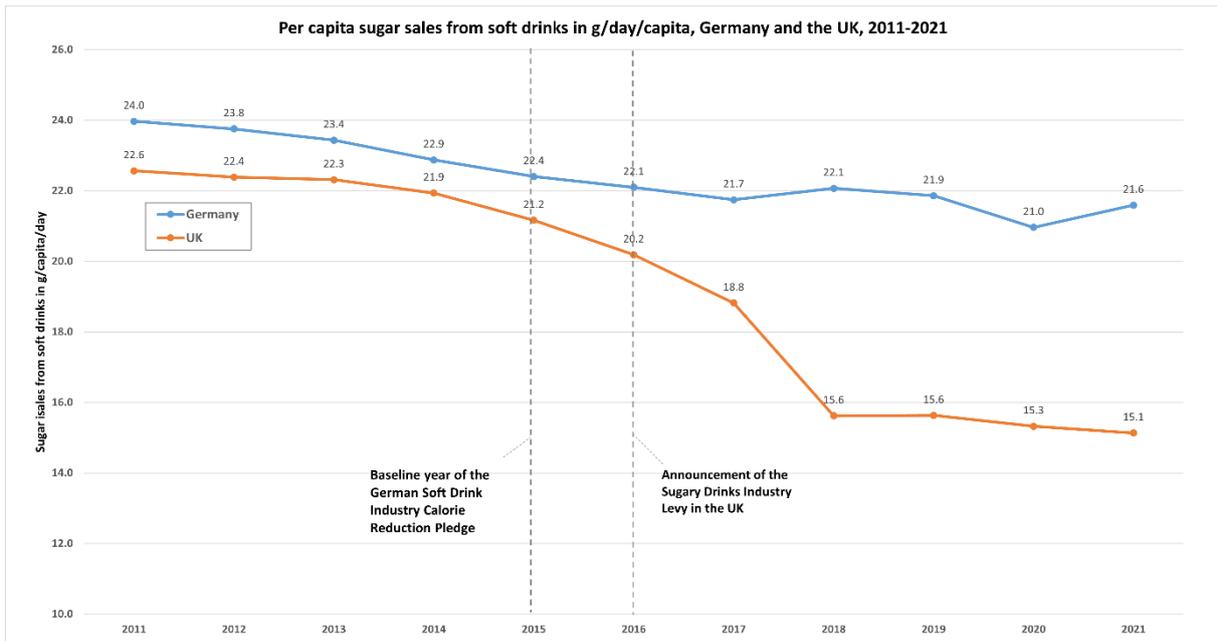
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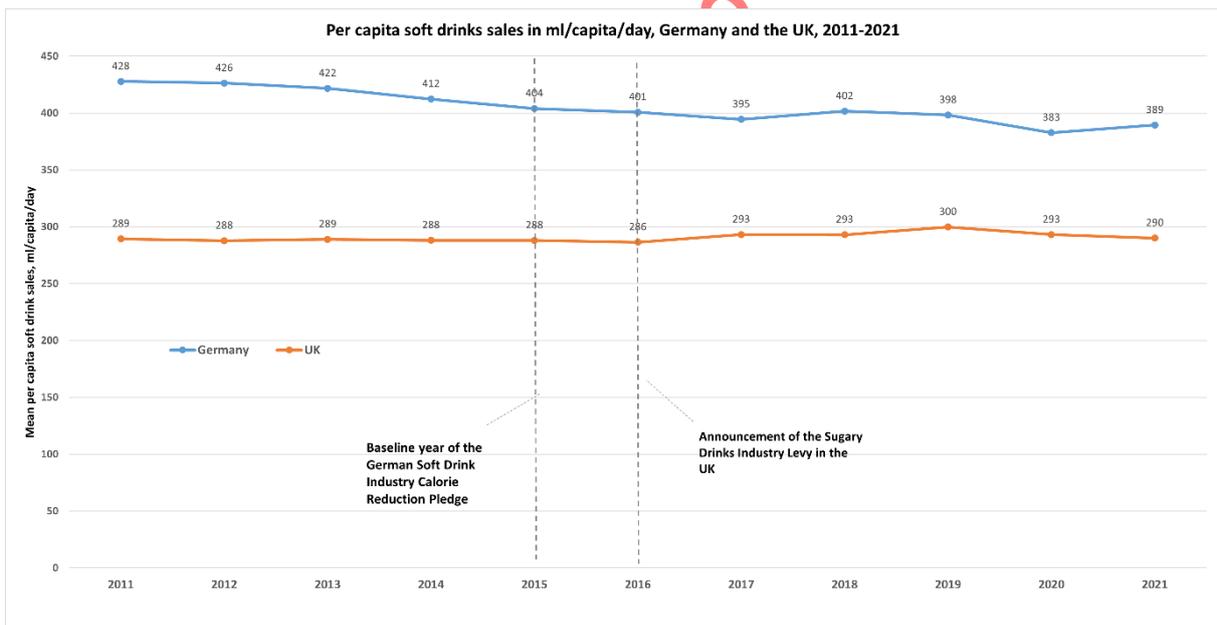
445 **Figures**



446 **Fig. 1.** Mean sales-weighted sugar content of soft drinks in Germany and the UK, 2011-2021 in g/100
 447 ml (solid lines), as well as the reduction path set by Germany’s national sugar reduction strategy
 448 (dashed line). Data sources: Own calculations based on data from Euromonitor International and
 449 Germany’s Federal Ministry of Food and Agriculture [16].
 450



451
 452 **Fig. 2.** Mean sugar sales from soft drinks per capita in Germany and the UK, 2011-2021 in g/d/capita.
 453 Data sources: Own calculations based on data from Euromonitor International (Passport database).



454
 455 **Fig. 3.** Mean soft drink sales per capita in Germany and the UK, 2011-2021 in ml/day/capita. Data
 456 sources: Own calculations based on data from Euromonitor International (Passport database).

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Tables

Country	Measure	Unit	2011	2012	2013	2014	2015 *	2016 **	2017	2018 ***	2019	2020	2021	Change 2011-2021	Change 2015-2021
Germany	Mean sales-weighted sugar content of soft drinks (excluding concentrates)	g/100 ml	5.4	5.3	5.3	5.3	5.3	5.3	5.3	5.2	5.2	5.2	5.2	-3.2%	-2.2%
Germany	Total sugar sales through soft drinks (including concentrates)	g/capita/day	24.0	23.8	23.4	22.9	22.4	22.1	21.7	22.1	21.9	21.0	21.6	-9.9%	-3.6%
Germany	Total soft drink sales (excluding concentrates)	ml/capit a/day	428	426	422	412	404	401	395	402	398	383	389	-9.0%	-3.6%
UK	Mean sales-weighted sugar content of soft drinks (excluding concentrates)	g/100 ml	5.6	5.5	5.5	5.5	5.3	5.1	4.6	4.0	3.9	3.7	3.8	-32.2%	-28.7%
UK	Total sugar sales through soft drinks (including concentrates)	g/capita/day	22.6	22.4	22.3	21.9	21.2	20.2	18.8	15.6	15.6	15.3	15.1	-32.9%	-28.5%
UK	Total soft drink sales (excluding concentrates)	ml/capit a/day	289	288	289	288	288	286	293	293	300	293	290	0.2%	0.7%

*Baseline year of the reduction targets of Germany's national sugar reduction strategy for soft drinks. **Year of the announcement of the Sugary Drinks Industry Levy (SDIL) in the UK; ***Year when the SDIL took effect in the UK. Abbreviations: UK: United Kingdom; SDIL: Sugary Drinks Industry Levy. Data sources: Own calculations based on data from Euromonitor International (Passport database).