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The content of caloric and non-caloric sweeteners in soft drinks in Germany

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ABSTRACT

Aims: Sweetened soft drinks play a major role in the global epidemic of obesity and type 2 diabetes. The aim of this study was to investigate the extent to which sweeteners, i.e. sugar and non-sugar sweeteners, are used in soft drinks (*Erfrischungsgetränke*) in Germany.
Methods: The authors visited three supermarkets representing Germany's leading food retailers and purchased all available soft drinks. These products were then evaluated on the basis of their content of non-sugar sweeteners (contained/not contained) and sugar (four levels: sugar-free, moderate sugar content, high sugar content, very high sugar content). The authors were able to identify a total of 463 different products.
Results: Of the soft drinks available in the visited supermarkets, 59% contain more than 5 g of sugar per 100 ml (high sugar content), and 37% contain more than 8 g of sugar per 100 ml (very high sugar content). Only 12% of the products are sugar-free, whereby 89% of these contain non-sugar sweeteners. A mere 6 of the 463 soft drinks in Germany that were examined in the context of this study (1.3%) contain neither sugar nor non-sugar sweeteners.
Conclusions: The majority of the soft drinks available in the visited supermarkets have a high or very high sugar content. The vast majority of calorie-free soft drinks contain other types of sweeteners. Only a very small percentage of the available soft drinks are unsweetened. There is a significant potential for the reduction of sugar content through reformulation.

1. Introduction

The rates of overweight and obesity among children, adolescents and adults have risen significantly over the past few decades. In this context the World Health Organisation (WHO, 2003) and the Organisation for Economic Co-operation and Development (OECD) (Sassi, 2010) have defined obesity as a "global epidemic".

According to the KiGGS study, 15% of children and adolescents between the ages of 3 and 17 years are overweight or obese (body mass index = BMI $\geq$ 25), and 6.3% qualify as obese (BMI $\geq$ 30). This means that the prevalence of overweight in children has risen by 50% since the 1980s and 1990s, and the prevalence of obesity in this age group has even doubled (Robert Koch Institute, 2003–2006). Over the past few years, the prevalence of obese adolescents has continued to increase while the prevalence of overweight in this age group has remained roughly the same (Robert Koch Institute, 2009–2012). A similar development has been observed among the general adult population, where 67% of men and 53% of women are now classified as overweight or obese. As with the younger age groups, the prevalence of overweight adults has remained the same in recent years while the prevalence of obese adults has continued to increase. For example, the prevalence of obesity rose from 22.5% to 23.9% among women and from 18.9% to 23.3% among men within a ten-year period after 1998 (Robert Koch Institute, 2015).

In the past 50 years, the number of people with diabetes in Germany has increased approximately 15-fold (Wirth and Hauner, 2013). According to the organisation German Diabetes Aid (Deutsche Diabetes-Hilfe), some 6 million people in Germany are currently living with diabetes (DiabetesDE, 2016a). This means that, since 1998, the age-adjusted prevalence of diabetes has increased by 24%. Type 2 diabetes accounts for more than 90% of all diabetes cases (DiabetesDE, 2016b). The current national health report even estimates that there are 6.7 million people in Germany with type 2 diabetes (Robert Koch Institute, 2015).

Public health experts view sugar-sweetened beverages as a

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major driver in these trends. Research has shown that the consumption of sugar-sweetened beverages contributes to the development of overweight, obesity and type 2 diabetes (Hauneret al., 2007) and is also associated with an increased risk of heart attack (de Koning et al., 2012; Fung et al., 2009). People who consume 1 to 2 cans of sugar-sweetened beverages a day (or more) have a 26% greater risk of developing type 2 diabetes than people who rarely have such drinks (Malik et al., 2010). Studies suggest that the calories provided by sugar-sweetened beverages do not provide the same feeling of fullness as solid foods. As a result, total energy intake may increase, potentially leading to unhealthy weight gain (Pan and Hu, 2011; World Health Organisation (WHO), 2017a).

In terms of sugar-sweetened beverage consumption, Germany ranks third in Europe. Only Belgium and the Netherlands have a higher per-capita consumption of sugar-sweetened beverages (European Healthy, 2016). According to information from the German Association for Non-Alcoholic Beverages (Wirtschaftsvereinigung Alkoholfreie Getränke, WAFG), the annual per capita consumption of all soft drinks (including "light" products) has increased by 150% since the 1970s, reaching 119.8 L per capita per year in 2014. Beverages that contain sugar, such as soft drinks, ice teas, energy drinks and beverages sweetened with fruit juice, account for approx. 90 L of this total. When all age groups and both genders are considered, the average individual consumes roughly 250 ml of sugar-sweetened beverages per day (German Association, 2011; German Association, 2015). According to information from the Robert Koch Institute (RKI), sugary drinks are particularly popular among young men, who consume an average of three 200-ml glasses per day (Robert Koch Institute, 2013). According to the above-mentioned findings and the so-called EsKiMo study, male children, adolescents and adults consume larger quantities of sugary beverages than their female counterparts. The EsKiMo study showed that boys between the ages of 12 and 17 years consume an average of just under half a litre (484 ml) of sugar-sweetened soft drinks per day (not including beverages sweetened with fruit juice), while girls of the same age group only drink half of this amount (283 ml) on average. Among male adolescents, unlike their female counterparts, the consumption of these beverages increases significantly with age (Kohler et al., 2007). According to the findings of the EsKiMo study, sugar-sweetened soft drinks provide a substantial amount (11%) of total carbohydrate intake among older male adolescents. On average, 40 g of sugar are consumed per day from these beverages.

For combating the rise in chronic disease, numerous governments and public authorities worldwide are focusing on strategies aimed at reducing the consumption of sweetened beverages. Several cities and countries, including Belgium, Chile, Finland, Hungary, Mexico, France, Philadelphia (USA), Berkeley (USA) and the UK, have implemented fiscal instruments that reduce the profitability of sweetened drinks – not only as an incentive for the manufacturers to reduce the sugar content of their drinks, but also as a source of funding for state-sponsored health programmes (World Cancer Research Fund, 2016). According to the WHO, sugar-sweetened beverage prices would need to be raised by 20% or more in order to generate meaningful health effects. Such taxes lead to more than proportional reductions in consumption and thus contribute to reducing overweight, obesity and noncommunicable diseases (NCDs) (World Health Organisation (WHO), 2015).

Beverages containing **non-sugar sweeteners** are also controversial. People who consume these beverages become accustomed to high levels of sweetness, which can lead to a poor (high-sugar) diet (French Agency for Food, 2014). Furthermore, evidence indicates that beverages with non-sugar sweeteners can contribute to the development of overweight, insulin resistance and type 2 diabetes (Bellisle and Drewnowski, 2007; Fagherazzi et al., 2013; Suez et al., 2014).

2. Materials and methods

The authors conducted the first-ever comprehensive investigation of the market for soft drinks (*Erfrischungsgetränke*) in Germany. The aim was to determine to what extent the available soft drinks are sweetened. To accomplish this, the authors visited Germany's three largest food retailers (LIDL, Edeka and Rewe) in the period July 2016 to August 2016 and purchased all available soft drinks in the following categories: "fruit-flavoured soft drinks and cola beverages", "spritzers", "near-water products", "vitamin-enriched beverages and energy drinks", "fizzy drinks and other soft drinks", "ice tea and beverages flavoured with tea" and "beverages sweetened with fruit juice" (German Association). In this context **463** different soft drinks were identified. Every flavour was counted as a separate product while no distinction was made between different container sizes of the same flavour.

The authors evaluated the soft drinks based on two criteria: **sugar** content and content of **non-sugar sweeteners**.

The evaluation of the **sugar content** was based on the Nutrition and Health Claims Regulation (EC) No. 1924/2006 (hereinafter NHCR) and the model of the UK Soft Drinks Industry Levy for beverages with added sugar: green for "sugar-free" (EU Nutrition, 2006) products (sugar content $\leq$ 0.5%), yellow for products with a moderate sugar content (0.6%–5%), orange for products with a high sugar content (5.1%–8%), red for products with a very high sugar content (>8%). In this context, no distinction was made between added sugar and natural sugar, for example in the form of fruit juices.

Owing to the fact that food manufacturers do not provide any information on the amount of non-sugar sweetener their soft drinks contain, the products in this study were categorised as either "contains non-sugar sweetener" (with information on the type of sweetener used) or "contains no non-sugar sweeteners".

3. Results

The majority of the soft drinks available in the visited supermarkets in Germany have a high or very high sugar content. The vast majority of calorie-free soft drinks contain other types of sweeteners. Only a very small percentage of the available soft drinks are unsweetened.

Of the soft drinks available in the visited German supermarkets, 59% (274 out of 463) have a high or very high sugar content (>5 g/100 ml, or more than 4 sugar cubes per 250-ml glass), and 37% (171 out of 463) have a very high sugar content (>8 g/100 ml, or more than 6.5 sugar cubes per 250-ml glass). Only 12% (55 out of 463) of the products are sugar-free according to the NHCR (see Fig. 1). However, 89% of these (49 out of 55) contain another form of sweetener instead of sugar. A mere 1.3% (6 out of 463) of the products contain neither sugar nor non-sugar sweetener (see Fig. 2).

The category with the highest average sugar content of all sugar-sweetened beverages comprises energy drinks and vitamin-enriched beverages (on average 9.8 g per 100 ml), followed by classic fruit-flavoured soft drinks and cola beverages (8.9 g per 100 ml) and beverages sweetened with fruit juice (7.3 g per 100 ml). Near-water drinks have the lowest average sugar content of all soft drinks (4.1 g per 100 ml). Overall, soft drinks with added sugar contain an average of 7.5 g of sugar per 100 ml, which is equivalent to approximately 6 sugar cubes per 250-ml glass.

The product with the highest sugar content in this study comes from the company PepsiCo: the energy drink "Rockstar Punched Energy + Guava" contains 78 g of sugar per 500-ml can (equivalent