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Consumption of Sugar-Sweetened Beverages in Paediatric Age: A Position Paper of the European Academy of Paediatrics and the European Childhood Obesity Group

Katarzyna Dereń[a, j] Daniel Weghuber[b, j] Margherita Caroli[c, j] Berthold Koletzko[d] David Thivel[e, j] Marie-Laure Frelut[f, j] Piotr Socha[g] Zachi Grossman[h, k] Adamos Hadjipanayis[i, k, l] Justyna Wyszyńska[a, j] Artur Mazur[a, j, k]

[a]Medical Faculty, University of Rzeszów, Rzeszów, Poland; [b]Department of Pediatrics, Paracelsus Medical University, Salzburg, Austria; [c]Paediatrician, Nutritionist, Brindisi, Italy; [d]Dr. von Hauner Children's Hospital, University of Munich Medical Centre, Ludwig -Maximilians-Universität Munich, Munich, Germany; [e]Clermont Auvergne University, Clermont Ferrand, France; [f]Pediatric Practice, Albi, France; [g]Department of Gastroenterology, Hepatology, Feeding Disorders and Pediatrics, The Children's Memorial Health Institute, Warsaw, Poland; [h]Maccabi Health Services, Tel Aviv, Israel; [i]Department of Paediatrics, Larnaca General Hospital, Inomenon Polition, Larnaca, Cyprus; [j]European Childhood Obesity Group, Brussels, Belgium; [k]European Academy of Paediatrics, Brussels, Belgium; [l]European University Medical School, Nicosia, Cyprus

Keywords
Sugar-sweetened beverages · Children · Adolescents

Abstract
Background: Health risks associated with the high consumption of sugar-sweetened beverages (SSBs) include overweight or obesity and their complications such as diabetes, as well as oral and dental decay, among others. ***Aim:*** The aim of the present statement is to inform health care professionals, parents, care-givers, teachers and school head teachers, stakeholders and governing bodies about the risks associated with drinking SSBs in infants, children and adolescents. ***Methods:*** We searched PubMed and the Cochrane databases for English language studies published from 2010 through October 1, 2018, for randomized clinical trials, meta-analyses, systematic reviews and observational studies (search terms are reported in eAppendix in the Supplement). We also manually searched the references of selected articles, reviews, meta-analyses and practice guidelines. ***Recommendations:*** Consumption of SSB by children and adolescents should be limited, and the consumption of water and other non-sweetened beverages should be promoted. Educational institutions such as nurseries, pre-schools and schools should offer unlimited access to drinking water, whereas the sale of SSBs should be banned.

KARGER

E-Mail karger@karger.com
www.karger.com/anm

Katarzyna Dereń
Medical Faculty
University of Rzeszów
Al. Kopisto 2a, PL–35-959 Rzeszów (Poland)
E-Mail kderen@ur.edu.pl

Introduction

Sugar sweetened beverages (SSBs) consumption is a drinking behaviour present worldwide. According to the National Health and Nutrition Examination Survey performed in 2008, 66% of children and 77% of adolescents consume SSBs daily [1].

Almost half (46.7%) of Australian children aged 2–18 years drink SSB, and the youth consume an average of 217 mL of SSB per day, which is equivalent to 5.5% of their total energy intake [2].

In Mexico, SSBs were found to be the main source of sugars, contributing to 69% of added sugars in the general population [3]. In China, in a sample of more than 53,000 children and adolescents aged 6–17 years, in 2013, 66.6% of participants consumed SSBs, and 9.6% reported a consumption of more than 7 servings of SSBs per week [4]. In Italy, 36% of children aged 8–9 years participating in Okkio alla Salute, the Italian arm of Childhood Obesity Survey Initiative, consume sweetened and carbonated beverages at least once a day [5].

Even though these studies have been performed using different methodology, they show a large consumption of SSBs in youth worldwide with intakes of free sugars higher than the WHO recommendation (which is less than 10% of total energy intake) [6].

Aim

The aim of the present statement is to inform health care professionals, parents, care-givers, teachers and school head teachers, stakeholders and governing bodies about the risks associated with drinking SSBs in infants, children and adolescents. Moreover, recommendations are made related to the consumption of SSB.

Terminology

Several public institutions have published dietary guidelines for sugars intake in different ages of life, which, however, differ from each other. One of the most important factors in this difference of recommendation is due to the different definitions of sugars. Sugars naturally occur in many foods and/or can be added for technical needs or to improve the food's taste [7]. Not all the sugars have the same metabolic effects and, thus, it is mandatory to be precise as to which sugars this Position Paper is addressing.

In this paper, the term total sugar is referred to the whole sugars' content in foods, including naturally present and added sugar. Free sugars are considered, according the WHO definition: "monosaccharides and disaccharides added to foods and beverages by the manufacturer, cook or consumer (i.e., added sugars), plus sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates (i.e., non-milk extrinsic sugars)" [6]. Added sugars are all sugars such as sucrose, fructose, glucose, starch hydrolysates (glucose syrup, high-fructose syrup, isoglucose) and other isolated sugar added to foods at different steps in their preparation, according the European Food Safety Authority [8].

In this paper, the health consequences of added sugar intake are addressed and, as SSBs are the richest foods in added sugars, the paper is mainly addressed to SSBs' and their effects on health. The study was conducted in accordance with the Declaration of Helsinki.

Methodology

We searched PubMed and the Cochrane databases for English language studies published from 2010 through October 1 2018, for randomized clinical trials (RCTs), meta-analyses, systematic reviews and observational studies (search terms are reported in eAppendix in the Supplement). We also manually searched the references of selected articles, reviews, meta-analyses and practice guidelines. Selected articles were mutually agreed upon by the authors Artur Mazur and Katarzyna Dereń. Emphasis was given to the selection of RCTs and meta-analyses and for the consideration of information of interest to a general paediatric medical readership.

Impact of SSBs on Health

Overweight

The increase in overweight and obesity among children and adolescents is a burning global health concern [9]. The WHO indicates that 41 million children under the age of 5 and over 340 million children and adolescents aged 5–19 were overweight or obese in 2016 [10]. Children who are overweight or obese become overweight adults and carry a markedly increased risk for long-lasting health burdens such as diabetes, cardiovascular diseases, orthopaedic problems and some forms of cancer

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[11]. Overweight and obesity generally result from following an unhealthy lifestyle. Dietary patterns, such as the consumption of SSBs, may contribute to the development of overweight and obesity through their high energy density, frequency of consumption and large portions [12, 13]. In addition, the calories provided by free sugars, especially in the form of drinks, may not give a sense of satiety and may not reduce the intake of food after their intake [14].

A high intake of fruit juices and soft drinks contributes to excessive weight gain and obesity in children. Recent research has not only found a positive association between regular SSBs consumption and weight gain but also with metabolic syndrome and obesity-increased risk of type-2 diabetes [15, 16].

Furthermore, parenting practices play an important role in the development of children's dietary habits [17]. Lippevelde et al. [18] found that 3 family-related factors (parental modelling, availability at home and drinking together) were positively associated with both fruit drink/juice and soft drink intake of the children across the different countries. A modelling study shows that the reduction in free sugars added to SSBs, without the use of artificial sweeteners, is predicted to reduce the prevalence of overweight, obesity and type 2 diabetes [19]. The high intake of SSBs in adolescents has been consistently linked to overweight and obesity; hence, interventions in this area should be prioritised [20]. To confirm this data, there is an increasing body of evidence that suggests that decreasing consumption of SSBs can impact positively on childhood overweight and obesity [21].

Other Impact to Health

Many health problems have been linked to the high consumption of sweetened beverages, such as caries and enamel erosion, short sleep duration, hyperactivity, increased blood pressure and non-alcoholic fatty liver disease (NAFLD) [22, 23].

High sugar content and low pH render SSB are a real threat to the developing dentition [24, 25].

Regular consumption of SSB may result in dental erosion. Dental erosion is defined as the chemical loss of tooth structure due to the action of acids that are not produced by bacteria [26, 27]. Most SSBs are acidic in nature and contact with acidic solution may destroy the hard tissues of the teeth.

Sleep duration was 12 min shorter per night in children who reported consuming regular soft drinks "at least once a day" compared with those who reported consuming "never" or "less than once a week". Future research is needed to establish causality and to investigate underlying mechanisms [28].

Children who consumed soft drinks more frequently showed higher ORs for ADHD risk compared to children who "never" consumed these drinks [29]. Another study on the association between mental health issues and SSBs consumption reported an increased ratio of hyperactivity and conduct problems in boys who consumed more than 4 glasses of SSBs per day compared to boys who consumed 1–6 glasses of SSBs week [30].

Consumption of soft drink is associated with increased blood pressure and dyslipidaemia [31]. Many SSBs contain fructose as sweetener instead of sucrose as added sugar, as the latter is considered "more natural" and has a higher sweetening power as compared to sucrose. The fructose metabolic pathway drives to a higher production of triglycerides, very-low-density-lipoproteins and other metabolites that would favour insulin resistance and hypertension [32].

A high intake of dietary fructose is associated with NAFLD and, in addition, it has been shown that children with NAFLD absorb and metabolize fructose more effectively than normal-weight children [33, 34]. Several studies have shown that children and adults with NAFLD have a higher mean fructose intake mainly resulting from a higher consumption of soft drinks and fruit juices as compared with subjects of same age without NAFLD [35, 36].

Studies showed that low consumption of SSBs is associated with high water consumption in children. Parenting practices towards both fruit juices and SSBs are associated with the water intake of the children, irrespective of their socio-economic status [17].

Consumption SSBs from Toddlers to Adolescents

SSB such as soft drinks and fruit juices (even 100% fruit juices) are high in sugar content. With the exception of 100% fruit juices, which may contain vitamins and minerals, sweet drinks provide "empty" calories with no nutritional benefit and thus, lead to low satiety response [37, 38].

Studies from Germany show that the majority of the soft drinks available in supermarkets have a high (>5 g per 100 mL) or very high (>8 g per 100 mL) sugar content [39]. The vast majority of calorie-free soft drinks do not contain sugars but sweeteners (saccharin, stevia, etc.,)

without calories. These types of beverages are not considered in this paper [39].

In 2007, in the United States, about 26% of children of 10–11 years of age had access to non-alcoholic beverages at school [40]. Excessive consumption of high-calorie non-alcoholic drinks seems to be an important factor for weight gain, favouring the development of overweight in children. Evidence suggests that the consumption of sweetened beverages has increased in parallel with trends regarding overweight and obesity [41]. Nowadays, sweetened non-alcoholic beverages constitute between 10 and 15% of the adolescents' caloric consumption and are the main sources of added sugar in the diet of children and adolescents in USA. Studies show that the incidence of total consumption of sweet drinks (≥500 kcal/day) between 1999 and 2008 increased among children aged 2–11 (4–5%), although it decreased among adolescents aged 12–19 (22–16%) and young adults (29–20%) in USA. Additionally, the consumption of sweetened beverages among pre-school children aged 2–5 dropped by 55 kcal/day [42]. In addition, the consumption of sports/energy drinks has tripled (4–12%) among teenagers [1]. Recent data from the nationwide child and adolescent health survey in Germany indicate a high mean daily consumption of sugar containing beverages of 454 and 569 mL in girls aged 3–10 and 11–17 years, respectively, and an even higher consumption of 568 and 708 mL in boys aged 3–10 and 11–17 years respectively [43].

However, whereas SSBs are generally incriminated for their unhealthy effects as bad for health and weight, children and parents often perceive fruit drinks and juice to be a healthy choice. Nevertheless, despite the presence of important nutrients in fruit drinks and juice, their consumption should be limited due to the high sugar content [18].

Children 0–3

In recent years, many studies have associated the nutrition of the first 1,000 days of life to the development of non-communicable diseases and in particular to the development of obesity [44]. Several factors might be involved in early programming of later obesity risk, cardiovascular disease and metabolic complications [45, 46].

Breast milk or infant formula, and water are the only drinks that should be offered before 6 months, and should be the main drinks up to 12 months of age. Starting from 4 to 6 months, when the complementary solid foods start to be offered, only spring water or natural mineral water – medium-mineralized, low-sodium, low-sulphate should be offered to infants. Carbonated drinks, including sparkling mineral water and flavoured waters, are not suitable, as they have limited nutritional value and can reduce babies' appetite for more nourishing foods and drinks. Also, the acidic nature and sugar content of these drinks increase the risk of tooth decay [47, 48]. In this age group, no RCTs have been done to prove the role of sweet taste, added sugar or SSB in the development of obesity, but still some observational trials show strong associations. In the Project Viva, juice intake at 1 year was associated with greater juice and SSBs intake during early (median 3.1 years) and mid-childhood (median 7.7 years) and also greater adiposity [49]. In the Infant Feeding Practices Study II, 2 groups of children were identified: children who consumed SSBs during infancy and non-SSB consumers. The obesity prevalence at 6 years was twice as high in SSB group compared to non-SSB consumers (17.0 vs. 8.6%) [50].

Children 3–7 Years Old

De Coen et al. [51] found that the mean soft drink consumption of children from 2.5 to 7 years from high parental socioeconomic status was 0.42 times higher than the children of low parental socioeconomic status. Portuguese pre-school children who consumed soft drinks in a daily basis were 1.52 times more likely to be classified as overweight/obese when compared to their peers who did not regularly consume those beverages [52]. In the Netherlands, the average drink intake by children aged 6–7 was 344 mL (SD 364) per day [53]. Myszkowska-Ryciak and Harton [54] show that education of kindergarten staff has a great potential in improving the assortment of beverages served in preschools. Education increased significantly the percentage of Polish preschools serving water during and between meals (67 vs. 83% and 93 vs. 99%, respectively), fruit/herbal tea (75 vs. 81%) and natural fruit juices (46 vs. 56%). The percentage of preschools offering fruit/soft drinks decreased from 23 to 15% after educational intervention.

Data from the Toybox study showed great variability in soft drink and water consumption among European populations attending kindergarten with the biggest soft drink consumption in Poland and Belgium and lowest water consumption in those 2 countries [55]. It indicates the need to implement country specific policies to improve dietary habits.

Children Over 7 Years Old

When comparing fruit drink/juice and soft drink intake of 10- to 12-year-old European children, Lippevelde et al. [18] found large differences between countries. Fruit drink/juice intake ranged from 236.2 mL/day among Spanish children to 380 mL/day among Dutch and Slovenian pupils. Soft drink consumption was high in the Netherlands, Hungary and Belgium (>450 mL/day) and low in Greece and Spain (<200 mL/day) [18]. In Germany, 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 [56].

In this age group, 2 RCTs were performed to prove the role of added sugar in development of obesity. In an 18-month trial, 641 primarily normal-weight children aged 4 years 10 months to 11 years 11 months were randomized to receive 250 mL (8 oz) per day of a sugar-free, artificially sweetened beverage (sugar-free group) or a similar sugar-containing beverage that provided 104 kcal (sugar group). The sugar-free group had significantly lower BMI and weight at the study end [37]. The role of SSB consumption seems to be explicitly proven mainly in this age group of children.

Adolescents

Soft drink consumption and sedentary behaviours, such as television viewing, are important behaviours in adolescents that exert pressure to a positive energy balance [57]. Generally, 80% of youth consume SSB every day [58]. Important environmental influences for adolescent' dietary behaviours such as availability and accessibility (i.e., physical environmental factors) of foods at home or social environmental factors (such as parental modelling and parental rules regarding [un] healthy eating) may result in increased behavioural control or more positive attitudes, which in turn may increase the likelihood of consumption. Actual evidences clearly show that parents shape the dietary behaviours of their children [59]. Soft drink consumption is a behaviour shared by adolescent friendship groups, with the strongest similarities in schools where there is high availability of soft drinks through vending machines [60].

Statement of Problem

Non-alcoholic sweet drinks are easily available to children and adolescents. They can be bought in school shops and vending machines, in many European countries and even in public institutions and in public schools. Products with minimal nutritional values (non-alcoholic beverages, chips and sweets) are mainly sold in vending machines [61]. Concomitantly, over the past few years, there has been a significant increase in political interest to public taxation of high-energy density food and sugary drinks. Since taxes on these products are a form of collective prophylaxis, these taxes can interfere with the interests of the food industry, which has a strong lobby. However, in many countries such as Finland, France, Portugal, Hungary and Mexico, taxes on sweetened beverages and/or energy drinks have been introduced [62]. Research shows that tax on beverages with high sugar content led to reduced purchase of beverages, particularly among less privileged families [63].

Some studies indicate a small reduction in the consumption of sugary drinks, which may be the result of changes in the behaviour of parents, careers and educational programmes [1, 42]. Schools have a strong position to influence children's diet; therefore, attention need to be paid to the food sold at school to improve diet. Therefore, conducting further intensive education among parents, careers and teachers is needed because they should have knowledge about the health consequences of the consumption of SSB.

Recommendations

Government

– Governments and the health care services should provide information consistently to families, teachers and educational institutions on the health risks of SSBs consumption and the benefits of replacing SSB by water and other non-sweetened beverages.

– Advertising of SSBs to children should be banned.

– Taxation on SSBS may contribute to decrease their consumption among children.

– The introduction on compulsory information on front of pack labels of SSB on health risks should be considered.

School

– Educational and behaviour-changing programs on appropriate choices of beverages and encouraging water consumption should be implemented in pre-schools and schools, also during training and play.

– Pre-schools and schools should offer unlimited access to drinking water, for example, by water fountains, whereas SSBs and other sweet beverages should not be made available.

Parents

– Parents should avoid the use of SSBs to please their children.

– SSBs should not be easily available at home.

Disclosure Statement

The authors declare that they have no conflicts of interest to disclose.

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