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Commentary
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Overconsumption of sugar-sweetened beverages: Why is it difficult to control?

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ABSTRACT

The consumption of sugar-sweetened beverages is a known contributory factor of childhood obesity that is documented around the globe. More importantly, reducing the consumption of sugar-sweetened beverages could reduce weight gain among overweight or obese children. Although sugar is present in many natural foods, artificial sugar is added into sugar-sweetened beverages, which has little or no nutritional value. However, the calories obtained from the sugar-sweetened beverages are linked to overweight and obesity, and an increase serving sizes of sugar-sweetened beverages over the years partly contributed to the alarming rise of childhood obesity around the globe. The sugar-sweetened beverages not only contain a high amount of sugar, but also contain a high amount of phosphate, and the possibility exists for an enhancing dual adverse health effects of sugar and phosphate. Increasing health awareness and limiting marketing approaches targeted towards the younger population are essential to reduce long-term health burdens that are linked to the overconsumption of sugar-sweetened beverages.

Keywords: *Sugar, Phosphate, Health risks, Metabolic diseases, Cardiovascular diseases*

A recently published review article in JPTCP by Haq and colleagues have detailed the health consequences of overconsumption of sugar-sweetened beverages.[1] The authors have also provided recommendations to minimize the potential health risks related to the consumption of sugar-sweetened beverages. As mentioned in the review article, there is an alarming increase in the prevalence of obesity across all age groups around the world.[1,2] According to the Centers for Disease Control and Prevention estimation, the obesity prevalence in the United States of America (USA) is as high as 20.6% among 12- to 19-year-olds; Hispanics (25.8%) and non-Hispanic blacks (22.0%) have a higher prevalence of obesity than non-Hispanic white (14.1%) population. Such a higher rate of obesity in the USA and beyond is also related to the worldwide increase rates of cardiovascular diseases, hypertension, and diabetes.[3,4] A large number of studies have pointed overconsumption of sugar-sweetened beverages as one of the major causes of the evolvement of childhood obesity.[5,6] Of importance, sugar-sweetened beverages, including soda drinks, energy drinks, and sports drinks are by far the largest sources of added sugar in the average American's diet. It is reported that there is a 26% higher risk of developing Type 2 diabetes among the individuals who drink one to two sugar-sweetened beverages per day, as compared to individuals who drink less than one per month.[7] Similar studies have reported that drinking merely 12 ounces of sugar-sweetened soda drink per day could increase the risk of cardiovascular mortality by nearly one-third.[8–10]

Despite known harmful health consequences of sugar-sweetened beverage consumption, due to aggressive marketing strategy that is usually attractive to the younger population, its sale is increasing around the globe.[11,12] For instance, approximately 10% of total energy intake in Mexico, across all age groups, is taken from sugar-sweetened beverages.[13] Of preventive implications, in high-income countries, the highest intake of sugar-sweetened beverages is often observed in individuals with lower socioeconomic status,[14] while the highest intakes in low- and middle-income countries are frequently observed in individuals with higher socioeconomic status.[11,15] In the USA, health care costs related to overweight and obesity are estimated to be around $147 billion or around 10% of total health care costs per year.[16] Such a staggering cost of managing obesity and related complications put an enormous economic burden on low or middle-income countries, in addition to human sufferings. Regardless of known health risks and accepted economic costs, why is it so difficult to reduce sugar-sweetened beverage consumption? One of the possible reasons might be related to relatively less appreciated sugar-induced addiction through overconsumption of sugar-sweetened beverages.[17]

To date, numerous studies have emphasized the adverse role of sugar-sweetened beverage consumption in the genesis of obesity across all age groups, and recommended that limiting the consumption of sugar-sweetened beverages should be a global health priority to reduce childhood obesity. It is however needed to be mentioned that there are reported studies that failed to establish a strong connection between sugar-sweetened beverage consumption and childhood obesity;[18,19] although such outcomes might be unintentionally influenced by either beverage industry funding or potential conflict of interest. In reality, a sugar-laden diet could increase the risk of cardiovascular disease-related death, even if, the person might not be overweight or obese.[8] A strong correlation exists between sugar-sweetened beverage uptake and gingivitis.[20, 21] Historically, such a relationship has been linked to the excessive amount of sugar consumption that is present in the sugar-sweetened beverages; it is, however, necessary to mention that sugar-sweetened beverages often contain a higher amount of phosphate.[22,23] Surveys surprisingly found that most of the future

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medical professionals are not aware of hidden sources of phosphate in the sugar-sweetened beverages.[22] More alarmingly, chronic kidney disease patients, undergoing hemodialysis, who are recommended to restrict dietary phosphate, are not aware of hidden phosphate-containing foods and drinks.[23] Similar to higher sugar intake, dietary consumption of phosphate is also high across all age groups. The recommended dietary allowance (RDA) of phosphorus for adults and the elderly in the USA is 700 mg/day. Studies have reported that around 35% of the adult population of the USA consume more than double the amount of phosphate than the recommended amount;[24,25] such a high intake of phosphate has been documented among the children, as well.[26] The increased amount of daily consumption of either phosphate or sugar has found to be associated with a higher prevalence of gingivitis.[27] Of biological importance, higher cellular phosphate burden has also been implicated in other inflammatory conditions, including obesity.[28] Of relevance, phosphate toxicity can impair systemic organ functions, ranging from bone function to renal function to cardiovascular function to tumorigenesis.[25,29–33]

Dental caries or dental decay is another common oral disorder. Numerous studies have shown a link between dental decay and the consumption of sugar-sweetened beverages.[34] As mentioned, two main components of sugar-sweetened beverages are sugar and phosphate. In a study, conducted on 8,317 school children (average age: 9.99 ± 0.68 years), the occurrence rate of dental decay was significantly higher among children who consumed higher amount of phosphate.[35] The study found that, for every single unit increase in calorie-adjusted sugar intake, the odds of having dental decay increased by 12%, and for 1 unit increase in phosphate, the odds of having any dental decay increased by 33%,[35] suggesting that high phosphate consumption might have even more deleterious effects on oral health than that of sugar. Of interest, when a study was conducted on 8,317 children, dental decay was found to be much more pronounced in children who consumed sugar-sweetened soda drinks than those who consumed fruit juice; even though both the drinks contain high levels of sugar, it is likely that sugar-sweetened beverages might contain certain ingredients that have pro-cariogenic effects, and there are reasons to believe that phosphate is one such harmful ingredient in sugar-sweetened beverages.[35] Further studies are needed to explain how high sugar and phosphate coordinately induced a microenvironment that is damaging for both gingival tissue and tooth structure.

CONCLUSION

As mentioned, promoting health awareness, providing education on healthy food, offering an alternative to sugar-sweetened beverages, and restrict marketing towards younger population are necessary to reduce long-term health burdens related to overconsumption of sugar-sweetened beverages across all age groups. Concerned health professionals have provided various recommendations to minimize the health risks of the venerable younger population:

- Provide a school-based health awareness campaign
- Restricting/reducing soft drink consumption in the schools
- Restrict selling soft drinks from the school premises
- Offering a soft drink alternative by providing access to safe drinking water or other healthy drinks in the school
- Impose higher taxes or levies on sugar-sweetened beverages, and use collected revenue to subsidize healthy food and drinks in the school
- Impose regulations to mandate food industry to reduce sugar content in the drinks

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- Restrict marketing strategy that is targeted towards the younger population
- Effective use of social media to reach younger population to make them aware of potentially harmful consequences sugar-sweetened beverages

In summary, taking into the consideration of available information, it is likely that reducing sugars consumption, through limiting sugar-sweetened beverages, might reduce the risk of overweight and obesity in children, adults, and elderly, and thereby could minimize the risk of many chronic diseases, including type 2 diabetes, cardiovascular diseases, oral diseases, certain types of tumors, and premature mortality.[36–38] Of importance, analyzing the data of the USA children from 2003 to 2014, a significant decline of sugar-sweetened beverage consumption has been noted (downed from 80% to 61% of at least one sugar-sweetened beverage per day).[39] Despite such encouraging declines, the consumption of sugar-sweetened beverages by the children and adolescents in the USA is still high, and much work needed to be done to reduce sugar-sweetened beverage-mediated short-term and long-term adverse health consequences, in the USA and beyond. Finally, involvement of government with specific regulations towards the food industry to control the marketization of artificially sugar- and phosphate-containing food and drinks is desirable.

FIG 1. Overconsumption of sugar-sweeten beverages can influence the evolvement of a wide range of diseases, ranging from metabolic diseases to cardiovascular diseases to skeletal deformities to oral diseases to tumorigenesis.

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A few potential long-term consequences of overconsumption of sugar-sweetened beverages are listed (Figure 1). Please note that affected organs by artificial sugar toxicity might be ranging from heart diseases (hypertension) to bone diseases (osteoporosis) to oral diseases (dental decay and gingivitis) to joint diseases (gout) to metabolic diseases (diabetes) to malignant diseases (pancreatic tumor) and beyond.

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CONFLICTS OF INTEREST

The author declare that no conflicts of interest exist.

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DATA AVAILABILITY STATEMENT

None.

COMPLIANCE WITH ETHICAL STANDARDS

None.

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