



HHS Public Access

Author manuscript

Curr Opin Endocrinol Diabetes Obes. Author manuscript; available in PMC 2015 May 08.

Published in final edited form as:

Curr Opin Endocrinol Diabetes Obes. 2013 October ; 20(5): 401–406. doi:10.1097/01.med.0000432610.96107.f5.

The sugar-sweetened beverage wars: public health and the role of the beverage industry

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Abstract

Purpose of review—To discuss the current data on sugar-sweetened beverage (SSB) consumption trends, evidence of the health impact, and the role of industry in efforts to reduce the consumption.

Recent findings—Previously rising SSB consumption rates have declined recently, but continue to contribute added sugars beyond the limit advised by the American Heart Association. A recent meta-analysis concluded that SSBs likely increase body weight and recent long-term studies support the previous findings of increased risk of diabetes, dyslipidemia, and hypertension. Beverage companies have played an active role in some SSB reduction efforts by reducing the sale of SSBs in schools, limiting television advertising to children, and increasing the availability of smaller portion-size options. Industry has opposed efforts to restrict the availability of large portion sizes and implement an excise tax. Current industry efforts include the promotion of alternative beverages perceived to be healthier as well as SSBs through Internet and social media.

Summary—Continuing high SSB consumption and associated health risks highlight the need for further public health action. The beverage industry has supported some efforts to reduce the consumption of full sugar beverages, but has actively opposed others. The impact of industry efforts to promote beverage alternatives perceived as healthier is unknown.

Keywords

industry; obesity; public policy; sugar-sweetened beverages

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Conflicts of interest: *Disclosures: J.A.W. and E.A.L.: no disclosures. A.D.S. has received remuneration as a member of the Nutrition Advisory Board of Dunkin Brands Inc.*

INTRODUCTION

Over the last year, concerns about sugar-sweetened beverage (SSB) consumption and its impact on the obesity and chronic disease epidemic in the USA have taken center stage. In the fall of 2012, the New York City Board of Health approved a nearly complete ban on the sale of single-serving SSBs greater than 16 ounces. In March 2013, the New York State Supreme Court struck down the city's ban [1]. This attempt to regulate SSB consumption set in motion an intense national debate about SSBs and the role of public health policy in addressing the obesity epidemic. The purpose of this review is to present the recent data on SSB consumption and its health impact, describe the possible mechanism of action through which SSB consumption affects health outcomes, and discuss the influence of the beverage industry on public health policies, as well as the strategies employed by the industry to influence consumption patterns.

SUGAR-SWEETENED BEVERAGE CONSUMPTION AND ITS ASSOCIATED HEALTH EFFECTS

SSBs, which include sodas and soft drinks as well as other beverages with caloric sweeteners (added sugars) such as fruit-flavored drinks, sports and energy drinks, and sweetened coffees and teas [2], are a major contributor of calories in the US diet. Consumption rose sharply in the USA through the latter half of the 20th century, but recent national dietary surveys indicate that this trend may have reversed over the last decade [3,4*]. SSBs contributed an estimated 2.5% of total energy in 1965 [5], 9.2% in 1999–2000, and 6.6% in 2007–2008 [3]. SSBs are the leading source of added sugars, contributing nearly half (49.3%) of those consumed by Americans [3]. Although the American Heart Association recommends that total added sugar consumption be limited to 150 calories for men and 100 calories for women (~5% of total energy) [6], most Americans exceed this limit in the calories they consume from SSBs alone.

Non-Hispanic blacks, Hispanics, and those from low-income and low education households consume SSBs most frequently [4*]. Consumption begins early in life, with 21.9% of toddlers aged 21–24 months consuming at least 1 SSB daily [7], and is highest among adolescents and young adults, who consume 9.1 and 9.5% of total energy as SSBs, respectively [3]. SSB consumption among children and adolescents is associated with parental SSB consumption patterns and accessibility of SSBs [8], frequency of fast-food consumption [9], and time spent watching television or viewing advertisements [10].

Consumption of SSBs is a public health concern because of its association with increased obesity and chronic disease risk [11–14]. A recent systematic review of the available evidence commissioned by the World Health Organization concluded that consumption of SSBs is a determinant of body weight, and that the change in body fat with increased consumption is mediated by increases in energy intake [15**]. Authors of other reviews including those who have examined the evidence among children have drawn similar conclusions [2,14,16*,17,18]. Consumption of SSBs has also been shown to be associated with an increased risk of diabetes, metabolic syndrome, and cardiovascular disease [13,19–22,23*,24*].

Several recent studies from large prospective cohorts support the findings of earlier epidemiologic and randomized controlled trials that have demonstrated increased health risks associated with SSB consumption [25]. Among participants in the Nurses' Health Studies I and II, a higher intake of SSBs was associated with an increased risk of hypertension and stroke [26*,27*]. The Nurses' Health Study II also showed that replacement of one serving of SSBs and fruit juices per day with one cup of plain water was associated with 7 and 8% lower risk of type 2 diabetes, respectively [28*]. Among participants in the Health Professionals Follow-Up Study, a higher intake of SSBs was associated with an increased risk of hypertension, stroke, and coronary heart disease, as well as adverse changes in lipid levels, inflammatory factors, and the energy-regulating hormone leptin [26*, 27*,29*].

POSSIBLE MECHANISMS OF ACTION

In addition to the recent evidence for health risks associated with SSB consumption, there have been important new developments in our understanding of the specific mechanisms that may underlie this increased risk. Hypothesized mechanisms center around two unique features of SSBs: they are the largest contributor of liquid calories to the diet and the added sugars they contain are the leading dietary source of the simple sugar fructose.

Liquid calories

The findings of multiple studies in humans indicate that compensation for calories consumed as liquids is incomplete, which can lead to an increased risk of energy imbalance and obesity [30,31]. Cassady *et al.* [32*] appears to have shed light on the mechanism behind this phenomenon when they demonstrated in their recent study that adults are more satisfied and eat less when they consume solid foods, or foods that they believe will be solid upon ingestion, than when they consume liquids. When consuming liquids compared to real or perceived solid foods, individuals reported more postprandial hunger, less fullness, more rapid gastric emptying, lower release of insulin and glucagon-like peptide 1, and attenuated suppression of the appetite-stimulating hormone ghrelin, all factors known to result in a weaker satiety response.

Fructose

SSBs contribute approximately 30% of the fructose consumed in the US diet [33]. The metabolic response to fructose differs substantially from that of other simple sugars. Unlike glucose, fructose metabolism occurs rapidly and almost exclusively in the liver. High intake of fructose but not glucose leads to increased visceral adiposity, lipid dysregulation, and decreased insulin sensitivity among overweight adults [34]. The importance of the liver in the development of adverse outcomes related to fructose consumption was supported by a recent study in mice. In the absence of fructokinase C, the enzyme responsible for initiating fructose metabolism in the liver, these outcomes do not occur [35*]. In a randomized controlled trial among overweight or obese adults, SSB consumption caused changes in adipocyte hormones, each of which was associated with distinct metabolic responses [36*]. Acylation-stimulating protein (ASP) concentrations were associated with postprandial

triglyceride levels, adiponectin with levels of abdominal and visceral fat, and leptin with body weight and insulin concentrations.

THE ROLE OF THE BEVERAGE INDUSTRY

The food and beverage industry produces and sells foods and beverages in a manner that is profitable for their shareholders. Though industry efforts have undoubtedly helped fuel the rise to current levels of SSB consumption, the extent to which beverage companies are willing and able to make meaningful changes that will improve beverage consumption patterns is unclear.

Marketing of sugar-sweetened beverages

With approximately 4000 calories worth of food available in the US food supply per capita, per day, the market is highly competitive [37]. To increase market share, food and beverage producers use a variety of strategies that promote sales and build brand loyalty, and they continually adapt these strategies in response to an ever-changing environment. In 2010, beverage companies spent \$948 million in advertising for sugary drinks and energy drinks; regular soda accounted for nearly one-half of spending, and fruit drinks, sports drinks, and energy drinks each comprised 14–17% of the total [38].

In response to concerns about industry advertising to children, the Council of Better Business Bureaus launched the Children's Food and Beverage Advertising Initiative (CFBAI) in 2006. Young children are uniquely vulnerable to commercial advertising and promotion because they are unable to differentiate information from advertising [39]. The food and beverage companies which have signed on to the CFBAI voluntarily agreed to either reduce their advertising to children or focus on advertising products that they defined to be healthier for children. Four major companies, including one of the leading beverage companies, agreed to not advertise food or beverage products on television programming directed to children under the age of 12 years. Recent research has demonstrated a reduction in television advertising between 2003 and 2009, with exposure to beverage ads decreasing more than 40% [4*].

Although beverage companies may be voluntarily scaling back advertising to children via traditional media outlets like television, they are shifting their efforts to capitalize on children's increasing use of the Internet and social media by creating company-sponsored websites, placing banner advertising on third-party websites, and engaging in social media [38]. Company-sponsored websites often have features that are intended specifically to appeal to children or adolescents, such as colorful images, animation, games, videos, music, and social media links [38]. Companies have Facebook pages for their products, with photos, videos, contests, downloads (e.g., wallpapers, screensavers, and emoticons); one leading beverage company has 30 million Facebook fans [38]. Beverage companies also sponsor smartphone applications, such as mobile phone games, and use text message advertising to promote their products among young consumers.

Product diversification

With increasing public concern about the health risks associated with SSB consumption, food and beverage producers have made changes in their marketing and distribution practices to promote a switch from sodas and other SSBs to beverage options, including vitamin waters, flavored water, sports drinks, fruit drinks, sweetened teas, and caffeinated energy drinks, which are healthier or perceived by consumers to be healthier. Companies have reduced the calorie content and created 'light' or 'diet' versions of their traditional beverages by replacing some or all of the caloric sweetener content with artificial sweeteners [38]. Although the resulting reduction in calories may be helpful, there are currently limited and contradictory findings on the health impact of artificial sweeteners. Though determined to be Generally Regarded as Safe (GRAS) by the Food and Drug Administration, safety concerns persist [40]. The results of limited research have also raised concerns about the impact of high-intensity artificial sweeteners on the development of taste preferences, particularly among young children, and on weight management. A recent review concluded that the majority of observational studies show a positive association between artificial sweetener consumption and body weight, whereas randomized controlled trials do not [40]. The authors also concluded that artificial sweeteners consumed in isolation do not affect metabolism; however, when given in combination with caloric sugars, they may have an effect. Currently, the US Dietary Guidelines advise consumption of only low-fat milk, water, and limited quantities of 100% fruit juice [41].

Portion sizes

Advances in technology, including refinement of the ability to convert corn sugar (glucose) to fructose and produce high-fructose corn syrup (HFCS), have helped the beverage industry to ensure a consistent and relatively low cost supply of caloric sweetener [42], making it cost-effective for them to provide larger portion sizes to the value-conscious consumer. The average portion size of SSBs consumed in 1977–1979 was 13.6 ounces, but by 1994–1996, it was 21.0 ounces, an increase of 62% [43]. Larger serving sizes are associated with higher intake [44]. Recently, the industry has begun to make a wider range of beverage sizes available including smaller 7.5 ounce containers [45]. It remains to be seen whether this has an impact on reducing the overall intake.

School access

In the past, public schools were the target of intensive industry efforts to promote product sales and for public health advocates working to reduce SSB consumption. In the early 1990s, cash-strapped public schools began selling 'pouring rights' to major beverage companies [46]. These contracts gave companies the exclusive right to sell their products in schools through vending machines, snack bars, and sporting events, as well as to advertise in schools, in exchange for providing funding to support the schools' education and athletic initiatives. In 2005, approximately 50% of public elementary schools and 80% of public high schools had signed pouring rights contracts [46]. However, a voluntary initiative between the American Beverage Association, the American Heart Association, and the Alliance for a Healthier Generation has led to the removal from schools of the vast majority

of full-calorie soft drinks. Between 2004 and 2010, there was a 90% reduction in beverage calories shipped to schools [47*].

Excise taxes

Excise taxes on SSBs have been proposed as a strategy that could result in a substantial reduction in their consumption and in the prevalence of obesity [48–50]. A recent study estimated the potential impact on health and spending of a nationwide penny-per-ounce excise tax on SSBs. It was estimated that the tax would reduce the consumption of SSBs by 15% among adults and prevent 2.4 million diabetes person-years, 95 000 coronary heart events, 8000 strokes, and 26 000 premature deaths, while avoiding more than \$17 billion in medical costs [51*]. The American Beverage Association, the trade association that represents America’s nonalcoholic beverage industry, has been reported to have actively opposed recent beverage tax proposals. Perhaps paradoxically, some Hispanic and African–American civil rights groups, which represent some of the communities hardest hit by the obesity epidemic, have joined business associations and the beverage industry in opposing soda regulation, apparently in exchange for tens of millions of dollars in grants from the beverage industry to support nonprofit and educational organizations in these communities [52].

CONCLUSION

National nutrition studies have demonstrated that the previously increasing trend in SSB consumption may have reversed over the last decade. Although the causes of this decrease are not clearly understood, voluntary efforts by the industry to reduce availability in the schools, to reduce marketing of SSBs during children’s television programming, and to provide more low-calorie and naturally sweet beverage alternatives may have contributed. Despite this encouraging change, SSBs still contribute nearly 7% of the energy consumed in the US diet, an amount that by itself exceeds the current guidelines for total added sugar intake.

The beverage industry appears to have made a move toward promoting ‘healthier’ beverages. Nevertheless, continued caution is needed when considering which beverage options should be promoted as healthy alternatives to SSBs. Further research is needed before beverages sweetened with artificial sweeteners are widely encouraged as alternatives to SSBs, particularly among children. Regarding 100% fruit juice, current guidelines advise that these be limited. As fruit juices contain essentially the same sugar and calories as SSBs and their contribution of other important nutrients is minimal, caution is advised before encouraging greater intake as a replacement for SSBs.

The voluntary reduction in television advertising to children is a positive but insufficient step. SSBs are increasingly promoted to children in a multitude of ways, with television advertisements becoming less of a concern because of the rapidly increasing number of electronic media options available to children. Further research is needed to explore the effects of social media on children’s attitudes toward the consumption of SSBs.

Finally, public health policies to address health disparities may be necessary. Such policies could create a level playing field, in which those sectors of the beverage industry that recognize a public health imperative and are willing to make health-promoting changes are not placed at a financial disadvantage by doing so. Research in this area is in its infancy.

REFERENCES AND RECOMMENDED READING

Papers of particular interest, published within the annual period of review, have been highlighted as:

- of special interest
- of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (pp. 496–497).

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KEY POINTS

- Previously rising sugar-sweetened beverage (SSB) consumption rates have declined recently; despite this decline, calories from SSB consumption alone continue to exceed the American Heart Association's recommendation for limiting added sugars in the diet. Continuing high SSB consumption and associated health risks highlight the need for further public health action.
- A recent meta-analysis concluded that SSBs likely increase body weight and recent long-term studies support previous findings of increased risk of diabetes, dyslipidemia, metabolic syndrome, and hypertension.
- Beverage companies have played an active role in supporting some SSB reduction efforts and in opposing others. The extent to which the industry is willing and able to make meaningful changes that will improve beverage consumption patterns is unclear.
- The beverage industry has developed alternative beverages marketed as 'diet' or 'light' that replace some of the sugar content with artificial sweeteners, but the impact of this trend is unknown.