Are sugar-sweetened beverages harmful?

H Wu and JP Chanoine
Endocrinology and Diabetes Unit, British Columbia’s Children’s Hospital, Vancouver BC V6H 3V4

key message

• Sugar-sweetened beverages (SSB) are a significant source of calories in youth
• Some but not all studies show an association between SSB consumption and increased bodyweight
• Potential mechanisms explaining the adverse effects of SSBs include excess calories, inappropriate compensation mechanisms and type of carbohydrate (fructose)
• Interventional studies aimed at decreasing SSB intake show positive but modest effects on body mass/composition in youth
• The effect of voluntary measures by beverage companies such as better label information or actions such as SSB taxation by regulatory authorities need to be evaluated

Sugar sweetened beverages (SSBs, defined as any drink with added sugar, including soft drinks and fruit drinks with less than 100% juice) may account for up to 20% of liquid calorie intake in Canadian children and adolescents. One of the commonly used sweeteners is high-fructose corn syrup which is found in over 40% of consumed products in the United States. Increased SSB intake correlates with increased bodyweight in some but not all studies. In a 10-year longitudinal study, SSB consumption at age 5 was associated with increased body fat, waist circumference and BMI percentile between 5 and 15 years. However, calorie intake was not a predictive factor, suggesting that the type of carbohydrate is more important than the calorie content. Data from the Longitudinal Study of Child Development in Quebec found no significant association between total daily SSB consumption and being overweight in 4.5 years. However, SSB consumption between meals increased the risk of being overweight, suggesting that liquid calories between the meals may not lead to a compensatory decrease in energy intake at subsequent meals. In a study of 365 low-income African American preschool children assessed over 2 years, each additional 30 ml of SSB consumption per day was associated with a 4% increase in the risk with of becoming overweight. In contrast, a 5-year follow-up of 2294 adolescents did not find a significant association between SSB intake and weight gain. Meta-analyses looking at the association between SSB consumption and body mass generally report positive correlations between SSB intake and body weight or adiposity although one found no correlation. The methodology of the latter study, supported by the beverage industry, has been criticized.

Several mechanisms may explain the unhealthy effects of SSBs. First, our body, which has used milk as the largest source of liquid calories throughout our evolutionary history, may be ill-equipped to deal with the rapid introduction of carbohydrate-rich calories in liquid form. This is in line with studies showing that milk consumption is neutral in terms of fat mass in adolescents. Second, SSB consumption could simply lead to a net increase in energy intake. In an analysis of data from the NHANES, replacing SSBs with water could potentially result in a 235 kcal reduction in daily calorie intake. Third, our body may not appropriately compensate for excess calories received in liquid form. In a study comparing the effect of 450 kcal given as jelly beans or soft drinks on subsequent energy intake, consumption of the jelly beans, but not of soft drinks, was associated with a compensatory reduction in caloric intake. Finally, fructose itself, which is metabolized through different pathways than glucose, has emerged as a possible causative factor. Fructose causes an increase in visceral adipose tissue and a decrease in insulin sensitivity.

If the positive association between SSB intake and changes in BMI reflects causality, then interventions to decrease beverage intake should result in a decrease in body mass. In a 12-month trail that included 644 schoolchildren aged 7 to 11, 29 classes in 6 schools were randomized to receive no intervention or an educational program designed to discourage carbonated beverage consumption and encourage water intake. At 12 months, SSB intake had decreased significantly in the intervention compared to the control group. There was no difference in the absolute BMI values between the 2 groups but the percent of overweight/obese children in the control group increased by 7.5% contrasting with a 0.2% decrease in the intervention group. These positive effects were lost after 2 years. In a 25-week trial performed in 13- to 18-year-old adolescents, weekly deliveries of non-caloric beverages were used to help decrease SSB intake. SSB consumption decreased by 82% but there was no overall change in BMI. However, those with a BMI in the upper BMI tertile at baseline experienced a 0.75 kg/m² decrease in BMI compared to the control group. Finally, a 16-week randomized controlled trial attempting to displace SSBs with milk caused a decrease in SSB consumption in the intervention group. BMI was not affected but lean mass accretion was greater in the intervention group. The modest results of these intervention studies may reflect the short duration of the trials or the fact that SSB is only one of the many determinants of obesity.

In summary, finding ways to decrease SSB intake is likely an important step towards preventing obesity in youth. Steps such as decreasing the sugar content or clearly marking the calorie content on the sticker of each bottle are being taken by several beverage companies. These measures may, however, have little effect on caloric consumption. Other measures such as taxation of SSBs are being considered by provincial and federal authorities.
References


Interested in contributing to the TROPIC 750 series? Contact us at tropic@obesitynetwork.ca for additional information.