


Reduction of Sugar-Sweetened Beverage Consumption in Elementary School Students Using an Educational Curriculum of Beverage Sugar Content

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Abstract

Introduction: Given the known association between sugar-sweetened beverage (SSB) intake and poorer health, we instituted an educational curriculum to reduce student consumption of SSBs. **Methods:** The program included third- to fifth-grade students. A simple demonstration using teaspoons of sugar or small candies showed students the quantity of added sugar in common beverages. This amount of sugar was compared to the daily limit recommended by the American Heart Association. Key principles were reinforced over a 4-month period. Anonymous beverage recall surveys were distributed to 213 students at baseline and 211 students 6 months after exposure to the curriculum. Primary endpoints included evaluation of SSB, real fruit juice (RFJ), diet soda, and water servings in the last 24 hours. **Results:** The proportion of children consuming 2 or more beverages daily decreased from 8.9% to 4.3% ($P = .0546$) for diet soda, from 70.0% to 58.3% ($P = .0123$) for SSB + RFJ, and from 60.1% to 47.4% ($P = .0087$) for SSB. At baseline, students reported an average consumption of 3.5 SSB, 4.5 SSB + RFJ, 0.4 diet soda, and 3.3 water servings per day. At 6 months after exposure, the average daily beverage consumption decreased to 2.7 servings per day for SSB ($P = .014$), 3.8 for SSB + RFJ ($P = .039$), and 0.2 for diet soda ($P = .027$). Water consumption increased from 3.3 to 3.6 servings per day ($P = .075$). **Discussion:** Our data suggest grade school students are receptive to information about the adverse effects of SSBs on health. Adding similar educational programs to elementary school curriculum may help reduce long-term SSB consumption.

Keywords

school age, early lifespan nutrition, obesity, overweight and comorbidities, effecting public policy change

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Introduction

Nearly one fifth of all American children and adolescents are obese and will consequently suffer multiple health complications, poorer quality of life, and shorter life expectancy.^{1–6} Both the American Academy of Pediatrics and the White House Task Force on Childhood Obesity highlight the need for simple approaches to prevent and reduce obesity, including the promotion of decreased sugar-sweetened beverage (SSB) and increased water consumption.⁷ Caloric contribution from SSBs among school-aged children in the United States has increased steadily over the past few decades and mirrors increases in obesity.⁸ According to the National Center for Health

Statistics, children and adolescents obtain approximately 16% of their total calories from added sugars, and half of those sugars (approximately 40 grams per day) come from what they drink.^{9,10} These numbers are alarming as the American Heart Association recommends children and teens consume no more than 25 grams of added sugars per

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day.¹⁰ To combat this alarming rate of excessive sugar consumption, members of a suburban Chicago elementary school Wellness Committee created a class lesson to teach students about the dangerously high levels of sugar in many commonly consumed beverages.

Methods

The program was instituted with third- to fifth-grade students in a suburban Chicago elementary school during the 2014-2015 academic year. A team of health professionals, teachers, and parents who formed the school Wellness Committee created an educational lesson called the "Sugar Show." Developed over the 2013-2014 school year, the program compared the American Heart Association's recommended daily added sugar limits to the amount of sugar contained in popular beverages. The parent co-chairs of the committee were health care providers who wanted to promote a simple message that would greatly influence health and create little controversy. At the time, many national, state, and local health organizations and non-profit groups were embracing the national Re-Think Your Drink Campaign. The campaign is promoted by the Centers for Disease Control and Prevention and focuses on teaching students about the amount of sugar in commonly consumed beverages, as well as their impact on health. As part of the campaign, the school Wellness Committee adapted the "Sugar Show" from a New York City adolescent obesity prevention program called "Energy Up," which posts information detailing the sugar content of commonly consumed products online.¹¹

The Wellness Committee developed a simple lesson plan that involved filling plastic bags with the amount of sugar found in commonly consumed SSBs, and then comparing them to bags with the American Heart Association's recommended daily limit for the age group. The lesson was further refined during school staff meetings, parent teacher association meetings and by students themselves. One student suggested that in addition to bags of sugar, students should be shown the sugar equivalent in pieces of candy, which was added to the lesson. For instance, one 20-ounce soft drink serving was the equivalent of 19 teaspoons of sugar and 19 pieces of candy. Both teachers and parents were interested in not just providing information regarding the sugar content of drinks but also about creating a school culture that encouraged drinking water and a peer-culture that would frown upon SSB consumption. To promote water drinking, at the Wellness Committee's request, a local hospital donated 2 new drinking fountains to the school and water bottle filling stations. The

fountains were placed in the cafeteria and a high-traffic hallway.

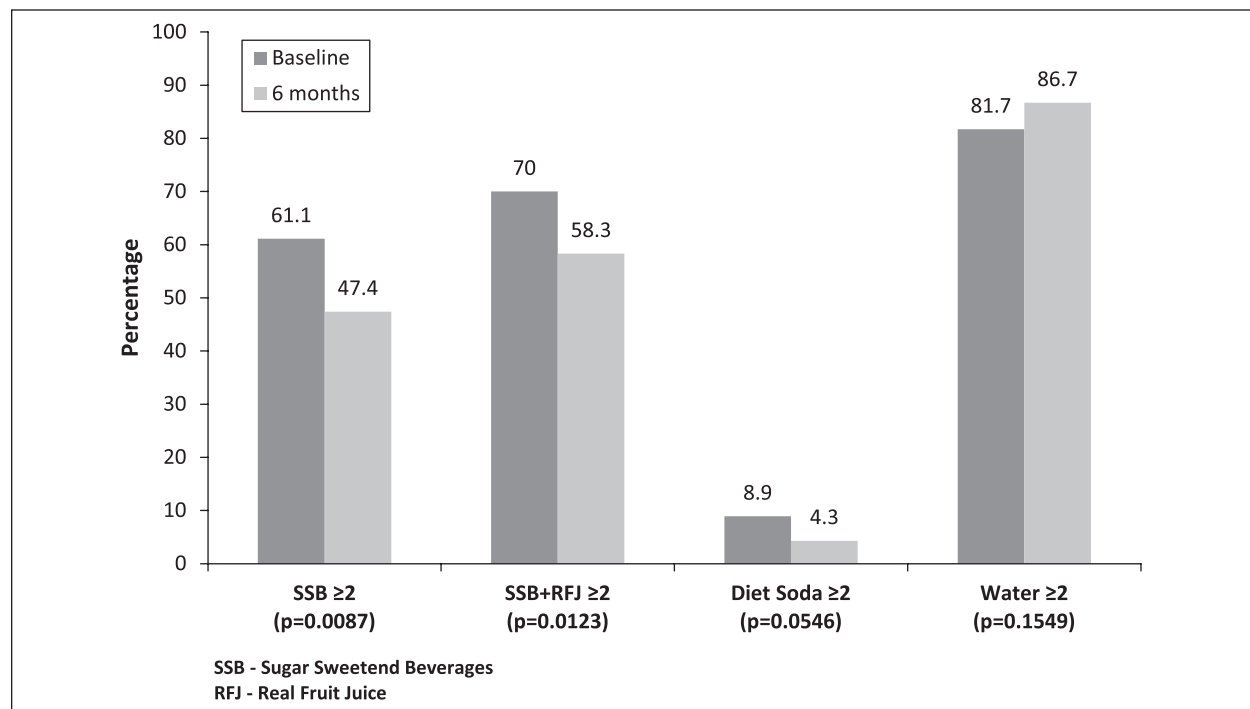
Before the program was implemented, the Committee sent a letter to all parents of third- to fifth-grade students detailing the specifics of the upcoming lesson as well as the reasoning for the new curriculum. The school parent teacher association purchased 100 water bottles with "Re-Think Your Drink" written in school colors above a picture of the school mascot. The lesson was administered by the co-chairs of the Wellness Committee, with assistance from parent volunteers and teachers, to all the third- to fifth-grade physical education classes in early November 2014. For 4 months following the lesson, weekly school announcements over the PA system concluded with a reminder to "re-think your drink." A water bottle raffle was also held, and posters reinforcing the principles taught during the lesson were placed in strategic areas of the school.

To study the program's impact, a parent committee member with a medical-research background created a 24-hour beverage recall survey based on an adult standardized survey called the Bev 15.¹² School teachers deemed both the lesson and the survey to be most appropriate for third- to fifth-grade students. The survey was approved by the local school board to be administered without any identifiers other than grade. As this program was conducted as a school wellness project led by parents and teachers, submission to the local medical center's institutional review board was not required. A parental letter explained the survey and its purpose, and gave parents and guardians the option of notifying their child's teacher if they did not want the survey to be collected. Students were anonymously surveyed 1 week prior to and 6 months after the lesson. The survey was administered in all third- to fifth-grade homerooms by the teachers. Table 1 can be referenced for an outline of the described developmental stages of the program.

Primary end points of the program included SSB (soda, sports drinks, mixed-fruit drinks, flavored milk, energy drinks), real fruit juice (RFJ), diet soda, and water consumed within the 24-hour recall period. Surveys were reviewed independently by 2 members of the research team. Any disagreements about the results of individual surveys were settled by a third research team member. A total of 213 surveys were distributed at baseline and at 6 months. Two surveys collected at 6 months were discarded because of illegible responses. The final sample size of 213 at baseline and 211 at 6 months were included in the data analysis. The school received no complaints and much praise about the lesson from staff, students, and parents.

Table 1. “Sugar Show” Development Steps.

School Wellness Committee develops outline of the “Sugar Show” lesson
School accepts donation of 2 new drinking fountains for high-traffic areas as well as cafeteria
Lesson presented to teachers at staff meeting and parent-teacher association meeting, and revised per their suggestions
Survey developed by committee member and presented to teachers on the School Wellness Committee
Parent-teacher association purchases 100 water bottles with school logo and “Re-Think Your Drink” slogan
Survey submitted to University of Chicago Survey Laboratory
School district approves revised survey and lesson plan
Letter sent home to all families of third- to fifth-grade students to explain lesson, survey, and ability to opt out of survey
All third- to fifth-grade students complete anonymous surveys in their homeroom classrooms
“Sugar Show” lesson presented in physical education classes for all third- to fifth-grade students
Weekly announcements with a Re-Think Your Drink reminder and water bottle raffle for 4 months
Sugar poster placed in cafeteria for 4 months
Students re-surveyed 1 and 6 months after receiving the lesson

**Figure 1.** Comparison of number of beverages (≥2) consumed daily at baseline and 6 months.

Statistical Analysis

Data were summarized using descriptive statistics (means and standard deviation for continuous variables; count and percentage for categorical variables). Beverage consumptions were categorized into 4 drink groups: SSB, SSB + RFJ, diet soda, and water. Changes in consumption between baseline and 6-month follow-up were compared using standard parametric and as needed nonparametric methods. The number of children consuming 2 or more beverages per day at baseline and 6 months were also compared using χ^2 tests. Data were analyzed with the help of a biostatistician using SAS 9.4

software (SAS Inc, Cary, NC), and the statistical significance level was set to .05.

Results

As shown in Figure 1, the proportion of children consuming 2 or more beverages per day decreased from 8.9% to 4.3% ($P = .0546$) for diet soda, from 70.0% to 58.3% ($P = .0123$) for SSB + RFJ, and from 60.1% to 47.4% ($P = .0087$) for SSB. Prior to the “Sugar Show” intervention, students reported an average consumption of 3.5 SSB servings, 4.5 SSB + RFJ servings, 0.4 diet soda servings, and 3.3 water servings per day. At 6

Table 2. Average Servings per Day of SSB, SSB + RFJ, Diet Soda, and Water Intake Among Elementary School Students at Baseline and 6 Months.

Beverage	Baseline (N = 213), Mean \pm SD	6 Months (N = 211), Mean \pm SD	P
SSB	3.5 \pm 4.3	2.7 \pm 3.8	.014
SSB + RFJ	4.5 \pm 5.0	3.8 \pm 4.7	.039
Water	3.30 \pm 1.7	3.6 \pm 1.6	.075
Diet soda	0.4 \pm 0.9	0.2 \pm 0.7	.027

Abbreviations: SSB, sugar-sweetened beverage; RFJ, real fruit juice.

months after exposure, the average daily beverage consumption decreased to 2.7 servings per day for SSB ($P = .014$), 3.8 for SSB + RFJ ($P = .039$), and 0.2 for diet soda ($P = .027$). Water consumption increased from 3.3 to 3.6 servings per day ($P = .075$). These results are depicted in Table 2. Analysis of Grades 3, 4, and 5 individually revealed similar results as with the overall cohort analysis.

Discussion

Many communities around the world are actively combatting SSB consumption as a means of targeting obesity, diabetes, and heart disease. In 2014, Mexico implemented a nationwide tax on SSBs to combat the high prevalence of diabetes, which represents a public health crisis for the nation. Early projections of this effort, based on observed consumption reductions, suggest that the SSB tax may substantially decrease morbidity and mortality related to diabetes and cardiovascular disease.¹³ In 2015, Berkeley, California, implemented a \$0.01-per-ounce tax on the distribution of SSBs. Analysis of this intervention revealed a 21% decrease in the consumption of SSBs just 4 months after the tax became effective.¹⁴

Other proposals have focused on educational intervention, with mixed results reported. In 2014, Avery and colleagues published a systematic review of controlled trials of school-based educational programs to reduce SSB consumption. Eight studies were described, all of which were at least 6 months in duration. Six of the 8 interventions reported significant reductions in SSB consumption; however, this was not always sustained. It was concluded that fostering a school environment that supports the educational programs and positive reinforcement among peers could improve effectiveness, which is what we aimed to achieve.¹⁵ Also, different from most described interventions, our program was conceived and developed from an organic collaboration between parents, children, health care professionals, and teachers as a school project.

A statistically significant lower intake of SSB and SSB + RFJ was reported after implementation of the “Sugar Show.” Water consumption was not significantly increased. As part of our analysis, we used whole number cutoffs (ie, 0-1 and >2) as a means of measuring SSB and RFJ intake among students. Analyzing the data in this fashion was based on comparable methods of assessment used in previous similarly designed studies. Although absolute cutoffs vary between studies, most use SSB consumption over a 24-hour period to assess intake. Possible reasons for the statistically significant decrease in SSB and RFJ consumption noted in our project include the heavier focus of the curriculum on the harms of excessive intake and the clear depictions of beverage sugar content. Peer pressure may have also influenced the results as lunchroom workers and parents noted groups of students reading and discussing drink labels together. The fact that increased water consumption did not reach statistical significance may be reflective of the curriculum’s lesser emphasis on alternative beverage choices.

Overall, the data suggests that grade school students are receptive to information regarding the adverse effects of SSB consumption on health. Incorporating educational programs like the “Sugar Show” into school curriculum may help reduce SSB intake, and ultimately obesity, as dietary habits often develop at a young age. The school district was impressed by the program as well as the positive results and elected to expand it to 15 schools with a population of over 7500 students.

Our hope is that the expansion project will address several of the limitations of our initial assessment. The relatively short time interval between initiation of the curriculum and follow-up survey assessment limits our ability to assess long-term behavior change. Also, the 24-hour snap shot of beverage consumption recorded on the surveys may not be reflective of beverage choices over a longer period. Varying levels of academic achievement and socioeconomic status may also have affected outcomes, especially with just one school involved. Finally, because the surveys were conducted anonymously, we were not able to track individual change before and after the intervention.

Ideally, the “Sugar Show” could be incorporated into school curriculum and taught by teachers. Many states require a physical education and nutrition curriculum, and decreasing added sugars could have a great impact on health. In addition to self-reported SSB consumption, knowledge, attitudes, and beliefs about the health impact of sugar could also be examined, as well as the impact of the “Sugar Show” on the families of children who receive the message. Given that added sugars are not easily identified on labels, another component could be

teaching children how to read and understand package labeling. There are some reports in the literature of school-based water promotion programs decreasing obesity.¹⁶ More research is needed to see if promoting water in schools and communities can increase water consumption and decrease SSB consumption.

Public Health Implications

In summary, implementation of an educational curriculum regarding SSB intake can be an effective method to combat unhealthy beverage choices in youth. Given that excess sugar intake is associated with obesity, diabetes, dental cavities, cardiovascular disease, and even certain cancers, we believe educational programs like ours will aid in improving overall health and decrease long-term health care spending.¹⁰ While a statistically significant reduction of SSB consumption was noted, unhealthy amounts of SSBs were still consumed after 6 months. This highlights the need for future interventions. Our hope is that the positive results yielded by our project will motivate others to implement similar interventions in their communities and generate new ideas to further reduce excessive sugar consumption among the population. Continued studies are suggested to further evaluate the long-term benefit of similar educational programs.

Author Contributions

JR, BM, ATa, LC, and TS contributed in study design, data collection, data analysis, and manuscript preparation, CW contributed in statistical analysis and manuscript preparation. ATa and VB contributed in data collection, data analysis and manuscript preparation.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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