RESEARCH ARTICLE

Reduced Availability of Sugar-sweetened Beverages and Diet Soda Has a Limited Impact on Beverage Consumption Patterns in Maine High School Youth

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ABSTRACT

Objective: To examine change in high school students' beverage consumption patterns pre- and post-intervention of reduced availability of sugar-sweetened beverages (SSB) and diet soda in school food venues.

Design: A prospective, quasi-experimental, nonrandomized study design.

Setting: Public high schools.

Participants: A convenience sample from control (n = 221) and intervention (n = 235) high schools.

Intervention: Schools aimed to reduce (n = 4) or not change (n = 3) availability of SSB and diet soda in food venues for 1 school year.

Main Outcome Measures: Subjects' beverage servings/day was determined from a food frequency questionnaire pre- and post-intervention.

Analysis: Two-by-two mixed analysis of variance model compared pre- to post-intervention servings/day between control and intervention subjects, stratified by gender.

Results: Consumption of SSB decreased in both intervention and control boys ($F = 53.69$, $P < .05$) and girls ($F = 22.87$, $P < .05$). Intervention girls decreased diet soda consumption as compared to control girls ($F = 6.57$, $P < .05$).

Conclusion and Implications: Reducing availability of SSB in schools did not result in a greater decrease in SSB consumption by intervention as compared to control subjects. The impact of reducing availability of SSB at school may be limited. A better understanding of beverage consumption patterns may be needed to determine the efficacy of school food policies on those youth susceptible to obesity.

Key Words: sugar-sweetened beverages, youth, school food policies

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INTRODUCTION

The prevalence of "overweight" and "at risk for overweight" in youth has risen rapidly in the past few decades and has become a major public health concern in Maine[1] and nationally.[2] Although the cause of overweight is complex and most likely multifactorial, consumption of sugar-sweetened beverages (SSB) is emerging as a potential contributor to weight gain in youth.[3,4] Sugar-sweetened beverages are defined as regular soda, fruit drinks, sweetened ice teas, sports drinks, and other sweetened beverages with added sugar or high-fructose corn syrup. Although cross-sectional studies consistently find a positive association between SSB intake and body weight,[5,6] inconsistent findings are reported with prospective studies,[7-9] and randomized clinical trials in youth are scarce. James et al reported a 1-year school-based educational program to reduce consumption of carbonated drinks had a modest reduction in carbonated drink consumption associated with a 0.2% reduction in the incidence of obesity as compared to a 7.7%

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increase in the control group.[10] Ebbeling et al found that a 25-week home delivery of noncaloric beverages designed to replace SSB reduced SSB consumption by 82% and was associated with a loss of body weight for youth with the highest baseline body mass index (BMI).[11]

Sources of SSB are ubiquitous. Data from a national sample of youth show home is the largest source of soft drinks per se followed by restaurant/fast-food venues, vending machines, and school cafeterias.[12] Although the location of vending machines was not included in these data,[12] other data suggest vending machines in schools are a source of soda and other SSB, especially at the high school level.[13] A recent study examined availability of beverages in secondary schools and found soft drinks, sports drinks, and/or fruit drinks (not 100% juice) were offered by 78.9% to 99.5% of high schools across 27 states.[13]

Efforts to reduce consumption of SSB are numerous. Indeed, the Dietary Guidelines for Americans 2005 recommend reducing consumption of SSB.[14] Moreover, the USDA requires schools that participate in the federal meal programs to develop and implement local wellness policies that address nutrition guidelines for all food items and beverages available for sale on campus.[15] This requirement has provided schools an opportunity to establish nutrition standards that reduce availability of SSB. A recent initiative between the Alliance for a Healthier Generation and major soft drink companies establishes beverage guidelines that will phase out the sale of regular soda and other SSB to public elementary and middle schools.[16,17] Of note, however, is the failure of this initiative to eliminate availability of sports drinks and other SSB in public high schools.[16,17]

Data examining the influence of diet soda on body weight are scarce. Evidence from some cross-sectional studies shows that diet soda is weakly associated with an increased BMI of children and adolescents[18,19]; however, other studies find no association.[20] Diet soda is available in schools, and how this availability affects students' beverage consumption patterns is largely unknown.

Limited data exist that examine the impact of reducing or eliminating school availability SSB or diet soda on beverage consumption patterns of high school-aged youth. Thus, this study examined the change in students' beverage consumption patterns (ie, servings/day of SSB, diet soda, milk, juice) pre- versus post-intervention of reduced availability of SSB and diet soda in a la carte and vending programs in Maine public high schools. It was hypothesized that reducing the availability of SSB and diet soda would decrease the overall consumption of these types of beverages in the intervention subjects as compared to control subjects.

METHODS

Study Design

This study examines changes in beverage consumption patterns of students from Maine public high schools that participated in a larger prospective, quasi-experimental nonrandomized study.[21,22] High schools volunteered as intervention schools (n = 4), with an aim to eliminate and/or reduce SSB and diet soda, or as control schools (n = 3), which made no changes in beverages offered in a la carte and vending programs for 1 school year. These schools were located in 6 counties throughout the southern and central regions of Maine. School enrollments were 757 ± 293 for control schools and 855 ± 422 for intervention schools. Community populations in these locations ranged from 2500 to 23 000.[23] According to the US Census Bureau's Census 2000, median household incomes for these communities ranged from $28 390 to $56 491.[24]

A convenience sample of students was recruited through presentations in selected classes (eg, physical education, health education, home economics, and science), as well as through posters and announcements on the public address system of the schools. Only students in grades 9-11 were eligible, because students had to be available over 2 school years. Students were offered a $10 gift certificate to a sporting goods store for each year of participation. A total of 581 students volunteered to participate from the 7 schools at pre-intervention, and 473 students were available at post-intervention for data collection. Students who did not complete post-intervention data collection were lost because they had moved from the school district or were absent on all data collection days. Thus, a total of 235 students from the intervention schools (girls, n = 158; boys, n = 77) and 221 students from the control schools (girls, n = 115; boys, n = 106) had pre- and post-intervention data. Students had a mean age of 15.8 ± 0.8 years and were mainly white (97.8%).

Subjects completed a youth food frequency questionnaire[25] pre- and post-intervention to determine beverage consumption patterns (servings/day of SSB, diet soda, milk, juice). Subjects who reported consuming <500 or >5000 calories/day were considered outliers in terms of a plausible caloric intake and were excluded from analysis (2.2%).

Pre-intervention data collection occurred the spring of 2004 prior to the intervention. Reduced availability of SSB and diet soda occurred at the start of the 2004-2005 school year in intervention schools. Post-intervention data collection occurred the spring of 2005, approximately 9 months after the start of the intervention. Monitoring of compliance to the intervention and control conditions occurred on a regular basis throughout the 2004-2005 school year. The research protocol was approved by the Institutional Review Boards of the University of Southern Maine and the Maine Center for Disease Control and Prevention, Maine Department of Health and Human Services. Parental and/or guardian consent and child assent were obtained.

Measures

Beverages available in schools. Trained personnel visited each school for a 1-week period pre- and post-intervention. The week selected for each school was not