Snacks, Beverages, Vending Machines, and School Stores: A Comparison of Alternative and Regular Schools in Minnesota, 2002 to 2008

Martha Y. Kubik, PhD, RN; Cynthia Davey, MS; Richard F. MacLehose, PhD; Brandon Coombes; Marilyn S. Nanney, PhD, MPH, RD

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ABSTRACT

In US secondary schools, vending machines and school stores are a common source of low-nutrient, energy-dense snacks and beverages, including sugar-sweetened beverages, high-fat salty snacks, and candy. However, little is known about the prevalence of these food practices in alternative schools, which are educational settings for students at risk of academic failure due to truancy, school expulsion, and behavior problems. Nationwide, more than 5,000 alternative schools enroll about one-half million students who are disproportionately minority and low-income youth. Principal survey data from a cross-sectional sample of alternative (n=104) and regular (n=339) schools collected biennially from 2002-2008 as part of the Centers for Disease Control and Prevention Minnesota School Health Profiles were used to assess and compare food practice prevalence over time. Generalized estimating equation models were used to estimate prevalence, adjusting for school demographics. Over time, food practice prevalence decreased significantly for both alternative and regular schools, although declines were mostly modest. However, the decrease in high-fat, salty snacks was significantly less for alternative than regular schools (−22.9% vs −42.2%; $P<0.0001$). Efforts to improve access to healthy food choices at school should reach all schools, including alternative schools. Study findings suggest high-fat salty snacks are more common in vending machines and school stores in alternative schools than regular schools, which may contribute to increased snacking behavior among students and extra consumption of salt, fat, and sugar. Study findings support the need to include alternative schools in future efforts that aim to reform the school food environment.
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IN US SECONDARY SCHOOLS, VENDING MACHINES AND school stores are a common source of low-nutrient, energy-dense snacks and beverages that include sugar-sweetened beverages, high-fat salty snacks, and candy.[1,2] For more than a decade, considerable multisector effort has been expended to improve the school food environment,[3-7] with many reporting generally positive results.[8-10] However, surveillance of the US school food environment has not typically included alternative schools, which are educational settings for students at risk of academic failure due to truancy, school expulsion, and behavior problems.[11,12] Nationwide, more than 5,000 alternative schools enroll about one-half million students in secondary alternative school programs, with enrollments increasing.[13] Most students attend an alternative school between 7 and 12 months, and almost one-third attend for >1 year.[14] Students attending these schools are disproportionately minority and low-income youth.[11,14]

All youth will benefit from an improved school food environment, where access to low-nutrient, energy-dense snacks and beverages is limited. It is especially important to provide supportive school food environments for minority and low-income youth, many with an increased risk of overweight and obesity and weight-related morbidities, such as cardiovascular disease and diabetes.[15-17] Limited research suggests vending machines and school stores and the low-nutrient, energy-dense snacks and beverages sold in vending machines and school stores are common in the alternative school setting and availability may be linked to an increased consumption of sugar-sweetened beverages and high-fat foods.[18-20]

The Centers for Disease Control and Prevention (CDC) School Health Profiles is a biennial survey that assesses school health policies and practices in participating states and territories. CDC uses a random, systematic, equal-probability sampling strategy to produce representative samples of public secondary schools that include one or more of grades 6 through 12.[21] In Minnesota, public schools that identified as alternative schools were included in the sampling frame from 2002 to 2008, providing unique opportunities to compare and contrast the alternative and regular school food environments over time.[22] In the current study, regular schools were defined as schools that did not identify as alternative, special education, distance learning, or correctional/treatment facilities.[22]

Therefore, the purpose of the current study was to examine the prevalence of select school food practices that included availability of vending machines and school stores and sugar-sweetened beverages, high-fat salty snacks, and candy sold in vending machines and school stores in alternative and regular schools, and to compare food practice prevalence within and between school type (alternative vs regular) over time. It was hypothesized that school type (alternative vs regular) would moderate the prevalence of food practices. Our study was conducted as part of the School Obesity-Related Policy Evaluation study, which aims to examine school obesity prevention policies in Minnesota secondary schools using existing state and national surveillance data.

METHODS

School-level data from the Minnesota School Health Profiles principal survey were used. Data collection for the present study occurred biennially between 2002 and 2008 and included a cross-sectional sample of alternative (n=104) and regular (n=339) secondary schools. School principals or a designee completed the mailed survey. Statewide participation rates for all years except 2006 were at least 70%.[23] During 2006 the statewide response rate was 66% (P. Rhode, MA, Minnesota Department of Health, personal communication, 2012). Because weighted data were not available from CDC for 2006,[23] data for the current study were analyzed without weights. However, all models included an adjustment for the original stratification scheme. Furthermore, sensitivity analysis of item responses across survey years found minimal differences when comparing weighted to unweighted data.

For the present study, the following questions from the Minnesota School Health Profiles principal survey were examined: Can students purchase snack foods or beverages from one or more vending machines at school or at a school store, canteen, or snack bar and, if yes, can students purchase each of the following snack foods or beverages from vending machines or at the school store, canteen, or snack bar: sweetened carbonated beverages or fruit drinks that are not 100% juice and/or sports drinks (coded as sugar-sweetened beverages), chocolate candy and/or other kinds of candy (coded as candy), and salty snacks that are not low in fat (coded as high-fat salty snacks)?[24,25] Responses for all items were yes/no.

School-level demographic characteristics obtained from the National Center for Educational Statistics (NCES) common core data included percent free/reduced-price lunch eligibility categorized as $<$40% or $\geq$40%, and percent minority enrollment categorized as $<$20% or $\geq$20%.[26] School grade level information was obtained from the Minnesota Department of Education.[22] All schools in the sample included the 12th grade, with the exception of two schools where the highest grade level was 11th grade. The low grade varied across schools from 4th grade to 9th grade. For analysis, school grade level was dichotomized as high grade 11 or 12 and low grade 9 vs high grade 11 or 12 and low grade 4 to 8. A combination of NCES and rural-urban commuting area classification schemes were used to classify school location as city, suburban, or town/rural.[26,27] The study was approved by the institutional review board of the University of Minnesota.

Logistic regression models were used to estimate prevalence of vending machines and school stores and sugar-sweetened beverages, high-fat salty snacks, and candy in vending machines and school stores in alternative and regular schools. Separate logistic regression models were estimated for each of the four outcomes. Statistical significance was accepted at $P<0.05$. No adjustments were made to the reported P values to reflect the multiple hypotheses that were tested. All models included the main predictor, school type (alternative or regular), year, and school-level demographics (eg, percent free/reduce price lunch eligibility, percent minority enrollment, school grade level, and school location). To account for the small number of schools that were included in multiple surveys, generalized estimating equation logistic models with an independent correlation structure were used. Models that included an interaction term between school type and year did not identify a significant effect at $P<0.05$ level on the logistic scale. Therefore, interaction terms were not included in the final models. The adjusted prevalence of each food practice was estimated from the logistic model. Change in practice prevalence over time was computed by comparing the difference between 2002 and 2008 adjusted prevalence. Difference in practice prevalence between the school types was estimated by calculating the difference in practice prevalence between school types, averaged over all years. The Figure compares crude prevalence for each food practice by school type. Analyses were conducted with Stata Statistical Software (release 12, 2011, StataCorp LP).

RESULTS AND DISCUSSION

Table 1 compares demographics by school type. The alternative school sample was significantly more racially diverse than the regular school sample and included a larger proportion of schools where 40% or more of students were eligible for the free/reduced price lunch program. A majority of schools were located in towns/rural areas. However, regular schools were significantly more likely to be in towns and rural areas than alternative schools (77% vs 55%; $P<0.0001$). National data indicate that alternative schools are more typically located in urban and suburban areas.[14]

The Figure compares the crude percentage for each food practice by year for alternative and regular schools. Table 2 shows the trends in food practice prevalence both within and between school types, adjusted for school-level demographics. Prevalence of all food practices was similar in alternative and regular schools in 2002 and consistent with other studies at that time indicating vending machines and school stores that sold sugar-sweetened beverages, high-fat salty snacks, and candy were readily available in most US secondary schools.[28] By 2008, in both alternative and regular schools, a significant decrease in prevalence occurred for all food practices except sugar-sweetened beverages, which showed a significant decrease in regular schools but not alternative schools. However, prevalence remained high during 2008. This was especially true for sugar-sweetened beverages, which were available in vending machines and school stores in more than 90% of all schools. Other studies examining the availability of sugar-sweetened beverages in large representative samples of US secondary schools have shown similar results, confirming that over time decreases in