Student Access to Competitive Foods in Elementary Schools

Trends Over Time and Regional Differences

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Objective: To examine the availability of competitive foods in elementary schools.

Design: Nationally representative mail-back survey.


Participants: Survey respondents at 2647 public and 1205 private elementary schools.

Main Outcome Measure: The availability of foods offered in competitive venues.

Results: Elementary school students’ access to foods in competitive venues on campus (vending machines, school stores, snack bars, or à la carte lines) remained constant over time. As of the 2009-2010 school year, approximately half of all public and private elementary school students could purchase foods in 1 or more competitive venues on campus. Sugary foods were available to almost all students with access to competitive foods on campus. Public elementary school students in the South had more access to competitive food venues and greater availability of salty and sweet products in those venues compared with students in other parts of the country; however, they also had greater availability of healthier foods, such as fruits and vegetables.

Conclusions: Many elementary school students can purchase competitive foods on campus. Most students with access to competitive venues could purchase sweet products, but healthier foods were less widely available.


The prevalence of obesity among children ages 6 to 11 years more than quadrupled from 4% in the late 1970s to almost 20% in the 2007-2008 National Health and Nutrition Examination Survey. Because children spend many hours in school, changes are needed to make the school environment healthier by limiting the availability of less healthy food products. The Healthy Hunger-Free Kids Act, signed into law in December 2010, gave the US Department of Agriculture the authority to set nutritional standards for all foods sold in schools, including those in the department’s lunch program, as well as so-called competitive foods (ie, products sold in vending machines, school stores, and à la carte lines). Specific changes are being developed. The only current regulation for competitive products is that foods of minimal nutritional value (including soft drinks) cannot be sold in the cafeteria during lunchtime; however, these products can be sold in vending machines or school stores at any time, and other sugary beverages, such as sweetened teas and sports drinks, are not covered by these regulations. In 2007, the Institute of Medicine issued a report about competitive foods in schools, noting that school meal programs should be the primary source of nutrition in schools, with limited student access to competitive foods but, where these products are available, that the items offered should consist of fruits, vegetables, whole grains, and lower-fat dairy products.

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the School Nutrition Dietary Assessment Study–III\textsuperscript{11} during the 2004-2005 school year and the School Health Policies and Programs Study 2006 by the Centers for Disease Control and Prevention\textsuperscript{12} in 2006. Both studies occurred before the Child Nutrition and WIC [Women, Infants, and Children] Reauthorization Act of 2004 (Pub L No. 108-265, §204), which required all school districts participating in the national school lunch programs, school breakfast programs, or other federal child nutrition programs to adopt and implement a wellness policy by the first day of the 2006-2007 school year. The law required each wellness policy to include nutrition guidelines for all foods and beverages available on campus during the school day; however, specific guidelines were not mandated, and most policies developed to date have been weak and fragmented.\textsuperscript{13}

Prior investigations on competitive foods in schools have documented widespread student access to competitive food venues and have shown that many products available in these venues are unhealthy. The School Nutrition Dietary Assessment Study–III found that competitive foods were available through 1 or more sources in almost all middle schools (97%) and high schools (100%) and, although less common in elementary schools, that 72.7% of public elementary schools had competitive foods available in vending machines, school stores, or à la carte lines.\textsuperscript{11} Almost one-third (29.1%) of elementary school students consumed competitive foods, and the most commonly consumed items were low-nutrient or energy-dense products, such as desserts and snacks, cookies, and candy.\textsuperscript{11} Furthermore, the availability of high-sugar and high-fat foods and beverages in competitive venues, such as school stores and à la carte lines, is significantly associated with greater calorie consumption among schoolchildren.\textsuperscript{14} Because of the importance of developing healthy eating habits early in childhood, efforts to improve the elementary school food environment are crucial to prevent childhood obesity.\textsuperscript{4}

This study presents the most up-to-date information available on student access to competitive foods in elementary schools, spanning 4 years from the 2006-2007 to the 2009-2010 school years. We also document student access to competitive foods in a nationally representative sample of private elementary schools.

METHODS

Since the beginning of the 2006-2007 school year, the Bridging the Gap Research Program has been collecting data annually on school-level practices relevant to childhood obesity. This program is supported by the Robert Wood Johnson Foundation.

DATA COLLECTION

Data were collected using mail-back school surveys conducted during the 2006-2007, 2007-2008, 2008-2009, and 2009-2010 school years. Data collection occurred primarily between February and June of every school year, with a few additional surveys received during the summer following each school year. Our 2-part survey was mailed to the school principal with a request that the second section (from which these data were obtained) should be completed by food service personnel; approximately half of the food and beverage surveys were completed by food service personnel, with the rest completed by administrators, teachers, or other staff. A $100 incentive was offered for completing and returning the survey. Surveys were processed and double-entered for quality assurance. Survey response rates were calculated using the American Association for Public Opinion Research\textsuperscript{15} method 2, counting partial responses as complete. Response rates (number of responding schools) were as follows across the years 2006-2007, 2007-2008, 2008-2009, and 2009-2010, respectively: for public schools, 34.6% (578 schools), 70.6% (788 schools), 61.8% (641 schools), and 64.5% (680 schools); for private schools, 66.2% (239 schools), 84.4% (336 schools), 76.2% (297 schools), and 78.8% (313 schools).

SAMPLING AND WEIGHTING

Our nationally representative samples of public and private elementary schools were developed at the Institute for Survey Research at the University of Michigan using sampling frames based on data sets from the National Center for Education Statistics. Public schools from all coterminous US states (excluding Alaska and Hawaii) were eligible for sampling. Because elementary schools vary in grade composition (eg, kindergarten through third grade and second through fifth grades), we selected third grade as a proxy for sampling and weighting. All schools included a third grade, and student-level weights were developed based on the enrollment of third-grade students. These weights provide inference to the percentage of elementary school students affected by each school-level practice. Weights were adjusted for nonresponse bias by modeling every school’s propensity to respond. Variables used to model these adjustments included locale, US census region, school size, the percentage of students eligible for free or reduced-price lunch (public schools only), and percentages of black, white, and Latino students.

OUTCOME MEASURES

We asked respondents to indicate whether beverages were sold in each of the following 3 competitive venues during lunchtime: vending machines, school stores or snack bars, and a la carte lines. For each venue present at the school, we asked which types of foods were available in that venue. For vending machines and school stores, response options were yes or no. For a la carte lines, response options were never, some days, or most or every day. The latter 2 responses were collapsed as a yes response. Product categories are listed in Table 1. In addition, we grouped foods into the following 4 categories: (1) any salty product whether regular-fat or low-fat (regular-fat chips and pretzels, baked chips, or other low-fat salty snacks), (2) any low-fat product (low-fat salty snacks, low-fat baked goods, and low-fat ice cream), (3) any sweet product (candy, ice cream whether low-fat or not, and cookies, cakes, or baked goods whether low-fat or not), and (4) any healthier product (salads, vegetables, fresh fruits, and other fruits).

CONTEXTUAL COVARIATES

We obtained school-level demographic and socioeconomic information from the National Center for Education Statistics Common Core of Data (CCD) (http://nces.ed.gov/ccd/). We obtained data from the 2006-2007, 2007-2008, and 2008-2009 CCD files for each corresponding year of public survey data and from the 2008-2009 CCD file for the 2009-2010 public school data (2009-2010 CCD data were unavailable at the time of the analysis). We obtained data from the 2005-2006 Private School Sample for the 2006-2007 private school data and from the 2007-2008 Private School Sample for the latter 3 years of
private school survey data. Contextual data were obtained on the total number of students in the school (school size), the percentage of students of white race/ethnicity at the school, US census region (West, Northeast, Midwest, or South [referent]), and locale (city [referent], suburb, township, or rural). An ordinal variable was created to reflect the following school size tertiles: small (<451 students), medium (451-621 students), or large (>621 students). For public schools only, we used the percentage of students eligible for free or reduced-price lunch as a proxy for socioeconomic status, and this variable was divided into the following 3 groups: higher socioeconomic status (33%-66% eligible), medium socioeconomic status (<33% eligible, [referent]), or lower socioeconomic status (>66% eligible). Year was coded using 3 dummy variables to compare each of the latter 3 years against baseline (2006-2007).

### STATISTICAL ANALYSIS

Public schools in our sample were clustered within school districts, with a mean of 1.5 schools responding per district. We conducted analyses with commercially available software (STATA/SE, version 10.0; StataCorp LP) using the survey command to adjust for the clustering of schools within districts.

We examined changes over time using a series of multivariate logistic regression analyses, one for each outcome listed in Table 1. Percentages are unadjusted for contextual covariates, but the statistical significance of regional differences was tested in multiple logistic regression analyses. These models were computed separately for public and private schools and included all contextual covariates and 3 dummy variables for each year vs baseline. Next, we examined public vs private school differences in a series of models using data from all schools. These models included school type × year interaction terms; none were significant, and for parsimony these terms were removed from the models. Because of the large number of regressions (19 each for public schools, private schools, and public school vs private school differences in a combined sample), we only present differences with significance of at least P < .01.

Results of the regression models for selected outcomes (access to competitive food venues and the availability of the 4 categories of food products) are given in Table 2. Because these regression analyses showed a consistent pattern of regional differences, Table 3 gives estimates of the percentage of public elementary school students with access to competitive food venues and the availability of the 4 categories of food products (salty, low-fat, sweet, and healthier products) by US census region. Percentages are unadjusted for contextual covariates, but the statistical significance of regional differences was tested in multiple logistic regression analyses controlling for all contextual covariates and year. We also examined regional differences in access and availability using a series of logistic regression analyses restricted to schools that offered competitive foods in 1 or more venues (Table 3). Logistic regression analyses for all outcomes in Table 3 were conducted using a set of US census

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### Table 1. Elementary School Students With Access to Competitive Food Venues and Products by Year and School Type

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<tbody>
<tr>
<td>Access to Competitive Food Venue, %</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Vending machine</td>
<td>2.6</td>
<td>3.4</td>
<td>3.9</td>
<td>3.7</td>
<td>12.0</td>
<td>15.8</td>
<td>13.1</td>
<td>10.3</td>
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<td>School store or snack bar</td>
<td>17.6</td>
<td>21.5</td>
<td>19.8</td>
<td>20.2</td>
<td>30.5</td>
<td>30.0</td>
<td>26.1</td>
<td>26.0</td>
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<tr>
<td>À la carte line</td>
<td>40.1</td>
<td>34.7</td>
<td>38.6</td>
<td>39.0</td>
<td>33.1</td>
<td>34.3</td>
<td>32.8</td>
<td>30.2</td>
</tr>
<tr>
<td>Any</td>
<td>50.0</td>
<td>45.9</td>
<td>47.6</td>
<td>49.6</td>
<td>58.9</td>
<td>56.8</td>
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| Availability of Product in Any Venue, % |
| Any salty (2 or 3) | 35.6 | 35.8 | 37.8 | 36.6 | 50.5 | 49.4 | 45.9 | 44.5 |
| Any low-fat (3, 5, or 7) | 42.7 | 42.3 | 42.3 | 44.1 | 51.4 | 51.2 | 45.9 | 42.6 |
| Any sweet (1, 4, 5, 6, or 7) | 44.1 | 41.2 | 42.3 | 44.7 | 52.5 | 52.9 | 48.2 | 45.2 |
| 1. Candy | 3.5 | 3.5 | 3.5 | 5.4 | 19.9 | 19.5 | 16.6 | 14.1 |
| 2. Salty snacks, not low-fat (eg, regular-fat chips) | 13.0 | 10.7 | 11.0 | 11.4 | 37.6 | 36.8 | 30.7 | 30.2 |
| 3. Low-fat salty snacks (eg, pretzels, baked chips) | 34.2 | 35.2 | 36.5 | 36.0 | 47.6 | 46.6 | 41.0 | 42.2 |
| 4. Baked goods, not low-fat (eg, cakes, crackers, cookies, pastries) | 22.9 | 18.4 | 18.4 | 19.0 | 37.3 | 39.3 | 31.8 | 34.6 |
| 5. Low-fat baked goods (eg, low-fat cakes, crackers, cookies) | 29.8 | 32.1 | 32.3 | 33.9 | 31.8 | 34.9 | 31.7 | 30.4 |
| 6. Ice cream, not low-fat (eg, regular-fat ice cream or frozen yogurt) | 22.3 | 18.0 | 18.8 | 15.3 | 28.3 | 31.1 | 23.7 | 21.8 |
| 7. Low-fat ice cream (eg, low-fat or nonfat ice cream or frozen yogurt, sherbet) | 31.5 | 30.7 | 29.4 | 31.6 | 26.6 | 26.8 | 23.4 | 22.9 |
| Any healthier | 38.2 | 34.9 | 36.4 | 36.4 | 41.5 | 40.4 | 34.3 | 33.4 |
| Salads | 26.9 | 24.5 | 27.4 | 27.2 | 25.3 | 25.8 | 24.3 | 23.1 |
| Vegetables | 32.9 | 29.7 | 28.6 | 30.2 | 28.3 | 26.3 | 19.9 | 26.8 |
| Fresh fruits | 36.0 | 32.4 | 32.4 | 33.6 | 35.5 | 34.2 | 25.4 | 27.9 |
| Other fruits | 31.9 | 28.9 | 28.8 | 29.0 | 31.0 | 26.9 | 17.9 | 23.9 |

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*a Estimates are weighted to the student level and represent percentages of elementary school students with access or availability. Estimates are unadjusted, but tests of significance are from multivariate logistic regression analyses as noted herein.

*b Difference between public and private school students significant at P < .001 in logistic regression analyses controlling for school size, US census region, locale, percentage of students of white race/ethnicity, and year.

*c Difference between public and private school students significant at P < .01 in logistic regression analyses controlling for school size, US census region, locale, percentage of students of white race/ethnicity, and year.

d Significant change from the 2006-2007 school year at P < .01 or better in logistic regression analyses controlling for school size, US census region, locale, percentage of students of white race/ethnicity, and year.
RESULTS

Table 1 gives estimates of percentages of students with access to competitive food venues at school, along with the availability of food products in any venue, for public and private school students separately. A series of logistic regression analyses controlling for contextual covariates and year revealed more snack bars on campus for private school students than for public school students; however, à la carte line competitive foods were more widely available for public school students. Compared with public school students, private school students also had greater availability of candy, salty snacks, regular-fat baked goods, and regular-fat ice cream.

Separately for each school type, we examined changes over time in logistic regression analyses controlling for contextual covariates. Access to competitive food venues and the availability of most products remained stable across time; however, the availability of regular-fat ice cream decreased over time for public school students.

Other than regional differences, the multivariate models did not reveal a consistent pattern of differences by contextual covariates. As summarized in Table 2, low-fat products and sweet products were less likely to be available at smaller schools than at larger schools for public school students. Compared with students in urban schools, students in suburban schools were more likely to be able to purchase salty, low-fat, and sweet products, probably because competitive foods were generally more available in any venue at these schools. In suburban schools, 53.2% of students had access to 1 or more competitive venues compared with 44.2% in urban schools, 41.2% in townships, and 54.6% in rural schools (data not shown). The ethnic/racial composition of schools was not significantly associated with outcomes, and socioeconomic status (the percentage of students eligible for free or reduced-price lunch) was not associated with outcomes other than less availability of healthier products in lower-income schools.
Student access to foods in à la carte lines and in any competitive food venue was more common in the South relative to all other regions, as was access to salty, low-fat, and sweet products. Restricting analyses to only those schools offering competitive foods, we found that the results continued to demonstrate greater availability of salty products in the South compared with the West and greater availability of sweet and low-fat products in the South compared with the Midwest and the West. However, healthy items, such as salads, vegetables, and fruits, were also more available in the South than in the Midwest.

By the 2009-2010 school year, approximately half of all public and private elementary school students could purchase foods in 1 or more competitive venues on campus. For public school students, the availability of regular-fat ice cream products decreased significantly over time; this was not accompanied by a corresponding increase in the availability of low-fat ice cream products. Student access to healthier options was limited, with approximately two-thirds of students who had access to competitive food venues being able to purchase salads, vegetables, or fruits in any of those venues. Sweet products were widely available in competitive food venues; although candy was not widely available, other sweet items were commonly available, and almost all students who had access to competitive venues could purchase sugary products in those venues. Striking regional differences emerged for public school students, with greater access to competitive food venues in the South and greater access to salty and sweet products in these venues in the South. However, among public school students with access to competitive foods, those in the South also had greater availability of healthier foods compared with students in the Midwest or the West. These results are intriguing considering that childhood obesity rates are highest in the South. According to the US Department of Agriculture, 47% of children and adolescents in the South were overweight or obese compared with 41% in the Midwest. 16 Although schools in the South were more likely to offer healthy products, much work remains to remove unhealthy food products from these schools.

Notably, student access to food in competitive venues did not change significantly over time in public schools; access decreased from 60% to 50% of students in private schools, although this was not statistically significant. This contrasts with our previously reported results showing a significant increase in student access to beverages in competitive venues during the same period. 17 Sales of food and beverage in competitive venues—particularly in a la carte lines—can generate significant revenues to cover shortfalls in food service operating costs, 18,19 and given recent economic pressures on school budgets, many schools and districts are seeking additional sources of revenue. However, schools can replace less healthy items with healthier items without loss of revenue, 20 and adding healthier competitive products may increase student participation in the school lunch program. 21,22 Providing healthier foods and beverages is important to reinforce nutrition education messages and to bring schools into compliance with nutritional recommendations, while also providing a source of needed revenue for schools.

As with any survey that relies on reported rather than observed data, it is possible that our estimates were affected by various reporting biases; however, desirability bias would likely lead to decreased reporting of less healthy products.
options rather than the other direction. Furthermore, given that more than half of the survey respondents were food service staff who would be familiar with the specific products available at schools, we expect that the information reported to us was accurate. Relative to other data sources, these estimates are based on large numbers of schools, and the nationally representative sample allows us to draw inferences about the conditions faced by students across the country. However, our results only pertain to competitive foods sold in the most common venues (ie, vending machines, school stores, snack bars, and à la carte lines) and do not include other competitive venues, such as foods served during parties, given as rewards, or sold as fundraisers; therefore, our findings may underestimate the availability of competitive foods that are sold or served in schools. In addition, because our survey only assesses the availability of broad categories of food products (eg, salty snacks) rather than specific brands, products, and portion sizes, we were unable to assess compliance with nationally recommended standards, such as the competitive food guidelines established by the Institute of Medicine6 and the Alliance for a Healthier Generation,23 which specify allowable caloric and nutritional content of snack foods.

In summary, many US elementary school students have access to competitive foods on campus, particularly in the South. Although lower-fat options are available, students can also purchase various less healthy options that are high in sodium, fat, or sugar. Continued efforts are needed to ensure that all competitive food products in elementary schools are in compliance with Institute of Medicine guidelines and to focus not only on removing unhealthy foods but also on assuring that all students with access to competitive foods can purchase healthy items. With the current development of US Department of Agriculture regulations pertaining to competitive foods and beverages in school, there is a window of opportunity to develop strong nationwide standards to improve the food environment in elementary schools.

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Author Contributions: Dr Turner had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Turner and Chaloupka. Acquisition of data: Turner. Analysis and interpretation of data: Turner. Drafting of the manuscript: Turner. Critical revision of the manuscript for important intellectual content: Turner and Chaloupka. Statistical analysis: Turner. Obtained funding: Chaloupka.

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Additional Information: Portions of this work (from the first 2 of the 4 years of data used in these analyses) are reported on the author’s Web site at http://www.bridgingthegapresearch.org

Additional Contributions: Anna Sandoval, MPH, assisted with data collection.

REFERENCES