

RESEARCH ARTICLE

# Availability of Vending Machines and School Stores in California Schools

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## ABSTRACT

**BACKGROUND:** This study examined the availability of foods sold in vending machines and school stores in United States public and private schools, and associations of availability with students' food purchases and consumption.

**METHODS:** Descriptive analyses, chi-square tests, and Spearman product-moment correlations were conducted on data collected from 521 students aged 8 to 15 years recruited from orthodontic offices in California.

**RESULTS:** Vending machines were more common in private schools than in public schools, whereas school stores were common in both private and public schools. The food items most commonly available in both vending machines and school stores in all schools were predominately foods of minimal nutritional value (FMNV). Participant report of availability of food items in vending machines and/or school stores was significantly correlated with (1) participant purchase of each item from those sources, except for energy drinks, milk, fruits, and vegetables; and (2) participants' friends' consumption of items at lunch, for 2 categories of FMNV (candy, cookies, or cake; soda or sports drinks).

**CONCLUSIONS:** Despite the Child Nutrition and Women, Infants, and Children (WIC) Reauthorization Act of 2004, FMNV were still available in schools, and may be contributing to unhealthy dietary choices and ultimately to health risks.

**Keywords:** childhood obesity; schools; foods of minimal nutritional value.

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Childhood obesity is one of the most serious threats to public health both nationally and globally.<sup>1</sup> In the United States childhood obesity affects approximately 17% (12.5 million) of children and adolescents.<sup>2</sup> This rate indicates the urgency in examining the predictors of childhood obesity, therefore that tailored and effective interventions can be designed and implemented to reduce its incidence.

The United States is often described as an "obesogenic" environment due to factors that promote increased energy intake and sedentary behaviors.<sup>2</sup> The

most commonly studied environments in the United States have been the child's home and school. This study focused on schools in Orange and San Diego counties, California.

### The School Environment and Its Role in Childhood Obesity

In the 2011-2012 school year approximately 49.5 million students were enrolled in public elementary and secondary schools.<sup>3</sup> About 5.3 million were

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enrolled in private schools.<sup>4</sup> According to the US Department of Agriculture (USDA), approximately 32 million US school-aged children receive their school meals through the National School Lunch Program (NSLP).<sup>5</sup> Schools have significant continuous, intensive contact, and influence on children during their first 2 decades of life.<sup>4</sup> Enactment and enforcement of school-based policies and programs to support healthy eating and physical activity are needed to assist with the reversal of obesity rates in children.<sup>6</sup>

In 2010 the Healthy, Hunger-Free Kids Act (HHFK) set “nutrition standards for competitive foods and beverages sold outside of the federal reimbursable school meals program during the school day. These standards set limits on calories, salt, sugar, and fat in foods and beverages and promote snack foods that have whole grains, low fat dairy, fruits, vegetables or protein foods as their main ingredients.”<sup>7</sup> “Competitive foods” are defined as foods offered for sale at school, other than meals served through USDA’s school meal programs—school lunch, school breakfast, and after-school snack programs. Competitive foods are often foods of minimal nutritional value (FMNV), providing less than 5% of the recommended daily allowance per serving for each of 8 specified nutrients: protein, vitamin A, vitamin C, niacin, riboflavin, thiamine, calcium, and iron.<sup>5</sup> All minimally nutritious foods and beverages are prohibited from being sold in food service areas during the meal period.<sup>8</sup> However, restrictions on FMNV during the meal period have not been effective in addressing childhood obesity, possibly because these foods are made available to students in many schools throughout the remainder of the school day.

The Fourth School Nutrition Dietary Assessment Study (SNDA-IV) showed that vending machines were widely available in high schools (85%) and middle schools (67%), more so than in elementary schools (13%). These figures represent a 15% to 19% decrease across elementary, middle, and high schools relative to SNDA-III data.<sup>9</sup> In a survey of 116 schools, 106 (91%) had vending machines, and only 18% of beverage items within the vending machines met criteria in the Dietary Guidelines for Americans for calories and type of beverages.<sup>10</sup> Another survey found that 83% of 152 schools had vending machines that primarily sold FMNV (soft drinks, chips, and sweets).<sup>11</sup> In another study, 18% of 4322 students surveyed had purchased less healthy snacks or beverages from vending machines 2 or more days during the previous 5 school days instead of buying school lunch.<sup>12</sup> The presence of beverage vending machines in schools has been associated with the weight status of students.<sup>13</sup>

The United States has enacted policies to limit children’s access to high-fat foods and sugar sweetened beverages in schools. The Child Nutrition and Women, Infants, and Children (WIC) Reauthorization Act of 2004 required every school district participating in the

NSLP to establish local school wellness policies by fall 2006.<sup>5</sup> However, the requirements, implementation, and enforcement of wellness policies have varied across school districts. According to the 2012 National School Health Policies and Programs Study (SHPPS), although progress has been made between 2006 and 2012 in the types of foods sold during school, there is still need for improvement. The study found that less than half of the school districts required their schools to prohibit the availability of junk foods in vending machines, and less than one-third of districts required schools to prohibit junk foods in school stores, canteens, or snack bars.<sup>14</sup> Thus, on June 28, 2013, amendments to the HHFK act set new standards consistent with the 2010 Dietary Guidelines for Americans for all foods sold (1) outside school meal programs, (2) on school campuses, and (3) at any time during the school day.<sup>15</sup> These new nutrition standards, which schools must have met by July 1, 2014, take a great stride in addressing consumption of unhealthy foods in schools. It will be important to evaluate the impact of these amendments on the availability and consumption of FMNV in future research.

In California, state regulations also govern competitive food and beverage items sold on elementary, middle, and high school grounds.<sup>16</sup> Prior to the above new amendments in elementary schools the sale of competitive foods were solely allowed at least one-half hour after school. In middle and high schools, snack items must be less than 250 calories per item and an entrée cannot be more than 400 calories. Snack items can have only 35% of calories from fat and only 10% of calories from saturated fat, and can only be 35% sugar by weight. An entrée must have less than 36% of calories from fat. Schools may sell milk, sweetened or unsweetened, with less than 2% milk fat, beverages that are more than 50% juice with no added sweeteners, and water. Middle and high schools can also sell electrolyte replacement beverages. The prohibition of sales of FMNV was effective only during a meal period and only in a food service area. FMNV sales were permitted in other locations at school or after the meal period.<sup>16</sup>

In the United States most studies on vending machines and school stores were conducted before the 2006 requirement to implement school wellness policies. Therefore, it is important to examine recent data to determine whether there have been improvements in the nutritive value of foods typically sold at schools that might affect the quality of students’ dietary intake.

### Theoretical Framework

The Behavioral Ecological Model (BEM) was used to conceptualize the influence of the availability of

vending machines and school stores on students' dietary intake. The BEM links behavioral science to basic biological sciences, as foundations for behavior and learning. It emphasizes ecological principles of selection by environmental consequences at the individual and group/cultural level.<sup>17</sup> It recognizes the intertwined relationship that exists between the individual and the environment, and assumes that the best predictor of human behavior is the person's environment.

Guided by the BEM, the aims of this study were to (1) identify the types of foods sold in vending machines and school stores in public and private schools in California; (2) determine whether the availability of FMNV in vending machines and school stores was associated with student purchase and consumption of FMNV; and (3) determine whether student purchase was associated with consumption.

## METHODS

Data analyses were conducted using cross-sectional baseline data collected by the Healthy Smiles Program, a 5-year longitudinal research study testing a multi-component intervention designed to increase physical activity, reduce sedentary practices, and promote healthy diets among youth. The intervention was conducted in orthodontic offices in Orange, Riverside, and San Diego counties.

### Participants

Participants were 521 preteens and teens 8-15 years of age receiving orthodontic treatment and their parents, who consented to participation between January 2010 and March 2013. Preteens who participated in organized sports or activities 3 or more days per week for 9 or more months a year, had severe medical conditions that hindered physical activity, required highly specialized diets, had less than 1 year left in treatment, or planned to move within the next 18 months were excluded from participation. Preteens participating in organized sports or activities were excluded because their high level of exercise left little room for improvement. Youth who were home-schooled were also excluded from the current analyses.

### Instruments

During home visits both parent and child completed self-administered questionnaires. Parents answered questions about their child's race, Hispanic ethnicity, sex, and age. Child participants were asked where they could buy food/snacks or drinks at school other than the cafeteria. Response options were vending machine; school store; food/drinks are only sold in the cafeteria; none of these things are at my school. Children were

then asked what food items (yes/no) were available in their school vending machines and school stores, and what items they purchased in the past week. The 14 response options were ice cream or frozen yogurt; cookies or cakes; sports drinks; energy drinks; water; milk; soda; fruit; french fries; chips; yogurt; vegetables; cheese; candy. Children were also asked how many of their friends they thought ate/drank each of the following 6 food categories during school days: yogurt or cheese; chips or french fries; fruits or vegetables; candy, cookies, or cake; soda or sports drinks; milk.

### Procedure

Orthodontic offices were recruited from listings in orthodontist directories, local yellow pages, and electronic search engines. Orthodontic patients were then recruited from participating offices by a letter from the orthodontist describing the study, followed by a telephone call from research staff for consenting families. Upon completion of the baseline surveys, participants were reimbursed for study participation.

### Data Analysis

Analyses were performed using SPSS version 19.0 (SPSS, Inc., 2012). Availability of vending machines and school stores, and frequencies of food items in vending machine and school stores were computed separately for private and public schools because USDA and California governmental food policies in regard to FMNV apply to public but not private schools, and the NSLP is only for public schools. Owing to data skew, Mann-Whitney *U* tests were used to assess differences by type of school, and Spearman rank-order correlations were used to evaluate associations of availability of items in vending machines and school stores with (1) participant purchase of items from those sources, and (2) the number of the participant's friends who consumed these food items at lunchtime.

## RESULTS

Characteristics of respondents are presented in Table 1. Participants were 55.1% female, ranging in age from 8 to 15 years. Fifty-one percent identified as white, non-Hispanic; 25.9% identified as Hispanic. The majority (73.3%) of the sample was of normal weight and over half (59.1%) were middle school students.

Availability of vending machines and school stores in schools is presented in Table 2. Either school stores or vending machines were reported available by 56.2% of respondents. Although there was a significant difference in the reported availability of vending machines between private (39.4%) and public (27.1%) schools ( $p < .05$ ), the difference in availability

**Table 1. Characteristics of Respondents (N = 521) Reporting on 339 Schools**

Characteristics	N	Percent
Sex		
Male	234	44.9
Female	287	55.1
Age in years, mean (SD)		12.0 (1.7)
Hispanic		
Native American	0	0.0
Asian	1	0.7
Pacific Islander	0	0.0
Black/African American	4	3.0
White/Caucasian	55	40.7
Multi-racial	3	2.2
Not specified	72	53.3
Non-Hispanic		
Native American	1	0.3
Asian	33	9.2
Pacific Islander	3	0.8
Black/African American	13	3.6
White/Caucasian	266	74.5
Multiracial	34	9.5
Not specified	7	2.0
Body mass index (BMI)*		
Underweight ( $\leq$ 5th percentile)	23	4.4
Normal weight (5th to 85th percentile)	382	73.3
Overweight (85th to 95th percentile)	68	13.1
Obese ( $\geq$ 95th percentile)	47	9
School type		
Public	450	86.4
Private	71	13.6
School classification		
Elementary school	180	34.5
Middle school	308	59.1
High school	33	6.3

\*Age- and sex-adjusted BMI percentiles are based on the Centers for Disease Control and Prevention 2000 reference standard.

**Table 2. Student Reported Availability of Vending Machines and School Stores by Public vs. Private School**

	Participants (N = 521)	Participants who reported the availability of school vending machines*		Participants who reported the availability of school stores	
		N	%	N	%
School type					
Public	450	122	27.1	213	47.3
Private	71	28	39.4	31	43.7

\*Percentages are significantly different by school type,  $p = .03$ .

of school stores between private (43.7%) and public (47.3%) schools was not statistically significant.

For respondents who reported the presence of vending machines and school stores on campus, Table 3 presents the percentage of those respondents reporting that a specific type of food item was available. The 521 respondents in our sample reported on 339 different schools, therefore in a number of instances

**Table 3. Student Reported Availability of Food Items in Vending Machines and School Stores by Public vs. Private School**

	Schools having vending machines		Schools having school stores	
	Public (N = 122) (%)	Private (N = 28) (%)	Public (N = 213) (%)	Private (N = 31) (%)
FMNV				
1. Ice cream/frozen yogurt	11	7	45	32
2. Cookies/cake	35	36	66	42
3. Candy	37	43	27	52
4. French Fries	1	0	5	7
5. Chips	66	68	75	68
6. Soda	20	46	19	26
7. Sports drink	69	82	69	68
8. Energy drink	1	14	5	7
Healthy items				
1. Water	80	89	80	71
2. Milk	14	14	35	26
3. Fruit	12	11	37	29
4. Yogurt	3	4	14	19
5. Vegetables	3	4	11	16
6. Cheese	5	0	17	3

more than one respondent reported on a given school. The most prevalent food items in vending machines and school stores in both types of schools were predominately FMNV. The most frequently reported FMNV were sports drinks (range: 68-82%), chips (range: 66-75%), and candy, cookies and cakes (range: 27-66%). Soda was also frequently available in private school vending machines (46%). Of healthy items, a high prevalence of water was reported in vending machines and school stores in both types of schools (range: 71-89%).

For schools having either vending machines or a school store, 33.9% of respondents attending public schools, and 35.6% attending private schools, reported purchasing food items from these sources in the last week. Considering both types of schools together, the most frequently purchased item was water. The other 5 healthy food items—yogurt, cheese, fruits, milk, and vegetables—were all purchased less often than any of the 8 FMNV items except for french fries and energy drinks. Participant report of availability of items in vending machines and/or school stores was correlated ( $p < .01$ ) with participant purchase of items from those sources for 10 of the 14 items. The 4 exceptions were energy drinks, milk, fruits, and vegetables.

We also tested associations of the number of one's friends who consumed items in each of 6 categories of foods at lunchtime—3 categories of FMNV and 3 categories of healthy foods—with the availability of items in a given category in either vending machines or school stores. Only 2 categories of items were significantly correlated—candy, cookies,

or cake ( $p = .017$ ); and soda or sports drinks ( $p < .001$ ). The chips or french fry category was near-significant ( $p = .072$ ), as was fruits or vegetables ( $p = .054$ ).

## DISCUSSION

Owing to increasing rates of childhood and adolescent obesity, attention has been paid to the impact of vending machines on students' health status.<sup>18</sup> Our results suggested that California private schools have more vending machines than public schools. This is not surprising, as private schools are exempt from complying with competitive food and beverage regulations. The types of competitive food items most frequently available in vending machines regardless of school type were predominantly FMNV despite legislative attempts to limit FMNV in both private and public school settings. These results are consistent with those of comparable studies.<sup>19,20</sup>

Although studies have been conducted to examine the role of vending machines in US schools, the role of school stores has largely been neglected. In our study, school stores were reported more frequently than vending machines for both school types, in contrast to data from prior studies.<sup>9,21</sup> As with vending machines, the competitive foods available from school stores were primarily FMNV. It is possible that California restrictions on vending machine content have increased the popularity of school stores in comparison to vending machines. In the United States prior to the HHFK Act of 2010, most policies restricting competitive food items in schools applied only to vending machines. For example, on July 1, 2004, California Senate Bill 677 (Chapter 415) banned the sales of carbonated beverages in vending machines in elementary, middle, and junior high schools, and replaced them with milk, water, and juice. The Senate bill also limited accessibility of vending machines in middle and junior high schools from one-half hour before the start of the school day to one-half hour after the end of the school day.<sup>15</sup> Even though this bill was established to promote healthy eating among students, it still exempted the sales of certain beverages at specified school events and failed to ban sales of such items in school stores. In the United States, the most frequently available item in school stores and vending machines was water. The availability of sports drinks was also reported frequently. With passage of the new legislation, schools may have replaced carbonated beverages with water and sports drinks. The potential contributions of sports drinks to childhood obesity should be considered in future research. Future legislation banning other FMNV from school venues has the potential to initiate the replacement of FMNV with healthier food items, as may have occurred with the ban of carbonated beverages. In the current US economy, an important

factor to consider is that school stores and vending machines play a fiscal role for schools. There has been a recent trend of school districts negotiating exclusive "pouring rights" contracts with soft drink companies.<sup>22</sup> Many of these contracts have provisions to increase the percentage of profits schools receive when sales volume of competitive foods increases. According to the BEM, such contracts are reinforcing social contingencies for increasing sugar-sweetened beverages.

Availability of FMNV in school vending machines and/or school stores was associated with participant purchase of the food items from those sources. Also, availability of most FMNV in vending machines and/or school stores correlated with participants' friends' consumption of those FMNV during lunch. Previous studies showed that students' food purchases at school were associated with availability of snack machines,<sup>23</sup> and that students who had access to FMNV in vending machines and/or school stores tended to choose those items instead of healthier food choices.<sup>19,23</sup> Furthermore, participant purchase of soda or sports drinks and milk from vending machines and school stores was significantly associated with friends' consumption of these items during lunch time. Although it is uncertain how much reducing the availability of FMNV in schools may impact childhood obesity, our findings support policies that restrict or eliminate FMNV from school vending machines and school stores.

## Limitations

Our survey did not ask participants what food items they saw their friends purchase from vending machines and/or school stores. In addition, we did not ask participants if they had access to vending machines or school stores during their mealtime. Therefore, we do not know to what extent participants and their friends actually purchased and ate snacks from these sources. Drawing the conclusion that vending machines/school stores are instrumental in student's poor dietary intake is premature. The sample was drawn from orthodontist offices; therefore, the youth in this study and the schools they attended may not be representative of the overall population of school children or of schools. Larger samples of students drawn from each of a random sample of schools would provide a more accurate indication of food item prevalence. In addition, it is important to note that data from this research study were collected during ongoing changes in school nutritional policies.

## Conclusions

We found that FMNV were still available in many schools after the Child Nutrition and WIC Reauthorization Act of 2004, and that schoolchildren

were more likely to purchase FMNV when they were available in vending machines and school stores. Further research is needed to determine the effect of the HFFK Act of 2010 on US school food services, to understand the impact of school policies on the eating practices of children better.

## IMPLICATIONS FOR SCHOOL HEALTH

Schools play an important role in combatting childhood obesity. The Child Nutrition and WIC Reauthorization Act of 2004 was implemented to address less healthy foods in schools. However, our study indicates that FMNV were still available in vending machines and school stores after its implementation. This access to FMNV increases the likelihood that students purchase and consume food items that promote obesity. The HFFK act of 2010 reauthorized the Child Nutrition programs, and allowed the USDA Secretary to establish regulations based on science-based nutrition standards for all foods sold in schools, to more effectively address the problem of FMNV.<sup>7</sup> Prior to this legislation the USDA secretary did not have authority to regulate food requirements for foods sold outside the NSLP and School Breakfast Program. More recent amendments to the HFFK act have set new standards to further limit accessibility to FMNV; however, the policies still exempt afterschool events and fund-raising activities not occurring in food service areas during meal periods.<sup>15</sup> To have maximum impact on child health, the ban on unhealthy foods should apply to the entire school environment. It is critical that policy makers and school personnel work together to find sources of revenue other than sales of FMNV at school activities to address the financial needs of schools.

## Human Subjects Approval Statement

This study was reviewed and approved by San Diego State University Institutional Review Board.

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