

Snacking in Children: The Role of Urban Corner Stores

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FINANCIAL DISCLOSURE: *Dr. Foster serves on the scientific advisory board for Con Agra Foods and has served as a consultant to General Mills. He has also received funding for research grants on the role of almonds (Almond Board of California) and diet beverages (Coca Cola Company) on adult obesity.*



WHAT'S KNOWN ON THIS SUBJECT: Childhood obesity is higher among ethnic minorities. The disparate prevalence of urban corner stores in low-income and high-minority communities could affect the quantity and quality of energy intake among youth at highest risk for obesity.



WHAT THIS STUDY ADDS: Purchases made in corner stores contribute significantly to energy intake among urban school children. Children shop at corner stores frequently and purchase energy-dense, low-nutritive foods and beverages that average more than 1497.7 kJ (356.6 kcal) per purchase.

abstract

OBJECTIVE: Childhood obesity is higher among ethnic minorities. One reason may be the limited access to affordable, healthy options. The disparate prevalence of urban corner stores in low-income and high-minority communities has been well documented. There are no data, however, on what children purchase in these environments before and after school. The purpose of this study was to document the nature of children's purchases in corner stores proximal to their schools.

METHODS: This was an observational study from January to June 2008. Participants were children in grades 4 through 6 from 10 urban K-8 schools with $\geq 50\%$ of students eligible for free or reduced-price meals. A total of 833 intercept surveys of children's purchases were conducted outside 24 corner stores before and after school. The main outcomes were type and energy content of items purchased.

RESULTS: The most frequently purchased items were energy-dense, low-nutritive foods and beverages, such as chips, candy, and sugar-sweetened beverages. Students spent $\$1.07 \pm 0.93$ on 2.1 ± 1.3 items (1.6 ± 1.1 food items and 0.5 ± 0.6 beverage items) per purchase. The total number of calories purchased per trip was 1497.7 ± 1219.3 kJ (356.6 ± 290.3 kcal). More calories came from foods than from beverages.

CONCLUSIONS: Purchases made in corner stores contribute significantly to energy intake among urban school children. Obesity prevention efforts, as well as broader efforts to enhance dietary quality among children in urban settings, should include corner store environments proximal to schools. *Pediatrics* 2009;124:1293–1298

Nearly one third (31.9%) of children are overweight or obese (\geq the 85th percentile of BMI for age) and 16.3% are obese (\geq the 95th percentile).¹ These rates are even higher among children of ethnic minorities who live in low socioeconomic environments, approximating 50% who are at least overweight and 25% who are obese.^{2,3} A potential explanation for the higher prevalence may be the limited access to healthy foods.

Corner stores, a part of the urban landscape, occupy relatively small square footage (\leq 200 sq ft) and concentrate on high-profit, low-nutritive items (eg, packaged foods including candy, chips, pretzels, ice creams, beverages).⁴⁻⁶ Corner stores can be found within or on the corners of urban residential blocks and may be located within a few hundred feet of a school. In Philadelphia, there are multiple stores within a 4-block radius of a given school. These stores also serve as a convenience store for families in communities where there are no supermarkets. The higher prevalence of corner stores in low-income and high-minority communities has been well documented.^{6,7} This disparity could affect both the quantity and quality of energy intake among youth at highest risk for obesity.

Snacking has increased across all age groups,^{8,9} and the contribution of snacking to daily calories increased by 30% between 1977 and 1996.¹⁰ According to recent estimates, snacking accounts for \sim 25% of total energy intake in children.¹⁰ Purchases from corner stores among urban youth before and after school may contribute significantly to snacking and overall energy intake. Although several have called for obesity prevention efforts to be focused on corner stores,⁴⁻⁶ we are not aware of any data on children's food and beverage purchases in these environments before and after school.

The purpose of this study was to quantify the contribution of corner store purchases to energy intake among fourth- to sixth-grade children. Given the disproportionately high rates of obesity among children in lower socioeconomic status groups,¹¹ the study was conducted in corner stores proximal to schools that had at least 50% of children eligible for federally subsidized, free or reduced-price meals.

METHODS

Study Design

Schools

Eligibility criteria for schools were 1) kindergarten through eighth grade, 2) \geq 50% of students eligible for free or reduced-price meals, and 3) proximity (\leq 4 urban blocks) to \geq 2 corner stores. Using a random-number generator, schools were randomly selected from among the 15 eligible in Philadelphia, Pennsylvania. A total of 12 schools were approached; 2 declined, and 10 were enrolled. The average free or reduced-price meal eligibility rate across the 10 schools was $82.1 \pm 7.4\%$.

Stores

Corner stores proximal to the 10 schools were identified by students through surveys administered during class. In addition, school staff (eg, administrators, crossing guards) and store owners identified stores as being frequented regularly by school children before or after school. Each school had between 2 and 4 stores within its 4-block radius for a total of 24 stores.

Participants

Participants for this study were any students who were from these 10 schools in grades 4 through 6 and making purchases at corner stores before or after school. We focused on schools with \geq 50% of students who

were eligible for free or reduced-price meals and children in grades 4 through 6 because of the previously documented high risk for obesity (14.9% incidence rate of overweight over a 2-year period).² The study was approved by Temple University's institutional review board.

Outcomes

Corner Store Purchases

All data were collected during January to June 2008. During school, participants were told that they may be asked questions about their corner store purchases (intercept survey) by research staff in identifiable clothing (shirts and jackets with the study's logo) outside corner stores. Data on corner store purchases were collected immediately outside the 24 corner stores as children left the store before school in the morning and after dismissal in the afternoon. Staff asked children what they purchased and requested to look into their bags to record each item's name, product type, and weight or size. Research staff also asked students a series of questions, including how much money they just spent and how frequently (per day and per week) they shop at corner stores. Each intercept lasted \sim 1.5 minutes. Study staff assessed corner store shopping behavior an average of 18.2 ± 5.4 times per school community during a 5-month period for a total of 182 observations (\sim 7.6 visits per store). Approximately half of the observations were conducted before school, and half were conducted after school. Each observation consisted of 1 to 2 research staff and was \sim 30 to 45 minutes in duration.

Nutrition Information

Nutrition information was obtained for all items (prepackaged and prepared) purchased by children at the corner stores. In the case of pack-

aged items, nutrition information was obtained by purchasing an identical item in the corner store and looking at the nutrition label. When items were no longer available for purchase or no nutrition label was present, staff contacted the manufacturer or distributor directly for nutrition information (via Web site or telephone). When information was not available directly from the manufacturer, data were obtained from online food databases such as CalorieKing.¹² After exhausting these methods, there were still a small number of items ($n = 22$ [6.2%]) that were no longer available for purchase, the manufacturer could not be contacted, and they were not listed in databases such as CalorieKing. For this small number of items, nutrition data were obtained on comparable items (similar in size, weight, and ingredients). These items were typically from local vendors (eg, Day's Soda) and had a very small distribution.

In the case of prepared items (eg, sandwiches), staff purchased the identical sandwiches as individual components (eg, bread, deli meat, condiments) with the help of store staff to be sure that the typical amounts and types of items were included. The components' brand and weight were recorded by staff and similar methods (described already) were used to obtain nutrition information for the prepared item, by using Nutritionist Pro software.¹³

Statistical Analysis

Descriptive statistics (means and SDs for continuous variables and percentages for categorical variables) were analyzed and reported for each variable of interest. Differences in items purchased by time of day (before school and after school) were analyzed by using χ^2 tests.

TABLE 1 School Characteristics

| Characteristic | Mean \pm SD |
|--|-------------------|
| School size (No. of students) | 515.0 \pm 111.7 |
| Race/ethnicity (%) | |
| Black | 54.0 \pm 37.8 |
| White | 11.6 \pm 25.5 |
| Asian | 10.8 \pm 20.9 |
| Hispanic/Latino | 22.9 \pm 29.0 |
| Other | 0.7 \pm 0.9 |
| Free or reduced-price meal eligibility | 82.1 \pm 7.4 |

Source: School District of Philadelphia (2006–2007). $N = 10$ K-8 schools.

RESULTS

School Characteristics

School characteristics are shown in Table 1. More than 80% (82.1 ± 7.4) of students in these 10 schools were eligible for free/reduced-price meals. Most students in the schools were black (54.0%) or Hispanic/Latino (22.9%).

Store Characteristics

On average, stores were 172.9 ± 70.4 square feet and contained 2.1 ± 0.5 aisles. Each store had only 1 cash register with 2.4 ± 1.0 employees working at a given time. These stores sell predominately packaged food. Typically, the only fresh foods that are sold are prepared sandwiches.

Corner Store Purchases

A total of 833 intercept surveys were collected from January to June 2008. The total number of calories per purchase was 1497.7 ± 1219.3 kJ (356.6 ± 290.3 kcal). On average, students spent $\$1.07 \pm 0.93$ on 2.1 ± 1.3 items (1.6 ± 1.1 food items and 0.5 ± 0.6 beverage items) per purchase. Purchase characteristics are shown in Table 2. The percentage of calories from fat was $29.2 \pm 22.8\%$, from protein was $5.2 \pm 5.6\%$, and from carbohydrates was $65.6 \pm 30.0\%$. Figure 1 displays the frequency of purchases broken down by item category (beverage, candy, gum, chips, frozen treats, pastries, and prepared items).

TABLE 2 Purchase Characteristics

| Characteristic | Mean \pm SD |
|--------------------------------|---|
| Total amount spent, \$ | 1.07 \pm 0.93 |
| Total No. of items | 2.1 \pm 1.3 |
| Food items | 1.6 \pm 1.1 |
| Beverage items | 0.5 \pm 0.6 |
| Calories, kJ (kcal) | 1497.7 \pm 1219.3kJ (356.6 \pm 290.3 kcal) |
| Calories from fat, % | 29.2 \pm 22.8 |
| Fat, g | 13.5 \pm 15.5 |
| Saturated fat, g | 3.8 \pm 5.4 |
| Calories from protein, % | 5.2 \pm 5.6 |
| Protein, g | 6.1 \pm 10.9 |
| Calories from carbohydrates, % | 65.6 \pm 30.0 |
| Carbohydrates, g | 54.6 \pm 45.1 |
| Sugars, g | 31.8 \pm 35.8 |
| Dietary fiber, g | 1.2 \pm 1.6 |
| Sodium, mg | 535.8 \pm 777.2 |

$N = 833$ purchases.

Food Items

Food items accounted for 81.3% of all items purchased. Chips were the most frequently purchased item (33.5% of all items purchased). The most popular chips purchased were 1-oz cheese flavored corn or potato chips at 588.0 to 714.0 kJ/oz (140 to 170 kcal/oz; eg, Cheetos, Doritos). Candy (21.3%) was the second most frequently purchased category of items. The most popular candies were items such as Peanut Chews and Sour Patch Kids. Prepared items were among the least frequently purchased items (6.9%) and included pizza, sandwiches, egg rolls, and chicken wings.

Beverages Items

Beverages accounted for 18.7% of all purchases. Figure 2 displays the breakdown of beverage purchases by type, which include soda, diet soda, artificially flavored fruit drinks, 100% fruit juice, water (water and nonsweetened sparkling), ice tea/lemonade, and other (eg, energy drink, chocolate flavored drink). Artificially flavored "fruit" drinks were the most popular beverages purchased, accounting for almost half of all beverage purchases (45.7%). The most popular item (beverage or food) purchased was a sugar-sweetened, artificially flavored fruit

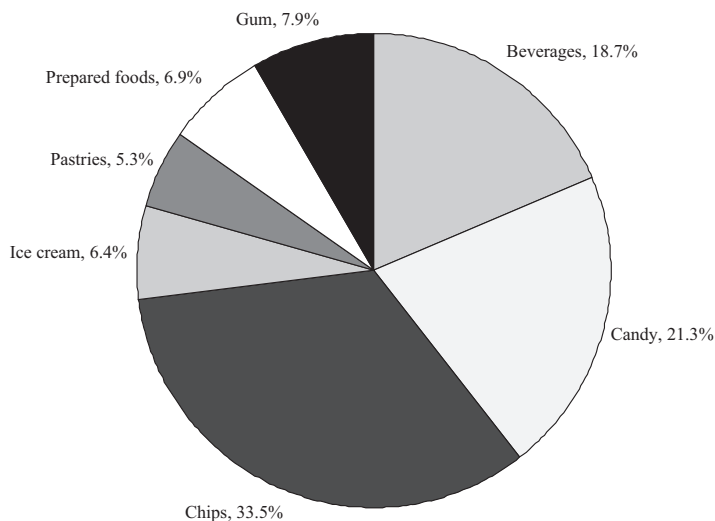


FIGURE 1

Total items purchased by type of item. Data were obtained from all intercept surveys ($N = 833$) conducted before and after school. Categories included chips (eg, corn and tortilla chips), beverages (eg, sugar-sweetened artificially flavored fruit drink, soda), candy (eg, candy bars, gum), frozen items (eg, water ice/Italian ice, popsicles), prepared items (eg, sandwiches, egg rolls, chicken wings), and pastries (eg, cupcakes).

drink called a “Hug,” or “Barrel,” which comes in either 8 or 16 oz at 147 kJ/8 fl oz (35 kcal/8 fl oz). Sugar-sweetened beverages accounted for >88% of all beverages purchased.

Morning Shopping Behavior

Approximately half (54.1%) of all intercepts were collected in the morning.

During this time, children spent $\$1.19 \pm 0.97$ and purchased 2.3 ± 1.4 items (1.8 ± 1.2 food items and 0.5 ± 0.6 beverage items). In the morning, children purchased 1638.4 ± 1322.6 kJ (390.1 ± 314.9 kcal), $30.6 \pm 22.3\%$ of which came from fat. The most popular category of item was chips (32.9%),

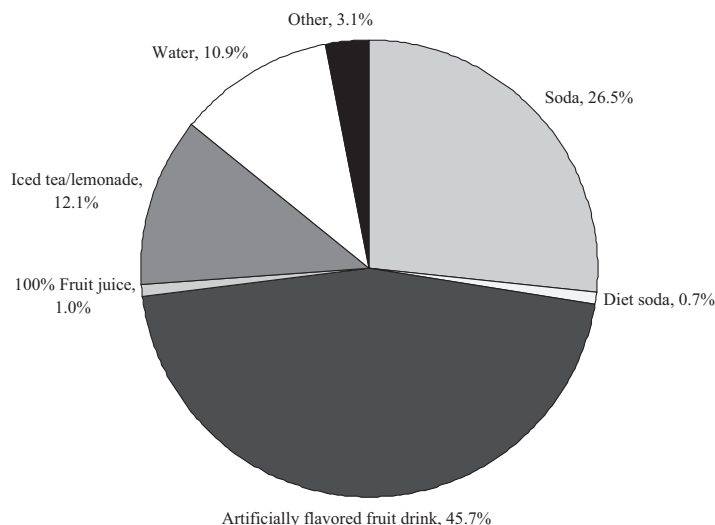


FIGURE 2

Total beverage items purchased by type of beverage. Data were obtained from all intercept surveys that contained a beverage item ($N = 363$) conducted before and after school. Categories included soda, diet soda, ice tea/lemonade, artificially flavored fruit drink, water, 100% fruit juice, and other (eg, energy drink, smoothies, chocolate flavored drinks).

followed by candy (23.9%), beverages (18.5%), gum (10.4%), prepared items (8.4%), pastries (4.2%), and frozen treats (1.7%). More candy and gum were purchased in the morning before school than in the afternoon ($P < .0001$).

Afternoon Shopping Behavior

A little less than half (45.9%) of all intercepts were collected in the afternoon. During this time, children spent $\$0.94 \pm 0.86$ and purchased 1.8 ± 1.0 items (1.4 ± 1.0 food items and 0.4 ± 0.5 beverage items). In the afternoon, children purchased 1331.8 ± 1062.6 kJ (317.1 ± 253.0 kcal), $27.0 \pm 23.3\%$ of which came from fat. The most popular category of item was chips (34.4%), followed by beverages (19.1%), candy (17.1%), frozen treats (14.0%), pastries (7.3%), gum (3.8%), and prepared items (4.3%). More frozen treats were purchased in the afternoon than in the morning ($P < .0001$). There were no differences between morning and afternoon purchases on any variable except for candy, gum, and frozen treats. More candy was purchased in the morning, and more frozen treats were purchased in the afternoon ($P < .0001$).

Frequency of Shopping

More than half (53.3%) of the participants reported shopping at corner stores every day, and another 21.9% reported shopping 2 to 4 times per week. Approximately 42% of participants reported that they usually shop at a corner store 2 times per day, and 53.9% reported shopping once a day. The most frequent shoppers, those who shop 2 times per day, 5 days/wk, represented 28.8% of the sample.

DISCUSSION

There are several principal findings from this study. First, urban children who were in grades 4 through 6 and shopped at corner stores before or

after school purchased, on average, 1495.2 kJ (356 kcal) per purchase. For the most frequent shoppers, those who shopped both before and after school, 5 times per week, this would amount to 2990.4 kJ/day (712 kcal/day), or 14 952 kJ/wk (3560 kcal/wk). Even the less frequent shoppers (13.3% of the sample), those who shopped once per day 3 days/wk, purchased 1495.2 kJ/day (356 kcal/day) and >4200 kJ/wk (>1000 kcal/wk) from corner stores.

The most frequently purchased items are energy-dense, low-nutritive items (eg, sugar-sweetened and artificially flavored drinks, nacho cheese flavored chips, candy). Previous research demonstrated the deleterious effects (both immediate and long-term) of poor-quality nutrition on health (eg, obesity, dental caries),¹⁴ as well as on behavior and cognition in children.^{15,16} Of additional concern is the prevalence of energy-dense and low-nutritive purchases just before children begin the school day.

A third major finding is that a little more than \$1.00 purchases 1495.2 kJ (356 kcal). This is not surprising given that energy-dense foods are generally inexpensive.¹⁷ A dollar has a high rate of return in an urban corner store. For example, \$0.25 can buy 8 oz of an artificially flavored fruit drink, a single-serving bag of chips, an assortment of candy/gum, or a popsicle.

The popularity of inexpensive, energy-dense, low-nutritive foods and beverages presents several opportunities for future intervention targets. Chips, for example, represent ~34% of all items purchased. Switching from regular (588 kJ [140 kcal]) to a baked (504 kJ [120 kcal]) version of 1 of the most frequently purchased nacho tortilla chips would reduce calories by 14.3%. This reduction is even larger (26.7%) when substituting baked (462 kJ [110

kcal]) for regular (630 kJ [150 kcal]) potato chips. Sugar-sweetened beverages accounted for ~16% of kilocalories per purchase, which is consistent with previous estimates of 10% to 15% of intake.¹⁸ An intervention that replaced sugar-sweetened beverages with water has the potential to decrease caloric purchases by ~252 kJ (~60 cal) per purchase. For a frequent shopper, this amounts to ~504 kJ/day (~120 kcal/day), or ~2520 kJ/wk (~600 kcal/wk).

These small changes could yield a significant impact on the quantity and quality of children's intake. For example, previous research suggested that decreasing energy intake by 462 to 693 kJ/day (110–165 kcal/day) may counterbalance among children the energy gap that is responsible for body weight increases from 1988 to 1994 and from 1999 to 2002.¹⁹ These alternative foods, however, may be more expensive or unavailable in stores. Future research is necessary to understand how factors such as price and availability influence child and adolescent purchases. Future interventions may consider targeting children directly through nutrition education in the schools, social marketing, and incentivizing purchases of healthier items. Interventions may also consider targeting store inventories by providing store owners with incentives or subsidies to provide more affordable, healthy options.

This study has several strengths. It is the first study to document the purchases that children make in corner stores proximal to their schools. As such, it quantifies an environmental and behavioral risk factor for obesity among children. A second strength is the collection of objective purchase data at the point of sale. Given the significant limitations in collecting self-report intake data among children,²⁰ we directly observed each item pur-

chased and obtained its relevant nutrition information. There are also several limitations. First, the shopping behavior of children may have been subject to demand characteristics of identifiable staff positioned outside corner stores. In addition, children may shop at multiple corner stores for different items (eg, 1 store for candy, 1 store for chips). These effects, however, would likely result in an underestimation of energy intake rather than an overestimation. Second, it was necessary for staff to be physically present at stores to collect data. The large number of stores ($N = 24$) precluded staff presence at every store twice a day. Third, our sample was restricted to fourth- to sixth-graders and data were collected during the school year, so the data should not be generalized to other age groups or times of year. This age group, however, is at high risk for obesity with a previously documented 14.9% incidence rate of overweight during a 2-year period.² Finally, it is unclear whether corner store purchases were made in place of or in addition to free- or reduced-price meals. Future research should address whether corner store purchases affect school meal participation.

CONCLUSIONS

This is the first study to document the purchases that children in grades 4 through 6 made in corner stores proximal to their schools. We observed that children shop at corner stores frequently and purchase energy-dense, low-nutritive foods and beverages that average 1497.7 ± 1219.3 kJ (356.6 ± 290.3 kcal) per purchase. Obesity prevention efforts in urban settings, as well as efforts to enhance dietary quality among urban youth, should take into account the corner store environment and its significant effect on energy intake.

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