

# Restricting Snacks in U.S. Elementary Schools Is Associated with Higher Frequency of Fruit and Vegetable Consumption<sup>1,2</sup>

Wendy Gonzalez, Sonya J. Jones, and Edward A. Frongillo\*

Center for Research in Nutrition and Health Disparities and Department of Health Promotion, Education and Behavior, Arnold School of Public Health, University of South Carolina, Columbia, SC 29208

## Abstract

Efforts are needed to improve U.S. children's poor diet quality. Our purpose was to examine whether a policy that restricts the availability of snack foods in the schools is associated with greater fruit and vegetable consumption in a nationally representative sample of 5th grade children. Children in schools with restricted snack availability had significantly higher frequency of fruit and vegetable consumption than children in schools without restricted snack availability. Our findings suggest that a restrictive snack policy should be part of a multi-faceted approach to improve children's diet quality. *J. Nutr.* 139: 142–144, 2009.

## Introduction

U.S. children have poor dietary quality due to excessive intake of foods that are high in sugar and fats and inadequate intake of fruits, vegetables, and whole grains (1–6). Efforts to increase children's fruit and vegetable consumption and reduce foods with added sugars and fats are needed. The Institute of Medicine's report, *Nutrition Standards for Schools: Leading the Way to Healthier Youth*, recommends that elementary schools not offer snacks other than fruits and vegetables (7). Although the report provides evidence that improving dietary quality is important for children, there is little evidence based on practice to guide efforts to improve the school nutrition environment. Our purpose was to examine whether a policy that restricts the availability of snack foods in the schools is associated with greater fruit and vegetable consumption in a nationally representative sample of 5th grade children.

## Methods

Data obtained from the Early Childhood Longitudinal Study-Kindergarten cohort included 10,285 5th grade children attending 2065 elementary schools (8). Children completed a questionnaire about their overall daily consumption of fruits and vegetables based on questions from the Youth Behavior Risk Factor Surveillance System. Evidence of validity of these questions has been reported elsewhere (9). Specifically, the children were asked "During the past 7 d, how many times did you eat 1) green salad; 2) carrots; 3) potatoes (do not count French fries, fried potatoes, or potato

chips); 4) other vegetables (do not count green salad, potatoes, or carrots); and 5) fruit, such as apples, bananas, oranges, berries, or other fruit (do not count fruit juice)?"

Responses were coded into 2 binary indicators of whether the children reported consuming fruits, green salad, carrots, potatoes, or other vegetables during the past 7 d occasionally (1–3 times per day) or frequently (>3 times per day) compared with rare consumption (<1 time per day).

To measure school policy about restricting snack availability, we used school administrator's self-reports of snack availability at their school. School administrators were asked: "Can students purchase, either from vending machines, school store, canteen, snack bar, or a la carte items from the cafeteria during school hours: 1) chocolate candy; 2) other kinds of candy; 3) cookies, crackers, cakes, pastries, or other baked goods that are not low fat; 4) ice cream or frozen yogurt that is not low in fat; 5) salty snacks that are not low in fat, such as regular potato chips; 6) low-fat or fat-free ice cream, frozen yogurt, or sherbet; 7) low-fat cookies, crackers, cakes, pastries, or other low-fat baked goods; 8) salty snacks that are low in fat, such as pretzels, baked chips, or other low-fat chips; 9) bread sticks, rolls, bagels, pita bread, or other bread products?" We interpreted the administrator's report as a statement of policy intent regarding whether availability was restricted (no snack items available) or unrestricted (at least 1 snack item available).

We calculated the frequency of children's consumption of fruits and vegetables at schools with restricted and unrestricted availability of snacks. Multi-level multinomial regression (implemented as 2 logistic regressions in xtlogit, STATA 9.1) (10) was used to determine the magnitude and significance of relationships between restricted and unrestricted availability of snacks at school and the child's consumption of fruits and vegetables, with the school entered into the model as a random effect. *P*-values < 0.05 were considered significant. We included gender, race/ethnicity, household income, Title 1 eligibility, and presence of 7th or 8th grade as covariates, given that a wider variety of snacks is expected to be available in schools with older grades (11). We used hierarchical cluster analysis assuming average linkage and a Jaccard measure of similarity to determine whether there were patterns of the type of snacks available at schools.

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\* To whom correspondence should be addressed. E-mail: efrongillo@sc.edu.

**TABLE 1** Percentage of children who were rare, occasional, or frequent consumers of fruit and vegetables throughout the day depending on whether the school had a policy of restricting snack availability

Snack policy <sup>1</sup>	Schools	Fruits			Vegetables		
		Rare (<1 time)	Occasional (1–3 times)	Frequent (>3 times)	Rare (<1 time)	Occasional (1–3 times)	Frequent (>3 times)
	<i>n</i>				%		
Available	1123	62.8	29.0	8.1	39.9	45.0	15.1
Not available	891	59.2	31.4	9.4	37.4	44.0	18.6

<sup>1</sup> Statistical tests for the association of snack policy and fruit and vegetable consumption are reported in model 1 of Table 2.

## Results

Fifty percent of the children were male. Almost 60% of children were white, 18% Hispanic, 11% African American, and 7% Asian. Fifty percent of children lived in households with an income higher than \$50,000. Approximately 65% of children attended schools that were Title 1 eligible and 35% attended schools without 7th or 8th grade.

In general, children did not consume the recommended daily intake of fruits and vegetables. Nearly 40% and 61% of the children reported consuming fruits and vegetables, respectively, less than 1 time per day. Only 9% and 16% of the children, respectively, consumed fruits and vegetables more than 3 times per day.

Consumption of fruits and vegetables differed by schools' policies of availability of snacks. Compared with children who attended schools without restricted-snack availability, children who attended schools with restricted-snack availability had ~3 percentage points lower frequency of consumption of fruits and vegetables (Table 1). Accounting for clustering by schools, there was a difference of 0.11 and 0.15, respectively, in the times per day of fruit and vegetable consumption (considered as a continuous variable) between the children who attended schools with and without restricted-snack availability.

Snack policy was associated with fruit and vegetable consumption accounting for school clustering (Table 2, model 1) and further accounting for gender and race/ethnicity (model 2). The latter shows a slight attenuation of odds ratios with adjustment. Compared with the children attending schools with restricted-snack availability, children in schools without re-

stricted availability were 10% ( $P = 0.025$ ) and 3% ( $P = 0.531$ ), respectively, less likely to report consuming fruits or vegetables occasionally. Furthermore, they were 13% ( $P = 0.05$ ) less likely to report frequent consumption of fruits and 21% ( $P = 0.001$ ) less likely to report frequent consumption of vegetables. The inclusion of the other covariates did not result in any further attenuation and there were no interactions with the covariates. Type or number of snacks available did not play a significant role in defining the association between the availability of snacks and consumption of fruits and vegetables and a cluster analysis revealed no meaningful patterns among the type of snacks available (results not shown).

## Discussion

The differences in fruit and vegetable consumption between schools with and without restrictive snack policies were modest, which is not surprising given that many personal and environmental factors determine children's fruit and vegetable consumption (12,13). These differences were greater for vegetable consumption. This is expected, because children prefer other foods to vegetables (14,15). If other foods are available, many children will select the alternative rather than vegetables. When not available, children appear to consume more vegetables.

This study has several limitations. Cross-sectional associations do not allow us to confer causality but can be an important step in the process of establishing causal relations. Dietary data collected from the children and reports of snack availability at schools are subject to measurement error and bias. Because snack availability and dietary intake were reported by school administrators and children, respectively, it is unlikely that the observed relationships were due to reporting bias. Random error in the reporting of snack availability would have resulted in an attenuation of the relationship with dietary intake.

These findings suggest, consistent with the Institute of Medicine's recommendation, that a restrictive snack policy should be part of a multi-faceted approach to improve children's diet quality, because it will positively affect daily fruit and vegetable consumption of elementary school children. Furthermore, restricting snack availability may avoid displacement of healthier food choices and decrease children's overall fat consumption (16–19). Our findings suggest that alternative policy options (e.g. limiting the number or types of snacks available) will not be as effective as restricting their availability for increasing children's fruit and vegetable consumption.

## Literature Cited

1. Krebs-Smith SM, Cook A, Subar AF, Cleveland L, Friday J, Kahle LL. Fruit and vegetable intakes of children and adolescents in the United States. *Arch Pediatr Adolesc Med.* 1996;150:81–6.
2. Munoz KA, Krebs-Smith SM, Ballard-Barbash R, Cleveland LE. Food intakes of US children and adolescents compared with recommendations. *Pediatrics.* 1997;100:323–9.

**TABLE 2** Association of consumption of fruits and vegetables by children with whether the school had a policy of restricting snack availability<sup>1</sup>

	Model 1 <sup>2</sup> ( <i>n</i> = 10,285)			Model 2 <sup>3</sup> ( <i>n</i> = 10,265)		
	Coefficient	OR	<i>P</i> -value	Coefficient	OR	<i>P</i> -value
Fruit consumption						
1–3 times per day vs. no consumption	–0.145	0.865	0.003	–0.110	0.896	0.025
>3 times per day vs. no consumption	–0.204	0.816	0.007	–0.144	0.866	0.050
Vegetable consumption						
1–3 times per day vs. no consumption	–0.037	0.964	0.446	–0.030	0.970	0.531
>3 times per day vs. no consumption	–0.274	0.760	0.000	–0.238	0.788	0.001

<sup>1</sup> Reference level is restricted availability of snacks at school.

<sup>2</sup> Unadjusted.

<sup>3</sup> Adjusted for females and race/ethnicity: non-Hispanic White (reference group), non-Hispanic African-American, Hispanic (any race), Asian, Native Hawaiian/Pacific Islander, and biracial.

3. Kennedy E, Goldberg J. What are American children eating? Implications for public policy. *Nutr Rev.* 1995;53:111–26.
4. Baranowski T, Smith M, Hearn MD, Lin LS, Baranowski J, Doyle C, Resnicow K, Wang DT. Patterns in children's fruit and vegetable consumption by meal and day of the week. *J Am Coll Nutr.* 1997;16:216–23.
5. USDA, Agriculture Research Service. Food and nutrient intakes by children 1994–96, Table set 17; 1998 [cited 2008 Aug 20]. Available from: [http://www.ars.usda.gov/SP2UserFiles/Place/12355000/pdf/scs\\_all.pdf](http://www.ars.usda.gov/SP2UserFiles/Place/12355000/pdf/scs_all.pdf).
6. Harnack L, Stang J, Story M. Soft drink consumption among US children and adolescents: nutritional consequences. *J Am Diet Assoc.* 1999;99:436–41.
7. Committee on Nutrition Standards for Foods in Schools. Nutrition standards for foods in schools: leading the way toward healthier youth. Washington, DC: Institute of Medicine; 2007.
8. U.S. Department of Education. Longitudinal Kindergarten-Fifth Grade Public-Use Data File ECLS-K. [CD-ROM]. Washington, DC: U.S. Department of Education; 2004.
9. USDA. Macro ORC. Design considerations for developing effective wording and format options for a children's nutrition behavior questionnaire. Final report to Economic Research Service, USDA. Calverton (MD): ORC Macro; 2002.
10. Stata Corporation. Stata Statistical Software [computer program]. Version 9.1. College Station, TX: Stata Corporation; 2006.
11. GAO. School meal programs: competitive foods are widely available and generate substantial revenues for schools. Washington, DC: United States Government Accountability Office; 2005.
12. Cullen KW, Baranowski T, Owens E, Marsh T, Rittenberry L, de Moor C. Availability, accessibility, and preferences for fruit, 100% fruit juice and vegetables influence children's dietary behavior. *Health Educ Behav.* 2003;30:615–26.
13. van der Horst K, Oenema A, Ferreira I, Wendel-Vos W, Giskes K, van Lenthe F, Brug J. A systematic review of environmental correlates of obesity-related dietary behaviors in youth. *Health Educ Res.* 2007;22:203–26.
14. Sandeno C, Wolf G, Drake T, Reicks M. Behavioral strategies to increase fruit and vegetable intake by fourth-through sixth-grade students. *J Am Diet Assoc.* 2000;100:828–30.
15. Domel SB, Baranowski T, Davis H, Leonard SB, Riley P, Baranowski J. Measuring fruit and vegetable preferences among 4<sup>th</sup>-and 5<sup>th</sup>-grade students. *Prev Med.* 1993;22:866–79.
16. Wildey MB, Pampalone SZ, Pelletier RL, Zive MM, Elder JP, Sallis JF. Fat and sugar levels are high in snacks purchased from student stores in middle schools. *J Am Diet Assoc.* 2000;100:319–22.
17. Kubik MY, Lytle LA, Hannan PJ, Perry CL, Story M. The association of the school food environment with dietary behaviors of young adolescents. *Am J Public Health.* 2003;93:1168–73.
18. Cullen KW, Eagan J, Baranowski T, Owens E, de Moor C. Effect of a la carte and snack bar foods at school on children's lunchtime intake of fruits and vegetables. *J Am Diet Assoc.* 2000;100:1482–6.
19. Kramer-Atwood JL, Dwyer J, Hoelscher DM, Nicklas TA, Johnson RK, Schulz G. Fostering healthy food consumption in schools: focusing on the challenges of competitive foods. *J Am Diet Assoc.* 2002;102:1228–33.