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Associations Between School Meals Offered Through the National School Lunch Program and the School Breakfast Program and Fruit and Vegetable Intake Among Ethnically Diverse, Low-Income Children

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Abstract

BACKGROUND—Despite evidence in support of the health benefits associated with fruit and vegetable (FV) intake, national data indicate that FV consumption among school-aged children is below recommended levels, particularly among low-income children. School meals offered through the School Breakfast Program and National School Lunch Program can provide an important contribution to child FV intake. This study examines the proportion of fruits and vegetables consumed from school meals programs among ethnically diverse, low socioeconomic status children.

METHODS—Participants (n = 103) included fourth to sixth grade boys and girls from 4 urban elementary schools in St. Paul, Minnesota serving primarily low-income populations. Research staff interviewed children during school hours and recorded dietary intake via 24-hour recall. Analysis included descriptive statistics using cross tabulations and means.

RESULTS—Average reported mean (SD) daily FV intake was 3.6 (2.5) servings, with 80% of children consuming fewer than 5 daily servings of FV. On average, children consumed over half of their daily FV intake within school. Children with low FV intake (<5 FV servings daily) consumed a higher proportion of their daily intake at school than children with higher FV intake (≥ 5 FV servings daily) (39% vs 59%; p = .002).

CONCLUSIONS—Child FV intake is below recommended levels. School meals provide an important contribution to the daily FV intake among ethnically diverse, low socioeconomic status

children, particularly among those with the lowest FV intake. School meals programs promoting FV intake within the school environment may provide an opportunity to encourage increased FV consumption.

Keywords

child nutrition; fruit and vegetable intake; school cafeteria; 24-hour recall

Despite the evidence in support of the health benefits associated with fruit and vegetable (FV) intake,¹ national data indicate that FV consumption of school-aged children is below recommended levels.² The dietary goals identified by Healthy People 2010 include increasing the proportion of youth who consume 2 daily servings of fruit and 3 daily servings of vegetables.³ Based on National Health and Nutrition Examination Survey (NHANES) data (1999–2000), the estimated mean daily intake of fruits and vegetables among boys and girls aged 9–13 years was 3.7 servings and only 18% to 20% of children in this age group consumed 5 or more daily servings of fruits and vegetables.² Furthermore, youth from families with low socioeconomic status are likely to consume the fewest daily servings of fruits and vegetables.⁴ Based on Consumer Expenditure Survey data (1991 and 2000), per person FV expenditures were significantly less for low-income households compared to other households; \$3.59 per capita per week versus \$5.02, respectively.⁵

Although reported student satisfaction with breakfast and lunch could be improved,⁶ school meals provide an important contribution to the daily FV intake among ethnically diverse, low socioeconomic status children. School meals offered through the School Breakfast Program (SBP)⁷ and the National School Lunch Program (NSLP)⁸ make fruits and vegetables available to children from low-income households at a free or reduced rate. In 2006, the NSLP provided nutritionally balanced, low-cost or free lunch to more than 30 million school children.⁸ It is the position of the American Dietetic Association that the NSLP and SBP are a particularly important source of nutrients for school-age children from low-income families and state that the nutrition goals of the NSLP and SBP should be supported and extended through school wellness policies that enable students to develop lifelong healthful eating habits.⁹ In three school-based interventions, the lunch meal accounted for approximately 15% to 30% of the total daily intake of fruits and vegetables among school-aged children.^{10–12} Recent research conducted by the Food and Nutrition Service of the United States Department of Agriculture suggests that elementary school participants in the NSLP were more likely than nonparticipants to consume fruit juice at breakfast and consume at least 1 vegetable at lunch.⁶ This study provides further examination of the importance of school meals within a specific population believed to be at increased risk for inadequate intake of fruits and vegetables. This investigation examines the contribution of NSLP and SBP to FV intake between male and female fourth to sixth grade students using data from an ethnically diverse, primarily low-income sample of public elementary school children within an urban area in the United States.

The aim of this study examines associations between child daily FV intake and location of eating occasion (school vs nonschool) in a sample of ethnically diverse, low socioeconomic status, fourth to sixth grade students. The following research questions were addressed in this study: (1) What is the total daily FV intake in this population; (2) What proportion of the daily FV intake is consumed at school; (3) Does FV intake differ by gender, race, age, or weight status?; and (4) What role do school meals play in contributing to FV intake among those with the lowest FV intake?

METHODS

Study Population and Design

The study population for these analyses included 103 children (78 females, 25 males) in fourth to sixth grade (ages 9–12) from 4 urban elementary schools in St. Paul, Minnesota, serving primarily low-income populations who participated in an evaluation of the Ready, Set, ACTION! (RSA) program, a theater-based intervention aimed at obesity prevention.¹³ The present investigation utilizes baseline data collected prior to the intervention. Approximately 90% of the students at each school qualify for free or reduced school lunch.¹⁴ Nearly, all (102 of the 103 participants) consumed the school lunch provided by the NSLP while a smaller proportion (61 of the 103 participants) consumed school breakfast. The mean (SD) age of the male and female children included in these analyses was 10.5 (1.1) and 10.2 (1.1) years, respectively. The child self-reported ethnic distribution was as follows: African-American 53% (n = 55), Asian/Hmong 12% (n = 12), White 8% (n = 8), Hispanic 3% (n = 3), and mixed/other 24% (n = 25). Written consent was obtained from parents or primary caregivers for their child to participate in the study. The study population included a sizable proportion of overweight students with 56% of males and 36% of females with body mass index (BMI) ≥85th percentile for age and gender. The children also signed a written assent form.

Assessment of Dietary Intake

Dietary intake was assessed using a 1-day 24-hour dietary recall collected by research staff using Nutrition Data System for Research (NDS-R) on Tuesday–Friday to ensure that only weekday eating patterns were recorded. Dietary recalls were utilized to obtain a record of the type and number of foods and beverages consumed by participants during a complete 24-hour period (from midnight to midnight) for the day preceding the interview. Dietary interviewers trained by the Nutrition Coordinating Center (NCC) used NDS-R dietary data collection computer software to obtain 24-hour dietary recalls from participants via face-to-face interviews utilizing a standardized multiple-pass approach in which NDS-R displays computer prompts to assist interviewers in following a consistent, systematic approach. Interviews were conducted during the school day and took 30–45 minutes to complete. Participants were shown standardized food portion models to assist in estimating amounts of food consumed.

The school meals program provides children with opportunities to eat school breakfast, lunch, and snacks at school. The 24-hour recall data were analyzed using the NDS-R software, version 2006 (University of Minnesota, St. Paul, MN). Servings of fruits, vegetables, and total fruits and vegetables were calculated using the food group serving count system based on the 2005 Dietary Guidelines for Americans. A summed score was created for total FV servings.

Fruit Intake Measure—Fruit servings are defined per the Dietary Guidelines for Americans 2005 as 1 medium apple, banana, orange or pear; ½ cup of chopped, cooked, or canned fruit; ¼ cup of dried fruit or ½ cup of fruit juice. Fruit servings include fruit and juice consumed separately (plain) and in fruit salad, but did not include fried fruits.

Vegetable Intake Measure—Vegetable servings are defined per the Dietary Guidelines for Americans 2005 as 1 cup of raw leafy vegetables, ½ cup of other cooked or raw vegetables, or ½ cup of vegetable juice. Vegetable servings include vegetables and vegetable juice consumed separately (plain) and in recipes containing vegetables, eg, stew, soup, lasagna, pizza, salad, casseroles, and commercial entrees, but did not include fried vegetables such as french fries.

Assessment of BMI

Height and weight measures were assessed by trained research staff using standardized equipment and procedures.¹⁵ Age and sex-specific BMI z-scores were calculated based on the Centers for Disease Control and Prevention growth charts, which are age and sex specific.¹⁶

DATA ANALYSIS

Descriptively we present the mean intake of fruit, of vegetables, and of fruit and vegetables combined as servings per day (mean and standard deviation) in total and as the proportion of the total eaten at school. These data are then stratified separately by gender, race, age, and weight status. A final stratification contrasts those with the highest FV intake of 5 fruits and vegetables per day versus those consuming less than 5 daily FV servings. The cutoff of 5 servings per day was based on the dietary goals identified by Healthy People 2010 which include increasing the proportion of youth who consume 2 daily servings of fruit and 3 daily servings of vegetables.³ At present, some government-led campaigns no longer specifically promote the consumption of 5 servings of fruits and vegetables per day, and instead focus on a “more is better” message.¹⁷

The focus is on the proportion of healthful intake coming from the school meals program, and how this differs across personal characteristics (gender, race/ethnicity, age, weight status) and intake. Analysis of variance was used to generate p-values. The inclusion of p-values for differences in the combined FV intake is primarily used to direct attention to aspects of the data of greater interest, first of differences in daily intake, and secondly in differences of the proportions attributed to the school meals program, rather than for strict statistical testing. Note that in calculating the mean proportion, individual proportions are weighted equally, not by the amount of intake per individual. For example, a participant with a low total intake of fruits and vegetables may have a high proportion coming from the school meals program. SAS Version 9.1 (SAS Institute, Inc., Cary, NC) was used for all analyses.

RESULTS

Daily FV servings consumed by fourth to sixth grade children are shown in Table 1. Average reported mean (SD) daily FV intake was 3.6 (2.5) servings. Children consumed over half of their daily FV intake within school (54%). Daily FV intake among males (3.0 servings) was lower than FV intake among females (3.7 servings). The observed proportion of daily FV consumed at school among males and females were 64% and 51%, respectively ($p = 0.09$). Of 103 children, 82 (80%) consumed fewer than 5 daily servings of FV. When compared to children with higher FV intake (≥ 5 FV servings daily), children with lower FV intake (< 5 FV servings daily) consumed a higher proportion of their daily intake at school (34% vs 59%) ($p = .002$). In this small dataset, daily FV intake and proportion of FV consumed at school did not differ statistically by gender, race, age, or weight status.

DISCUSSION

The primary aim of this study was to examine the cross-sectional associations between child FV intake and location of eating occasion for ethnically diverse, low socioeconomic status school-aged children. Findings suggest that for this population, the school meals program provided an important contribution to overall daily FV intake. The majority of participants reported low FV intake, with only 20% consuming ≥ 5 FV servings per day. Study participants consumed more than half of the daily FV intake at school. The school meals program appears to be particularly important for students with the lowest level of FV intake.

Participants with the lowest daily FV intake consumed a significantly greater proportion of FV at school than students with the highest daily FV intake.

Findings indicating low levels of FV intake among children in this study are consistent with national data which indicate that boys and girls ages 9–13 consume 3.7 FV servings/day and only 18% to 20% of children in this age group consume 5 or more daily servings of fruits and vegetables.² Children in this study consumed greater than 50% of their daily FV intake within the school setting. Previous studies have reported that the lunch meal accounted for an approximate range of 15% to 30% of the total daily FV intake.^{10–12} School meals offered through the SBP⁷ and the NSLP⁸ may provide an important opportunity for increased FV consumption. Previous research suggests that participants in SBP were more likely than nonparticipants to consume 100% fruit juice or some type of fruit for breakfast, compared with nonparticipants.⁶ Furthermore, about half of all NSLP participants consumed at least one vegetable at lunch, compared with 23% of nonparticipants; however, this pattern was primarily driven by increases in the consumption of potato foods, such as french fries and tater tots.⁶ The vegetable measure utilized in this investigation excludes fried vegetables (eg, french fries), and yet accounts for 44% of the daily vegetable intake among study participants.

The findings from this study, in conjunction with previous research⁶ underscore the importance of the School Meals Program for all children, but particularly for children from low-income families. School meals may have the greatest impact on the FV intake for children who may not have a high level of home FV availability and accessibility^{4,18,19} or exposure to parental modeling of FV intake.^{4,19–22} This issue becomes of even greater importance during hard economic times when families are making difficult decisions about how best to allocate financial resources. Some families may perceive fruits and vegetables as a costly option when compared to other more energy dense foods. A major strength of this study is the specific focus on children from low-income and ethnically diverse backgrounds who participated in the School Meals Program and who may be at greatest risk for low FV intake.

Limitations

Dietary intake was assessed using 24-hour recall data collected by research staff; however, it was limited to a single day and did not include direct observation. Furthermore, FV servings were somewhat lower than the self-reported daily FV intake reported in a companion survey completed by the children.²³ This may have been due in part to the exclusion of fried potatoes from the vegetable 24-hour recall measure, or to bias due to self-report. Finally, because this study utilized a small convenience sample and did not control for a variety of possible confounding variables, we are unable to make generalizations beyond the population measured. A larger sample size may have provided additional insight into associations among participants with differing demographic characteristics and FV intake.

Conclusions

The majority of children consumed fewer than 5 daily servings of fruits and vegetables. School meals provided an important contribution to the daily FV intake among ethnically diverse, low socioeconomic status children, particularly among those with the lowest FV intake. School meals programs promoting FV intake within the school environment may provide an opportunity to encourage increased FV consumption.

IMPLICATIONS FOR SCHOOL HEALTH

The findings from this study support previous research indicating that school breakfast and school lunch make an important contribution to overall dietary intake of youth. Promoting

nutrition education messages within the classroom and cafeteria and providing students with multiple opportunities to select fruits and vegetables at school lunch and school breakfast may lead to increased FV consumption long-term and assist in reducing childhood obesity and food insecurity.

Research results support and encourage the ongoing efforts of school administrators, educators, and school food service personnel to embrace the tremendous opportunity to expand and enhance programs promoting increases in intake of fruits and vegetables.

Schools are an ideal venue to promote improvements in FV preferences and increased FV consumption among elementary-aged children. In the past decade, a wide variety of school-based, multicomponent interventions have been developed to promote increased FV intake among elementary school children.^{11,12,24–26} Future research should involve continued investigation of the most effective intervention strategies aimed at promoting increased FV intake among school-aged children.

Policies and strategies designed to promote and strengthen school meals programs should be encouraged and supported. Recent legislation has prompted a review of the impact of school meals on nutritional intake of youth,²⁷ thus it is an ideal time to consider opportunities to strengthen the school meals program.

Given the positive impact that the school meals program may have on the dietary intake of children we need to also examine dietary intake outside of the school year and promote alternative programs to parents to sustain the FV intake of children year-round. A greater emphasis on establishing school-home partnerships may further contribute to the promotion of health-enhancing habits among youth.

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Human Subjects Approval Statement This study was approved by the University of Minnesota's institutional review board and the Saint Paul Schools Research Committee.

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Table 1

Daily Fruit and Vegetable Servings Consumed by Fourth to Sixth Grade Children and Proportion Consumed at School (N = 103)

Characteristic	Fruit Intake		Vegetable Intake		Fruit and Vegetable Intake			
	Total Servings mean (SD)	School Proportion %	Total Servings mean (SD)	School Proportion %	Total Servings mean (SD)	p Value	School Proportion %	p Value
Total (N = 103)	2.1 (1.9)	64	1.5 (1.2)	44	3.6 (2.5)		54	
Gender						0.15		0.09
Male (n = 25)	1.7 (1.8)	74	1.3 (1.2)	58	3.0 (2.2)		64	
Female (n = 78)	2.2 (1.9)	61	1.6 (1.3)	40	3.7 (2.4)		51	
Race/Ethnicity						0.11		0.14
African American (n = 55)	1.8 (1.7)	74	1.4 (1.2)	51	3.2 (2.0)		61	
Asian/Hmong (n = 12)	1.8 (0.9)	34	1.0 (0.7)	58	2.8 (1.0)		48	
White (n = 8)	3.0 (2.7)	52	1.7 (1.6)	33	4.7 (3.2)		50	
Other/Mixed (n = 28)	2.3 (2.3)	57	1.8 (1.4)	29	4.1 (2.9)		44	
Age (years)						0.11		0.98
9 (n = 32)	1.9 (1.8)	74	1.0 (0.9)	34	2.9 (1.7)		53	
10 (n = 25)	1.7 (1.3)	58	1.8 (1.4)	45	3.6 (1.9)		52	
11 (n = 30)	2.2 (2.2)	57	1.4 (1.2)	57	3.7 (2.5)		56	
12 (n = 16)	2.6 (2.3)	66	2.1 (1.5)	41	4.6 (3.3)		54	
Weight Status						0.15		0.71
BMI < 85th pet (n = 60)	2.1 (2.1)	65	1.6 (1.3)	41	3.8 (2.6)		53	
BMI 85–95th pet (n = 19)	2.5 (1.6)	47	1.5 (1.0)	53	4.0 (2.3)		51	
BMI 95th pet (n = 24)	1.5 (1.4)	76	1.3 (1.2)	47	2.8 (1.5)		59	
Daily FV Intake						<0.001		0.002
5 Servings FV (n = 21)	4.8 (2.0)	38	2.4 (1.6)	29	7.2 (2.0)		34	
<5 Servings FV (n = 82)	1.4 (1.0)	71	1.3 (1.0)	49	2.6 (1.2)		59	

School Proportion: Percent of total daily FV intake consumed at school, averaged.