

Relationship between socioeconomic status and fruit and vegetable intake among Washington State middle school students

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Abstract

Relationship between socioeconomic status and fruit and vegetable intake among Washington State middle school students

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PURPOSE: To determine the associations between individual-level measures of socioeconomic status (SES) of middle school students and their rates of fruit and vegetable (FV) consumption within the school environment and away from the school environment. **METHODS:** Student FV consumption at school and away from school was assessed by a self-administered Beverage and Snack Questionnaire in 64 middle schools in Washington State. For both the at school and away from school environments, consumption data was categorized into “yes FV” and “no FV” groups. Self-reported eligibility for free and reduced price lunch was used as a proxy for low SES. χ^2 testing was used to analyze the relationship between markers of SES and FV consumption. Logistic regression analysis was used to further investigate the association between SES markers and FV consumption at school and away from school by controlling for school-level differences, sex, and race dichotomized as white and non-white. **RESULTS:** Data from 6646 seventh graders were used in analysis of FV consumption at school and data from 7066 seventh graders were used in analysis of FV consumption away from school. χ^2 analysis indicated that FV consumption while at school is positively related to markers of low SES (χ^2 value = 14.76, df =1, p< .001) but is negatively related to markers of low SES away from school (χ^2 value = 17.46, df =1, p< .001). Logistic regression analysis showed that students with markers of low SES had 1.35 greater odds of FV consumption at school (95% CI: 1.18 to 1.55; p<0.001) than those without markers of low SES. Away from school, students with markers of low SES had lower odds of FV consumption at 0.65 (95% CI: 0.48 to 0.89; p=0.006) compared to students without low SES markers. **CONCLUSIONS:** Among WA State middle school students, individual-level markers of low SES are associated with a greater likelihood of FV consumption at school but also with a lower likelihood of FV consumption away from school. Interventions that would allow for greater opportunities for FV consumption in schools may help improve the diets of adolescents.

Introduction

School-based programs that provide fruits and vegetables (FV) to low-income children have the potential to reduce disparities in health behaviors and health outcomes. FV are high in fiber and micronutrients. These low-energy dense foods contribute to satiety and satiation; they may be displaced by higher-energy dense but micronutrient-poor foods from the diet such as salty snacks and baked goods (1). An abundance of epidemiological evidence suggests that diets high in fruit and vegetables help to promote health and reduce the risk of developing chronic diseases such as obesity, stroke, cardiovascular disease, type 2 diabetes and some cancers (2). In addition, there is growing evidence that FV consumption in children may protect against a range of childhood illnesses (3). Yet in spite of these reported benefits, studies consistently show that average daily FV consumption for both children and adults in the U.S. fall far below national dietary recommendations. Only one in every four American youths age 9 to 18 years old eats the recommended servings of five or more half-cup servings of FV per day (4). Likewise, children's consumption of FV in most European countries and Australia is also low. For instance, the average intake of FV for children in the UK is around 2.5 servings per day (5).

Adherence to dietary guidelines is even lower among youth of low socioeconomic status (SES). A recent review found that low SES in children and adolescents (ranging in age from 6-18 years) is consistently associated with less frequent intake of FV. Specifically, seven out of 14 identified papers showed a positive association for family income of youth while nine out of 11 papers showed a positive association for parental occupation-related SES status, and all (11 out of 11 papers) found that parental education was positively associated with FV consumption (6).

Puberty is a potentially critical period for the establishment of body composition and dietary habits. Hormonal changes occur that are involved in regulating appetite, satiety and fat distribution. Such hormonal shifts can set the stage for body composition in later life (7). Moreover, adolescence can be a time of dramatic behavior changes as children test their autonomy. Children's assertion of independence from their caregivers during this period may affect food choices (7). Dietary habits established in youth have been shown to continue into adulthood and become highly resistant to modification (7). Therefore, helping children and teenagers - especially those who are vulnerable due to low SES - establish and maintain a healthy diet that includes high FV intake should be a priority in public health.

Schools can be important settings on which to focus such efforts to establish and maintain healthy diets because they play large roles in children's food intakes. School-aged children spend a minimum of six hours at school on school days and obtain up to nearly half of their calories from meals and snacks consumed at school (8). For more than 30 million participating children, the federally sponsored school meal programs—the National School Lunch Program (NSLP) and the School Breakfast Program (SBP)—are major sources of foods

eaten at school (8). Nearly all American public schools participate in the NSLP, and more than 80% of these also participate in the SBP (8).

Meals provided to students in school as part of school meal programs include FV and may therefore provide millions of lower-SES students who qualify for low-cost or free meals the opportunity to consume FV in-line with the dietary guidelines. When access to competitive foods such as cookies and chips within school food environments is restricted, students participating in the NSLP have been shown to increase FV consumption (9). Elementary school students participating in the NSLP have better diets than those who brought their lunch from home. In one study, 43% of those who ate a school lunch ate two or more FV at lunch and 51% did not eat snack foods. In contrast, more than half of those who brought a lunch from home did not eat any fruits or vegetables at lunch, and more than 40% ate two or more snack foods (10).

It might therefore stand to reason that the negative effects of low SES on students' diets and health status overall would be mitigated by their participation in school meal programs. However, while children from low-income families are more likely to receive free or reduced-price school meals than children from higher income, primarily non-Hispanic white families, they are also more likely to be overweight (11, 12). The influence of school meal programs on the nutritional status of low-SES children is therefore unclear.

While many studies have investigated the association between SES and markers of diet quality among school-aged children, there has been a lack of research devoted to investigating FV intake at school and how it is linked to children's SES. The aim of this study is to investigate the association between individual-level measures of SES as determined by eligibility for free or reduced price school meals and the frequency of FV consumption at school and away from school among seventh grade students in Washington State. Do students of lower SES have a significantly lower likelihood of FV consumption away from school compared to high SES students, while simultaneously having a significantly higher likelihood of FV consumption at school than high SES students?

Gaining insight into the dietary patterns of children of lower SES both at school and away from school will inform interventions aimed at improving students' adherence to nutritional recommendations for FV consumption. Limited resources that are available for combating the deleterious effects of poor nutrition make it imperative that programs intended to improve eating behaviors have the data necessary to target areas or individuals that will lead to maximum benefits.

Methods

This is a cross-sectional observational study using data obtained as part of a larger study (13). During the 2007–2008 school year, a research team worked with participating schools to administer the Beverage and Snack Questionnaire (BSQ) to all seventh graders (13). To maintain student anonymity, the research team provided the schools with parent letters, student assent forms, a teacher script, and the survey tool. The schools provided the letters to families asking them to return signed forms if they did not want their student to participate. Student assent was obtained. Each school decided how they would administer the surveys to all seventh grade students, either all at once (for example during first period) or during a specific class (for example, during homeroom). The schools returned the completed surveys to the research team. The BSQ was developed through a process of cognitive and psychometric testing and has been found to have adequate validity ($r = .72-.85$) and reliability ($r = .69-.71$) with seventh graders (13).

The BSQ included eight snack, five SSB beverage, two milk, one fruit and one vegetable category. Students were asked to provide categorical responses regarding the frequency of consumption over a period of one week for each food category. Students indicated the frequency of consumption at school and away from school for each food category. One question was asked regarding frequency of consumption for fruit and another regarding frequency of vegetable consumption. Categorical responses for frequency of consumption included “never or less than 1 per week”, “1 per week”, “2-4 per week”, “5-6 per week”, “1 per day”, “2-3 per day” and “4+ per day” (14).

Recruitment

School recruitment was designed to ensure representation from middle schools that serve low-income and racial/ethnic minority students and geographically diverse parts of Washington State by using existing relationships to engage schools. The Washington State School Directors Association, Office of the Superintendent of Public Instruction and public health advocates announced the project at meetings, through newsletters, in letters mailed directly to school administrators and leaders and through personal contact. All public schools that enroll seventh-grade students and participate in USDA school meal programs were eligible to participate. A total of 65 schools from 29 districts returned a letter of cooperation agreeing to participate in all phases of data collection.

Statistical Analysis

The unit of analysis was the individual. SPSS version 21 (Armonk, NY) was used to analyze descriptive data and perform a chi-square test of independence for each pair of variables: fruit and vegetable consumption frequency at school and away from school. An alpha level of 0.05 established statistical significance.

Results

Student Response Data

Data representing 28 school districts were collected in 64 of the 65 schools that volunteered to participate in the study. One school district withdrew from the study due to flooding and school closures. Questionnaires were collected from 10,618 of the 13,889 seventh graders enrolled in the 64 study schools for a total response rate of 76%.

Characteristics of Subjects

The students included in this study are described in Table 1. Nearly equal proportions of seventh graders – 47.1% – reported being 12 and 13 years of age. The median reported age was 13 years.

Table 1. Characteristics of All Survey Respondents (n = 10,618)		
Student Characteristics	n	Percent (%)
Students reporting free or reduced price lunch eligibility **	2953	29.4
Race/ethnicity *		
Asian	608	6.1
American Indian/ Alaskan Native	925	8.7
Native Hawaiian or other Pacific Islander	331	3.1
Black	605	5.7
White	7,384	69.5
Other	1,389	13.9
Hispanic **	1,653	19.7
Sex **		
Male	4,858	49.2
Female	5,025	50.8

* Students given the option to mark more than one response

** Percentage of valid responses

The characteristics of the students excluded from statistical analysis because they did not select a valid option for one of the survey questions regarding FV consumption differ from those of all survey respondents (Table 2). Compared to 69.5% of all 10,618 survey respondents identifying their racial background as white and 19.7% identifying their ethnic background as Hispanic, an average of 22.5% less of the students excluded from analysis due to missing or invalid responses regarding FV consumption self-identified as white and an average of 9.5% more students self-identified as Hispanic (Table 2).

Table 2. Respondents that were Excluded: Demographic Characteristics of Those Excluded for Not Providing Usable Answers to Specific Survey Questions

Survey Questions	FRPL – Don’t Know	FRPL – No Answer	Fruit Consumption At School	Fruit Consumption Away From School	Vegetable Consumption At School	Vegetable Consumption Away From School
All Survey Respondents n (% of total sample)						
	2580 (24.3)	568 (5.3)	1096 (10.3)	513 (4.8)	1069 (10.1)	508 (4.8)
By Race/ethnicity ** n (% of exclusions for each question)						
Asian	279 (10.8)	10 (1.8)	72 (6.6)	29 (5.7)	61 (5.7)	30 (5.9)
American Indian/ Alaskan Native	201 (7.8)	9 (1.6)	98 (8.9)	38 (7.4)	87 (8.1)	41 (8.1)
Native Hawaiian or other Pacific Islander	76 (2.9)	7 (1.2)	32 (2.9)	18 (3.5)	30 (2.8)	20 (3.9)
Black	138 (5.3)	9 (1.6)	63 (5.7)	25 (4.9)	59 (5.5)	31 (6.1)
White	1831 (71.0)	71 (12.5)	584 (53.3)	218 (42.5)	551 (51.5)	207 (40.7)
Other	348 (13.5)	23 (4.0)	160 (14.6)	50 (9.7)	162 (15.2)	53 (10.4)
Hispanic ***	406 (20.6)	34 (39.5)	191 (28.3)	72 (29.0)	183 (29.0)	79 (30.5)
By Sex *** n (% of exclusions for each question)						
Male	1229 (50.1)	161 (52.4)	459 (52.2)	165 (49.3)	474 (55.8)	179 (53.8)
Female	1224 (49.9)	146 (47.6)	420 (47.8)	170 (50.7)	375 (44.2)	154 (46.2)

FRPL indicates “Free or Reduced Price Lunch”

*Includes students with multiple answers or no answers

** Students given the option to mark more than one response

*** Percentage of valid responses

In contrast, the sample of students who were excluded from analysis because they selected “I Don’t Know” for the question regarding eligibility for free or reduced price lunch (FRPL) have a racial and ethnic

profile more similar to that of all 10,618 survey respondents; the percentage of those excluded students self-identifying as white is 1.5% above the percentage of all survey respondents self-identifying as white and the percentage of excluded students self-identifying as Hispanic is within 1% of all survey respondents self-identifying as Hispanic (Table 2).

Table 3. Final Sample of Washington State Middle School Students Reporting Consumption of Fruits and Vegetables at School and/or Consumption of Fruits and Vegetables Away From School					
	Fruit and Vegetable Consumption At School			Fruit and Vegetable Consumption Away From School	
Student Characteristics	n	Percent (%)		n	Percent (%)
Students reporting free and reduced price lunch eligibility **	2568	38.6		2750	38.9
Race/ethnicity *					
Asian	577	8.7		604	8.5
American Indian/Alaskan Native	556	8.4		601	8.5
Native Hawaiian or other Pacific Islander	222	3.3		228	3.2
Black	400	6.0		427	6.0
White	4932	74.2		5218	73.8
Other	867	13.0		947	13.4
Hispanic **	1032	18.2		1114	18.5
Sex **					
Male	3064	48.3		3278	48.6
Female	3286	51.7		3465	51.4

* Students given the option to mark more than one response

** Percentage of valid responses

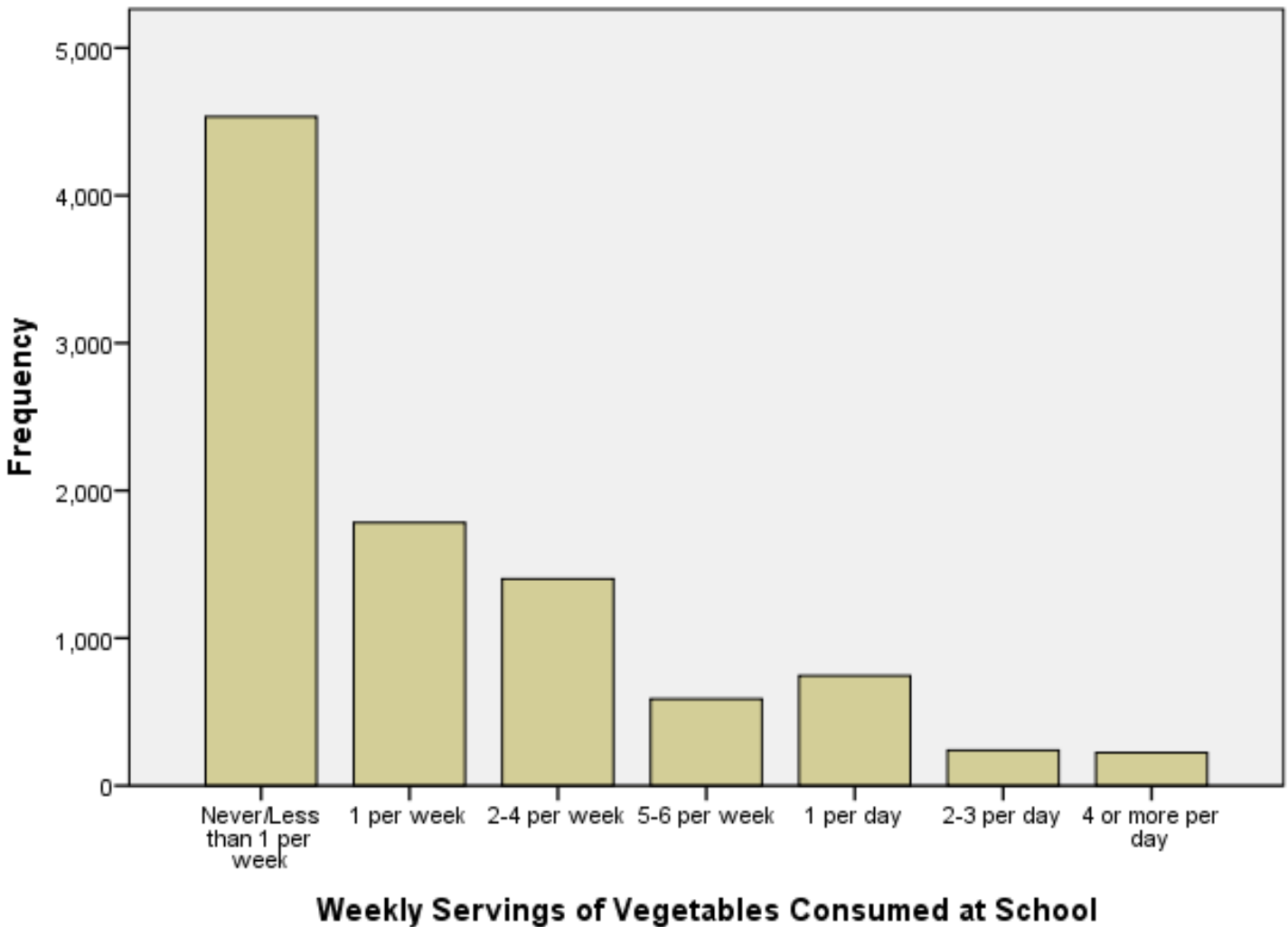
All students included in the sample for χ^2 and logistic regression analysis of FV consumption at school had valid responses for both the question regarding fruit consumption at school and the question regarding vegetable consumption at school as well as a “yes” or “no” response regarding FRPL eligibility (Table 3). Likewise, all students included in the final sample for χ^2 and logistic regression analysis of FV consumption away from school had valid responses for both of the questions concerning fruit and the vegetable consumption away from school as well as a “yes” or “no” response regarding FRPL eligibility (Table 3). The final sample of students analyzed for FV consumption at school includes 4.7% more students who identify themselves as white

while the final sample of students analyzed for FV consumption away from school includes 4.3% more students who identify themselves as white (Table 3).

Fruit and Vegetable Intake

The median amount of reported vegetable servings eaten at school is “1 per week” while the mode is “Never/Less than one per week.” Of all valid responses, 47.6% indicate fewer than one vegetable per week consumed at school and 18.7% indicate the “1 per week” consumption rate (Figure 1).

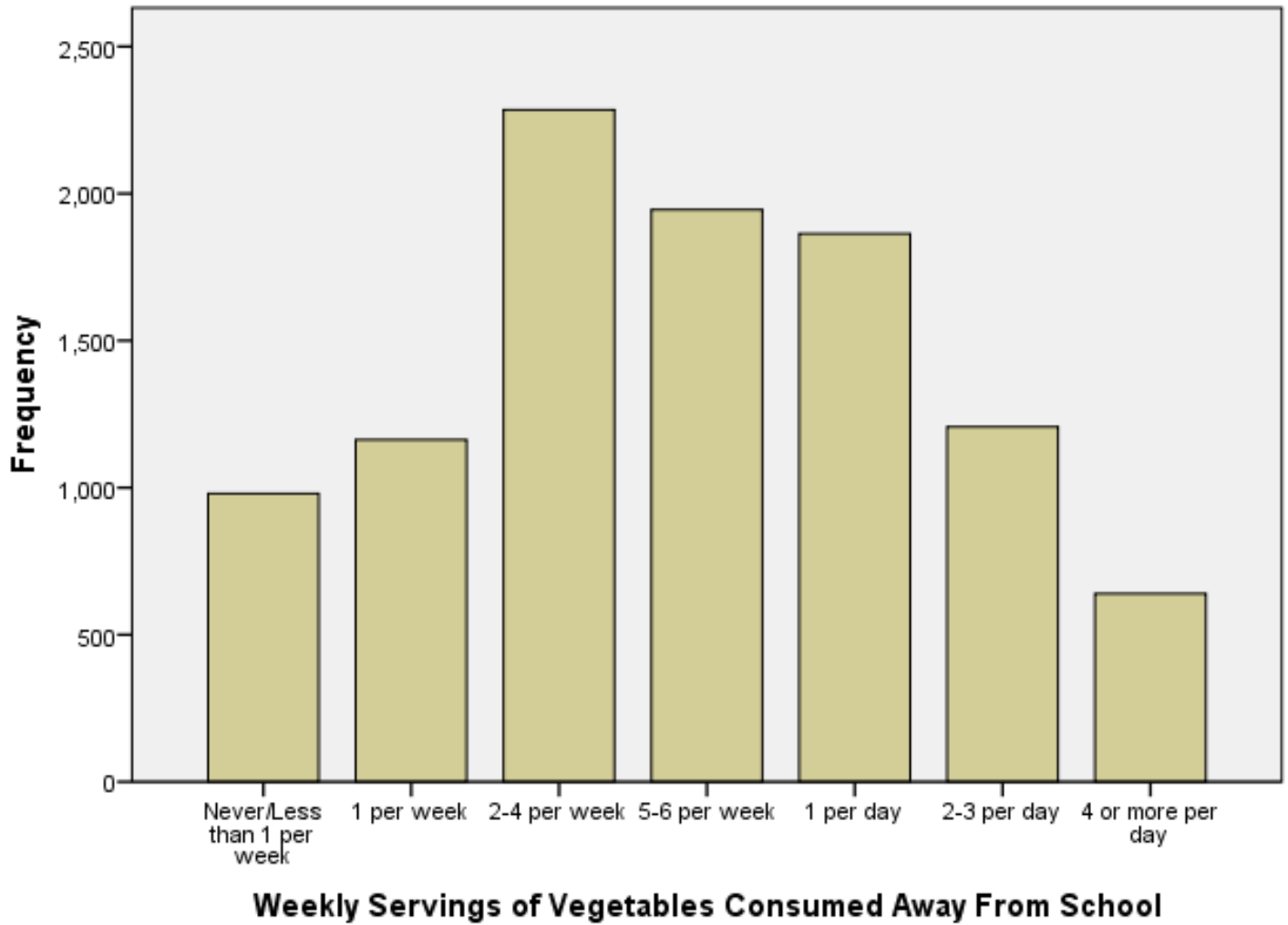
Figure 1. Weekly Servings of Vegetables Eaten at School Reported by Seventh Grade Students in Washington State



The median amount of reported vegetable servings eaten away from school is “5-6 per week.” Of all students with valid responses, 19.3% indicate this rate of vegetable consumption (Figure 2). The mode is “2-4

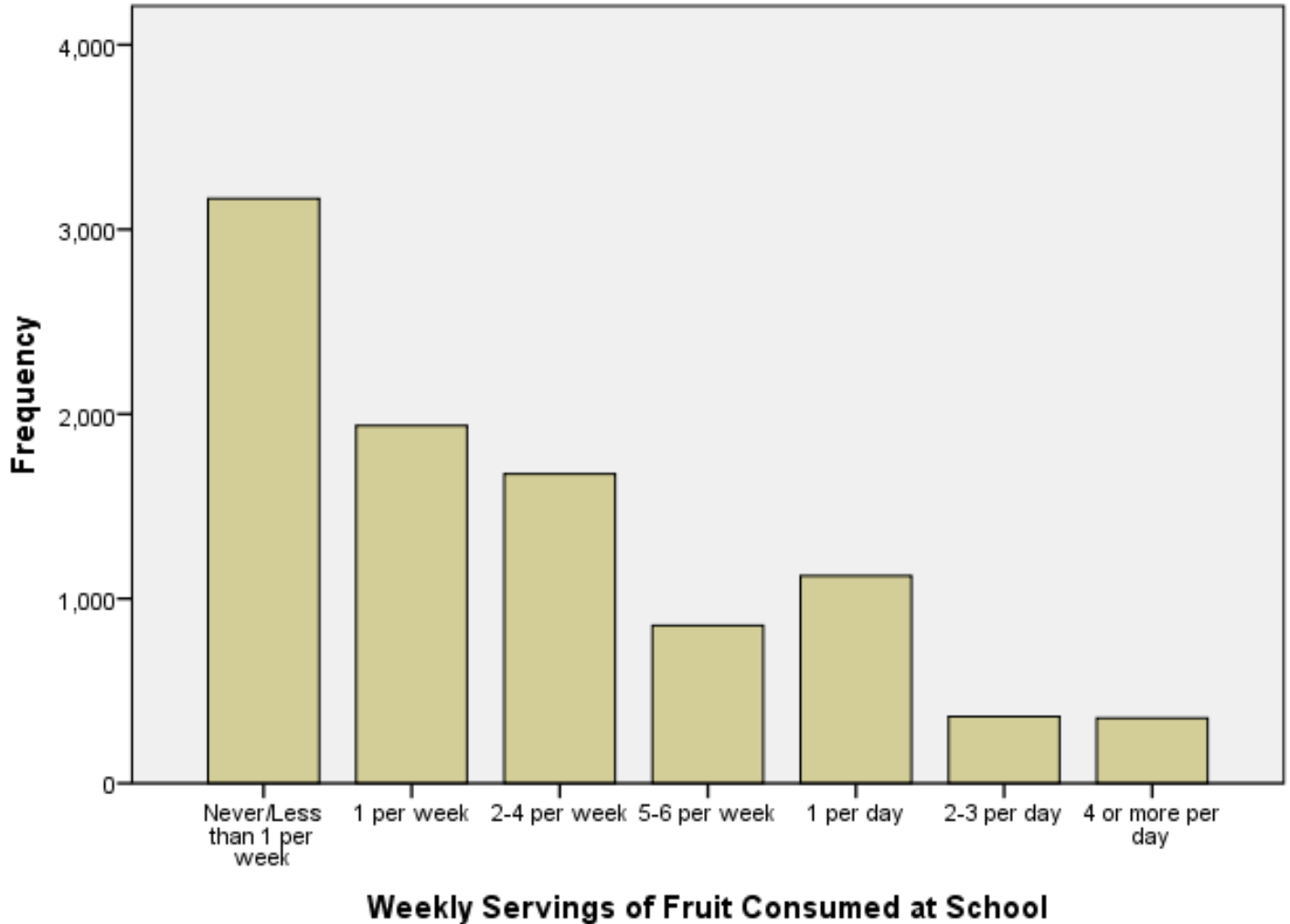
per week,” with 22.7% of students with valid responses indicating this consumption range. Of all students with valid responses, 9.7% indicate fewer than one vegetable per week consumed away school.

Figure 2. Weekly Servings of Vegetables Eaten Away From School Reported by Seventh Grade Students in Washington State



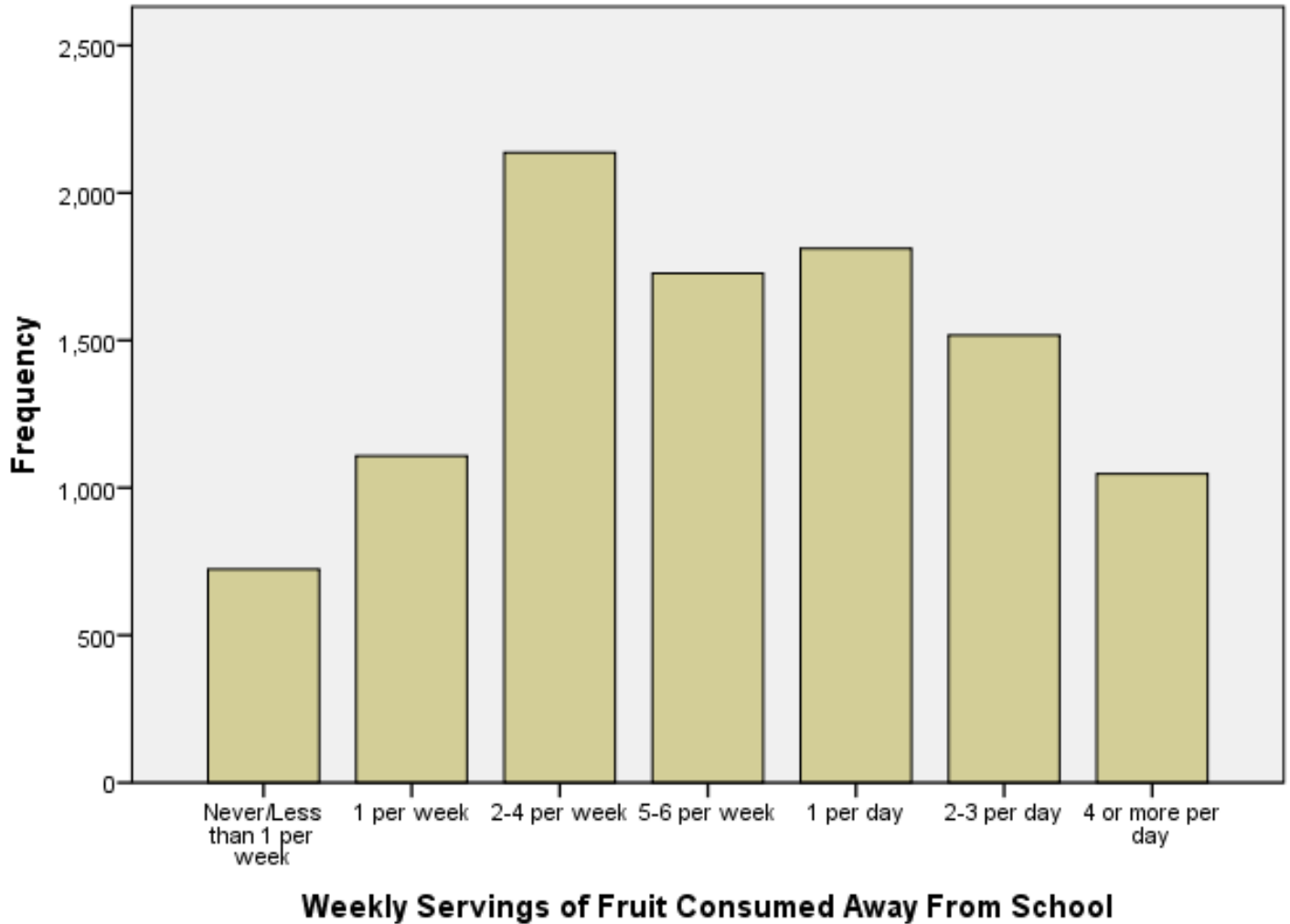
The median amount of reported fruit servings eaten at school is “1 per week” while the mode is “Never/Less than one per week.” Of all valid responses, 33.4% indicate less than one fruit per week consumed at school (Figure 3).

Figure 3. Weekly Servings of Fruit Eaten At School Reported by Seventh Grade Students in Washington State



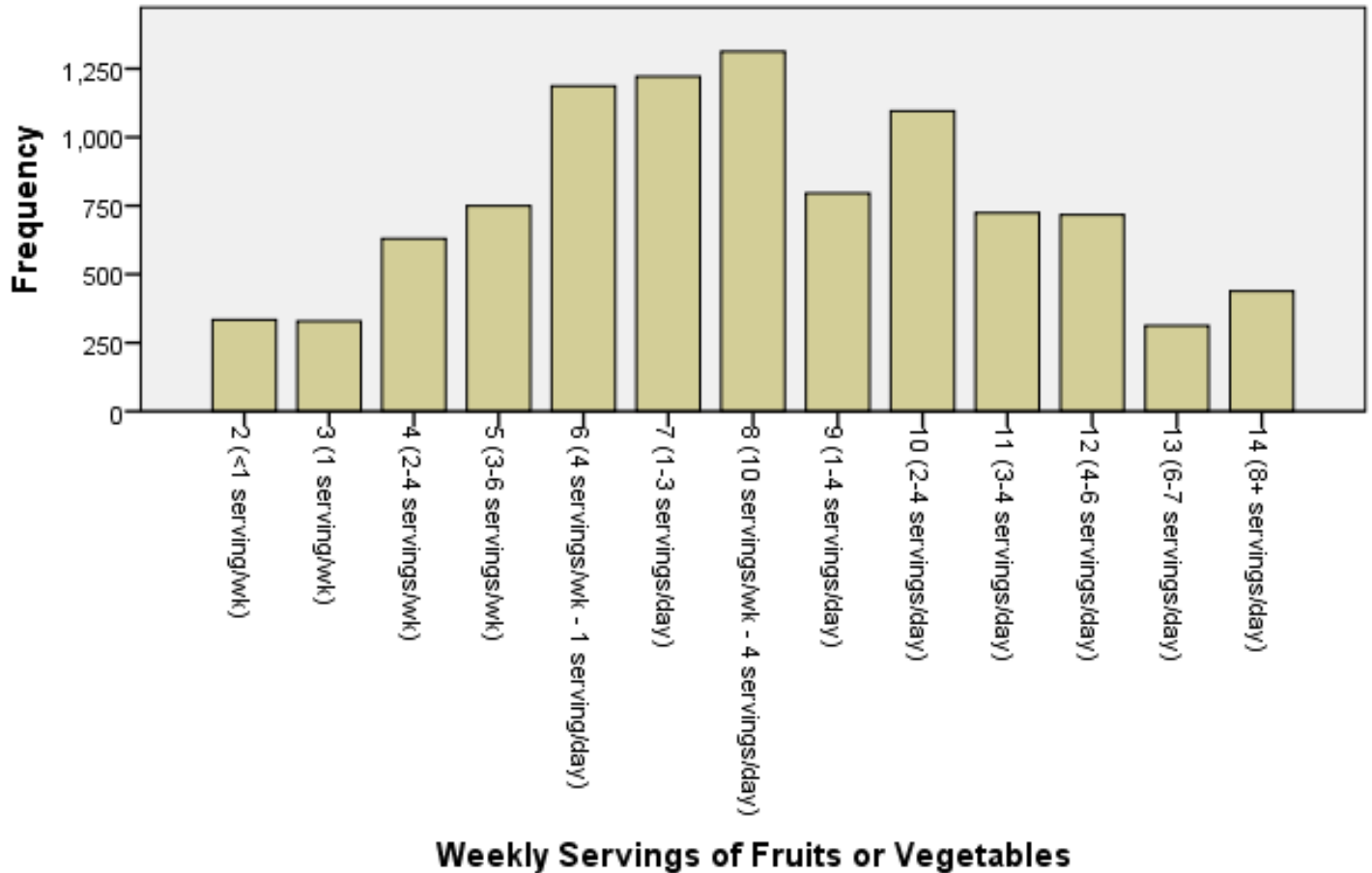
The median amount of reported fruit servings eaten away from school is “5-6 per week.” While 17.1% of students with valid responses indicate this range of consumption, an even greater proportion of students with valid responses – 18.0% – report consuming one serving of fruit per day while away from school (Figure 4). The mode is “2-4 per week.” Of students with valid responses, 21.2% indicate this consumption range while 7.2% indicate eating less than one fruit per week consumed away from school.

Figure 4. Weekly Servings of Fruit Eaten Away From School Reported by Seventh Grade Students in Washington State



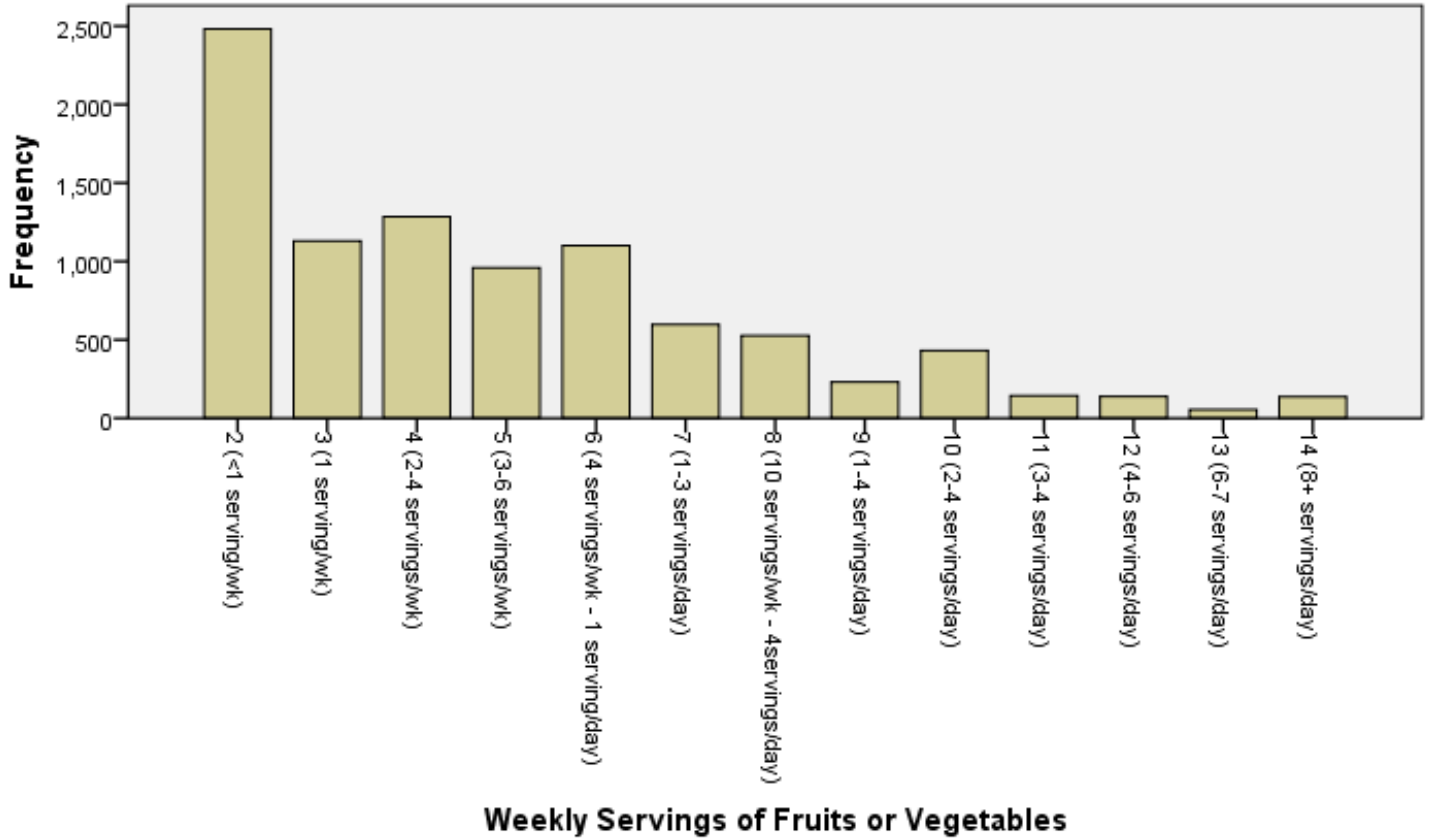
Combining the frequency of fruit consumption while away from school with the frequency of vegetable consumption while away from school results in a more symmetric distribution (Figure 5) than the right-skewed distribution that results when the frequency of fruit consumption while at school is combined with the frequency of vegetable consumption while at school (Figure 6).

Figure 5. Weekly Servings of Fruits and Vegetables Eaten Away From School Reported by Seventh Grade Students in Washington State



Data combined from separate questions - one regarding fruit and the other regarding vegetable consumption in the past week. For each question, students were instructed to select options 1-7, with 1 being "never or less than 1 per week," 2 being "1 per week," 3 being "2-4 per week," 4 being "5-6 per week" 5 being "1 per day," 6 being "2-3 per day" and 7 being "4+ per day."

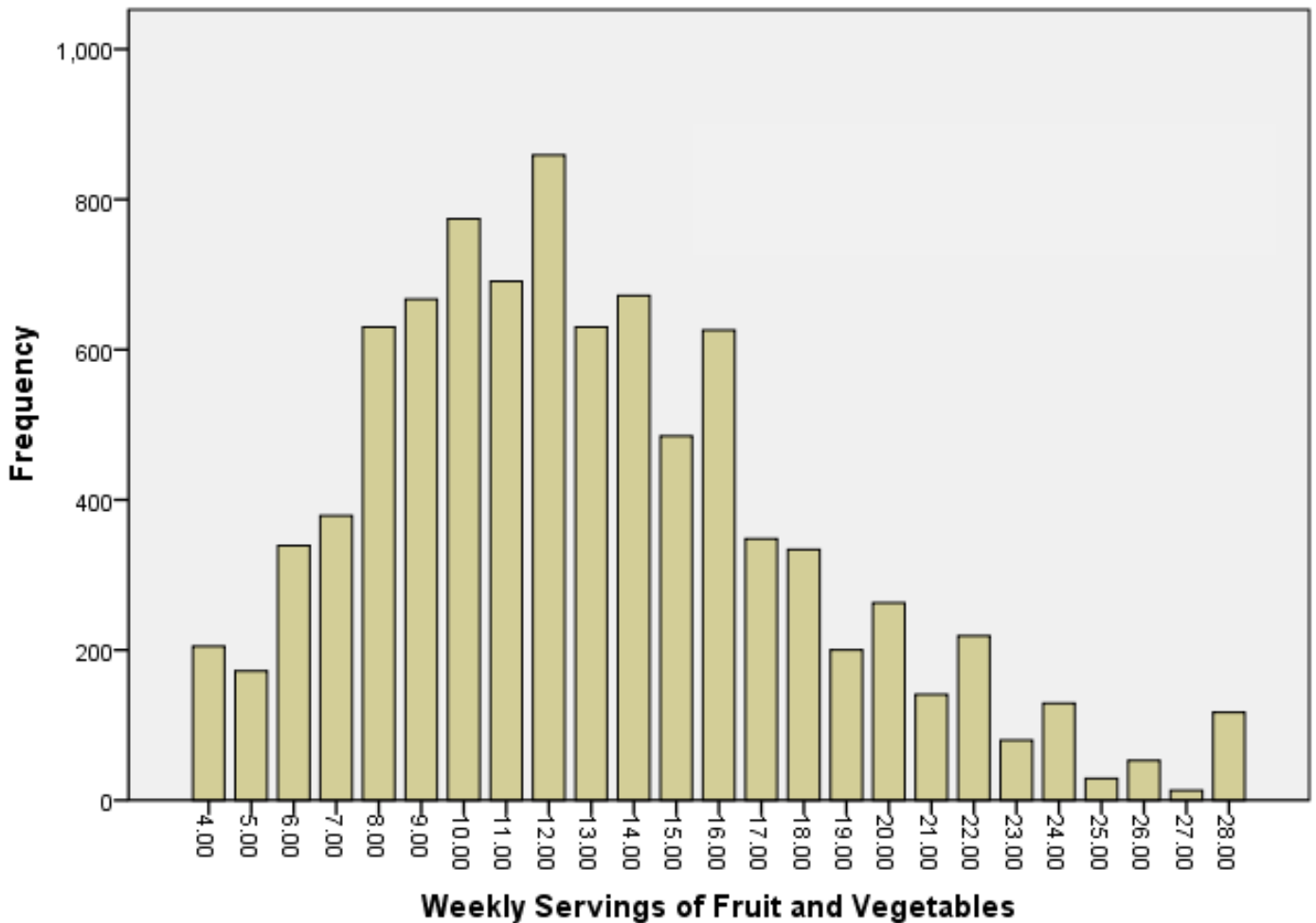
Figure 6. Weekly Servings of Fruits and Vegetables Eaten At School Reported by Seventh Grade Students in Washington State



Data combined from separate questions - one regarding fruit and the other regarding vegetable consumption in the past week. For each question, students were instructed to select options 1-7, with 1 being "never or less than 1 per week," 2 being "1 per week," 3 being "2-4 per week," 4 being "5-6 per week" 5 being "1 per day," 6 being "2-3 per day" and 7 being "4+ per day."

When all valid responses for fruit and vegetable consumption both at school and away from school are combined (Figure 7), 2.3% indicate consumption of less than one FV serving per week both at and away from school. The median and mode of the combined valid responses to these four questions regarding FV consumption at and away from school is 12 (with options 1-7 for each individual question).

Figure 7. Combined Responses for Weekly Servings of Fruit and Vegetables Eaten At School and Away From School Reported by Seventh Grade Students in Washington State



Data combined from four separate questions - two regarding fruit and vegetable consumption at school and two regarding fruit and vegetable consumption away from school in the past week. For each question, students were instructed to select options 1-7, with 1 being "never or less than 1 per week," 2 being "1 per week," 3 being "2-4 per week," 4 being "5-6 per week" 5 being "1 per day," 6 being "2-3 per day" and 7 being "4+ per day."

χ^2 Analysis

The combined data of FV consumption reported for both at school and away from school was dichotomized into “no FV” for those students reporting an intake of less than one fruit and less than one vegetable per week or “yes FV” for students reporting an intake of at least one fruit or at least one vegetable per week. Only 3.2% of students (n=228) reported eating less than one fruit as well as less than one vegetable in the past week while away from school. In contrast, 26.8% of students (n=1,782) reported eating less than one fruit as well as less than one vegetable in the past week while they were at school.

χ^2 testing revealed that FV consumption while at school (Table 4) is positively related to students’ eligibility for free and reduced price lunch (χ^2 value = 14.76, df =1, p< .001). Likewise, FV consumption while

away from school (Table 5) is negatively related to students' eligibility for FRPL (χ^2 value = 17.46, df =1, $p < .001$). Of those reporting FRPL eligibility, 9.3% say that they eat less than one serving of FV within a one-week period while at school compared to 17.5% of students eating less than one serving of FV within one week who report that they are not eligible for FRPL. In contrast, more students who report FRPL eligibility – 1.7% – say that they eat less than one serving of FV per week relative to the 1.5% of the students not eligible for FRPL who report less than one FV serving per week when away from school.

Table 4. Proportion of Fruit and Vegetable Consumption At School of Seventh Grade Students by Eligibility for Free and Reduced Price Lunch			
	Eligible for Free and Reduced Price Lunch (n)	Not Eligible for Free and Reduced Price Lunch (n)	Total (n)
Students reporting less than one serving of fruits or vegetables reported eaten in the past week	621	1161	1782
Students reporting one or more servings of fruits or vegetables reported eaten in the past week	1947	2917	4864
Total	2568	4078	6646

Table 5. Proportion of Fruit and Vegetable Consumption Away From School of Seventh Grade Students by Eligibility for Free and Reduced Price Lunch			
	Eligible for Free and Reduced Price Lunch (n)	Not Eligible for Free and Reduced Price Lunch (n)	Total (n)
Students reporting less than one serving of fruits or vegetables reported eaten in the past week	119	109	228
Students reporting one or more servings of fruits or vegetables reported eaten in the past week	2631	4207	6838
Total	2750	4316	7066

Logistic Regression

Controlling for race (dichotomized as white/non-white), sex and School ID in logistic regression analysis supported the χ^2 test results. Eligibility status for FRPL had a significant effect on students' FV consumption both at school and away from school. Seventh graders had 1.35 greater odds of eating fruits or vegetables at school (95% confidence interval: 1.18 to 1.55; $p < 0.001$) if they reported being eligible for FRPL than those who reported being ineligible. Their odds of eating fruits or vegetables away from school dropped to 0.65 (95% confidence interval: 0.48 to 0.89; $p = 0.006$) if they reported being eligible for FRPL than those who reported being ineligible for FRPL.

Discussion

This study shows SES differences in FV intake at school and away from school amongst a large group of middle-school students in WA State. Numerous studies have examined the association between FV intake and SES. However, few have taken into account the influence of the environment at school compared to the environment away from school in relation to FV intake. The findings of this study are partially consistent with the conclusion of a recent review that children and adolescents of low SES are more likely to have a low or less frequent FV intake (6). Our data suggests that food environments at school are protective for low-income children, promoting FV consumption amongst them relative to higher-SES children at levels not seen outside of school. We speculate that the FV included in school meals that low-SES students are more likely to receive (11) help prevent recipients from falling into the “no FV” category. But while we found that FRPL-eligible seventh graders were 35% more likely to consume FV than their FRPL non-eligible classmates while at school, they were 35% less likely to than their FRPL non-eligible classmates to consume FV away from school.

A key strategy to favorably influence the dietary behavior of youth is to increase participation in School Breakfast Programs. A recent review determined that Universal school breakfast programs offering free breakfast to all students and allowing students to eat breakfast in the classroom after school begins rather than the cafeteria before the start of school can dramatically increase participation in school breakfast (15). Such increased participation may further raise students' FV intake since school breakfast is required to include a minimum of one cup of fruit per day effective July 1, 2014 (16).

The study is limited by its cross-sectional nature, which prohibits the drawing of causal inferences. Moreover, methods relying on self-report for dietary assessment have problems of inaccurately reported intake due to the potential of misreporting and challenges of memory and portion size estimation. However, the accuracy of the data used in this study was strengthened by the use of a survey tool with adequate validity and reliability (13).

The study was also strengthened by the methods of analysis. Results of the χ^2 analysis are supported by findings from logistic regression analysis that controls for the potential confounding variables of sex, race and variations in school-level food-related policies. Dichotomizing the data into “yes FV” and “no FV” categories should minimize inaccuracies stemming from misreport. Most of the potential for misclassification of FV consumption under such dichotomization is likely limited to students being deliberately deceitful about their weekly FV consumption, students unknowingly consuming FV (as might occur if FV is “hidden” or “sneaked” into a prepared meal) or students unable to understand the directions of the question. It is unclear whether these errors of misclassification disproportionately affected the lower SES students or any other group within the study.

Likewise, it is unknown to what extent students’ self-report of FRPL eligibility is subject to differential misclassification. Using FRPL eligibility as a proxy for low SES is another limitation of the study since it is only a rough indicator of student SES (17). Nevertheless, this practice is commonly used in research and policymaking to provide insight into students’ (and their families’) access to economic resources (17).

The large sample size included in the survey as well as the varying racial and socioeconomic backgrounds of the participating students and the varying geographic locations of the participating schools (within WA State) are also among the study’s strengths.

Conclusion

This study highlights the need for school meal programs with FV offerings to protect the health of low-SES youth in WA State and perhaps the entire country. Improving the quality and quantity of FV available as part of school meal programs may help to further improve markers of diet quality and health status among recipients. Low-income children stand to benefit the most, since these students are more likely to be dependent on foods obtained in school to maintain their FV intake.

Since the data for this study was collected during the 2007-2008 school year, passage of the Healthy, Hunger-Free Kids Act prompted the USDA to set new standards for school meals. The new standards ensure that students are offered both fruits and vegetables every day of the week (18). The guidelines also set minimum standards for the nutritional quality of competitive foods sold in schools (18). It is therefore possible that if this study were repeated now that the new rules have been implemented, the school food environment would be shown to have even more of a protective effect on the diet quality of low-SES students than in the present study.

Children’s FV intake could be increased even further outside of the breakfast and lunch meals through the expansion of the The Fresh Fruit and Vegetable Program (FFVP), a federally assisted program providing free fresh fruits and vegetables to students during the school day. However, the FFVP is currently limited to elementary schools with the highest free and reduced price enrollment (19). Further research is needed to

determine whether expansion of the FFVP to more schools with older children and/or the adoption of Universal school breakfast programs can serve to make the school food environment protective against low or no FV consumption.

Many factors are at play in determining the nutritional status of youth, but most are beyond the reach of broad public health interventions. Implementing policies to improve school food environments may be the most reasonably achieved method of positively impacting the dietary habits of all students. Lower SES youth stand to benefit the most from such policy changes, as these students appear to be less likely to eat FV outside of the school environment.

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