

# Offering Salad Bars Increased Vegetable Variety and Prevalence of 4<sup>th</sup>-Grade Students Choosing Vegetables and Decreased Plate Waste



Stephanie L. Smith, PhD, RDN<sup>1</sup>, Barbara Lohse, PhD, RDN<sup>2</sup>, Leslie Cunningham-Sabo, PhD, RDN<sup>1</sup>



<sup>1</sup>Department of Food Science and Human Nutrition, Colorado State University, Fort Collins, CO

<sup>2</sup>Wegmans School of Health and Nutrition, Rochester Institute of Technology, Rochester, NY

## Abstract

**Purpose:** Most U.S. school-aged children do not meet federal dietary guidelines for fruit and vegetable (FV) intake. School cafeteria salad bars are proposed to increase students' lunch FV intake but evidence of their impact is inconsistent. We compared 4<sup>th</sup>-grade student FV selection, consumption, and plate waste between 2 school districts. One district served fresh FV from salad bars and the other served pre-portioned fresh FV. Both districts served pre-portioned hot vegetables from the tray line.

**Methods:** Cross-sectional lunch plate waste collection occurred during fall of 4 successive school years. Before lunch, digital photographs were taken of all FV served. These "pre" photographs were compared to post consumption photographs of students' trays and FV waste estimated to the nearest 10%. Gram weight of FV wasted and consumed were calculated from percent waste and portion weights. Data were transformed for normality and district means compared using independent samples T-test.

**Results:** Of trays photographed (n=995; 54% from males, 58% from salad bar district), 92% included fruit, 60% included vegetables. More than twice as many students with the salad bar option chose vegetables (n=421) compared to the pre-portioned option (n=182). Selection of hot vegetables from both districts remained low. Proportion of students choosing fruit was similar for both districts (90% salad bar; 95% pre-portioned).

Students with the salad bar option chose smaller vegetable portions (61.7g vs. 78.6g; p<0.0001), wasted less (20.2g vs. 36.2g; p<0.0001) and chose a greater variety (26 vegetables vs. 11). Mean vegetable weight consumed did not differ by district (41.5g vs. 42.0g). Students with a salad bar option also selected smaller fruit portions (111.7g vs. 129.2g; p<0.0001) and wasted less (32.5g vs. 58.7g; p=0.001). Mean fruit weight consumed did not differ by district (84.7g vs. 81.1g). There were no differences by sex in FV portions taken, consumed, or wasted.

**Conclusions:** Findings of this study support salad bars over pre-portioned fruits and vegetables as a delivery option in school meal programs because more students chose vegetables, students chose a greater variety of vegetables and in a preferred portion size, and wasted less.

## Background

Most U.S. school-aged children do not meet federal dietary guidelines for fruit and vegetable (FV) intake.<sup>1,2</sup> School cafeterias serving fresh fruit and vegetables (FV) from salad bars are proposed to increase students' lunch FV intake but evidence of their impact is inconsistent.<sup>3</sup>

*The purpose of this study was to compare 4<sup>th</sup>-grade student FV selection, consumption, and plate waste between 2 school districts. One district served fresh FV from salad bars and the other served pre-portioned fresh FV.*

## Participants

4<sup>th</sup>-grade students from 8 elementary schools in Northern Colorado participated in this cross-sectional study during fall of 4 successive school years. Four schools, from one district, served fresh FV from salad bars and four schools in one district served pre-portioned fresh FV. Recruited students were participants in the *Fuel for Fun: Cooking with Kids Plus Parents and Play* research project.<sup>4</sup>

**Table 1: Percent free/reduced price lunch eligibility and 4<sup>th</sup>-grade enrollment (average of 4 school years for each variable)\***

	Schools with Salad Bars				Schools without Salad Bars			
	A	B	C	D	E	F	G	H
Free/reduced lunch eligibility (percent)	51.6	25.6	35.6	45.4	61.0	60.5	24.7	62.6
4 <sup>th</sup> grade enrollment	47	90	65	85	37	35	77	31

\*Schools participated 4 years with exception of D, which participated 3 years

## Cafeteria Settings

### Schools with Salad Bars



Fresh fruit and vegetables served from two, 6-foot long, youth-height cold salad bars

### Schools without Salad Bars



Fresh fruit and vegetables served in pre-portioned containers from cold side of tray line

## Methods

### Plate Waste Assessment

- All FV served were digitally photographed before lunch; student trays were photographed after lunch.
- Pre and post consumption photographs of student trays were compared to estimate waste of each FV item to nearest 10%.<sup>5</sup>
- Gram weight of FV wasted and consumed were calculated from percent waste and portion weights.



FV Reference Photograph



Post Consumption Student Tray

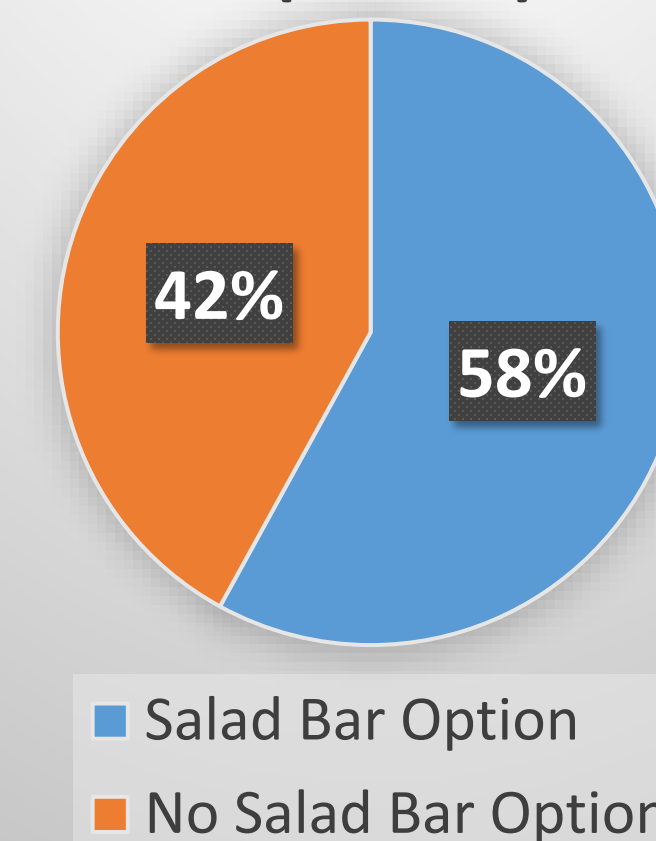
### Data Analysis

- School district means of FV selected, consumed and wasted were compared using independent samples T-test (SPSS, for Windows, 24.0).
- Significance set at  $p < 0.05$

## Results

FV waste was estimated from 995 student lunch trays (54% male). A greater proportion of students were from schools serving fresh FV from salad bars.

**Fresh FV Service Method (n=995)**



**Table 2: Number and percent of students choosing vegetables or fruit**

	Total	Salad Bar	No Salad Bar
Vegetables	603 (60%)	421 (42%)	182 (18%)
Fruit	918 (92%)	515 (52%)	403 (41%)

- All students chose fewer vegetables than fruit.
- More than twice as many students with the salad bar option chose vegetables than those without the salad bar option.

- Of the 603 total students choosing vegetables, 70% were from schools with salad bars compared to the pre-portioned option.
- Selection of hot vegetables from both schools with salad bars and those without remained low (data not shown).
- The proportion of students choosing fruit was similar for both schools with salad bars (90%) and those with the pre-portioned option (95%).

**Table 3: Fresh FV portion weight taken, wasted, and consumed by 4<sup>th</sup>-grade students from schools with a salad bar option and those without**

	Salad Bars	No Salad Bars	p value
Vegetable portions taken (g)	<b>61.7</b>	<b>78.6</b>	<0.0001
Vegetable portion consumed (g)	41.5	42.0	0.628
Vegetable portion wasted (g)	<b>20.2</b>	<b>42.0</b>	<0.0001
Fruit portion taken (g)	<b>111.7</b>	<b>129.2</b>	<0.0001
Fruit portion consumed (g)	84.7	81.1	0.117
Fruit portion wasted (g)	<b>32.5</b>	<b>58.7</b>	<0.0001

- Students with the salad bar option chose smaller vegetable portions, but wasted less and chose a greater variety (26 vegetables vs. 11)
- Mean vegetable weight consumed did not differ by district
- Salad bar option students also chose smaller fruit portions and wasted less.
- Mean fruit weight consumed did not differ by district.

## Conclusions and Implications

Findings of this study support the use of salad bars over pre-portioned FV as a delivery option in school meal programs because:

- More students from salad bar schools chose vegetables with lunch
- Students from salad bar schools chose a greater variety of vegetables in a preferred portion size and therefore wasted less vegetables

## References

- Krebs-Smith S, et al. Americans do not meet federal dietary recommendations. *J Nutr.* 2010;140(10), 1832-1838.
- Kimmons J, et al. Fruit and vegetable intake among adolescents and adults in the United States: percentage meeting individualized recommendations. *Medscape J Med.* 2009;11(1):26.
- Adams M, et al. Use of salad bars in schools to increase fruit and vegetable consumption: where's the evidence? *J Acad Nutr Diet.* 2015;115(8), 1233-1236.
- Cunningham-Sabo, L, et al. Fuel for Fun: a cluster-randomized controlled study of cooking skills, eating behaviors, and physical activity of 4th graders and their families. *BMC Public Health.* 2016; 16:444.
- Smith SL and Cunningham-Sabo L. Food choice, plate waste and nutrient intake of elementary- and middle-school students participating in the US National School Lunch Program. *Public Health Nutr.* 2014; 17(6): 1255-63.

## Acknowledgements and Funding

USDA This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2012-68001-19603. Any opinions, findings, or recommendations in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.