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# Fruit and Vegetable Weights or Pan Weight are Valid Methods to Estimate Elementary Student Self-Service Salad Bar Portions

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## Abstract

**Objective:** To assess the validity of weighing both individual fruit and vegetable (FV) pieces and salad bar pans of specific FV for estimating amounts taken from self-service salad bars.

**Study Design, Setting, Participants, Intervention:** Cross-sectional design with 4th graders in 4 elementary schools participating in Fuel for Fun program. In lunch line, trained researchers recorded types and number of salad bar selections on card affixed to students' trays.

**Outcome Measures and Analysis: Individual FV weights:** Minimum of 3 individual pieces of each FV on the salad bar were weighed and averaged. Average weights were multiplied by number of pieces taken by each student. Pan weights: each pan of specific FV was weighed before and after students went through lunch line. Difference between pre and post weights was divided by number of students selecting a particular FV to derive portion weight. To validate these 2 methods, actual salad bar portions were also weighed. Estimations using individual FV and pan weights were then compared to each other and with actual weighed portions using paired t-tests.

**Results:** FV portions measured from 47 lunch trays. Mean weighed salad bar portions = 148g, mean portion from individual FV weights = 142g, mean portion from pan weights = 131g. Differences were not significant. Although individual FV and pan weights both estimated portion weights similarly to actual portion weights, pan weight method tended to underestimate portion weights.

**Conclusions and Implications:** Variability in children's self-service salad bar portions chosen presents challenges for portion size determination. Findings support use of either individual FV or pan weights as valid methods to estimate student portions.

## Background

- Most school-aged children do not meet US Dietary Guidelines for FV intake.<sup>1,2</sup>
- Salad bars are proposed to increase students' FV intake at lunch.<sup>3,4</sup>
- Salad bars are self-serve, portion sizes not standard; assessment of impact problematic.

The purpose of this study was to determine the best method for estimating the amounts of FV children take from self-service salad bars in school lunch rooms.

## Participants

4<sup>th</sup>-grade students from 4 elementary schools in Fort Collins, Colorado participated in this cross-sectional study. Recruited students were participants in the pre-intervention cohort of the *Fuel for Fun: Cooking with Kids Plus Parents and Play* research project.

**Table 1: Percent free/reduced price lunch eligibility; 4<sup>th</sup>-grade enrollment; 4<sup>th</sup>-grade NSLP participation by school**

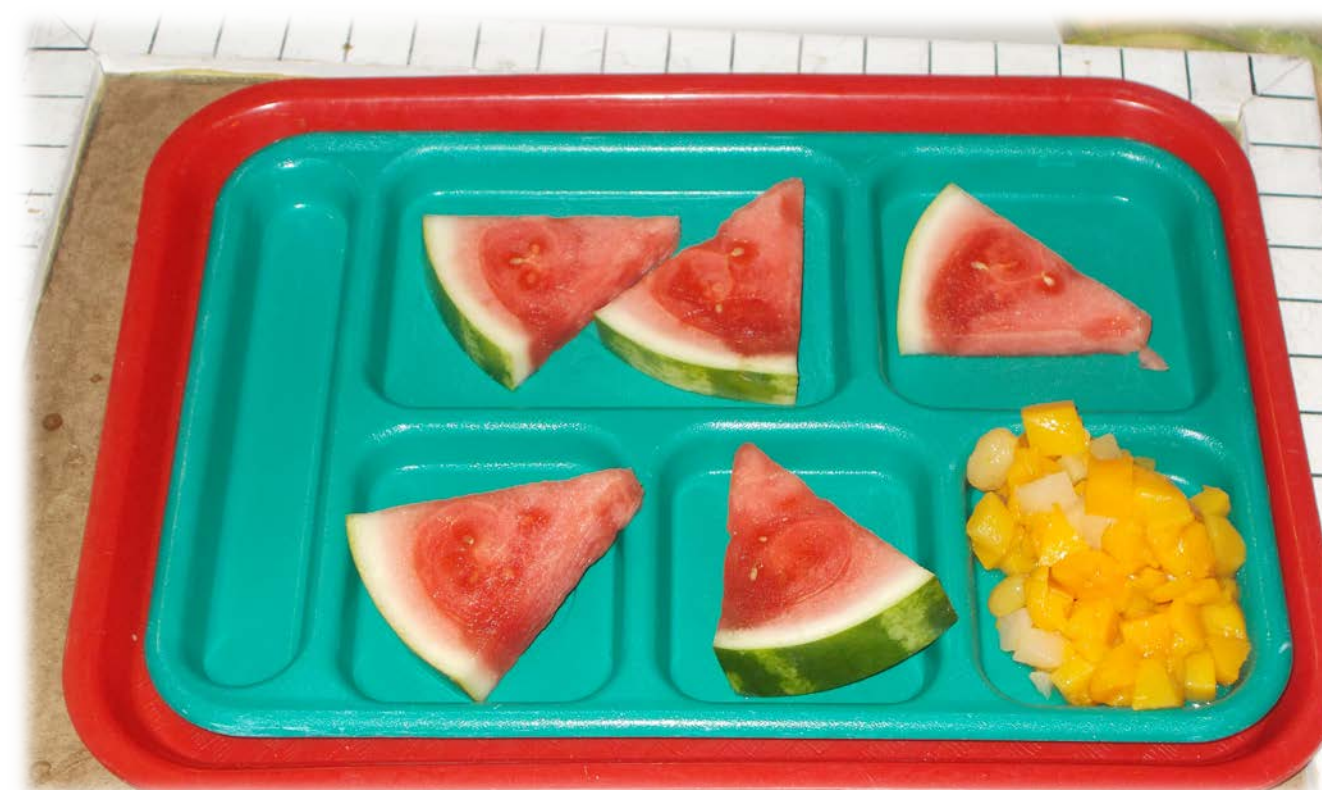
	School A	School B	School C	School D
Free/reduced price lunch eligibility	50%	24%	34%	47%
4 <sup>th</sup> grade enrollment	42	87	56	73
4 <sup>th</sup> -grade NSLP participation	57%	39%	68%	63%

## Methods

Two methods to measure FV were tested at each school to determine which more accurately estimated salad bar FV portions taken compared to weighed portions. Salad bar FV waste and consumption were assessed with digital photography.

### Plate Waste Assessment

- Digital photography used to photograph pre-consumption reference FV and post consumption of 47 student trays<sup>5</sup>
- Trained evaluators compared reference photographs to post photographs to estimate waste of each FV item on student trays to the nearest 10%



FV Reference Photograph



Post Consumption Student Tray

### Weighed FV Portions (gold standard)

- FV weighed before and after eating for every 3<sup>rd</sup> student who consented to participate
- Each student's tray was numbered and each FV selected from the salad bar was recorded
- Amount FV consumed calculated from difference in pre/post weights

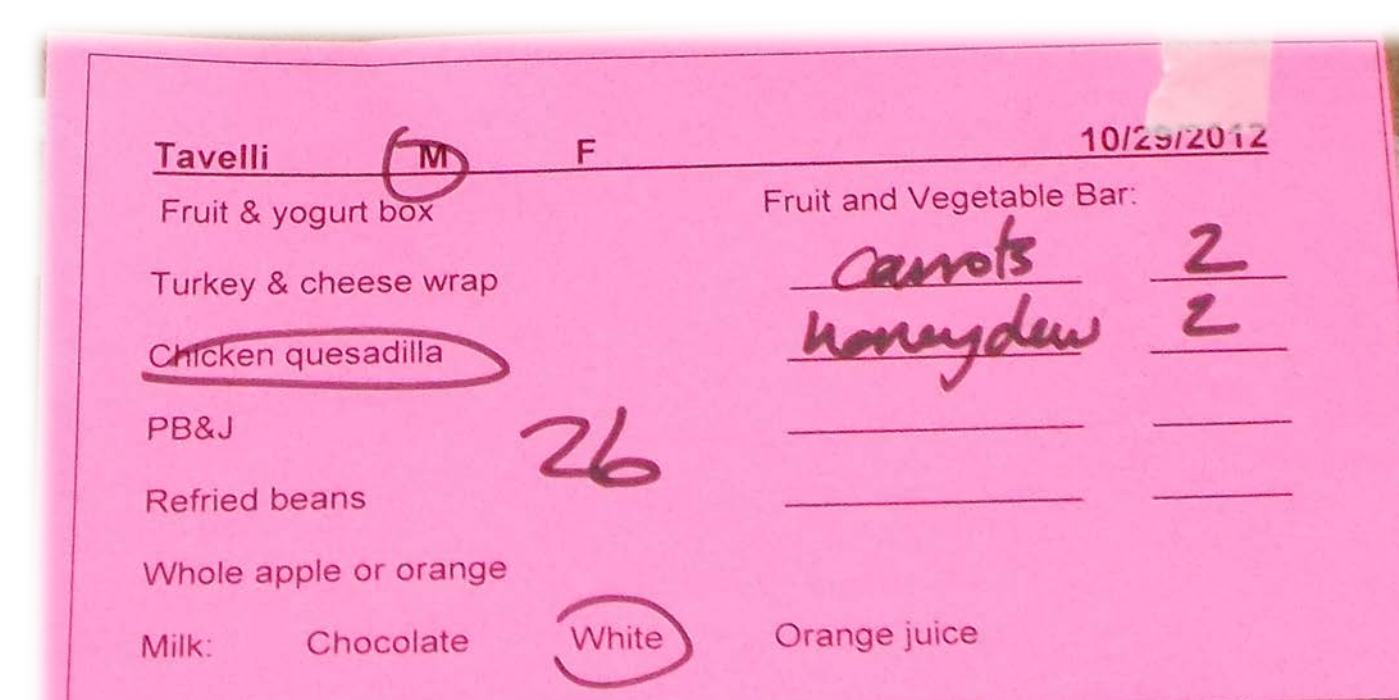
### Pan Weight FV Portion Estimation

- Individual salad bar pans weighed before and after 4<sup>th</sup>-grade lunch service;
- Number of students taking each FV from salad bar determined from plate waste photographs
- Pre/post pan weight difference divided by number of students taking that FV to derive average weight of the amount taken in grams



### Individual FV Weight Portion Estimation

- 3-5 pieces of each salad bar item offered were weighed and the average calculated
- Number of pieces each student took determined from plate waste photographs and tray tag cards
- To determine the FV portion weight taken, the average weight of the FV pieces was multiplied by the number of pieces taken by each student



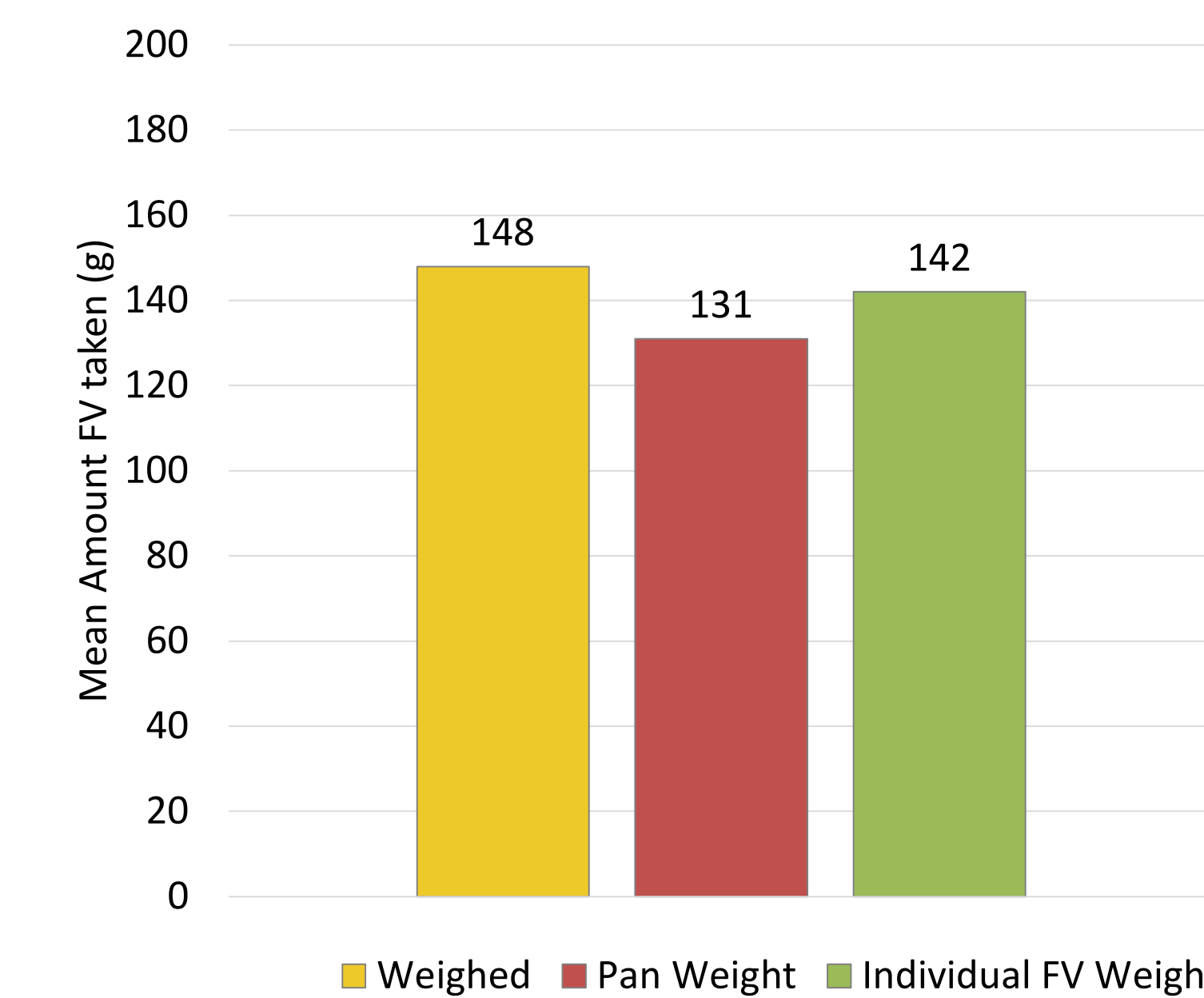
### Data Analysis

- Mean amount of each FV taken and consumed calculated for each portion estimation method
- Paired t test (SAS for Windows, 9.3) used to compare means of each method to each other
- Significance set at  $p < 0.05$

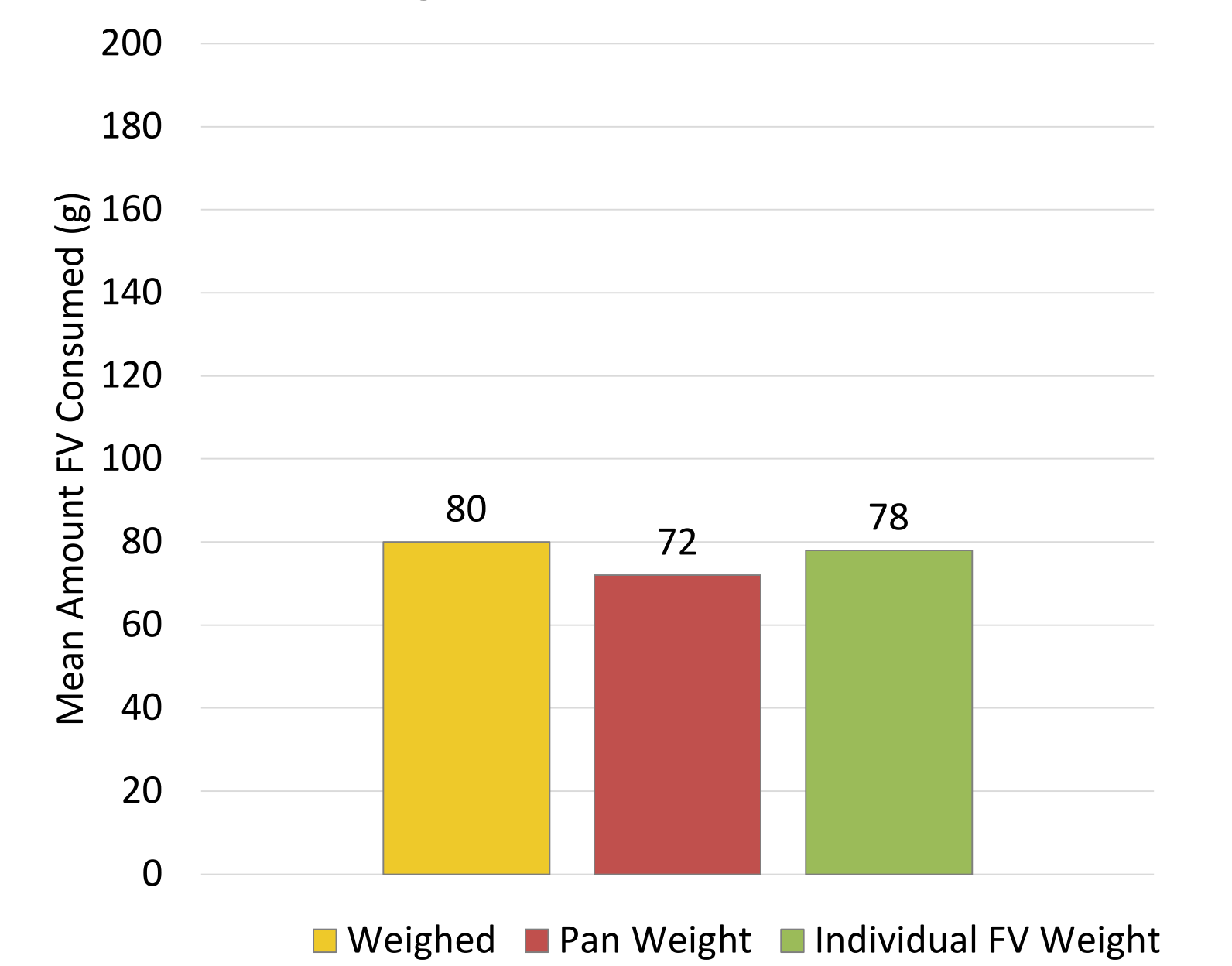
## Results

FV portions were measured by all three methods from 47, 4<sup>th</sup>-grade student lunch trays. Of these 47, 8 were from school A, 11 from school B, 14 from school C, and 14 from school D.

Fruit and vegetables taken from the salad bar by 4<sup>th</sup>-grade students (n=47) according to FV estimation method



Fruit and vegetables from the salad bar consumed by 4<sup>th</sup>-grade students (n=47) according to FV estimation method



- No significant difference in FV amount taken between individual FV item weight and weighed portions ( $p=0.39$ ), or pan weight and weighed FV portions however, pan weight tended to be lower ( $p=0.09$ )
- No significant difference in FV amount consumed between individual FV item weight and weighed FV amounts ( $p=0.74$ ) or between pan weight and weighed portions ( $p=0.14$ )

## Conclusions and Implications

- Individual FV weight method was not significantly different from weighed FV portions.
- The difference between pan weight and weighed FV portions was also not significant, however pan weight tended to underestimate the FV amount taken.
- Although either method could be used in conjunction with digital photography or other plate waste assessment method, the individual FV weight method would provide a more accurate estimate of FV taken from salad bars.
- These results demonstrate the implementation effect of salad bars can be measured with assurance.

## References

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