Visual estimation of dietary intake during school lunch for Iowan students

Abstract

Childhood obesity is considered to be one of the greatest public health challenges of this century, especially considering the impact of this disease on the future health and life expectancy of Iowans as well as US Citizens. School-based programs designed to improve health behaviors are one important strategy for solving obesity. Presently in Iowa we are disseminating the United States Department of Agriculture-funded SWITCH program: School Wellness Integration Targeting Child Health. The message of SWITCH is to help children to switch what they “Do, View, and Chew”. From a nutrition perspective, children are encouraged to consume more fruits and vegetables. 87% of the U.S. population is not meeting the recommendation for vegetable intake, including 93% of all children. As part of the evolution of the SWITCH program in Iowa, our research team is using visual estimation methods to understand how SWITCH might influence children’s dietary intake. Dietary intake from students in SWITCH schools or non-SWITCH schools will be estimated using plate waste methodology. The current study focus is to compare different visual estimation systems. Our hypothesis is that the quarter estimation system will have greater accuracy and precision compared to the third and eighth estimation systems.

To compare three visual estimation methods for plate waste and use the methods to estimate the food waste in SWITCH schools in Iowa. The eating patterns in elementary schools will also be explored.

Two estimators participated in three training sessions on using the Third, Quarter, and Eighth systems of visual estimation methods to estimate food waste.

- Third system: measuring food waste in how many third(s) of the food are left
- Quarter system: measuring food waste in how many quarter(s) of the food are left
- Eighth system: measuring food waste in how many eighth(s) of the food are left

• Plate waste data were collected in SWITCH schools in Iowa.
• The three estimation methods mentioned above were used to estimate food waste. This information was also used to help to understand the dietary intake and eating patterns in elementary school children.

Results

Comparison of Third, Quarter, and Eighth systems of visual estimation

An accuracy and precision test was generated including 45 paired-pictures (before & after consumption) to compare among three estimation methods about their accuracy and precision to estimate food waste. After comparing estimated amount with the true weight, Room Mean Square Error (RMSE), accuracy, and precision were calculated. Figure 1 shows the comparisons among the three methods in two estimators.

Table 1: Paired T-test results of comparing any two methods among Third, Quarter and Eighth system.

<table>
<thead>
<tr>
<th>Method</th>
<th>Estimator 1 (p value)</th>
<th>Estimator 2 (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third VS Quarter system</td>
<td>3.02E-05</td>
<td>0.6642</td>
</tr>
<tr>
<td>Third VS Eighth system</td>
<td>7.051E-08</td>
<td>0.4988</td>
</tr>
<tr>
<td>Quarter VS Eighth system</td>
<td>0.606</td>
<td>0.6925</td>
</tr>
</tbody>
</table>

Table 1. Paired T-test results of comparing any two methods among Third, Quarter and Eighth system.

As shown in Table 1, in estimator 1, there was a significant difference between Third and Quarter system, and between Third and Eighth system. However, in estimator 2, there was no significant difference between any of the three methods.

Estimating plate waste data collected in SWITCH schools in Iowa

Plate waste data collected in 2 SWITCH schools was estimated by Estimator 2 using Third, Quarter, and Eighth systems. ANOVA was used to test the significant difference among the three methods. Results showed there was no significant difference among the three methods (Pr(2F)=0.95). This result is consistent with the accuracy and precision test (Table 1).

Conclusions

- Different estimators respond differently to different estimation methods. It is recommended to calculate and compare accuracy and precision of each method before making decisions about which visualization method should be used.
- Hot entrée and fresh vegetables are more popular than cold entrée and cooked vegetables in Iowa SWITCH elementary schools.
- Serving sliced fruits may help to decrease waste.