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EFFECTS OF A WEB-BASED FOOD PORTION TRAINING PROGRAM ON FOOD PORTION ESTIMATION

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Abstract

Objective— Assess the effects of a prototype computerized food portion tutorial (CFPT).

Design— Participants were randomly assigned to estimate portion sizes for selected foods either prior to or following CFPT training (between group), and those estimating before CFPT training re-estimated portions after training (within group).

Setting— Research offices.

Participants— Seventy-six adult participants without dietary restrictions.

Intervention— The CFPT is a web-based food portion training that displays varied portions of 23 foods with user-controllable reference objects and viewing angles.

Main Outcome Measures— Estimated vs. weighed portions of foods selected for meal.

Analysis— Nonparametric tests were performed on estimated vs. weighed portion differences and on accuracy ratios between and within groups.

Results— A significant difference was found between conditions, both within and between groups, on the discrepancy between estimated and weighed portions for a number of the foods. Training exposure, however, resulted primarily in a shift from underestimation to overestimation, not more accurate estimation.

Conclusions and Implications— The CFPT produced a significant impact on food portion estimation but appeared to sensitize participants to underestimation errors, leading to overestimation errors. Computerization of food portion training programs hold promise for providing cost-efficient portion estimation training but require further development and evaluation before being considered for clinical use.

Keywords

computer-assisted instruction; dietary assessment; education-Internet; nutrition education research

INTRODUCTION

Errors in assessing dietary intake can compromise or obscure dietary research findings including diet-disease relationships and the effects of various interventions on dietary intake. Food portion estimation inaccuracies are a significant source of dietary assessment errors (1–

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3). Even with training assistance, numerous errors in food portion estimation can occur (4) including overestimation of small food portions and underestimation of large portions, or the “flat slope” effect (5). Amorphous foods also are more difficult to accurately estimate than solids or liquids (6,7). Concerns about food portion estimation accuracy have led some to use standard serving size estimates instead, but standard estimates produce considerably greater error than participant estimates of portion size (8).

Education on serving sizes has been used to improve the accuracy of dietary intake recording (9,10). Food portion training using pictures or other visual aids has been shown to enhance accuracy of portion estimates (11). In a series of studies (4,12–14), Nelson and colleagues showed that pictures of varying food portion sizes for selected foods produced substantially less portion estimation error than the picture of one typical portion which consistently caused underestimation of actual food portions. Presentations of varying food portions have been shown to improve the accuracy of food frequency questionnaires (15,16). Plastic food models also have been used successfully to improve food portion estimation (17). Although plastic models present a three-dimensional, actual scale reference, these models typically show only one serving size for each food, not varying sizes. Referencing food portions on a plate also has been found to improve portion estimation (18).

Although food portion training procedures have been shown to improve the accuracy of food portion estimation for various dietary assessment methods, these training methods tend to be labor intensive and unstandardized. Training in food portion estimation is typically performed via face-to-face dietary counseling sessions which vary in content, coverage, feedback, and outcome evaluation. In addition, training materials such as picture books or food models provide only a limited number of foods and portion sizes (19). Limited food portion estimation information also is available from numerous web sites (e.g. http://win.niddk.nih.gov/publications/just_enough.htm; <http://hin.nhlbi.nih.gov/portion/>; <http://www.cnpp.usda.gov/Insights/insight11.PDF>), but these sites were not designed to provide comprehensive training in food portion estimation.

The Computerized Food Portion Tutorial (CFPT) was developed to serve as an interactive, computer-based program providing multimedia training and feedback regarding food portions of common foods. For initial development and validation, 23 foods distributed among the major food groups were displayed. The program consisted of both reference and feedback modules. In the reference module, users selected a food from a drop down menu, and 3 to 6 different portion sizes of the food were displayed in a 3 x 2 picture matrix on a single screen for food portion comparison purposes. Portion labels (e.g. 4 oz., ½ cup) were displayed below each picture. Each food portion was shown on a standard 9-inch plate with a fork and knife provided for reference. Users could select any of the food portions to enlarge the image to nearly full screen. With this full screen food portion image, users could drag and drop proportional reference objects such as a deck of cards or a tennis ball on the picture or use a turntable video display to rotate the plate to improve depth perception. Users also could print actual size PDF images of the food portion displayed. There were a total of 109 different images with a mean of 4.7 different portion presentations for each food.

In the feedback module, the user was randomly presented a display of one portion size of one food (enlarged, nearly full screen display without portion label) from among the 109 food displays in the database and asked to estimate the portion size from a multiple choice list. Feedback on correct and incorrect responses, including percent accuracy, was provided. The program also provided users feedback on the tendency to over- or underestimate food portions.

The aim of this study was to assess if this prototype CFPT program could improve portion size estimation accuracy by comparing CFPT trained and untrained participants on food portion

estimation of a typical meal, and subsequently provide CFPT training to the untrained group to assess program effects on re-estimation following training. Usability and perceived utility of the CFPT were assessed as secondary outcome measures.

METHODS

Participants

One hundred and twenty-three adults (age 18 or older) responded over a two week period to local newspaper ads and flyers in nearby business offices and grocery stores for a food portion estimation study including a free lunch. From this recruitment effort, 88 potential participants were scheduled. Of the 35 individuals not scheduled, 11 were excluded because they did not meet one of the following inclusion criteria: no medical dietary restrictions ($N = 5$), no experience recording food intake in the last month ($N = 4$), and no prior experience using computers ($N = 2$). The remainder of those not scheduled ($n = 24$) could not be reached or failed to return calls prior to the end of the enrollment period. Of the 88 scheduled, 76 showed as scheduled during the one month enrollment period.

Of the 76 participants enrolled, 75% were female and 25% were male. Racial breakdown was 84% White, 12% African American, and 4% Asian, generally consistent with national percentages of these racial groups. Only one percent of the sample, however, was of Latino ethnicity, indicating an underrepresentation of this ethnic group in the sample. Mean age was 51 years ($sd = 15$). Mean BMI was 26.9 ($sd = 6.3$). Four percent were underweight ($BMI < 18.5$), 33% were normal weight (18.5 to 24.9), 46% were overweight (25 to 29.9), and 17% were obese (> 30). Only 18% of participants reported ever recording daily food intake and only 13% reported doing so in the last year. Twenty-two percent ($N = 17$) reported having received some form of past instruction in food portion estimation.

Procedures

Design Overview—This study was approved by the Institutional Review Board (IRB), and all participants signed informed consent before participating in the study. The study design consisted of both a between and within group comparison of the effects of the Computerized Food Portion Tutorial (CFPT) on portion estimation. Eligible participants were scheduled in groups of 4 to 8 and were randomly assigned within these groups to immediate training ($n = 42$) or delayed training ($n = 34$) conditions. Participants assigned to the immediate training condition (IT) received CFPT training before estimating portion sizes of a buffet meal. Participants assigned to the delayed training condition estimated portion sizes of their meal prior to CFPT training (Pre-DT), but subsequently received CFPT training following the meal and were then asked to re-estimate portions following training (Post-DT). This design provided a within group comparison (Pre-DT vs. Post-DT) as well as a between group comparison (Pre-DT vs. IT) of CFPT effects.

CFPT Training—Either before or after estimating food portions depending on condition, participants were seated in cubicles at individual computer terminals and asked to practice using the portion reference module of the CFPT. The research assistant insured that the participant was comfortable with site navigation and provided written instructions for CFPT use. After utilizing the portion reference module for a minimum of 30 minutes, participants were asked to use the feedback module, estimating a minimum of 40 portion sizes. Upon completing CFPT training, participants completed usability ratings.

Serve and Weigh Meal—As immediate training (IT) participants were completing the CFPT, the delayed training (DT) participants arrived, completed informed consent, demographic information, and were weighed (IT condition participants completed consent,

demographics and weighing before CFPT training). Participants in both conditions were then instructed to serve themselves from a lunch buffet of 13 foods catered by Chicken Out Rotisserie (see Table 1 for list of foods). Participants were free to serve themselves the foods they wanted to eat in the amounts they wanted to eat, including returning for seconds if desired, and ample amounts of each food were available for each participant to serve themselves as much as they wanted. As participants served themselves each food from the buffet, a research assistant weighed each portion to within 0.1 ounces. After all portions were weighed but prior to eating, participants were instructed to estimate the amount of each food that they had selected in units they normally use (i.e. ounces, cups, unit size). Responses were reviewed by the research assistant to insure portion estimations could be converted to ounces using the USDA National Nutrient Database for Standard Reference Release 15. If participants used qualitative estimates which were difficult to convert (e.g. serving, piece), they were encouraged to estimate using quantitative estimates such as ounces, cups, or inches. After estimating all of the foods selected, participants ate their meals as a group and could engage in typical meal conversation but were not allowed to discuss the study procedures during the meal.

After estimating food portions and eating lunch, the delayed training (DT) participants used the CFPT in the same manner and with the same instructions as the immediate training (IT) participants. After completing CFPT use, the DT participants rated usability of the program, and then recalled the foods they served themselves at lunch and re-estimated the amounts (post-DT portion estimation). Participants were not able to refer to their initial estimations and had to visually remember the portion of food served for this re-estimation task, but were prompted if they forgot to re-estimate a food that was served and estimated prior to CFPT use.

Data management and analysis—Volume and dimension estimations were converted to ounces using equations based on the USDA National Nutrient Database SR 15 and were confirmed by weighing various volumes and sizes of the actual foods used in the study. These converted estimated portions were aggregated with the weighed or actual portions in an Excel spreadsheet and then imported to SPSS for analysis.

Differences in ounces between estimated and actual portions were computed for all foods that participants served themselves, with the number of estimations for each food representing the subset of participants who served and estimated each food. An accuracy ratio (estimated/actual) was computed to obtain a standardized index of accuracy across the range of foods and portion sizes (20). One food, cookie, was excluded from analysis due to difficulty converting size estimates to ounces.

Given the non-normal distributions of difference scores and accuracy ratios, medians and interquartile ranges (i.e. range from the 25th to 75th percentile) were used for summary descriptions of the data. Nonparametric tests were used for between (Mann-Whitney U-Test) and within (Wilcoxon Matched Pairs Signed-Rank) group comparisons of these variables (21). Mann Whitney U results are reported as a Z test statistic to provide comparable values to the Wilcoxon Z test statistic.

To explore portion estimation effects for individual vs. group data, accurate estimation was defined as within one ounce for all foods except gravy (accuracy = $\pm 1/3$ oz.) and butter (accuracy = $\pm 1/6$ oz). Chi square analyses were used to compare conditions by the number underestimating, overestimating, or accurately estimating portions based on these criteria. The primary hypotheses of this trial were: a) that those exposed to CFPT before portion estimation (IT) would produce more accurate estimations than those not exposed to the CFPT before estimation (pre-DT), and b) that those in the DT condition would produce more accurate re-estimations following CFPT use (pre-DT vs. post-DT).

RESULTS

Preliminary Analyses

T and χ^2 tests revealed no significant differences between conditions on any of the baseline variables including the actual portion sizes or the types of foods selected. There were trends in the direction of the DT group having a greater percent exposure to previous food portion instruction (32% vs. 14%) and a higher BMI (28.2 vs. 25.8) than the IT group, but these differences were not significant. Therefore, subsequent analyses were performed without covariate adjustments.

Estimation Discrepancy by Condition

Table 1 gives the median and interquartile range (IQR) differences in ounces between estimated and actual portions for the delayed training condition prior to (pre-DT) and following (post-DT) CFPT training and for the immediate training (IT) condition. The number of data points in each condition varies by food based on the number of participants in each condition who selected and estimated that food before eating. The pre-DT (i.e. control) group tended to underestimate most portions with median differences by food ranging from -1.70 oz. (beverage) to 1.00 oz. (butter). Re-estimation following CFPT training in this group (post-DT) resulted in a significant improvement in the estimations of mashed potatoes (-1.00 to -0.30 oz; $Z = -2.96$, $p = .003$), baked beans (-1.05 to -0.18 oz; $Z = -2.48$, $p = .013$), and bread (-1.00 to 0.30 oz; $Z = -2.12$, $p = .034$). Significant differences pre vs. post training in the DT group also were found for gravy (-0.33 to 0.25 oz; $Z = -2.31$, $p = .02$) and pasta salad (-0.30 to 0.65 oz; $Z = -2.33$, $p = .02$) but post-CFPT portion estimations were overestimated for these foods. Across all foods except pulled BBQ chicken and butter, estimated portion sizes in the DT group increased following CFPT training.

Between group comparisons of the pre-DT vs. IT groups showed a similar pattern of increased portion size estimation resulting from CFPT use with significant differences on estimated - actual discrepancies for pulled BBQ chicken (-0.50 vs. 0.50 oz; $Z = -2.02$, $p = .04$), mashed potatoes (-1.00 vs. 0.85 oz; $Z = -2.88$, $p = .004$), and baked beans (-1.05 vs. 1.25 oz; $Z = -2.76$, $p = .006$). For all three foods, the magnitude of overestimation in the immediate training (IT) group was greater than the underestimation in the delayed training group prior to training (pre-DT). This trend toward overestimation errors was observed in the IT group for all foods except beverages.

Accuracy Ratio by Condition

Table 1 also gives the ratio of estimated/actual by condition. Since participants served themselves, actual portion sizes for each food varied by participants. The ratio of estimated/actual adjusts for the actual portion size being estimated. For the within group comparisons (pre-DT vs. post-DT), significant differences were found for mashed potatoes, gravy, mixed vegetables, and pasta salad. As with the analyses of differences in ounces, the direction of change was primarily from underestimation prior to CFPT use to overestimation following CFPT use. Accuracy to within 10 percentage points (.90 to 1.10) was observed for four foods prior to CFPT use (pulled BBQ chicken, gravy, mixed vegetables, and bread) and five foods following CFPT use (rotisserie chicken, pulled BBQ chicken, mashed potatoes, baked beans, and beverage), but whereas only two foods were overestimated (> 110%) prior to CFPT use, seven foods were overestimated following CFPT use.

Comparable findings were obtained in the immediate training (IT) group with 9 of 12 foods overestimated as defined by accuracy ratios greater than 110 percent. Although there were significant differences between the IT and pre-DT groups on accuracy ratios for 7 foods, only

one of these differences (pasta salad) was the result of a more accurate median accuracy ratio for the IT group (1.02) than for the pre-DT group (0.81).

Percent Under, Over, and Accurately Estimating Portions

To determine the effects of the CFPT on individual as opposed to group estimation errors, accurate estimation was defined as estimation within one ounce of actual for all foods but gravy (within 1/3 oz.) and butter (within 1/6 oz.) and percentages of under, over and accurate estimation were computed for each food selected. As displayed in Table 2, the percentage of participants in the pre-DT (i.e. control) group who accurately estimated each food ranged from 20% (baked beans) to 75% (mixed vegetables). For most foods, underestimation errors were more prevalent than overestimation errors (e.g. 55% underestimated baked beans, 52% underestimated mashed potatoes). Following CFPT training (post-DT), however, the DT group shifted toward higher portion estimations, resulting in significant proportional differences for 6 of 12 foods. These differences, however, were primarily due to those initially underestimating subsequently accurately estimating or overestimating following CFPT use. Those who initially overestimated a portion size tended to continue to overestimate following CFPT use.

A similar pattern of results was observed for the between group analyses. Significant differences were found for rotisserie chicken, mashed potatoes, and baked beans, but these differences were primarily the result of proportional differences between those underestimating and overestimating by condition, not for those accurately estimating by condition. As displayed in Table 2, only a small percentage of the immediate training (IT) group underestimated foods whereas substantial percentages overestimated most foods.

Subjective Ratings by Participants

All participants rated the usability and utility of the CFPT on 5 pt. Likert scales with 5 the highest rating. Mean (SD) rating of overall usefulness was 4.1 (0.8), ease of navigation was 4.5 (0.9), and site aesthetics was 4.3 (0.8).

DISCUSSION

The results of this initial trial of a prototype computerized food portion tutorial (CFPT) showed that this web-based food portion tutorial was well accepted and had a significant impact on food portion estimation, but that this impact was characterized primarily by a tendency to overestimate portion sizes, not to estimate foods more accurately. This increased portion estimation effect was observed both between groups (pre-DT vs. IT) and within groups (pre-DT vs. post-DT). The only exceptions to this overestimation pattern were estimations of dense amorphous foods such as baked beans and mashed potatoes which the DT participants tended to initially underestimate but estimated more accurately following CFPT use. Compared to the between group comparisons, however, it is important to note that the within group comparisons may have been affected by differences in satiation (i.e. pre-training estimate prior to eating, post-training estimates after eating) and in the availability of actual portions for reference (i.e. pre-training estimation of observed portions, post-training estimation from visual memory of portions). Although the within group findings are potentially impacted by these confounds, the similarity of results of the within group comparisons with the between group comparisons provides further validation for the effects of the CFPT on portion estimation.

Although the CFPT tended to produce overestimation instead of more accurate estimation, the portion estimation accuracy following CFPT use was comparable to the accuracy found in other estimation training studies. Following training, studies have found absolute percent errors of 11 to 77% (9), 17 to 103% (10) and 21 to 113% (7), depending on the food estimated. We chose not to report absolute percent errors in this study because this scale limits underestimation

variance (i.e., one can overestimate but not underestimate by more than 100%) and inflates small portion differences (e.g. a 1 oz estimate of a 1/2 oz portion equals 100% overestimation), but for comparison, median absolute percent errors of trained participants in this study ranged from 13 to 66%. Using a scale comparable to this study, Slawson and Eck (20) found accuracy ratios of 100 to 185 for standard training and 100 to 124 for intensive training. In comparison, this study produced accuracy ratios of 91 to 163 following training.

What most differentiates the results of this study from other portion estimation training studies is the accuracy of portion estimates by the control condition participants (pre-DT). Prior to exposure to the CFPT, participants produced accuracy ratios of 82 to 143 depending on the food being estimated. In contrast, the Slawson and Eck (20) control group produced accuracy ratios of 67 to 290. A majority of participants in this study, regardless of condition, were able to accurately estimate most foods to within one ounce. Median differences between estimated and actual portions also were typically within one ounce across all foods and conditions. Therefore, the effects of the CFPT may have been limited by the pre-training estimation accuracy of this sample. This sample was older than typically studied in food portion estimation trials and may have had more real-life experience with portion estimation than younger, often college-based samples. Regardless of reason, this finding illustrates the need to provide food portion estimation training in a targeted manner, providing training only to those who poorly estimate portion sizes and only for those foods they estimate less accurately than required for the purpose of the dietary assessment.

Although this sample was already somewhat skilled at portion estimation prior to training and although the post-training accuracy is comparable to that found in other portion estimation training studies, the results clearly show that the primary effect of the CFPT was to produce overestimation, not more accurate estimation, of portion sizes. A number of factors could have resulted in this overestimation bias. Computerized food portion tutorials have a number of potential advantages over low-tech training (e.g. greater variety of foods and portion sizes displayed, automated training and feedback, ease of dissemination), but also introduce potential disadvantages. Pictorial and video screen displays of most objects, including the CFPT foods, are commonly displayed in smaller-than-actual size with referent objects of known size used to provide size and depth perception. CFPT foods were displayed with a variety of proportional reference objects, but the smaller-than-actual size of the portions on the screen may have led participants to overestimate portions when compared to their mental representations of foods as observed on the screen. Further study of the cognitive processes involved in food portion estimation are needed (22), especially when the referent portion sizes are based on pictures or video displays that are not actual size.

Limited program exposure and estimation feedback also may have been inadequate to refine participants' estimation skills but sufficient to undermine estimation confidence. Participants were exposed to the CFPT reference module in an unstructured manner for 30 minutes, followed by the feedback module which provided correct or incorrect estimation feedback for 40 or more food displays. Instead of improving estimation accuracy, the duration and quality of this training may have sensitized participants to their inaccuracies which, in the context of study demands favoring overestimation, resulted in the overestimation bias observed. Further study and refinements of the CFPT need to be performed to consider factors such as computerized food portion presentation, training duration and structure, estimation feedback procedures, and thresholds of perceivable portion increments to improve the usefulness of computerized approaches for portion estimation training.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Despite the overestimation errors produced by the prototype CFPT, this training method was well accepted by participants and holds considerable promise for improving portion estimation abilities. Computerized food portion training programs can standardize food portion training and testing procedures while also utilizing a wide array of food samples displayed in various portion sizes and from different vantage points. The use of interactive tools, tailored training, and the ability to disseminate such training widely and cost efficiently are additional advantages of computerized portion estimation training approaches. The results of this study, however, illustrate that the promise and potential advantages of computerized approaches to food portion estimation training must be balanced with empirical validation and the need for further refinements before such methods can be accepted.

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Table 1

Median and Interquartile Ranges (IQRs) for Portions Selected, Estimated Minus Actual Differences, and Accuracy Ratios (Estimated/Actual) by Immediate Training (IT) and Delayed Training (DT) Conditions

Food	N*		Median (IQR) Portions (Oz.)		Median (IQR) Difference (Oz.)		Median (IQR) Accuracy Ratio (Est./Act.)	
	DT	IT	DT	IT	Pre-DT	Post-DT	Pre-DT	Post-DT
Food								
Rotisserie Chicken	27	19	5.7 (5.5)	4.6 (4.9)	-0.50 (2.90)	-0.40 (2.00)	0.86 (0.43)	0.95 (0.33)
Pulled BBQ Chicken	17	34	1.9 (1.7)	2.4 (2.6)	0.10 (1.65)	-0.15 (1.95)	1.06 (0.80)	0.93 (0.90)
Mashed Potatoes	25	26	3.1 (1.8)	3.1 (2.3)	-1.00 (2.08)	-0.30 (4.23) ^a	0.68 (0.54)	0.91 (1.23) ^a
Gravy	13	11	0.6 (0.6)	0.9 (0.7)	-0.33 (0.75)	0.25 (1.40) ^a	0.94 (1.06)	1.25 (1.52) ^a
Baked Beans	20	17	2.5 (3.3)	2.5 (1.5)	-1.05 (2.96)	-0.18 (3.03) ^a	0.64 (1.06)	0.96 (1.32)
Mixed Vegetables	20	20	1.5 (1.4)	2.0 (1.3)	-1.00 (0.87)	0.42 (1.65)	0.94 (0.59)	1.30 (0.93) ^a
Cole Slaw	18	29	1.9 (1.6)	2.1 (1.3)	-0.25 (0.77)	0.20 (1.42)	0.81 (0.48)	1.24 (0.81)
Orzo Pasta Salad	22	27	2.3 (2.3)	2.2 (1.5)	-0.30 (1.32)	0.65 (1.05) ^a	0.81 (0.52)	1.20 (0.61) ^a
Bread	13	15	2.3 (0.5)	2.5 (0.3)	-1.00 (1.20)	0.30 (1.30) ^a	0.96 (0.55)	1.15 (0.63)
Butter	6	8	0.2 (0.2)	0.2 (0.2)	1.00 (0.33)	0.10 (0.35)	1.33 (2.99)	1.67 (1.44)
Brownie	15	11	2.0 (0.8)	2.2 (0.5)	0.90 (1.90)	1.70 (1.80)	1.43 (1.40)	1.63 (1.53)
Beverage	31	42	12.0 (8.1)	11.4 (4.9)	-1.70 (5.70)	0.90 (7.15)	0.82 (0.40)	0.94 (0.55)

* Note that Ns for each food vary based on the number of participants who served themselves each food

^a Wilcoxon Signed-Rank Test significant ($p < .05$) within group (NT-pre vs. NT-post)

^b Mann-Whitney *U*-Test significant ($p < .05$) between groups (NT-pre vs. T)

Table 2

Percent Underestimating, Overestimating, and Accurately Estimating Foods by Condition.

Food	Delayed Training-Pre (Pre-DT)			Delayed Training-Post (Post-DT)			Immediate Training (IT)		
	Percent Under	Percent Accurate	Percent Over	Percent Under	Percent Accurate	Percent Over	Percent Under	Percent Accurate	Percent Over
Rotisserie Chicken ^{a,b}	40.7	40.7	18.6	36.0	44.0	20.0	10.5	47.4	42.1
BBQ Chicken ^a	17.6	64.7	17.6	17.6	47.1	35.3	8.8	50.0	41.2
Mashed Potatoes ^b	52.0	36.0	12.0	29.2	29.2	41.7	11.5	38.5	50.0
Gravy	30.8	46.2	23.0	8.3	41.7	50.0	27.3	45.4	27.3
Baked Beans ^{a,b}	55.0	20.0	25.0	23.8	38.1	38.1	11.8	35.3	52.9
Mixed Vegetables ^a	15.0	75.0	20.0	10.5	57.9	31.6	5.0	55.0	40.0
Cole Slaw	11.1	72.2	16.7	11.1	66.7	22.2	10.3	65.5	24.1
Orzo Pasta Salad	22.7	63.6	13.7	9.5	61.9	28.6	11.1	70.4	18.5
Bread	23.1	61.5	15.4	0.0	81.8	18.2	6.6	46.7	46.7
Butter	0.0	50.0	50.0	0.0	66.7	33.3	12.5	75.0	12.5
Brownie ^a	6.7	53.3	40.0	20.0	46.2	53.8	9.1	45.5	45.5
Beverage ^a	48.4	38.7	12.9	45.2	29.0	25.8	31.0	54.8	14.2

Note: Accuracy defined as within 1 oz., except for gravy (within 1/3 oz.) and butter (within 1/6 oz.)

^a χ^2 significant ($p < .05$) within group (Pre-DT vs. Post-DT)

^b χ^2 significant ($p < .05$) between groups (Pre-DT vs. IT)