

## **Sugar-Sweetened Beverage Intake among EFNEP Participants – An Evaluation Using the National EFNEP Database**

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### **Objective**

To evaluate the impact of Expanded Food and Nutrition Education Program (EFNEP) training on sugar-sweetened beverage intake in the US Western Region (WR). Analysis compares the quantity, quality, and cost of foods between recalls including sugar-sweetened beverages to those that do not.

### **Background**

This proposal describes a secondary analysis of the EFNEP WR data set from 2014. Specifically, a pre/post-training comparison was made of the quantity and cost of sugar-sweetened beverages (SSB) consumed by EFNEP participants in the WR. The change in diet quality at the population level as estimated by the Healthy Eating Index 2010 (HEI-2010) will also be reported.

### **EFNEP Data**

Pre- and post-training twenty-four hour diet recall data is available from EFNEP, a large USDA nutrition education program for resource-limited individuals. EFNEP is administered by United States Department of Agriculture (USDA)'s National Institute for Food and Agriculture and serves audiences in all 50 states, the District of Columbia, American Samoa, Guam, Micronesia, Northern Marianas, Puerto Rico, and the Virgin Islands. The adult program targets families with young children and is designed to provide the knowledge, skills, attitudes, and behavior change necessary for nutritionally sound diets. Participants gain skills in food production, preparation, storage, safety, and sanitation, and they learn to better manage their food budgets and related resources available from federal, state, and local food assistance agencies and organizations. The program is delivered in community settings or, less often, in participants' homes as a series of weekly lessons by paraprofessionals (peer educators). Family-and-consumer-science professionals provide on-the-job-training and supervise the paraprofessionals who deliver EFNEP, including collection of dietary data. The paraprofessionals typically live in the communities where they work. They personally recruit participants and receive referrals from current and former participants as well as from community organizations and agencies.

### **Research Objectives/Questions**

This proposal describes a secondary analysis of the EFNEP data set from 2014. The analysis includes estimations of the change in SSB intake and expenditures among EFNEP program participants. The primary objectives of this proposal are to evaluate the impact of EFNEP on SSB intake, to calculate the impact of EFNEP training on diet quality as estimated by the HEI-2010, and to estimate expenditures on SSBs by WR EFNEP participants.

### **Methods**

Diet recalls for the 2014 EFNEP participants were kindly provided via the Agricultural Research Service (ARS) and EFNEP. Data were provided on CD-ROM (SAS format) and imported into JMP, a SAS statistical

program that manages and analyzes data. The data included demographic data for participants of ages 0 and up, males and females. Analysis was limited to adult female participants.

The provided data included diet recalls for each participant. Each diet recall includes individual food items, each coded with an ARS Food and Nutrient Database for Dietary Studies (FNDDS) food code number [<https://www.ars.usda.gov/northeast-area/Beltsville-md/Beltsville-human-nutrition-research-center/food-surveys-research-group/docs/fndds/>]. FNDDS is a nutrient database for foods as eaten, as would be collected in a diet recall. Analysis was restricted to cases that had matched pre- and post-training recalls.

The provided data included dietary analyses based on the FNDDS including gram weights of food items, energy per 100g of food, and HEI-2010 sub-scores and totals. The HEI [<https://www.cnpp.usda.gov/healthyeatingindex>] is a measure of diet quality summed from 12 sub-scores based on reported food consumption. The foods, such as Total Fruits, are found within the FNDDS. A SAS script is available to compute the HEI total and sub-scores, but these scores were provided within the EFNEP database.

The USDA Center for Nutrition Policy and Promotion has a downloadable food price database for the FNDDS food codes, based on 2003-2004 food prices [<http://www.cnpp.usda.gov/USDAFoodPlansCostofFood.htm>]. The prices were inflation-adjusted to 2016 and merged with the EFNEP database.

ARS provides a script for parsing FNDDS food codes into 4 digit What We Eat in America (WWEIA) codes. SSBs have WWEIA codes beginning with 72. All foods in the EFNEP database that received a WWEIA code beginning with 72 were assigned a 1 to indicate SSB. All other foods were assigned a 0. Some analyses, such as energy, cost, and SSB intake, were conducted with this file.

The individual food items were summed for each pre- and post-training recall for analyses at the individual level. The EFNEP HEI-2010 scores, which were provided at the individual level, were merged with the summed energy and cost file. If a recall contained a SSB, it was coded 1. If not, it was coded 0.

## **Results**

### **Sample**

Of all US states and jurisdictions, 16 fell within the WR and are shown in Figure 1. Of the total 124,647 2014 EFNEP participants, 20,549 were from the WR. Cases were constrained to female adults who had matched pre/post training recalls and whose energy intake fell within the 99.5% percentile (<5,045 kcal/d) of cases. The resulting sample included 9,987 cases. The energy distribution was calculated from all (pre- and post-training) recalls. The pre-training 99.5%-ile was 5,256 kcal/d, while the post-training 99.5%-ile was 4,597 kcal/d.

### **Energy Intake**

Figure 2 shows the distribution of energy intakes for the pre- and post-training recalls, trimmed at > 99.5%-ile. Distributions were 0 bounded and right hand-skewed, and values were given as median (interquartile range). Distribution of caloric (kcal/d/person) intakes of valid cases was bimodal for both

pre- and post-training recalls due to cases where only water, or little energy intake, was reported. The median pre- and post-training recall energy intakes were 1,284 kcal/d and 1,228 kcal/d, respectively.

### **Sugar-Sweetened Beverage Intake**

The distribution of energy intakes from SSBs in both pre- and post-training recalls are shown in Figure 3.

**Initial Recall.** 68% of cases did not report SSB intake. Across all pre-training recalls, the SSB energy intake accounted for 5.9% of calories. Among those that did report SSB intake, SSBs accounted for 15.1% of calories. Median energy intake was 13% higher among SSB consumers than non-consumers in the initial recall.

**Final Recall.** 77% of cases did not report SSB intake. Across all post-training recalls, the SSB energy intake accounted for 2.4% of calories reported. Among those that did report SSB intake, SSBs accounted for 6.8% of calories. Median energy intake was 24% higher among SSB consumers than non-consumers.

**Comparison of Recalls.** 57% of participants did not report SSB intake in either recall, while 12% of participants reported SSB intake in both recalls. Mean SSB intakes were 259 vs. 241 kcal/d (initial/final), although the distribution was highly skewed. Median SSB energy intake (182 kcal/d) was the same for initial and final recalls. The lower median reflects the right hand-skewed distribution. A paired non-parametric comparison of intake was used to analyze SSB intake. The percentage of energy from SSBs was significantly lower (-23.1 kcal/d) in final recalls in paired comparisons (Wilcoxon signed rank).

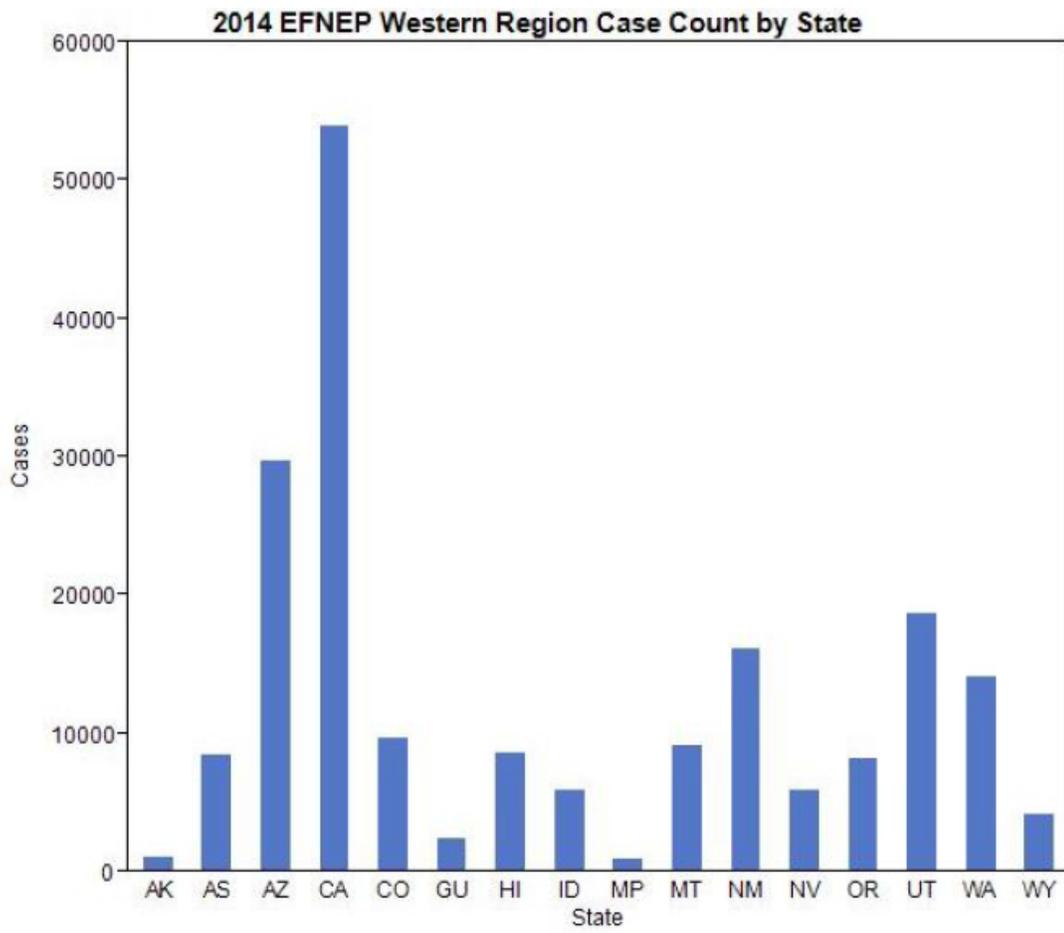


Figure 1. Valid cases of female adults selected from the 2014 EFNEP data set.

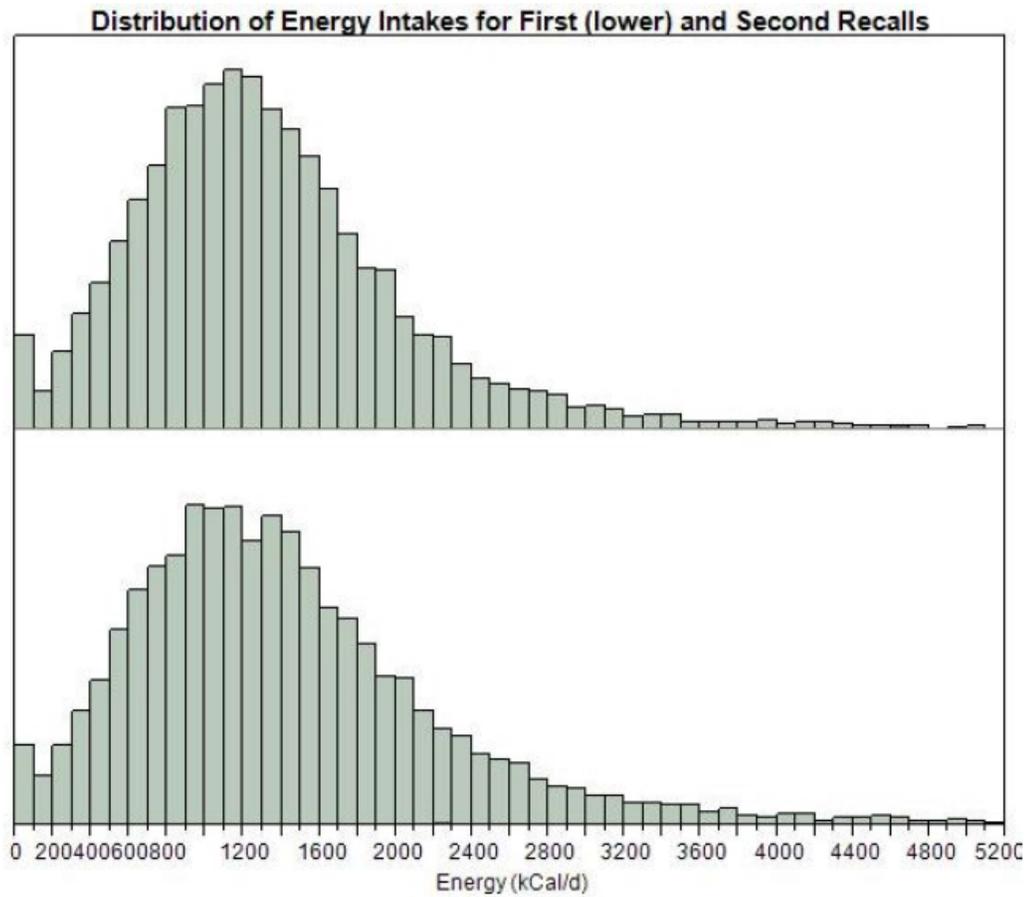
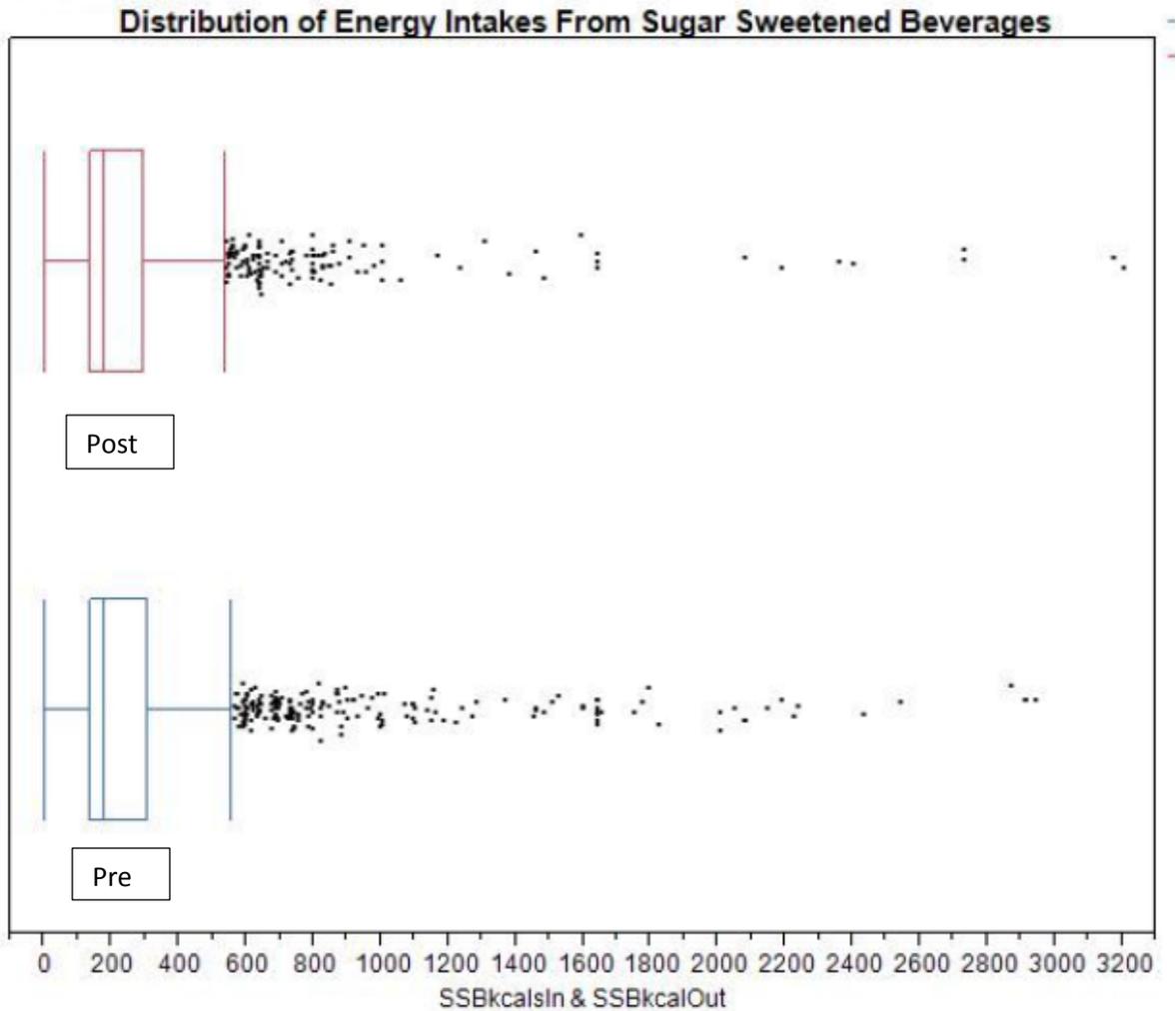


Figure 2. Reported energy intake of female adults selected from the 2014 EFNEP data set. Cases with intakes > 99.5-%ile excluded from analysis.

The bimodal distribution near zero results from cases reporting water but not energy containing foods.



**Figure 3.** The distribution of sugar sweetened beverage (SSB) intake (kcal/d) in pre- and post-training recalls among Western Region EFNEP participants in 2014.

### HEI-2010

For the purposes of this report, 2014 HEI-2010 scores provided by EFNEP were analyzed. 1.8% of cases had missing HEI scores and were excluded from the analysis.

The distribution of HEI Total scores were normal. Box plots of HEI-2010 scores are shown in Figure 4. The final scores were significantly higher by Wilcoxon non-parametric testing. The following list summarizes the HEI-2010 findings.

### Initial Recall

- All reports
  - Median HEI Total was 55.0 out of 100 possible points

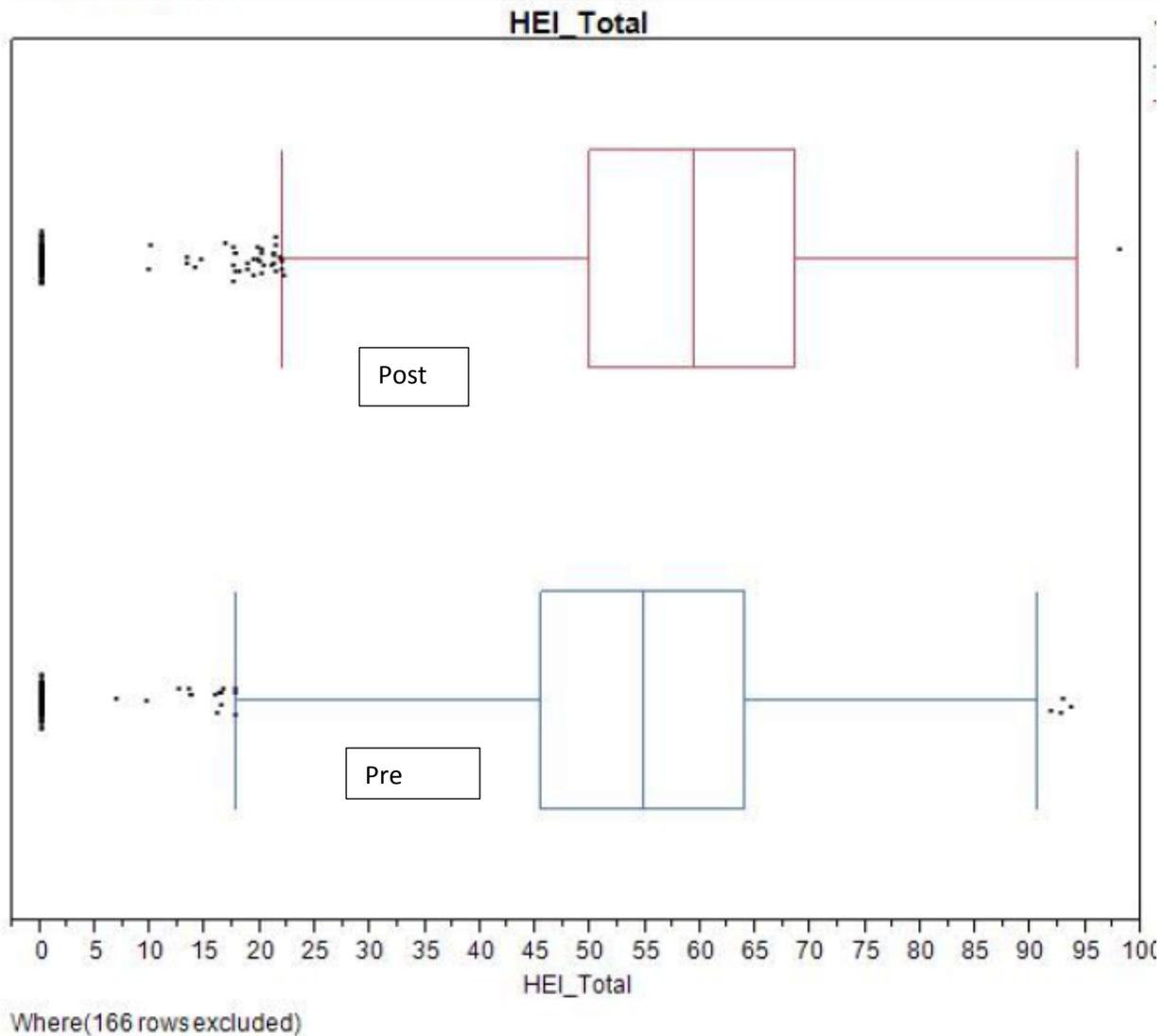
- Median SoFAAS (calories from solid fat, alcohol, and added sugars) was 18.2 out of 20 possible points
- SSB non-consumers
  - Median HEI Total was 55.8
  - Median SoFAAS was 19.4
- SSB consumers
  - Median HEI Total was 53.2
  - Median SoFAAS was 15.9

### **Final Recall**

- All reports
  - Median HEI Total was 59.7
  - Median SoFAAS was 19.7
- SSB non-consumers
  - Median HEI Total was 60.5
  - Median SoFAAS was 20
- SSB consumers
  - Median HEI Total was 57.4
  - Median SoFAAS was 17.3

### **Comparison of Recalls**

- HEI Total mean (SD) score improved from 54.9 (13.0) to 59.2 (13.3) ( $p < 0.05$ ).
- HEI SoFAAS mean (SD) score improved from 16.3 (16.4) to 17.1 (17.3) ( $p < 0.05$ ).



**Figure 4.** Healthy Eating Index 2010 Total scores in pre- and post-training recalls among Western Region EFNEP participants in 2014.

### Cost

Food prices (n=180,877) were assigned from the [cnp.usda.gov](http://cnp.usda.gov) database and inflation-adjusted +34.2% (Economic Research Service) to 2016 prices. Missing prices (n=143) for alcoholic beverages were estimated from current prices. Missing prices for water (n=16,977) were set to zero. Food prices (\$/weight) were multiplied by consumed weight to generate a food cost. Food item costs were summed to generate per capita daily food expenditures. Weighted daily expenditures were not normally distributed.

The estimated daily cost of food per capita for the initial recall was \$2.85/d (2.32 Interquartile Range), while the figure rose significantly (Wilcoxon) to \$2.96 (2.24 IQR) for the final recall.

Figure 5 shows box plots of the food cost findings. The following list summarizes the food cost findings.

## Initial Recall

- All cases
  - Median cost per mCal (1,000 kcal)/person/d was \$2.85 (2.32)
  - Median percent SSB cost of daily expenditures was 0% (5.82)
- SSB consumers
  - Median percent SSB cost of daily expenditures was 10.8% (12.7)

## Final Recall

- All cases
  - Median cost per mCal/person/d was \$2.96
  - Median percent SSB cost of daily expenditures was 0% (5.82)
- SSB consumers
  - Median percent SSB cost of daily expenditures was 10.8% (12.6)

## Comparison of Recalls

- Total cost per mCal/person/d increased from initial to final recall ( $p < 0.05$ ).
- The change in expenditures on SSB from initial to final recall was not significant (Wilcoxon  $p = 0.7$ ).

INSERT FIGURE 5

## Conclusions

In paired comparisons (same participant), caloric intake from SSBs dropped from initial to final recall, showing some effect of EFNEP training. At the population level, as estimated by the median, there was little effect on SSB-based caloric intake when comparing initial and final recall. However, when making paired comparisons, there was a significant reduction in energy from SSBs following EFNEP training.

The HEI-2010 scores, both Total and SoFAAS scores, were lower among those that consumed SSBs (a lower SoFAAS score indicates more sugar and solid fat intake). The effect of EFNEP training, as estimated by initial to final score change, indicates improvements in both Total and SoFAAS scores.

Total dietary costs appear to be reasonable when compared to expectations. Daily food costs for a female aged 19-50 for June 2016 were estimated by the USDA to be \$5.36/day [<https://www.cnp.usda.gov/sites/default/files/CostofFoodJun2016.pdf>], whereas the current estimate of \$2.85/mCal/d equates to \$5.70/d for 2,000 kcal/d.

Daily costs were slightly, but not significantly, higher for the final recall. Guenther and Luick found significantly higher costs for the final recall in an analysis of 2011 EFNEP WR data. In the current analysis, SSB costs were stable from pre- to post-EFNEP training. The 12% of cases that reported SSB intake in both recalls, combined with 2/3 and more than 2/3 not reporting SSB intake in initial and final recalls, respectively, indicates that a certain fraction of the EFNEP audience is responsive to SSB EFNEP messaging.

## **Implications**

Interventions based on decreasing SSB intake alone may effectively improve diet among EFNEP participants, as well as bring about food cost savings. SSB-specific training and reporting may be beneficial to EFNEP participants and program efficacy.