Validation of a 10-item Questionnaire Measuring Fruit and Vegetable Consumption in 9-11 year old Children Living in Low-Income Households

THESIS

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Abstract

Background: Many low-income children do not consume the recommended amounts of fruits and vegetables (FV). For this reason, a primary objective of the Supplemental Nutrition Assistance Program Education (SNAP-Ed) is to increase children’s consumption of FV. To accurately measure dietary changes related to FV intake, validated assessment tools that are quick and easy to administer are needed; however, few such tools exist.

Objective: To test a 10-item fruit and vegetable questionnaire (10-item FVQ) for criterion and convergent validity, sensitivity, test-re-test reliability, and internal consistency.

Participants: The study took place among 9-11 year old children attending a SNAP-Ed-eligible elementary school. Four 3rd grade and four 4th grade classrooms were invited to participate. The study included 3rd (n=46) and 4th grade (n=40) participants, with the majority being white (93%).

Main Outcome Measures: Criterion validity was assessed by comparing the total score on the 10-item FVQ to total servings of FV as reported on a single 24-hour dietary recall (24-HDR). Convergent validity analyzed the “variety” and “snack” constructs from the 10-item FVQ compared to variety and snack reference scores generated from the matched 24-HDR. Sensitivity of the 10-item FVQ was assessed by comparing scores
pre- and post- a 4 lesson FV intervention to FV servings reported on the 24-HDR. Reliability was evaluated by administering the 10-item FVQ at two time points one week apart, pre-intervention, and internal consistency by analyzing scores on a single 10-item FVQ. Pearson correlation was used to assess criterion and convergent validity, and sensitivity. Reliability was measured using a pairwise t-test, intraclass correlation coefficient, and Cronbach’s alpha.

**Results:** Correlation between the total scores on the 10-item FVQ and 24-HDR was significant ($r = 0.36, p < 0.005$), in addition to the total variety ($r = 0.306, p < 0.01$) and total snack scores ($r = 0.329, p < 0.01$). Fruit as a snack ($r = 0.322, p < 0.01$) and variety of vegetables ($r = 0.256, p < 0.05$) demonstrated a moderately significant correlation to the 24-HDR reference scores. Sensitivity testing showed a moderately significant correlation of $r = 0.287 (p < 0.05)$. Test-re-test reliability demonstrated agreement between repeated testing measures ($r = 0.784, p < 0.0001$) and internal consistency assessment yielded a Cronbach’s alpha of 0.806 and a significant intraclass correlation coefficient of 0.775 ($p < 0.001$).

**Conclusions and Implications:** Results from this study suggest that the 10-item FVQ is a valid and reliable measure of FV intake behaviors among 9-11 year old children. Further testing of the 10-item FVQ in a pre/post intervention design is needed to further investigate the questionnaire’s sensitivity to detecting change, differences among gender, and use within various ethnic groups. Evidence from this study suggests the 10-item FVQ may be used as a short and easy to administer alternative to traditional
methods of dietary collection in assessing FV intake among low-income 9-11 year old SNAP-Ed participants.
To my mother and father who never questioned my dreams and always believed I was meant to accomplish great things. Above all to my wonderful husband who has selflessly supported me in pursuing my passion and never doubted I could accomplish anything I put my mind to.
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Chapter 1: Introduction

Validated instruments assessing behavioral outcomes related to nutrition are necessary for determining the effectiveness of and improving upon nutrition education programs (Townsend, 2006). Validity is defined as “the extent to which a measuring instrument measures what it is intended to measure”, or, in the context of nutritional assessment, “the ability of a dietary assessment tool to measure food consumption data that represents the true dietary intake of the individual” (Burrows, Martin, & Collins, 2010; Townsend, 2006; Townsend & Kaiser, 2005). A method is considered valid if reported dietary intake does not vary significantly from the actual dietary intake consumed (Burrows et al., 2010). For credibility, measures used must be face and content validated, and meet accepted standards for validity, reliability, sensitivity, and internal consistency (Townsend, 2006). The purpose of this study was to test the validity and reliability of a 10-item fruit and vegetable questionnaire (10-item FVQ) assessing frequency of fruit and vegetable (FV) consumption in low-income children ages 9 to 11 years. The 10-item FVQ has been validated for face and content validity by way of focus groups and expert panel review (Manganello, 2012). To further validate the 10-item FVQ, criterion and convergent validity, sensitivity, internal consistency, and test-re-test reliability must be confirmed (Townsend, 2006; Angelelli & Jacobson, 2009; Carmines & Zeller, 1979; Siegle,
Validity is expressed if the following are demonstrated: individual scores on the 10-item FVQ correspond to servings of FV on the established 24-HDR (criterion validity); if individual constructs measured by the 10-item FVQ (variety and snacks) correlate with similar reference intake values reported on the 24-HDR (convergent validity); if the 10-item FVQ is able to detect change in behaviors related to frequency of FV intake (sensitivity); if the items on the 10-item FVQ are inter-correlated and are thus measuring the same construct (internal consistency); if the 10-item FVQ yields similar scores upon repeated administration (test-re-test reliability). Based on preliminary data from Manganello (2012), we hypothesize that this brief 10-item FVQ will be a valid, easily administered tool for identifying behavior change related to FV consumption in 9-11 year old children living in low-income households, and be able to serve as a proxy for more costly and time intensive methods of dietary collection, such as the 24-HDR.

The specific aims of this study were to:

1) Examine the criterion validity of the 10-item FVQ by comparing scores to an established measure of dietary intake, a 24-HDR.

2) Assess the convergent validity of the variety and snack constructs from the 10-item FVQ as compared to the 24-HDR reference FV intake values.

3) Test the sensitivity of the 10-item FVQ in detecting changes in FV consumption patterns using a pre- and post-intervention testing design.

4) Analyze the internal consistency of each item in the scale and report the degree to which each item relates to frequency of FV intake.

5) Assess the 10-item FVQ for test-re-test reliability among 9-11 year old children using a pre- and post-test design with no intervention between test points.
Chapter 2: Review of the Literature

Fruit and Vegetable Consumption in Children

Many children do not meet the recommended daily requirements for FV intake despite the established benefits (Guenther, Dodd, Reedy, & Krebs-Smith, 2006; Hohnbaum & James, 2010; Lohse, Cunningham-Sabo, Walters, & Stacey, 2011; Lorson, Melgar-Quinonez & Taylor, 2009; Serdula et al., 1996; Wall, Least, Gromis, & Lohse, 2012); this is particularly true among low-income populations (Lorson et al., 2009). Lorson et al., (2009) conducted a study using the 1999-2002 National Health and Nutrition Examination Survey (NHANES) data, reporting only 16.2% of school-aged children (6-11 years old) met the USDA vegetable recommendations. The 2010 National Fruit and Vegetable Alliance’s National Action Plan report card indicates 8% of children eat the recommended 1 ½ cups of fruit per day and a mere 6% are achieving the recommended 2 ½ cups of vegetables each day (2010 National Fruit and Vegetable Alliance’s National Action Plan Report Card). The Centers for Disease Control and Prevention’s 2013 State Indicator Report on Fruits and Vegetables shows the national percentage of U.S. adolescents who report consuming FV less than one time daily is 36% and 37.7%, respectively (2013).
Link between Fruit and Vegetable Intake and Health Outcomes

Fruit and vegetable consumption is linked to lowered risk of chronic diseases, including heart disease, hypertension, and several cancers, as well as a decreased risk of obesity, while vegetable intake in particular is correlated with children’s weight status (Guenther et al., 2006; Lorson et al., 2009; Wall et al., 2012). FV have been the only two food groups to consistently show a decreased risk of almost every type of cancer studied (Willett & Trichopoulos, 1996). Childhood overweight (BMI 85th -<95th percentile of BMI-for-age growth charts) and obesity (BMI ≥95th percentile) affect more than 1 in 3 children ages 2 to 19 years of age and 27% of children 6-11 are considered obese (Ogden, Carroll, Kit, & Flegal, 2014). With the rising rates of childhood obesity, there is also mounting evidence pointing to the long-term impact of childhood dietary habits on overall health. Healthy, whole-food dietary habits including fresh FV are indicated in the prevention of obesity and chronic disease (Liu, 2013).

Need for Programs Targeting Fruit and Vegetable Intake Behaviors

A key behavioral outcome of both the Dietary Guidelines 2010 and the Supplemental Nutrition Assistance Program Education (SNAP-Ed) is increasing FV intake (United States Department of Agriculture, 2012). Fruits and vegetables are a good source of under-consumed nutrients such as folate, magnesium, potassium, dietary fiber, and Vitamins A, C, and K (Dietary Guidelines for Americans, 2010). Including more FV in the diet can help people achieve and/or maintain a healthy weight, and the Dietary Guidelines 2010 advises eating a variety of vegetables,
specifically dark green, red, and orange varieties. Concern over the long-term health impact of low FV intake among children has generated a need for programs that encourage consumption and positive health behaviors. Targeting positive nutrition-related behaviors, such as increasing consumption of FV, may promote healthy eating practices and mediate unhealthy gains in weight among children. Interventions focused on elementary school-age children influence behaviors before they are permanently established, which may lead to more lasting effects (Sandeno, Wolf, Drake, & Reicks, 2000; Shariff et al., 2008). Evidence of the long-term impact of childhood dietary habits on adult health outcomes and chronic disease risk further enforces the need for programs promoting healthy dietary patterns in children (Dietz, 1998; Steinberger, Moran, Hong, Jacobs, & Sinaiko, 2001). Research also supports the school environment as a promising target for interventions focused on improving children’s dietary intake (Briefel, Crepinsek, Cabili, Wilson, & Gleason, 2009). Experts recommend integrated, experiential school-based interventions that feature sequential lessons and positive and enjoyable approaches to develop nutrition-related skills (Lohse et al., 2011; Nicklas & Hayes, 2008). In order to improve upon the effectiveness of these programs, validated evaluation tools are needed (Thiagarajah et al., 2008).

**SNAP-Ed for Low-Income Populations**

The Supplemental Nutrition Assistance Program (SNAP), operating through the United States Department of Agriculture (USDA) under Food and Nutrition Services (FNS), aims to provide individuals’ living in low income household’s access to food
The Supplemental Nutrition Assistance Program Education (SNAP-Ed) is a voluntary component of SNAP participation in which educational messages on dietary quality, food resource management, and food safety are delivered to low-income adults and children (Wyker, Jordan, & Quigley, 2012). The goal of SNAP-Ed is to increase the likelihood that SNAP benefit participants will make healthy food choices within a limited budget and choose physically active lifestyles consistent with the USDA’s Dietary Guidelines for Americans (2010). SNAP-Ed is delivered directly to both youth and adults through group and individual interactive learning opportunities. For states choosing to participate in SNAP-Ed, guidance is provided by FNS for using the most effective nutrition education tools and strategies available. States are encouraged to focus on the following behavioral outcomes when assessing nutrition education needs, evaluating outcomes, and developing SNAP-Ed objectives:

1. Eat fruits and vegetables, whole grains, and fat-free or low-fat milk products every day.
2. Be physically active every day as part of a healthy lifestyle.
3. Balance caloric intake from food and beverages with calories expended.

In addition to the behavioral targets of SNAP-Ed programs, the USDA’s 2010 Dietary Guidelines for Americans states the following recommendations related to foods and nutrients:

1. Increase vegetable and fruit intake.
2. Eat a variety of vegetables, especially dark-green and red and orange vegetables and beans and peas.
3. Choose foods that provide more potassium, dietary fiber, calcium, and vitamin D, which are nutrients of concern in American diets. These foods include vegetables, fruits, whole grains, and milk and milk products.
Children are a particularly important target for nutrition education programs due to the growing body of evidence documenting the vital role that optimal nutrition plays throughout the lifespan (United States Department of Agriculture, 2012). Eating patterns established in childhood often track into later life, making early intervention regarding adoption of healthy nutrition and physical activity behaviors a priority (Dietary Guidelines for Americans, 2010). For this reason, SNAP-Ed programs are specifically targeting primary school-aged children by incorporating evidence-based, validated nutrition lessons into low-income schools.

Food insecurity is specifically associated with lower diet quality and a greater incidence of diet-related health problems. Low-income populations have also been shown to eat fewer FV when compared to other groups (Champagne et al., 2007). For these reasons, community nutrition programs, such as SNAP-Ed, can be useful in targeting specific nutrition-related behaviors and increase the likelihood of low-income groups making healthy food choices (United States Department of Agriculture, 2012).

**Child Nutrition Questionnaires**

Numerous questionnaires assessing children’s nutrition intake, knowledge, and behaviors have been developed; however, no such brief child-facilitated tools exist to evaluate FV consumption behaviors in 9-11 year old low income children. The following assessment measures were developed to assist in the evaluation of specific child nutrition program outcomes. Each study detailed below is included based on 1) its use of an assessment questionnaire within a child nutrition education
program, 2) the program’s aim of assessing nutrition outcomes, including FV intake and/or behaviors, and/or 3) the testing of the questionnaire for validity, reliability, and/or sensitivity. Although the following studies are not directly comparable to the present study, the intervention and questionnaire validation procedures were used to guide the methodology behind the current research process.

The Healthy Children, Healthy Families Behavioral Checklist (HCHFBC) was developed and tested as a measure of behavior change for a behaviorally based Expanded Food and Nutrition Education Program (EFNEP) (Dickin, Lent, Lu, Sequeira, & Dollahite, 2012). The curriculum uses active play, nutrition, and parenting education in an 8-session series for parents and/or guardians of 3-11 year old children. Research objectives were to 1) develop an easily-administered tool assessing change in nutrition, active play, and parenting behaviors between initial and final sessions of HCHF; 2) ensure questionnaire items were interpreted as intended, covered key learning objectives, and were feasible for use in programming; 3) assess the scale’s test-re-test reliability and convergent validity. The BC was assessed by an expert panel, cognitive testing interviews, field testing, test-re-test study, and assessment of convergence with detailed previously validated instruments. The nutrition objectives were that the tool would detect increases in parent and child FV consumption. This tool is used in low-income populations, but is a parent-report.

The School Physical Activity and Nutrition (SPAN) questionnaire is a surveillance instrument developed to measure physical activity, nutrition attitudes,
and dietary and physical activity behaviors in children and adolescents (Hoelscher, Day, Kelder, & Ward, 2003; Thiagarajah et al., 2008). Fourth graders at five elementary schools (n=110) participated in the study to evaluate the validity of food consumption items on the 10-page, 54 item questionnaire. Measurements included recall of high fat food items, high calorie/low nutrient food items, fruits, vegetables, and grain products, nutrition knowledge, attitudes, and physical activity patterns. Agreement between child responses to the SPAN questionnaire and reference values obtained through a single 24-HDR were measured using Spearman correlation, percentage agreement, and kappa statistic. Results indicated the SPAN questionnaire can be administered in a 4th grade classroom quickly to measure several dietary behaviors from the previous day; however, assessment of “vegetables” needs further investigation. While this SPAN questionnaire proves to be a valid tool in this population, it requires approximately 25-30 minutes for completion, which exceeds the time allotted for evaluation among many community nutrition programs.

The Day in the Life Questionnaire (DILQ) was developed to measure children’s consumption of FV from the previous day using words and pictures to encourage recall (Edmunds & Ziebland, 2002). This study conducted by Edmunds and Ziebland (2002) tested the validity, reliability, and sensitivity to change of the DILQ in children aged 7-9 years (n=255) across four schools. The DILQ was intended to be used as a 24-HDR for diet and activity, and was compared to direct observations. K-coefficients were used to compare counts of FV reported on the
DILQ and the researcher’s observations, and differences in reporting were examined through Wilcoxon-Mann-Whitney and Kruskal-Wallace tests. The questionnaire performed well or acceptably on the validity, reliability, and sensitivity tests, leading researchers to conclude that the DILQ could be recommended as a method of collecting data about FV consumption in 7-9 year olds. This validated method of collecting dietary intake only provides information from the previous day, and does not focus specifically on FV, but rather uses open-ended questions to gather dietary intake information and activity. While this format is effective for informing programs of intake, it may be difficult for use among community nutrition programs due to the time it takes to code for and enter qualitative data. Additionally, it has not been tested in low-income populations.

The School Lunch Recall is a self-administered questionnaire to assess school lunch intake and the impact of farm-to-school programs among large samples of children (Paxton, Baxter, Fleming, Ammerman, 2011). A validation study was conducted during summer school over a four-day period. Third to fifth-grade (8-11 years old) children (n=18) completed the questionnaire, which prompts for school lunch items by asking children whether they chose a menu item, how much of it they ate, how much they liked it, and whether they would choose it again. Thirty-seven total observation school lunch recalls sets were completed and compared against direct observations. Reporting, observing, and recording food amounts were based on standardized school meal portions for each item. To capture additional FV brought from home, the school lunch recall asked four probing questions specific to
FV consumption. Results indicated that comparison of the School Lunch Recall against observations demonstrated high accuracy. The pilot study demonstrated that the school lunch recall could be used as a valid, efficient tool for assessing school lunch intake; however, the sample size was small and the questionnaire only examined items consumed during lunch and could not serve as a representation of total dietary intake.

A validation study conducted by Eaton et al. (2013) aimed to compare FV intake estimates based on responses to three sets of survey questions, with criterion FV intake in servings per day based on 24-HDR interview data (Eaton et al., 2013). The purpose of the study was to compare daily FV intake estimates based on students’ responses to three question sets with estimates of FV intake based on three 24-HDR interviews: 1) the standard set of Youth Risk Behavior Surveillance System (YRBSS), which asks for FV intake in “in the previous 7 days”; 2) “times per day” fruits and/or vegetables are consumed; 3) “servings per day” of fruits and/or vegetables”. High School students (n=610) completed each of the three sets of questionnaires related to FV intake, in addition to three phone-facilitated dietary recalls. T-tests and corrected Pearson correlations were used to compare estimates of FV intake from the 24-HDR responses and each of the questionnaires. Of the three sets of survey questionnaires, the established YRBSS questions produced estimates and percentages that were most consistent with the 24-HDR estimates. The YRBSS tool may be an accurate and valid measure for FV intake, but is only valid for use in a high-school population.
A study by Cullen, Watson, & Zakeri (2008) aimed to assess the reliability and validity of the “Block Kids Questionnaire”, a self-reported dietary collection method based off the adult Block Food Frequency Questionnaire (FFQ), in 10-17 year old children and adolescents (Cullen et al., 2008). Participants (n=83) reported their consumption of 72 food/beverage items for the past 7 days using six response categories (from none to every day). Each child also completed two-24-HDR’s for comparison. In children ≤12 years, differences were observed for most nutrients and food servings between the Block Kids Questionnaire and the 24-HDR; most 24-HDR mean estimates were significantly greater than the mean Block Kids Questionnaire estimates. Researchers concluded the Block Kids Questionnaire may be a more valid form of assessment for adolescents >12 years versus children ≤12 years.

Another study examining measures of FV consumption in children analyzed the reliability and validity of digital imaging (DI) or digital imaging plus observation (DI+O) during school lunch (Taylor, Yon, & Johnson, 2014). Fruit and vegetable consumption was assessed (in grams) using DI and DI+O to compare against weighted plate waste (WPW). Pearson correlations compared the methods for assessing fruit, vegetable, and total fruit and vegetable consumption per tray, and for assessing consumption of items within each FV item category. The major findings of the study were that DI was reliable for estimating children’s FV consumption, DI and DI+O produced valid estimates of mean FV consumption when compared with the gold standard WPW, and DI and DI+O were less precise for assessing FV
consumption for individual trays. This method may be effective for evaluating FV intake, but only represents FV consumed during school lunch.

One additional study by Blackburn et al. (2006) investigated the validity and reliability of a Food Behavior Checklist (FBC); although the questionnaire did not assess children, the aim and style of the questionnaire is similar to the 10-item FVQ and the study design comparable to the current study. The 11-item FBC was developed to evaluate the impact of food assistance program education on fruit and vegetable intake among low-income adult women (Blackburn et al., 2006). The primary aim focused on whether the FBC could be used as an alternative to the 24-HDR in assessing fruit and vegetable intake. Researchers used three 24-HDR recalls and total serum carotinoids at baseline and follow-up (post 6 hours of nutrition education) to test the criterion and convergent validity, internal consistency, sensitivity, and reliability. Criterion validity was analyzed by correlating the FBC questions to total serum carotinoids, while convergence was assessed by correlating FV intakes and specific nutrient intakes as determined by the FBC and three 24-HDRs. Cronbach’s alpha was used to determine internal consistency, while the FBC administration at two time points, three weeks apart with no intervention assessed test-re-test reliability. Researchers found the FBC to be easier to administer and less cumbersome than the 24-HDR, and concluded that the FBC appears to be a valid and reliable assessment of FV intake.
Need for Validated Assessment Tools

Evaluation of school-based interventions for primary school-aged children is hindered by the scarcity of valid, reliable, and cost-effective methods for gathering self-reports of dietary intake in a school setting (Rockett & Colditz, 1997). A review by McPherson, Hoelscher, Alexander, Scanlon, & Serdula (2000), examined dietary assessment methods in school-aged children, concluding there is a shortage of acceptable methods for assessing FV consumption. Traditional validated methods of dietary collection include the 24-HDR and FFQ; however, these methods are costly, time consuming, and have a high respondent burden, making them an impractical choice for ongoing monitoring of public programs with limited resources such as SNAP-Ed (Blackburn et al., 2006; Thiagarajah et al., 2008; Townsend, 2006). Biomarkers such as serum carotinoids may also serve as a useful assessment measure of FV intake (Taylor-Powell, 2006). The invasiveness and expense, however, makes the use of biomarkers less common and often impractical for community-based programs (Campbell et al., 1994). For this reason, high-quality evaluation measures that are valid and reliable for the population, have a low-respondent burden, are simply worded, and are feasible for program use, are needed to measure behavioral outcomes in program contexts and inform program decisions (Blackburn et al., 2006; Edmunds & Ziebland, 2002; Thiagarajah et al., 2008; Townsend, 2006). In order for an instrument to be considered valid, it must show reliability, sensitivity, and internal consistency in addition to meeting the standards listed above for the sake of practical application in the field (Townsend, 2006). A
lack of validated food-selection questionnaires for low-income children presents the opportunity for the development of new instruments that will accurately reflect the dietary patterns in the specified age-group.

Accurate methods of dietary assessment, particularly measuring FV intake, are important to determine the nutritional adequacy of an individual child’s diet (Burrows et al., 2010). Diet records, diet history interviews or recall, estimated or weighted food records, food frequency questionnaires, and direct observation are used to evaluate dietary intake in children, with validation studies of self-reported measures in children including comparisons with diet records or diaries (Burrows et al., 2010; Edmunds & Ziebland, 2002). For the present validation study in 9-11 year old children, the 24-HDR, which gives a snapshot of an individual’s food intake, was selected as the standard of reference of comparison for the 10-item FVQ. A systematic review by Burrows et al. (2010) studied the validity of dietary assessment methods in children as compared with the gold standard reference method of doubly labeled water found that while all methods of self-reported dietary intake are subject to misreporting and under-reporting, the 24-hour multiple pass recall produced more modest over-reports of dietary intake than other methods. Other studies have also shown that the 24-HDR is a valid method to assess dietary intake in 8-11 year old children, and the literature suggests a transition period between ages 8 and 12 years during which a child becomes a more accurate reporter of his or her own dietary intake (Burrows et al., 2010; Lytle, Murray, Perry, & Eldridge, 1998). Food frequency questionnaires could also serve as a standard for dietary reference;
however, FFQ’s place a significant response burden on children, are time consuming, and children in this age group are thought too young to be able to complete an FFQ on their own (Edmunds & Ziebland, 2002; Paxton et al., 2011). For the reasons stated above, the 24-HDR was identified as an acceptable choice for validating the 10-item FVQ in our study population (Burrows et al., 2010; Lytle et al., 1993). Evaluation provides both internal and external value to nutrition education programs. Improved practice and programs, enhancement of professional growth, generation of resources, demonstration of scholarship, adding to the evaluation knowledge bases, recognition of individual, team and program excellence increases, and organizational learning each occur as organizations implement validated assessment methods. Evaluation allows programs to improve by focusing on specific outcomes that are measured through the evaluation process, as well as motivation and momentum for program improvements (Taylor-Powell, 2014).

Appropriate programmatic evaluation tools are essential to ensure an emphasis on quality and attention to participant outcomes (Dickin et al., 2012).

**Validity Testing of Assessment Tools**

Townsend (2006) illustrates the process by which evaluation tools should be developed for food stamp nutrition education programs (SNAP-Ed) (Townsend, 2006). The first step in the development phase of the validation process requires evaluation for content and face validity. For the 10-item FVQ, Manganello (2012) completed the necessary developmental validation methods (content and face validation). The next phase of validation encompasses “testing of items” in the
population for criterion, convergence, sensitivity to change, internal consistency, and test-re-test reliability (Townsend, 2006). Listed below are explanations of the subsequent types of validity being explored in the context of validating the 10-item FVQ.

1) **Criterion Validity:** Criterion-related evidence requires comparing an instrument with an established criterion (Siegle, (n.d.)). Criterion validity is the degree to which individuals’ scores on a new test correspond to their scores on an established test of the same construct that is administered shortly before or after the new test. The established test is the criterion against which the new test is to be validated (Kimberlin & Winterstein, 2008). If a measure demonstrates criterion validity, then the scores will correlate with scores on a test that is known to be valid. Examining whether the numerical scores on the 10-item FVQ are comparable to a dietary reference tool measuring servings of FV per day, the 24-HDR, in measuring frequency of FV consumption will determine criterion validity.

2) **Convergent Validity:** Convergent validity shows an instrument is comparable with other variables which it should theoretically correlate, and is assessed by comparing constructs within the new instrument to another instrument measuring the same construct (Siegle, (n.d.)). Convergence is the agreement between two instruments or indicators measuring the same construct (Blackburn et al., 2006). Furthermore, it is the degree to which a test measures what it is intended to measure, and insurance that the scores truly reflect the construct they are intended
Constructs within a questionnaire that do not have an exact quantifiable meaning must be tested against values of similar constructs in order to support the evaluation method’s measure of intended constructs (Townsend & Kaiser, 2005). Convergent testing determines how well the questionnaire measures the underlying constructs it is targeting (Mahoney, Thombs, & Howe, 1995). Evidence of convergent validity will ultimately support the meaning of the test scores generated from the 10-item FVQ. Examination of construct validity asks the question, “Do the items reflect actual behavior as we are claiming?” (Townsend, 2006). The level of correspondence between the two constructs on the 10-item FVQ, frequency of eating a variety of FV and frequency of choosing a FV for a snack, compared to the 24-HDR variety and snacking scores will give evidence to convergent validity.

3) Sensitivity or Responsiveness: A sensitive test is one with the ability to detect changes in behavior over time (Kimberlin & Winterstein, 2008). The extent to which a measure is sensitive or responsive to changes in a desired behavior will determine its ability to be used in repeated measures of change in a given construct (Townsend, 2006). Sensitivity is assessed in a pre- and post-intervention design. Outcome measures intended to evaluate the effectiveness of educational interventions, particularly SNAP-Ed, responsiveness to changes that result from the intervention is required (Kimberlin & Winterstein, 2008; Townsend, 2006).
4) **Internal Consistency:** This is also known as homogeneity of the scale, meaning all items in the questionnaire contribute to the construct (Townsend, 2006). Internal consistency tests each item’s internal reliability by analyzing how well each item correlates to the total score (Blackburn et al., 2006; Cronbach, 1951). The 10-item FVQ is proposing to measure frequency of FV consumption and testing for internal consistency will determine whether similar constructs produce similar scores. Individual item examination determines the extent of the relationship between each item with the rest of the items in the construct, and a positively correlated item value predicts a respondent’s performance on the test as a whole (Townsend & Kaiser, 2005).

5) **Test-re-test reliability:** In order for a test to be considered valid, it must be reliable. A reliable test is one that yields a similar score upon repeated administration, measuring the respective items consistently (Kimberlin & Winterstein, 2008; Siegle, (n.d.)). Reliability represents the consistency of a subject’s response on an evaluation tool and can be evaluated by examining the consistency of test scores from the same respondent at two different points in time (Townsend, 2006; Wall et al., 2012). If an instrument is reliable, then respondents will reply to the item with the same answer at each administration point with no educational intervention. Test-retest reliability measures consistency of the same individual from one administration point to the next without an intervention, determining the correlation or strength of association between the two sets of scores (Kimberlin & Winterstein, 2008; Siegle, (n.d.)).
The time between test administrations should be long enough that subjects are not victim to recall bias (e.g. a subject’s memory of responses to the first administration of the test), but not so distant that a learning or event could alter the way subjects respond during the second administration (Siegle, n.d.).

**Rationale Behind Validating the 10-item FVQ**

This review of the literature demonstrates the absence of validated dietary assessment tools measuring FV consumption in 9-11 year old children living in low-income households. The 10-item FVQ was developed to assess FV consumption in low-income 9-11 year olds participating in SNAP-Ed programs (Manganiello, 2012). The 10-item FVQ combines 3 patterns of behavior, each related to FV intake: 1. frequency of consumption; 2. frequency of consuming a variety of FV; and 3. frequency of trying new FV. A total score is calculated from the 10-item FVQ reflecting actual FV intake. The 10-item FVQ has been developed to represent FV intake, with an increase in the 10-item FVQ score representing an increase in actual FV consumption.

Questions were developed to be age-appropriate for the target population (low-income, 9-11 year old children) and reflect themes from the 2010 Dietary Guidelines. Each question was rigorously tested for content and face validity via a 95-person national expert panel and multiple child (9-11 year old) focus groups, respectively (Manganiello, 2012).

While detailed and validated dietary assessment measures, such as 24-HDRs and FFQs, do exist for this target population, these dietary assessment measures are
not appropriate for public health nutrition programs due to the limited resources available for their administration and analysis (Blackburn et al., 2006). The 24-HDR was chosen as the standard of comparison based on its ability to quantify estimated FV intake, the age and cognitive ability of the target population, as well as its widespread use among other community-based nutrition interventions and validation studies (Blackburn et al., 2006; Cullen et al., 2008; Eaton et al., 2013; Edmunds & Ziebland, 2002; Reynolds et al., 2000; Thiagarajah et al., 2008; Townsend, 2006; Townsend & Kaiser, 2005). Ideally, a 3-day 24-HDR would be used as the criterion of comparison in this study; however, given the time limitations dictated by the school, researchers were unable to arrange for multiple testing days. A food record would also be appropriate for gathering accurate dietary intake; however, food records in this child population can be difficult to send home and rely on children to return. Additionally, normal dietary habits may change due to the record keeping, and children have been shown to under-report as much as 20% in addition to the high response burden (Australasian Child and Adolescent Obesity Research Network 2010). For the above reasons, the 24-HDR was chosen as the representation of dietary intake for this study. The absence of brief, validated dietary assessment tools measuring FV consumption among 9-11 year old children in SNAP-Ed programs makes validation of tools like the 10-item FVQ essential to assess dietary intake and evaluate the efficacy of community nutrition programs.
Chapter 3: A Pilot Study: Feasibility of the 10-item Fruit and Vegetable Questionnaire

The purpose of the pilot study was to test the feasibility of implementing the 10-item FVQ in a low-income classroom setting. Feasibility Studies are used to estimate parameters needed to design the main study, and are defined as “pieces of research done before a main study in order to answer the question “Can this study be done?” (National Institute for Health Research, 2014). In this pilot study, feasibility was assessed by observing each participant’s ability to self-complete the 10-item FVQ, the time needed to complete both tests, and the practicability of administering the 24-HDR and the 10-item FVQ within the same testing period. Results from this study were used to inform the implementation of a large-scale study encompassing convergent and criterion validity, sensitivity, internal consistency, and test-re-test reliability. The Ohio State University’s Institutional Review Board approved the study protocol (2013HO193).

Participant Recruitment:

The University District Freedom School (UDFS) is a summer literacy program that enrolls low-income children grades pre-kindergarten-12th. Children enrolled in the 3rd and 4th grade classrooms (9-11 years) at the UDFS were invited to participate in the study. Recruitment took place during the first week of the UDFS summer program at child pick-up and drop-off when parents could be accessed to
take and sign consent forms. All children enrolled at the UDFS took part in a 6-week nutrition and physical activity program called “Camp Nutrition and Fitness” (CNF); however, consent was needed for assessment of primary and secondary program outcomes. For the purpose of this report, we will only focus on the feasibility portion of the study. Participants were identified as those who 1) were enrolled in the UDFS 3rd or 4th grade classroom (9-11 years), 2) signed the child assent and had parental consent, 3) completed a matched 10-item FVQ and 24-HDR.

**Testing**

The study sought to replicate testing conditions needed for examining validity and reliability. In examining validity, the new test and established test must be administered at the same time. Prior to the start of CNF or following the completion of CNF, child participants aged 9-11 years (n=17) completed the 10-item FVQ followed by a one-day 24-HDR during the same testing period, with the 10-item FVQ always being administered before the child met with a 24-HDR facilitator. Trained graduate and undergraduate nutrition research assistants and nutrition professionals administered the 10-item FVQ followed by the 24-HDR to study participants. A food record was also sent home with each child to fill out and bring back the following day to assist in the 24-HDR collection.

Each child sat individually with a trained graduate/undergraduate nutrition research assistant or nutrition professional to complete the 24-HDR using the USDA multiple pass approach. Several cognitive techniques have been set in place to assist children in the dietary recall process. For example, *recognition* involves providing
children with a list of foods and asking him or her to report or recognize whether he or she ate the food. Recognition does not require construction of the previous day’s meals or activities in order to recall particular foods (Baranowski & Domel, 1994). In this study, children were provided with a list of lunch items served in the school cafeteria the previous day to aid in the recall. Retrieval occurs when a person is asked to remember the previous day and construct what was eaten during the day. Children must use the information about events that happened the previous day in order to cue what he/she ate (Baranowski & Domel, 1994). Retrieval techniques were used to prompt children to remember events of the day preceding in order to recall foods eaten. Attention to foods eaten is required for accurate recall; if a child does not notice some aspect of his or her meal, it cannot be recalled (Baranowski & Domel, 1994). To overcome this barrier to accurate recall, the trained research assistants used probing techniques for FV, where components of a meal, dish, or food that may have been forgotten are anticipated by the facilitator and presented to the child; this provided him or her with the opportunity to recall forgotten components of the meal. Facilitators also used the National Dairy Counsel [fruit and vegetable] Food Models which provide visual cues of the FV itself, along with the appropriate serving size. These models along with plates, cups, and measuring spoons assisted children in relaying more accurate information regarding the types and amounts of fruits or vegetables they ate.

The 10-Item FVQ is designed to serve as a quick measure FV intake among 9-11 year old low-income children; therefore, the test was administered as it would
be in a SNAP-Ed group setting to test fidelity of implementing the tool in a classroom setting during SNAP-Ed programming, as well as the feasibility of testing in a larger research setting. The 10-item FVQ survey items were read aloud to eliminate bias towards variability in reading ability among students and between classrooms (Edmunds & Ziebland, 2002; Townsend, 2006). Children were allowed to read and work ahead; however, each question was read completely by the facilitator and ability to complete the questionnaire was assessed. Prior to the questionnaire’s completion, the facilitator read aloud a standardized script, explaining the questionnaire and encouraging honest answers. (Appendix A).

**Analysis**

The main outcome measure was testing feasibility. Feasibility was assessed by facilitator observation based on the child participant’s ability to 1. Fully understand and complete the 10-item FVQ in a group setting; 2. Complete the 24-HDR and 10-item FVQ during the same testing period; 3. Complete the 24-HDR and 10-item FVQ within the allotted time period (45-minutes). Abilities pertaining to the feasibility assessment were documented in a checklist next to each child participant’s ID number. Researchers also noted if students were unable to understand any of the questions.

**Results and Discussion**

All child participants ages 9-11 (n=17) were able to fully complete the 10-item FVQ on their own, demonstrating feasibility of using the 10-item FVQ in
classroom setting among children living in low-income households. Additionally, all child participants ages 9-11 were able to complete the 24-HDR assessment following the 10-item FVQ. Each child participant was additionally able to complete both assessment measures within the allotted 45 minute testing period. Completion of the 10-item FVQs took anywhere from 5-10 minutes.

Two bilingual children (Spanish and English speaking) had greater difficulty completing the questionnaire from a language standpoint versus comprehension. Once assisted by a translator, the questionnaires were accurately completed. In future studies or research settings, a copy of the 10-item FVQ in Spanish may assist in accurate data collection. Additionally, after the standardized 10-item FVQ script was read to the children and questions were encouraged, several questions arose related to specific foods and whether they counted as a fruit or vegetable (i.e. fruit juice, vegetable juice, French fries, ketchup, tomatoes, olives, beans). In future studies, the script should be modified to include common foods that are often misunderstood in order to provide accurate reports of intake from the 10-item FVQ. Children may have a particularly difficult time identifying which foods are vegetables. Only one student returned his or her completed food record the following day, and two students brought them the following day but the records were incomplete. The lack of compliance children had in returning the self-completed forms suggests that food records may be an unreliable form of dietary collection for the purpose of a larger-scale study. The results from this study support and help to inform the design of a larger validation study among low-income child participants.
Conclusions and Implications of Findings

Feasibility studies are pieces of research conducted prior to a larger study in order to estimate the parameters needed to design the main study (National Institute for Health Research, 2014). Feasibility was demonstrated in the 10-item FVQ’s quick and easy administration in a classroom setting, and the capability of the questionnaire to be completed by the child participants in the allotted time. In addition, children demonstrated the ability to complete both the 10-item FVQ and 24-HDR within the same testing period, making this an appropriate design for future validation studies.

This study serves as the groundwork for a larger validation study encompassing convergence, sensitivity, internal consistency, test-re-test reliability, and further validation of criterion-related validity. A larger validation study should include an increased sample size (n=85-100) to give greater power to the study and thus establish stronger evidence of validity. Modifications should be made to the script read before the 10-item FVQ to ensure children are properly classifying FV, and translators or translated questionnaires need to be available to overcome language barriers. Validation of this quick and easily administered tool will allow its use among 9-11 year old children living in low-income households, strengthening the assessments conducted among SNAP-Ed program participants and providing a dietary assessment tool that may be used to assess dietary intake in place of more cumbersome methods.
Chapter 4: Validation of a 10-item Questionnaire Measuring Fruit and Vegetable Consumption in 9-11 year old Children Living in Low-Income Households

Abstract

**Background:** Many low-income children do not consume the recommended amounts of fruits and vegetables (FV). For this reason, a primary objective of the Supplemental Nutrition Assistance Program Education (SNAP-Ed) is to increase children’s consumption of FV. To accurately measure dietary changes related to FV intake, validated assessment tools that are quick and easy to administer are needed; however, few such tools exist.

**Objective:** To test a 10-item fruit and vegetable questionnaire (10-item FVQ) for criterion and convergent validity, sensitivity, test-re-test reliability, and internal consistency.

**Participants:** The study took place among 9-11 year old children attending a SNAP-Ed-eligible elementary school. Four 3rd grade and four 4th grade classrooms were invited to participate. The study included 3rd (n=46) and 4th grade (n=40) participants, with the majority being white (93%).

**Main Outcome Measures:** Criterion validity was assessed by comparing the total score on the 10-item FVQ to total servings of FV as reported on a single 24-hour dietary recall (24-HDR). Convergent validity analyzed the “variety” and
“snack” constructs from the 10-item FVQ compared to variety and snack reference scores generated from the matched 24-HDR. Sensitivity of the 10-item FVQ was assessed by comparing scores pre- and post- a 4 lesson FV intervention to FV servings reported on the 24-HDR. Reliability was evaluated by administering the 10-item FVQ at two time points one week apart, pre-intervention, and internal consistency by analyzing scores on a single 10-item FVQ. Pearson correlation was used to assess criterion and convergent validity, and sensitivity. Reliability was measured using a pairwise t-test, intraclass correlation coefficient, and Cronbach’s alpha.

**Results:** Correlation between the total scores on the 10-item FVQ and 24-HDR was significant ($r = 0.36, p < 0.005$), in addition to the total variety ($r = 0.306, p < 0.01$) and total snack scores ($r = 0.329, p < 0.01$). Fruit as a snack ($r = 0.322, p < 0.01$) and variety of vegetables ($r = 0.256, p < 0.05$) demonstrated a moderately significant correlation to the 24-HDR reference scores. Sensitivity testing showed a moderately significant correlation of $r = 0.287 (p < 0.05)$. Test-re-test reliability demonstrated strong agreement between repeated testing measures ($r = 0.784, p < 0.0001$) and internal consistency assessment yielded a Cronbach’s alpha of 0.806 and a significant intraclass correlation coefficient of 0.775 ($p < 0.001$).

**Conclusions and Implications:** Results from this study suggest that the 10-item FVQ is a valid and reliable measure of FV intake behaviors among 9-11 year old children. Further testing of the 10-item FVQ in a pre/post intervention design is needed to further investigate the questionnaire’s sensitivity to detecting change,
differences among gender, and use within various ethnic groups. Evidence from this study suggests the 10-item FVQ may be used as a short and easy to administer alternative to traditional methods of dietary collection in assessing FV intake among low-income 9-11 year old SNAP-Ed participants.

**Methods**

The study design for the 10-item FVQ validation was based off multiple peer-reviewed validation studies related to dietary intake and/or FV intake in children. In addition, the research was used to guide the methodology behind each type of validity testing (Blackburn et al., 2006; Cullen et al., 2008; Dickin et al., 2012; Eaton et al., 2013; Edmunds & Ziebland, 2002; Lytle et al., 1993; Paxton et al., 2011; Thiagarajah et al., 2008; Townsend, 2006; Wall et al., 2012; Willett & Trichopoulos, 1996). The Ohio State University’s Institutional Review Board approved the study protocol (2014B0048). Written permission was also obtained from the principal of the elementary to participate in both SNAP-Ed programming and the research study.

**Study Population and Recruitment**

This study took place in a rural elementary school in Wintersville, Ohio. Wintersville Elementary is a SNAP-Ed eligible school based on ≥50% of the children being on free or reduced lunch. Prior to this study, no FV lessons have been taught by SNAP-Ed to this population. In addition, no nutrition research interventions have been conducted in this setting, making this a population without
saturation from previous programs and studies. Four 3rd and four 4th grade classrooms were invited to participate in the study and recruitment packets were sent home with an information flyer to parents. A demographics questionnaire was also sent home along with the recruitment materials to be filled out by a parent or guardian. Potential participants were offered a red “Ohio State Extension” reusable grocery bag upon form return. Children who returned completed parental consent and child assent forms were able to participate.

**10-Item Fruit and Vegetable Questionnaire Administration**

The 10-item FVQ was administered in a group setting, either in the classroom or by a testing set-up in the school cafeteria. Each time the 10-item FVQ was administered prior to the 24-HDR recalls. Children were asked to complete their own questionnaire without discussing with other classmates. A standardized script was read aloud to ensure children’s comprehension of the questions being asked, and to define which foods were classified as a fruit and/or vegetable for the sake of the 10-item FVQ (Appendix B). Additionally, children were encouraged to ask questions if a particular food item was unclear as being a FV. The 10-item FVQ survey items were read aloud to eliminate bias towards variability in reading-ability between students and classrooms (Edmunds & Ziebland, 2002; Townsend, 2006). Participants were allowed to work ahead, but guidance was given for those who preferred verbal cues for each item. The 10-item FVQ was given at three time points:
1) Pre-intervention [Pre-test 1 (pre-test for test-re-test reliability)]
2) Re-test after 1 week with no intervention [Pre-test 2 (post-test for test-re-test reliability; pre-test for sensitivity; criterion, and convergent validity testing)]
3) Re-test after the 4 lesson intervention [Post-test (post-test for sensitivity)]

24-Hour Dietary Recall Interviews

The single 24-HDRs were administered to each individual participant by a facilitator trained in the USDA’s multiple-pass method ( Procedures for Collecting 24-hour Food Recalls) This method includes the following steps: 1) obtain a complete list of foods eaten the previous day; 2) after all foods are listed, go back and obtain amounts of each food eaten and whether all the food served was eaten; 3) once all foods and amounts have been reported, go back through the list and probe for forgotten foods. The recalls were given during a non-weekend period (Tuesday-Friday) to represent typical intake. With each participant, 24-HDR administration always followed the completion of the 10-item FVQ, with each test covering the same dietary reference period (Thiagaraja et al., 2008). Recalls were collected at two time points with all eligible and present participants, pre- and post-intervention.

Several cognitive techniques have been set in place to assist children in the dietary recall process. For example, recognition involves providing children with a list of foods and asking him or her to report or recognize whether he or she ate the food. Recognition does not require construction of the previous day’s meals or activities in order to recall particular foods (Baranowski & Domel, 1994). In this study, 24-HDR facilitators were provided with the school breakfast and lunch menu to aid in each child’s ability to recall foods purchased from the school. Retrieval
occurs when a person is asked to remember the previous day and construct what was eaten during the day. Children must use the information about events that happened the previous day in order to cue what he/she ate (Baranowski & Domel, 1994). In this study, retrieval techniques were used to prompt children to remember events from the preceding day in order to accurately recall foods eaten. Attention to foods eaten is required for accurate recall; if a child does not notice some aspect of his or her meal, it cannot be recalled (Baranowski & Domel, 1994). To overcome this barrier, research assistants used probing techniques, where components of a meal or food that may have been forgotten are anticipated by the facilitator and presented to the child, providing the opportunity to recall each component of the meal.

**Intervention**

The intervention focused on increasing FV consumption in 9-11 year old children through the use of an evidence-based nutrition education curriculum, “Balance My Day” for 3rd-5th grade. “Balance My Day” incorporates group work, discussion, movement, observation, reasoning, knowledge, and behavioral-based strategies based on the Centers for Disease Control HECAT (Health Education Curriculum Analysis Tool) outcomes and standards, to help promote healthy eating habits among children. The curriculum is based on the Social Cognitive Theory and the Socio Ecological Model. Social Cognitive Theory seeks to affect health knowledge, self-regulatory skills (motivation and decision-making), and self-efficacy (confidence level) by offering lessons and activities that teach and provide practice for the development of these skills (Hohnbaum & James, 2010). Each of the
FV focused lessons were taught by a SNAP-Ed Program Assistant (PA) who was trained in using the “Balance My Day” curriculum. A standardized lesson script was also provided to the educator to ensure consistency between lessons taught to different classrooms. The curriculum provides 3 lessons focusing specifically on FV at breakfast, snack, and meal time. In addition, a fourth lesson related to “MyPlate” and healthy eating was added to give the children a baseline of nutrition knowledge. Other studies have demonstrated 4-lessons to be adequate for improving nutrition knowledge and promoting behavior change in children (Wall et al., 2012). The intervention lessons were designed to be delivered in the classroom setting, with one nutrition education session delivered every week to each of the four 3rd and four 4th grade classrooms.

10-Item Fruit and Vegetable Questionnaire Analysis

The 10-item FVQ responses were coded, with each answer worth a varying point value, where higher values represent greater frequency of FV intake. A total score was then calculated for each of the three administration points, representing frequency of FV consumption at each test point. Incomplete questionnaires were omitted from analysis.

A=5, B=4, C=3, D=2, E=1

5) During the past week, I ate fruit:

a. Everyday
b. Almost everyday
c. Sometimes
d. Almost never
e. Never
For questions where participants were able to choose multiple responses, one point was given for each response chosen, with the exception of option “f. I do not eat vegetables”, where 0 points were awarded to ensure the total score accurately reflects intake.

4) When I eat vegetables, I eat them (You can circle more than one answer):

   a. With my breakfast (1)
   b. As a morning snack (1)
   c. With my lunch (1)
   d. As an afternoon snack (1)
   e. With my dinner (1)
   f. I do not eat vegetables (0)

The questionnaire consists of five fruit specific questions and five vegetable specific questions. A total score for both FV, independently, was also calculated for comparison against individual FV servings, as reported by the 24-HDR.

A variety score was generated for fruits, vegetables, and total FV based on the following two questions: (A=5, B=4, C=3, D=2, E=1)

I eat different kinds of fruit everyday:

   a. Always
   b. Almost always
   c. Sometimes
   d. Not very often
   e. Never

I eat different kinds of vegetables everyday:

   a. Always
   b. Almost always
   c. Sometimes
   d. Not very often
   e. Never
Similarly, a snack score was also computed for fruits, vegetables, and total FV based on the following questions pertaining to FV snacking:

A=5, B=4, C=3, D=2, E=1

1) During the past week, I ate **fruit as snacks**:
   - a. Everyday
   - b. Almost everyday
   - c. Sometimes
   - d. Almost never
   - e. Never

2) During the past week, I ate **vegetables as snacks**:
   - a. Everyday
   - b. Almost everyday
   - c. Sometimes
   - d. Almost never
   - e. Never

**24-Hour Dietary Recall Analysis**

Servings of FV were analyzed using the Nutrition Data System for Research (NDSR) [additional details about the Food Group Serving Count System are available from (Harala P, ed. NDSR Nutrition Data System for Research. Minneapolis, MN: University of Minnesota; 2009)]. Fruits and vegetables consumed were totaled by the NDSR system and reported in food group “servings”, in line with the USDA guidelines for FV servings (Choose MyPlate: What Counts as a Cup?). Three serving scores were calculated: 1) A total FV score; 2) A total fruit only score; 3) A total vegetable only score. School breakfast and lunch menus were used to clarify school lunch items recorded on the 24-HDRs. In addition, a variety and snack score were also derived from the 24-HDR data for both FV. Each meal was
analyzed for the number of different kinds of FV consumed, independent of servings. Similarly, FV recorded as snacks on the 24-HDR were translated to a FV snack score. From there, a total score, fruit only score, and vegetable only score were calculated for both variety and snacks.

The goal of the 10-item FVQ is to measure behavior changes in FV intake resulting from nutrition education programs. The definition of a FV serving for the purpose of this study included sources of whole or cut-up FV (canned, dried, cooked or uncooked) as described by “MyPlate” (Dietary Guidelines for Americans, 2010), and whole FV included in a mixed dish or as a topping. Fruits and/or vegetables with low nutrient or high fat and/or sugar content or those that contribute mostly energy and should not count toward achieving the recommended cup servings were not counted in the consumption score. For example, tomato sauce, ketchup, jelly, pies, fruit and vegetable drinks (100% or fruit flavored), pizza, vegetable chips, potatoes and fried potatoes were not counted because these foods do not reflect the desired behavior change and are lower in nutrients and/or contribute mostly to excess energy, sugar, and/or fat (Cullen, Baranowski T., Baranowski J., Herbert, De moor, 1999; Smith et al., 1995). The NDSR system uses the amounts of FV entered from the 24-HDRs to generate total serving scores for each food group. In general, 1 cup of raw or cooked vegetables and 2 cups raw leafy greens are equal to 1 cup of vegetable, and 1 medium piece of fruit, 1 cup of fruit, or ½ cup of dried fruit count as 1 cup from the fruit group (Choose MyPlate: What Counts as a Cup?).
Data Analysis

Data were analyzed through the Statistical Package for Social Sciences (SPSS) (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.). Each outcome measure and its analysis are detailed below. Pearson correlation was chosen based on the data’s normal and linear distribution. Statistical significance was set at \( P < 0.05 \) for all analyses. Correlation strengths were reported as follows: 0-0.19, regarded as very weak, 0.2-0.39 as weak, 0.40-0.59 as moderate, 0.6-0.79 as strong and 0.8-1 as very strong correlation; these, however, are arbitrary limits, and the context of the results should be considered (Armitage & Berry, 1994).

Criterion Validity

A total score was calculated from each 10-item FVQ, and a total FV servings score generated from each 24-HDR. The level of agreement was tested between the pre-intervention 10-item FVQ and matched 24-HDR scores to demonstrate the level at which the 10-item FVQ represents FV intake as reported by the 24-HDR. Reference values from the 24-HDR were used as the criterion to compare 10-item FVQ scores. Pearson correlation was used to assess the level of agreement between the tests. The 10-item FVQ was considered valid against the 24-HDR if a statistically significant relationship \( (p < 0.05) \) existed between the two measures.

Convergent Validity

To test for convergence, two of the FV constructs reflected in the 10-item FVQ were analyzed: frequency of consuming a FV snack, and frequency of
consuming a variety of FV. These constructs were chosen for their ability to be correlated to the 24-HDR. A variety score was calculated for each participant based on the number of different kinds of FV reported on a single 24-HDR. The fruit variety score from the 24-HDR was then correlated with the score on the 10-item FVQ question pertaining to frequency of consuming a variety of fruits, and the score on the 10-item FVQ question related frequency of consuming a variety of vegetables was correlated with the 24-HDR vegetable variety score. Agreement was also tested between total variety scores, calculated for both the 10-item FVQ (F+V question scores) and the 24-HDR (F+V intake reference values). Similarly, FV snack scores (fruit only, vegetable only, total F+V) were calculated from each 24-HDR based on whether FV were eaten as snacks (as reported on the 24-HDR). The 24-HDR snack scores were tested for agreement with responses to the frequency of consuming a FV snack on the 10-item FVQ. Pearson correlation was used to analyze the convergence between each construct. The snack and variety constructs were considered valid if a statistically significant relationship existed between the construct on the 10-item FVQ and intake reported on the 24-HDR (FV snack, FV variety).

Sensitivity

Sensitivity analysis was conducted to investigate the extent to which the 10-item FVQ detects a change in frequency of FV consumption. The total scores from the 10-item FVQ and the total servings of FV reported on the 24-HDRs were used to test for change in FV intake behaviors pre- and post-intervention. Pearson correlation was used to test the significance of the difference between the 10-item
FVQ pre- and post-intervention scores and 24-HDR pre- and post-intervention scores. A paired t-test was also used to test the level of change between the pre and post test scores on the 24-HDR and 10-item FVQ. The 10-item FVQ was considered sensitive if a statistically significant relationship existed between the change in pre and post scores on the 10-item FVQ and 24-HDR, and if the 10-item FVQ and 24-HDR detected change in a similar manner.

**Internal Consistency**

Internal Consistency of the 10-item FVQ was assessed by comparing scores reported for each question from the pre-reliability test point. Cronbach’s alpha was used to test the strength of the questions within the questionnaire. Inter-item-total correlations (ITC) were calculated to examine the strength of each question or the extent of the relationship between each item and the rest of the items on the questionnaire. A Cronbach’s alpha between 0.60 and 0.69 is minimally acceptable, and an alpha greater than 0.70 is desirable (Cronbach, 1951; Nunnally & Bernstein, 1994). To allow for variation in scores, an ITC range of +0.2-0.8 is preferred among nutrition education instruments (Nunnally & Bernstein, 1994; Townsend, 2006).

**Test-re-test Reliability**

Testing for test-re-test reliability took place one-week prior to 24-HDR collection, and prior to the nutrition education intervention. The first administration of the 10-item FVQ (pre-test 1) took place in the classroom setting and standardized procedures were followed (see 10-item FVQ Administration section). The 10-item FVQ was re-administered one week later (pre-test 2) to eliminate recall bias, with no
nutrition education administered during the week. Students completed the test a second time in the school cafeteria where a classroom experience was replicated; child participants were read the standardized script and encouraged to ask questions for clarification. The two test scores were analyzed to quantify the strength of the correlation between pre- and post-tests using a paired t-test and Intraclass Correlation Coefficient (ICC). The t-test was used to test for consistency or bias across all subjects between the two testing points, while the 2-way mixed ICC was used to demonstrate inter-rater reliability and provide a means for quantifying the level of rater agreement and consistency, or, how consistent and stable the test is over time (Laschinger, 1992). In general, the ICC can be classified as a slight agreement if under 0.20, a fair agreement being from 0.20-0.40, a moderate agreement from 0.40 to 0.60, a substantial agreement from 0.60 to 0.80, and perfect agreement from 0.80 to 1.00 (Landis & Koch, 1977).

**Results**

**Participants**

The study participants consisted of 86 students, 9-11 years of age. Participants voluntarily returned completed parental consented and child assent forms in order to participate. Baseline respondent characteristics including gender and grade (based on total participants, n=86), as well as ethnicity and food assistance (based on parent-completed demographics questionnaires, n=29) are detailed in Table 1.
Data Collection

The timeline for data collection and specific tests administered is detailed in Table 2.

<table>
<thead>
<tr>
<th>Table 1: Baseline Characteristics of 3rd and 4th Grade Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender (n=86)</strong></td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td><strong>Grade (n=86)</strong></td>
</tr>
<tr>
<td>Third Grade</td>
</tr>
<tr>
<td>Fourth Grade</td>
</tr>
<tr>
<td><strong>Age</strong></td>
</tr>
<tr>
<td>9 years</td>
</tr>
<tr>
<td>10 years</td>
</tr>
<tr>
<td>11 years</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
</tr>
<tr>
<td>White (non-hispanic/Latino)</td>
</tr>
<tr>
<td>African American</td>
</tr>
<tr>
<td>American Indian</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td><strong>Food Assistance</strong></td>
</tr>
<tr>
<td>School Breakfast</td>
</tr>
<tr>
<td>Free and/or Reduced Lunch</td>
</tr>
<tr>
<td>SNAP&lt;sup&gt;b&lt;/sup&gt; Assistance</td>
</tr>
<tr>
<td>Food Pantries or Food Banks</td>
</tr>
<tr>
<td>WIC&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Fruit and Vegetable Servings</strong>&lt;sup&gt;d&lt;/sup&gt; (n=77)</td>
</tr>
<tr>
<td>Fruit Servings</td>
</tr>
<tr>
<td>Vegetable Servings</td>
</tr>
<tr>
<td>Total Fruit and Vegetable Servings</td>
</tr>
</tbody>
</table>

<sup>a</sup>Data from parent-completed participant demographics questionnaires (n=29)
<sup>b</sup>Supplemental Nutrition Assistance Program
<sup>c</sup>Women, Infants, Children
<sup>d</sup>Servings of fruits and vegetables based on 1-day 24-hour dietary recall; means reported by NDSR (Nutrition Data System for Research)
<sup>e</sup>Standard Deviation
### Table 2: Schedule of Testing and Intervention Procedures

<table>
<thead>
<tr>
<th>Date</th>
<th>Testing/Lessons</th>
<th>Curriculum/Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friday, March 28&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Initiate Consent Process in school</td>
<td>Parental Consent/Child Assent-Visit each class</td>
</tr>
<tr>
<td>Monday, March 31&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Consent Form Reminder/Return</td>
<td>SNAP-Educator visit and remind students</td>
</tr>
<tr>
<td><strong>Tuesday April 1&lt;sup&gt;st&lt;/sup&gt;</strong> Pre-Test 1</td>
<td>Pre-test, Reliability</td>
<td>10-Item FVQ</td>
</tr>
<tr>
<td><strong>Tuesday, April 8&lt;sup&gt;th&lt;/sup&gt;</strong> Pre-Test 2</td>
<td>Post-Test, Reliability Criterion, Convergent Pre-test, Sensitivity</td>
<td>10-Item FVQ and 24-HDR Administration</td>
</tr>
<tr>
<td>Wednesday, April 30&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Lesson #1</td>
<td>Breakfast Power-“My Plate Planning Tool”</td>
</tr>
<tr>
<td>Wednesday, May 14&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Lesson #2</td>
<td>Breakfast Power-“Go to Foods, Fruits &amp; Veggies”</td>
</tr>
<tr>
<td><strong>Monday, May 19&lt;sup&gt;th&lt;/sup&gt;</strong> - Observe</td>
<td>Lesson #3</td>
<td>Meal Appeal-“Amazing Fruits &amp; Veggies”</td>
</tr>
<tr>
<td><strong>Tuesday, May 27&lt;sup&gt;th&lt;/sup&gt;</strong></td>
<td>Lesson #4</td>
<td>Snack Attack-“Fruits &amp; Veggies: Crunch &amp; Munch”</td>
</tr>
<tr>
<td><strong>Wednesday, May 28&lt;sup&gt;th&lt;/sup&gt; &amp; Friday, May 30&lt;sup&gt;th&lt;/sup&gt;</strong> Post-Test</td>
<td>Post-Test, Sensitivity</td>
<td>10-Item FVQ and 24-HDR Administration</td>
</tr>
</tbody>
</table>
Validity and Reliability Reports

A summary of the statistical analyses for each type of validity and reliability are reported in Tables 3, 4, and 5, and detailed below.

Criterion Validity

A total of 77 respondents completed a matched 10-item FVQ and 24-HDR at the pre-intervention test point. Correlation between 10-item FVQ total scores ($M = 32.22, SD = 6.55$) and total servings of FV as reported on the 24-HDR ($M = 3.14, SD = 3.05$) was significant with a weak to borderline moderate correlation ($r = 0.36, p < 0.005$).

Convergent Validity

A total of n=77 matched 10-item FVQs and 24-HDRs were analyzed to determine convergence of both the variety and snack constructs within the 10-item FVQ. The total variety (F+V) score from the 10-item FVQ ($M = 6.47, SD = 1.82$) [i.e. “I eat different kinds of fruit/vegetables everyday”] was significantly correlated with the total variety score calculated from the different kinds of FV reported on the 24-HDRs ($M = 3.195, SD = 2.248$), ($r = 0.306, p < 0.01$). The fruit only variety scores between the 10-item FVQ ($M = 3.56, SD = 1.07$) and 24-HDR ($M = 1.51, SD = 1.25$), were not significantly correlated ($r = 0.051, p > 0.05$). However, the vegetable only variety scores between the 10-item FVQ ($M = 2.91, SD = 1.13$) and 24-HDR ($M = 1.69, SD = 1.82$), were significantly correlated ($r = 0.256, p < 0.05$).
Additionally, total combined scores from the two snack questions on the 10-item FVQ (M=6.68, SD=1.66) [“During the past week, I ate fruit/vegetables as snacks”] were significantly correlated with FV consumed as snacks as reported on the 24-HDR (M=0.7922, SD=1.06), (r = 0.329, p < 0.01). Examining the fruit snack scores and vegetable snack scores individually, the “fruits as snacks” question was significantly correlated with children eating fruit as a snack (r = 0.322, p < 0.01); however, the “vegetables as snacks” question was not significantly correlated to the 24-HDR reports (r = 0.141). The significant correlations are classified as weak based on the 0.2-0.39 cut-points.
Table 3. Association between 10-item Fruit and Vegetable Questionnaire Responses and Items Recorded from 24-Hour Dietary Recall

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>r (^a)</th>
<th>p value(^*)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Criterion(^b) (n=77)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FVQ(^c)</td>
<td>32.22</td>
<td>6.55</td>
<td>.360</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>24HDR servings(^d)</td>
<td>3.14</td>
<td>3.05</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Convergence</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total snack score(^e) (n=77)</td>
<td>---</td>
<td>---</td>
<td>.329</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>FVQ total snack score</td>
<td>6.68</td>
<td>1.66</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>24HDR total snack score</td>
<td>.79</td>
<td>1.06</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Snack Score, Fruit (FVQ &amp; 24-HDR)</td>
<td>---</td>
<td>---</td>
<td>.322</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Snack Score, Vegetable (FVQ &amp; 24-HDR)</td>
<td>---</td>
<td>---</td>
<td>.141</td>
<td>NS(^g)</td>
</tr>
<tr>
<td>Total variety(^f) (n=77)</td>
<td>---</td>
<td>---</td>
<td>.306</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>FVQ variety score</td>
<td>6.47</td>
<td>1.82</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>24HDR variety score</td>
<td>3.19</td>
<td>2.25</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Variety, Fruit (FVQ &amp; 24-HDR)</td>
<td>---</td>
<td>---</td>
<td>.051</td>
<td>NS(^g)</td>
</tr>
<tr>
<td>Variety, Vegetable (FVQ &amp; 24-HDR)</td>
<td>---</td>
<td>---</td>
<td>.256</td>
<td>&lt; 0.05</td>
</tr>
</tbody>
</table>

FVQ indicates the 10-item fruit and vegetable questionnaire; 24-HDR indicates a 1-day 24-hour dietary recall

\(^a\)Pearson correlation coefficients

\(^b\)Total scores (0-50) from FVQ and total servings scores from the 24-HDR

\(^c\)Score 0-50 based on added scores from each of the 10 questions on the FVQ

\(^d\)Servings of fruit + servings of vegetables per day based on 24-HDR

\(^e\)FVQ combined (total) score from 2 snack-specific questions (0-10); 24-HDR total snack score reported in servings of fruits as snacks + vegetables reported as snacks. Individual fruit and vegetable snack scores calculated from both the FVQ (snack questions) and 24-HDR (snack servings)

\(^f\)FVQ combined (total) score from 2 variety-specific questions (0-10); 24-HDR total variety score reported in number of different kinds of fruits + number of different kinds of vegetables. Individual fruit variety and vegetable variety scores calculated for both the FVQ and 24-HDR

\(^g\)NS indicates “no significance”

\(^*\)P ≤ 0.05
Sensitivity

The mean servings of FV decreased from 3.141 (pre-intervention) to 2.655 (post-intervention), as reported by the NDSR analysis of the 24-HDRs. Additionally, the mean score on the 10-item FVQ also decreased from pre-intervention (32.221, n=77) to post-intervention (29.609, n=68). There was a significant but weak correlation ($r = 0.287, p < 0.05$) between the change in post minus pre scores on the 24-HDR and change in post minus pre scores on the 10-item FVQ (n=68). However, results from the paired t-test [(Post 24HDR-Pre 24HDR), ($t(-1.13) =67, p = 0.264$); (Post 10itemFVQ-Pre10item FVQ), ($t(-3.75) =67, p < 0.0005$)] report the change recorded from the 10-item FVQs as being significant, while the 24-HDR reports no significant change.

<table>
<thead>
<tr>
<th>Testing Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Tests</th>
<th>$p$ value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Δ post-pre $^a$</td>
<td></td>
<td></td>
<td>.287$^a$</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>FVQ (post-pre scores)$^b$, n=68</td>
<td>(-2.19)</td>
<td>4.85</td>
<td>(-3.75)$^c$</td>
<td>&lt;0.0005</td>
</tr>
<tr>
<td>24HDR (post-pre scores)$^d$, n=69</td>
<td>(-.411)</td>
<td>3.00</td>
<td>(-1.13)$^c$</td>
<td>NS$^e$</td>
</tr>
</tbody>
</table>

FVQ indicates the 10-item fruit and vegetable questionnaire; 24-HDR indicates a 1-day 24-hour dietary recall
Fruit juice, vegetable and/or fruit based condiments and snack foods (jellies, ketchup, sauces, tortilla chips), potatoes or fried potatoes were not counted toward vegetable and/or fruit serving scores on the 24-HDR

$^a$Correlation [Pearson] between the change in the 24-HDR servings of fruits and vegetables (Δ post-pre) and the change in the FVQ scores (0-50) (Δ post-pre)

$^b$FVQ; scores (0-50); pre and post intervention; Lower scores denote lower FV intake

$^c$t-statistic (paired samples t-test)

$^d$24-HDR; scores based on servings of fruits and vegetables eaten per day; pre and post intervention; Lower scores denote lower FV intake

$^e$NS indicates *no significance

*P ≤ 0.05
Test-re-test Reliability

A sample of 76 respondents completed the 10-item FVQ twice, with no intervening nutrition education. The ICC of the 10-item FVQ was calculated at 0.775 (95% of confidence interval: 0.667<ICC<0.852). The p value was significant at $p < 0.0005$. The pre-test 1 scores ($M = 32.49, SD = 7.45$) and the pre-test 2 scores ($M = 32.04, SD = 6.40$), analyzed by the paired t-test were not significantly different from one another ($t(75) = 0.838, p = 0.405$), indicating the strong correlation between the two tests was significant ($r = 0.784 (p < 0.0001)$.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Tests</th>
<th>$p$ value*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test-re-Test</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Test 1</td>
<td>32.49</td>
<td>7.45</td>
<td>.838&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Pre-Test 2</td>
<td>32.04</td>
<td>6.40</td>
<td>.784&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>(Pre-test 1 – Pre-test 2)</td>
<td>.447</td>
<td>4.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Internal Consistency</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td>32.26</td>
<td>7.33</td>
<td>.806&lt;sup&gt;d&lt;/sup&gt;</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(n=85)</td>
<td></td>
<td></td>
<td>.775&lt;sup&gt;e&lt;/sup&gt;</td>
<td>(.038-.685)</td>
</tr>
</tbody>
</table>

FVQ indicates the 10-item fruit and vegetable questionnaire

<sup>a</sup> FVQ given at two time points; (Pre-test 1) followed by (Pre-test 2) one week later, no intervention in between

<sup>b</sup> Paired t-test (t-statistic)

<sup>c</sup> Paired t-test (correlation between Pre-test 1 and Pre-test 2)

<sup>d</sup> Cronbach’s alpha

<sup>e</sup> Intraclass Correlation Coefficient

<sup>f</sup> Item Total Correlation (Range of 10-item fruit and vegetable questionnaire scores; 19 items analyzed; 18 items reported: Results from “I do not eat vegetables” coded as 0 if chosen; Item total correlation = 0.000)

* $P \leq 0.05$
**Internal Consistency**

The internal consistency of the 10-item FVQ questions (n=85) was acceptable based on a Cronbach’s alpha of 0.806 ($M = 32.26$, $SD = 7.33$). ITC ranged from 0.038-0.685, with the exclusion of answer choice “F-I do not eat vegetables” (0.000), which was coded as a “0” regardless of whether it was chosen or not. Each ITC is detailed in Table 4.

<table>
<thead>
<tr>
<th>Question on 10-item FVQ&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Item Total Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>During the past week, I ate vegetables as snacks</td>
<td>0.685*</td>
</tr>
<tr>
<td>When I am offered a vegetable that I have never eaten before</td>
<td>0.654*</td>
</tr>
<tr>
<td>I eat different kinds of fruit everyday</td>
<td>0.571*</td>
</tr>
<tr>
<td>During the past week, I ate vegetables</td>
<td>0.536*</td>
</tr>
<tr>
<td>I eat different kinds of vegetables everyday</td>
<td>0.525*</td>
</tr>
<tr>
<td>During the past week, I ate fruits as snacks</td>
<td>0.451*</td>
</tr>
<tr>
<td>During the past week, I ate fruit</td>
<td>0.432*</td>
</tr>
<tr>
<td>When I eat vegetables: With my lunch&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.414*</td>
</tr>
<tr>
<td>When I eat vegetables: As an afternoon snack&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.399*</td>
</tr>
<tr>
<td>When I eat vegetables: With my breakfast&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.363*</td>
</tr>
<tr>
<td>When I am offered a fruit that I have never eaten before</td>
<td>0.343*</td>
</tr>
<tr>
<td>When I eat vegetables: With my dinner&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.341*</td>
</tr>
<tr>
<td>When I eat fruit: As a morning snack&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.304*</td>
</tr>
<tr>
<td>When I eat fruit: As an afternoon snack&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.296*</td>
</tr>
<tr>
<td>When I eat fruit: With my breakfast&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.269*</td>
</tr>
<tr>
<td>When I eat vegetables: As a morning snack&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.146</td>
</tr>
<tr>
<td>When I eat fruit: With my dinner&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.127</td>
</tr>
<tr>
<td>When I eat fruit: With my lunch&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.038</td>
</tr>
<tr>
<td>When I eat vegetables: I do not eat vegetables&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.000</td>
</tr>
</tbody>
</table>

*Items considered acceptable based on +0.20 inter-item correlation
<sup>a</sup>For the questions where multiple items may be selected “When I eat fruit/vegetables” each answer choice is reported independently
<sup>b</sup>Questions are listed in order of decreasing item total correlation
The primary purpose of this study was to test a 10-item FV evaluation tool for validity and reliability. “Validity refers to the extent to which a measuring instrument (item or scale) measures what it is intended to measure” (Townsend & Kaiser, 2005). To our knowledge, this is the first brief assessment tool to specifically measure FV intake in 9-11 year old children living in low-income households. This 10-item FVQ is intended for use among federally funded nutrition education programs (i.e. SNAP-Ed) to quickly and easily portray changes in desired dietary intake behaviors. Validated evaluation tools are necessary for use among government-funded programs in order assess program effectiveness, demonstrate behavior change among participants, and advance community nutrition programs. The 10-item FVQ is a non-quantified method of measuring the frequency of FV consumption, aiming to detect changes in patterns of FV intake, with the total score reflecting frequency of FV consumption. A 24-HDR was selected as the criterion method of comparison for this study. Multiple validation studies have used the 24-HDR as the standard of reference for comparing newly developed dietary behavior questionnaires (Blackburn et al., 2006; Eaton et al., 2013; Thiagarajah et al., 2008; Townsend & Kaiser, 2005). Ideally, a 3-day 24-HDR would be used as the criterion of comparison in this study; however, given the time limitations dictated by the school, researchers were unable to arrange for multiple testing days. A food record would also be appropriate for gathering accurate dietary intake; however, food records in this child population can be difficult to send home and rely on children to
return. Additionally, normal dietary habits may change due to the record keeping, and children have been shown to under-report as much as 20% in addition to a high response burden (Australasian Child and Adolescent Obesity Research Network, 2010). Results from the CNF feasibility study (where food records were distributed and children asked to return records the following day) indicated the impracticality of distributing and recollecting food records in this population. Due to the limited exposure researchers had with the study population, records would have been difficult to obtain. In this study population (3rd and 4th grade children, 9-11 years), the 24-HDR is an appropriate tool for collecting dietary intake (Burrows et al., 2010; Lytle et al., 1998).

Criterion testing examined whether scores on the 10-item FVQ correspond to reference values for dietary intake. The significant correlation \( r = 0.36, p < 0.005 \), although falling in the weak correlation range, suggests the scores achieved on the 10-item FVQ may represent FV intake as reported on a 24-HDR. These results are encouraging for community nutrition programs, where validated assessment tools that can be administered by a single program assistant to a wide group of children are needed to measure changes in FV intake behaviors.

The 4-lesson FV focused intervention was designed to encourage FV consumption, thus increasing FV intake. The purpose of this intervention was to elicit behavior change in FV consumption to test the sensitivity of the 10-item FVQ in measuring behavior change. “Balance My Day” is an evidence-based nutrition education curriculum designed to promote positive nutrition and fitness habits in
children by delivering lessons to classroom-sized groups and using activity sheets and goal setting to reinforce target messages. Post-intervention, a decrease in FV intake was detected on the 10-item FVQ, and the negative change in the 24-HDR scores was not significant. Several factors may explain the decrease resulting from threats to the intervention’s fidelity in the areas of intervention adherence (how well intervention components were delivered), exposure (the amount of the intervention delivered to participants), and quality of delivery (Dane & Schneider, 1998). First, the intervention was initially designed to be delivered one time per week to each individual 3rd and 4th grade classroom, meaning, the educator would teach two classes per day, Monday-Thursday over the course of 4-weeks. However, due to the school’s schedule and inability to accommodate additional curriculum, lessons were delivered one day per week in two sections: all 4th grade (4 classrooms, 40 minutes), followed by all 3rd (4 classrooms, 40 minutes). As a result, the SNAP-Ed PA had to modify the delivery of the lessons by making them more large-group oriented (high-energy, active participation), removing all small-group activities, eliminating the use of activity sheets and goal setting worksheets, and by not using intended props and visuals (location moved to a gymnasium vs. classroom setting). This compromised intervention adherence (components of the curriculum were not delivered well or as intended), and planned exposure (did not deliver all of the intervention; larger portions were omitted). Secondly, the large group setting made delivery of the messages difficult as children had a hard time hearing and focusing on key messages and concepts. This interfered with the quality of delivery, as the PA was unable to
teach in a way that engaged each child and reinforced messages. Outside factors beyond the intervention itself also may have inhibited desired outcomes. For example, the OAA (Ohio Achievement Assessment) standardized testing took place at the school between lessons one and two, meaning there was one week where children had no nutrition education, making the intervention five weeks long with four lessons. The post-testing also took place during the last week of the school year when special events were taking place at the school and children were outside of a normal routine (such as fair and field days where non-FV foods were provided). Finally, pre-testing took place at the beginning of the month (April 8th) while post-testing took place at the end of the month (May 28th and 30th) due to a delay in the teaching schedule. With this population being primarily low-income, the effect of intra-month variability in food resources for those on food assistance (SNAP) benefits may play a role in food availability. It is well established in the literature that food assistance is often used at the beginning of the month (food supply is adequate), yielding a food-shortage at the end of the month. This phenomenon may hinder a family’s ability to supply a varied and nutrient-rich diet (i.e. FV) thus inhibiting a child’s ability to consume FV regardless of desire (Darko, Eggett, & Richards, 2013). In this study, a decrease may indeed have occurred; however, the cause was most likely independent from the FV intervention, and reflective of dietary changes at the end of the school year, and possibly intra-month variability in food availability.
There was a weak correlation between the change in pre-post intervention scores on the 10-item FVQ and 24-HDR, with the 24-HDR detecting no change and the 10-item FVQ detecting a small, though statistically significant ($p < 0.0005$) decrease in FV post-intervention. The greater decrease in consumption observed by the 10-item FVQ compared to the 24-HDR may be due to the 10-item FVQs asking for typical habits or in the past week, versus the 24-HDR only reporting one day’s worth of intake. The results from the sensitivity testing, however are not conclusive and should be re-examined under conditions where the intervention is implemented as intended.

The 10-item FVQ incorporates multiple questions with varying constructs (consumption of FV at different meals/times of day, variety of FV intake, and willingness to try new FV) for the purpose of reflecting typical behaviors and attitudes that parallel consumption. Research has shown that students with a higher preference for FV also have higher average daily intakes of these foods (Baxter & Thompson, 2002; Wall et al. 2012). Findings of this study support preference as an indicator of intake; ITCs for “preference” questions [“When I am offered a vegetable/fruit I have never eaten before…”] were 0.654 and 0.343, respectively. For vegetables in particular, a higher score on the one preference question predicts a higher overall score on the questionnaire (greater consumption), and a lower score on the vegetable preference question predicts a lower score. The strongest question [“During the past week, I ate vegetables as snacks” (ITC = 0.685)] also suggests that children who eat vegetables as snacks more frequently tend to have a higher FV
intake overall. It is worth noting that vegetable questions tended to have higher ITCs than comparable fruit questions. This may be explained by children having a lesser intake of vegetables in general, and therefore those who do consume a greater amount of vegetables may tend to have a higher overall FV intake, and thus a higher score, while those with a lesser vegetable score would have a lesser overall FV intake (Vitáriusová et al. 2010). These findings are important for understanding which behaviors related to FV intake are most advantageous to target for change in nutrition education programming such as trying new FV and incorporating vegetables as snacks. Vegetable preference may be related to or predictive of total FV intake. For questions falling below the 0.2 acceptable cut-point, one [“I do not eat vegetables”] is reported as a 0 due to its coding to represent typical intake. The other three questions falling below the suggested 0.2 mark are components of the multiple option questions, asking [“When I eat fruit: with my lunch/dinner”; “When I eat vegetables: as a morning snack”]. These questions need further examination. While they present a lower ITC, the questions of eating fruit with lunch and eating vegetables as a morning snack may in fact be representative of actual intake behaviors. For example, fruit is always offered as part of the National School Lunch Program; thus, children who with a lower score on the questionnaire overall may in fact consume fruits with lunch. Similarly, those scoring high or low may not choose eating vegetable as a morning snack, since typical patterns of child behaviors do not include eating vegetables in the morning. Additionally, the school in which the study was conducted did not offer a morning snack, making this question irrelevant.
to the population. Questions should be reexamined under a different study population.

The two indicators of dietary intake (total variety and total snack) used for convergent validity corresponded fairly well to the 24-HDR variety and snack reference scores. Since the 10-item FVQ only provides an approximate frequency of FV intake as opposed to actual dietary intake values, the variety and snack constructs were calibrated for comparison with a standard of reference dietary intake values for the purpose of giving meaning (validity) to the 10-item FVQ scores. Individual FV scores did not perform as well as total F+V scores, possibly because only a one day dietary record was obtained for reference, making it difficult to gauge true consumption patterns. Despite the fruit variety and vegetable snack score showing no statistical significance, the convergence analysis provides support for the combined questions assessing the individual 10-item FVQ constructs, suggesting the 10-item FVQ may be a good representation of various aspects of dietary intake.

The 10-item FVQ demonstrates substantial test-re-test agreement with a correlation of $r = 0.775$, which is close to the 0.8-1 range indicating perfect agreement. Variability between children’s responses from pre-test 1 to pre-test 2 two could be explained based on the questionnaire’s probing for not only typical habits, but also specific intake “during the past week”, which may change for some children week to week. The lack of a significant difference between pre tests 1 and 2 suggests the 10-item FVQ is a reliable tool for assessing FV intake. Additionally, the correlation ($r = 0.784$) indicates scores achieved on the pre-test 1 tend to be
similar in terms of ranking on the pre-test 2. In other words, lower scores at time one are associated with lower score at time two, and higher scores at time one are associated with higher scores at time two, suggesting reliability and consistency among scores when the test is repeated. These results are an important indicator of not only the test’s stability over repeated program use, but also in its ability to represent actual FV intake patterns.

These results suggest that scores achieved on the 10-item FVQ may correspond to FV intake and represent usual dietary patterns. While several child nutrition questionnaires do exist for the purpose of assessing FV intake, many are tailored to specific program outcomes and not appropriate for assessing dietary behaviors among SNAP-Ed program participants. For example, the SPAN questionnaire (Hoelscher et al., 2003; Thiagarajah et al., 2008) provides validated vegetable and fruit questions that can be used among elementary school children. However, the time to complete is greater than the 10-item FVQ (25-30 minutes versus 5-10 minutes) and questions ask about specific foods, whereas the 10-item FVQ aims to evaluate overall dietary patterns of FV consumption. The program goal of SNAP-Ed is to increase FV consumption rather than specific food items; therefore, the 10-item FVQ is most appropriate as it is tailored to measuring SNAP-Ed program outcomes. Similarly, the DILQ (Edmunds & Ziebland, 2002) is also a validated instrument for providing information on dietary intake; however, among government funded community nutrition programs, tools that are easy to code and report numerically are needed (versus the more time intensive open-ended questions)
due to the limited time and budget of the programs themselves. Based on findings from this study, the 10-item FVQ may be most valid in comparing mean FV intake within a targeted population vs. individual dietary intake reference values.

A key strength of this study is that it was conducted under typical SNAP-Ed field conditions, with intervention changes based on the school’s schedule, child absences, and use of the “Balance My Day” curriculum taught by a SNAP-Ed educator. Additionally, the sample size was large (n=68-85), and from the data multiple aspects of validity and reliability were assessed.

Limitations

This study had several limitations. First, this tool was tested in a specific population (9-11 year old children living in low-income households), and cannot be generalized to all 3rd and 4th grade students. Additionally, the study population was primarily white making these results difficult to generalize among minority groups. Participants were not randomized and voluntarily chose to participate, which may not give an accurate representation of all potential SNAP-Ed participants.

Due to the limited time allotted by the school for the purpose of data collection, only a single 24-HDR was collected as a reference for dietary intake, whereas a three-day 24-HDR is considered a more accurate criterion for comparison (Townsend, 2006). Both dietary reference methods rely on memory of FV eaten, meaning the scores are only estimates of dietary intake and cannot serve as an absolute representation of diet. Also, the 24-HDR and the 10-item FVQ are not directly comparable due to the 24-HDR reporting one day’s worth of food versus the
usual intake or “in the past week” questions on the 10-item FVQ. The intervention was limited and implementation not as the curriculum is intended, thus diminishing the results from the sensitivity tests. Also, a control school was not included due to the few number of Ohio SNAP-Ed educators working with the desired population group (3rd-4th grade).
Implications and Future Research

Results from this study suggest that the 10-item FVQ is a valid and reliable measure for assessing frequency of FV intake among 9-11 year old children. Further testing of the 10-item FVQ in an appropriately delivered pre/post intervention design is needed to further investigate the questionnaire’s sensitivity to detecting behavior change. The questions on the 10-item FVQ are reflective of SNAP-Ed program outcome objectives; the validity and reliability demonstrated by the present study will provide a tool that is an easy to administer and cost-effective alternative to gathering dietary intake information and revealing improvements resulting from community nutrition education programs. Evidence from this study suggests the 10-item FVQ may useful as a proxy for other dietary assessment measures to assess FV intake among SNAP-Ed child participants.
Reference List


Appendix A: Pilot Study 10-item Fruit and Vegetable Questionnaire

Standardized Instructions for 10-Item Fruit and Vegetable Questionnaire

*(Read aloud to children)*

This survey will ask you about the fruits and vegetables that you typically eat. Each question will be asking about a fruit OR a vegetable, and how often or not-often you eat fruits and vegetables. There is no right or wrong answer and you will not be graded on the answers you choose, this is a survey about what you do and what you like to do.

We will go through each question together and I will read each question out loud. You will have time to think about each response before answering. If you have a question, please raise your hand and I will assist you. Remember, it is very important that you answer based on the fruits and vegetables that you *actually eat*, not based on what you would like to eat or what you think you should put for an answer.

This activity is for you to complete on your own, keep your answers to yourself, there is no need to discuss with your neighbor. If you need help, raise your hand and I will assist you. Remember, there is no right or wrong answer, circle the response that is true for you.

What questions do you have before we begin?
Appendix B: Validation Study 10-item FVQ and Standardized Script

Standardized Instructions for 10-Item Fruit and Vegetable Questionnaire
(Read aloud to children)

“This survey will ask you about the fruits and vegetables that you typically eat. Each question will be asking about a fruit OR a vegetable, and how often or not-often you eat fruits and vegetables. There is no right or wrong answer and you will not be graded on the answers you choose, this is a survey about what you do and what you like to do.

We will go through each question together and I will read each question out loud. You will have time to think about each response before answering. If you have a question, please raise your hand and I will assist you. Remember, it is very important that you answer based on the fruits and vegetables that you actually eat, not based on what you would like to eat or what you think you should put for an answer.

This activity is for you to complete on your own, keep your answers to yourself, there is no need to discuss with your neighbor. If you have a question about whether a specific food is considered a fruit or vegetable, raise your hand and I will assist you. Remember, there is no right or wrong answer, circle the response that is true for you.

The following foods are not considered a fruit or vegetable for this survey:
White Potatoes, French fries, fried sweet potatoes, ketchup, fruit juice, fruit snacks, olives, fruit flavored yogurts or ice cream, or products made with a vegetable such as chips, fruit pies, corn chips or tortillas. Tomatoes are considered a vegetable for the purpose of this survey.
1) During the past week, I ate **fruit as snacks**:
   a. Everyday  
   b. Almost everyday  
   c. Sometimes  
   d. Almost never  
   e. Never  

2) During the past week, I ate **vegetables as snacks**:
   a. Everyday  
   b. Almost everyday  
   c. Sometimes  
   d. Almost never  
   e. Never  

3) When I eat **fruit**, I eat them (You can circle more than one answer):
   a. With my breakfast  
   b. As a morning snack  
   c. With my lunch  
   d. As an afternoon snack  
   e. With my dinner  

4) When I eat **vegetables**, I eat them (You can circle more than one answer):
   a. With my breakfast  
   b. As a morning snack  
   c. With my lunch  
   d. As an afternoon snack  
   e. With my dinner  
   f. I do not eat vegetables  

5) During the **past week**, I ate **fruit**:
   a. Everyday  
   b. Almost everyday  
   c. Sometimes  
   d. Almost never  
   e. Never  

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6) During the past week, I ate vegetables:
   a. Everyday
   b. Almost everyday
   c. Sometimes
   d. Almost never
   e. Never

7) I eat different kinds of fruit everyday:
   a. Always
   b. Almost always
   c. Sometimes
   d. Not very often
   e. Never

8) I eat different kinds of vegetables everyday:
   a. Always
   b. Almost always
   c. Sometimes
   d. Not very often
   e. Never

9) When I am offered a fruit that I have never eaten before:
   a. I always try new fruits
   b. I almost always try new fruits
   c. I sometimes try new fruits
   d. I almost never try new fruits
   e. I never try new fruits

10) When I am offered a vegetable that I have never eaten before:
    a. I always try new vegetables
    b. I almost always try new vegetables
    c. I sometimes try new vegetables
    d. I almost never try new vegetables
    e. I never try new vegetables
Appendix C: Demographics Questionnaire

The following Demographics Questionnaire is to be completed by the parent or guardian of the child participating in the Balance My Day Nutrition Program. The survey is anonymous. The questions relate to your child who is participating in the Balance My Day Nutrition Program and your family. Your participation in the study is through completion of this demographics questionnaire. If you do not wish to participate in this study or complete this questionnaire, your child is still able to participate in the Balance My Day Nutrition Program and you or your child will not be penalized.

Please have your child return this form to school along with the parental/guardian consent form
About You and Your Family

Participant / ID# ___________ Date ___________ / ___________

Questions 1-5 are about YOUR CHILD. Fill in the appropriate circle.

1. How old is your 9-11 year old child?
   □ 9 years   □ 10 years   □ 11 years

2. Is this child a boy or girl?
   □ Boy
   □ Girl

3. What is your 9-11 year old child’s ethnicity/race? You may choose more than one.
   (Check (√) all that apply).

   RACE and ETHNICITY OF THIS CHILD

   Is your child Latino/Hispanic? Check (√) one answer.

   _____ Yes   _____ No

   What is your child’s race? Check (√) all that apply.
   You may check more than one answer.

   _____ American Indian or Alaska Native   _____ Native Hawaiian/Pacific Islander
   _____ African American or Black   _____ Asian
   _____ White   _____ Other
   OR   _____ Declined to state

4. On average, how many days of the week does this child live in your home?
   □ □ 1-3 days
   □ □ 4 or more days
5. What is your relation to the 9-11 year old child? (Choose one)

_____ Mother/Father  
_____ Grandparent  
_____ Aunt/Uncle  
_____ Legal Guardian  
_____ Foster Parent  
_____ Other _________________  

Questions 6-10 are about YOU and YOUR FAMILY

6. What is your gender? Check (✓) one answer.

_____ Female  
_____ Male

7. What is your age category? Check (✓) one answer.

_____ 18-59 years old  
_____ 60 or older

8. Think of all the people who live in your household, including yourself.  

Write in the number of people for each category below.

How many people are 0-4 years old? ________

How many people are 5-17 years old? ________

How many people are 18-59 years old? ________

How many people are 60 or older? ________
9. Think of the past 30 days. Did you or anyone else in your household use any of the food assistance programs listed below? Check YES or NO for each program used. You may check more than one answer.

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>____</td>
<td>Food Assistance Benefits</td>
</tr>
<tr>
<td>____</td>
<td>School Breakfast</td>
</tr>
<tr>
<td>____</td>
<td>School Lunch</td>
</tr>
<tr>
<td>____</td>
<td>Food Pantry or Food Bank</td>
</tr>
</tbody>
</table>

10. What is YOUR ethnicity/race? You may choose more than one. (Check (✓) all that apply.)

Are you Latino/Hispanic? Check (✓) one answer.

_____Yes  _____No

What is your race? Check (✓) all that apply. You may check more than one answer.

_____American Indian or Alaska Native  _____Native Hawaiian/Pacific Islander
_____African American or Black  _____Asian

_____White  _____Other  OR  _____Declined to state

Thank you for your participation! Please have your child return this form to school along with the parental/guardian consent form
Appendix D: Parental Consent and Child Assent Forms

The Ohio State University Parental Permission For Child’s Participation in Research

Study Title: Balance My Day: Validation of a 10-Item Questionnaire
Measuring Fruit and Vegetable Consumption in 9-11 year old Children Living in Low-Income Households

Researcher: Ana Claudia Zubieta; Laura Berger

Sponsor: SNAP-Ed

This is a parental permission form for research participation. It contains important information about this study and what to expect if you permit your child to participate.

Your child’s participation is voluntary.
Please consider the information carefully. Feel free to discuss the study with your friends and family and to ask questions before making your decision whether or not to permit your child to participate. If you permit your child to participate, you will be asked to sign this form on the last page and will receive a copy of the form.

If you are uncertain about any part of this form or unclear on what the research study is or what it requires, please contact Laura Berger, 614-202-0853 or berger.311@osu.edu.

Purpose:
The purpose of this study is to collect information on your child’s typical intake of fruits and vegetables. As a research team, we are trying to see if there are any changes in your child’s intake of fruits and vegetables from before he or she takes part in nutrition lessons to after the lessons.

What does this Study Require? Procedures/Tasks:
Your child will be participating in 4 nutrition education lessons at school, focusing on fruits and vegetables. The Balance My Day lessons are taught during allotted programming time during the school day and will not interfere with normal
The lessons are taught through the SNAP-Ed program (Supplemental Nutrition Assistance Program Education). The lessons feature hands-on learning and are fun and interactive. As part of the research study, your child will be asked to complete a short survey about his or her typical intake of fruits and vegetables. This survey will be given at three different points. Your child will also participate in a dietary recall, where he or she sits one-on-one with a trained research assistant and is asked to name all the foods they ate the day before. The survey and dietary recall also take place at school while nutrition lessons are being taught. No feedback or criticism is given, only dietary information collected. All answers to survey questions are kept private and stored in a safe place.

**Duration:**
The duration of the study, including collection of this parental consent form, child assent, and demographic surveys (to be completed by parent/guardian), dietary recalls, and lessons, will take place over 8 weeks: March 18th-May 7th. Your child may leave the study at any time. If you or your child decides to stop participation in the study, there will be no penalty and neither you nor your child will lose any benefits to which you are otherwise entitled. Your decision will not affect your future relationship with The Ohio State University.

**Risks and Benefits:**

There are minimal risks to participate in this study. By participating in this program, your child will be able to experience nutrition education through the use of an interactive, hands-on nutrition curriculum. Your child will also benefit by gaining valuable knowledge about fruits and vegetables, and how to make healthy dietary choices.

The team will make every effort to administer surveys and collect your child’s answers quickly. Dietary information is collected by using positive and fun procedures to ensure that children do not feel singled out or embarrassed by answers. Questions are read aloud to eliminate bias towards reading ability.

**Confidentiality:**
Efforts will be made to keep your child’s study-related information confidential. The research team makes every effort to ensure the answers your child provides are not shared outside of the research team. In addition, your child will be assigned a number that is linked to his or her answers and his or her name will not be disclosed.

However, there may be circumstances where this information must be released. For example, personal information regarding your child’s participation in this study may be disclosed if required by state law. Also, your child’s records may be reviewed by the following groups (as applicable to the research):
Office for Human Research Protections or other federal, state, or international regulatory agencies;
The Ohio State University Institutional Review Board or Office of Responsible Research Practices;
The sponsor, if any, or agency (including the Food and Drug Administration for FDA-regulated research) supporting the study.

**Incentives:**

As a participant in the study, your child will receive a red shopping bag for returning the child assent and parent/guardian consent forms, a “Healthy Kids Challenge” Bookmark, and a “My Plate” pencil.

**Participant Rights:**

You or your child may refuse to participate in this study without penalty or loss of benefits to which you are otherwise entitled. If you or your child is a student or employee at Ohio State, your decision will not affect your grades or employment status.

If you and your child choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights your child may have as a participant in this study.

An Institutional Review Board responsible for human subject research at The Ohio State University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

**Contacts and Questions:**

For questions, concerns, or complaints about the study, or you feel your child has been harmed as a result of study participation you may contact Ana Claudia Zubieta at zubieta.1@osu.edu (614) 292-5655, or Laura Berger at (614) 202-0853 berger.311@osu.edu.

For questions about your child’s rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.
Signing the parental permission form

I have read (or someone has read to me) this form and I am aware that I am being asked to provide permission for my child to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to permit my child to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

________________________
Printed name of subject

________________________  __________________________
Printed name of person authorized to provide permission for subject  Signature of person authorized to provide permission for subject

AM/PM

________________________  __________________________
Relationship to the subject  Date and time

Investigator/Research Staff

I have explained the research to the participant or his/her representative before requesting the signature(s) above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

________________________  __________________________
Printed name of person obtaining consent  Signature of person obtaining consent

AM/PM

________________________
Date and time
You are being asked to be in a research study. Studies are done to find better ways to treat people or to understand things better. This form will tell you about the study to help you decide whether or not you want to participate.

You should ask any questions you have before making up your mind. You can think about it and discuss it with your family or friends before you decide. It is okay to say “No” if you don’t want to be in the study. If you say “Yes” you can change your mind and quit being in the study at any time without getting in trouble.

If you decide you want to be in the study, an adult (usually a parent) will also need to give permission for you to be in the study.

1. What is this study about?

Balance My Day’s goal is to teach children about nutrition so they can make healthier choices with the foods they eat.

2. What will I need to do if I am in this study?

To be a part of this study you will join in a nutrition program, Balance My Day, and answer some questions before and after the program. The program takes place during your school day when there’s time for extra programs. Testing includes one nutrition worksheet. Also, you will complete a survey called a ‘24-hour food recall’ where we will ask you what you ate the day before.
3. How long will I be in the study?

The Balance My Day program will last 4 weeks, with a short activity one week before the lessons begin. Lessons will take place one time each week for 4 weeks and 45 minutes each lesson.

4. Can I stop being in the study?

You may stop being in the study at any time.

5. What bad things might happen to me if I am in the study?

Bad things will not happen to you if you join in the study. You will talk about what you ate the day before with one of the researchers. If this makes you feel uncomfortable you may choose not to do it. If you feel uncomfortable at anytime, you may stop being in the study.

6. What good things might happen to me if I am in the study?

If you want to be in this study, you will take part in lessons about nutrition with your classmates during the school day. You will do fun activities, taste-testing’s, and crafts, and use food models to show what you ate the day before. As a part of the study, you will learn how to make healthy food choices.

7. Will I be given anything for being in this study?

If you choose to be a part of the study, you will receive a red shopping bag, a “Healthy Kids Challenge” Bookmark, and a My Plate pencil.

8. Who can I talk to about the study?

For questions about the study you may contact Laura Berger at berger.311@osu.edu (614) 202-0853, or Ana Claudia Zubieta at zubieta.1@osu.edu (614) 292-5655

To discuss other study-related questions with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.
Signing the assent form

I have read (or someone has read to me) this form. I have had a chance to ask questions before making up my mind. I want to be in this research study.

Signature or printed name of subject __________________________ Date and time __________________________

Investigator/Research Staff

I have explained the research to the participant before requesting the signature above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

Printed name of person obtaining assent __________________________ Signature of person obtaining assent __________________________

Date and time __________________________

This form must be accompanied by an IRB approved parental permission form signed by a parent/guardian.
Appendix E: The Ohio State University Institutional Review Board Approval

March 24, 2014

Protocol Number: 201409014

Protocol Title: VALIDATION OF A 16-ITEM QUESTIONNAIRE MEASURING FRUIT AND VEGETABLE CONSUMPTION IN 9-11 YEAR OLD CHILDREN LIVING IN LOW-INCOME HOMES

Area Co-Principal Investigator: Anna Fabiano, Laura Berger, OSU-EP - Extension

Type of Review: Initial Review—Exempt

IIR Exp. Contact: Michael Donovan, Phone: 614-292-6930, Email: Donovan.6@osu.edu

Dear Dr. Fabiano,

The Behavioral and Social Sciences IRB has found a research project approved under 45 CFR 46.101(O)(2) which might be of interest to you. The Board has determined that the research meets the applicable criteria and one or more categories of research eligible for expedited review, as indicated below:

Date of IRB Approval: March 24, 2014
Date of IRB Approval Expiration: March 24, 2016

Expeditious Review Category: 7

In addition, the research was approved for the inclusion of children (permission of one parent or legal guardian need not be solicited). If applicable, informed consent (and IHEA if the research involves human research) must be obtained from subjects or their legally authorized representatives and documented prior to research involvement. The IRB-approved consent forms and procedures must be used. Changes to the research (e.g., recruitment procedure, advertisement, enrollment, etc.) of the intervention protocol must be approved by the IRB before they are implemented (except in emergency situations when it is necessary to eliminate apparent immediate hazards to subjects).

This approval is valid for one year from the date of IRB notification when approved or modified above as required. The approval is not lengthy and must be in effect on the date listed above as the IRB approval date. A Continuing Review application must be submitted within the timeframe stipulated by the IRB approval and resumed research activities. A Final Report must be provided to the IRB and all records relating to the research (including signed consent forms) must be retained and submitted for a minimum of 5 years after the research has ended.

It is the responsibility of all investigators and research staff to promptly report to the IRB any serious, unexpected, and related adverse events and potential investigational problems involving serious adverse events.

This approval is issued under The Ohio State University’s IRB Federally Authorized #00000078. All forms and procedures can be found online at: http://www.osu.edu/IRB. For questions or concerns, please contact the OSU IRB staff contact listed above with any questions or concerns.

Michael Donovan, Ph.D., Chair
Behavioral and Social Sciences Institutional Review Board

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