# A Single-Session Nutrition Intervention in the Context of a Health Fair Might Positively Influence the Factors that Determine and Mediate the Dietary Behaviors of 4th-6th Grade Students

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# ABSTRACT

**Background:**

A number of nutrition interventions have been conducted in recent years to improve the diets of children in the United States. However, few studies have been conducted analyzing the efficacy of these interventions. . In particular, it is unknown how a relatively low-cost single-session intervention might influence the factors that determine the diets of children.

**Objectives:**

The primary aim of this study was to determine if 4th-6th graders who completed the nutrition screener and read the nutrition handout at the "Let's Get Healthy!" fair in Union County, Oregon increased questionnaire scores significantly more than participants who attended the fair but did not both complete the nutrition screener and read the nutrition handout. The questionnaires measured personal, environmental, and behavior factors that determine and mediate dietary behavior, as outlined by the Social Cognitive Theory. Secondary aims were to determine if 4th-6th grade females improved questionnaire scores significantly more than males after completing the diet screener and reading the nutrition handout at the "Let's Get Healthy!" fair in Union County, Oregon and to determine if age is significantly associated with a change in questionnaire score.

**Method:**

In this study, participants visited the Oregon Health & Science University's "Let's Get Healthy!" fair in Union County, Oregon. At the fair, participants completed a diet screener that informed them of their estimated intakes of various foods. They marked their screener results on a nutrition handout, which also contained information about why and how they could change their diets. Evaluative pre-fair and post-fair nutrition questionnaires were administered to the students two weeks before and after the fair. The effectiveness of the intervention on changing determinants and mediators of behavior was analyzed through a comparison of participants' pre-fair and post-fair questionnaire scores.

**Results:**

Participants who completed the full intervention did not have significantly greater improvements in scores than participants who attended the fair only. Females also did not have significantly greater improvements in scores than males nor did scores differ by age. Students who reported teacher discussion of the fair had significant improvements in total questionnaire scores and construct sub-scores measuring dietary intention, dietary preference, social reinforcement, and self-efficacy. There was no significant improvement in scores among students who reported no teacher discussion.

**Conclusions:**

This study found that a single-session nutrition intervention in the context of a health fair has the potential to positively change the personal, environmental, and behavioral factors that determine and mediate the dietary behaviors of 4th-6th grade students, particularly if teachers participate in discussion of the fair experience. The study did not show that tailored feedback in the form of computerized diet screener and nutrition handout was a more effective means of changing factors that determine diets of children than simply attending a single-session health fair. This study also did not confirm that girls improve scores more than boys nor that change in scores was higher among older children. Future research is needed to determine what methods are most successful in changing factors that determine and mediate children's nutrition-related behaviors.

# CHAPTER 1: INTRODUCTION

## OVERVIEW

The average child in the United State does not meet established dietary recommendations (1). While a number of interventions have been conducted to improve children's diets, few studies have analyzed the contribution of the different components of these interventions. In particular, it is unknown how a relatively low-cost single-session intervention might influence the factors that determine the diets of children. This study analyzed the effect of a single-session nutrition intervention, delivered in the context of a health fair, had on measures of personal, environmental, and behavioral factors that determine and mediate the dietary behaviors of 4th-6th grade students. In this intervention, students visited the Oregon Health & Science University's "Let's Get Healthy!" fair in Union County, Oregon. At the fair, students completed a diet screener that informed them of their estimated intakes of fruits, vegetables, dietary fat, and sugar-sweetened beverages, as well as their recommended intake of these foods. Students marked their screener results on the nutrition handout they received upon arrival at the fair. The handout also contained information about why they should and how they could improve their diets. Evaluative pre-fair and post-fair nutrition questionnaires were administered to the students two weeks before and two weeks after the fair. The effectiveness of the intervention on changing determinants and mediators of behavior was

analyzed through a comparison of participants' pre-fair and post-fair questionnaire scores.

## PRIMARY QUESTION:

Does providing tailored nutrition feedback at the "Let's Get Healthy!" fair in Union County, Oregon change questionnaire scores measuring personal, environmental, and behavior factors that determine and mediate dietary behavior, as outlined by the Social Cognitive Theory?

## SPECIFIC AIMS:

Aim 1:

To determine if 4th-6th graders who completed the nutrition screener and read the nutrition handout at the "Let's Get Healthy!" fair in Union County, Oregon increased questionnaire scores measuring personal, environmental, and behavior factors that determine and mediate dietary behavior, as outlined by the Social Cognitive Theory, significantly more than participants who attended the fair but did not both complete the nutrition screener and read the nutrition handout

Aim 2:

To determine if 4th-6th grade females improved questionnaire scores significantly more than males after completing the diet screener and reading the nutrition handout at the "Let's Get Healthy!" fair in Union County, Oregon.

Aim3:

To determine if age is significantly associated with a change in questionnaire

score after completing the diet screener and reading the nutrition handout at the "Let's Get Healthy!" fair in Union County, Oregon among participants 9 to 12 years of age.

## HYPOTHESIS:

### Hypothesis 1:

The 4th-6th graders who complete the diet screener and read the nutrition handout at the "Let's Get Healthy!" fair in Union County, Oregon will increase questionnaire scores measuring personal, environmental, and behavior factors that determine and mediate dietary behavior, as outlined by the Social Cognitive Theory, significantly more than participants who attended the fair but did not both complete the diet screener and read the nutrition handout.

### Hypothesis 2:

The 4th-6th grade females will improve questionnaire scores significantly more than males after completing the nutrition screener and reading the nutrition handout at the "Let's Get Healthy!" fair in Union County, Oregon.

### Hypothesis 3:

Older participants will have significantly greater improvement in questionnaire scores after participating in the diet screener and reading the nutrition handout at the "Let's Get Healthy!" fair in Union County, Oregon than younger participants.

# CHAPTER 2: BACKGROUND

## CHILDHOOD NUTRITION CONCERNS

The quality of the average child's diet in the United States (US) is below nationally established standards. Survey data obtained by the Center for Nutrition Policy and Promotion found that only 12% of children 9 years of age or older have diets classified as "good", as defined by the Healthy Eating Index (1). A poor childhood diet can result in chronic health conditions. One complication of poor childhood nutrition is obesity. From 1979 to 2003, obesity rates among U.S. children 6 to 11 years of age increased from 4% to 17%; among 12 to 18 year olds, obesity rates increased from 6% to 18% (2). Three aspects of dietary intake that are of particular interest are children's intake of fruit and vegetables, dietary fat, and sugar-sweetened beverages.

## FRUIT AND VEGETABLE INTAKE

Most children in the United States are not meeting the 2005 United States Department of Agriculture's (USDA) daily dietary recommendations of 1 to 3 cups of fruit and 1 to 4 cups of vegetables (3-7). Fresh fruit consumption has decreased over the past 100 years. A large percentage of current fruit consumption is in the form of fruit juices, some of which have a substantial amount of added sugar. About half of current vegetable consumption is in the form of french fries and potato chips, which are high in fat, high in sodium, and low in nutritional quality (8).

Low intake of fruits and vegetables may be one of the reasons for the increased prevalence of childhood obesity. Fruits and vegetables tend to be rich in nutrients and fiber, and low in calories. Children who consume many high-calorie/low-nutrient dense foods may fill up on them rather than consume nutrient-rich fruits and vegetables (4). However, findings from studies among children regarding the relationship between fruit and vegetable intake and obesity have been inconsistent. The USDA 1994-96 Continuing Survey of Food Intakes by Individuals (USDA, CSFII) shows that the relationship between fruit and vegetable intake and body mass index among children varies widely by age and gender. For some age and gender groups, there are negative correlations between vegetable intake and body mass index, while among other groups there is no correlation (7, 9). Adequate fruit and vegetable consumption is important to the health of a child in many facets beyond the prevention of obesity. Fruits and vegetables play an important role in the prevention of a number of chronic diseases including type II diabetes, stroke, cardiovascular diseases, coronary heart disease, kidney stones, bone loss, as well as mouth, stomach and colorectal cancers (3, 4, 10).

## DIETARY FAT INTAKE

Adequate dietary fat intake is essential to healthy childhood growth. The Institute of Medicine recommends that children consume between 25-35% of their total energy from fat (11). Children should receive most of their fat from monounsaturated and polyunsaturated sources. These types of fats

can replace potentially harmful saturated and hydrogenated fats. Saturated and hydrogenated fats commonly occur in animal and vegetable fats that are solid at room temperature. Monounsaturated and polyunsaturated fats are found in higher concentrations in liquid oils, tub margarine, nuts, and fats from fish (11).

While the amount of fat US adults consume is excessive, experts question whether fat consumption is also excessive among children (12). Unlike their adult counterparts, most children in the United States meet but do not exceed the current fat intake recommendations. The National Health and Nutrition Examination Surveys (NHANES) reveal that US children's total fat consumption remained relatively stable between 1989 and 1994; the total number of grams of fat consumed by children did not significantly change. In fact, there was a decrease in percent of total energy consumed from fat due to an increase in carbohydrate consumption (13).

Despite adequate fat consumption among the majority of US children, some children consume more fat than recommended. Current research about the impact of high-fat diets on the health of children is conflicting and complex. Some studies show a correlation between high-fat diets and obesity (14, 15). Some show a correlation between low-fat diets and obesity. Others show no relationship between fat intake and obesity(11). These conflicting results are likely the result of differences in study designs such as if the study was prospective, retrospective, cross-sectional, or observational. The studies

also differ in how fat intake was measured, in the definition of obesity, and in the number of participants. Nonetheless, children's diets that are high in fat can have negative health consequences unrelated to obesity. Some reports show that children with high-fat diets have increased cardiovascular risk factors as a result of increased low density lipoprotein (LDL) cholesterol levels in the blood and the presence of fatty streaks in the aortas. The long-term effects of fatty streaks in aortas of children are unknown, but some hypothesize that they contribute to higher long-term risk of cardiovascular disease. Conversely, research shows that fat restriction among children can have negative effects on health status, such as lowered levels of protective high density lipoprotein (HDL) cholesterol, vitamin E, and zinc (11, 12). More research is needed on the effects high-fat and low-fat diets have upon children's health.

## Sugar-Sweetened Beverage Intake

Excessive sugar-sweetened beverage consumption among U.S. children has emerged as a major dietary concern in recent years. The percent of total dietary energy that regular soft drinks (a type of sugar-sweetened beverage) contribute to the average child's diet increased from 3.0% to 6.9% of total energy between 1977 and 2001 (16). Sugar-sweetened beverages are the main source of added sugar in the U.S. child's diet. Increased consumption of added calories in the form of sugar-sweetened beverages may contribute negatively to children's health. For example, children with

high consumption of soft drinks tend to have lower intakes of riboflavin, folate, Vitamin C, calcium, and phosphate (17).

The rate of the increase in childhood obesity is similar to the rate of increase in soft drink consumption, suggesting a possible relationship between the two trends (16). The USDA's Continuing Survey of Food Intakes by Individuals (CSFII) found that children with higher sugar-sweetened beverage intake tend to have higher body mass indexes (17). A number of studies have investigated this relationship (18-21). Observational studies have found that children who increase their sugar-sweetened beverage intakes are more likely to become overweight or obese in the following years than children who do not increase their intake of these beverages (21). Furthermore, a randomized controlled trial of over 100 adolescents found that elimination of sugar-sweetened beverages from the diet can help overweight children lose weight (22).

Survey data over the past thirty years show that milk consumption has decreased at roughly the same rate that sugar-sweetened beverage consumption has increased (23-24). Milk and dairy products provide about 70% of the calcium in the US diet (24). Adequate intake is crucial to achieve peak bone mass. Inadequate bone mass among children leads to increased risk of osteoporosis and bone fracture later in life (25).

In summary, data demonstrate that U.S. children, similar to their adult counterparts, are becoming heavier and appear not to meet many national

dietary recommendations. In children, three areas of particular interest are intake of fruit and vegetables, dietary fat, and sugar-sweetened beverages.

## Behavior Change

The poor state of U.S. children's diets has led health professionals to develop nutrition interventions to improve the diets of children. As a result, consumer exposure to messages about nutrition has expanded to almost every media outlet, including talk shows that feature nutrition experts; cooking shows, nutrition columns in magazines and newspapers, innumerable websites with nutrition information and advice; and food producers use of nutrition buzz words such as "low-fat" and "low-carbohydrate" to promote sales (26). Yet, despite increased exposure to nutrition messages, children's diets have not improved. Reasons for this apparent contradiction are complex, but in brief, behavior is dictated by a variety of factors beyond exposure to and knowledge of information.

Behavioral psychologists have developed a number of theories that identify specific factors that influence and determine one's behavior. According to these theories, change in behavior usually occurs only after influencers and determinants are addressed. As a result, well-designed childhood nutrition behavioral change interventions should focus on addressing factors which determine and influence nutritional behaviors (26).

## Theoretical Framework

The theory most commonly used in the development and analysis of childhood nutrition interventions is Bandura's Social Cognitive Theory (SCT),

which outlines both the determinants of behavior and the mediators of behavioral change (26). According to the SCT, a person's behavior is the result of a series of interactions between personal, environmental, and behavioral factors. Personal factors are the beliefs, thoughts, and feelings that a person has about themselves and their capabilities to change their behavior. They include one's outcome expectancies and self-efficacy. Outcome expectancies are the beliefs and values that a person has about the outcomes of a particular behavior. Self-efficacy is the confidence that someone has that they are able to change their behavior. Changes in self-efficacy may occur when solutions to barriers to change are addressed and goal setting is encouraged. Environmental factors are the external factors that influence personal behavior. Environmental factors may change through modifications to environment, creation of a new environment, and/or changes in how a person reacts to the environment. Finally, behavioral factors are the skills and knowledge that a person has to perform a specific behavior in the short-term and in the long-term (26-29).

For example, an intervention based on the SCT that aims to increase children's vegetable consumption would address personal, environmental, and behavioral factors that effect vegetable intake. The intervention might change personal factors by informing children that eating vegetables will help them grow big and strong (outcome expectancies) and sharing testimonies of other children who successfully added more vegetables to their diets (self-efficacy). Environmental factors could be addressed by

providing free vegetables at school (environmental change), and by encouraging children to take advantage of the free vegetables (reaction to environment). Changes to behavioral factors might include providing comprehensive nutrition education about the recommendations and benefits of vegetables (knowledge) and providing ideas of other ways to increase vegetable consumption outside of school (long-term skills).

An example of a study that utilized the SCT to improve childhood nutrition influencers was the Child and Adolescent Trial for Cardiovascular Health (CATCH) (30). CATCH was a longitudinal school-based cardiovascular health intervention that took place over three years and was completed by more than 6000 students who were in the third grade at the beginning of the intervention. The goal of the intervention was to reduce cardiovascular and psychosocial risk factors, that would theoretically lower behavioral and physiological risk factors. Participants were assigned to one of three groups: a control group, a group that participated in a school-based intervention, and a group that participated in a home-based intervention as well as the school based intervention. The school-based intervention consisted of a health curriculum, a physical activity program, a no-smoking policy and school cafeteria improvements (30). CATCH evaluated the intervention using questionnaires that measured participants' dietary intention, usual food consumption, dietary knowledge, perceived social reinforcement for healthy foods, and self-efficacy. The questionnaires were administered four times over a period of three years and were validated for internal consistency,

content, and other factors. Questionnaire scores increased significantly in both intervention groups. The intervention that was school-based and home-based resulted in greater dietary knowledge among participants than the intervention that was school-based alone. Girls reported higher levels of social reinforcement than boys. There were no other differences in scores based upon intervention group, gender, or ethnicity (30). CATCH demonstrated the effectiveness that interventions utilizing the SCT might have upon modifying the factors that influence children's dietary behavior.

## Design of Nutrition Interventions

Other than utilization of the SCT, there is currently no gold standard for the design and format of childhood nutrition interventions. In 2006, the Cochrane Collaboration released a detailed literature review of published studies of interventions aiming to reduce childhood obesity. The ideal intervention aiming to prevent childhood obesity should be "cost-effective" and use "health promoting strategies to achieve the goal of healthy weight for all children." However, the review acknowledged that more research needed to be conducted to determine the ideal intervention. Recommendations included use of a theoretical framework, sufficient sample size, use of reliable measures, use of adequate statistical analysis, involvement of stakeholders, and sustainability (31). Since childhood obesity has many of the same causes and consequences as general poor childhood nutrition, these intervention recommendations generally apply to childhood nutrition interventions. However, existing publications about interventions using the SCT for

childhood nutrition are limited and vary widely in intervention time-frame and method of information delivery.

### Time Frame of Interventions

There is little consensus in existing research about the most effective length of time for a childhood nutrition intervention. The CATCH intervention is an example of a long-term intervention. It took place over three years and yielded significant results. However, not all nutrition interventions are long term. "Squires Quest!" is an example of a short-term intervention that utilized the SCT and yielded significant results. "Squire's Quest!" is a computer based "game" that 1,578 fourth graders played ten times over a period of five weeks. Pre-intervention and post-intervention 24-hr recalls found that participants increased their fruit and vegetable intake by at least one serving more than control students (32). These studies showed that both shorter-term and longer-term interventions can yield significant results. Other studies focusing on older students yielded similar results (8, 33, 34).

### Design of Single-Exposure Interventions

There are a few studies that use single-exposure interventions to change factors that influence health related behaviors. However, these studies have not been conducted with children, are not based upon the SCT, and/or do not focus on health behaviors beyond nutrition. For example, a nutrition intervention study (not based upon the SCT) in the Netherlands provided tailored feedback on the internet to adult participants after they

completed nutrition questionnaires. Questionnaires administered at baseline and three-week post-intervention showed that the intervention significantly improved fruit and vegetable intake and the determinants of fruit and vegetable intake (35). Similar tailored interventions have been conducted on adult populations, yielding significant improvements in nutrition and scores measuring the influencers of good nutrition. Information is typically tailored to participant behavior, gender, age, income, attitudes, self-efficacy, readiness to change and health status (36). Tailored interventions may be effective, despite their often short-term nature, because they are seen "as more personally relevant, more individualized, more interesting, and more likely to be read completely than non-tailored materials" (37).

Another type of short-term intervention is nutrition education that takes place at health fairs. Health fairs can educate a large number of people at one time, use the same educational materials at multiple venues, and utilize volunteers, all of which helps to keep costs relatively low (38). Fairs are also a way to get information to populations that would otherwise be hard to reach. For example, an uninsured individual might be more likely to visit a health fair than a costly health clinic. Unfortunately, there are very few published studies evaluating the effectiveness of nutrition health fairs. One of the only examples is a study published in 1987 that found that 37% of adult participants in a fitness station at a health fair had self-reported improvements in diet when followed-up 12 months later (39).

Based on the aforementioned gaps, research needs to be conducted to evaluate the effect that single-session nutrition behavior interventions could have upon the factors that determine and influence children's diets. Two understudied methods of providing nutrition information to children are the use of tailored feedback and health fairs. Thus, a novel study that would help researchers develop future nutrition interventions for children would feature tailored feedback in the context of a single-session health fair. It should be developed using the SCT to improve efficacy. If such an intervention proved effective, health professionals would have a cost-effective tool for improving the factors that determine or mediate children's diets. Therefore, this study evaluated the effectiveness of single-exposure nutrition intervention in changing the factors that determine and mediate the diets of children.

## "Let's Get Healthy!" fair

The intervention analyzed in this study was a component of the "Let's Get Healthy!" fair. "Let's Get Healthy!" is an interactive education and research health fair developed by Oregon Health & Science University (OHSU) in conjunction with partner research and health organizations. When a school is interested in having the "Let's Get Healthy!" fair at their school, teachers and school administrators partner with OHSU to schedule fair dates and locations. The fair takes place during school hours, over one to two days in a school gymnasium or at a community center. A typical fair is free to the public and everyone in the school is invited. Participants can choose to

enroll or decline enrollment as anonymous research subjects at the various research stations. The stations are run by volunteer health experts, health care students, and/or community members. The data gathered at the research stations is used to educate participants about their health and to gather anonymous population level data about the community. The stations at the fair are outlined below:

- *Entry Station*: At this station, each participant is given a wristband with a unique ID number. This wristband can be scanned at each station the participant visits, allowing researchers to link data while retaining anonymity. Each participant is asked to enter their age, gender, race, and ethnicity at this station.
- *Diet Station*: This station provides the information analyzed in this thesis. At this station, participants complete a computerized diet screener and receive immediate tailored nutrition feedback and education. The station utilizes a modified version of Block Food Screeners for Ages 2-17, 2007, a food frequency screener that quickly estimates the adequacy of the diets of children (40). The Block Food Frequency Screeners developed for adults have been validated (40-41) however full validation has not yet been achieved for Block Food Screeners for Ages 2-17, 2007. The detailed procedures for this station are outlined later in the methods section.
- *Body Composition Station*: At this station, body measurements of height, weight, waist circumference, and percent body fat are taken. Participants

are then given brief feedback by the researchers on how their measurements compare to national standards and recommendations.

- *Other Stations*: There are also other stations at the fair developed by partner organizations. These stations educate on physical activity, alcohol and substance abuse, bone health, additional nutrition information, and various other topics.
- *Exit Station*: When participants are finished visiting the various stations, they can complete an exit survey that asks questions about their fair experience.

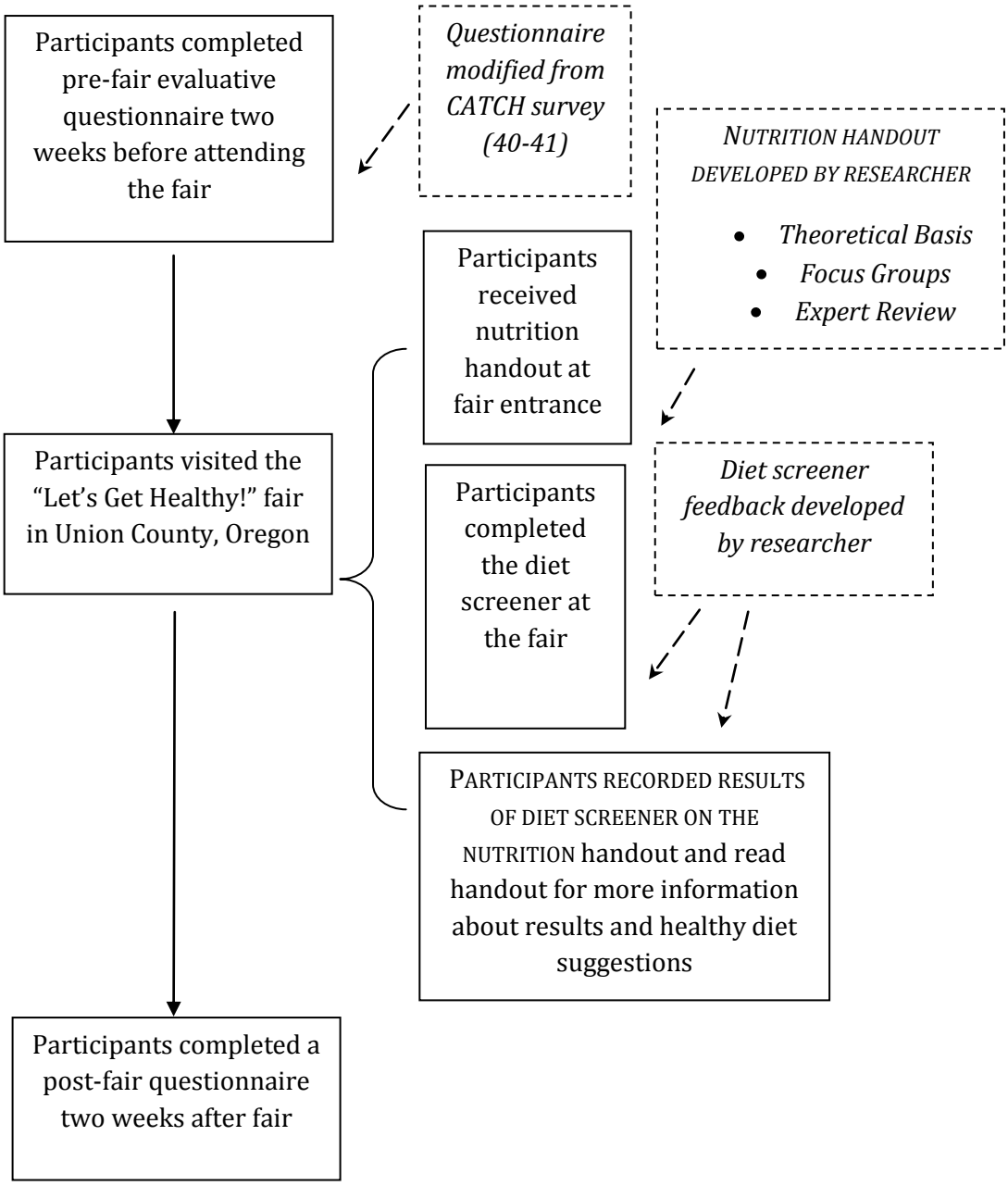
# CHAPTER 3: METHODS

The intervention used in this study was comprised of three components: attendance at the "Let's Get Healthy!" fair, completion of the electronic diet screener, and reading the nutrition handout. A brief description of each of these components is outlined below.

- Fair attendance: Participants attended the "Let's Get Healthy!" fair in Union County, OR. This fair was held in the fall of 2010.
- Diet screener: During the fair, participants completed a computerized diet screener that compared their estimated daily intake of fruits, vegetables, dietary fat, and sugar-sweetened beverages to recommended dietary intakes for children of their age and gender. The diet screener included questions from the Block Food Screeners for Ages 2-17 2007 (40). An algorithm developed by the primary investigator was used to estimate intake of the four dietary components of interest.
- Nutrition handout: Participants recorded their estimated and recommended intake information from the diet screener on a nutrition handout provided at the entrance to the fair. The nutrition handout included "kid-friendly" information about the benefits of consuming fruits and vegetables and cautionary information about over-consumption of dietary fat, and sugar-sweetened beverages. The handout was created by the primary investigator using constructs of the SCT and results of focus groups conducted by the primary investigator with middle school aged children.

The intervention was evaluated by analyzing responses to questions included in pre-fair and post-fair questionnaires. The questions were modified from questionnaires used in other studies (42-43). The questionnaires were designed to analyze personal, environmental, and behavior factors that determine and mediate dietary behavior as outlined by the SCT. The specific question constructs that were measured were dietary intention, dietary preferences, dietary knowledge, typical dietary behaviors, social reinforcements, and self-efficacy. The questionnaires were administered in school classrooms by teachers two weeks before and two weeks after attendance at the fair. Pre-fair and post-fair questionnaires were compared to determine the influence that the intervention had upon determinants and mediators of dietary behavior. A general outline of the study procedures is shown in Figure 1.

**FIGURE 1**
**GENERAL STUDY PROCEDURES**



## Development of Study Tools

This section provides a detailed description of the development of the study tools, the administration of the study intervention, and the evaluation of the study intervention.

### Diet Screener Development

The tailored feedback that participants received was derived from the results of the diet screener they completed at the "Let's Get Healthy!" fair in Union County, Oregon. The diet screener used questions from the Block Food Screeners for Ages 2-17 2007 (40), a computerized food frequency questionnaire designed to assess nutrient intake of people under the age of 18. The computerized diet screener used in this study asked participants to report whether or not they ate certain types of food during the past week. If they ate a certain food, they were asked to estimate the number of times the food was eaten. Response choices consisted of "none," "a little," "some," or "a lot." Questions about the intake of various types of foods were asked, but the screener was designed primarily to assess the intake of fruits, vegetables, dietary fat, and sugar-sweetened beverages. Therefore feedback was only provided in these four areas, since they were the four areas that had the most accurate estimates. In addition to questions derived from the Block Kids Screener, questions about consumption of energy drinks were included.

An algorithm was developed by the primary investigator to estimate food intake based on responses to the diet screener. The algorithm was used to compare the estimated intake of each food group to recommended intake

based on the child's self-reported age and gender. The algorithm translated self-reported intake of specific foods and servings on the diet screener to cups or grams of fruits, vegetables, dietary fat, and sugar-sweetened beverages. The algorithm was created using standardized servings of each type of food established by the USDA's MyPyramid (4), the USDA Food Database (44), and the American Dietetic Association Exchange Lists (45). The algorithm used to determine age-specific and gender-specific recommended intakes was generated using recommendations in the USDA's MyPyramid (4) and the Dietary Guidelines for Americans (DRIs)(3). For example, if a child said that he/she consumed three apples and four pears during the past week, the screener would calculate average daily fruit intake as one cup. The algorithm is located in Appendix A. After completion of the screener, the computer provided participants with their estimated intakes of fruits, vegetables, dietary fat, and sugar-sweetened beverages as well as the recommended intakes for these foods. Participants were instructed to write these values on the nutrition handout.

## Development of The Nutrition Handout

At the entrance to the "Let's Get Healthy!" fair in Union County, participants were given a fair booklet that included the two page nutrition handout. The nutrition handout provided a place for participants to write their results from the diet screener and receive educational information about fruits, vegetables, dietary fat, and sugar-sweetened beverages. To develop the nutrition handout, focus groups were conducted with middle-

school students to insure that the handouts provided nutrition information in an age-appropriate manner. The information provided in the handout was developed to focus on the personal, environmental, and behavioral factors that determine and mediate dietary behavior, as outlined in the constructs of the SCT.

## FOCUS GROUP FEEDBACK

Focus groups were used to determine the best way to present nutrition information to participants on the nutrition handout. Two focus groups, one all-female (n=14) and one all-male (n=9) were conducted in October of 2010 at St. Helens Middle School in St. Helens, Oregon. Gender-specific groups were used to enhance participant comfort and to prevent bias in responses due to the presence of the opposite gender. Focus groups were limited to twenty students per group to ensure that each participant had the opportunity join in the discussion and that a variety of perspectives could be obtained.

The school administration chose two groups of 6th-8th grade students involved in an after-school program to participate in the focus groups. The week before the discussion, all of the students in the after-school program were sent home with an information sheet describing the purpose of the focus-groups and an opt-out form to share with their parents. Immediately before the focus group discussions, students were given an information sheet that outlined the focus group session. They were reminded that their responses would remain anonymous, that the sessions would be tape-

recorded, and that they could opt-out of focus-group participation at any time.

The focus groups were facilitated by the primary investigator who encouraged students to exchange ideas and opinions and who redirected the conversation to keep the discussions focused on the study topic. The facilitator intervened as little as possible. The focus groups were tape-recorded using two machines, and an assistant took field notes on quotations and emerging themes. During the discussion, examples of handouts previously published and posted on the internet about various nutrition-related topics were given to the participants. Participants discussed what they liked and what they did not like about each handout. They discussed how and what they would like to learn about nutrition. (See Appendix B for focus group script).

The recordings generated by the focus groups were transcribed verbatim and supplemented with the written notes. The verbatim transcript was used for data analysis and archived for later use in the event of a loss or misunderstanding of any comments and to reduce the chance of selective analysis. Content analysis was performed to identify how and what students wanted to learn about fruits, vegetables, sugar-sweetened beverages, and dietary fat.

The graduate student researcher reviewed the transcripts of the focus groups' discussions for general impressions and then identified specific

themes or trends about how and what students wanted to learn about nutrition. Classification was carried out systematically using Krueger's and Casey's standard procedure (46). The frequency, specificity, emotion, and extensiveness of each theme were used to determine how much weight or emphasis to place on a theme. The following themes emerged from the focus groups:

- *Appearance matters:* The majority of the comments that the students made were about the visual appearance of the nutrition education materials. The students said that if a handout was not visually engaging, they would not bother reading it. A visually engaging handout was described as using a variety of bright colors, funny graphics, a variety of images, and minimal words. The images should be relevant to the message of the handout, as focus group participants reported confusion when presented with irrelevant information.
- *Students value variety and informative materials:* Many of the students indicated that they preferred the handouts that they perceived as more informative and that covered a variety of topics and information. They stated that handouts that only covered one topic lacked information and were less interesting. They also stated that the information presented should be easy to understand.
- *Materials should be fun:* The students repeatedly stated that they liked handouts that they perceived as humorous. One of their favorite handouts was one featuring dancing bananas and other fruit characters.

Throughout the focus group, they referred back to the dancing fruit. They also said that they were more likely to read and share funny handouts.

- *Relate information to families and teachers:* Throughout the sessions, students repeatedly related the information that they learned on the handouts to how this information might impact their family and teachers. Many students expressed concerns about unhealthy behaviors of their family members and thought that the information on the handouts would be important for their family members to read. Students believed that their teachers would not want them to throw away the handouts. Students cited grandparents, parents, and teachers as sources of nutrition information.

In summary, the focus groups revealed that students want nutrition information to be engaging, visually appealing and humorous, while providing information in a straight-forward, non-confusing way. They also wanted the information to be something that they could share with their families. The results of the focus groups were used to develop the nutrition feedback handout for the "Let's Get Healthy!" fair.

## Content of the Nutrition Handout

As a result of the focus group conclusions, the nutrition handout developed for the "Let's Get Healthy!" fair used a number of images, information, cartoons, and bright colors. The handout is available in Appendix C. The content of the nutrition information provided on the handout was developed using both the focus group results and the constructs

of the SCT. As previously described, the SCT describes behavior as the result of the interaction between personal, environmental, and behavioral factors (26-29). The handout was composed of the following four sections:

- *"Your Results":* Upon completion of the diet screener, participants were instructed to record their estimated and recommended intakes of fruits and vegetables, dietary fat, and sugar-sweetened beverages on this portion of the handout.
- *"More About Fruits and Veggies":* This section of the handout provided participants with information about fruits and vegetables. The first portion of this section, "I love Fruits and Veggies because...," described the various reasons why someone might want to eat fruits and vegetables. Another portion, "Fun Ways to Enjoy Fruits and Veggies," informed participants how to incorporate fruits and vegetables into their diets. Finally, in the portion titled "Pick a Fruit and Veggie Goal!" participants were encouraged to choose a fruit and vegetable goal and to share this goal with their parents, teachers, and friends.
- *"More About Fatty Foods":* In this section of the handout, participants received information about dietary fat. In the "Eat the Right Kind of Fat," participants were encouraged to lower their intake of saturated fats and instead consume unsaturated fats. Examples of each type of fat were included in the handout. Participants were told that while they should not eat too much fat, fat is a necessary part of a child's diet. Just as in the fruit and vegetable section of the handout, participants are asked to "Pick

a Fatty Food Goal" and share their goal with their parents, teachers, and friends.

- *"More About Soda and Energy Drinks"*: In this section of the handout, participants were provided with information about sugar-sweetened beverages. Participants were informed that sugar-sweetened beverages contain added sugar and caffeine, which can have negative effects on health. In the section "How Much Sugar and Caffeine are in Different Drinks?" an illustration of the amounts of the sugar and caffeine in commonly consumed drinks was provided. Finally, as in the previous two sections, participants were asked to "Pick a Drink Goal" and to share the goal with their parents, teachers, and friends.

## DEVELOPMENT OF THE EVALUATIVE QUESTIONNAIRES

To evaluate the effectiveness of the study intervention, an evaluative questionnaire measuring influencers that determine dietary behavior was developed. The questionnaire was modeled after the CATCH Health Behavior Questionnaire, which was developed for grade school students. The questionnaire focused on nutrition and measured the determinants of nutrition behavior based on the Social Cognitive Theory (30). Some questions from the CATCH questionnaire were omitted, including ones on smoking assessment and physical activity, and ones that did not have a clearly correct answer. New questions assessing sugar-sweetened beverage consumption were developed using the same format as the other questions in the questionnaire.

A draft of the questionnaire was reviewed by middle school teachers from St. Helens Middle School in St. Helens, Oregon and members of the Nutrition Education Services Division of the Oregon Dairy Council (ODC). The teachers suggested shortening the questionnaire and changing some of the words to make it more readily understood by school-age children. The staff at the ODC suggested removing questions that were redundant and changing the format and content to improve clarity and nutritional accuracy. For example, some questions did not have a clearly "correct" answer choice and these questions were modified.

The final pre- and post-fair questionnaires consisted of 52 questions that measured dietary intentions, dietary preferences, dietary knowledge, dietary behavior, social norms, and self-efficacy (see Appendix D). Each of the question categories measured one or more of the components of the SCT. The post-fair questionnaire contained five additional questions to determine if the participant attended the fair, completed the diet screener, read the nutrition handout, printed out the nutrition handout (this was not an option during the intervention), and if his/her teachers discussed the fair in the classroom. The questionnaires were designed to take about 25 minutes to complete.

The questionnaire included five question types or constructs designed to evaluate the personal, environmental, and behavioral factors that

determine and mediate dietary behavior, as outlined by the SCT. Each construct is described below:

- *Dietary Intention* (seven questions): These questions measured the behavioral and environmental factors of the SCT. For each question, there were two response options. Participants identified which of two foods they were more likely to choose. For each question, one of the two answers was more healthful than the other. The more healthful choices were fruits, vegetables, foods lower in dietary fat, and foods lower in added sugar.

- *Dietary Preference* (seven questions): These questions measured the behavioral factors of the SCT. They analyzed usual dietary choices, but not overall consumption. Each question had two response options, one of which was more preferable than the other. Like the dietary intention questions, the more healthful choices were the fruits, vegetables, foods lower in fat, and foods lower in added sugar.

- *Dietary Knowledge* (seven questions): These questions measured the behavioral factors of the SCT. Each question had two response options, one of which was more preferable than the other. Like the dietary intention and preference questions, the more healthful choices were the fruits, vegetables, foods lower in fat, and foods lower in added sugar. (The first two of these seven questions were later taken out of the

evaluation because they did not have a clear "more nutritious" or "less nutritious answer").

- *Typical Dietary Behavior* (eight questions). These questions assessed the behavioral factors of the SCT. They assessed whether the respondent demonstrated a particular dietary behavior. The response options were either "yes" or "no." One of the answers was more healthful or desirable than the other. The questions assessed the level of involvement that the respondent had upon his or her behavior, or whether the participant usually consumed fruits, vegetables, fatty foods, and sugar-sweetened beverages.

- *Perceived Social Reinforcement* (fourteen questions): These questions assessed perceived social reinforcement from parents, teachers, and friends towards healthful dietary behaviors. They measured the environmental, behavioral, and personal factors of the SCT. Participants chose whether they thought their parents, teachers, and friends wanted them to eat fruits, vegetables, and foods lower in fat, and foods lower in added sugar. "Yes" was always the preferred answer.

- *Self Efficacy* (seven questions): These questions measured behavioral and personal factors of the SCT. Participants indicated how sure they were of choosing a healthful food choice. The scale was a three-point ordinal response set. Responses to each question included "not sure," "a

little sure," and "very sure." "Very sure" was always the most desired answer.

## Intervention Methods

The intervention consisted of three components: attendance at the "Let's Get Healthy!" fair, completion of the diet screener, and reading the nutrition handout. Participants who completed all three of these components completed the full intervention.

## Study Participants

The study used a convenience sample of students who lived in Union County, Oregon. Union County is a rural county in Eastern Oregon with six school districts, fifteen schools, and 3,900 students (47-48). At the time of the 2008 census, the population of Union County was 91.3% non-Hispanic white, 3.4% Hispanic, and 4.3% other race/ethnicity. The median family income in Union County was $54,471 and about 19.6% of families with children were below the poverty line. In addition, 24.9% of people under the age of 18 were below the poverty line (48).

## Recruitment and Consent/Assent

Through written correspondence, researchers contacted teachers of fourth through sixth grade students in Union County who planned to attend the "Let's Get Healthy!" fair as a classroom activity. The teachers were asked if they would like participate in this study. Each school developed and implemented its own parental consent and student assent procedures to

participate in the health fair. (See Appendix E for letter to teachers and information document for students about study).

Pre-fair and post-fair questionnaires were sent to teachers who agreed to participate in the study, along with detailed administration instructions.

When the students arrived at the "Let's Get Healthy!" fair, they were given the fair booklet that included the nutrition handout. They also were invited to visit the diet station to complete the diet screener and read the nutrition handout, and were reminded that participation was voluntary.

Participants voluntarily completed the computerized diet screener at the diet station of the fair, which was facilitated by the graduate student researcher. It took students approximately 10-15 minutes to complete the screener. Students were encouraged to clarify questions about the screener with the researcher. The researcher also read aloud some of the questions when requested. Upon completion of the screener, the number of cups of fruits and vegetables, the grams of dietary fat, and the number of cups of sugar-sweetened beverages recommended based upon the participant's age and gender was displayed on the computer screen. The computer also estimated the participants' consumption of these foods and nutrients based on the results of the diet screener. The participants were instructed to write down their estimated intakes and the recommended intakes of each listed

food and nutrient on the nutrition handout. The researcher explained the results of the screener to the study participants.

Participants who did not complete the diet screener had the option of reading the nutrition information in the handout without inputting their personal information (therefore it was a non-tailored handout for participants who did not complete the diet screener). All students were encouraged to take the handout home and to share the information with their parents.

## Administration of the Evaluative Questionnaires

Pre-fair and post-fair questionnaires were administered to evaluate the effectiveness of the intervention on improving scores measuring the constructs of the SCT. Pre-fair and post-fair questionnaires were mailed to the schools who agreed to participate in the "Let's Get Healthy!" fair and the evaluation of the fair. The questionnaires were accompanied by detailed written instructions on administration procedure. Teachers were instructed to administer the questionnaire two weeks before and two weeks after the fair. Each student created and labeled their questionnaires with a unique identification code that allowed researchers to match the completed pre-fair and post-fair questionnaires. The identification code was the numeric date of the day of their birth, the first two letters of their mother's first name, and the last 2 digits of their phone number. The teachers returned both sets of completed questionnaires to the researchers in pre-addressed envelopes.

## Data Entry and Cleaning

The completed questionnaires were sent to Pacific Research & Evaluation in Portland, Oregon, where responses were converted to an electronic dataset using Microsoft Excel. The participant's identification code, school, teacher, and responses to all questions were recorded. Generic values of 1, 2, or 3 were assigned to each question response option and recorded on the Excel spreadsheet.

After the electronic dataset was developed and returned to OHSU, it went through extensive data cleaning and response option values were converted to weighted-numerical values based on correct, incorrect, or missing values. Individual's pre-fair and post-fair questionnaires were matched using their personal identification codes. If the code matched completely, the questionnaires were considered matched. If the code was different by one letter or number, but same gender, age, and teacher, the questionnaires were considered matched. If there were no apparent matches, the questionnaires were excluded from analysis. For each question of the questionnaire, there was a "more nutritious" and "less nutritious" answer choice. If the question had only two possible answers, the more nutritious answer was re-coded as 1 and the less nutritious answer was re-coded as 0. If there were three answers, the most nutritious was re-coded as 1, the somewhat nutritious was re-coded as 0.5 and the least nutritious was re-coded as 0. Participants who did not answer at least 75% of the questions on either the pre- or post-fair questionnaire were excluded from the study.

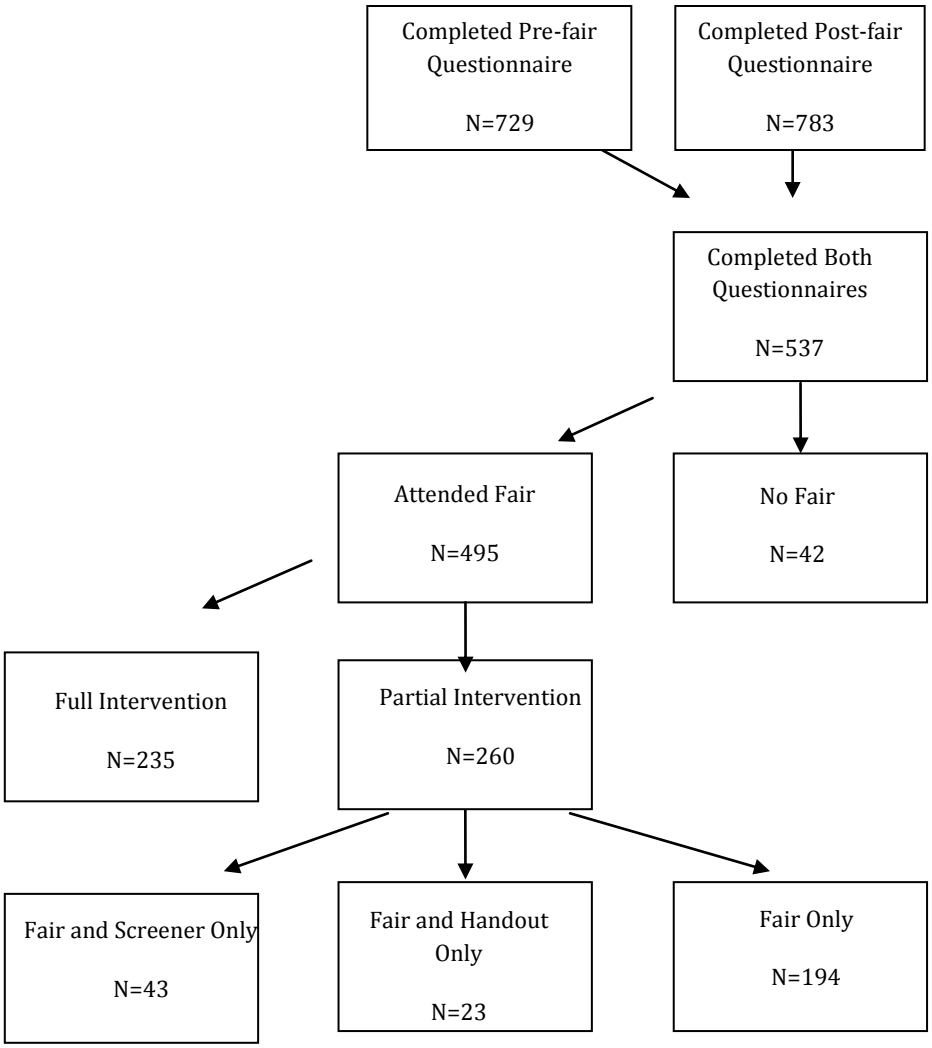
If a participant did not answer a question, their score on that question was coded as 0. The scores for each question for each participant were summed to generate a total score for each question construct and a total questionnaire score. (A different coding system was considered to deal with the missing values. In this system, the researcher removed the questions with the missing values from each individual participant's total score and then divided the total score for each participant by the total number of questions answered, rather than total number of questions asked. This method was not used because it provided a less conservative estimate of any true association among variables).

## Degree of Participation

The full dietary intervention consisted of three components: attending the Union County "Let's Get Healthy!" fair, completing the diet screener at the fair, and reading the nutrition handout at the fair. Participants who fulfilled all three of these components completed the full intervention. Participants who did not complete all of these components did not complete the full intervention. The scores of the participants who completed all components of the intervention were compared to the scores of participants who attended only the fair. All other participants were excluded from analysis due to low number of participants in each of these groups. Groups excluded groups from analysis included those who completed the screener but not the handout, those who read the handout but did not complete the

screener, and those who did not attend the fair. Figure 2 outlines the different categories of participation.

**FIGURE 2**
**OUTLINE OF CATEGORIES OF PARTICIPATION**



## Statistical Analysis Procedures

Various statistical tests were conducted to analyze the effects the intervention on scores measuring the determinants and mediators of the dietary behaviors of participants. All of these tests were conducted using Stata statistical software (Version 12, StataCorp, College Station, Texas) . Unpaired and paired t-tests were used to compare pre-fair and post-fair questionnaire scores of participants who completed the full intervention or attended the fair only between participants of different ages and genders. Differences were considered significant when the p-value was less than 0.05.

## Analysis of Effect of Degree of Participation on Questionnaire Scores

Paired and unpaired t-tests were conducted to determine the effect that completion of the full intervention versus attending the fair only had upon pre-fair and post-fair questionnaire scores. For the group reporting full participation in the intervention (attended fair, read handout, completed diet screener) and the participants who attended only the fair, the mean pre-fair and mean-post fair overall questionnaire scores and questionnaire scores for each construct subgroup were calculated. Changes in total questionnaire scores in each group and for each question construct sub-score were calculated as the percent difference [(post-fair score minus pre-fair score)/number of questions x 100].

Paired t-tests were conducted to determine if each group's post-fair scores were significantly higher than their pre-fair total and construct sub-

scores. Unpaired t-tests were conducted to determine if the group that attended the full intervention had significantly greater changes in questionnaire scores from pre-fair to post-fair than the group that attended only the fair. Data was not analyzed for the students who did not attend the fair due to small sample

### Comparison of Change in Score By Gender

The "change in score" of pre-fair to post-fair questionnaires for students categorized by gender was also calculated. One-sided unpaired t-tests were conducted to determine if girls improved their scores more than boys after participating in the intervention. Furthermore, for each gender and degree of participation, one-sided paired t-tests comparing total and construct subgroup scores were conducted to determine if post-fair scores were higher than pre-fair scores. Unpaired one-sided t-tests were conducted to determine if change in total questionnaire score and construct subgroup scores of the group that completed the full intervention were significantly higher than the group that attended the fair only.

Analysis of variance (ANOVA) tests were conducted to determine if there were significant differences in mean change in total score and each construct subgroup score between each gender/intervention group ($F<0.05$ being considered significant). The groups compared were females/full intervention vs. females/fair only vs. males/full intervention vs. males/fair only.

## Comparison of Changes in Score By Age

ANOVA was used to determine if the mean change in overall score and each construct subgroup score differed by degree of participation and age. Changes in scores from pre-fair to post-fair questionnaires were compared for significance among participants who completed the full intervention and among participants who attended the fair only for each age group.

## Comparison of Change In Score By Teacher Discussion

Though not a specific aim of the study, the impact that teachers' discussions of the fair had upon participants' scores was analyzed. The mean pre-fair and post-fair questionnaire total and construct specific questionnaire scores for the participants who reported teacher discussion of the fair experience, and participants who reported no teacher discussion of the fair experience were calculated. Unpaired one-sided t-tests were used to determine if total and construct specific "changes in scores" of participants who reported teacher discussion of the fair experience were higher than the "changes in scores" of participants who did not report teacher discussion.

ANOVA tests were conducted to determine if there were significant differences in change in total scores and in construct subgroup scores between each teacher participation/intervention group. The groups compared were teacher discussion/full intervention vs. teacher discussion /fair only vs. no teacher discussion/full intervention vs. no teacher discussion/fair only.

## STEP WISE REGRESSION: VARIABLE SELECTION

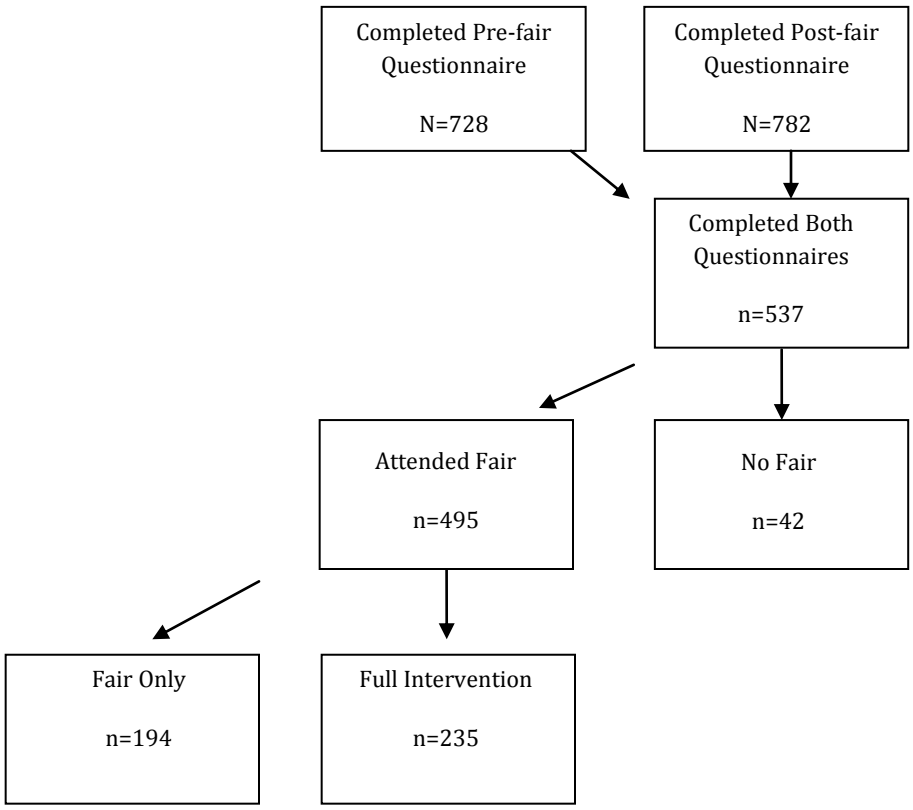
Stepwise regression (pr=0.20) was used to determine which variables significantly affected the change in questionnaire scores among participants. The independent variables were fair participation (yes/no), participation in the diet station (yes/no), reading of the nutrition handout (yes/no), teacher discussion (yes/no), age (each age), and gender (male/female).

# CHAPTER 5: RESULTS

The primary aim of this study was to determine if providing tailored nutrition feedback at the "Let's Get Healthy!" fair in Union County, Oregon significantly changed scores measuring the personal, environmental, and behavior factors that determine and mediate the diets of 4th-6th graders. This question was tested through the comparison of scores on pre-fair and post-fair questionnaires completed by students at the schools that participated in the fair.

As illustrated in Figure 3, 728 participants completed the pre-fair questionnaire and 782 participants completed the post-fair questionnaire. Of these participants, 537 had their questionnaires matched. Of the 537 participants who completed both questionnaires, 42 (7.8%) did not attend the fair while 495 (92%) attended the fair. Of the participants who attended the fair, 235 (44%) completed both the diet screener and read the nutrition handout. There were 260 participants (48%) who attended the fair but did not complete both the diet screener and read the nutrition handout.

**FIGURE 3**
**NUMBER OF PARTICIPANTS IN EACH CATEGORY OF PARTICIPATION**




The number of male and female participants and the number of 4th, 5th, and 6th grade participants who reported completion of both the pre-fair and post-fair questionnaires is displayed in Table 1. Slightly more females (51%) than males (47%) attended the fair and slightly more females (57%) than males (42%) completed both the diet screener and read the nutrition handout at the fair. There were slightly more males (56%) than females (45%) who attended the fair but did not complete the screener and read the handout. The largest group of participants who completed the

questionnaires were 5th grade students (37%), followed by 4th grade students (29%) and 6th grade students (15%).

**TABLE 1:**
**DISTRIBUTION OF PARTICIPANTS BASED UPON COMPLETION OF INTERVENTION COMPONENTS AT "THE LET'S GET HEALTHY!" FAIR**

| Degree of Participation | Gender # (%) | | | Grade # (%) | | | |
|---|---|---|---|---|---|---|---|
| | Boys | Girls | unknown | 4th | 5th | 6th | unknown |
| Attended Fair n=495 | 234 (47) | 255 (51) | 5 (2) | 144 (29) | 183 (37) | 73 (15) | 95 (19) |
| Full Intervention=235 | 98 (42) | 133 (57) | 4 (2) | 69 (29) | 79 (34) | 33 (14) | 54 (23) |
| Fair only n=194 | 105 (56) | 87 (45) | 2 (1) | 58 (30) | 78 (40) | 27 (14) | 31 (16 |

## WITHIN GROUPS: CHANGE IN SCORE BY DEGREE OF PARTICIPATION

Table 2 reports the mean pre- and post-fair questionnaire scores and scores changes of the total and each SCT construct sub-score on the diet questionnaire based upon level of self reported participation in the study intervention.

There was no significant increase in total questionnaire score among participants who completed the full intervention, ($p=0.0814$). Construct sub-scores measuring dietary intention ($p<0.001$), dietary preference ($p<0.001$), and social reinforcement ($p=0.004$) were significantly higher after the

intervention than before; construct sub-scores measuring dietary knowledge ($p=1.0$), typical behavior ($p=0.986$), and self-efficacy ($p=0.060$) were not higher after than before the intervention.

Among participants who attended the fair but did not complete the full intervention, there was a significant increase in total questionnaire score ($p=0.014$). Constructs sub-scores measuring dietary intention ($p<0.001$), dietary preference ($p<0.001$), social reinforcement ($p=0.017$), and self-efficacy ($p=0.016$) were higher after than before attending the fair. Construct sub-scores measuring dietary knowledge ($p=1.0$) and dietary behavior ($p=0.401$) were not higher after attending the fair than before.

**TABLE 2: WITHIN GROUP COMPARISON: DIFFERENCE IN MEAN SCORES ON THE PRE- AND POST-FAIR QUESTIONNAIRES BASED ON COMPLETION OF INTERVENTIONN COMPONENTS**

| | Subgroup Construct | Pre-fair Score* | Post-Fair Score* | % Δ in Score** | P Value*** |
|---|---|---|---|---|---|
| Full Intervention n=235 | Total Score (max=50) | 33 ± 7.9 | 33 ± 7.3 | 1.0 ± 12 | 0.0814 |
| | Dietary Intention (max=7) | 4.2 ± 1.8 | 4.7 ± 1.9 | 6.4 ± 24 | 0.001 |
| | Dietary Preference (max=7) | 3.9 ± 1.8 | 4.2 ± 1.9 | 4.1± 23 | 0.001 |
| | Dietary Knowledge (max=5) | 4.2 ± 1.2 | 3.5 ± 0.99 | -13 ± 21 | 1.00 |
| | Typical Behavior (max=8) | 4.9 ± 1.3 | 4.7 ± 1.6 | -2.6 ± 18 | 0.986 |
| | Social Reinforcement (max=15) | 9.5 ± 3.1 | 10 ± 3.5 | 3.4 ± 16 | 0.004 |
| | Self Efficacy (max=8) | 5.8 ± 1.8 | 6.0 ± 1.9 | 2.6 ± 23 | 0.060 |
| Fair only n=194 | Total Score | 30 ± 6.4 | 31 ± 8.3 | 1.9 ± 17 | 0.014 |
| | Dietary Intention (max=7) | 3.6± 1.8 | 4.2 ± 2.0 | 7.9 ± 24 | <0.001 |
| | Dietary Preference (max=7) | 3.3 ± 1.6 | 3.7 ± 1.9 | 7.2 ± 24 | <0.001 |
| | Dietary Knowledge (max=5) | 4.3 ± 1.1 | 3.5 ± 1.1 | -18 ± 22 | 1.00 |
| | Typical Behavior (max=8) | 4.4 ± 1.4 | 4.4 ± 1.5 | 0.37 ± 18 | 0.401 |
| | Social Reinforcement (max=15) | 8.9 ± 2.8 | 9.3 ± 3.4 | 1.4 ± 17 | 0.017 |
| | Self Efficacy (max=8) | 5.5 ± 1.9 | 5.7 ± 2.0 | 4.0 ± 23 | 0.016 |

* MEAN SCORE ± STANDARD DEVIATION
**(POST-PRE)/PRE X 100
***ONE-SIDED PAIRED T-TEST

## BETWEEN GROUP: DIFFERENCE IN CHANGE IN SCORE

Unpaired one-sided t-tests found that the change in total questionnaire scores (post-fair minus pre-fair scores), and construct sub-scores of participants who completed the full intervention was not higher than the change in score of those who attended the fair only (see Table 3)

**TABLE 3: BETWEEN GROUP COMPARISON OF CHANGE IN TOTAL SCORES AND SPECIFIC DIETARY CONSTRUCT SCORES BY DEGREE OF PARTICIPATION**

| Questions Construct | P value |
|---|---|
| Change in Total Scores | 0.754 |
| Change in Dietary Intention Scores | 0.733 |
| Change Dietary Preference Scores | 0.815 |
| Change in Dietary Knowledge Scores | 0.255 |
| Change in Typical Behavior Scores | 0.952 |
| Change in Social Reinforcement Scores | 0.381 |
| Change in Self Efficacy Scores | 0.290 |

*UNPAIRED ONE SIDED T-TEST: CHANGE IN SCORE OF FULL INTERVENTION

PARTICIPANTS COMPARED TO CHANGE IN SCORE OF FAIR ONLY PARTICIPANTS

## Analysis of Change in Total and Construct Specific Questionnaire Scores By Gender

Table 4 shows the total and construct-specific change in questionnaire scores of males and females who completed the full intervention or who attended the fair only.

## TABLE 4: WITHIN AND BETWEEEN GROUP COMPARISONS OF MEAN CHANGE IN TOTAL AND CONSTRUCT SPECIFIC QUESTIONNAIRE SCORESS

| Gender | Question Construct | Full Intervention* | Fair Only* | p Value** |
|---|---|---|---|---|
| Males<br><br>Full Int. n=98<br><br>Fair only n=105 | Total Score (max=50) | 0.48 ± 12<br>p=0.350 | 0.61 ± 12<br>p=0.726 | 0.830 |
| | Dietary Intention (max=7) | 0.78 ± 4.0<br>p=0.028 | 0.96 ± 3.2<br>p= 0.001 | 0.637 |
| | Dietary Preference (max=7) | 0.57 ± 3.4<br>p=0.052 | 0.82 ± 3.1<br>p=0.004 | 0.703 |
| | Dietary Knowledge (max=5) | -1.4 ± 2.4<br>p=1.00 | -1.6 ± 2.3<br>p=1.00 | 0.379 |
| | Typical Behavior (max=8) | -0.51 ± 3.3<br>p=0.911 | 0.11 ± 3.0<br>p=0.653 | 0.776 |
| | Social Reinforcement (max=15) | 0.67 ± 4.9<br>p=0.088 | 1.4 ± 5.1<br>p=0.002 | 0.864 |
| | Self Efficacy (max=8) | 0.53 ± 3.9<br>p=0.211 | 0.59 ± 3.9<br>p=0.061 | 0.692 |
| Females<br><br>Full Int. n=133<br><br>Fair only n=87 | Total Score (max=50) | 1.2± 11<br>p=0.237 | 1.7 ± 13<br>p=0.898 | 0.619 |
| | Dietary Intention (max=7) | 0.98 ± 3.1<br>p<0.001 | 1.3 ± 3.6<br>p<0.001 | 0.755 |
| | Dietary Preference (max=7) | 0.51 ± 3.2<br>p=0.034 | 0.95 ± 3.6<br>p=0.009 | 0.821 |
| | Dietary Knowledge (max=5) | -1.2 ± 1.9<br>p=1.00 | -1.2 ± 2.0<br>p=1.00 | 0.582 |
| | Typical Behavior (max=8) | 0.38 ± 2.6<br>p=0.950 | 2.8 ± 2.8<br>p= 0.179 | 0.958 |
| | Social Reinforcement (max=15) | 0.96 ± 5.7<br>p=0.027 | 0.00 ± 5.1<br>p=0.517 | 0.091 |
| | Self Efficacy (max=8) | 0.40 ± 3.4<br>p=0.120 | 0.41 ± 3.1<br>p=0.114 | 0.514 |

*MEAN % CHANGE IN SCORE (POST-SCORE MINUS PRE-SCORE) ± SD, ONE SIDED PAIRED T-TEST POST SCORE>PRE SCORE

** P VALUE OF ONE-SIDED P-TEST- FULL INTERVENTION CHANGE IN SCORE COMPARED TO FAIR ONLY

Neither the males who completed the full intervention nor the males who only attended the fair had significantly higher post-fair total questionnaires scores than pre-fair questionnaire scores (p=0.350 and p=0.726). Among the males who completed the full intervention, post-fair scores were significantly higher among construct sub-scores measuring dietary intention (p=0.028), but not among constructs measuring dietary preference (p=0.052), dietary knowledge (p=1.00), typical behavior (p=0.911), social reinforcement (p=0.088), or self-efficacy (p=2.11). Among males who attended the fair only, post-fair construct sub-scores were significantly higher for questions measuring dietary intention (p=0.001), dietary preference (p=0.004), and social reinforcement (p=0.002), but not among questions measuring dietary knowledge (p=1.00), typical behavior (p=0.653) and self-efficacy (p=0.061). The change in total questionnaire score from pre-fair questionnaires to post-fair questionnaires were not significantly higher among males who completed the full intervention compared to males who attended the fair only (p=0.830). Similarly, none of the change in scores among any of the construct subgroups were significantly higher among males who completed the full intervention than males who attended the fair only.

Similarly, neither the females who completed the full intervention nor the females who attended the fair only had significantly higher post-fair total questionnaire scores than pre-fair questionnaire scores (p=0.237 and p=0.898). Among females who completed the full intervention, post-fair

questionnaire scores measuring the constructs of dietary intention ($p<0.001$), dietary preference ($p=0.034$), and social reinforcement ($p=0.027$) significantly improved from pre-fair questionnaire scores, while post-fair questionnaire scores measuring dietary knowledge ($p=1.00$) and typical behavior ($p=0.950$) did not significantly improve from pre-fair questionnaire scores. Among females who attended the fair only, post-fair questionnaire scores significantly improved from pre-fair questionnaire scores in the construct scores measuring dietary intention ($p<0.001$) and dietary preference ($p=0.009$), but construct scores measuring dietary knowledge ($p=1.00$), typical behavior ($p=0.179$), social reinforcement ($p=0.517$), and self-efficacy ($p=0.114$) did not change. The change in total questionnaire scores from pre-fair questionnaires to post-fair questionnaires were not significantly higher among females who completed the full intervention than females who attended the fair only ($p=0.619$). Similarly, none of the change in scores among any of the construct subgroups was significantly higher among females who completed the full intervention than females who attended the fair only.

Table 5 illustrates the changes in questionnaire scores between males and females who completed the full interevention or who attended the fair only using unpaired one-sided t-tests. The change in total questionnaire score and questionnaire score of each construct subgroup were not significantly higher among females than males.

**TABLE 5: COMPARISON OF MEAN TOTAL AND CONSTRUCT SPECIFIC CHANGES IN DIETARY QUESTIONNAIRE SCORES AMONG MALES AND FEMALES OF DIFFERENT DEGREES OF PARTICIPATION**

| Degree of Participation | Question Construct | P value * |
|---|---|---|
| Full intervention<br><br>Male n=98<br>Female n=133 | Total Score | 0.313 |
| | Dietary Intention | 0.338 |
| | Dietary Preference | 0.554 |
| | Dietary Knowledge | 0.261 |
| | Typical Behavior | 0.428 |
| | Social Reinforcement | 0.340 |
| | Self Efficacy | 0.440 |
| Fair only<br><br>Male n=105<br>Female n=87 | Total Score | 0.192 |
| | Dietary Intention | 0.240 |
| | Dietary Preference | 0.394 |
| | Dietary Knowledge | 0.070 |
| | Typical Behavior | 0.174 |
| | Social Reinforcement | 0.976 |
| | Self Efficacy | 0.642 |

*UNPAIRED ONE SIDED T-TEST: CHANGE IN SCORE FEMALES>MALES

## ANALYSIS OF VARIANCE TESTS COMPARING CHANGE IN SCORES BETWEEN MALES AND FEMALES

ANOVA tests were conducted to determine if the mean change in total score from pre-fair to post-fair differed significantly between females and

males who completed the full intervention or who attended the fair only (that is, is the mean change in total score among each gender who completed full intervention different from the mean change in score among each gender who attended the fair only). There was no significant difference in mean change in total score between females and males who completed the full intervention or attended the fair only (prob>F=0.6417). Likewise, there was no significant difference in construct specific sub-scores between males and females who completed the full intervention or attended the fair only: dietary intention (prob>F=0.117), dietary preference (prob>F=0.531), dietary knowledge (prob>F=0.065), typical behavior (prob>F=0.265), social reinforcement (prob>F=0.757), self-efficacy (prob>F=0.7894).

### Change in Score By Age and Degree of Participation

ANOVA tests were conducted to determine if there was a difference in mean change in total and construct sub-scores of participants who completed the full intervention and participants who attended the fair only, among participants of different ages (mean change in score for full intervention of each age = mean change in score for fair only of each age). There were no differences in mean changes in total questionnaire scores of participants of difference ages and levels of participation (prob>F=0.246). There were also no differences in changes in construct specific sub-scores measuring dietary intention (prob>F=0.075), dietary preference (prob>F=0.139), dietary knowledge (prob>F=0.085), typical behavior (prob>F=0.403), social reinforcement (prob>F=0.745), or self-efficacy (prob>F=0.543).

## Comparison of Change in Score By Teacher Discussion and Degree of Participation

One question on the post-fair questionnaire asked students to report if teachers discussed the fair with them in the classroom. Post-hoc analysis of the results revealed that not all teachers discussed the fair with their students. While not one of the aims of the study, the effect that the student-reported teacher discussion had on changes in scores was analyzed.

Table 6 compares changes in questionnaire total and construct sub-scores between participants who reported that their teachers discussed the fair with them to scores of participants who reported that their teachers did not discuss the fair with them.

Participants who reported teacher discussion of the fair had significantly higher post-fair than pre-fair total questionnaire scores ($p=0.032$) and construct specific sub-scores measuring dietary intention ($p<0.0001$), dietary preference ($p<0.001$), social reinforcement ($p=0.013$), and self-efficacy ($p=0.032$). Post-fair scores were not higher than pre-fair scores for dietary knowledge ($p=1.00$) or dietary behavior ($p=0.980$).

Participants who did not report teacher discussion did not have significantly higher post-fair than pre-fair total scores or construct sub-scores.

**TABLE 6: WITHIN GROUP COMPARISON IN CHANGE OF QUESTIONNAIRE SCORES OF STUDENTS WHO REPORTED TEACHER DISCUSSION TO STUDENTS WHO DID NOT REPORT TEACHER DISCUSSION OF FAIR**

| | Subgroup Construct | Pre-fair Score* | Post-Fair Score* | % Δ in Score** | P Value*** |
|---|---|---|---|---|---|
| Teacher Discussion N=293 | Total Score(max=50) | 31.9 ± 7.13 | 32.6 ± 7.67 | 1.30 ± 12.0 | 0.032 |
| | Dietary Intention (max=7) | 4.16 ± 1.79 | 4.68 ± 1.81 | 7.41 ± 24.3 | 0.000 |
| | Dietary Preference (max=7) | 3.72 ± 1.79 | 4.08 ± 1.82 | 5.11 ± 23.7 | <0.001 |
| | Dietary Knowledge (max=5) | 4.13 ± 1.19 | 3.51 ± 1.02 | -12.5 ±21.7 | 1.00 |
| | Typical Behavior (max=8) | 4.84 ± 1.32 | 4.67 ± 1.47 | -2.14 ± 17.8 | 0.980 |
| | Social Reinforcement (max=15) | 9.42 ± 3.13 | 9.79 ± 3.40 | 2.48 ± 18.9 | 0.013 |
| | Self Efficacy (max=8) | 5.64 ± 1.89 | 5.83 ± 2.00 | 2.45 ± 22.6 | 0.032 |
| No Teacher Discussion N=110 | Total Score (max=50) | 30.3 ± 7.13 | 29.8 ± 8.63 | -10.6 ± 12.6 | 0.811 |
| | Dietary Intention (max=7) | 3.7 ± 1.91 | 3.82 ± 2.04 | 1.69 ± 28.0 | 0.264 |
| | Dietary Preference (max=7) | 3.52 ± 1.75 | 3.59 ± 2.06 | 1.04 ± 25.0 | 0.332 |
| | Dietary Knowledge (max=5) | 4.14 ± 1.23 | 3.19 ± 1.34 | -18.9 ± 27.8 | 1.00 |
| | Typical Behavior (max=8) | 4.47 ± 1.51 | 4.45 ± 1.56 | -0.338 ± 17.6 | 0.580 |
| | Social Reinforcement (max=15) | 8.78 ± 2.99 | 9.23 ± 3.61 | 2.97 ± 21.3 | 0.074 |
| | Self Efficacy (max=8) | 5.69 ± 1.93 | 5.49 ± 2.16 | -2.44 ± 25.0 | 0.847 |

*MEAN SCORE ± SD

**MEAN % CHANGE IN SCORE (POST-PRE) ± SD

*** P VALUE OF ONE-SIDED T-TEST- FULL INTERVENTION CHANGE IN SCORE>FAIR ONLY

ANOVA tests were conducted to determine if there were differences in mean change in total and construct specific sub-scores of participants who completed the full intervention, participants who completed the fair only, participants who reported teacher discussion and participants who reported no teacher discussion. There were no differences in change in total scores of participants with different degrees of teacher discussion and levels of

participation (prob>F=0.249). There was also no difference in changes in construct sub-scores measuring dietary intention (prob>F=0.063), dietary preference (prob>F=0.330), typical behavior (prob>F=0.236), social reinforcement (prob>F=0.756), and self-efficacy (prob>F=0.0093). There was a significant change in construct scores measuring dietary knowledge (prob>F=0.005). A series of paired t-tests were conducted to determine which groups had significantly different dietary knowledge scores (degree of participation/teacher involvement) (Table 7). There was no difference in change in dietary knowledge scores between any of the groups analyzed in this study. Further analysis shows that the difference in dietary knowledge scores detected in the ANOVA tests was the result of differences in scores between participants who did not indicate that there was teacher discussion or participants who did not indicate whether they completed all components at the fair. Thus, when their scores were excluded, there was no significant difference in scores.

**TABLE 7: COMPARISON OF CHANGE IN DIETARY KNOWLEDGE SCORES BASED UPON TEACHER DISCUSSION AND PARTICIPATION IN THE "LET'S GET HEALTHY!" FAIR**

| Groups Compared | | P Value* |
|---|---|---|
| No Teacher Discussion<br>Full Intervention<br>n=50 | No Teacher Discussion<br>Fair Only<br>n=25 | 1.00 |
| No Teacher Discussion<br>Full Intervention<br>n=50 | Teacher Discussion<br>Full Intervention<br>n=185 | 0.656 |
| No Teacher Discussion<br>Full Intervention<br>n=50 | Teacher Discussion<br>Fair Only<br>n=56 | 0.788 |
| No Teacher Discussion<br>Fair Only<br>n=25 | Teacher Discussion<br>Full Intervention<br>n=185 | 0.748 |
| No Teacher Discussion<br>Fair Only<br>n=25 | Teacher Discussion<br>Fair Only<br>n=56 | 0.834 |
| Teacher Discussion<br>Full Intervention<br>n=50 | Teacher Discussion<br>Fair Only<br>n=56 | 0.888 |

*UNPAIRED TWO SIDED T-TEST COMPARING CHANGE IN SCORE BETWEEN TWO GROUPS

## VARIABLE ANALYSIS

Forward, stepwise, elimination, variable, selection, regression analysis (pr=0.2) was used to determine which variables (completed diet screener, read nutrition handout, attended fair, discussed fair with teacher, age, and gender) significantly influenced change in total questionnaire score. The only variables that significantly influenced the change in the totalscore were if students attended the fair and if teachers discussed the fair with the students.

## SUMMARY OF RESULTS

In summary, various comparisons between pre-fair and post-fair questionnaire scores of study participants were conducted. Participants who completed the full intervention (attended the fair, visited the diet station, and read the nutrition handout) did not have significantly greater improvements in total or construct specific scores than participants who attended the fair only. Females did not have significantly greater improvements in total or construct specific questionnaire scores than males. There was also no difference in changes in questionnaire scores between participants of different ages. Participants who reported teacher discussion of the fair in their classrooms had significantly higher total post-fair questionnaire scores and construct sub-scores measuring dietary intention, dietary preference, social reinforcement, and self-efficacy than their pre-fair questionnaire scores. Among participants who reported no teacher discussion, post-fair total scores were not higher than pre-fair scores. Likewise, construct specific

post-fair sub-scores were not higher than construct specific pre-fair subscores.

# CHAPTER 6: DISCUSSION

Poor childhood diet quality has emerged as a major public health concern over the past several decades. According to the Center for Nutrition Policy and Promotion, only 12% of United States children 9 years of age and older have "good diets" (1). For instance, most children in the United States do not eat enough fruits and vegetables (3-7), consume 6.9% of their energy from sugar-sweetened beverages (17), and are at increased risk of consuming excessive fat (13). One of the many consequences of poor childhood nutrition is obesity, and the rate of childhood obesity has increased from 4% to 17% among 6 to 11 year olds and 6% to 18% among 12 to 18 year olds between the years of 1970 and 2003 (2).

The poor diets of children have led investigators to develop interventions to improve the nutritional quality of childhood eating behavior. The one most commonly used behavior change model to influence childhood nutrition is the Social Cognitive Theory (SCT). The SCT states that people's behaviors are the result of a series of interactions between personal, environmental, and behavioral factors (26-29). However, beyond the utilization of the SCT, there is little consensus among investigators on the most effective design and format of childhood nutrition interventions. For instance, it is not known how the duration of an intervention influences the effectiveness of the intervention. Most published nutrition research

describes interventions that take place over several weeks, months, or years (8, 30-37). The Child and Adolescent Trial for Cardiovascular Health (CATCH) compared questionnaire scores measuring cardiovascular risk factors based upon the SCT between students in a control group and students in intervention groups over a period of three years (31). A shorter-term intervention that utilized the SCT was "Squire's Quest," a nutrition computer game that students played over a period of five weeks (32). There are currently no known published studies describing a childhood nutrition intervention using the SCT in a single exposure, one-day intervention. It is unknown if a single-session intervention could be effective. A limited number of studies focusing on changing health behaviors through single-exposure interventions (not necessarily nutrition behavior) in various populations (typically adults) have been published. The single-exposure interventions with the most success typically tailor health information to individual participants (35-37). Health fairs are one type of single-exposure intervention that are commonly utilized but rarely studied for effectiveness.

Based upon these gaps in existing literature, this study evaluated the effectiveness of a single-exposure nutrition intervention in changing the factors that determine and mediate the diets of children. These determinants and mediators of dietary behavior were based upon the constructs of the SCT. The intervention was designed using the SCT in the context of a health fair (the "Let's Get Healthy!" fair in Union County, Oregon). Participants received tailored feedback to a brief computerized dietary screener. They

also received a more detailed nutrition handout. A questionnaire, modified from the CATCH questionnaire (30), was used to compare pre-fair and post-fair scores to questions measuring factors that determine nutrition behavior, as outlined by the SCT.

## Discussion of Results

None of the study hypotheses were supported. However, the results of this study suggest that single-session health fairs might have a positive role in changing factors that determine and mediate nutrition behavior, particularly when reinforced by teachers.

Most participants who attended the fair experienced improvements in questionnaire scores that measured various determinants of dietary behavior, regardless of whether they completed the full intervention (completed the diet screener and read the nutrition handout) or simply visited the fair. There are various explanations for why both groups experienced increases in scores rather than just the full intervention group. These reasons include the use of a convenience sample and the influence of agents of change besides the diet screener and handout, such as teacher discussion of the fair in the classroom.

A possible explanation why the full intervention group did not increase scores more significantly than the group that attended the fair only relates to the use of a convenience sample. While absolute post-fair scores were higher among participants who completed the full intervention than

participants who attended the fair only, pre-fair scores among full intervention participants were also higher, leaving less room for improvement as compared to participants who attended the fair only. Therefore, higher-achieving participants may have been more likely to participate in the full intervention group. This is a possible reason to explain why the full intervention group did not have greater increases in scores than the fair only group. This intervention used a convenience sample because it allowed for a much larger sample size. Rarely are participants randomly assigned to an intervention opportunity in real-world situations. Therefore, even though there was no randomly assigned intervention group, the study results reflect what would happen in a real world situation. A different study utilizing randomly assigned groups would need to be conducted to determine the true efficacy of the screener and handout.

The use of a convenience sample might explain why participants who completed the full intervention did not improve their scores more than participants who attended the fair only, yet the question remains as to why both groups had improvements in scores. Since results did not differ based upon whether participants completed the full intervention, something else occurred during the fair experience that resulted in improvements in scores. Each participant was exposed to a variety of factors, influencers, and activities during the fair experience that might have affected their scores. First, from the moment that participants learned that they were going to attend the health fair, discussions about the fair could have occurred

between the participants and their families, friends, and teachers. During the fair, participants had the opportunity to participate in various other stations that educated in various health topics, including eight tabletop exhibits related to nutrition and physical activity that were distributed around the exhibit space. After the fair, participants might have discussed the fair once again with their families, friends and teachers. Our study did not ask participants to indicate if they completed all of these elements, however, we did ask them if they discussed the fair within the classroom (but did not ask if the discussion occurred before or after the fair). Our results suggest that teacher discussion of the fair may have had a significant effect upon participants' scores. Participants who reported teacher discussion had significant increases in total scores ($p=0.032$), scores measuring dietary intention ($p=0.000$), dietary preference ($p=0.001$), social reinforcement ($p=0.013$), and self-efficacy ($p=0.032$). Participants who did not report teacher discussion did not have significant improvements in total scores or any construct scores. Participants who did report teacher discussion had higher pre-fair and post-fair scores than participants who did not report teacher discussion. Therefore, their scores improved more than other groups despite already having pre-fair scores closer to the highest score possible.

Previous nutrition education interventions have varied greatly by who provides and facilitates the actual intervention. Some have utilized teachers to administer the intervention (CATCH) (30), some have utilized "nutrition experts" to administer the intervention, while others have used

non-human educators, such as the computerized intervention provided in "Squire's Quest" (32). While significant improvements to measures of children's dietary behavior have occurred with each of these methods, few studies exist that determine if the results of the intervention would change if a different person administered the education. A 2007 Italian randomized controlled study was an example of an intervention that asked this question. It compared the changes in children's fruit and vegetable intake following exposure to the 36–week-long nutrition intervention, "Bring Some Fruit To School", by whether students received their education from a nutritionist or a teacher. The group of students who were educated by teachers increased their fruit intake (47% of students), vegetable intake (58% of students), and legume consumption (38% of students) and decreased their sugar-sweetened beverage (47% of students) and chip consumption (34% of students). Meanwhile, fewer of the students who were educated by a nutritionist increased their fruit intake (26% of students) and increased their vegetable intake (18.2% of students), decreased their sugar-sweetened beverage intake (3% of students) and decreased their chip intake (19% of students). Furthermore, the students in the nutritionist-educated group actually decreased their legume intake (3% of students). This study demonstrates that teachers might be significantly more effective in changing students' dietary behaviors than outside "experts" (49). These results are similar to the results of our study, which show that teacher-facilitated

classroom discussion of the fair helped promote changes in the factors that determine and mediate dietary behaviors.

It is possible that participants who reported teacher discussion would have improved scores regardless if they attended the fair or not, and that the teacher discussion was the main reason that participants in both groups (full intervention and those who attended the fair only) had improvements in score. It would be interesting to conduct a study comparing changes in scores among students who receive teacher education of nutrition information to students who attend a health fair.* It would also be useful to see if discussion among families and friends about the fair influenced participant scores.

One of the study hypotheses predicted that girls would have greater increases in questionnaire scores than boys. Some studies, such as the El Paso Trial of the CATCH intervention, have shown that girls can have greater changes in behavior due to nutrition interventions (50). Our results show that just as participants who completed the full intervention typically had higher pre-fair and post-fair scores than participants who attended the fair

* Our analysis also compared the change in score of participants who completed the full intervention and reported teacher discussion, participants who completed the full intervention and did not report teacher discussion, participants who attended the fair only and reported teacher discussion, and participants who attended the fair but did not report teacher discussion, but there was no significant difference. This lack of significant difference was likely the result of statistical power lost by splitting the groups. A larger study with a larger sample size in each group is needed to determine if there was truly no difference in change in scores between groups

only, girls typically had higher pre-fair and post-fair scores than boys. Yet, among girls who attended the fair and completed the full intervention, the gap in difference in scores between girls and boys became narrower: girls did not significantly improve their overall or construct specific scores more than boys.

Similarly, another one of our hypotheses was that age would significantly impact change in score. Some previous studies, such as the CATCH intervention, have shown differences in score based upon age (30). However, our results show that there was no significant change in questionnaire score based upon age of the participant. Perhaps dietary interventions do not need to be significantly modified to a participant's age: a single intervention might be appropriate for participants within a particular age range. This allows nutrition educators to effectively reach a larger audience without costly modifications of curriculum.

An unexpected result of the study was that the total knowledge score decreased in the intervention group. Typically knowledge scores are expected to increase before other constructs specific sub-scores (26). There are no clear explanations for the drops in knowledge scores. A possible contributing factor could be that not all of the concepts tested in the knowledge section (low-fat milk versus whole milk, for example), were clearly emphasized in the intervention. Further evaluation of the five knowledge questions that comprise the total knowledge score did not show

any error in scoring or errors in calculations. Furthermore, four out of the five questions had lower average scores in the post-fair questionnaires, demonstrating that the overall decrease in knowledge score was not the result of one particular question lowering the score significantly more than another.

## Study Weaknesses

This study had various weaknesses. First, it was not a randomized controlled trial. Participants self-selected their degree of participation, which could have created confounding variables. Higher improvements in scores in the groups that completed all components of the interventions could have been the result of higher achieving students being more likely to complete all the portions of the intervention, rather than the result of the actual intervention. Furthermore, as previously discussed, students in the full intervention group had higher pre-fair scores than participants in the fair-only group, leaving them less room to improve their scores. However, this type of bias and self-selection reflects the real life situation where this type of intervention would be used.

Nutrition-related feedback provided bythis study was tailored to age, gender, and dietary intake while the majority of previously published studies tailored interventions to individual's behavior, preferences, and psychosocial characteristics (26, 50-52). Therefore, the tailored feedback in this

intervention might have been more effective if it had been adapted to areas beyond demographics and dietary intake. For example, participants with low social reinforcement toward healthy eating could have information targeted towards changing their environment and perceptions of their environment

The nutrition handout and diet screener could have been more interactive and fun. Many behavior psychologists stress the importance of interaction in children's learning (35-36, 51-53). While completion of the questionnaire on the computer could be considered somewhat interactive, hands-on interaction beyond completion of a computer survey could have helped as well. Furthermore, the time it took for each participant to complete the questionnaire might have taken the 'fun' out of the process. The focus groups conducted in the preliminary methods of this thesis found that one of the most important components of learning is 'fun'. In addition to wanting the intervention to be enjoyable, students in the focus group also stated a dislike for long "wordy" documents. While the handout provided at the fair was colorful and had many pictures, it still may have been too "wordy" for many of the participants. The handout attempted to address several topics at once. Perhaps a longer-term intervention might have been more effective because it would have allowed researchers to focus on one topic at a time, instead of providing an excessive amount of information at once. The handout also could have been tailored toward the individual needs of each participant. For instance, a participant with low dietary intention scores and low fruit and vegetable intake might receive information aimed to

change their intentions to eat fruits and vegetables. There are many ways that the information could have also been provided in a more "fun" and less "wordy" manner than a written document., such as through a interactive computer game similar to Baranowski's "Squire's Quest," (32). A "game" like this could still provide the information in a tailored and automated fashion, but participants might have been more interested in reading their results and engaging in the intervention.

The screener asked participants to report portion sizes using subjective terms such as "a little", "some", or "a lot". Therefore the values that were calculated with the algorithm and the actual intake of participants were likely not precisely the same. Furthermore, the algorithm generated recommendations for participants using general recommendations for age and gender. It did not take into account physical activity or medical conditions that would affect an individual's daily dietary requirements. However, the screener still provided a quick general estimate of intake. Furthermore, it was discovered after the fair that the algorithm to determine fat intake was entered incorrectly by the programmer. This resulted in fat intake being calculated as much lower than it actually should have been. This may have caused participants to think they needed to eat more fatty foods, when in fact their actual fat intake might have been adequate or even high.

The evaluative questionnaire was modified from a validated questionnaire, but lost much of its previously established validity through

the modifications applied for this study. How the questionnaire was scored may have affected the results as well. When participants did not answer a question, their response was assumed to be incorrect and a score of zero was assigned to that question. This could have created falsely low scores among participants who either forgot to answer a question or did not understand a question. In addition, the evaluation was completely self-reported, which could have affected the accuracy of the results.

The statistical analysis procedures were determined after the data was gathered. This could have created some researcher bias as the analysis was established after the data was gathered.

Finally, this study only aimed to change factors that determine and mediate nutrition-related behavior, rather than aiming to change overall nutrition behavior. The ultimate goal of nutrition education and nutrition intervention is to generate positive nutrition-related behavior change. It is possible that positive changes could occur in these factors that determine and mediate behavior without actual behavior change occurring. Therefore, further research needs to be conducted to determine how such changes to these factors affect long-term nutrition behavior.

## STUDY IMPLICATIONS

This study suggests that single-session health fairs might have a positive role in changing factors that determine and mediate nutrition behavior, particularly when teachers are involved. This is the first known

study that analyzed the effects of a single-session health fair-based intervention designed using the SCT and tailored feedback to positively influence the factors that mediate and influence the diets of children. Health fairs and other similar interventions are relatively common, yet rarely studied. Most researchers and institutions conduct health fairs and other similar interventions with the hope and assumption that they will positively influence the health of participants. Yet, most of the designs of these interventions are not evidenced-based and researchers do not know if their resources are being used effectively. This study suggests that health fairs can be effective since statistically significant changes in diet questionnaires scores were detected. This is promising information for researchers aiming to influence the health and diets of children through easy, single-session, low-cost interventions such as health fairs. However, this study does not answer questions about why or how health fairs influence the diets of children, nor the long term implications of them.

# CHAPTER 7: CONCLUSIONS

## GENERAL CONCLUSIONS

In conclusion, this study found that a single-session nutrition intervention in the context of a health fair has the potential to positively change the personal, environmental, and behavioral factors that determine and mediate the dietary behaviors of 4th-6th grade students, particularly if teachers participate in discussion of the fair experience. The study did not show that tailored feedback in the form of computerized diet screener and nutrition handout was a more effective means of changing factors that determine diets of children than simply attending a single-session health fair. This study also did not confirm that girls improve scores more than boys nor that change in scores was higher among older children.

## RECOMMENDATIONS FOR FUTURE RESEARCH

Future research should compare different single-session nutrition interventions to determine what methods are most successful in changing factors that determine and mediate children's nutrition-related behaviors. Further research is needed to identify the most effective format of nutrition health fairs because health fairs that are formatted correctly have the potential to significantly improve the factors that determine and mediate children's dietary behaviors in a cost–effective and time-efficient manner. It would be interesting to see how different nutrition education curriculum

used at a health fair could impact participant scores and how interactions between participants and their families and friends influence their scores.

Furthermore, similar interventions should be conducted to compare short-term and long-term interventions. Extensive research needs to be conducted analyzing the role that teachers and other influencers of health (friends and family) play in nutrition education interventions. It would also be helpful to use tools that are validated and to utilize non-subjective biochemical and anthropometric measures of behavior such as pre-fair and post-fair body mass index and body fat percentage measures in determining the effect that this type of intervention has upon participants.

The long-term changes of this type of short-term intervention have on the factors that determine and influence children nutrition behaviors needs to be studied. How these types of interventions affect overall nutrition behavior also need to be studied, as the ultimate goal of nutrition-related interventions is to promote positive dietary behaviors.

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# Appendix A

## Algorithm

Instructions: Each food is listed below, divided by food group. The highlighted foods have scores in more than one food group. Some foods are subdivided into type of specific food (ex. Types of milk). Then for each food type, it is divided into serving size and frequency. The daily content of the specific food group is then listed as number for each food, serving, and frequency combination. The total servings of fruits and vegetables, grams of fat, and cups of sugar sweetened beverages will be tabulated by adding up the daily scores of all the foods in each food group. Students will also enter their age and gender.

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **frequency** | 1x per week | | | 2x per week | | | 3-4x | | | 5-6x | | | everday | | |
| Fruit and vegetable | | | | | | | | | | | | | | | | | |
| | 1. fruit juice, orange juice, apple juice, mexican fruit juice, licuado | | | | | | | | | | | | | | | | |
| | | **serving si** | 1 glass | 2 glasses | 3+ glass | 1glass | 2 glasses | 3+ glasses | 1 glass | 2 glasses | 3+ glasses | 1 glass | 2 glass | 3+ glasses | 1 glass | 2 glasses | 3+ glasses |
| | | **amount fc** | 0.142857 | 0.285714 | 0.428571 | 0.285714 | 0.571429 | 0.857143 | 0.5 | 1 | 1.5 | 0.785714 | 1.571429 | 2.357143 | 1 | 2 | 3 |
| | 2. apples, banana, oranges | | | | | | | | | | | | | | | | |
| | | | half | 1 | 2 | half | 1 | 2 | half | 1 | 2 | half | 1 | 2 | half | 1 | 2 |
| | | | 0.071429 | 0.142857 | 0.285714 | 0.142857 | 0.285714 | 0.571429 | 0.25 | 0.5 | 1 | 0.392857 | 0.785714 | 1.571429 | 0.5 | 1 | 2 |
| | 3. applesauce, fruit cocktial | | | | | | | | | | | | | | | | |
| | | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot |
| | | | 0.071429 | 0.142857 | 0.285714 | 0.142857 | 0.285714 | 0.571429 | 0.25 | 0.5 | 1 | 0.392857 | 0.785714 | 1.571429 | 0.5 | 1 | 2 |
| | 4. fruits, strawberries, grapes | | | | | | | | | | | | | | | | |
| | | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot |
| | | | 0.071429 | 0.142857 | 0.285714 | 0.142857 | 0.285714 | 0.571429 | 0.25 | 0.5 | 1 | 0.392857 | 0.785714 | 1.571429 | 0.5 | 1 | 2 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Vegetables | | | | | | | | | | | | | | | | | |
| | 1. french fries, hashbrowns, tater tots | | | | | | | | | | | | | | | | |
| | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | |
| | | 0.071429 | 0.142857 | 0.285714 | 0.142857 | 0.285714 | 0.571429 | 0.25 | 0.5 | 1 | 0.392857 | 0.785714 | 1.571429 | 0.5 | 1 | 2 | |
| | 2. other potatoes, like mashed or baked | | | | | | | | | | | | | | | | |
| | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | |
| | | 0.071429 | 0.142857 | 0.285714 | 0.142857 | 0.285714 | 0.571429 | 0.25 | 0.5 | 1 | 0.392857 | 0.785714 | 1.571429 | 0.5 | 1 | 2 | |
| | 3. ketchup or salsa | | | | | | | | | | | | | | | | |
| | 4. lettuce salad | | | | | | | | | | | | | | | | |
| | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | |
| | | 0.035714 | 0.071429 | 0.142857 | 0.071429 | 0.142857 | 0.285714 | 0.125 | 0.25 | 0.5 | 0.196429 | 0.392857 | 0.785714 | 0.25 | 0.5 | 1 | |
| | 5. tomatoes, including in a salad | | | | | | | | | | | | | | | | |
| | | 1/4 tomat | 1/2 tomat | 1 tomato | 1/4 tomat | 1/2 tomat | 1 tomato | 1/4 tomat | 1/2 tomat | 1 tomato | 1/4 tomat | 1/2 tomat | 1 tomato | 1/4 tomat | 1/2 tomat | 1 tomato | |
| | | 0.035714 | 0.071429 | 0.142857 | 0.071429 | 0.142857 | 0.285714 | 0.125 | 0.25 | 0.5 | 0.196429 | 0.392857 | 0.785714 | 0.25 | 0.5 | 1 | |
| | 6. green beans or peas | | | | | | | | | | | | | | | | |
| | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | |
| | | 0.035714 | 0.071429 | 0.142857 | 0.071429 | 0.142857 | 0.285714 | 0.125 | 0.25 | 0.5 | 0.196429 | 0.392857 | 0.785714 | 0.25 | 0.5 | 1 | |
| | 7. other vegetables such as corn, carrots, green broccoli | | | | | | | | | | | | | | | | |
| | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | |
| | | 0.035714 | 0.071429 | 0.142857 | 0.071429 | 0.142857 | 0.285714 | 0.125 | 0.25 | 0.5 | 0.196429 | 0.392857 | 0.785714 | 0.25 | 0.5 | 1 | |
| | 8. veggie soup, tomato soup, onion soup | | | | | | | | | | | | | | | | |
| | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | |
| | | 0.071429 | 0.142857 | 0.285714 | 0.142857 | 0.285714 | 0.571429 | 0.25 | 0.5 | 1 | 0.392857 | 0.785714 | 1.571429 | 0.5 | 1 | 2 | |
| | 9 chili beans, pinto, black | | | | | | | | | | | | | | | | |
| | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | |
| | | 0.071429 | 0.142857 | 0.285714 | 0.142857 | 0.285714 | 0.571429 | 0.25 | 0.5 | 1 | 0.392857 | 0.785714 | 1.571429 | 0.5 | 1 | 2 | |
| | 10. refried beans | | | | | | | | | | | | | | | | |
| | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | |
| | | 0.071429 | 0.142857 | 0.285714 | 0.142857 | 0.285714 | 0.571429 | 0.25 | 0.5 | 1 | 0.392857 | 0.785714 | 1.571429 | 0.5 | 1 | 2 | |
| | Other vegetables like broccoli, corn, cabbage? | | | | | | | | | | | | | | | | |
| | | 0.035714 | 0.071429 | 0.142857 | 0.071429 | 0.142857 | 0.285714 | 0.125 | 0.25 | 0.5 | 0.196429 | 0.392857 | 0.785714 | 0.25 | 0.5 | 1 | |

| sugar sweetened bev | 1x | | | 2x | | | 3-4x | | | 5-6x | | | everday | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| soda | 1 bottle | 2 bottles | 3 bottles | 1 bottle | 2 bottles | 3 bottles | 1 bottle | 2 bottles | 3 bottles | 1 bottle | 2 bottles | 3 bottles | 1 bottle | 2 bottles | 3 bottles |
| | 0.142857 | 0.285714 | 0.428571 | 0.285714 | 0.571429 | 0.857143 | 0.5 | 1 | 1.5 | 0.785714 | 1.571429 | 2.357143 | 1 | 2 | 3 |
| | 1 bottle | 2 bottles | 3 bottles | 1 bottle | 2 bottles | 3 bottles | 1 bottle | 2 bottles | 3 bottles | 1 bottle | 2 bottles | 3 bottles | 1 bottle | 2 bottles | 3 bottles |
| energy drink | 0.142857 | 0.285714 | 0.428571 | 0.285714 | 0.571429 | 0.857143 | 0.5 | 1 | 1.5 | 0.785714 | 1.571429 | 2.357143 | 1 | 2 | 3 |

| fat | | 1x | | | 2x | | | 3-4x | | | 5-6x | | | everday | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| milk | whole | 1 glass | 2 glasses | 3+ glasses | 1 glass | 2 glasses | 3+ glasses | 1 glass | 2 glasses | 3+ glasses | 1 glass | 2 glasses | 3+ glasses | 1 glass | 2 glasses | 3+ glasses |
| | | 1.142857 | 2.285714 | 3.428571 | 2.285714 | 4.571429 | 6.857143 | 4 | 8 | 12 | 6.285714 | 12.57143 | 18.85714 | 8 | 16 | 24 |
| | 2% | | | | | | | | | | | | | | | |
| | | 0.714286 | 1.428571 | 2.142857 | 1.428571 | 2.857143 | 4.285714 | 2.5 | 5 | 7.5 | 3.928571 | 7.857143 | 11.78571 | 5 | 10 | 15 |
| | 1% | | | | | | | | | | | | | | | |
| | | 0.428571 | 0.857143 | 1.285714 | 0.857143 | 1.714286 | 2.571429 | 1.5 | 3 | 4.5 | 2.357143 | 4.714286 | 7.071429 | 3 | 6 | 9 |
| | nonfat | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | soy | | | | | | | | | | | | | | | |
| | | 0.714286 | 1.428571 | 2.142857 | 1.428571 | 2.857143 | 4.285714 | 2.5 | 5 | 7.5 | 3.928571 | 7.857143 | 11.78571 | 5 | 10 | 15 |
| | lactaid | | | | | | | | | | | | | | | |
| | | 0.357143 | 0.714286 | 1.071429 | 0.714286 | 1.428571 | 3.214286 | 1.25 | 2.5 | 3.75 | 1.964286 | 3.928571 | 5.892857 | 2.5 | 5 | 7.5 |
| french fries, hashb | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot |
| | | 1.428571 | 2.857143 | 4.285714 | 2.857143 | 5.714286 | 8.571429 | 5 | 10 | 15 | 7.857143 | 15.71429 | 23.57143 | 10 | 20 | 30 |
| refriend beans | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot |
| | | 0.198571 | 0.397143 | 0.794286 | 0.397143 | 0.794286 | 1.588571 | 0.695 | 1.39 | 2.78 | 1.092143 | 2.184286 | 4.368571 | 0.198571 | 2.78 | 5.56 |
| hamburgers, cheese | | 1 small ha | large | 2 large | 1 small ha | large | 2 large | 1 small ha | large | 2 large | 1 small ha | large | 2 large | 1 small ha | large | 2 large |
| | | 1.428571 | 2.142857 | 5.714286 | 2.857143 | 5.714286 | 11.42857 | 5 | 10 | 20 | 7.857143 | 15.71429 | 31.42857 | 10 | 20 | 40 |
| macaroni and chees | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot |
| | | 0.357143 | 0.714286 | 1.428571 | 0.714286 | 1.428571 | 2.857143 | 1.25 | 2.5 | 5 | 1.964286 | 3.928571 | 7.857143 | 2.5 | 5 | 10 |
| hot dogs, corn dogs, | | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| | | 2.142857 | 4.285714 | 6.428571 | 4.285714 | 8.571429 | 12.85714 | 7.5 | 15 | 22.5 | 11.78571 | 23.57143 | 35.35714 | 15 | 30 | 45 |
| lunch meat, balogna | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot |
| | | 0.714286 | 1.428571 | 2.142857 | 1.428571 | 2.857143 | 4.285714 | 2.5 | 5 | 7.5 | 3.928571 | 7.857143 | 11.78571 | 5 | 10 | 15 |
| pizza or pizza pocket | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot |
| | | 2.142857 | 4.285714 | 6.428571 | 4.285714 | 8.571429 | 12.85714 | 7.5 | 15 | 22.5 | 11.78571 | 23.57143 | 35.35714 | 15 | 30 | 45 |
| beef, like roast, stea | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot |
| | | 2.142857 | 4.285714 | 6.428571 | 4.285714 | 8.571429 | 12.85714 | 7.5 | 15 | 22.5 | 11.78571 | 23.57143 | 35.35714 | 15 | 30 | 45 |
| meatballs, meat loaf | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot |
| | | 2.142857 | 4.285714 | 6.428571 | 4.285714 | 8.571429 | 12.85714 | 7.5 | 15 | 22.5 | 11.78571 | 23.57143 | 35.35714 | 15 | 30 | 45 |
| pork - chops, roast, r | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot |
| | | 2.142857 | 4.285714 | 6.428571 | 4.285714 | 8.571429 | 12.85714 | 7.5 | 15 | 22.5 | 11.78571 | 23.57143 | 35.35714 | 15 | 30 | 45 |
| popcorn | | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot |
| | | 0.238095 | 0.47619 | 0.714286 | 0.47619 | 0.952381 | 1.428571 | 0.833333 | 1.666667 | 2.5 | 1.309524 | 2.619048 | 3.928571 | 1.666667 | 3.333333 | 5 |
| snack chips like pota | | few chips | small bag | large bag | few chips | small bag | large bag | few chips | small bag | large bag | few chips | small bag | large bag | few chips | small bag | large bag |
| | | 0.714286 | 1.428571 | 4.285714 | 1.428571 | 2.857143 | 8.571429 | 2.5 | 5 | 15 | 3.928571 | 7.857143 | 23.57143 | 5 | 10 | 30 |
| ice cream | | 1 scoop | 2 scoops | 3 scoops | 1 scoop | 2 scoops | 3 scoops | 1 scoop | 2 scoops | 3 scoops | 1 scoop | 2 scoops | 3 scoops | 1 scoop | 2 scoops | 3 scoops |
| | | 2.142857 | 4.285714 | 6.428571 | 4.285714 | 8.571429 | 12.85714 | 7.5 | 15 | 22.5 | 11.78571 | 23.57143 | 35.35714 | 15 | 30 | 45 |

| | a little= 2 small cookies= 5 g fat | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| cookies, cakes, donu | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot |
| | 0.714286 | 1.428571 | 2.142857 | 1.428571 | 2.857143 | 4.285714 | 2.5 | 5 | 5*3/7*3.5 | 3.928571 | 7.857143 | 11.78571 | 5 | 10 | 15 |
| cheese | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot |
| | 1.142857 | 2.285714 | 3.428571 | 2.285714 | 4.571429 | 6.857143 | 4 | 8 | 12 | 6.285714 | 12.57143 | 18.85714 | 8 | 16 | 24 |
| | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot |
| chicken | 1.285714 | 2.571429 | 3.857143 | 2.571429 | 5.142857 | 7.714286 | 4.5 | 9 | 13.5 | 7.071429 | 14.14286 | 21.21429 | 9 | 18 | 27 |
| | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot |
| fish | 1.285714 | 2.571429 | 3.857143 | 2.571429 | 5.142857 | 7.714286 | 4.5 | 9 | 13.5 | 7.071429 | 14.14286 | 21.21429 | 9 | 18 | 27 |
| | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot | a little | some | a lot |
| any other meat | 2.142857 | 4.285714 | 6.428571 | 4.285714 | 8.571429 | 12.85714 | 7.5 | 15 | 22.5 | 11.78571 | 23.57143 | 35.35714 | 15 | 30 | 45 |

Sheet two is the "answer key" for the scores. The recommended scores are different for each gender/age combination. The students fruit and vegetable, fat, and sugar

sweetened beverage scores are compared to the scores on the answer key for their age and gender.

If their reported scores are greater than/less than the recommended scores, they will be put into the inadequate/adequate category for their age and gender for each of these food categories. The student then receives automated feedback for their fruit/vegetable score, fat score, and sugar sweetened beverage score.

| Age | gender | food | inadequat | adequate |
|---|---|---|---|---|
| 4 | | | | |
| | m | | | Note: Adequate will always be "and equal to" when number=cut off |
| | | fruit and v | <2.5 | >2.5 |
| | | fat | >62 | <62 |
| | | sugar swe | >1 | <1 |
| | f | | | |
| | | fruit and v | <2.5 | >2.5 |
| | | fat | >54 | <54 |
| | | sugar swe | >1 | <1 |
| 5 | | | | |
| | m | | | |
| | | fruit and v | <2.5 | >2.5 |
| | | fat | >62 | <62 |
| | | sugar swe | >1 | <1 |
| | f | | | |
| | | fruit and v | <2.5 | >2.5 |
| | | fat | >62 | <62 |
| | | sugar swe | >1 | <1 |

| | | | | |
|---|---|---|---|---|
| 6 | | | | |
| | m | | | |
| | | fruit and v | <3 | >3 |
| | | fat | >70 | <70 |
| | | sugar swe | >1 | <1 |
| | f | | | |
| | | fruit and v | <2.5 | >2.5 |
| | | fat | >62 | <62 |
| | | sugar swe | >1 | <1 |
| 7 | | | | |
| | m | | | |
| | | fruit and v | <3 | >3 |
| | | fat | >70 | <70 |
| | | sugar swe | >1 | <1 |
| | f | | | |
| | | fruit and v | <2.5 | >2.5 |
| | | fat | >70 | <70 |
| | | sugar swe | >1 | <1 |
| 8 | | | | |
| | m | | | |
| | | fruit and v | <3 | >3 |
| | | fat | >78 | <78 |
| | | sugar swe | >1 | <1 |
| | f | | | |
| | | fruit and v | <3 | >3 |
| | | fat | >70 | <70 |
| | | sugar swe | >1 | <1 |
| 9 | | | | |
| | m | | | |
| | | fruit and v | <3.5 | >3.5 |
| | | fat | >78 | <78 |
| | | sugar swe | >1 | <1 |
| | f | | | |
| | | fruit and v | <3.5 | >3.5 |
| | | fat | >70 | <70 |
| | | sugar swe | >1 | <1 |

| | | | | |
|---|---|---|---|---|
| 10 | | | | |
| | m | | | |
| | | fruit and v | <3.5 | >3.5 |
| | | fat | >86 | <86 |
| | | sugar swe | >1 | <1 |
| | f | | | |
| | | fruit and v | <3.5 | >3.5 |
| | | fat | >78 | <78 |
| | | sugar swe | >1 | <1 |
| 11 | | | | |
| | m | | | |
| | | fruit and v | <3.5 | >3.5 |
| | | fat | >86 | <86 |
| | | sugar swe | >1 | <1 |
| | f | | | |
| | | fruit and v | <3.5 | >3.5 |
| | | fat | >78 | <78 |
| | | sugar swe | >1 | <1 |
| 12 | | | | |
| | m | | | |
| | | fruit and v | <4 | >4 |
| | | fat | >86 | <86 |
| | | sugar swe | >1 | <1 |
| | f | | | |
| | | fruit and v | <3.5 | >3.5 |
| | | fat | >86 | <86 |
| | | sugar swe | >1 | <1 |
| 13 | | | | |
| | m | | | |
| | | fruit and v | <4.5 | >4.5 |
| | | fat | >101 | <101 |
| | | sugar swe | >1 | <1 |
| | f | | | |
| | | fruit and v | <3.5 | >3.5 |
| | | fat | >86 | <86 |
| | | sugar swe | >1 | <1 |

| | | | | |
|---|---|---|---|---|
| 14 | | | | |
| | m | | | |
| | | fruit and v | <4.5 | >4.5 |
| | | fat | >109 | <109 |
| | | sugar swe | >1 | <1 |
| | f | | | |
| | | fruit and v | <4 | >4 |
| | | fat | >109 | <109 |
| | | sugar swe | >1 | <1 |
| 15 | | | | |
| | m | | | |
| | | fruit and v | <5 | >5 |
| | | fat | >117 | <117 |
| | | sugar swe | >1 | <1 |
| | f | | | |
| | | fruit and v | <4 | >4 |
| | | fat | >93 | <93 |
| | | sugar swe | >1 | <1 |
| 16 | | | | |
| | m | | | |
| | | fruit and v | <5 | >5 |
| | | fat | >124 | <124 |
| | | sugar swe | >1 | <1 |
| | f | | | |
| | | fruit and v | <4 | >4 |
| | | fat | >93 | <93 |
| | | sugar swe | >1 | <1 |
| 17 | | | | |
| | m | | | |
| | | fruit and v | <5 | >5 |
| | | fat | >124 | <124 |
| | | sugar swe | >1 | <1 |
| | f | | | |
| | | fruit and v | <4 | >4 |
| | | fat | >93 | <93 |
| | | sugar swe | >1 | <1 |

| | | | | |
|---|---|---|---|---|
| 18 | | | | |
| | m | | | |
| | | fruit and v | <5 | >5 |
| | | fat | >124 | <124 |
| | | sugar swe | >1 | <1 |
| | f | | | |
| | | fruit and v | <3.5 | >3.5 |
| | | fat | >93 | <93 |
| | | sugar swe | >1 | <! |

# APPENDIX B

*Focus Group Script*

Protocol #3694

**General**

Group size of 10-12. Schedule 60-90 minutes

Representative group within each gender (achievement level, ethnicity)

**Introduction:**

-Introduce self

**-**Review consent form/purpose of study/confidentiality

- Go through ground rules:

**Ground Rules**

- **"**What is said today, stays in the room. Please don't share your fellow students' answers with anyone outside of this group."
- "Everyone's opinion is important. Please be respectful of others by allowing them to express their opinions. Hearing different opinions will help us…"
- "There are not any right or wrong answers (You won't get a grade on this and your honest opinions help us the most.)
- "Be honest."

**Focus Group Script:**

1. "There are a lot of ways to get information about your health and diet. What ways do you prefer to learn about health and diet?"
    a. Prompts: fliers, pictures, social networking websites, educational websites, games, classroom activities.
    b. "Why do you like each method?"
2. "What are some of the ways that you have learned about nutrition in the past? What did like or dislike about each way you learned about nutrition?"
3. "What would you like to learn about fruits and vegetables?"
    a. Hand out learning tools (flier, website handouts, etc.)
        i. "How would you use this tool?"
        ii. "What do you like/dislike about each learning tool?"
        iii. "Which is your favorite? Why>"

4. “What would you like to learn about sugar?”
    a. Hand out learning tools
        i. “How would you use this tool?”
        ii. “What do you like/dislike about each learning tool?”
        iii. “Which is your favorite? Why?”
5. “What would you like to learn about fat?”
    a. Hand out learning tools
        i. “How would you use this tool?”
        ii. “What do you like/dislike about each learning tool”
        iii. “Which is your favorite? Why?”
6. “After looking at all the different methods of learning about nutrition, which example do you like the best? What do you like about it? What could be changed about it?”
7. “We are going to be putting together a computer program where students will be asked questions about what they eat. Based upon how each student responds, he or she will receive individually generated information about nutrition. Do you have any further advice for us as we develop this computer program?”

# APPENDIX C

## *NUTRITION HANDOUT*

## More About Fatty Foods

**Eat the Right Kind of Fat**

For good health, **Limit Solid Fats** and **Instead Eat Fats From Oils.**

**Solids Fats ("Bad" Fat)**


Chips


Beef, Burgers


Solid Butter & Margarine


Bacon


2% or Whole Milk

Other: Fried Food, Breaded Meats, Ice Cream, Cheese, Hot Dogs

**Oily Fats ("Good" Fat)**


Fish


Nuts


Oils like Olive Oil & Canola Oil

Eating **too much** or **too little** fat will cause problems. Read the nutrition facts label to see how much fat is in your food!

**Pick a Fatty Food Goal!**

- ☐ I will **replace** a high fat snack with a low fat snack this week.
- ☐ I will snack on **nuts** at least once this week.
- ☐ I will **ask my parents** to buy low-fat or fat free milk.
- ☐ I will **eat fish** at least once this week.
- ☐ Other– Make your own: _____

**Share your goal with your parents, teachers, and friends!**
**You can achieve any of these goals!**

## More About Soda and Energy Drinks

***Soda Pop and Energy Drinks*** are full of **Sugar** and **Caffeine**. Drinks with less sugar, like water, will help you from **Gaining Too Much Weight**. Caffeine is an **Addictive Drug** that you should limit.

**How Much Sugar and Caffeine are in Different Drinks?**

| | | | | |
|---|---|---|---|---|
| **9** Cubes of Sugar<br>**140** calories<br>**35 mg** caffeine | **16** cubes of sugar<br>**240** calories<br>**57** mg caffeine | **14** cubes of sugar<br>**220** calories<br>**160** mg caffeine | **0** cubes of sugar<br>**0** calories<br>**0** mg caffeine | **3** cubes of sugar<br>**70** calories<br>**0** mg caffeine |
|  |  |  |  |  |
| Can of Non-Diet Soda Pop | 20 oz Bottle of Soda Pop | 16 oz Energy Drink Can | Glass of Water | Cup of Non-Fat Milk |

**Pick a Drink Goal!**

- ☐ I will drink **no** soda or energy drinks for one day this week.
- ☐ I will **replace one** soda or energy drink with milk or water this week.
- ☐ I will drink **no** soda or energy drinks this week.
- ☐ Other– Make your own: _____

**Share your goal with your parents, teachers, and friends!**
**You can achieve any of these goals!**

# APPENDIX D

## NUTRITION QUESTIONNAIRE

**General Information about the Let's Get Healthy! Nutrition Questionnaire**

Thank you for administering this questionnaire. These results will help us learn about the impact that the Let's Get Healthy! exhibit has on nutrition-related behaviors among children. This questionnaire is the first of two questionnaires (one before and one after the event). ***It is important that students complete both questionnaires.***

1. Please read through the questionnaire before distributing it to your class. The questionnaires have about 60 multiple-choice questions (53 on pre-survey and 58 on post-survey). It will take students about 10-20 minutes to complete.

2. Surveys are anonymous and use a student-created unique ID (described below) to compare the pre-fair and post-pair responses by individual students. Pen or pencil is fine, but no markers please (due to bleed-through).

3. Please encourage your students to answer all the questions. However, the questionnaire is voluntary; therefore no students should be forced to complete it. If a student expresses difficulty about picking one answer for a multiple-choice question, please encourage them to choose the answer that describes their behavior most of the time.

4. When students have finished the survey, place **completed surveys and the survey summary sheet** directly into the envelope provided to you. Return the sealed envelope to the main office (they will return the surveys to us).

**Completion of the Unique ID**

Completion of the Unique ID is **very important, and can be challenging, so *please walk your students through the process by giving them these instructions and going through the example below as a group*.** If your students do not know their mother's first name or phone number, please have them choose alternate letters or numbers that they can remember.

1. The first two spaces of the ID are the day of your birth date (e.g., March 12 = 12). Make sure students fill in two digits.

2. The third and fourth spaces of the ID are the first two letters of your mother's first name.

3. The fifth and six spaces of the ID are the last two numbers of your phone number (e.g. 541-123-4567 = 67). Use two digits.

4. Example: Someone born on March 12th whose mother's first name is Jane and phone number is 541-123-4567, would use "12JA67" as their ID number.

**Read out loud the study information below**

Before students begin the questionnaire, please read aloud the following study information, give them time to ask any questions and allow them to choose whether they would like to participate:

"You have been invited to participate in this anonymous questionnaire because you are a student between the ages of 8-18 years old. This questionnaire is voluntary and will take approximately 15 minutes to complete. The questionnaire will ask you questions about what you like to eat, what you usually eat and things you do that are related to food. The questionnaire results will help us learn more about how improve nutrition feedback for other students your age. Questionnaire answers are anonymous and your questionnaires will be destroyed within one year. If you have any questions about this questionnaire now or in the future, you can contact us at 503-494-8775."

THANK YOU!!!

**Let's Get Healthy! Nutrition Post-Survey**

*This is a questionnaire about health. This is a voluntary questionnaire. There are no right or wrong answers. Please read each question and answer the best you can.*

*In order for you to remain unidentified but allow us to compare your responses to the survey taken after the fair, we need for you to establish a unique ID number.* ***In the first two spaces below, please put the day of your birth. In the second two spaces, please put the first two letters of your mother's first name. In the last two spaces, please put the last two digits of your phone number.*** *Example, if you were born on March 12th, your mother's first name is "Jane" and your phone number is 123-4567, your ID number would be "12JA67"*

OREGON HEALTH & SCIENCE UNIVERSITY

ID Number: ___ ___ / ___ ___ / ___ ___ Today's Date_____/_____/_____

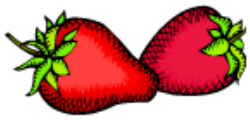
School Name: _____ Teacher Name: _____

Age:_____ Gender O M O F

**Section A: What would you choose?** *Instructions: For each question,* ***FILL IN THE CIRCLE*** *for the food that you would choose if had to choose just one*

1. Which one would you choose for dessert?

O ice cream or O strawberries



2. Which food would you choose for a snack?

O carrot sticks or O potato chips

3. Which would you choose to drink?


O regular (whole) milk or O low fat/fat free milk

## What would you choose?

4. Which food would you choose for a snack?

O candy bar or O fresh fruit

5. Which would you choose to drink?

O energy drink or O water

6. Which would you choose?

O French fries or O baked potato

7. Which would you choose to drink?


O Soda pop or O milk


## Section B: What do you eat the more often?

*Instructions: For each question, pick the food that you usually eat more often.*

8.

O cookies or O an apple

**What do you eat the more often?**

9.

O buttered popcorn

or

O popcorn without butter

10.

O orange juice

or

O an orange

11.

O ice cream

or

O fresh fruit popsicle

12.

O regular (whole) milk

or

O low-fat, fat free, or skim milk


13.


O energy drinks or soda pop

or

O milk


3

**What do you eat the more often?**

14.

O salad

or

O french fries

## Section C: Which food do you think is better for your health?

*Instructions: For each question, pick the food that you think is better for your health*

15.

O cold cereal

or

O eggs and bacon

16.

O beef

or

O beans

17.


O low fat, fat-free, or skim milk

or

O regular (whole) milk

18.

O french fries

or

O green salad

**Which food do you think is better for your health?**

19.


O raisins

or

O candy bar

20.

O french fries

or

O baked potato

21.


O energy drink or soda pop

or

O milk


**Section D: Things that you do <u>most</u> of the time**

*Instructions: The questions in this section ask about what you do most of the time.*

| | Yes | No |
|---|---|---|
| 22. Do you choose or fix your own food for breakfast? | O | O |
| 23. Do you choose or fix our own lunch on school days? | O | O |
| 24. Do you help your parents pick out foods at the grocery store? | O | O |
| 25. Do you get to choose what you eat for dinner? | O | O |
| 26. Do you eat fresh fruit on most days? | O | O |
| 27. Do you eat desserts at home? | O | O |
| 28. Do you eat vegetables on most days? | O | O |
| 29. Do you drink energy drinks or soda pop on most days? | O | O |

## Section E: What do other people want you to do?

*Instructions: The questions in this section ask about what other people want you to do.*

| | Yes | No |
|---|---|---|
| 30. Do your parents want you to eat lots of fruits and vegetables? | O | O |
| 31. Do you teachers want you to eat lots of fruits and vegetables? | O | O |
| 32. Do your friends want you to eat lots of fruits and vegetables? | O | O |
| 33. Do your parents want you to drink skim or low fat milk instead of whole milk? | O | O |
| 34. Do your teachers want you to drink skim or low fat milk instead of whole milk? | O | O |
| 35. Do your friends want you to drink skim or low fat milk instead of whole milk? | O | O |
| 36. Do your parents want you to eat the chicken meat without the skin? | O | O |
| 37. Do your teachers want you to eat the chicken meat without the skin? | O | O |
| 38. Do your friends want you to eat the chicken meat without the skin? | O | O |
| 39. Do your parents want you to eat salad instead of hamburger? | O | O |
| 40. Do your teachers want you to eat salad instead of hamburger? | O | O |
| 41. Do your friends want you to eat salad instead of hamburger? | O | O |
| 42. Do your parents want you to drink milk instead of energy drinks or soda pop? | O | O |
| 43. Do your teachers want you to drink milk instead of energy drinks or soda pop? | O | O |
| 44. Do your friends want you to drink milk instead of energy drinks or soda pop? | O | O |

## Section F: How sure are you?

*Instructions: The questions in this section ask about how sure you are about being able to eat some of the foods below. Please answer that if you are not sure, a little sure, or very sure..*

| | Not Sure | A Little Sure | Very Sure |
|---|---|---|---|
| 45. How sure are you that you can ask your parents for **popcorn without salt and butter?** | O | O | O |
| 46. How sure are you that you can drink **low fat white milk instead of regular white milk?** | O | O | O |
| 47. How sure are you that you can eat **cereal instead of a donut?** | O | O | O |

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| How sure are you? | Not Sure | A Little Sure | Very Sure |
|---|---|---|---|
| 48. How sure are you that you can **eat fresh fruit instead of a candy bar?** | O | O | O |
| 49. How sure are you that you can **take the skin off of chicken (and not eat the skin)?** | O | O | O |
| 50. How sure are you that you can drink **milk instead of a soft drink?** | O | O | O |
| 51. How sure are you that you can eat **cooked vegetables without margarine or butter?** | O | O | O |
| 52. How sure are you that you can **drink water or milk instead of an energy drink?** | O | O | O |

## Section G: Additional Questions

| | Yes | No |
|---|---|---|
| 53. Did you go to the Let's Get Healthy! health fair in La Grande? (if no, you can skip the questions below) | O | O |

If you answered "yes" to Question#53:

| | Yes | No |
|---|---|---|
| 54. Did you answer questions on the computer about what you normally eat? (if no, you can skip the questions below) | O | O |

If you answered "yes" to Question#54:

| | Yes | No |
|---|---|---|
| 55. Did you read the information about nutrition and food that the computer gave you? | O | O |
| 56. Did you print out the information and take it home with you? | O | O |
| 57. After you returned to your classroom, did your teacher talk to you about what you learned about health at the fair? | O | O |

THE END

Thank you for participating in this survey!

# Appendix E

## *RECRUITMENT*

Letter to Schools Regarding Questionnaires

OREGON HEALTH & SCIENCE UNIVERSITY

OHSU Health Discoveries Program

*Let's Get Healthy!*

Mail code L606
3181 S.W. Sam Jackson Park Road
Portland, OR 97239-3098
tel 503 494-8775
fax 503 494-7519
www.octri.org/letsgethealthy

Lisa Marriott, Ph.D.
Associate Director
marriott@ohsu.edu

(Date)

(School Name)
(School Address)
(School City, State Zip)

Dear (School Name),

We are looking forward to your school attending the *Let's Get Healthy!* exhibit in La Grande this fall! As part of the health fair, your students will get immediate, tailored feedback about different aspects of their own health.

We are working to improve the diet and nutrition education component of the exhibit and are researching the effect that the exhibit has upon changing children's dietary behaviors. Anne Southworth, a graduate student in human nutrition at OHSU, is leading this project. Anne has developed two questionnaires that assess the educational value of our diet station to children. We would like to ask if you would be willing to administer these questionnaires to students in your school.

Questionnaires would be given one week before and two weeks after the fair. Each questionnaire takes 10-20 minutes to complete (depending on the age of the student) and consists of approximately 55 questions related to what students like to eat, what they usually eat, and other nutrition-related behaviors. Student identities and responses are completely anonymous and participation is voluntary. Copies of the questionnaires are attached. These questionnaires have been reviewed by our Teacher Review Board and approved by OHSU's Institutional Review Board.

Thank you for considering this request. Your students' responses will greatly help us improve the educational value of the exhibit for other children. Please contact us if you have any questions about these questionnaires or the exhibit.

Sincerely,

Lisa Marriott, Ph.D.

Anne Southworth

# Links between Diet, Weight and Chronic Disease

APPROVED: Sept. 14, 2010 (Under 18 years)

A RESEARCH STUDY

You are invited to join a research study.

The purpose of this voluntary study is to understand how the Let's Get Healthy! fair changes knowledge and attitudes related to diet and participation in research.

This study is open to persons under 18 years of age and you may join this study for free.

We will not ask for your name, address, telephone number or other personal information. We collect the following information about you, instead:

**~ Gender ~ Age ~ School Name ~ Teacher Name ~**

We cannot match you, your health or the answers you give us to the information you give to us for this study. The unique ID number that you select is the only item that links your survey responses.

You may choose to join any or all parts of this study – here are your choices:

- Complete a survey before the fair (10 minutes)
- Attend the Let's Get Healthy! fair
- Complete a survey after the fair (10 minutes)

A volunteer has explained this research study to me and has answered my questions. I know how it may or may not help me. I also know that this study will help researchers know more about maintaining a healthy weight and lifestyle.

Principal Investigator: Jackilen Shannon, PhD
OHSU IRB #3694

OREGON HEALTH & SCIENCE UNIVERSITY