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The Missing Link: The Impact of Nutrition Education and the School Lunch Program

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by

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ABSTRACT

In the U.S., the weight status of overweight and obesity in children is increasing from recent decades (Carrol & Ogden, 2010). Research shows that the prevalence of children developing chronic diseases is influenced by obesity and overweight statuses, shown by existing risk factors (Freedman, Dietz, Srinivasan, & Berenson, 1999). Recent legislation of the National School Lunch Program has aimed to improve the nutritional value of school lunches in elementary schools by requiring fruit and vegetable meal components be provided on each lunch tray (Nutrition Standards, 2012). This quasi experimental study aimed to increase fourth graders nutrition knowledge and fruit and vegetable intake during school lunch by applying concepts of the Health Belief Model (HBM) to a nutrition education session. A convenience sample of 25 fourth graders was selected and administered a pre and post questionnaire along with a plate waste survey to measure fruit and vegetable consumption before and after a nutrition education lesson was given. A paired samples t-test indicated that student's nutrition knowledge significantly increased ($t(21)=2.60$, $p=.015$) after the nutrition education lesson was implemented. However, more research is needed to determine the frequency and length of nutrition education programs needed to increase fruit and vegetable consumption in children. Frequency distribution of HBM concepts recorded on the questionnaires also suggests that students appeared to notice fewer barriers to eating fruits and vegetables. This study showed that concepts of the HBM may be effective and appropriate for use in developing positive nutrition education lessons for children.

Key words: Child nutrition, National School Lunch Program, Health Belief Model, nutrition education, childhood overweight, obesity, fruit and vegetable consumption

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CHAPTER I

INTRODUCTION

Overweight and obesity are rising epidemics occurring in our nation's elementary schools today. The Centers for Disease Control and Prevention (2013) report that overweight status in elementary age children is defined by a BMI percentile above the 85th percentile for age, and obesity is defined by a BMI above the 95th percentile for age. The Bogalusa Heart study suggests that with the increase in unhealthy weight status among children, health risks and illnesses are occurring earlier in the life span (Freedman, Dietz, Srinivasan, and Berenson, 1999).

Along with the obesity epidemic in the United States, the prevalence of Type II diabetes mellitus is occurring earlier in the lifespan. Type II diabetes is described as insulin resistance, and as body fat increases in adolescents, so do HBA1c levels, which is a marker for insulin resistance and glucose intolerance (Wilson, 2013). Obesity and sedentary habits in adolescents should be addressed since it is estimated that 50% of diabetes mellitus cases in this age group are of the lifestyle related, Type II (Wilson, 2013). Demmer, Zuk, Rosenbaum, and Desvarieux (2013) reported that approximately half of all adolescent diabetes diagnoses are of type II, and one third remain undiagnosed. Type II diabetes along with childhood obesity also is correlated with earlier development of hypertension, another contributing factor to heart disease (Rhodes et al., 2011).

Dietary improvements, especially by increasing fruit and vegetable consumption, are used in treating both conditions according to the Bogalusa Heart Study (1999). Fruit and vegetable intakes are linked to decreased disease risk factors, such as high LDL cholesterol, which is related to heart disease. In a study by Epstein et al. (2001), a diet

sufficient in fruits and vegetables was found to contribute to better food choices overall. However, young children tend to prefer foods that are high in calories, sugar, and sodium and particularly low in nutritional value (Reedy & Krebs-Smith, 2010). If healthy snacking is encouraged and nutritional knowledge is increased early in children's lives, they may be more likely to be continued into adulthood. Thus nutrition education programs are essential to our future generations.

Nutrition education programs are incorporated into elementary school curriculums to assess, measure, and improve children's eating habits both in the school setting and in their homes. Data are gathered before and after a nutrition education session or program in order to determine its effectiveness. However, a majority of studies published on nutrition education programs for elementary aged children only assess student's knowledge, preferences, and perceived benefits (Tuuri et al., 2009). Furthermore, they lack assessment of eating behavior affected by the knowledge gained during nutrition programs. Increased nutritional knowledge in young children may influence their choices and preferences as well as improve their fruit and vegetable intake during school hours. A plate waste survey would add to the literature on effectiveness of nutrition education programs by evaluating students' behavior after nutritional information is delivered and knowledge has been assessed. A plate waste survey is also more accurate than some other commonly used dietary assessment methods, such as a 24 hour recall (Swanson, 2008). Food frequency questionnaires often contain discrepancies in portion amounts of food eaten and may result in overestimates of food children consume (Wilson & Lewis, 2004).

Nutrition education programs are essential to student's overall health because children spend a majority of their time at school, and are offered at least one nutrient

dense meal each day. The US Department of Agriculture provides schools with meal guidelines that fulfill recent legislation requirements of the National School Lunch Program and Healthy Hunger Free Kids Act. This legislation requires public schools to meet Dietary Guidelines for Americans recommendations for fruit and vegetable servings (Nutrition Standards, 2012). Perhaps, if students are encouraged and provided with positive influences and materials, they may be more likely to consume the available foods that are optimal for nutrition and will be provided with a foundation for healthy living. Therefore, the purpose of this quasi-experimental study is to provide information about nutrition, particularly focusing on fruit and vegetable consumption and healthy snacking, and assess the lesson's affect on students' eating behavior during school lunch hours through a plate waste survey.

The following primary research questions will be addressed:

1. What effect does a single nutrition education lesson have on improving children's knowledge of the benefits of choosing fruits and vegetables?
2. Does the implementation of nutrition education cause an increase or decrease in fruit and vegetable consumption in elementary school students?

The following secondary research questions will be addressed:

1. What is the relationship between change in nutrition knowledge and fruit and vegetable intake?
2. Do nutrition knowledge gains differ between male and female students?

3. What effect does incorporating concepts of the Health Belief Model have on changing student's attitudes towards choosing more fruits and vegetables?

CHAPTER II

LITERATURE REVIEW

Childhood Overweight, Obesity and the Relationship to Chronic Disease

Overweight and obesity status are defined by body mass index (BMI), which is a calculation of a height to weight ratio to estimate an individual's amount of body fat (Overweight and Obesity, 2012). Since children are in a state of growth, the CDC provides growth charts that separate children by age and gender and divide BMI ranges by percentiles. Childhood overweight is defined by a BMI between the 85th and 95th percentiles for age, and percentiles above the 95th are classified as obese (Overweight and Obesity, 2012). Overweight and obesity among children are rising epidemics in the United States today. Data from the most recent NHANES survey from 2007 to 2008 showed that 16.9% of citizens from the ages of two to nineteen were classified as obese (Carrol & Ogden, 2010). Students in the age group, six to eleven, which is the population of this study, exhibited a 6.5% increase in obesity from the years 1976-1980 to 2007-2008 (Carrol & Ogden, 2010). The most recent NHANES data also indicate that overweight status in children aged 6 to 17 increased by 11% from 1976 to 2006 (National Center for Health Statistics, 2009). The National Conference of State Legislatures (ncsl.org, n.d.) reported that 44.4% of children in the state of Mississippi were overweight or obese in 2007. However, the state has shown a slight decline in childhood overweight and obesity from 2008-2011, but only by 0.7 % (Centers for Disease Control and Prevention, 2013).

Overweight and in particular obesity may lead to multiple health problems such as type II diabetes mellitus, heart disease and high blood pressure. Freedman, Dietz,

Srinivasan, and Berenson (1999) analyzed data from a large sample of 12,048 school aged children and adolescents in Washington Parish, Louisiana as part of the Bogalusa Heart Study to determine whether illnesses, such as heart disease and hypertension, were occurring in children who fell within overweight percentiles. The study's large sample size was due to the 21 year length of the study and age of the participants ranging from five to 19. More than half of the participants were evaluated at least twice to determine if risk factors increased with age. Blood samples were obtained from the participants to measure triglycerides and cholesterol, which can contribute to cardiovascular disease if levels are beyond optimal. Blood pressure readings and BMI calculations were also variables of interest used (also shown to be individual risk factors for cardiovascular disease). Results of the study showed that subjects who measured above the 85th percentile using the Quetelet index (a.k.a BMI) had increased risks for future diseases while lipid, insulin, and blood pressure levels were not abnormal for participants with the Quetelet index at levels <85th percentile. Significant links could be made between obesity and its correlation to diseases such as cardiovascular disease, type 2 diabetes mellitus, and hypertension. This is due to the fact that more than half (58%) of the overweight sample was found to have at least one of the disease risk factors noted above. Logistic regression showed that the odds of having one of the risk factors with a Quetelet index > 85th percentile were 2.4 for elevated diastolic blood pressure, 3.0 for elevated low-density lipoprotein cholesterol, 3.4 for low high-density lipoprotein cholesterol, 4.5 for elevated systolic blood pressure, 7.1 elevated triglycerides, and 12.6 for elevated fasting insulin.

Another study by Rhodes et al. (2011) showed the prevalence of adolescent Type II diabetes mellitus and its progression into adulthood with associated risk factors for other related diseases. A sample of 3,500 people from the age of 15 to 24 recently diagnosed with Type II diabetes mellitus was obtained by secondary analysis and divided into Markov model cohorts of age groups from 25 to 94 with 10 year intervals with an added youth model age 15 to 24. The Markov model was used to assess disease progression over time. The youth model showed progression of the disease into adulthood and its contribution to developing cardiovascular disease as well. The study showed that an early diagnosis of Type 2 diabetes mellitus resulted in a remaining life expectancy estimation of 43.09 years from diagnosis. A review of literature by Valerie Wilson (2013) noted that a high percentage of body fat contributes to the cause of Type II diabetes mellitus, insulin resistance.

Childhood Obesity, Overweight and the Relationship to Diet

The large amount of high calorie and low nutrient content foods that children tend to consume during snack times are a contributing factor to childhood obesity, as shown in a study by Seo and Lee (2012) which correlated childhood obesity with availability of junk food at school and parental monitoring of snacks at home. There were 246 student parent pairs from sixth to eighth grade which were recruited within the Indiana public school system (from several locations) and surveyed. Two separate questionnaires were issued to students and parents, analyzed using multivariate logistic regression to determine odds ratios. The questionnaires included types of food available at home and on campus, amount of physical activity students' participated in, and parental control over family meals and eating habits. The students' BMI was determined by a self report

of the student's height and weight and an additional report on these measurements from the child's parent. Results of the multivariate logistic regression analysis indicated that children who attended schools where junk food, high fat/salty snacks or soda were sold had higher odds of being overweight ($p \leq .05$ for each variable) than children attending schools that did not allow these items to be sold. Likewise, family meals together resulted in lower odds of being overweight ($p \leq .05$).The study concluded that children's meal patterns at home, such as junk food consumption, contributed to overweight status if not monitored by parents. Sedentary behavior, such as television viewing every day, was also a contributor to overweight status ($p = .038$). Intervention methods may be effective in reducing these risk factors by demonstrating that the components of lower calorie, vitamin packed snacks, such as fruits and vegetables, are better options, and daily physical activity is also important. Since research shows that children consume up to 40 percent of their calories from snacking on insufficient nutrient sources (Reedy & Krebs-Smith, 2010), it is important for children to be taught how to prepare healthy snacks on their own and encouraged to choose healthy options during the school hours, where they spend a majority of their day.

Adding a higher amount of fruits and vegetables to children's diets may reduce overweight and obesity risk factors because encouragement, rather than limitation, may decrease unhealthy snacking patterns that include high calorie, low nutrient content foods. In a study by Epstein et al. (2001), 27 families with one obese parent and a child of normal weight underwent two separate weight loss treatment conditions over the course of one year. The first group of parents was given a treatment plan that increased their fruit and vegetable intake, while the second group was told to limit their intake of high fat

and sugar foods. The treatments were administered by group meetings which occurred weekly or monthly for 6 months, and progress was measured by the parent's weight. At the one year mark, the Food Habits Questionnaire was given to parents in the study to measure dietary changes that occurred as a result of the treatment conditions. The authors concluded that parents in the group targeted to increase their fruit and vegetable intake decreased their intake of high fat and high sugar foods by (-15.9) which was greater than the group targeted to limit their intake (-2.4).

If children learn the benefits of healthy snacking, particularly fruits and vegetables, instead of depriving them of the sugary, sweetened foods they crave, they may be more willing to select the better option, which, in turn, may improve their weight status and overall health (Epstein et al., 2001). The field of dietetics recognizes that restricting foods desired by clients may yield unsuccessful results as noted above in the Epstein et al. study. Polivy, Coleman, and Herman (2005) conducted a study on food deprivation and its results by recruiting a sample of 103 female college students who complied with a food cravings deprivation experiment. The participants underwent food deprivation of chocolate, vanilla, or no food deprivation for one week before reporting to the laboratory having not eaten for 3 hours. During their laboratory experiment the participants completed the Food Desirability Questionnaire to assess particular cravings such as chocolate and vanilla. In the lab setting, students were asked to complete a short word anagram task then allowed to taste a sample of food items containing the deprived foods in a cross-over fashion and then rate their perceptions. Food cravings were also assessed by the time it took the participant to request the sample of food upon completing the first task. Students were then asked to complete the Dietary Restraint Scale and

divided into restrained and unrestrained eaters based on pre-determined cutoff scores. Data were analyzed in this two x three factorial design by ANOVA looking at interactions between restraint category and flavor deprivation (chocolate vs. vanilla) with post-hoc contrasts conducted to assess group differences. The results indicated that restrained eaters deprived of chocolate, then ate more chocolate when it was available than any other treatment condition ($p<.05$). Also, students who were deprived of chocolate for one week prior to the experiment, spent less time on the word anagrams before asking to sample the food items than students who had been deprived of vanilla or had not been deprived of any food regardless of their eating restraint status ($p<.05$). Evidence from the two studies, Epstein et al. and Polivy et al., suggest that encouraging people to eat healthy nutrient dense foods such as fruits and vegetables better influence their behavior than the practice of completely depriving them of the sugary items they desire. For this reason, children may benefit from the concept of teaching them that plenty of healthy fruits and vegetables should be added to each meal. MyPlate developed the key message, “Make half your plate fruits and vegetables” (choosemyplate.gov).

An adequate intake of fruits and vegetables has the ability to combat high levels of the unhealthy low density lipoprotein, a contributing factor to developing cardiovascular disease. A study by Aptekmann and Cesar (2013) showed that people who regularly consume fruit or fruit juice, particularly orange, had lower total and LDL cholesterol levels than others who did not. The cross sectional design sampled 129 orange juice factory employees, 103 male and 26 female. Of the males, 38% (n=39) had high serum cholesterol (≥6.2 mmol/L). Of the sample, 41% had a regular intake of two cups of orange juice each day for one year. The sample with normal lipid levels had a mean ±

standard deviation of 3.35 ±0.61 mmol/L among non orange juice drinkers compared to lower levels of 2.74 ±0.80 mmol/L among participants who did consume orange juice daily. Of those with moderately high lipid levels, the non-orange juice consumers mean ± standard deviation LDL levels were 4.78 ± 0.48 mmol/L compared to the lowered LDL levels of those who did consume orange juice of 4.20 ± 0.8 mmol/L.

Because fruits and vegetables are not animal products, they are naturally free of cholesterol. They do not cause the body to produce extra cholesterol, which could result in excessive total serum cholesterol levels (Gylling et al., 2012). A low density lipoprotein level of 160 mg/ dL is considered high, and a contributing factor to heart disease. The Bogalusa Heart Study provided evidence that elevated LDL levels occur in overweight and obese children (Freedman et al., 1999). Thus it is important to promote dietary intakes that have been associated with lowering LDL levels. Interventions delivered in the elementary school setting may be able to make an impact on dietary intake and eventually disease risk factors.

In relation to childhood obesity and continued health problems, overweight and obesity are diseases themselves that may also continue through the lifespan when they begin as early as childhood. In a review of literature on the development of food preferences by children, Venter and Harris (2009) noted the foods children learn to eat during the developmental years are easily carried on to the teen years, where diets high in sodium, sugar, calories, and fat are often routine choices that may be easily tracked into the lifestyle of a busy adult. If children learn to select and enjoy beneficial foods such as fruits and vegetables, not only may future health risks be reduced, but healthy eating habits are likely to last a lifetime.

The Importance of Nutrition Education Programs

The acceptance and willingness of school children to eat and try the provided fruits and vegetables during school lunch times may be influenced by social factors such as mentors, educators, and peers (Addessi, Galloway, Visalberghi, & Birch, 2005). Addessi, et al., 2005 demonstrated the effects of social influences on food intake by selecting 27 preschool children aged 2 to 5 years to participate in an experimental study involving new foods. In a laboratory, children were presented with a new food item, semolina pasta with different color variations for two conditions of the study. In the first same color condition, a familiar adult was seated with the child and given the same food item with the same color. In the second condition, the scenario was the same, but the food item the adult received was a different color than the child's. A third condition was added to include presence of the adult, who was seated with the child, but didn't receive any food (presence only). Latency to try the new food was measured in seconds and the leftover food was measured (in grams) by the plate waste method to determine how much of the new food the child tried. The researchers also counted the number of times the child put food in his/her mouth or was chewing food by assessing clips of the five minute video recording of the experiment. A non-parametric ANOVA was used to analyze differences between the three treatment conditions and Wilcoxon Signed Ranks test was used as the post-hoc pair wise comparison if the ANOVA was significant at ($p < .05$) Researchers determined that latency to ingestion was estimated about 100 seconds faster in the same color condition than in the presence only ($p < .01$) and different color conditions ($p < .05$). The number of times children put food in their mouths or were chewing food in the video analysis was significantly higher in the same color condition

compared to the presence only and different color conditions ($p < .01$ and $p < .05$, respectively). Finally, the children ate more of the new food when they had the same color food as the adult compared to the presence only condition ($p < .05$) and the different color condition ($p < .05$). Thus, when healthy eating is modeled, children may be motivated to consume more fruits and vegetables and impact their fellow student's actions as well. If nutrition education programs are to be successful, the element of influence must be incorporated and the goal of such education sessions is to inspire all who are involved to model healthy eating behavior.

The nutrition education study titled, "Smart Bodies school wellness program increased children's knowledge of healthy nutrition practices and self-efficacy to consume fruit and vegetables," by Tuuri et al. (2009) used a social cognitive theory based intervention to promote change in 4th and 5th graders' confidence to eat fruits and vegetables, preferences for fruits and vegetables, and knowledge of nutrition. Social cognitive theory states that behavior change is influenced by surroundings, and teachers in the study served as role models to the students. The program involved a multi component nutrition education curriculum which included concepts of modeling and exposure to new foods. The 12 week intervention components included healthy food sampling and a field trip to a simulation "walk- through of the human body and digestion." It also consisted of interactive school assemblies, dolls, videos, books, and activities that were incorporated into the academic curriculum. Eight pairs of schools were matched by standardized test scores, percentage eligible for free or reduced lunch prices and school size. Then they were randomly assigned to the intervention or a control condition. Surveys were given to students before and after the 12 week intervention to

test their food preferences, self efficacy for choosing fruits and vegetables, social norms around eating fruits and vegetables, and outcome expectancies of eating fruits and vegetables. It also assessed whether their nutrition knowledge improved over the 12 weeks of the program. Student responses from 14 of the 16 schools were used in the data analyses which consisted of ANOVA that accounted for pairing of schools and nesting of students within a school. Tukey-Kramer least square means were conducted for between group and within group differences if the ANOVA was significant at $p \leq .05$. Results indicated that students in the intervention significantly increased their nutrition knowledge and their self-efficacy to consume fruits and vegetables. However fourth graders' preference for certain vegetables decreased after the intervention when compared to their stated preference for these same foods prior to the intervention. Additionally, 5^{th} graders had higher nutrition knowledge scores and some self-efficacy scores than 4^{th} graders and boys showed a greater preference for some strong-flavored vegetables like onions compared to girls.

The Smart Bodies program was limited in that it was designed to improve fruit and vegetable preferences, and survey data focused on the areas of increasing knowledge and self efficacy to consume fruits and vegetables. However, it did not assess actual eating behaviors. Future research in the area of behavior change in consumption of fruit and vegetables to determine if nutrition education programs are effective in increasing actual fruit and vegetable intake is appropriate.

Since less than half of the populations of school children today are choosing not to touch the fruits and vegetables provided on their trays (Tuuri, et al., 2005), research such as that done in the Smart Bodies program is needed to determine what would be

most effective in improving elementary children's actual fruit and vegetable intake. Additionally, the school setting is an ideal environment for nutrition education sessions to take place, especially since recent legislation of the Healthy Hunger Free Kids Act of 2010 requires schools to provide all of the components of a healthy lunch and satisfy the requirements for intake from the fruit and vegetable groups according to the Dietary Guidelines for Americans (Department of Agriculture, 2012). Nutrition education sessions completed in the school setting may use multiple resources and materials catered to the age group participating. They may also include activities to get children moving, another component to healthy lifestyles. Perhaps the recent changes to student's lunches need something more, such as nutrition interventions designed to entice children's food preferences and information to prompt them to consume the healthy foods available to them. Nutrition education programs implemented during school hours could achieve these results.

Nutrition education programs should include aspects of modeling, informative and persuasive teaching techniques, lively activities, family involvement, and even mild physical activity (Tuuri, et al., 2009). In another social cognitive study by Fairclough, et al. (2013), a multi-component nutrition education session titled, Change!, was administered by teachers who demonstrated modeling of the material being taught, as well as provided information about physical activity and food choices. To assess behavior change after administering the nutrition education program, which was implemented as part of the normal education curriculum, body mass index and waist circumference of student participants were measured before and after the study, and a 24 hour recall food intake questionnaire was also administered at the program's end. Across 12 schools

which participated in the study, 318 students were divided into an intervention group (n = 166) or comparison group (n = 152) The nutrition education sessions took place over twenty weeks and included multiple healthy food components such as carbohydrates, fats, breakfast, snacking, balance, fruits, vegetables, and physical fitness. A decrease in body mass index shown by a z score of -0.24 following the sessions served as evidence that implementing nutrition education sessions as part of elementary school curriculums could result in healthier weight statuses of students and could be implemented as a long term goal for elementary education.

Though the study by Fairclough, et al. (2013) did use the 24 hour food recall questionnaire, it was used to assess differences in eating behavior between the two groups who participated in the study. There was no significant difference in fruit and vegetable consumption of students who received a nutrition intervention or the comparison group. The 24 hour recall was only administered once and lacked data assessing intake before and after the nutrition intervention.

Prelip, Kinsler, Chan Le, Erausquin, and Slusser (2012) implemented a social cognitive theory and theory of planned behavior based nutrition education program focusing on fruit and vegetable consumption in Los Angeles, CA that provided nutrition education in the elementary school setting. It differed from that of Fairclough et al. (2013) by involving parents and thoroughly training the teachers who administered the sessions in one experimental condition and omitting the parents from a second experimental group. A third comparison group of 2 schools was included to compare both intervention conditions. The researchers wished to determine if a multi-component nutrition education program that included parents would improve nutrition knowledge,

attitudes, beliefs and consumption of fruits and vegetables among low-income children. The multi component program required trained teachers to administer ten hours of nutrition segments per quarter (10-20 hrs total during the school year) to a sample of 399 students from third, fourth, and fifth grade. In the nutrition education + parent condition, the students' parents were invited to attend five nutrition education workshops. The analysis indicated that students in the intervention + parent group experienced increases in nutrition knowledge related to food groups and the health benefits of fruits and vegetables ($p < .01$) and their attitudes and beliefs about consuming fruits and vegetables ($p < .05$). However, neither intervention condition resulted in improved consumption of fruits and vegetables or availability of fruits and vegetables in the home. This study conducted using social cognitive theory showed that the use of other theories, such as the Health Belief Model, may need to be tried in nutrition education sessions to better influence eating behavior change and increase fruit and vegetable consumption.

In a shorter study by Fahlman, Dake, McCaughtry, and Martin (2008), researchers implemented a nutrition education program in which an eight lesson nutrition education session was given over the course of one month. Pre and post tests questionnaires were used to assess knowledge and a self reported food frequency section was added to assess eating behaviors. The sample consisted of 407 middle school students who were administered the intervention by their homeroom class instructor who underwent eight hours of training prior to its implementation. The lessons contained information about the food groups and their benefits, eating based on the food groups, food label interpretation, body image and surviving fast food restaurants and the school cafeteria. The differences between pre and post tests of students were analyzed by a repeated measures analysis of

variance for within group (pre vs. post) and between group (intervention vs. control) comparisons. Three subscales were used to measure eating habits, nutrition knowledge, and efficacy expectations. Responses to the questionnaire indicated the intervention resulted in increased knowledge scores of students who received it ($F = 72.82$, $p < .001$) which were also higher than the control group post test results of $F = 67.07$, $p < .001$. The food frequency portion of the surveys revealed increased fruit consumption ($F = 3.97$, $p = .047$) and vegetable consumption ($F = 5.61$, $p = .018$) of the intervention and compared to the control group. The program's length did not seem to have a significant difference when compared to longer implemented curriculums in that it also resulted in improved knowledge. This nutrition education program was shorter than that of Tuuri et al. (2009), Fairclough et al. (2013), and Prelip et al. (2012) but also showed significant improvements in knowledge and fruit and vegetable intake as measured by the researchers' surveys and food frequency questions. Because the food frequency questionnaire was self- reported, it might have errors in that children may not remember every item they consumed one day prior. The nature of the food frequency survey also had limitations because the choices may not have been exactly relatable to a child's preferences. A plate waste survey may be more accurate in assessing actual intake results after a nutrition education intervention has taken place.

Social cognitive theory is commonly used in nutrition education programs to influence eating behavior, but as shown by Prelip et al. (2012), it hasn't always been successful. Therefore, there is a need to explore other theories in nutrition education such as the Health Belief Model. The Health Belief Model is commonly used to encourage behavior change by increasing an individual's awareness to a disease condition using the

concepts of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self efficacy (Bauer et al., 2012). The same aspects of the model could be applied to nutrition education in an encouraging manner indicating that fruits and vegetables are beneficial to one's health because they contain several nutrients that help the body in many ways. If information about healthy foods like fruits and vegetables are presented to children in a method that is fun and activity filled, children may be cued to action to eat more of them during school lunch. In learning how great healthy foods are for the body and that they can be prepared in appealing recipes, their self efficacy to select more fruits and vegetables may also improve. The availability of fruits and vegetables daily through the school lunch program could be used to tackle perceived barriers of unavailability of fresh healthy foods to students.

Research by O'Connell, Price, Roberts, Jurs and McKinley (1985) showed that diet is influenced by concepts of the Health Belief Model in young people. A sample of 100 high school underclassmen of normal weight and 69 obese students determined by triceps skin fold measurements was recruited for the study. Students ranged in age from 15 to 16 (age 16 was the cut off). The student groups received surveys containing questions related to the Health Belief Model such as, "If you were obese, what kinds of benefits or rewards would you get if you lost weight through an exercise program?" or "If you were obese, what kinds of things might prevent you from exercising, make it more difficult for you to exercise, or cause you not to exercise?" and "What are the disadvantages of losing weight by dieting?" Discriminant analysis was used to assess the concepts of the HBM that had the greatest impact on the adolescent's dieting behavior change. Results of the analysis showed that 23% of the variance of obese adolescents

responded best to benefits of dieting and social approval dieting behavior. In the non obese adolescents group, 19% of the variance accounted for susceptibility to the causes of obesity and social approval for dieting.

Though the Health Belief Model's use is limited in children's nutrition research, some studies do exist exploring its effect on behavior change in elementary students. Zhang, Dalal, and Wang (2013) used the Health Belief Model to study student's risk behaviors associated with safety and injuries occurring at school. The study's sample included 932 third and fourth grade students from Shanghai, China who received surveys to assess risk behaviors over the last 30 days. The researcher's claimed that the stronger the individual's health belief, the greater the likelihood of adopting healthy behavior. Of the survey, 49 questions were related to concepts of the HBM and scored on a five point scale ranging from strongly agree to strongly disagree. A chi-square test analyzed the survey data and revealed significant differences in male and female student's results. Results of the HBM questions showed that the boys had higher scores than girls in perceived susceptibility (mean difference -0.0205, $p = 0.000$).

Another study with a health educational basis by Morton (2008) focused specifically on elementary school children and used the Health Belief Model (HBM). Morton stated in her research that, "the HBM serves as a foundation to understand the health-related knowledge of children when controlled for age and cognitive level so that material is conceptually and developmentally appropriate." Morton's study gave a health promotion education session to elementary school students from kindergarten to third grade. The nine month curriculum broadcasted the health education segments over the school intercom system, and a sample of 368 students were selected to evaluate the

study's effectiveness through pre and post tests. ANOVA was used to determine that first, second, and third graders scored higher than kindergarteners on the post test. However, kindergartens did show improvement of knowledge gained from pre to post test $F (3, 159) = 19.55$, $p= 0.000$). Morton's study shows that the HBM may also be an effective approach to nutrition education involving elementary school children

Summary

In summary, nutrition education plays a role in both increasing elementary school students' knowledge and self efficacy to select healthy options. Some studies were even effective in improving students' food preferences and food choices of fruits and vegetables. Since national initiatives have been implemented under the Healthy Hunger Free Kids Act (Nutrition Standards, 2012), more efforts, such as in nutrition education offered in elementary schools should be used to encourage students to consume more of the healthy options that are now available to them. If healthy food preferences are not learned at a young age, children are more susceptible to serious lifestyle related diseases such as cardiovascular disease and type II diabetes mellitus. Research shows that childhood obesity and overweight status is correlated with rising diagnoses of these lifestyle related illnesses.

CHAPTER III

METHODOLOGY

The Sample

The quasi-experimental research design consisted of a convenience sample of fourth graders from one elementary school in Jackson County, Mississippi who were administered a HBM-based nutritional education session to test its effects on their nutrition knowledge and fruit and vegetable intake. East Central Upper Elementary School, a public school in Hurley, Mississippi, was the setting, and the targeted population for this study was fourth grade students. Parental consent was obtained for each student to participate in the study and each student's assent was also obtained. All study procedures were reviewed and approved by the Institutional Review Board at the University of Southern Mississippi prior to conducting the study (Appendix A).

One homeroom class was selected to participate in the study. Of the 222 students that made up the whole fourth grade population at East Central Upper Elementary School, 25 were asked to participate in this study. From the entire fourth grade student population, 106 were male and116 were female. The sample demographics of the class chosen to participate consisted of 11 males and 14 females. The students were aged nine to ten years, and no previous nutrition education had been offered to them under the school curriculum. Students who did not wish to participate in the proposed study were required to go to another regularly scheduled enrichment class instead.

Background Information on East Central Upper Elementary School

East Central Upper Elementary School is a public school in Jackson County, Mississippi where students in the grades third through fifth are taught. It is located in a

rural community between Hurley and Wade, Mississippi with a small population of approximately 1,550. The Food Service Department at East Central prepares menus to meet at least one third of the Recommended Dietary Allowance for key nutrients and calories and also follows the guidelines of the Hunger Free Kids Act (Christian, n.d.).

East Central Upper Elementary School participates in Apples for Education, where the local grocery store receipts for apple purchases may be used to award the school funds for education. Box Tops for Education is a similar program that uses proof of purchases from packaged food items, such as cereal, to award school's funds for education that East Central also participates in (ECUE PTO Newsletter, 2013). However, neither of these programs contains an active nutrition education component. Thus, exposure to other nutrition education messages/sources was not anticipated at the time of this study.

Instruments and Materials

A digital plate waste survey was used to assess student's fruit and vegetable consumption. It included two sets of photos for each student who received a tray lunch, before and after consumption. A plate waste study may be more accurate, particularly when used to assess school lunch intake, because children may over or under analyze their own nutrient intake as shown in a study by Baxter, Guinn, Smith, Royer, and Hardin (2007). Using the multi-pass 24 hour dietary recall method, dietitians interviewed fourth graders who self reported their school lunch and breakfast consumption over a period of three days. Dietitians also unobtrusively observed and recorded the student's intake during school lunch and breakfast. The students' food recalls and dietitian's observations of intake were then compared to assess the accuracy of children's self reporting using a

series of general linear mixed models. Students showed better accuracy scores when interviewed to obtain 24 hour dietary recalls on multiple occasions, however, overall accuracy of children's self reporting compared to observations of food actually consumed was low.

Questionnaires and paper surveys are a common method used in other nutrition education studies that target elementary school students, particularly in fourth grade age groups (Tuuri et al., 2009). Surveys generally include simple questions addressing the nutrient components of certain food groups, and sometimes ask the frequency of which healthy and unhealthy food items are eaten. For the purpose of this study, the previously validated Pizza Please questionnaire designed by Struempler and Raby (2005) was self-administered and used to assess students' pre and post knowledge before and after a nutrition intervention (Appendix B). The survey's simple questions and colorful design were appealing to younger students, and the content was approved by the study sample's fourth grade teacher. The questionnaire's knowledge questions included food group categories. Knowledge gains related to MyPlate food groups were accurately assessed because the Pizza Please questionnaires contained sections asking students to correctly select food items belonging in each food group which directly corresponded to the MyPlate segment of the nutrition intervention. Each question of the Pizza Please Survey was scored and represented by either the number 1 for correct or 0 for incorrect answers. Questions were then summed to arrive at a total scores (a perfect score = 16). Five additional questions were added to questionnaires designed to identify student's beliefs and attitudes related to the HBM concepts the nutrition intervention was based upon.

The nutrition education session included games and activities, and students were provided with food models, food picture cards, and hula hoops representing each food group. The nutrition lesson began with an ice breaker activity consisting of a five minute, comical physical fitness routine designed for classroom use titled, “Move to Learn (The Bower Foundation, 2013).” “Move to Learn” also served as an introduction to the physical activity components of healthy living and eating, a key part of the nutrition education lesson.

In an effort to increase student’s awareness to the benefits that fruits and vegetables have on the body and to influence student’s eating behavior to consume more of them, the lesson plan applied concepts of the Health Belief Model (Appendix C). In an effort to increase self-efficacy in selecting healthy fruits and vegetables, both an activity and game were planned to help students prepare a healthy plate using food models and MyPlate templates. Students were asked to identify food items on picture cards and race to place each item in the correct food group category represented by a colored hula hoop. Research has indicated that increases in self-efficacy are associated with improved health behaviors such as fruit/vegetable consumption (Fairclough et al., 2013). Self-efficacy was assessed using the data collected from pre and post questionnaires and plate waste observations.

Key components of MyPlate were also applied to the nutrition education curricula because its visual teaching technique is appealing to young learners, and a take home worksheet (Appendix D) was provided to each student demonstrating the concept to make half your plate fruits and vegetables. Because learning emphasis was placed on the

food groups and their benefits, especially fruits and vegetables, MyPlate served as the most recent design to incorporate into a lesson plan (choosemyplate.gov).

Procedures

The study took place over two days. On day one the Pizza Please questionnaire was administered first to assess any nutritional knowledge the students already had. The plate waste observation to assess their consumption of fruits and vegetables was done during their lunch period that same day. On day two, the nutrition education session was conducted and concluded with the same post-test Pizza Please questionnaire and second plate waste observation to evaluate the lesson's benefits on child nutrition knowledge and food choices.

Each student was assigned an identification number in order for all participants' names and personal identification to remain anonymous and confidential. The identification number was recorded on each questionnaire administered as well as each student's lunch tray. The identification number was used to match each student's survey data with his or her results of the plate waste observation. Correlations were later made between nutrition knowledge and fruit and vegetable intake.

For the plate waste study, each student was assigned a color coded sticker to attach to their trays at the tray line in the cafeteria to represent demographic data, pink for female students and blue for males, because fruit and vegetable choices and intake may differ between sexes. Each student had their trays photographed before being seated at an assigned class table and before any food consumption. Upon completion of the lunch period, a second photograph of each student's tray was taken to collect food consumption data. All photos solely contained each student's tray, food, and identification number

with demographic markers. Food amounts eaten were estimated using the percentage method to determine if percentages of either 25, 50, 75, or 100 were consumed per portion of fruit or vegetable on a student's tray.

Data Analysis

To determine if nutrition knowledge among students improved after the implementation of a nutrition intervention, questionnaire pre and post scores were compared using a paired samples T- test. To determine if students consumed more fruits and vegetables after the implementation of a nutrition intervention, a paired samples T-test was also used to compare percentages of fruit and vegetable portions eaten. The paired samples T-tests compared both pre and post survey data and pre and post plate waste data under the condition of a nutrition education lesson.

To determine if correlations were present between knowledge improvement and fruit and vegetable intake, a Spearman's Rank Order correlation was used. A change score was calculated by subtracting pretest scores from posttest scores as well as mean percentages from pre and post estimated fruit and vegetable consumption. An independent samples T-test was also used to assess differences between knowledge gains and fruit and vegetable consumption among boys and girls.

Because the Health Belief Model played a major role in the development of the nutrition education lesson, five questions related to the concepts of perceived benefits, perceived barriers, perceived susceptibility, perceived severity, cues to action, and self-efficacy were added to the Pizza Please survey, and students were asked to agree or disagree with each statement by circling yes or no (coded 1, 0 respectively for analysis). However, because this study contained a very small sample size, a frequency distribution

was used to summarize the responses. The frequency distribution was used to determine whether students appeared to notice fewer barriers, more benefits, and cues to action.

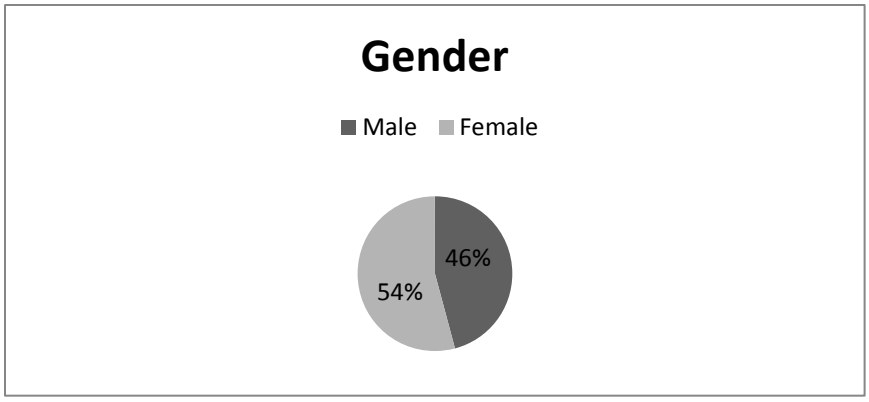
CHAPTER IV

RESULTS

The fourth grade class consisted of 24 total students with the majority of the population being 13 females. The males represent only 46% of the population with only 11 students.

Figure 1.

Demographics of Students



Knowledge Scores

Of the 24 students who participated in the study, 23 pre questionnaires and 22 post questionnaires were completed. Because surveys were paired using a t test to determine a difference in scores pre and post, 22 of the questionnaires were matched and analyzed. Results of the paired samples t-test indicated a significant increase in knowledge from pre- to post- education session, $t(21)=2.60$, $p=.015$. The mean improvement in knowledge scores was 2.27 points (SD +/- 4.04).

There was no difference between genders in change in knowledge from pre to post- education session. The mean change in knowledge was 2.27 for boys and girls

alike. However, a wider standard deviation among male students (±5.06) showed a wider range of change than females students (±2.93).

Fruit and Vegetable Intake

Out of the 24 students who participated in the study, 13 ate lunch through the tray service school lunch program. Because results were needed for analysis on two days given the condition that a nutrition education lesson was provided in between, one student was eliminated due to class absence for a total of 12 students who ate lunch from the school cafeteria on both days. While a mean improvement in fruit intake was indicated by a mean difference score of 12.5 (±44.6) points, the paired samples t test resulted in t(11)=0.97, p=0.35, which was not significant. Vegetable intake mean scores increased by 18.75 points. However, the t test indicated this was not a significant difference (t(11)=1.05,p=0.31).

Table 1.

Knowledge Scores and Plate Waste Survey Results

Variable	Condition		*t*	*df*
	Pre	Post		
Knowledge Score	6.71 (3.20)	9.19 (2.73)	3.16*	20
Fruit Intake	43.75 (46.62)	56.25 (33.92)	.971	11
Vegetable Intake	33.33 (45.64)	52.08 (44.54)	1.059	11

Note. $^{*}= p \leq .05$. Standard Deviations appear in parentheses below means.

Correlation Analysis

To determine if change in knowledge was correlated with changes in intake of fruits and vegetables, Spearman's rank order correlation was used. A correlation was not shown between knowledge improvement and fruit intake indicated by r_s=0.378, p=0.23. A strong correlation was determined between knowledge scores and vegetable intake indicated by r_s = -0.664, p=.024.

Table 2.

Spearman's Rank Order Correlation for Knowledge Improvement with Fruit and Vegetable Intake

	Intake	
	Fruit	Vegetable
Knowledge Change	.378	-.644*

Note. * = $p \leq .05$. N = 12 for all analyses.

Health Belief Model Frequencies

Students answers to the five additional concepts of the Health Belief Model where recorded and assessed for frequency of answers before and after the nutrition intervention. Table 3 lists the frequency distribution of student's responses; there was one less student completing the post-test survey. Students seemed to identify fewer barriers to consuming fruits and vegetables. The concepts of perceived susceptibility, severity, and cues to action showed an increase in frequency of yes answers representing that students appeared more aware of the negative outcomes to not consuming fruits and vegetables and seemed more aware of personal triggers to select fruit and vegetables in the future.

Table 3.

Frequency of Health Belief Model Concepts

	Pre		Post	
Concept	Yes	No	Yes	No
Benefits	22	1	21	1
Barriers	18	5	13	9
Perceived Susceptibility	13	10	15	7
Perceived Severity	19	4	20	2
Cues to Action	18	5	22	0

CHAPTER V

DISCUSSION

Knowledge Improvement

Students' knowledge scores improved after a nutrition education lesson was implemented. The lesson was planned using components of the Health Belief Model, a behavior change theory rarely used with children. This study demonstrated that a nutrition education session planned using concepts of the Health Belief Model may be effective in improving fourth graders nutrition knowledge. An increase in nutrition knowledge may then serve as a first step in improving fruit and vegetable intake. It is not uncommon for elementary school students to lack preferences for fruits and vegetables (Tuuri, et al., 2005).However, repeated introduction of healthy foods may be necessary to increase children's tendency to consume fruits and vegetables (Mustonen,& Tuorila, 2010). If repeated exposure to healthy foods is needed to promote change in eating, regular nutrition education curriculums may aid in improving the diets of school children. Mandated nutritional guidelines to school lunch programs seem to lack motivational components. The use of nutrition education may be a valuable addition to the success of school lunch initiatives by providing the motivation to try new healthier foods.

The Health Belief Model incorporates five aspects to promote lifestyle changes. Because the theory includes perceived susceptibility and severity often referring to disease, the Health Belief Model is widely accepted for use in counseling and educating adults. Studies involving the use of the Health Belief Model with children and adolescents are limited, but a few related to health education have begun to emerge. As part of a health education promotion program, Morton demonstrated that brief segments

of HBM based lessons may be effectively administered to kindergarten through third graders to change health and wellness learning and assess knowledge gained (2008). Because pre and post test scores increased after the 9 month curriculum, the HBM may be appropriate for use with children (Morton, 2008). In the current study, the Health Belief Model described the benefits of choosing fruits and vegetables, as well as barriers elementary school students face in not choosing them. This study also differed in that a nutrition education lesson was specifically planned and taught based on concepts of the HBM. During the intervention, students were encouraged to participate in active discussion drawing awareness to barriers and benefits.

Other aspects of the HBM used included susceptibility and severity of problems that could affect school aged children who do not consume enough fruits and vegetables, particularly during school lunch. The activities incorporated into the nutrition lesson required the use of energy and teamwork, which aimed to help students' improve their confidence and recognize cues to action.

While there was not a statistically significant difference in mean knowledge score improvement between boys and girls, the wider range of improvement in male students' scores may have been related to the lesson. The Health Belief Model used in this lesson may have appealed more to male students than female students. To demonstrate the severity of not eating enough fruits and vegetables, the researcher incorporated a comical pirate who appeared to have scurvy and may have appealed more the male students than females.

Fruit and Vegetable Intake

Fruit and vegetable intake after a nutrition education lesson was administered did not significantly change regardless of knowledge gained. The fruit and vegetable choices offered by the school lunch program were not similar on both days of the study, and while a vegetable may have been chosen by students after the lesson was administered, low percentages were consumed. In some cases, students selected an entire salad as their meal but did not select a fruit component at all. When salads were selected, vegetable intake appeared larger while fruit actually decreased. Because a chef salad is a large vegetable portion, if students didn't consume all of the meal, percentages of vegetable intake were low. The vegetable offered on the day of the plate waste study after the lesson was given, lima beans, could have caused confusion to the students. MyPlate represents beans as both a protein source and a vegetable. The current study differed from previous studies in its nutrition education content because MyPlate replaced the Food Guide Pyramid. MyPlate serves as the most recent guideline for identifying food groups.

A negative correlation was shown between vegetable intake and knowledge improvement. As knowledge improved, vegetable intake did not. Other studies differed by measuring preferences for vegetables as opposed to actual intake, but preferences for certain vegetables did not seem to increase after a nutrition intervention (Tuuri, et al., 2005). Tuuri et al. suggests that taste may be a factor in children's preferences for fruits and vegetables (2005). This study did not incorporate methods of taste testing or fruit and vegetable preparation, therefore, future research could be effective if fruits and vegetables are introduced to students on more than one occasion and in the instance of regular nutrition education sessions (Tuuri et al., 2005).

Fruit intake remained constant. Students who ate lunch through the school lunch program did not choose to eat more fruits after knowledge increased, but intake did not decrease in relation. Fruit generally tastes sweeter than vegetables and children may be more likely to select fruits over vegetables. For this reason, more needs to be done to influence children's eating behaviors of consuming more vegetables. The nutrition lesson and activities only included faux foods and did not offer approaches to make vegetables more appealing. In the future, including activities to involve students in food preparation may encourage selection and consumption of fruits and vegetables overall.

Limitations

A convenience sample of only 24 total students was used for this study. The small sample size made results and t tests difficult to analyze, particularly in the area of fruit and vegetable intake because only 13 students ate a tray lunch through the elementary school resulting in a very small sample size for analysis. A second limitation of the study included the researcher was unable to choose the dates of the lesson and pre- and post-questionnaires, resulting in fruit and vegetable offerings in the cafeteria that were not alike over the course of the plate waste study.

Future research is needed to not only improve children's nutrition knowledge, but also influence eating behaviors. While a sole nutrition lesson increased fruit and vegetable knowledge, it did not result in more fruit and vegetable intake. Previous studies addressed fruit and vegetable preferences before and after nutrition education lessons were implemented (Tuuri, et al., 2005). Reintroduction of new foods is needed up to 10 times before children may develop preferences for certain foods (Brown, et al., 2011).

For this reason, more live activities incorporating fruit and vegetables and extended or reintroduced nutrition education lessons should be studied.

Conclusion

This study was effective in improving nutrition knowledge in fourth grade students using concepts of the Health Belief Model. Well planned and executed nutrition education lessons may be valuable and beneficial to elementary schools by helping children realize the importance of choosing to eat healthy. It may be concluded that the Health Belief Model serves as a positive and efficient resource for nutrition education lessons designed for children. Fruit and vegetable intake may be improved through broadened studies that introduce nutrition education more than once.

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APPENDICES

APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL

THE UNIVERSITY OF
SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
118 College Drive #5116 | Hattiesburg, MS 39406-0001
Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional-review-board

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.

Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: **13122001**
PROJECT TITLE: **Nutrition Education Programs in Elementary Schools and their Influence on Eating Behavior during School Lunch**
PROJECT TYPE: **New Project**
RESEARCHER(S): **Rachel Calhoun**
COLLEGE/DIVISION: **College of Health**
DEPARTMENT: **Nutrition and Food Programs**
FUNDING AGENCY/SPONSOR: **N/A**
IRB COMMITTEE ACTION: **Exempt Review Approval**
PERIOD OF APPROVAL: **12/20/2013 to 12/19/2014**

Lawrence A. Hosman, Ph.D.
Institutional Review Board

APPENDIX B

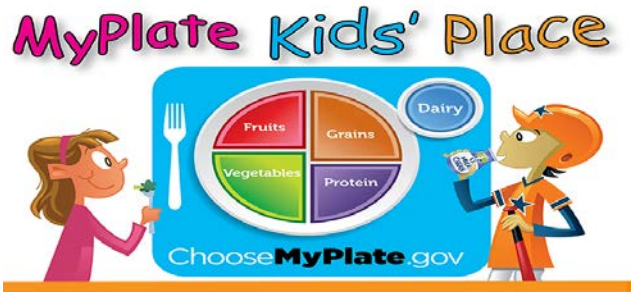
PIZZA PLEASE QUESTINNAIRE

Name: _____Date:_____

ID Number: _____

Fun Food

Questionnaire



My Plate has six food groups. Circle the correct food items for each group below.

1. Which food belongs in the Grains Group?

   Waffle Noodles Apple Oatmeal

2. Which food belongs in the Vegetables Group?

   Broccoli Carrots Cabbage Pear

3. Which food belongs in the Fruits Group?

   Strawberries Pineapple Watermelon Corn

4. Which food belongs in the Protein Group?

   Turkey Chicken Potato Ham

5. Which food belongs in the Dairy Group?

   Cheese Crackers Pudding Yogurt

6. Which food belongs in the Fats and Oils Group?

   Hamburger Butter Cupcake Candy

Food Contains Nutrients!
Match each food item with its Nutrient

7.	_____ Milk	A. Vitamin C
8.	_____ Bread	B. Calcium
9.	_____ Fruits and Vegetables	C. Protein
10.	_____ Meat	D. Sugar
11.	_____ Soft Drinks	E. Carbohydrates

Nutrients perform specific functions in your body.
Match each Nutrient with its Function

12.	_____ Helps eyes see in the dark	A. Vitamin C
13.	_____ Heals cuts and bruises	B. Calcium
14.	_____ Makes bones strong	C. Protein
15.	_____ Makes muscles strong	D. Vitamin A
16.	_____ Gives you energy	E. Carbohydrates

The last few questions ask how you feel about food.
Circle Yes or No.

17. I believe that eating plenty of fruits and vegetables will give me energy to do the things I enjoy.

Yes No

18. I do not always prefer the vegetable choices provided to me at lunchtime?

Yes No

19. I think that I may be more vulnerable to becoming sick if I do not eat fruits or vegetables each day.

Yes No

20. I may not be able to participate in my favorite sports or activities if I do not eat fruits and vegetables often.

Yes No

21. My dinner plate looks like MyPlate, and it reminds me to fill one side with fruits and vegetables.

Yes No

Thank You for your Participation in this Nutrition Study!

APPENDIX C

NUTRITION EDUCATION LESSON PLAN

Session #: 1

Topic: Nutrition Education based on the Health Belief Model

Lesson Title: Breaking Barriers: Fruits and Vegetables are Fun Foods!

Goal: Increase awareness to the benefits of eating fruits and vegetables and identify barriers fourth graders face to choosing to eat them.

Objectives: After the lesson, students will be able to:

1. Identify one benefit to eating a fruits or vegetables.
2. Determine one barrier to eating vegetables that are offered during school lunch.
3. Using food models, place two correct food items on a MyPlate template.
4. Identify one fruit or vegetable that contains Vitamin C.

Time allotted: 20 minutes

Content and Sequence	Talking Points/ Description of Activity	Target HBM Concept
Welcome and Introduction	• Welcome students. "Today we will learn about fruits and vegetables and why we should eat them.	
Ice Breaker Activity/ Physical Fitness Factor	• Everyone on your feet! Let's do a five minute MovetoLearn exercise in the classroom. (www.movetolearnms.org)	
Introduce MyPlate	• Now that you are energized and ready to learn, let's talk about some healthy foods. • How many of you have heard or seen MyPlate before? • MyPlate replaced MyPramid in 2011 to represent the five food groups that you can visualize on your dinner plate.	• Perceived Benefits

	• Vegetables are any plant that is grown for food. Examples are broccoli (flower), celery (stem), spinach (leaf), carrots (roots). Even peas and beans are vegetables. • Fruits are edible plants with seeds. Examples are apples, bananas, grapes, peaches, citrus, berries, and melons. • Next is the Dairy group, which includes milk, yogurt, cheese, pudding. Dairy foods contain Calcium, which keeps your bones strong! • Grains are made from wheat, rice, oat, barley, or other cereal grains. Think breads, cereals, and pasta. • Proteins are meats, eggs, seafood, beans, peas, and soy. Proteins make things in our bodies like organs and muscles. • Fats and oils are another component of foods. Some are better than others, like olive oil, avocados, and nuts. But sometimes, it's okay to eat cake.	
Why should we eat fruits and vegetables?	• Vitamins and Minerals: All fruits and vegetables contain them. Carrots have Vitamin A, Broccoli, lemons, strawberries, peppers, and many more have Vitamin C! • Energy: Fruits and vegetables are low in fat and full of carbohydrates. Carbohydrates give us energy to do the things we love.	• Perceived Benefits

Public Service Announcement	• Vitamins in fruits and vegetables help prevent diseases! • A surprise visit from the Proper Nutrition Pirate (individual in a pirate costume knocks on the door and enters the classroom singing an energetic song, "I'm here today to sing you a song about Vitamin C, and how if you don't eat enough, you could get Scurvy! Scurvy turns your teeth green like a pirate out at sea. So eat your fruits and veggies and you won't be worried. So kids beware go eat a pear and try some strawberries. An orange or two is good for you, and lots of broccoli!	• Perceived Severity
How do you feel when you don't eat enough fruits and vegetables?	• It's likely you'll feel groggy by 2:00 p.m. • You may be more likely to catch a cold more often. • You may be too tired to play your favorite sports after school.	• Perceived Susceptibility
Why don't we eat fruits and vegetables?	• Open discussion with students. • Are vegetables boring? • Does not having a choice in the vegetable or fruit we are provided with during lunch make us not want to eat them?	• Perceived Barriers

Fruits and Vegetables can be Fun!	• Create dips to spruce up sliced fruits and veggies • Make edible creatures out of raw fruits and vegetables with your friends and family, such as apple teeth, butterfly carrots, bugs on a log(celery with peanut butter and raisins). • Try them, try them, try them!	
Learning Activities	• MyPlate game: Set up five hula hoops around the class room. Label each one with a different food group poster. Divide students into five teams and give each team a set of picture cards with a food item. Have students race to place each food picture in the correctly labeled hula hoop food group. • Using a plastic MyPlate template and food models, let students take turns filling the template with the correct food for each category on the plate, particularly focusing on making half your plate fruits and vegetables.	• Cues to Action • Self Efficacy
Evaluation	• Knowledge questionnaires (pre and post) were used to assess effectiveness of the lesson. • Plate waste observations (pre and post) noted changes in fruit and vegetable consumption	

Materials:

Microsoft Office PowerPoint (animated)
Projector screen
Computer

Five hula hoops
Assorted picture cards with food
MyPlate template plastic plate
Food models

APPENDIX D

HANDOUT