EVALUATION OF AN OCES NUTRITION EDUCATION PROGRAM, *THE STORY OF BENNY THE TRAVELING BEAN*, ON FIRST GRADE CHILDREN'S WILLINGNESS TO TRY FOODS CONTAINING LEGUMES

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CHAPTER I

INTRODUCTION

Many nutrition education campaigns targeting children in the United States focus on increasing fruit and vegetable consumption. Fruits and vegetables are low in fat, high in fiber and provide many nutrients growing children need in their diet.[1,2] However, many educational campaigns overlook legumes, which are an important vegetable. Legumes may have been overlooked because they were previously grouped with the meats in the Food Guide Pyramid.[3] In the new United States Department of Agriculture MyPyramid, legumes are in both the vegetable and meat group because they are a plant-based food like other vegetables, but are also a good source of protein, like meat.[4-6]

Legumes are a good source of protein, folate, potassium, iron, and magnesium, and research has shown children who eat legumes get more of these valuable nutrients in their diets than children who do not.[4] In addition, legumes are low in fat and high in fiber.

Iron is a key nutrient for school age children because of their rapid growth rate.[7] Four to eight-year-olds need 10 milligrams of iron in their diet each day, while nine to 13- year-olds need eight milligrams.[8] National Health and Nutrition Examination Survey 1999-2000 revealed seven percent of one to two- year-olds, and five percent of three to five-year-olds were iron deficient.[9] Losing primary teeth makes it hard for some children

to chew meats, a high iron source, until their permanent teeth come in. Cooked legumes are easy for children to chew, and are a good source of iron. For example, a one-half cup cooked portion of legumes provides slightly less iron than a three ounce sirloin steak, and one-half cup of cooked kidney beans contributes almost three milligrams of iron, compared to two milligrams of iron from three ounces of ground beef.[10]

Only 30 percent of six to 11-year-old children consume the recommended amount of fiber.[11] A one-half cup portion of cooked kidney beans provides almost 23 percent of children's daily fiber needs (5.7 grams), making beans a high fiber food.[12, 13] Fiber helps with weight management because it makes people feel fuller longer, and most high fiber foods are low in calories.[14] Fiber is also important for normal laxation.[11]

From 1963 to 2000, the percentage of overweight (defined as greater than the 95th percentile Body Mass Index – for age) children in the United States jumped from approximately four percent to slightly over 15 percent in the six to 11 year-old-age group.[15] Children who are overweight are more likely to develop adverse medical conditions.[16] In fact, type 2 diabetes, which previously affected adults 40 years old or older, is increasingly affecting children, and most of these children are overweight.[17] Legumes are a low fat, high fiber food, which could be beneficial for weight management.[14]

Another benefit of legumes is their affordability. This is important because 46 percent (399,240) of children in Oklahoma are from low-income households (defined as a household income less than two times the federal poverty level), and 18 percent (158,524) are considered poor (defined as a household income below 100 percent poverty level).[18] Although legumes are nutrient rich and inexpensive, a survey of bean

consumption in the United States revealed that children under the age of 12 years represented 18 percent of the surveyed population, but consumed only nine percent of the cooked legumes eaten by the surveyed population.[19]

Research pertaining to why children in the United States don't consume legumes is lacking. Regardless of why they aren't eating legumes, there is a lack of educational materials promoting legume consumption for children. Nutrition campaigns that focus on legumes could increase consumption of legumes, and thus iron, fiber, protein and other important nutrients in young children's diets.

Purpose

The purpose of this study is to determine the effect of an Oklahoma Cooperative Extension Service nutrition education program, "The Story of Benny the Traveling Bean," on first grade children's willingness to try foods containing legumes.

Null Hypotheses

Ho1: There will be no significant difference in the frequency of first grade children's willingness to take foods containing legumes after participating in the OCES nutrition education program, "The Story of Benny the Traveling Bean."

Ho2: There will be no significant difference in the frequency of first grade children's willingness to taste foods containing legumes after participating in the OCES nutrition education program, "The Story of Benny the Traveling Bean."

Assumption

Snacks the children chose to take or taste reflected the children's attitude about legumes and reflected the children's own personal food choices and not choices influenced by peers.

Limitation

One limitation is the small sample size used in the study. A second limitation is the use of a convenience sample, resulting in lack of randomization.

Definitions

1. Dietary Reference Intakes – nutrition recommendations developed by the Institute of Medicine
2. USDA Food Guide Pyramid – United States Department of Agriculture recommended framework for daily food consumption used from 1992 to 2005 and based on the *Dietary Guidelines for Americans*. Composed of five main food groups (1-breads, cereals, rice, and pasta 2-fruits 3-vegetables 4-meat, poultry, fish, dry beans, eggs, and nuts 5-milk, yogurt, and cheese) and an additional group - fats, oils, and sweets. Replaced by the USDA MyPyramid.
3. Legumes – plants having a pod with two seams and an enclosed seed; includes beans, peas, peanuts, and lentils. In this report, legumes refers to beans only (e.g. black, navy, pink, white, kidney, and pinto beans), and does not include peas, peanuts, or lentils.

4. USDA MyPyramid – United States Department of Agriculture recommended framework for daily food consumption based on the *2005 Dietary Guidelines for Americans*. Replaced the USDA Food Guide Pyramid, emphasizing a more individualized system with an interactive website and physical activity. Includes five main food groups (1-grains 2-vegetables 3-fruit 4-milk 5-meat and beans), an additional category – oils, and information on "discretionary calories."
5. Oklahoma Cooperative Extension Service (OCES) – informal education program providing research based information to improve the lives of Oklahoma residents; provided by Oklahoma State University and Langston University.
6. Percent Daily Value (% DV) – the percentage amount a single serving of a food contributes to the daily recommended amount of a specified nutrient.
7. United States Department of Agriculture (USDA) – federal program which operates several agencies including Agricultural Research, Food and Nutrition, Cooperative State Research and Education, and Food Safety and Inspection.

CHAPTER II

REVIEW OF LITERATURE

Health Benefits of Fruits and Vegetables

Fruits and vegetables (FV) contain many nutrients which have proven health benefits. As a group, FV are low in calories and fat and are good sources of potassium, dietary fiber, folate, vitamin A, vitamin E, and vitamin C.[1, 2]

There have been many studies on the roles of FV particularly related to lowering the risk of certain types of cancer and coronary heart disease (CHD). A large meta-analysis cohort study showed a link between the amount of FV in the diet and the incidence of CHD. This study revealed for each additional portion of FV consumed per day, the risk of CHD decreased by four percent.[20] Another study, *The Dietary Approach to Stop Hypertension*, or *DASH Study,* showed a relationship between FV and hypertension. During an eight week period, hypertensive subjects ate a diet high in FV, and experienced an average 11.4 mm Hg drop in systolic blood pressure and 5.5 mm Hg drop in diastolic blood pressure.[21]

Some of the nutrients found in FV, specifically vitamin C and vitamin E, act as antioxidants, destroying free radicals, which could reduce the risk of developing certain types of cancer and CHD.[22] In addition, FV are low in calories, and as plant foods,

contain no cholesterol, which is also beneficial for lowering the risk of certain types of cancer and CHD.[1, 2] Fruits and vegetables are a good source of dietary fiber, which is associated with lower blood pressure and improved lipoprotein profiles.[22] Furthermore, FV contain non-nutritive phytochemicals. Phytochemicals are biologically active compounds that provide health benefits through their many physiological activities.[23] For instance, lycopene, a phytochemical found in tomatoes, has displayed a protective effect against CHD by decreasing cholesterol synthesis.[22]

The beneficial nutrients found in FV coupled with the low calorie content and lack of cholesterol also help guard against type 2 diabetes, kidney stones, and bone loss.[1, 2] Diabetes is one of the most prevalent diseases in children and adolescents, affecting approximately 151,000.[17] The incidence of type 2 diabetes is increasing among adults and children, and is attributed to increasing rates of obesity. Hodge et al. tested the effect of specific dietary patterns on development of type 2 diabetes in 36,787 adults in the Melbourne Collaborative Cohort Study. Over a four year period, 365 cases of diabetes surfaced.[24] An increased risk of diabetes was associated with diets high in meats and fatty foods, while a diet high in salad and cooked vegetables was associated with a lower risk of type 2 diabetes.

Although these are primarily adult on-set diseases, they are affected by nutrition behaviors throughout the lifetime. In fact, offering FV early in life, can increase children's preference and consumption of FV.[25] Because of the many health benefits of FV the USDA MyPyramid, for a reference 2,000 calorie diet, recommends two cups of fruits and two and one half cups of vegetables each day.[26, 27] Children age four to 13 years need one and one half cups of fruit each day, and one and one half to two and one

half cups of vegetables each day.[26, 27] MyPyramid encourages a varied vegetable intake each week by including dark green vegetables, orange vegetables, starchy vegetables, other vegetables, and legumes.[28] For a reference 2,000 calories diet, three cups of legumes each week are recommended. It is recommended children four to eight years old consume one cup of legumes, girls nine to 13 years consume two and a half cups, and boys nine to 13 years consume three cups of legumes each week.

Nutrition Curriculums Focus on Fruits and Vegetables

Overweight and obesity are determined by Body Mass Index (BMI), calculated from an individual's height and weight. For adults, "overweight" is classified as BMI between 25 and 29.9, while "obese" is classified as a BMI of 30 or higher.[29] Overweight is classified slightly different with children. BMI-for-age is charted on growth charts over a period of time. BMI percentiles between 85 and 95 are classified as "at risk of overweight," while "overweight" children have body mass indexes at or above the 95th percentile.[30] Using a population of 2,214 subjects from the years 1992 to 2002, it has been estimated that 30 percent of six to 11-year-old children are "at risk of overweight" and "overweight" using a BMI-for-age of greater than or equal to the 85th percentile.[15]

It is well understood that being overweight increases the risk of developing chronic conditions such as type 2 diabetes, CHD, and certain cancers.[31] Researchers have seen an increase in the number of children categorized as overweight in the last few years. As a result, nutrition education emphasizes increasing consumption of FV in attempt to decrease the risk of overweight and chronic conditions.

A literature search of FV consumption in children reported 896 unduplicated published studies.[31] Seven education interventions for increasing FV consumption among seven to 12-year-olds were chosen and analyzed from 1990 to 2002. The study population included 8,156 female and male students, 59 percent of which received the intervention and 41 percent included in the control group. The average classroom intervention was two years at approximately 10 hours a year. Six of the seven studies reported significant increases in FV intake following intervention compared to control groups. The average increase in FV intake was 18 percent.[31] The one study that did not result in a significant increase in FV consumption, the CATCH study, did however, report a reduced fat intake and increase in physical activity. Table 1 provides a summary of these studies in order of greatest to lowest impact on FV consumption. The two programs having the greatest positive influence, *Integrated Nutrition Program (INP)* and *Alabama High 5*, are discussed in detail.

Table 1. FV intervention summary.

Study	Grades Targeted	Theory Used	Study Design	Format of Intervention	Evaluation Tools	Resulted in Significant FV Increase?
Integrated Nutrition Project (NIP)	K – 5th	Social Cognitive Theory	Cross-sectional; quasi-experimental	Classroom - 24 weekly lessons. Included family component.	24 hour recall; plate waste survey	Yes
Alabama High 5	3rd – 5th	Social Cognitive Theory	Pretest-Intervention-Posttest design Matched pairs	Classroom-14 lessons in 7 weeks. Included family & food service component.	24 hour recall; plate waste & observation	Yes
Colorado 5 A Day	2nd – 4th	Social Cognitive Theory	Cross-sectional; quasi-experimental	Classroom – 16 lessons given weekly, including 6 parent taught classroom activities.	Plate waste	Yes
California's 5 A Day Power Play	4th – 5th	Reciprocal Determinism; Resiliency Theory	Pretest-Posttest design	Classroom – 10 activities led by teachers.	24-hour food diary; telephone interviews with teachers and principles to evaluate materials	Yes
Minnesota's 5 A Day Power Plus	4th	Social Cognitive Theory	Randomized Community Trial	Classroom-16 lessons given 2 times a week for 8 weeks. Included family component.	24-hour recall; observation; parent telephone survey; health behavior questionnaire	Yes
Gimme 5	High School	Stages of Change	Randomized paired design; matched pairs; cross sectional	Classroom – Five 55 minute workshops. Included media campaign, food service & family components.	Questionnaire	Yes
CATCH	3rd – 5th	Social Cognitive Theory	Randomized field trial	Classroom – 55 lessons.	24-hour recall	No

Howerton MW, Bell BS, Dood KW, Berrigan D, Stolzenberg-Solomon R, Nebeling L. School-based nutrition programs produced a moderate increase in fruit and vegetable consumption: Meta and pooling analyses from 7 studies. *Journal of Nutrition Education and Behavior*. 2007; 39(4): 186-196.

The Integrated Nutrition Project was completed at Denver Public Schools over a four year period. The project was designed using behavior change theory and the children's readiness to learn.[32, 33] Lessons had a present rather than future focus, and emphasized how food tasted and to eat more whole grains, fruits, and vegetables. Lessons de-emphasized how foods influenced diseases, specific nutrients in foods, serving-sizes, and eating in moderation. Small group work, eating, and hands-on food preparation reflected the belief that knowledge is gained through activity, and aimed to increase preference of certain foods through exposure. Classroom teachers, trained by public health nutritionist, volunteered to teach nutrition lessons. Due to different funding agencies, the program varied slightly from year to year. During the first year, assessment and evaluation included focus groups with parents and teachers, and teacher interviews. Focus groups identified barriers, motivators, and project support. Interviews revealed teachers' opinions on the effectiveness of the program after its completion. During the first two years, treatment and comparison classrooms from the same school were evaluated using a quasi-experimental design. During the third and fourth years, the design was cross-sectional, quasi-experimental pre/post test (early fall and late spring).

Project objectives were: (1) increasing consumption of whole grains, fruits, and vegetables (2) increasing knowledge and attitudes toward fruits and vegetables (3) increasing knowledge of the Food Guide Pyramid and 5 A Day program and (4) improving food preparation skills.[32, 33] Comparison and treatment schools were matched based on ethnicity, socioeconomic status and school lunch style. More than 80 percent of children received free or reduced-price lunches. During the third year, 268 children were

assigned to the treatment group and 181 to the comparison group. During the fourth year, 456 children were in the treatment group and 395 in the comparison group.

Classroom teachers were trained during three in-services, and were then responsible for teaching 24 weekly lessons to their students.[32, 33] Parents received 12 bimonthly, low-literacy newsletters, participated in nutrition classes, and two "Family Fun Nights." Parents also taught six school lunchroom activities.

Evaluation methods consisted of: plate waste, food recalls, surveys, interviews, and process evaluations.[32, 33] Plate waste was used as a lower-cost method of food weighing and provided comparable estimates of the amount of foods eaten. Food recalls were completed on fourth and fifth grade children (recalls did not include portion sizes). Surveys assessed the knowledge of the Food Guide Pyramid and attitudes of whole grains, fruits and vegetables. Sample questions included: write name of food groups on a blank Food Guide Pyramid, and select foods from the list which would increase whole grain, vegetable or fruit in a meal. An evaluation team gave the survey rather than teachers to ensure consistency. Kindergartners participated in interviews rather than food recalls and surveys due to decreased literacy capability. The five minute interview assessed their knowledge of whole grains, fruits, and vegetables and used techniques such as sorting and naming fruits and vegetables and distinguishing between whole grains and white bread. Teachers were interviewed to determine (1) changes in interest and confidence in teaching nutrition education in their classrooms (2) attitude of effectiveness of nutrition lessons and (3) quality of in-service training.

Data were entered into ASCII files for analysis.[32, 33] Chi-square analyses, analysis of covariance, and mixed-model analysis of covariance compared demographic

characteristics and outcome measures. Analysis of covariance or mixed-model analysis of covariance controlled for pretest scores and effects of demographic variables. Regression models were run on key outcomes.

According to plate waste data, children in the treatment group significantly increased servings on fruits and vegetables during school lunch compared to children in the comparison group by one-fifth more servings of fruit and one-fourth more servings of vegetables.[32, 33] Children in the treatment group had higher levels of knowledge than the comparison group and approximately 90 percent knew the 5-A-Day recommendations compared to 10 percent of the comparison children in kindergarten and 60 percent of the comparison children in fourth and fifth grades. During teacher interviews, 75 percent reported teaching more nutrition on their own as a result of the program.

Limitations to this study were identified as high student turnover and significant absenteeism.[32, 33] Self-reported dietary assessments (i.e. food recalls) had the potential of falsely increasing fruit and vegetable intake. Teachers volunteered to participate in the project, and were not randomly selected, and may have had a greater interest in the subject. In addition, the exact content of the nutrition lessons varied.

Alabama High 5 Program included 28 elementary schools (1,698 students), paired by ethnicity and number receiving free or reduced-price lunches.[34] Eighty-three percent of the students were European American, 16 percent were African-American, and one percent classified as other. One school in each pair was randomly assigned to an intervention group, while the other school served as the control group. Assessment was conducted at baseline, year one follow-up, and year two follow-up.

The curriculum consisted of 14 lessons that used modeling, self-monitoring, problem-solving, reinforcement, taste testing, characters, and naming to increase fruit and vegetable consumption.[34] Lessons were taught by trained curriculum coordinators to children, food service managers, and parents. The program was conducted on three consecutive days of the week. The first and third day consisted of a 30 to 45 minute lesson, while the second day was a "High 5 Day." On High 5 Days, children and parents were encouraged to eat five servings of fruits and vegetables and keep food records.

Parents participated in a "Kick Off Night" which oriented them to the program.[34] They also received the "Freggie Book," containing seven homework assignments that children and parents were to complete together. At completion of the homework assignments, parents signed a voucher and returned it for prize drawings during class.

Food service managers participated in one-half day trainings on purchasing, preparing, and promoting fruit and vegetables.[34] Cafeterias earned two to four stars each month based on completion of 10 intervention activities. Each four star cafeteria received a certificate for reinforcement.

Twenty-four hour dietary recalls were conducted for each student for each day of the week during a face-to-face interview or phone recall.[34] Information was entered into the Nutrition Data System.

Within 54 of the 108 classes, a sample of nine children was randomly chosen for plate waste observation.[34] Before children entered the cafeteria, trained data collectors measured fruits and vegetables that would be served to estimate average portion sizes.

Questionnaires were given in classrooms to measure: knowledge, stages of change, asking skills, outcome expectancies, perceived self-efficacy, and social norms.[34] Children took questionnaires home for their parents to complete.

Demographics and outcome measures were summarized with descriptive statistics and measures of association.[34] Tests for normality of continuous measures and transformations to stabilize variance and improve normality were also conducted. Freeman-Tukey transformation was used to analyze distribution. Standard errors were approximated by Delta and psychosocial scales summarized with principal axis factor analyses and varimax rotation. To determine if changes were desirable, staging data was analyzed using PROC CATMOD in SAS and sign tests. Analysis of covariance was used to allow adjustment for baseline values.

Children and parents in the intervention group consumed significantly more servings of fruits and vegetables than students in the control group.[34] At follow-up one, children's psychosocial variables differed on (1) cognitive, physical, and negative outcome expectancy scores; (2) self-efficacy; (3) knowledge of 5-A-Day servings; (4) knowledge of the Food Guide Pyramid; and (5) teacher social norms. At Follow-up one, the parents' psychosocial variables differed on (1) negative outcome expectancy, (2) general self-efficacy, and (3) knowledge of 5-A-Day servings.

Nutrition Education Lacks Legume Component

Many nutrition education tools focus on increasing FV intake in children, but few include legumes. In the seven studies reviewed by Howerton et al., specific FV were rarely mentioned, so it is hard to determine if legumes were included. However, most

followed the 5-A-Day Campaign, which did not include legumes. The Colorado 5-A-Day program was designed so menus in four schools included apple wedges, vegetable sticks, corn, and fruit cocktail.[33] Plate waste of the chosen four FV were used to evaluate the effectiveness of the program. The INP program also evaluated plate waste of apple wedges, vegetable sticks, corn, and fruit cocktail.[32] Included in the fruit group of the NIP curriculum were tropical fruits and fruit varieties found in salads, smoothies and parfaits. In the vegetable group, root vegetables, leafy greens, Chinese vegetables, and vegetable varieties in soups and salads were included.

A series of books about the current USDA MyPyramid, "The New Food Guide Pyramid," designed for kindergarten through third grade children, included a book for each of the five food groups, oils, and a "Healthy Eating" book. Legumes were excluded from the "Vegetable" book, but were mentioned in the "Meat & Beans" book.[35, 36] Reference was made to beans having very little fat and meat and beans as being high in protein and iron.[35] However, "beans" or "legumes" were not found in the index.

There is limited research about why legumes have not been promoted in nutrition education. One study reported dietitians desired more resources to support legume recommendations, such as recipes, pamphlets, food demonstrations and internet sites.[37] Legumes may have been overlooked in nutrition education because of the confusion about what food group they fit in to. Legumes are scientifically classified as vegetables, but are higher in protein than most vegetables. Because of their high protein content, legumes are sometimes categorized as meat substitutes in dietary planning. The previous USDA Food Guide Pyramid included legumes in the "Meat & Beans" group. However,

the current USDA MyPyramid includes legumes in both the "Vegetable" and "Meat" groups.[38]

Nutrient Benefits of Legumes

Studies have shown when people exclude legumes from their diet, it is often due to flatulence, lack of familiarity, and not knowing how to prepare dry-beans.[37] People may not realize legumes are a good source of iron, folate, potassium, magnesium, protein, fiber, and other nutrients (depending on legume variety) and low in fat. This makes legumes valuable in diets to prevent obesity, colon cancer, prostate cancer, cardiovascular disease and diabetes.

Types of legumes differ in their specific nutrient content. Using the cooked kidney bean example and 10 percent DV as a determinant of good sources, one-half cup kidney beans are a good source of: fiber (23 percent DV), protein (40 percent DV), thiamin (24 percent DV), vitamin B6 (18 percent DV), folate (58 percent DV), phosphorus (25 percent DV), magnesium (31 percent DV), iron (26 percent DV), zinc (19 percent DV), and manganese (28 percent DV), with only 0.44 g fat.[8, 13] These amounts were calculated based on the Dietary Reference Intakes for four to eight-year-old children.

Importance of Specific Nutrients Found in Legumes

Iron has important metabolic functions including transporting oxygen, synthesis of DNA and electron transport.[39] Although iron is widely available and can be found in meat and plant-based foods, iron deficiency is a common disorder in children.[40, 41] In

developing countries, iron deficiency is often due to low dietary intake of meat or low bioavailability from plant-based diets.[42, 41] In industrialized, well developed countries, such as the United States, deficiency is often caused by an increased iron need rather than low intake.[41] Young children have a increased need for iron because of their rapid growth rate. A recent survey found 21 percent of six to 11-year-old girls and 15 percent of six to 11-year-old boys to be iron-deficient with or without anemia.[40] Iron deficiency promotes decreased exercise capacity, small intestine changes, behavior alterations, and decreased cognitive function. Decreased cognitive function in children is one of the most recent researched consequences of iron deficiency. The National Health and Nutrition Examination Survey III tested 5,398 children between the ages of six and 16. While 49 percent of children with a normal iron status scored below average in math, 71 percent of iron deficient children without anemia and 72 percent of children with iron-deficiency anemia scored below average in math.

Folate is needed for the formation of methionine from homocysteine and as a source of one-carbon units for DNA synthesis.[43] These functions make folate important for growth, development, and maintenance throughout life.[44] Folate deficiency increases the risk of cardiovascular disease, some cancers and psychiatric disorders. Infants of women who do not consume enough folate during pregnancy may suffer from neural tube defects. In 1998, the FDA required enriched cereal-grains in the United States be fortified with folic acid. Significantly improved folate status of the U.S. population has been observed from mandatory folic acid fortification.[43] Although enriched cereal-grains are now a major source of folate in the U.S. diet, natural food sources include vegetables, legumes, dairy, beef, pork and eggs.

Potassium has several functions in the body including synthesis of DNA and proteins, growth and division of cells, and enzymatic functions.[45] Potassium is abundant in the U.S. diet[46] and good sources of potassium are fruits, vegetables, whole grains, dairy, poultry and legumes.[47] However, potassium deficiency, or hypokalemia, can occur following use of diuretic and antibiotics, as a response to excessive hormone production (especially aldosterone), magnesium deficiency and diseases such as leukemia.[46] More relevant factors in children include diarrhea, vomiting or prolonged physical activity in hot environments.

Magnesium is important for many enzymatic reactions including metabolism, glucose utilization, muscle contraction, ATPase functions, reactions of hormones, and maintenance of electrolyte balance.[48] Magnesium intake has been reported to be lower than recommended levels.[49] While magnesium is found in fruit, vegetables, grains, nuts, shellfish, and legumes,[47] bioavailability is low.[48] Magnesium deficiency is associated with cardiovascular diseases (including arrhythmia, angina, dyslipidemia, myocardial infarction, and hypertension) diabetes, headaches and poor bone growth.[49, 48] Like potassium, magnesium deficiency can also result from prolonged periods of vomiting and diarrhea.[48]

Legumes are one of the richest sources of protein in the human diet, and in some parts of the world where meat consumption is lacking, legumes serve as the most abundant protein source.[50] In fact, protein accounts for 20 to 40 percent of the dry weight of legumes. Specific amino acid profiles differ within each type of legume, but in general, legumes are a good source of lysine, an essential amino acid lacking in cereals.

Non-digestible carbohydrates and lignin found in plant foods such as grains, legumes, fruits, and vegetables, are known as dietary fiber.[51] A diet with sufficient fiber reduces the risk of cardiovascular disease, constipation, some cancers, obesity, and diabetes. Fiber is usually divided into two categories: water soluble and water insoluble.[52] Legumes contain mostly soluble fiber, which is known to form a gel-like substance in the gastrointestinal tract with water, binding substances, including cholesterol, and reducing their absorption.

Thiamin, or vitamin B1, is important in metabolism of carbohydrates and amino acids.[53] Deficiency of thiamin causes a disease known as beriberi. Good sources are plant foods such as legumes, nuts, wheat germ, and whole grains, as well as meat foods including lean pork, organ meats, poultry, eggs and fish.[54]

Vitamin B6 is needed for metabolic reactions including protein synthesis.[55] Although rare, vitamin B6 deficiency leads to decreased immune function. Other than legumes, good food sources are poultry, fish, whole grains, nuts and bananas.[56]

The majority of phosphorus is in our bones and teeth.[57] It is also found in soft tissues and extracelluar spaces. Phosphorus is needed for the high energy compound, creatine phosphate, ATP, nucleic acids, phospholipids and phosphoproteins. Phosphorus is widely distributed in food and dietary sources include meats, breads, cereals, nuts, milk, dairy, eggs, legumes and rice.

Zinc has many essential roles and is needed for fetal and infant growth, and lactation.[58] National nutrition surveys have found that 1 to 10-year-old children have an overall low intake of zinc.[59] Deficiency results in slowed growth, altered behavior and

cognition, and decreased immune function.[58, 60] Good food sources of zinc include oysters, meat and legumes.[60]

Manganese is necessary for the production of enzymes that metabolize proteins and fats and are needed for immune function, blood sugar regulation, reproduction, digestion, blood clotting, and act as antioxidants.[61] Deficiency can lead to slowed growth, seizures, fertility issues, birth defects and poor bone formation. Good dietary sources include nuts, cereals, and legumes.[62]

Legumes also contain beneficial compounds known as antioxidants, which defend against oxidative stress.[63] Antioxidants prevent the formation of free radicals, scavenge free radicals, and repair damage caused by oxidation.[64]

Nutrient Bioavailability

It should be noted that while legumes are nutrient rich foods, bioavailability of some of the nutrients are decreased by substances found in the legumes such as phytate, polyphenols and dietary fiber. Phytate potentially prevents zinc, iron and magnesium absorption by binding to them and forming insoluble substances.[65] Polyphenols affect iron and thiamin absorption by forming insoluble complexes with iron and inactivating thiamin. Fiber forms viscous solutions that bind and prevent absorption of nutrients, especially folate.

The effect of phytate, polyphenols, and fiber on the absorption of these nutrients varies widely and is dependent on several mechanisms, some of which are not yet completely understood. One mechanism is addition of foods that interact with phytate, polyphenols and fiber, increasing absorption during food preparation. Organic acids from

fermented milk products (i.e. yogurt) and vegetables can increase absorption of zinc and iron.[65] Ascorbic acid from citrus fruit and vegetables increase iron and folate absorption. Proteins can also enhance absorption of zinc and iron by forming soluble complexes. Other preparation techniques that can enhance absorption include thermal processing, boiling and germination. In general, the soaking and cooking of dried legumes before consumption is enough to overcome the inhibiting factors.[66]

Health Conditions Affecteded by Legumes

Current research shows that legumes should be included in a healthy diet to help prevent obesity, colon cancer, diabetes and cardiovascular disease. Legumes are important during weight management because their fiber content has a satiety effect, making people feel fuller faster and longer, thus decreasing the amount of calories consumed.[50] In addition, several proteins found in legumes also help prevent obesity. Proteases help legumes prevent colon cancer through their anti-proliferation properties. Legumes are also credited in preventing diabetes due to their low glycemic index and high content of fiber. Legumes help prevent cardiovascular disease because they are low in saturated fat, high in fiber, and have a low glycemic index.

Legumes Are a Cost Effective, Nutrient Rich Food

Forty-six percent (399,240) of children in Oklahoma are from low-income households.[18] Legumes are an inexpensive food and are a part of food assistance programs, including WIC. However, legumes are not often consumed. A survey of Oklahoma children found that the top three food sources of macronutrients and fiber were

breads (i.e. bagels, buns, rolls, flour tortillas), potato chips & crackers, and peanuts/peanut butter.[67] Beans (pinto & refried) were fourth on this list.

CHAPTER III

METHODOLOGY

Participants

The sample for this study was a convenience sample selected from the total population of 58 students (31 male and 27 female), at McCall Elementary School in Atoka, Oklahoma. Class A served as the intervention group and consisted of 12 male student and six female students. Class B served as the control group and consisted of 10 male students and 10 female students.

Experimental Design

The design used in this study was a quasi experimental pre, post, follow-up design.

Design and Intervention Procedure

Prior to the beginning of the 2008-2009 school year, two first grade classes from McCall Elementary School were chosen based on teachers' willingness to participate. The three week program took place during school in the cafeteria and met once a week during October 2008.

This study was approved by the Oklahoma State University Institutional Review Board for Human Subjects (Appendix D). Parents provided written informed consent, and verbal assent was obtained from the children (Appendices E and F)

For confidentiality purposes, re-usable name tags were used to identify participants. Each student randomly drew a pre-numbered name tag and was allowed to add their own art work to the name tag. Teachers made a master list of names corresponding to the number on the tag. This list was kept in a secure and confidential location, and was used to pass the name tags out to the correct student each week.

During the first and third weeks, all students participated in snack tasting and observation. The intervention and snack tasting occurred during the second week. Class A and Class B participated in the education program in the morning.

During the second week, Class A, the intervention group, was read *The Story of Benny the Traveling Bean*, an OCES story. The control group, Class B, was read *Are You My Mother,* by P.D. Eastman, a story which does not include food. After the story, students participated in snack tasting and observation. The study design is summarized in Table 2

Table 2. Study design.

	Class A **Intervention**	**Class B** **Control**
Week 1: Pre	Observation & Recording Snack Tasting	Observation & Recording Snack Tasting
Week 2: Post	Bean Lesson Observation & Recording Snack Tasting	Non-food Lesson Observation & Recording Snack Tasting
Week 3: Follow-up	Observation & Recording Snack Tasting	Observation & Recording Snack Tasting

Instrument

A recording form was developed and used for data collection (See Appendix C). The form tracked student number, gender, snacks put on plate and snacks tasted. Observers used check marks to indicate when snacks were "put on plate" and "tasted." Bean dip was weighed before and after snack tasting because it is difficult to observe if it was tasted. Under the "beginning amount" and "ending amount" columns, weights were recorded in ounces. If there was a difference in beginning and ending weights, bean dip "tasted" was checked.

Procedure for Observation and Recording

Four snacks were provided at each data collection period (see Appendix B for recipes): two containing legumes (*Bean Quesadillas from Mexico* and *New England Bean Dip*, both from *The Story of Benny the Traveling Bean*) and two not containing legumes (gold fish crackers and ham & cheese sandwiches). Snacks were displayed on a table in the following order: gold fish crackers, quesadillas, ham & cheese sandwiches, bean dip with chips. Fifteen gold fish crackers were counted out and placed in snack-size plastic bags. Ham & cheese sandwiches were pre-assembled, cut in half, and each half was placed in snack-size plastic bags. Quesadillas were pre-assembled, cut into six pieces, and each piece was placed in snack-size plastic bags. Snack-sized bags containing five tortilla chips were assembled to eat with the bean dip. When a student chose bean dip: bean dip was placed in four ounce soufflé cups by a server, weighed with a kitchen scale, the student's number was written on the cup, and the cup was placed on the student's pre-numbered plate. The weighted amount of bean dip was recorded on the recording form under the "beginning amount" column. Drinking water was also provided.

Paper plates were numbered corresponding to student number. Each snack name was read aloud to the class. Students were instructed to line up according to their number and take the plate with the same number as the number on their tag. They were allowed to take one of each snack, but were not required to take any. They would then return to their table, and eat none, or as much as they wanted. During the time students chose snacks and tasted, researchers used the recording form to observe if students put snacks on their plates. Students were not allowed to share snacks. Students were instructed to leave their snack-bags and soufflé cups on their numbered plates when finished. Observation on tasting was then determined by counting gold fish, and examining sandwiches and quesadillas. Bean dip was re-weighed, and this number was recorded in the recording form under "ending amount."

Observers included the researcher, high school teacher, volunteer, and two high school teaching aides. Before the study began, observers were trained in counting and weighing snacks, and recording data on the recording form.

Data Analysis

For each snack at each time period (pre, post, and follow-up) data were coded as "1" if the child took or tasted the snack and as "0" if the child did not take or taste the snack. Data for both legume snacks (Bean Quesadillas from Mexico and New England Bean Dip) were combined for analysis and defined as "legume snacks" and data for the two non-legume containing snacks (gold fish crackers and ham & cheese sandwiches) were combined for analysis and defined as "non-legume snacks." Chi-square test was used to analyze the frequency of legume and non-legume snacks taken and tasted between the intervention and control groups at pre, post, and follow-up.

For each snack, from pre to post, post to follow-up, and pre to follow-up, changes in frequency of legume and non-legume snacks taken and tasted were defined as“decreased” and coded as “-1” if a child took or tasted a snack at the first time period and did not take or taste the snack at the later time period; as “same” and coded as “0” if the child either took or tasted the snack at both time periods; and as “increased” and coded as “1” if the child did not take or taste the snack at the first time period but did take or taste the snack at the later time period. Data for both legume snacks were combined for analysis and defined as “legume snacks” and data for the two non-legume containing snacks were combined for analysis and defined as “non-legume snacks.” Chi-square test was also used to analyze change in frequency of legume and non-legume snacks taken and tasted from pre to post, post to follow-up, and pre to follow-up between the intervention and control group.

Data were analyzed using the PC Statistical Analysis System (SAS) for windows, version 9.1 (SAS Inst. Inc., Cary NC). Significance level was set at $p \leq 0.05$.

CHAPTER IV

RESULTS & DISCUSSION

Students who did not participate in all three snack tastings were excluded from the data analysis. Of the 38 eligible students, a total of 30 students were included in the data analysis, 17 in the control group and 13 in the intervention group (see table 3 for demographic information).

Table 3. Demographic information.

	Female Students	**Male Students**	**Total Students**
Control Group	8	9	17
Intervention Group	6	7	13

The frequency of children taking and tasting legume and non-legume snacks between the intervention and control groups at pre, post, and follow-up are summarized in Table 4. The frequency of changes in children taking and tasting legume and non-legume snacks from pre to post, post to follow-up, and pre to follow-up between the intervention and control group are summarized in Table 5.

Table 4. Frequency of legume and non-legume snacks taken before, after and following an education program.

Frequency of taking legume snacks

	Pre				Post				Follow-up			
	Yes	No	χ2	P-value	Yes	No	χ2	P-value	Yes	No	χ2	P-value
Control[1], No. (%)	24 (69)	11 (31)			13 (36)	23 (64)			16 (43)	21 (57)		
Intervention , No. (%)	16 (55)	13 (45)	1.21	0.27	9 (35)	17 (65)	0.01	0.90	16 (53)	14 (47)	0.68	0.41

Frequency of tasting legume snacks

	Pre				Post				Follow-up			
	Yes	No	χ2	P-value	Yes	No	χ2	P-value	Yes	No	χ2	P-value
Control[1], No. (%)	17 (49)	18 (51)			12 (33)	24 (67)			16 (43)	21 (57)		
Intervention , No. (%)	15 (52)	14 (48)	0.06	0.80	8 (31)	18 (69)	0.04	0.83	16 (53)	14 (47)	0.68	0.41

Frequency of taking non-legume snacks

	Pre				Post				Follow-up			
	Yes	No	χ2	P-value	Yes	No	χ2	P-value	Yes	No	χ2	P-value
Control[1], No. (%)	32 (91)	3 (9)			30 (83)	6 (17)			33 (89)	4 (11)		
Intervention , No. (%)	22 (76)	7 (24)	2.92	0.09*	21 (81)	5 (19)	0.07	0.79*	25 (83)	5 (17)	0.49	0.48*

Frequency of tasting non-legume snacks

	Pre				Post				Follow-up			
	Yes	No	χ2	P-value	Yes	No	χ2	P-value	Yes	No	χ2	P-value
Control , No. (%)	32 (91)	3 (9)			29 (81)	7 (19)			33 (89)	4 (11)		
Intervention , No. (%)	21 (72)	8 (28)	4.03	0.04*	19 (73)	7 (27)	0.48	0.49	25 (83)	5 (17)	0.49	0.48*

[1]Control was a non-food education program.
[2]Intervention was a legume education program.
[3]Pre data was collected 1 week before the education program.
[4]Post data was collected immediately following the education program.
[5]Follow-up data was collected 1 week following the education program.
* Contains cells which had expected counts less than 5, Chi-square may not be a valid test.

Table 5. Change in frequency of legume and non-legume snacks taken and tasted from pre to post, post to follow-up and pre to follow-up.

Change in taking legume snacks

	Pre to Post					Post to Follow-up					Pre to Follow-up				
	Decrease	Same	Increase	χ2	P-value	Decrease	Same	Increase	χ2	P-value	Decrease	Same	Increase	χ2	P-value
Control , No. (%)	13 (38)	19 (56)	2 (6)			2 (5)	29 (81)	5 (14)			13 (37)	19 (54)	3 (9)		
Intervention , No. (%)	7 (27)	18 (69)	1 (4)	1.11	0.57*	0 (0)	21 (81)	5 (19)	1.71	0.42*	4 (14)	21 (75)	3 (11)	4.14	0.13*

Change in tasting legume snacks

	Pre to Post					Post to Follow-up					Pre to Follow-up				
	Decrease	Same	Increase	χ2	P-value	Decrease	Same	Increase	χ2	P-value	Decrease	Same	Increase	χ2	P-value
Control , No. (%)	8 (23)	24 (71)	2 (6)			2 (5)	28 (78)	6 (17)			7 (20)	24 (69)	4 (11)		
Intervention , No. (%)	7 (27)	18 (69)	1 (4)	0.19	0.91*	0 (0)	20 (77)	6 (23)	1.77	0.41*	3 (11)	22 (78)	3 (11)	1.06	0.59*

Change in taking non-legume snacks

	Pre to Post					Post to Follow-up					Pre to Follow-up				
	Decrease	Same	Increase	χ2	P-value	Decrease	Same	Increase	χ2	P-value	Decrease	Same	Increase	χ2	P-value
Control , No. (%)	4 (12)	29 (85)	1 (3)			1 (3)	32 (89)	3 (8)			3 (8)	30 (86)	2 (6)		
Intervention , No. (%)	1 (4)	23 (88)	2 (8)	1.80	0.41*	1 (4)	23 (88)	2 (8)	0.06	0.97*	1 (4)	25 (89)	2 (7)	0.69*	0.71

Change in tasting non-legume snacks

	Pre to Post					Post to Follow-up					Pre to Follow-up				
	Decrease	Same	Increase	χ2	P-value	Decrease	Same	Increase	χ2	P-value	Decrease	Same	Increase	χ2	P-value
Control , No. (%)	5 (15)	28 (82)	1 (3)			1 (3)	31 (86)	4 (11)			3 (8)	30 (86)	2 (6)		
Intervention , No. (%)	3 (11)	21 (81)	2 (8)	0.78	0.68*	1 (4)	21 (81)	4 (15)	0.32	0.85*	0 (0)	26 (93)	2 (7)	2.54	0.28*

Control was a non-food education program.
[2]Intervention was a legume education program.
[3]Pre data was collected 1 week before the education program.
[4]Post data was collected immediately following the education program.
[5]Follow-up data was collected 1 week following the education program.
* Contains cells which had expected counts less than 5, Chi-square may not be a valid test.

No significant differences were observed in the frequency of children taking and tasting legume and non-legume snacks between the intervention and control groups at pre, post, and follow-up (Table 4), or in the frequency of changes in children taking and tasting legume and non-legume snacks from pre to post, post to follow-up, and pre to follow-up between the intervention and control group (Table 5).

Taking and tasting legume snacks at pre, post and follow-up.

The control group took 24 legume snacks at pre, 13 at post, and 16 at follow-up (Table 4). The intervention group took 16 legume snacks at pre, nine at post, and 16 at follow-up. The control group tasted 17 legume snacks at pre, 12 at post, and 16 at follow-up. The Intervention group tasted 15 legume snacks at pre, eight at post, and 16 at follow-up.

Taking and tasting non-legume snacks at pre, post and follow-up.

The control group took 32 non-legume snacks at pre, 30 at post, and 33 at follow-up (Table 5). The intervention group took 22 non-legume snacks at pre, 21 at post, and 25 at follow-up. The control group tasted 32 non-legume snacks at pre, 29 at post, and 33 at follow-up. The intervention group tasted 21 non-legume snacks at pre, 19 at post, and 25 at follow-up.

Changes in taking legume snacks from pre to post, post to follow-up and pre to follow-up.

In the control group from pre to post, 13 legume snacks were taken at pre that were not taken at post ("decrease"), 19 legume snacks were either taken at both pre and post, or not taken at both pre and post ("same"), and two legume snacks were taken at post that were not taken at pre ("increase") (Table 5). From post to follow-up, there was a "decrease" of two legume snacks taken, 29 legume snacks were the "same", and an "increase" of five legume snacks taken. From pre to follow-up for the control group there was a "decrease" of 13 legume snacks taken, 19 legume snacks were the "same," and an "increase" of three legume snacks taken.

In the intervention group from pre to post there was a "decrease" of seven legume snacks taken, 18 legume snacks were the "same", and an "increase" of one legume snack taken (Table 5). From post to follow-up for the intervention group, there was no "decrease" in legume snacks taken, 21 legume snacks were the "same," and an "increase" of five legume snacks taken. From pre to follow-up there was a "decrease" of four legume snacks taken, 21 legume snacks were the "same," and an "increase" of three legume snacks taken.

Changes in tasting legume snacks from pre to post, post to follow-up and pre to follow-up

In the control group from pre to post there was a "decrease" in tasting legume snacks of eight, 24 legume snacks were the "same", and an "increase" of two legume snacks tasted (Table 5). From post to follow-up, there was a "decrease" of two legume snacks tasted, 28 legume snacks were the "same," and an "increase" of six legume snacks

tasted. From pre to follow-up there was a "decrease" of seven legume snacks tasted, 24 legume snacks were the "same", and an "increase" of four legume snacks tasted.

In the intervention group from pre to post there was a "decrease" of seven legume snacks tasted, 18 were the "same," and an "increase" of one legume snack tasted (Table 5). From post to follow-up there was no "decrease" in legume snacks tasted, 20 were the "same," and an "increase" of six legume snacks tasted. From pre to follow-up, there was a "decrease" of three legume snacks tasted, 22 were the "same," and an "increase" of three legume snacks tasted.

Changes in taking non-legume snacks from pre to post, post to follow-up and pre to follow-up.

In the control group from pre to post there was a "decrease" in taking non-legume snacks of four, 29 were the "same," and an "increase" of one non-legume snack taken (Table 5). From post to follow-up, there was a "decrease" of one non-legume snack taken, 32 were the "same," and an "increase" of three non-legume snacks taken. From pre to follow-up, there was a "decrease" of three non-legume snacks taken, 30 were the "same," and an "increase" of two non-legume snacks taken.

In the intervention group from pre to post, there was a "decrease" of one non-legume snack taken, 23 were the "same," and an "increase" of two non-legume snacks taken (Table 5). From post to follow-up, there was a "decrease" in one non-legume snack taken, 23 were the "same," and an "increase" of two non-legume snacks taken. From pre to follow-up, there was a "decrease" of one non-legume snack taken, 25 were the "same," and an "increase" of two non-legume snacks taken.

Changes in tasting non-legume snacks from pre to post, post to follow-up and pre to follow-up.

In the control group from pre to post there was a "decrease" of five non-legume snacks tasted, 28 were the "same," and an "increase" of one non-legume snack tasted (Table 5). From post to follow-up, there was a "decrease" of one non-legume snacks tasted, 31 were the "same," and an "increase" of four non-legume snacks tasted. From pre to follow-up there was a "decrease" of three non-legume snacks tasted, 30 were the "same," and an "increase" of two non-legume snacks tasted.

In the intervention group from pre to post there was a "decrease" of three non-legume snacks tasted, 21 were the "same," and an "increase" of two non-legume snacks tasted (Table 5). From post to follow-up, there was a "decrease" of one non-legume snack tasted, 21 were the "same," and an "increase" of four non-legume snacks tasted. From pre to follow-up, there was no "decrease" in non-legume snacks tasted, 26 were the "same," and an "increase" of two non-legume snacks tasted.

Discussion

This study evaluated if an OCES nutrition education program intended to increase children's willingness to try legume snacks was effective. The results of this study indicate the program did not change children's willingness to take or taste legume snacks provided. These results may have been influenced by several factors including small sample size, peer influence, the specific snacks provide, and the taste, flavor, and texture preferences of the children.

Although not significant, from post to follow-up and pre to follow-up, there was a larger increase in legume snacks taken in the intervention group (19% post to follow-up,

11% pre to follow-up) compared to the control group (14% post to follow-up, 9% pre to follow-up). In addition, from post to follow-up, there was a larger increase in tasting legume snacks in the intervention group (23%) than the control group (17%).

Children are susceptible to peer influence when making food choices.[68] Negative comments about legume snacks made by a few of the children may have influenced snack choices of some of the other children. After the pre time period, for example, the children learned "the musical fruit song" which negatively portrays foods containing legumes. This song, taught by the teacher, was not part of the curriculum and could be a factor in the large "decrease" in taking and tasting legumes from the pre to post time periods (taking: 38% control, 27% intervention; tasting: 23% control, 27% intervention) (Table 5).

The specific snacks chosen for the study may have also influenced the results. Goldfish crackers and ham & cheese sandwiches may have been chosen more often because of their popularity with this age group. Also, some of the children did not know what a quesadilla was and did not like some of the ingredients, such as onions and peppers.

Studies have shown that toddlers often need to be exposed to new foods repeatedly before accepting the food.[69] If the same is true for school age children, this may be reflected in the results of this study. The largest increase in taking and tasting legume snacks was observed from post to follow-up in both groups (taking: 14% control, 19% intervention; tasting: 17% control, 23% intervention), which could be a result of the "exposure effect." Another possible indication of the "exposure effect" was in the follow-up time period for both groups, every legume snack that was taken was also tasted

(control: 16 taken, 16 tasted; intervention: 16 taken, 16 tasted) (Table 4), which was not true for the two previous time periods.

Taking and tasting non-legume snacks was fairly consistent across the time periods for each group. Children did not take or taste as many legume snacks as non-legume snacks. The range of legume snacks taken was 35 – 69% across all time periods, compared to 76-91% of non-legume snacks taken. The range of legume snacks tasted was 31-53% across all time periods, compared to 72-91% of non-legume snacks tasted. These results are consistent with studies reporting children do not eat many legumes.[19]

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to determine the effect of an OCES nutrition education program, "The Story of Benny the Traveling Bean," on first grade children's willingness to try foods containing legumes.

Null hypothesis one stated that there would be no significant difference in the frequency of first grade children's willingness to take foods containing legumes after participating in the OCES nutrition education program, "The Story of Benny the Traveling Bean." No significant differences were observed in the frequency of first grade children's willingness to take foods containing legumes after participating in the OCES nutrition education program. Therefore, null hypothesis one is not rejected.

Null Hypothesis two stated that there would be no significant difference in the frequency of first grade children's willingness to taste foods containing legumes after participating in the OCES nutrition education program, "The Story of Benny the Traveling Bean." No significant differences were observed in the frequency of first grade children's willingness to taste foods containing legumes after participating in the OCES nutrition education program. Therefore, null hypothesis two is not rejected.

Conclusions

Research has shown that legumes are under-utilized in children's diets. However, legumes are inexpensive and full of nutrients that children may not be getting enough of. There are many nutrition education programs focusing on increasing fruits and vegetables in the diet, but most don't specifically promote legumes.

The OCES nutrition education program evaluated in this study, "The Story of Benny the Traveling Bean," did not increase children's willingness to take or taste snacks containing legumes. The design of the study had several constraints that could have affected the results including small sample size, peer influence, and specific snacks offered.

Recommendations

Based on the literature review, the researcher suggests children need programs promoting legumes. The researcher recommends the creation and evaluation of other legume promoting programs, or an altered design of the current study.

If the current program were to be used in another study, the researcher recommends a larger sample size. In addition, the researcher recommends a design in which students entered a room one at a time, without their peers, and were allowed to choose one of the four snacks, to help control peer influence. Another option would be incorporating the study into the school lunch program and offering legume entrées during lunch.

The researcher also recommends providing instruction to participating teachers about the research process and importance of not providing outside education related to

the research topic during the study period. Lastly, the researcher recommends conducting preliminary research on popularity of snacks and choosing legume and non-legume snacks that have equal popularity.

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APPENDICES

APPENDIX A

THE STORY OF BENNY THE TRAVELING BEAN

The Story of
BENNY THE TRAVELING BEAN

A BEAN RESOURCE FOR THE ENTIRE FAMILY

Developed by:
Star Edwards, FCS/4-H Extension Educator, Atoka County
In cooperation with:
Ginny McCarthick, FCS/4-H Extension Educator, Johnston County

Illustrated by Amy Smith
July 2006

OKLAHOMA STATE UNIVERSITY COOPERATIVE EXTENSION

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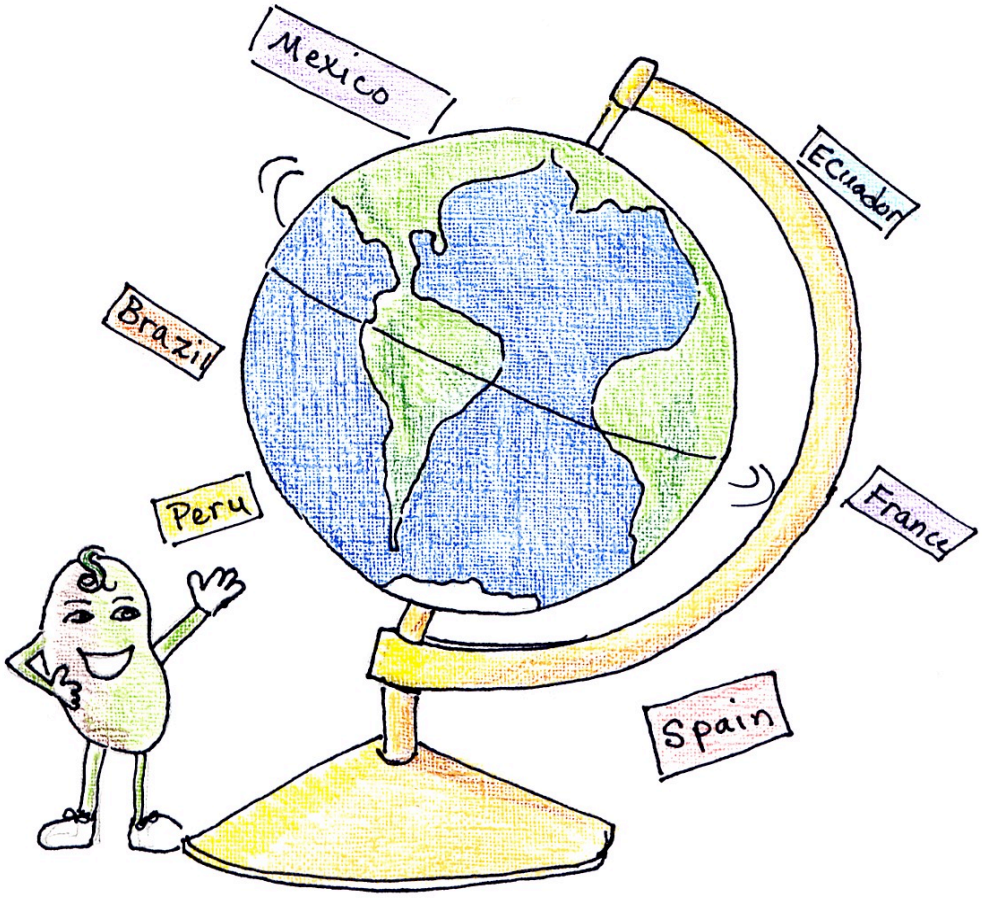
This is the Story of Benny the Traveling Bean



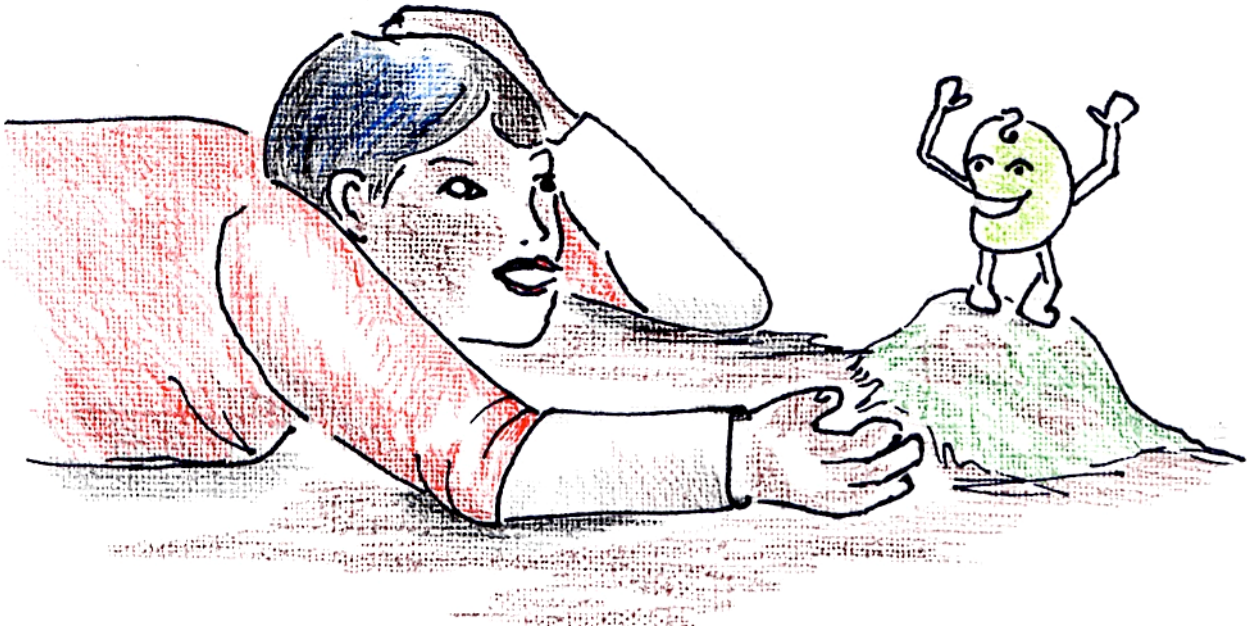
On a warm, sunny day, many thousands of years ago, a bean named Benny sprouted in the far away land of Peru.

Benny was born in a cornfield where a boy named Carlo was working.

Carlo almost stepped on Benny, but Benny yelled, “Stop!”

At first Carlo was frightened; he had never seen a bean before.

Carlo and Benny talked, and soon became great friends.



Carlo threw Benny a birthday party and invited all of the people of Peru.

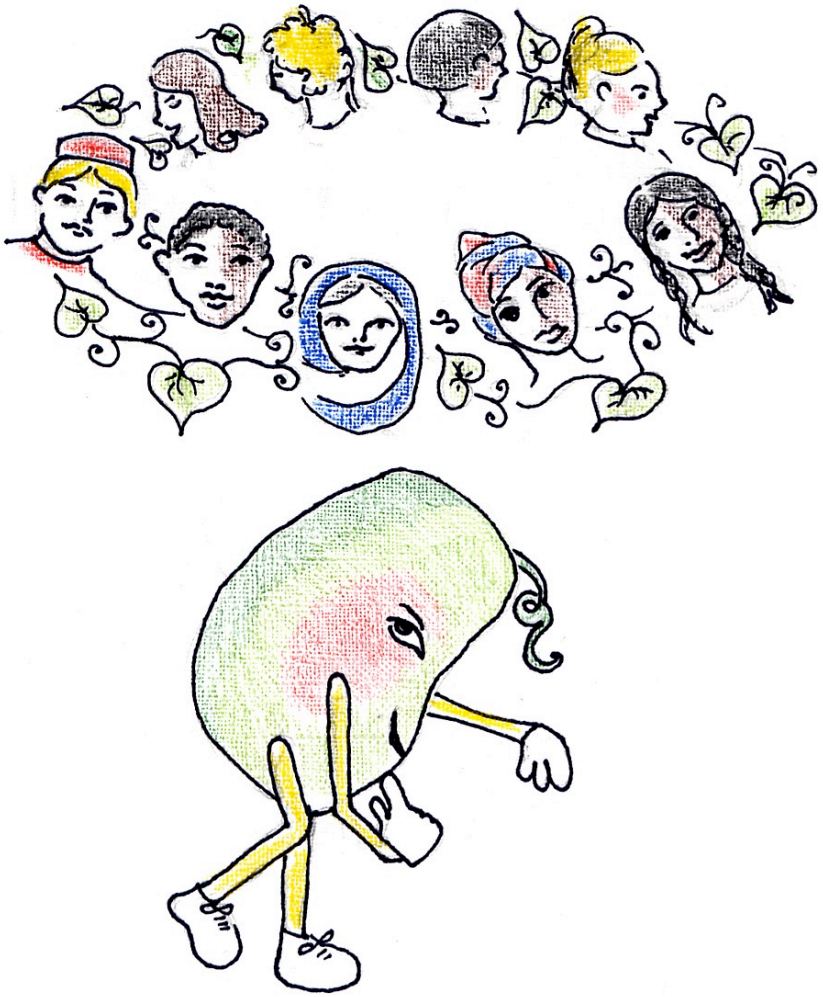
The people of Peru loved Benny! So Benny taught them how to make wonderful food. This food gave them energy to work in the fields all day, and kept their hearts and bodies healthy.

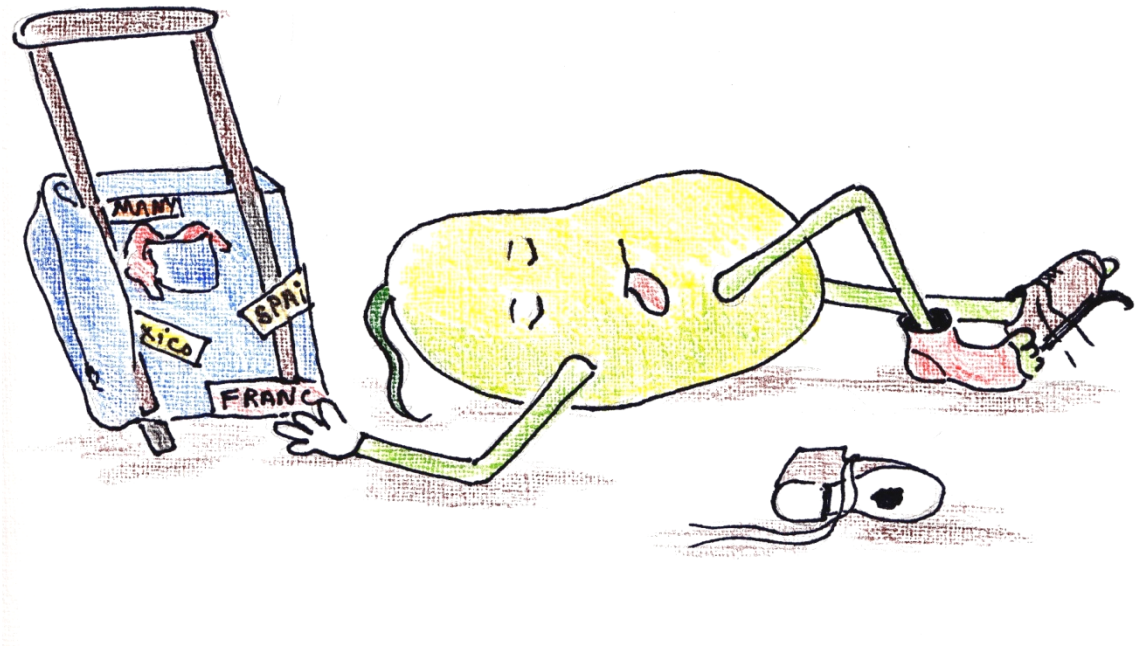
They were so excited about what Benny had taught them, they wanted to share him with everyone in the whole world. So Benny went on vacation to meet people in other countries and to teach them how to cook beans and be healthy.

First, Benny went to Mexico. He taught the people how to grind beans with stones, and cook them over a red-hot fire to make refried beans.

Benny also traveled to Europe. He showed Europeans how to cook beans with lamb meat in a big pot. This made stew that would keep them warm through the night as they protected their sheep.

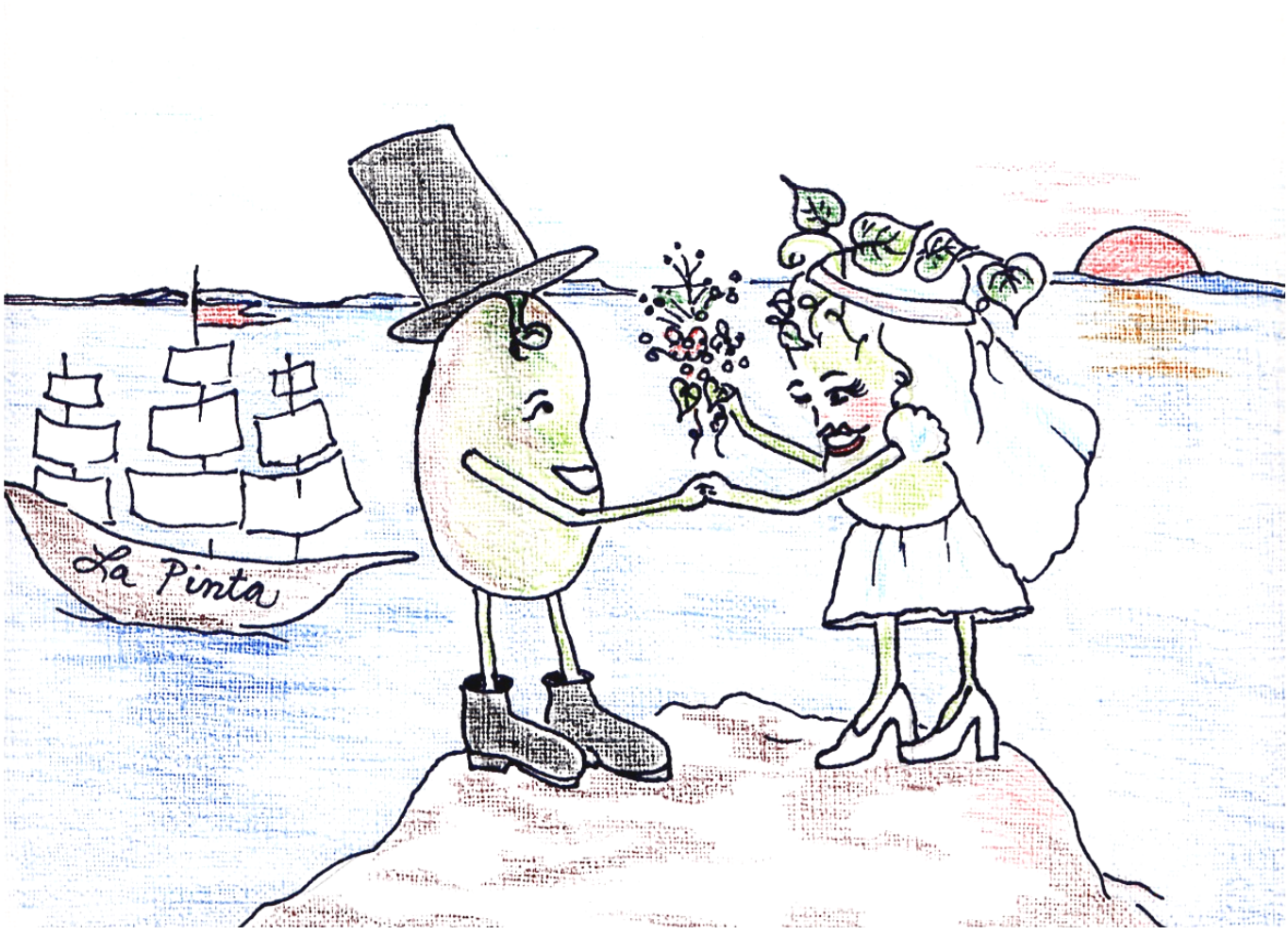
Everyone who met Benny wanted to tell others about the wonderful things they had learned. Soon beans spread to other countries like Africa, Brazil, and even America.





Benny made friends sharing beans with the world, but he was tired.

Benny sailed back to Peru and met another bean named Betty. Benny and Betty had a beautiful wedding on the beach and lived happily ever after.



BENNY'S BEAN LESSONS

A FEW REASONS WHY BEANS ARE GOOD FOR YOU:

Beans have B vitamins & complex carbohydrates, which give you energy.

Protein in beans helps you grow and repair body tissue

Beans are full of fiber and low in calories, which helps prevent cancer, heart disease, and helps us stay at a healthy weight.

FOOD SAFETY ISSUES:

- Always wash your hands with warm soapy water for 20 seconds before cooking or eating.

- Clean up spills and messes with warm soapy water and a paper-towel.

- Never eat raw or undercooked beans.

- Refrigerate cooked bean dishes immediately. Don't leave cooked beans or bean dishes at room temperature for more than two hours.

- Cooked beans should be thrown away after four days.

RECIPES

Brazil Black Beans

Middle Eastern Hummus

Bean Quesadillas From Mexico

New England Bean Dip

Spanish Shipwreck Stew

American Cowpoke Chili

BRAZIL BLACK BEANS

Feijoada (pronounced “Fay-wha-da”) means Brazilian Black Beans, and is the national dish of Brazil. Try this recipe for a simple and tasty black bean meal:

INGREDIENTS:

1 lb. ground turkey

2 (14 oz.) cans black beans

1 (14 oz.) can chicken broth

1 (14 oz.) can peeled, cut tomatoes

1 med. Onion, chopped

DIRECTIONS:

1. Heat a deep large skillet or saucepan over medium heat.
2. Add ground turkey and onion to the skillet or saucepan and cook until the turkey has browned and the onion is transparent.
3. Add undrained beans, broth and tomatoes to the skillet or saucepan.
4. Bring to a boil, then lower the heat.
5. Simmer 30 minutes uncovered and season to taste.

Source: www.cooks.com/rec/doc/0,1948,15169-243205.html 2/15/2006

MIDDLE EASTERN HUMMUS

Hummus in popular in Middle Eastern countries such as: Syria, Lebanon, Israel, Palestinian territories, Turkey, Greece, and Cyprus. In these countries, it is served with a flatbread, like pita. In non-Middle Eastern Countries, it is often served with tortilla chips.

INGREDIENTS

1 can (15 oz) garbanzo beans

1 clove garlic, crushed

2 teaspoons ground cumin

1/2 tsp salt

1 Tbs olive oil

DIRECTIONS

1. Drain the beans and save the liquid.
2. In a blender or food processor combine garbanzo beans, garlic, cumin, salt, and olive oil.
3. Blend on low speed, gradually adding reserved bean liquid, until desired consistency is achieved.

Source: Allrecipes.com (Extra Easy Hummus) 2/15/06

BEAN QUESADILLAS FROM MEXICO

INGREDIENTS:

1 Tbs. vegetable oil

1 onion, finely diced

2 cloves garlic, minced

1 (15 oz) can black beans, rinsed and drained

1 green bell pepper, chopped

2 tomatoes, chopped

1/2 (10 oz) package frozen corn

12 (12 in) flour tortillas

1 c. shredded cheddar cheese

1/4 c. vegetable oil

DIRECTIONS:

1. Heat 1 Tbs. oil in a skillet over medium heat, and sauté the onion and garlic until soft.
2. Mix in beans, bell pepper, tomatoes, and corn; cook until heated through.
3. Spread 6 tortillas with equal amounts of the bean and vegetable mixture.
4. Sprinkle with equal amounts of the cheddar cheese, and top with the remaining tortillas to form quesadillas.
5. Heat 1/4 c. oil in a large skillet over medium-high heat. Place quesadillas in the skillet and cook, turning once, until cheese is melted and both sides are lightly browned.

Source: www.allrecipes.com (Bean Quesadillas) 2/15/2006

NEW ENGLAND BEAN DIP

INGREDIENTS:

1 (16 oz) can refried beans

2 cups shredded cheddar cheese

1 (1 oz) package ranch dressing mix

1 c. sour cream

DIRECTIONS:

1. In a small saucepan, combine beans, cheese, ranch dressing mix, and sour cream.
2. Heat the mixture over a medium heat, stir until the ingredients are well blended and warm.

Source: www.Allrecipes.com (Ranch Bean Dip) 2/15/2006

SPANISH SHIPWRECK STEW

INGREDIENTS:

1 lb. ground beef

3/4 C. chopped onion

1/4 C. uncooked rice

2 c. chopped potatoes

1 (15 oz) can kidney beans

1 (8 oz) can tomato paste

1/2 tsp. Worcestershire sauce

1/4 tsp. chili powder

1/4 tsp. pepper

1 tsp. salt

DIRECTIONS:

1. Preheat oven to 350 degrees.
2. Brown ground beef with onion in skillet, stirring until crumbly; drain.
3. Layer ground beef mixture, rice, potatoes and beans in large casserole dish.
4. Combine remaining ingredients with 1/2 c. water in bowl, mixing well. Pour over casserole.
5. Bake covered, at 350 degrees for 1 1/2 hours.

Source: www.KidsKuisine.com (Shipwreck Stew) 2/15/2006

AMERICAN COWPOKE CHILI

INGREDIENTS:

1 pound ground beef
1 (16 oz) can chili beans, undrained
1 (14.5 oz) can peeled and diced tomatoes with juice
1 small onion, chopped
1/4 c. chopped green bell pepper

DIRECTIONS:

1. In a medium saucepan over medium heat, cook beef until brown.
2. Stir in beans, tomatoes, onion and bell pepper.
3. Reduce heat and simmer 30 minutes.

Source: www.Allrecipes.com (Easy Chili II) 2/15/2006

The Story of
BENNY THE TRAVELING BEAN

APPENDIX B

SNACK RECIPES

SNACKS:

Bean Snacks:

1. Bean Quesadillas from Mexico (See Recipe from Appendix A, p. 68)
2. New England Bean Dip with Tortilla Chips (See Recipe from Appendix A, p. 69)

Non-Bean Snacks:

1. Gold Fish Crackers
2. Ham & Cheese Sandwiches, quartered

APPENDIX C

RECORDING FORM

RECORDING FORM

Week # ___________ Class:_____________________________ Control / Intervention

Student # _____________ Gender: Female Male

Snack	Put on Plate	Tasted	Beginning Amount	Ending Amount
Gold Fish Crackers				
Quesadillas				
Ham & Cheese Sandwich				
Bean Dip				

Student # _____________ Gender: Female Male

Snack	Put on Plate	Tasted	Beginning Amount	Ending Amount
Gold Fish Crackers				
Quesadillas				
Ham & Cheese Sandwich				
Bean Dip				

Student # _____________ Gender: Female Male

Snack	Put on Plate	Tasted	Beginning Amount	Ending Amount
Gold Fish Crackers				
Quesadillas				
Ham & Cheese Sandwich				
Bean Dip				

Student # _____________ Gender: Female Male

Snack	Put on Plate	Tasted	Beginning Amount	Ending Amount
Gold Fish Crackers				
Quesadillas				
Ham & Cheese Sandwich				
Bean Dip				

Student # _____________ Gender: Female Male

Snack	Put on Plate	Tasted	Beginning Amount	Ending Amount
Gold Fish Crackers				
Quesadillas				
Ham & Cheese Sandwich				
Bean Dip				

APPENDIX D

OSU INSTITUTIONAL REVIEW BOARD APPROVAL

Oklahoma State University Institutional Review Board

Date:	Wednesday, May 28, 2008
IRB Application No	HE0773
Proposal Title:	Effect of an Oklahoma Cooperative Extension Service Nutrition Education Program on Legumes with First Grade Children
Reviewed and Processed as:	Expedited (Spec Pop)

Status Recommended by Reviewer(s): Approved **Protocol Expires: 5/27/2009**

Principal Investigator(s):

Star Edwards
475 S. Bentley Rd.
Atoka, OK 74525

Janice R. Hermann
315 HES
Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

☒ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTernan in 219 Cordell North (phone: 405-744-5700, beth.mcternan@okstate.edu).

Sincerely,

Shelia Kennison, Chair
Institutional Review Board

APPENDIX E

PARENTAL CONSENT FORM

Parent Permission Form

Program Title: The Story of Benny the Traveling Bean

Program Educator: Star Edwards, OSU Graduate Student, Nutritional Sciences

Purpose: To determine the effect of a Cooperative Extension program, "The Story of Benny the Traveling Bean," on first grade children's willingness to try foods containing beans. Data collected will be used as part of a thesis project.

Procedures: Children will be divided into two groups: one group will be read a book about beans and one group will be read a non-food related book.

Week # 1: All children will be offered two snacks (Bean Quesadillas and Bean Dip with Pita Chips) containing beans and two snacks without beans (Gold Fish Crackers & Ham and Cheese Sandwiches), and will be observed for their willingness to try each snack.

Week # 2: One group will be read the book, "The Story of Benny the Traveling Bean," offered two snacks that contain beans (Bean Quesadillas and Bean Dip with Pita Chips) and two snacks that do not contain beans (Gold Fish Crackers & Ham and Cheese Sandwiches), and be observed for their willingness to try each snack. Another group will be read a non-food related book ("Are You My Mother by P.D. Eastman), offered two snacks containing beans and two snacks not containing beans, and be observed for their willingness to try each snack.

Week # 3: Children will be offered two snacks containing beans and two snacks without beans, and will be observed for their willingness to try each snack.

Risks of Participation:

There are no known risks with this program greater than that usually found in daily life.

Please note that children will be offered snacks. If for any reason, including allergies or religious beliefs, your child is restricted from consuming ingredients in these snacks (see attached recipes), do not sign this consent.

Information on the snacks will be available. If a child gets sick normal school procedures will be followed.

Benefits: Many nutrition education programs targeting children in the United States focus on increasing fruit and vegetable consumption. However, many educational programs overlook beans, which are an important vegetable. Beans are a good source of protein, folate, potassium, iron, and magnesium. Research has

shown children who eat beans get more of these valuable nutrients in their diets than children who do not. In addition, beans are low in fat and high in fiber. Nutrition education programs focusing on beans could increase intake of beans, and thus iron, fiber, protein and other important nutrients in first grade children's diets.

Confidentiality:

Children will be assigned a number. The classroom teacher is the only person who will know children's name and number. The program educator will know only numbers, and thus children's confidentiality will be kept. At the conclusion of the three week program, the teacher will be asked to destroy the list that matches numbers and names.

Study records will be kept private. Any written results will only discuss group findings and will not include information that will identify your child. Research records will be stored securely and only researchers will have access to the records. It is possible that the consent process and data collection will be observed by research oversight staff responsible for safeguarding the rights and wellbeing of people who participate in research.

Contacts:

Star Edwards
Star.edwards@okstate.edu
(580) 371-5183

Dr. Janice Hermann, Advisor
Janice.hermann@okstate.edu
(405) 744-4601

If you have questions about your rights as a research volunteer, you may contact Dr. Shelia Kennison, OSU Institutional Review Board Chair, 219 Cordell North, Stillwater, OK 74078, 405-744-1676 or irb@okstate.edu.

Participant Rights:

Your child's participation is voluntary and your child may discontinue the program at any time without reprisal or penalty.

Signatures:

If you agree to let your child participate in this nutrition education program, please sign this consent form and **return it to the classroom teacher by:_____.**

Parental Signature for Minor:

I have read and fully understand this consent form. As parent or guardian I authorize _____ (print your child's name) to participate in the described education program.

_____ _____
Parent/Guardian Name (printed) Date

_____ _____
Signature of Parent/Guardian Date

APPENDIX F

YOUTH ASSENT

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Youth Assent Script

My name is Star and I am doing a program called, “Benny the Traveling Bean.” I’m going to come see you once a week for the next three weeks, and bring you snacks. During the second week, I’m also going to read a book to you. Each time I come, you will have a chance to choose some snacks, and I’m going to visit with you while you eat because I want to find out what your favorite snacks are.

Your parents said it was okay for you to participate, but if you don’t want to participate on any of the days, you can go with your teacher during the program. Your teacher will read you a different book than we will be reading, and you’ll also get snacks.

VITA

Cassandra Star Edwards

Candidate for the Degree of

Master of Science

Thesis: EVALUATION OF AN OCES NUTRITION EDUCATION PROGRAM, *THE STORY OF BENNY THE TRAVELING BEAN,* ON FIRST GRADE CHILDREN'S WILLINGNESS TO TRY FOODS CONTAINING LEGUMES.

Major Field: Nutritional Sciences

Biographical:

Personal Data: Born in Sherman, Texas on April 26, 1983.

Education: Received a Bachelor of Science degree in Nutritional Sciences from Oklahoma State University in May 2005; completed requirements to become a Registered Dietitian from Oklahoma State University in June 2008.

Experience: Family & Consumer Sciences / 4-H Youth Development Educator, Oklahoma Cooperative Extension, 2005-2007; Community Dietitian, Chickasaw Nation, 2008-2009; WIC Nutritionist, Chickasaw Nation, 2008 to present.

Professional Memberships: American Dietetic Association, Oklahoma Dietetic Association, Southeast District Dietetic Association, Society for Nutrition Education.

Name: Cassandra Star Edwards Date of Degree: December, 2009

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: EVALUATION OF AN OCES NUTRITION EDUCATION PROGRAM, *THE STORY OF BENNY THE TRAVELING BEAN,* ON FIRST GRADE CHILDREN'S WILLINGNESS TO TRY FOODS CONTAINING LEGUMES.

Pages in Study: 85 Candidate for the Degree of Master of Science

Major Field: Nutritional Sciences

Scope and Method of Study: An OCES Nutrition Education Program, *The Story of Benny the Traveling Bean,* was evaluated for its impact on first grade children's willingness to try foods containing legumes. The sample included 38 first grade children in a small rural Oklahoma town. Data from the pre, post, follow-up design was recorded on a recording form developed for the study, which tracked snacks put on plate and snacks tasted. During the first and third weeks, students only participated in snack tasting and observation. During the second week, the intervention group was read *The Story of Benny the Traveling Bean*, and the control group was read a non-food related book. After the stories, students participated in snack tasting and observation. Four snacks were provided at each data collection period; two containing legumes, and two not containing legumes.

Findings and Conclusions: Frequency of children taking and tasting legume and non-legume snacks between the intervention and control groups at pre, post, and follow-up were analyzed using chi-square analysis. Significance was set at $p \leq 0.05$. The frequency of changes in children taking and tasting legume and non-legume snacks from pre to post, post to follow-up, and pre to follow-up between the intervention and control group were also analyzed using chi-square analysis. No significant differences were observed in the frequency of children taking and tasting legume and non-legume snacks between the intervention and control groups at pre, post, and follow-up or in the frequency of changes in children taking and tasting legume and non-legume snacks from pre to post, post to follow-up, and pre to follow-up between the intervention and control group.

ADVISER'S APPROVAL: Janice Hermann