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Efficacy of a Nutrition Education Program designed for Grades K-3
Piloted in Johnson County Schools

A thesis
presented to
the faculty of the Department of Family and Consumer Sciences
East Tennessee State University

In partial fulfillment
of the requirements for the degree
Master of Science in Clinical Nutrition

by
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May 2005

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Keywords: nutrition, education, childhood obesity, healthy behaviors

ABSTRACT

Efficacy of a Nutrition Education Program Designed for Grades K-3 Piloted in Johnson County Schools

by

Allison Lowry

The purpose of this study was to increase the nutrition knowledge of elementary school students by implementing nutrition education lessons. The subjects included 49 kindergarten through third grade students in Johnson County, Tennessee during the fall of 2004. Knowledge increase was measured by pretest and posttest scores. The tests were analyzed by paired t-tests. While all students showed an increase in mean score, kindergarten and first grade students did not show a significant increase in posttest scores. However, second and third grade students showed a significant increase in posttest scores, indicating an increase in nutrition knowledge.

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CHAPTER 1

INTRODUCTION

The United States incurs billions of dollars in healthcare costs every year due to obesity (1). Physical inactivity and poor nutrition contribute to the problem of obesity, which is on the rise in children and adolescents (2). Nutrition education can play a significant role in the prevention of childhood obesity; yet nutrition education is not an essential component of school curricula nationwide. The Healthy People 2010 objectives call for nutrition education in schools. Nutrition education programs need to be offered in school settings in an effort to prevent childhood obesity and promote health (1). Current data demonstrate that mean energy intake in children and adolescents has increased over the past two decades (3). Research shows only 10% to 20% of children consume the recommended five fruits and vegetables per day (3). Almost 25% of vegetables consumed by children are french fried potatoes (3). Inadequate intake of nutrients can impact the growth and development of children. If nutritious eating habits are established early in life, those habits will often remain throughout life (3).

In this study the principal investigator developed a nutrition education program to be taught in Johnson County, Tennessee schools in grades kindergarten, first, second, and third.

Statement of the Problem

The rate of childhood obesity is rapidly increasing in the United States. Data from the National Health and Nutrition Examination Survey IV, part 1 (NHANES) conducted in 1999-2000 estimated that 15% of children ages 6 to 19 are overweight. This is a four percent increase from the NHANES III conducted in 1988-1994 (3). Teaching children about nutrition could improve nutritional status and decrease the prevalence of childhood obesity. Schools in Johnson

County, Tennessee offer children in grades kindergarten, first, second, and third teach one nutrition lesson per year in each classroom. The lessons currently used were designed in 1993 using a 4-H cooperative curriculum system for Agricultural Extension personnel. Some of the concepts and content being taught are outdated and the lessons do not build on one another or review lessons from years past. Without current knowledge regarding nutrition concepts, the children cannot be expected to improve nutritional status. The purpose of this study is to determine the effects of nutrition lessons on improving nutritional status.

Hypothesis

Children in grades kindergarten, first, second, and third in the Johnson County School System will demonstrate a significant difference between pretest and posttest performance.

Null Hypothesis

Children in grades kindergarten, first, second, and third in the Johnson County School System will demonstrate no significant difference between pretest and posttest performance.

Limitations

Limitations of this study include:

1. A small sample size.
2. All students were not present for the pretest/posttest.
3. A limited time for instruction in each grade level.
4. No follow-up education was conducted.
5. The testing instruments were not validated prior to administration.
6. Subjects were not matched for pretests and posttests.

Assumptions

Assumptions of this study include:

1. The testing tools accurately measure the subjects' knowledge of the lessons taught to that grade level.
2. The subjects do not react differently to the principal investigator than to the classroom instructor.

Delimitations

Delimitations of this study include that the study was only conducted in Johnson County, TN in Laurel Elementary School. Therefore, results cannot be compared to other elementary school nutrition programs.

CHAPTER 2

REVIEW OF LITERATURE

Childhood Obesity

Childhood obesity has dramatically increased in the United States in recent years. Nationally, 15% of children ages 6 to 9 are overweight (4). Overweight children suffer short and long-term effects, including physical, psychosocial, and emotional consequences. Overweight children are at increased risk for premature health problems, including elevated cholesterol, high blood pressure, type 2 diabetes, and becoming overweight adults. These children may also experience psychosocial effects from negative attitudes developed by peers. These negative attitudes lead to teasing and name calling. Overweight children often have lower self-esteem and depression and are perceived as less popular (4). Educators who are aware of the consequences of childhood obesity can respond more appropriately and help to decrease the incidence of childhood obesity. Schools are an ideal location for preventing and treating childhood obesity because schools provide children with at least one meal per day and can integrate healthful lifestyle programs into the curriculum. Cafeteria staff, families, and the community can learn to promote healthful lifestyle behaviors through schools. Schools can eliminate the sale of high fat and high sugar foods such as candy, chips, and soft drinks. The schools should only provide children with access to healthful foods (4).

Nutrition Education

Behavior change correlates positively with the amount of nutrition instruction received (5). Fifty hours of instruction is thought necessary to impact behavior. In US schools, the mean number of hours per school year spent on nutrition education is 13 (5). Nutrition education is a critical component of most major health promotion and disease prevention programs (6).

Beginning nutrition education early in life is important because of the relationship between diet and health. Inadequate nutrient intake negatively affects children's health status and ability to learn. To develop lifelong healthy eating habits nutrition education should begin early and involve active learning. Nutrition education should be relevant and developmentally appropriate (7). Nutrition education in the schools should address the needs and interests of the students while taking into account what the children already know. The education should be delivered so that children can understand the information so they can learn the skills and knowledge required to strengthen healthy eating habits (8). Focus groups conducted in 9-12 grades in Louisiana schools show lack of availability, variety, and inconsistency in taste as the main barriers to increasing consumption of fruits and vegetables at school and outside of school (8). Nutrition education must be developmentally appropriate to help children make informed food choices. Identifying the students' motivation for good nutrition is important in program development. Motivators for boys are sports, muscle strength, and achievement of better athletic performance, whereas for girls personal appearance is the primary motivator. Factors influencing children's food choices are availability of ready-to-eat food, taste, satiety, and appealing packaging (8). According to Perez-Rodrigo and Aranceta, "Tailoring interventions to individual characteristics, level of dietary intake, risk of poor nutrition, readiness to change, self-efficacy and sociodemographic aspects can enhance effectiveness (8)."

Nutrition education programs should emphasize a strong behavioral component as well as take into account individuals' motivation to change. Nutrition education programs should also help build one's confidence in decision making ability. Before students take action to make diet changes, awareness should be raised and desire to change should be present (9). Successful school-based nutrition programs should begin in elementary school and extend to high school (8,

10). In order to be successful, incorporation of nutrition education into the schools should involve teachers, family, and community professionals. School-based nutrition education should not only focus on nutrition information but also include development of skills in areas such as food preparation, preservation, and storage; social and cultural aspects of food; and enhanced self-esteem and positive body image (8).

Successful nutrition education programs incorporate lessons in other subjects such as math and language (8). When incorporating lessons into other subject areas, students can calculate calories, serving sizes, or percentage of daily intakes for math. Science classes can include segments focusing on gardening and biology or human digestion and health (8). By incorporating lessons into other subject areas, students develop skills and behaviors related to areas other than nutrition. Involving other skills in nutrition education makes the nutrition lessons creative, engaging, and appropriate for various settings. Teaching methods can include discussions, work-sheets, food records, shopping exercises, or tasting and creating. For nutrition programs to be successful, it is essential to have adequate time, adequate knowledge transfer, appropriate resources, and suitable educational materials and teacher training (8, 10). Getting families involved enhances the effectiveness of nutrition education programs in younger children (10). The focus should be on stimulating awareness and gaining parental support to encourage variety in the diet and availability of healthy foods at home (11).

Lack of time for the coordination of nutrition education is a barrier for educators. Health educators express the desire to work with other teachers for nutrition education but lack time to coordinate planning (12). Teachers also express the desire to work with food service staff to implement nutrition education. Teachers find it difficult to collaborate with the food service staff because of scheduling conflicts (12). Lack of reinforcement at school and home is another

barrier in nutrition education. Health educators report frustration when nutrition education is not reinforced at school and home. Many educators are concerned that nutrition lessons are not reinforced by the choices offered in school cafeterias (12). Consistent nutrition education cannot be achieved without efforts from school and home. Administrators want staff who are resourceful in providing nutrition education. Health educators have stated that involved and supportive administrators would improve nutrition education (12). Health educators feel that when administrators reduce funding, coordinating staff for nutrition programs are eliminated. Administration must fund personnel to organize, facilitate, and assist with nutrition education if more nutrition education is to take place (12).

School Environment

Social and physical environments (including schools) can directly and indirectly affect health beliefs and behaviors (13). School environments can be important influences on the dietary and physical activity patterns of children (13). As children grow older, parental control decreases, leading to behavior patterns developed from peer norms and actions. Behaviors established during adolescence are likely to remain throughout life. Research has shown healthful and unhealthful behaviors established by sixth grade remain throughout high school, demonstrating the need for interventions to promote healthful behaviors early in middle school and elementary school. Schools provide an ideal setting for nutrition education because students spend a large portion of the day in school and have one or two meals at school each weekday (13). Nutrition education in a school setting targets a large number of children in a cost-effective manner. School personnel can also promote healthy eating habits and reinforce instruction. Additionally, schools can promote physical activity as part of the curriculum, recess, and extracurricular activities (10).

Diet and Learning Behavior

Malnutrition in children negatively affects intellectual development. Children who skip breakfast have slower memory recall and increased errors (14). Eligible students participating in the school breakfast program were found to have improved academic performance and decreased tardiness and absenteeism when compared with those students not participating (14). Nutrition has been linked to learning readiness and academic achievement, decreased discipline problems, and decreased emotional problems (15).

Cost Savings of School-Based Nutrition Programs.

The cost of obesity has a huge economic impact in the United States. The prevalence of obesity is rapidly increasing. Obesity leads to diseases such as diabetes, heart disease, and certain cancers, thereby increasing health care costs. Preventing this epidemic can begin in schools (16). While nutrition education programs often lead to positive outcomes, they can also be cost-effective. A study, conducted in Boston, Massachusetts determined the cost-effectiveness and cost-benefit of a school-based nutrition intervention program. A school-based intervention to reduce obesity was implemented. The costs examined were medical costs, intervention costs, and costs of productivity loss. The study determined, at a cost of \$14 per student, the program would save an estimated 4.1 quality adjusted life years. A savings of \$15,887 in medical costs and \$25,104 in lost productivity can be achieved through nutrition programs (16). These results showed nutrition education programs in the schools would be cost effective. These programs would lead to decreased costs of health care and loss of productivity costs (16).

Childhood Nutrition

The amount of energy intake that children require varies widely based upon their resting energy expenditure, rate of growth, and activity. Growth increases the demands for all nutrients (17). Appetite usually follows the rate of growth; therefore, food intake is not always consistent. Family influences children's intake because parents and siblings provide a role model for children. Vitamins are necessary to help make possible the process by which other nutrients are digested, absorbed, and metabolized or built into body structures (17). Adequate intake of vitamins, minerals, and energy are necessary for protein synthesis to take place. Inadequate intake of vitamins and minerals leads to slow growth rates, inadequate mineralization of bones, insufficient iron stores, and anemia. Vitamins and minerals are found in a variety of fruits and vegetables. Adequate calcium intake is necessary for adequate bone growth and mineralization. Because milk and dairy products are the primary sources of calcium, children who consume limited amounts of these products are at risk for deficient calcium intake (17).

Children's Consumption Patterns

The Bogalusa Heart Study conducted from 1973-1994 was a longitudinal study designed to examine cardiovascular risk factors (18). The study collected data on individuals from infancy to adulthood, which provided an opportunity to examine trends in children's food intake. The study found children's energy intake from protein and carbohydrate had increased, while the percentage of energy from fat and saturated fat had decreased. Although total fat and saturated fat intake had declined, 75% of children still consumed above the current dietary recommendations for fat and saturated fat (18). The study also found decreased consumption of vegetables, desserts, candy, eggs, pork, milk, and bread/grains. Intake of cheese, sweetened beverages, fruit and fruit juices, luncheon meats, poultry, salty snacks, and condiments was

significantly increased. The amount of foods consumed at school and restaurants also dramatically increased (18). This study illustrates the need for nutrition education among children to increase fruit and vegetable intake as well as other nutrient dense foods (18).

School lunches have been found to exceed the levels for fat and saturated fat. In many schools children also have access to a la carte foods and vending machines. These foods are usually high in calories, fat, saturated fat, sugar, cholesterol, and sodium (15). Federal guidelines have established that school lunch should provide one-third of the RDA for protein, vitamins A and C, iron, calcium, and energy for students. Lunches must also provide no more than 30% of energy from fat and 10% of energy from saturated fats (3). The National School Lunch Program was developed to subsidize to cost of meals to children and adolescents. Reduced price or free lunches are made available to income-qualifying students. One in 12 students purchases a reduced priced meal, while 50% of students receive free lunches (3). Studies have shown those students participating in school lunch programs were more likely to consume milk, vegetables, and fruit than those students bringing lunch from home (3). It has been found that only 2% of school-aged children meet the recommendations of the Food Guide Pyramid for all food groups, and less than 30% consume the recommended amount from any one of the five food groups. More than 84% of school-aged children consume more than recommended amount of fat (5). Fifty-one percent of students have less than one serving of fruit a day, and 29% have less than one serving a day of vegetables that are not fried (5).

Beverage Consumption Patterns

Over the past half century consumption of milk has significantly decreased. In 1945, Americans drank four times more milk than soft drinks, but in 1997 Americans drank 2.5 times more soft drinks than milk (4). Milk consumption decreased 24% among boys and 32% among

girls ages 6 to 11 between 1977 and 1994 (4). Decreased milk consumption leads to decreased mineralization of bones and bone growth due to lower calcium intake. Increased soft drink consumption leads to increased energy intake contributing to obesity. Increased soft drink consumption results in decreased milk consumption and can also have a negative effect on the intakes of many nutrients including calcium, phosphorous, folate, vitamin A, and vitamin C. Soft drinks replace more nutritious beverages such as milk and fruit juice (4). An increased intake of sweetened juice beverages has also been seen over two decades. Children consuming an increased intake of sweetened juice beverages have higher total energy intakes, leading to obesity (4).

Dietary Guidelines for Americans 2005

The Dietary Guidelines for Americans promote health and reduce risk for chronic disease, targeting the general public over two years of age. The Dietary Guidelines form the basis of nutrition education and information programs throughout the nation (19). Dietary Guidelines for 2005 recommend that overweight children reduce the rate of body weight gain while still allowing for growth and development. One of the key recommendations of the Dietary Guidelines is to consume a sufficient and varied amount of fruits and vegetables each day, while keeping total calories within recommended energy needs. It is also recommended for children ages two to eight years of age to consume 16 ounces per day of fat-free or low-fat milk or equivalent milk products (19). The Guidelines state, “Increased intakes of fruits, vegetables, whole grains, and fat-free or low-fat milk and milk products are likely to have important health benefits for most Americans (19).” The Guidelines also recommend three or more servings of whole grain products per day, with least half of the grains consumed being whole grains. It is

also recommended that Americans limit intake of fats and oils high in saturated and trans fatty acids (19).

Evidence demonstrates beneficial health effects from consuming a variety of fruits and vegetables. People who have an increased intake of fruits and vegetables have a decreased risk of chronic diseases such as stroke, cardiovascular disease, type 2 diabetes, and cancer (19). A range of 5 to 13 servings of fruits and vegetables per day is recommended depending on the calorie level. Although, fruits and vegetables provide many micronutrients and fiber, most people do not consume the recommended intake of vegetables. It is recommended to increase intake of dark green vegetables and orange vegetables to help consume adequate vitamins and minerals (19). The guidelines state “Milk product consumption has been associated with overall diet quality and adequacy of intake of many nutrients. The intake of milk products is especially important to bone health during childhood and adolescence (19).” Following the Dietary Guidelines is an easy way to ensure a healthy diet and nutritious intake of foods and beverages.

CHAPTER 3

METHODS AND PROCEDURES

Participants

Community partners in Johnson County, Tennessee chose the location for the pilot program. The participants in the study were students in grades kindergarten, first, second, and third at Laurel Elementary School in Johnson County Tennessee. Laurel Elementary School was chosen because there was one class per grade level. Class size ranged from 10 to 15 students depending on grade level. Kindergarten had 10 subjects. First grade had 12 subjects. Second grade had 13 subjects. Third grade had 15 subjects. Informed consent and child assent forms were not necessary due to nutrition lessons being presented in the classroom during academic periods with supervision of the classroom instructor.

Instrumentation

The principal investigator developed the testing tools, consisting of true/false and short answer questions specific for each lesson taught and grade level. Two faculty members in the Department of Family and Consumer Sciences at East Tennessee State University reviewed the instruments for each grade level. After review of the instruments all suggested revisions were made before being administered. A copy of instruments for each grade can be found in Appendix A.

Procedure

The Nutrition Coalition and Diabetes Coalition requested development of nutrition lesson plans for use in the school system. Lesson plans were developed for the nutrition education presentations based on review of literature focusing on increasing fruit, vegetable, and dairy intake. Before instruction was implemented the principal investigator provided the classroom instructor with the pretest. The classroom instructor administered the pretest and returned the completed pretest to the principal investigator. The principal investigator presented a nutrition lesson to each of the participating classes during the fall of 2004. Each lesson took approximately one hour of instruction. The lesson plans for the four grade levels can be found in Appendices B, C, D, and E. A summary of the lesson had been developed and was distributed to each student to take home. This was an effort to inform the parents of the nutrition lesson that was taught and how to incorporate or reinforce the healthy concepts at home. The summary of the lessons can be found in Appendix F. The students were given the opportunity to ask any questions during the lesson or following the lesson. After instruction was provided, the principal investigator left an identical posttest for the classroom instructor to administer. The classroom instructor collected the completed posttest and returned it to the principal investigator.

Data Analysis Procedures

All questions on the pretests and posttests were analyzed for percentage of correct responses. Data for the pretests and posttests were collected and organized for entry into an SPSS data file. Means were calculated for each grade. Data were analyzed using a paired t-test with an alpha level of .05. The statistical results were used to decide whether the null hypothesis should be rejected or fail to be rejected.

CHAPTER 4

RESULTS

The Population

Participants in the program were students at Laurel Elementary School in Johnson County, Tennessee. Participants included students in one class from each grade kindergarten, first, second, and third. No data were collected on sex, age, ethnicity, or socioeconomic status. In the Kindergarten class, 9 subjects completed the pretest and 10 subjects completed the posttest. In first grade, 11 subjects completed the pretest and 12 subjects completed the posttest. In second grade, 13 subjects completed the pretest and posttest. In third grade, 16 subjects completed the pretest and 15 subjects completed the posttest.

Data Analysis

The testing tool consisted of four objectively-scored questions for kindergarten and first grade (Appendix A). The testing tool consisted of six objectively-scored questions for second grade. The testing tool consisted of eight objectively-scored questions for third grade. The subjects were instructed to leave the question blank or guess if they did not know the answer. No response was counted as incorrect. The results of the mean scores of the pretest and posttest are listed in Table 1 with responding results of the paired t-tests. The results of each question are listed in Tables 2-5 with the number of respondents and the percentage of correct responses for each answer. Paired t-tests were used to determine statistical significance for total scores on pretests and posttests. The level of significance was set at 0.05 for all tests. The statistical analysis for these items is included in Appendix G.

Grade	Pretest	Posttest	p-value for paired t-test	Statistical Significance
Kindergarten n=9	2.44	3.33	>.05	no
First Grade n=11	3.36	3.63	>.05	no
Second Grade n=13	1.77	4.62	<.05	yes
Third Grade n=15	1.20	6.4	<.05	yes

Question	Pretest n=9 No., (%)		Posttest n=10 No., (%)	
	Correct	Incorrect	Correct	Incorrect
Identify fruit	6 66.6%	3 33.3%	7 70%	3 30%
Identify vegetable	5 55.5%	4 44.4%	9 90%	1 10%
Nutritious food	3 33.3%	6 66.6%	6 60%	4 40%
Nutritious food	8 88.8%	1 11.1%	10 100%	0 0%

Kindergarten

The first question on the kindergarten test asked the subjects to identify and circle the fruit out of three food items pictured. The three food items were strawberry, hamburger, and ice cream. The responses for the first question were very similar between pretest and posttest scores. The second question asked the subjects to identify the vegetable from three food items pictured. The three food items were pizza, carrot, and doughnuts. This question showed an increase in the correct answers between pretest and posttest scores. The third question showed the subjects a picture of cake and asked them to circle a “smiley” face if the food was good for them and a

“frowning” face if the food was bad for them. This question showed an increase in correct responses between pretest and posttest scores. It was common for the subjects to circle a “smiley” face thinking that cake tastes good. The fourth question showed the subjects a picture of an apple and asked the students to circle a “smiley” face if the food was good for them and a “frowning” face if the food was bad for them. Responses were similar between pretest and posttest scores. Students were 100% correct on the posttest for this question.

Question	Pretest n=11 No., (%)		Posttest n=12 No., (%)	
	Correct	Incorrect	Correct	Incorrect
Identify fruit or vegetable	10 90.9%	1 9.09%	11 91.7%	1 8.3%
Identify fruit or vegetable	9 81.8%	2 18.2%	11 91.7%	1 8.3%
Identify fruit or vegetable	9 81.8%	2 18.2%	12 100%	0 0%
Identify fruit or vegetable	9 81.8%	2 18.2%	9 75%	3 25%

First Grade

All of the questions for the first grade pretest and posttest asked the subjects to identify a fruit or vegetable beginning with a certain letter when pictured among two other choices. The results were very similar between pretest and posttest scores with the most improved being question number three. This question asked subjects to identify the fruit or vegetable beginning with the letter P. The choices were pizza, pie, and pumpkin. With pumpkin being the correct response, all subjects chose the correct answer on the posttest.

Table 4. Second Grade Responses to Questions				
Question	Pretest n=13 No., (%)		Posttest n=13 No., (%)	
	Correct	Incorrect	Correct	Incorrect
Number of servings	0 0%	13 100%	11 84.6%	2 15.4%
Blue/Purple color group	7 53.8%	6 46.2%	9 69.2%	4 30.8%
Red color group	3 23.1%	10 76.9%	11 84.6%	2 15.4%
Yellow/Orange color group	6 46.2%	7 53.8%	9 69.2%	4 30.8%
White color group	2 15.4%	11 84.6%	11 84.6%	2 15.4%
Green color group	5 38.5%	8 61.5%	9 69.2%	2 15.4%

Second Grade

All questions on the second grade testing tool showed improvement between pretest and posttest scores. The first question demonstrated the most marked improvement. The first question asked the subjects how many servings of fruits and vegetables they should eat every day. Two and three were popular responses, but five was the only answer that was considered correct. The remaining questions asked the subjects to name a fruit or vegetable of a specific color group. All of these questions showed improvement between pretest and posttest scores.

Table 5. Third Grade Responses to Questions				
Question	Pretest n=16 No., (%)		Posttest n=15 No., (%)	
	Correct	Incorrect	Correct	Incorrect
Source of calcium other than dairy	0 0%	16 100%	4 26.7%	11 73.3%
Calcium requirements	0 0%	16 100%	14 93.3%	1 6.7%
Osteoporosis	0 0%	16 100%	15 100%	0 0%
Calcium in the body	2 12.5%	14 87.5%	11 73.3%	4 26.7%
Servings of calcium	6 37.5%	10 62.5%	13 86.7%	2 13.3%
Source of calcium	6 37.5%	10 62.5%	15 100%	0 0%
Source of calcium	4 25%	12 75%	12 80%	3 20%
Source of calcium	1 6.25%	15 93.75%	12 80%	3 20%

Third Grade

All questions on the third grade test showed improvement between pretest and posttest scores. Although question one showed improvement, most subjects still responded with incorrect answers to this question. The subjects were asked to name a source of calcium other than dairy products. Question number two showed a significant improvement between pretest and posttest scores. Question number two asked subjects the calcium requirement for children ages 9 through 18. Only 1300 mg was counted as correct. Question number three showed the most improvement between pretest and posttest scores. Question number three asked subjects to name the disease that is associated with too little calcium in the diet. The correct answer was osteoporosis.

CHAPTER 5

DISCUSSION, CONCLUSIONS, RECOMMENDATIONS

Discussion

The data collected and analyzed for kindergarten and first grade did not show a significant increase in knowledge of elementary school subjects participating in nutrition education programs. While analysis of data showed improvement between means of pretest and posttest scores for kindergarten and first grades, it was not enough to be statistical significant. Analysis of responses to questions also showed some improvement between pretest and posttest kindergarten and first grade (Tables 2 and 3). The results obtained could be due to a very small population size. The results could also be due to using a test that was not validated. If the study was repeated with a larger population size, the outcome might be statistically significant. It is hard to determine if the results were not statistically significant because the lessons and tests were not appropriate for the grade level or if it was because of the small population size.

The data collected and analyzed for second and third grade indicated a significant increase in knowledge among elementary school students participating in nutrition education programs. The increased level of knowledge was statistically significant when analyzed by a paired t-test with an alpha level of .05. The level of knowledge gained verifies the subjects learned the information presented in the nutrition education programs.

Due to the design of the research project, no follow-up education was conducted. Following up with the subjects to determine if they retained the information and applied the knowledge to their life would be the best indicator of success. However, in practicality, it would be difficult to follow subjects for the time required to application of knowledge.

From observations made in the classrooms, it was difficult for the kindergarten subjects to adequately take the pretest and posttests. They wanted to color the pictures instead of answering the questions. Administering the tests in this grade was also time consuming. The first grade students already seemed to have knowledge of what the tests were trying to measure. Even though the first graders did show improvement, they had high pretest scores before the lesson was taught. Once again these results could be due to lack of validating the instrument.

Conclusions

The subjects who participated in the nutrition education programs demonstrated an increase in knowledge. The subjects in second and third grade demonstrated more of an improvement when compared to kindergarten and first grade students. The hypothesis was rejected and the null hypothesis failed to be rejected for kindergarten and first grade. The hypothesis failed to be rejected and the null hypothesis was rejected for second and third grade students. As found in the literature, use of information that is developmentally appropriate impacts the subjects' ability to gain knowledge and skills needed for implementation of behavior change (7). Helping subjects to increase their nutrition knowledge better enables them to adopt and follow the Dietary Guidelines, improving overall health and promoting academic achievement.

Recommendations

Reinforcement of the lessons presented is important to help the children make informed choices about foods and nutrition. Providing frequent nutrition information to students would be beneficial in increasing students' ability to make healthy choices. In future lessons, follow-up with the children would be helpful in determining the appropriate direction for the nutrition lessons. Incorporating nutrition lessons into the school curricula would provide increased

knowledge about healthful choices for the students. Providing nutrition education to students at a young age would be beneficial in helping the students make lifelong changes. Providing the students with nutrition knowledge promotes independence for the students in making informed choices. Continuous nutrition education provides knowledge for improved long-term health status.

Additionally, the lesson plans and testing instruments should be reviewed by an educational specialist to determine the appropriate grade level of information. The tests should be validated in order to ensure readability and validity. In the future it would be beneficial to use an educational team consisting of an education professional, nutrition professional, and health education professional to design and implement the nutrition program. It is recommended that once approval of the lesson plans and tests is obtained, the nutrition lessons should be implemented in the school system. Follow-up with students from grade to grade should be incorporated in order to build knowledge base and achieve long-term benefits. Making sure healthy food choices were available to students in the cafeteria would reinforce the lessons. Also, observing student choices in the cafeteria could show the application of the lessons.

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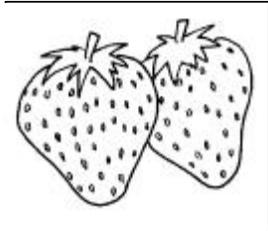
APPENDIX A

Testing Tools

Kindergarten

Pretest

1.



Strawberry

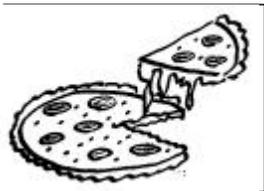


Hamburger

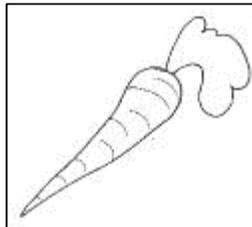


Ice cream

2.



Pizza



Carrot

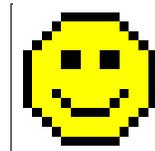
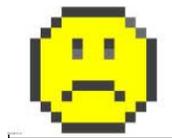


Doughnut

3.

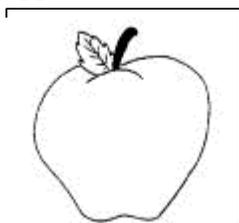


Cake

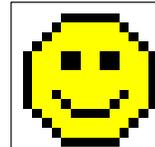


4.

Apple



30



Kindergarten Pretest/Posttest Instructions

For Pretest: Tell the students that “*we are going to see how much you know about fruits and vegetables*”. Tell them to “*circle the picture that you think is right.*”

For Posttest: Tell the students that “*we are going to see if the lesson today has taught you about fruits and vegetables.*”

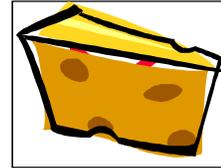
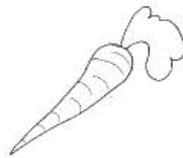
1. Ask the students to: “*circle the picture that is a fruit*”.
2. Ask the students to: “*circle the picture that is a vegetable.*”
3. Ask the students to: “*circle the smiley face if you think cake is good for you; circle the frowning face if you think cake is not good for you.*”
4. Ask the students to: “*circle the smiley face if you think an apple is good for you; circle the frowning face if you think an apple is not good for you.*”

“*Thank you for helping us to understand what you know about fruits and vegetables.*”

If necessary, you may tell the students what each picture is if they do not recognize it, but otherwise do not tell them.

Circle the fruit or vegetable that starts with each letter:

C

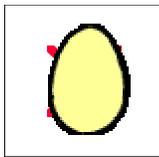


Cake

Carrot

Cheese

E

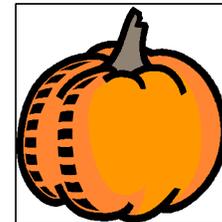


Egg

Eggplant

Egg Salad

P



Pizza

Pie

Pumpkin

J



Jello

Jelly Beans

Juice

1. How many servings of fruits and vegetables should you eat every day?
2. Name a fruit or vegetable from the blue/purple color group?
3. Name a fruit or vegetable from the red color group?
4. Name a fruit or vegetable from the yellow/orange color group?
5. Name a fruit or vegetable from the white color group?
6. Name a fruit or vegetable from the green color group?

1. Name another source of calcium other than dairy products.
2. Name the calcium requirements for children ages 9-18.
3. What is the name of the disease you can get if you don't eat enough calcium?
4. Where is the calcium in your body found?
5. How many servings of calcium should you eat a day?
6. Name three sources of calcium

APPENDIX B

Lesson Plan Kindergarten

Ricky's Garden Adventure

Goals: Promote increased awareness of the need for fruits and vegetables.

Objectives: Students will be able to identify fruits and vegetables when placed among other foods.

Students will verbalize the desire to increase fruits and vegetable consumption.

Materials: Ricky's Garden Adventure
Fruit and Vegetable cards
Crayons
Glue stick
Posttest
Letter to Parents

Instructional Technique:

1. Tell students "Today we are going to read a story about a rabbit and the food he eats."
2. "The food the rabbit eats in the story is fruits and vegetables and you are going to help us tell the story."
3. Handout a fruit and vegetable card to each student. If there are less than 24 students in the class let some students have two cards.
4. Tell students to color with crayons the fruit and vegetable cards.
5. Read Ricky's Garden Adventure as each fruit and vegetable is talked about in the story have the student with that fruit or vegetable card bring it to the front to have it glued in the story book. The teacher can place clue on the card and place the card into book.
6. Discuss with students, "The foods you have colored and learned about today are fruits and vegetables we should try to eat these at every meal and for snacks." The foods that are good for Ricky the rabbit are also good for us. Eating fruits and vegetables help our bodies fight diseases and keep us healthy. When we have choices of fruits or vegetables such as carrots, celery, apples, strawberries, and other fruits and vegetables it is a better choice than things like cake, doughnuts, ice cream, and chips.
7. Ask the students to name some fruits and vegetables they have learned about today.
8. Distribute posttest.

APPENDIX C

Lesson Plan First Grade

Eating the Alphabet

Goal: Promote increased awareness of the need for fruits and vegetables.

Objectives: Students will be able to identify at least one fruit or vegetable for each letter of the alphabet.

Students will be able to recognize a variety of fruits and vegetables.

Materials: Eating the Alphabet book
Very Hungry Caterpillar book
Alphabet Caterpillar Kit (pictures of fruits and vegetables, caterpillar head with string attached, clothespins.)
Posttest
Letter to Parents

Instructional Technique:

1. Tell students, "Today we are going to learn about fruits and vegetables and all the different kinds we can eat every day."
2. Read The Very Hungry Caterpillar book
3. Pass out pictures of fruits and vegetables to class
4. Hold up "A" page of Eating the Alphabet and ask students who has a food that begins with that letter.
5. Have student bring picture up and attach to the caterpillar head
6. Repeat for each letter of the alphabet.
7. Discuss with students, "These are all healthy foods and you should eat some every day." "These foods help us stay healthy and fight diseases." "Help your parents pick out these foods at the grocery store."
8. Ask for questions
9. Distribute posttest

APPENDIX D

Lesson Plan Second Grade

5 a Day

Goals: Promote increased awareness of need for fruits and vegetables.

Objectives: Students will visualize the correct serving size of fruits and vegetables.
Students will verbalize the desire to increase the variety of fruits and vegetables in their diet by using the color groups.

Materials: 1 medium sized fruit
 $\frac{3}{4}$ cup fruit juice
 $\frac{1}{2}$ cup canned fruits or veggies
1 cup raw leafy vegetables
 $\frac{1}{4}$ cup dried fruit
Put a Rainbow on Your Plate
Rainbow Shopping Word Find
Is There a Rainbow on Your Plate?
Crayons
Glue Stick

Instructional Technique:

1. Ask the students, "Has anyone heard of 5 a Day?"
2. Explain to the students that 5 a day means eating at least 5 servings of fruits and vegetables every day. Explain we need to eat fruits and vegetables so that we get the nutrients we need to help keep us healthy.
3. Tell the students we are going to show what a serving size is for fruits and vegetables so that you will be able to count your servings every day.
4. Show students 1 medium sized fruit, $\frac{3}{4}$ cup fruit juice, $\frac{1}{2}$ cup canned vegetables, 1 cup raw leafy vegetables, $\frac{1}{4}$ cup dried fruit.
5. Now ask students how they can incorporate more fruits and vegetables into their diet?
6. Tell the students they can ask their parents to add vegetables to macaroni and cheese like spinach or zucchini. Make fruit smoothies using fruit, yogurt, and ice. Add fruit to their cereal. Add vegetables to their spaghetti sauce, and pizza toppings. Eat peanut butter and banana sandwiches or apple slices with peanut butter. Add tomato and lettuce to sandwiches. Add vegetables to scrambled eggs. Drink 100% fruit juice. Add cooked vegetables to pasta or rice. Eat vegetable soup, have fruit for dessert, add fruit in jello, carrots celery and tomatoes dipped in low fat ranch dressing.
7. Explain to student that an easy way to get 5 a day is to eat one fruit or vegetable from 5 different color groups. Can anyone name a fruit or vegetable from the blue/purple color group? It includes blackberries, blueberries, plums, eggplant, grapes, plums, and raisins.

Can anyone name a fruit or vegetable from the green color group? Green includes asparagus, broccoli, kiwifruit, honeydew melon, green pepper, spinach, and zucchini. Can anyone name a fruit or vegetable from the white color group? White includes bananas, cauliflower, onions, potatoes, corn apples, pears, and mushrooms. Can anyone name a fruit or vegetable from the yellow/orange color group? Yellow/orange includes squash, carrots, cantaloupe, lemon, oranges, peaches, pineapples, sweet potatoes, pumpkin, and apricots. Can anyone name a fruit or vegetable from the red color group? Red includes beets, cherries, cranberries, grapefruit, red peppers, raspberries, strawberries, tomatoes, and watermelon.

8. Tell students to help their parents put together the grocery list and help them grocery shop to choose more fruits and vegetables. Tell the students to help their parents plan menus so they can choose some fruits and vegetables for the family and have fruit for dessert instead of sweet stuff.
9. Ask the students to raise their hand if they want to add more fruits and vegetables to their diet.
10. Distribute Put a Rainbow on Your Plate activity. Use directions on activity sheet
11. Distribute Rainbow shopping word find, and Is There a Rainbow on Your Plate? For students to take home or leave at school to fill in daily.
12. Distribute Letter to parents and ask students to fill in their name.
13. Distribute posttest

APPENDIX E

Lesson Plan Third Grade

3 a Day

Goals: Students will recognize the importance of adequate calcium intake.

Objectives: Students will be able to identify at least three calcium rich foods.
Students will be able to identify calcium requirements for children ages 9-18.
Students can identify how many servings of calcium are needed per day.

Materials: “What have you eaten?” worksheet
Construction paper
Crayons or markers
Laminating paper

Instructional Technique:

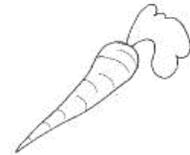
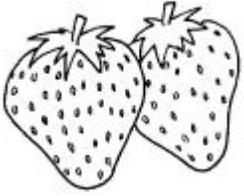
1. Tell students, “Today we are going to talk about calcium” Ask students can anyone tell us where we find calcium? We can find calcium in different foods that we eat and calcium is also found in our bodies.
2. Distribute the “What have you eaten?” worksheet. Ask the students to list all of the food and drinks they have consumed in the last 24 hours. When finished, ask the students to fold over the sheet and find any foods from the selected list that match the foods on their list. Write down the amount of calcium for each match and add them together for the total calcium intake for the last 24 hours. Have each student share with the class his/her total calcium intake.
3. Discuss with students calcium helps build our strong bones and teeth. 99% of the calcium in our body is stored in our bones and teeth. The calcium in our teeth helps make our enamel on our teeth hard and helps resist decay so we don’t get cavities. The calcium in our bones helps make our bones strong so we can have less broken bones. The best time to build your bones is during the development that takes place while you are young and through your teenage years. So, you want to put calcium in your bones everyday to make them as strong as possible, because we start to lose bone mass when we get older.
4. Does anyone know how much calcium you should have? The daily requirements are for children 4-8 years old 800 milligrams, 1300 milligrams for ages 9-18. This is 3-4 servings per day of calcium.
5. Ask students, “Does anyone know where what foods give us calcium?”
6. The best source of calcium is milk. We can also get calcium from foods such as cheese, yogurt, and pudding. Did you know that we can also get calcium from foods like greens, sardines, and salmon, calcium fortified orange juice, broccoli, baked beans, and bread?
7. If you don’t get enough calcium now for your bones you can get osteoporosis when you get older.

8. Have students stand up and hunch over. Tell them this is what can happen if you get osteoporosis.
9. Explain osteoporosis thins the bones and causes an increased risk of fractures.
10. Show class an example of placemat. Explain that they are going to make their own placemat to take home. Provide every student with one sheet of construction paper. Tell them to draw a large number 3 on their paper. Tell them to think of 3 examples of foods with calcium they like to eat. Have them draw the foods around the number 3. When they are finished have them bring their placemat to the instructor. The instructor will laminate them.
11. Ask students to name some sources of calcium.
12. Ask the students what the calcium requirement for ages 9-18 is.
13. Distribute posttest.

APPENDIX F

Summary of Lessons

Kindergarten



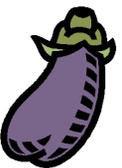
Dear _____,

In my class today I learned that just by eating more fruits and vegetables I can be stronger and healthier. I also learned that there are many different fun, tasty, and exciting fruits and veggies from which to choose.

Scientists have found that eating 5-9 servings a day promotes better health and helps prevent disease, yet half of all children eat less than one serving of fruit a day, rather than the recommended 5-9 daily servings.

I need to eat more fruits and veggies, and I need your help in trying more of the foods that will help me become stronger and healthier.

Love _____

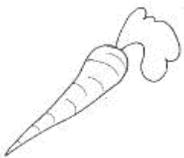


Dear _____



Today in school I learned about fruits and vegetables. I learned that there is a fruit or vegetable for every letter of the alphabet. I also learned that it is important to eat a variety of fruits and vegetables every day. Please help me eat more fruits and vegetables so that I can be healthy!

Love _____





Dear _____

Today in school I learned about eating 5 servings of fruits and vegetables per day. Please ask me how we can add more servings of fruits and vegetables to our meals. Please let me help you pick out fruits and vegetables at the grocery store so we can stay healthy.

Love,





Dear _____

Today in school I learned about calcium. I learned how much calcium I need every day. I also learned foods I can get calcium from. Please help me get 3 servings of calcium every day so I can grow strong bones!

Love _____



APPENDIX G

Statistical Analysis

t-Test

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 Kpre	2.4444	9	1.33333	.44444
Kpost	3.3333	9	.70711	.23570

Paired Samples Correlations

	N	Correlation	Sig.
Pair 1 Kpre & Kpost	9	-.309	.418

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Kpre - Kpost	-.88889	1.69148	.56383	-2.18908	.41130	1.577	8	.154

t-Test

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 firstpre	3.3636	11	.92442	.27872
firstpost	3.6364	11	.50452	.15212

Paired Samples Correlations

	N	Correlation	Sig.
Pair 1 firstpre & firstpost	11	-.117	.732

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 firstpre - firstpost	-.2728	1.10371	.33278	-1.01421	.46876	-	10	.432

1	firstpost	.27273					.820	
---	-----------	--------	--	--	--	--	------	--

t-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	secondpre	1.7692	13	1.78670	.49554
	secondpost	4.6154	13	1.55662	.43173

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	secondpre & secondpost	13	.505	.079

Paired Samples Test

		Paired Differences				t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower Upper			
Pair 1	secondpre - secondpost	2.84615	1.67562	.46473	-3.85872 -1.83359	6.124	12	.000

t-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	thirdpre	1.2000	15	1.08233	.27946
	thirdpost	6.4000	15	1.29835	.33523

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	thirdpre & thirdpost	15	.193	.490

Paired Samples Test

		Paired Differences				t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower Upper			
Pair 1	thirdpre - thirdpost	5.20000	1.52128	.39279	-6.04246 -4.35754	13.239	14	.000

VITA

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