Farm to School and Nutrition Education: Positively Affecting Elementary School-Aged Children's Nutrition Knowledge and Consumption Behavior

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Abstract

Background: Good nutrition is crucial. School-aged children battle social and health issues such as poor nutrition, childhood obesity, and minimal nutrition knowledge. This study was a quasi-experimental design analyzing the effects of the Coordinated Approach to Child Health (CATCH) nutrition curriculum with a Farm to School program to assess nutrition knowledge of 3rd grade students, and to increase fruit and vegetable consumption behavior.

Methods: Third grade boys and girls ($n=65$) participated in this study. The intervention consisted of two nutrition education classes and a farm tour. Data were collected at baseline and postintervention. Surveys assessed nutrition knowledge, fruit and vegetable consumption behavior, and awareness of farms and farmers. Chi-squared tests of independence were performed to examine the relation between the baseline and postintervention responses.

Results: Significant differences were found concerning knowledge of fiber ($p<0.001$). Knowledge of vitamins and minerals, reported vegetable consumption behavior at school, and farm exposure were also significant ($p<0.05$).

Conclusions: These findings suggest that CATCH nutrition education and farm tours can positively affect school-aged children's nutrition knowledge and fruit and vegetable consumption behavior.

Introduction

Fruits and vegetables are essential components of the diet. They provide the human body with antioxidants, energy, fiber, minerals, and vitamins. The USDA MyPlate recommends that individuals strive to fill half of their plate with fruits and vegetables.¹ Varying individual factors, such as gender, age, and activity level, determine the required daily amounts of fruits and vegetables.^{1,2} By eating a variety of fruits and vegetables in a range of colors, nutritional benefits will be even greater.³ Fruits and vegetables contain compounds called phytochemicals.⁴ The positive side effects of consuming the recommended amounts of fruits and vegetables include health benefits, such as weight management, reduced risk of chronic disease, lower cholesterol, bone, joint, and eye health, and the overall improvement in quality of life in the United States.^{5–10} These health benefits are vital for all ages, but extremely crucial for growing children.

Childhood and adolescent overweight and obesity are serious health problems in the United States. The NIH has stated that childhood obesity is the most common health issue that children struggle with today.¹¹ It has been reported that approximately 17% of children and adolescents, aged 2–19 years, in the US battle obesity.¹² According to the National Health and Nutrition Examination Survey (NHANES), today childhood obesity rates are approximately three times higher than they were 30 years ago.¹³

Farm to School programs and Coordinated Approach to Child Health (CATCH) are initiatives that could help improve the current trend of childhood obesity among elementary school-aged children in the United States. Farm to School is a program that encourages the consumption of locally grown foods to support farmers in addition to implementation of nutrition and agricultural education.¹⁴ This program was established during the 1990s and has been

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growing since. To date approximately 10,000 schools participate in Farm to School programs.¹⁴

CATCH is a coordinated school health program that focuses on bettering the health of elementary school-aged children. CATCH emphasizes topics such as nutrition and physical activity to promote a healthy lifestyle.¹⁵ To implement CATCH, a nutrition education curriculum along with educational activities incorporating physical activity are developed and introduced. It has been reported that implementing CATCH can reduce the rate of increase or risk of overweight in children.¹⁶

Conceptual models have been developed to better understand aspects of nutrition behavior. The Social Ecological Model (SEM) of behavior proposes that multiple levels of factors influence health behaviors: Intrapersonal (individual), interpersonal (family and friends), organization or institutional, community, and public policy.¹⁷ Characteristics such as knowledge, attitudes, beliefs, and personality traits are intrapersonal factors. Interpersonal influences are the social supports, such as family and friends. Community factors are the norms and values that exist within an entity such as a school or neighborhood. Organization or institutional factors are the policies and regulations that may impact behavior. Public policy factors are those regulations and laws at all levels of government enacted to promote health. Literature on fruit and vegetable consumption has largely focused on the individual; however, SEM allows for consideration of the cultural, economic, policy, and environmental factors that influence dietary behavior. Each of these levels in the ecological model plays a significant role in influencing the nutrition environment and are the backbone of Farm to School programs.

The purpose of this study was to introduce the CATCH nutrition curriculum and Farm to School program to assess nutrition knowledge of 3rd grade students, and increase their fruit and vegetable consumption behavior. This study was guided by the following research questions:

1. How does a CATCH nutrition education intervention affect nutrition knowledge of elementary school-aged children?
2. Does nutrition knowledge affect elementary school-aged children's fruit and vegetable consumption behavior?
3. Do farm tours affect elementary school-aged children's fruit and vegetable consumption behavior?

Methods

This study used a quasi-experimental design proposed to assess nutrition knowledge and fruit and vegetable consumption behaviors of 3rd grade students participating in a Farm to School program. All 3rd grade students were assigned to participate in this study. The 3rd grade students were divided between a control and an experimental group for the farm portion of the study.

Sample

A total of 65 3rd grade students from an elementary school in southern Illinois participated in the study. Historically, this rural region of Illinois represents low-income and low-educational levels, high rates of poverty, illness, and mortality, as well as large numbers of medically underserved residents.¹⁸ The elementary school under study is a Title 1 school with 56% of students using the free or reduced lunch program. Active parental consent was obtained prior to implementation. All subjects, based on parental consent, were allowed to participate in the nutrition intervention. The nutrition intervention consisted of two nutrition education lessons that ranged approximately 30 minutes in duration and a farm tour in southern Illinois. This study was reviewed and approved by the Office of Sponsored Projects Administration at Southern Illinois University.

Data Collection

Data collection took place in the 3rd grade classrooms at the elementary school. Surveys were administered by the 3rd grade teachers at baseline and at postintervention. Surveys were completed by individual students. The survey was reviewed and approved by a Delphi panel. The expert panel felt the comprehension level of the survey was adequate; therefore, it was unnecessary to read the survey aloud to individual students.

CATCH

As previously stated, the CATCH program encourages a healthy lifestyle among children.¹⁵ The nutrition curriculum focuses on healthy eating and the concepts of "go," "slow," and "whoa" foods. The terms, "go," "slow," and "whoa," were utilized in this study as part of the classroom nutrition education component to help elementary school-aged children distinguish between nutrient-dense foods and energy-dense foods.

Nutrition Knowledge Survey

There were a total of 22 questions and statements were divided into four sections on the survey. The majority of the survey items were taken from previous studies on school nutrition education interventions.^{19–25} Survey items included multiple choice, yes/no/don't know (yes=2, no/don't know=1), yes/no/sometimes (yes/sometimes=2, no=1), and matching. Items assessed individual demographics; nutrition knowledge; awareness of farms and farmers; understanding of CATCH's "go," "slow," and "whoa" foods; and self-reported fruit and vegetable consumption behavior at home and school. The survey was reviewed by a Delphi panel of experts consisting of 3rd grade teachers, Registered Dietitians, and a culinary expert from the southern Illinois area. In addition, the survey was pilot tested in a 3rd grade classroom in southern Illinois. A Cronbach (α) alpha score of 0.622 was obtained for the nutrition knowledge items, and a Cronbach α score of 0.733 was obtained for awareness of farms and farmers items.

Nutrition Education Intervention and Farm Tour

The nutrition intervention and farm tour took place during weeks 2–4 of the intervention. Nutrition education was divided into two lessons, and implemented during weeks 2 and 3. Lessons were implemented exactly 1 week apart. Lesson plans were created based on the survey and the 3rd grade CATCH nutrition curriculum. Lesson one covered CATCH nutrition knowledge. Four items, found in section two of the survey, assessed the 3rd grade student's nutrition knowledge and each was answered with either "yes!," "don't know," or "no way!" These items were: "Fruits and vegetables are part of a healthy diet," "Fiber is part of a healthy diet," "Fruits and vegetables contain vitamins and minerals," and "A healthy diet includes a variety of fruit and vegetables of different colors." Props such as balloons and a poster that read "Paint Your Plate with Color" were on display. At the end of the lesson, an activity was implemented to reinforce student learning. This activity involved a large beach ball covered with various colors. The ball was thrown out to the students and when someone caught it, they were to stand up, pick a color, and name a fruit or a vegetable of that color.

Lesson two covered the CATCH matching portion on the survey where food items were matched to either "go," "slow," or "whoa." During lesson two these terms "go," "slow," and "whoa" were defined and foods of those categories were identified. To evaluate students' understanding, a stop light activity was implemented. Each child received three paper plates representing a stop light: green="go," yellow="slow," and red="whoa," respectively, and they were asked to identify the food item that was named with their "stop light."

The farm tour occurred during week 4. The purpose of the farm tour was to increase awareness of farms and farmers to the students. It has been suggested that students may show a greater interest in local fruits and vegetables if they are given the opportunity to participate in gardening and/or farm activities.²⁶ Gregoire termed this consumer interest in local foods and wanting to know where food comes from as "food with a face."²⁷ In our study, we wanted to give the farmer a face by allowing the students to meet him or her, see where their school's local fruits and vegetables were grown, and measure whether or not this had an impact on their behavior.

The farm tours were divided by classrooms to create a control group and an experimental group. Each tour lasted approximately 2 hours and consisted of a hayride throughout the farm. The tour began by introducing the students to the farmer, the farm, and some of the animals that live on the farm. The farmer then talked about the importance of nutrient-dense soil in comparison with dirt. The students were allowed to smell and handle the soil in the greenhouse. The farmer also discussed the importance of farms, as well as how fruits and vegetables were grown on the farm. Each student was given an apple that was grown on the farm to eat. The tour concluded with questions for the farmer.

Assessment of the farm tour was section three of the survey. Four questions were asked to determine awareness of farms and farmers: "Have you ever been to a farm?," "Farmers are important because they grow fruits and vegetables," "Farmers must take good care of the soil so they can grow the best foods possible," and "I would eat more fruits and vegetables if I knew who grew the food." Each question or statement was answered with either a "yes!," "don't know," or "no way!" response. The same tour was given to the control group after the postsurvey was administered.

Data Analysis

The Statistical Package for the Social Sciences (Version 18.0) was used to analyze inferential statistics for this study. Chi-squared tests were used to identify relationships among categorical variables.²⁸

Results

Descriptive Statistics of the Sample

There were a total of 64 surveys collected at baseline and 65 surveys collected at follow-up from the 3rd grade students. All surveys were used for this study.

Demographics

Demographic information obtained from the 3rd grade students included gender and ethnicity. The majority of students (65%) were Caucasian. An additional 15% of students were African American and 9% were Hispanic. Eleven percent of 3rd grade students were Asian or Pacific Islander or more than one race. The ethnic diversity in this 3rd grade class is highly representative of the American population. In terms of gender, 45% were female while 55% were male.

Research Question 1

The first research question was "How does a CATCH nutrition education intervention affect nutrition knowledge of elementary school-aged children?" For these four survey items, participants were asked to circle either "yes!," "don't know," or "no way!" to a series of statements concerning nutrition. Results indicated two items were significant. There was a significant relationship between preknowledge and postknowledge ($\chi^2 = 11.697, p < 0.001$) for the item "For a healthy diet, you should eat fiber every day." In addition, the relationship between preknowledge and postknowledge for "Fruits and vegetables contain vitamins and minerals" was significant ($\chi^2 = 4.458, p < 0.05$). The remaining two items "Fruit and vegetables are a part of a healthy diet" and "A healthy diet includes fruits and vegetables of different colors," were not significant because the majority of 3rd grade students knew that a healthy diet contained fruits and vegetables of a variety of colors prior to the intervention. To complete research question one, baseline and follow-up means of CATCH nutrition knowledge were assessed. These questions were matching, in which participants had to match each food item to its

coordinating correct answer of either “go,” “slow,” or “whoa.” Mean scores, with the exception of mashed potatoes and baked potato, increased from baseline to follow-up; however, no statistically significant improvements could be reported. No significant differences were found between genders in terms of CATCH nutrition knowledge.

Research Question 2

The study’s second research question asked “Does nutrition knowledge affect elementary school-aged children’s fruit and vegetable consumption behavior?” Chi-squared tests identified any relationships between self-reported fruit and vegetable consumption behavior at baseline and follow-up. Each 3rd grader was asked to respond to each statement by circling either “yes!,” “sometimes,” or “no way!” The item, “At school, I eat vegetables” increased significantly ($\chi^2 = 3.936, p < 0.05$), which means there was a relationship from baseline to follow-up due to the nutrition intervention. All remaining variables, with the exception of home fruit consumption, increased slightly, but not significantly.

Research Question 3

The third research question, “Do farm tours affect elementary school-aged children’s fruit and vegetable consumption behavior?” was answered using a chi-squared test to identify a relationship between self-reported fruit and vegetable consumption behavior and awareness of farms and farmers among the control and experimental groups. The control group consisted of students who went on the farm tour after the postsurvey, whereas the experimental group comprised the 3rd grade students who went on the farm tour before the postsurvey was administered. No significant relationships were found between self-reported fruit and vegetable consumption behavior and participation in the farm tour. Although the farm tour did not appear to show a relationship with the students’ reported fruit and vegetable consumption behavior, a parallel plate waste examination of the study indicated that students were consuming more fruits and vegetables and wasting less food by the end of the study.

Awareness of farms and farmers among the control and experimental groups was also examined. There were four items in this section. Each item found in this section was answered with either “yes!,” “don’t know,” or “no way!” The item “Have you ever been to a farm?” was significant at the $p < 0.05$ level. Because the experimental group was the group that went on the field trip to the farm all of those students were able to answer “yes!” to the item regarding whether they had visited a farm. The other items: “Farms are important because they grow fruits and vegetables,” “Farmers must take good care of the soil so they can grow the best foods possible,” and “I would eat more fruits and vegetables if I knew who grew the food,” were not significant because participants had prior awareness of these items before the study.

Discussion

This study assessed elementary school-aged children’s CATCH nutrition knowledge, fruit and vegetable consumption behavior, and awareness of farms and farmers. This study was unique because it employed a 3rd grade nutrition intervention in conjunction with a Farm to School program. Assessment data were obtained through a 22-item survey. The study took place during the month of September, 2011, and lasted a total of 4 weeks. The survey was administered at baseline (week 1) and follow-up (week 4). The nutrition education intervention was created with the help of the 3rd grade CATCH nutrition curriculum. Nutrition education was implemented during weeks 2 and 3 to ($n = 65$) 3rd grade students. Each lesson lasted 30 minutes and consisted of an education component and activity to help reinforce the nutrition intervention. The farm tour was given during week 4 at a local farm. Participants met the farmer and learned about farms and how fruits and vegetables were grown on the farm. The farm tour was intended to create awareness of farms and farmers as well as to educate 3rd graders on the differences between soil and dirt and how fruits and vegetables are grown.

Findings from our study revealed that a CATCH nutrition education intervention increased participants’ understanding of fiber. Previous studies have examined this topic with 11- and 12-year-old children and found that students were able to understand the importance of fiber for a healthy diet.²⁵

In addition, 3rd graders’ knowledge of vitamins and minerals increased from baseline to follow-up ($p < 0.05$). These findings may be the result of the creative method of delivering this topic. For example, this lesson began with a person dressed up as a carrot in a bucket of soil; this instantly grabbed the students’ attention, and developed into a detailed discussion of how carrots, along with other fruits and vegetables, contain vitamins and minerals and fruits and vegetables contain fiber. Previous research found that school-aged children had limited knowledge on how nutrients play a role in the human body.²⁹ Findings from the current study were significant. The study contributes to the literature by explaining how nutrients play a role in the human body. In terms of fiber, the 3rd graders were taught that it eliminates bacteria from our bodies; therefore, they should eat it every day.

All studies have limitations; many are inherent due to lack of funding and available resources. An initial limitation of this study was the use of only one school in southern Illinois. If funding were available, future research may attempt to include more schools and a control group for a broader scope. In addition, the research was located in a rural area. Therefore, this study cannot be generalized to schools in urban populations.

The time frame for the study was limited, lasting only 4 weeks. Future studies could conduct the study over a longer period of time to include more information on nutrition knowledge. In addition, the CATCH “go,” “slow,”

and “whoa” lesson could have been separated into three separate lessons, with each one focusing on one concept. Each concept is compact, and therefore an appropriate amount of time is needed to educate 3rd grade participants on the information. This may increase participants’ understanding of each CATCH term. Last, the reported reliability of the nutrition knowledge items on the survey was lower than preferred ($\alpha=0.622$); this could be due in part to a limited number of questions to measure knowledge. Future research should increase the material and number of questions to measure nutrition knowledge. However, it should allow sufficient time to cover the nutrition knowledge material for student engagement and retention.

Conclusions

Findings from the current study revealed that a CATCH nutrition education intervention increased participants’ understanding of fiber and knowledge of vitamins and minerals from fruits and vegetables. Findings from the current study indicated that the nutrition education component of the intervention was useful and therefore should be implemented in elementary school-aged children’s curriculum. This study contributes to the literature by demonstrating educational methods for improving understanding of how nutrients play an important role in the human body. Participants in this study reported eating more vegetables at school from baseline to follow-up. This was due in part to the nutrition education curriculum as well as the Farm to School initiative that was taking place at the school.

Overall, there were significant findings in this research study, suggesting that CATCH nutrition education and farm tours can positively affect elementary school-aged children’s nutrition knowledge, fruit and vegetable consumption behavior, and awareness of farms and farmers. This is evidenced by 3rd grade student’s increased knowledge of fiber, vitamins, and minerals, participants’ increased reporting of vegetable consumption behavior at school, and participants’ increased farm exposure. In addition to routinely implementing nutrition education, field trips to farms should be taken annually and customized to each grade level throughout the elementary school-aged years. Farm to School programs are in a unique position to incorporate all aspects of the SEM by connecting the individual, family, institution, community, and public policy advocates to educate and promote healthy fruit and vegetable consumption to elementary school-aged students. These findings could be useful to Registered Dietitians, school food service professionals, and teachers for promoting farm tours and educating students on the nutritional benefits of fruits and vegetables in the classroom. Others who may find this information useful are parents of elementary school-aged children, as well as staff who implement Farm to School programs, and the CATCH curriculum.

Acknowledgments

This study was funded by the USDA Specialty Crop Block Grant: SC-11-16.

Author Disclosure Statement

No competing financial interests exist for the authors

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