Effectiveness of “Fun”tastic Nutrition ProgramSM on Nutrition knowledge and Dietary Behavior of Fourth- and Fifth-Grade Students

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Abstract

There is a lack of evidence for the effectiveness of school programs that develop healthy habits, this is critical given the rising concerns related to childhood obesity. The aim of this study was to assess the effectiveness of a comprehensive nutrition education program in improving nutrition knowledge and behaviors among elementary aged students involving four elementary schools in greater St. Louis metropolitan area, inclusive of East St. Louis, Illinois. Educational lessons providing a comprehensive curriculum of nutrition and health education including interactive lectures, activities, and demonstrations were divided among six topics: My Plate; digestion; heart health; food label reading; skeletal system and calcium; and healthy snacking were evaluated by assessing pre- and post- surveys to determine changes in knowledge and behavior. Results concluded that a short-term nutrition intervention using a comprehensive nutrition and health education curriculum has the capacity to increase nutrition knowledge in an ethnically diverse population of fourth- and fifth grade students.

Keywords: Nutrition education; School program; Intervention; “Fun”tastic Nutrition ProgramSM

Introduction

There is an epidemic of childhood obesity within the United States. From 2011-2012 the Centers for Disease Control and Prevention (CDC) reported obesity affected 17% of all children and adolescents in the United States - triple the rate from just one generation ago (“Centers for Disease Control and Prevention”). Globally, the number of overweight children under the age of five in 2013 was estimated to be over 42 million, making childhood obesity one of the most serious public health challenges of the 21st century [1]. Furthermore, childhood obesity is problematic due to the harmful effects, such as hypertension and high cholesterol [2], impaired glucose tolerance, insulin resistance, and type 2 diabetes [3] in addition to social and psychological problems that can continue into adulthood [4]. Additionally, there is evidence to support a direct correlation to increased healthcare costs as it

relates to childhood obesity; for example, total costs for children and youths with obesity-related hospitalizations increased from \$125.9 million in 2001 to \$237.6 million in 2005 [5]. With the increasing problematic concerns associated with the continual rise in the childhood obesity epidemic, there is a burgeoning need for effective prevention methods.

One tactic to help combat this issue is the implementation of educational programs related to good nutrition and physical activity targeting the younger population. The CDC identifies schools as an ideal setting to promote healthy eating via multicomponent, comprehensive programs and such programs have shown success in improving dietary behavior, knowledge, intentions, and self-efficacy [6]. School age is a crucial time for learning about healthy lifestyles and schools provide an appropriate environment for nutrition education and learning healthy lifestyle [7]. Additionally, health education programs comprising longer intervention exposure times to nutrition and health education and parental involvement have proven to have the most success in behavioral changes among students [8-10].

The BJC Healthcare School Outreach and Youth Development “Fun”tastic NutritionSM Program (FNP) curriculum was created for grades 2-5 in an effort to help these students make healthier choices. The curriculum was implemented in four schools throughout the Metropolitan Saint Louis Area including schools from both Missouri and Illinois, where the prevalence of overweight and obese children are 31% and 34.5%, respectively [11]. Currently, no research exists regarding the FNP effectiveness on improving nutrition knowledge and behaviors. There is a need to assess the effectiveness of school-based nutrition programs in order to promote and enhance the success of these programs [12]. The purpose of this study was to assess the effectiveness of the “Fun”tastic NutritionSM education program on nutrition knowledge of fourth- and fifth grade students, and dietary behavior changes after completion of the FNP.

Methods

Research Design

This study was a secondary analysis of retrospective, summative data from 4 elementary schools within greater St. Louis metropolitan area, inclusive of East St. Louis, Illinois that enrolled in the FNP from 2011-2013. The schools within this study varied in demographic characteristics. School A was a private school and School B was a charter school, while School C and School D were both public schools. Specific school locations included within this study were the only schools enrolled in the FNP program from 2011-2013. The FNP is a multicomponent, comprehensive nutrition program that is divided among 6 lessons: My Plate; digestion; heart health; food label reading; skeletal system and calcium; and healthy snacking. Students individually completed a baseline pre-test prior to lesson one, 6 session nutrition intervention as a classroom, and individually completed a post-test after lesson six. Interventions and pre- and post-tests were administered by a Registered Dietitian (RD). Pre-tests were collected prior to the beginning of lesson one and post-tests were collected after completion of the sixth lesson. This study was determined to be exempt by Saint Louis University Institutional Review Board (IRB) as this was a retrospective review of existing anonymous data and all subjects were not identifiable.

Intervention

The FNP consisted of six educational lessons, each one hour in length, providing a total of six hours of comprehensive curriculum of nutrition and health education. The curriculum provided interactive lectures, activities, and demonstrations. The lessons were intended to be delivered weekly, although some schools required lessons to spread out, or compressed, for the sake of scheduling purposes. Length of curriculum was created due to coordination of school scheduling and feasibility. Schools A, B, C, and D participating in this study all completed the 6 intervention lessons. Each lesson correlated with 6 overall objectives: to teach healthy eating guidelines according to MyPlate; to learn how food is used by the body; to read food labels and make informed decisions about food; to understand the importance of bone health; to recall and state ways to keep one's heart healthy; and to identify ways exercise helps to keep your body healthy and growing. The intervention curriculum was created based on the Missouri Grade Level Expectations (GLE) [13,14] and Illinois Learning Standards (ILS)[15], along with the Centers for Disease Control and Prevention's National Health Education Standards [16].

Education Curriculum

Lesson 1: MyPlate: This lesson illustrated the five food groups using a familiar mealtime visual (MyPlate), giving insight to how to “build your plate” when making food choices. Students were asked a series of questions including: “How many of you have seen MyPlate?” and “What food groups are listed on MyPlate?” The objectives of the lesson were to identify MyPlate and foods represented from each food group, indicate the health

benefits and nutrients of each food group, and recognize the role of exercise on overall health.

Lesson 2: Digestion: This lesson addressed the function of the digestive system to process food into forms the body can use for growth and to remove waste from the body. The students were asked questions pertaining to the lesson: “What is a body system?”; “What are the examples of body systems?”; and “What is the main job of the digestive system?” This lesson engaged students in the story of digestion and used a digestive system handout. The objectives of the lesson were to identify the purpose and function of the digestive system and to identify the organs in the digestive system.

Lesson 3: Heart health: The cardiovascular system was the primary topic of this lesson. The lesson highlighted food choices and physical activity that affect the health of the heart and the other tissues that make up the cardiovascular system. The lesson began by asking students questions: “How big is our heart?”; “What is your heart's job?”; “What are some ways you have learned to keep your heart healthy?”; and “Is trans-fat good for you?” The lesson incorporated an interactive Give Your Heart a Good Start worksheet. The objectives of this lesson were to identify the function of the heart and circulatory system, classify foods high in fat or low fat, identify exercise as important component of heart health, and relate the concepts of balance, moderation, and variety into a daily diet plan.

Lesson 4: Label reading: The topic of lesson four was how to read food labels and provided students with the skills to find foods that are nutrient dense, and aided students to make healthy food choices. The lesson had key questions related to the topic: “Why would the government require food labels on their product package?”; “What items are included on a food label?”; and “Why are ingredients required on food packages?” The main activity of this lesson consisted of students completing a *Read Your Label* worksheet as a class, helping students to navigate how to properly read a food label. The objectives of the lesson were to determine serving size of product by reading a food label, determine the amount of calories and fat in a product, and read the ingredients found in a variety of food choices.

Lesson 5: Skeletal system & calcium: This lesson taught students about the skeletal system as well as tendons, ligaments and cartilage that connect them. Lesson five discussed the function of the skeletal system: protection, support, movement, storage, and blood cell formation. The lesson begins by asking the students questions related to the skeletal system: “Does anyone know what the skeletal system does for our body?”; “Does everyone's skeleton look the same?”; “How many bones do we have?”; and “What are the nutrients that helps bones?” The main activity of this lesson involves completing a Bone up on Nutrition worksheet. The objectives of the lesson were to identify the nutrients that are important for bone health (highlighting calcium as a key nutrient in bone health), identify the functions of the skeletal system, recognize foods that are high in calcium, calculate calcium intake, and indicate the consequence of bone health if inadequate nutrients are not met.

Lesson 6: Healthy snacking: This lesson focused on the importance of healthy snacks within the diet. The curriculum explored nutrient dense “grab and go” snacks and thoughtful planning of snacks for student and parents. The lesson began by asking the students a few questions related to healthy snacking: “What are some healthy snacks you enjoy?” and “How do you know if a snack is healthy?” The main activity involved completing a Healthy Snacking worksheet, while snack ingredients were placed correctly in MyPlate groups. The objectives of this lesson were to list healthy and nutrient dense snacks students can make at home and recognize the importance of nutritious snacks for a healthy diet.

Instrument

The survey tool, created by members of the healthcare community and nutrition professionals, was reviewed for having face and content validity. Cronbach’s alpha reliability coefficient for the knowledge construct was 0.65, the behavior construct was 0.72, and the overall total score including the knowledge and behavior construct was 0.76. The survey tool has a Flesch-Kincaid Readability score of 4.3. The survey tool used for pre- and post- test was a ten multi-response questionnaire, consisting of six of the questions related to nutrition knowledge, three related to behavior, and one related to environment. Questions were developed from content presented in education sessions and consisted of multiple choice, matching, circle best option, and identifying questions.

Constructs

The knowledge construct produced a total of 11 possible responses from four multiple choice questions, one two-part fill-in-the-blank question, and one five-part matching question pertaining to general nutrition and health knowledge correlating with the FNP curriculum and the following questions were found on both the pre- and post-test survey:

- (1) “Match the food group to what it does in your body (1a. Grains, 1b. Protein, 1c. Fruits, 1d. Dairy, 1e. Vegetables)”
- (2) “What is the serving size? and how many grams of fat per serving?”
- (3) “Circle the foods that are calcium-rich.”
- (4) “Circle the answer that best represents a MyPlate/heart healthy meal.”
- (5) “What is the minimum number of minutes you should exercise each day?”
- (6) “The job of the digestive system is to?”

Each question was scored as correct or incorrect.

The behavior construct included 3 questions pertaining to general nutrition and health behaviors related to the preadolescent population. Questions found on both the pre- and post-test survey included:

- (1) “What did you drink with lunch yesterday?”

- (2) “The next time I am having a snack, I will probably eat.”

- (3) “On an average school day, how many hours do you watch TV or a DVD, play video or computer games, or use a computer for something that is not school work?”

The three questions were scored based on the ideal response for each question. For question one, the ideal response was considered to be either milk or water. For question two, the ideal responses were dairy, fruits, or vegetables. For the third question, the ideal responses were none, one hour per day, or two hours per day.

The environmental construct consisted of one question pertaining to the number of family dinners eaten together in one week. Possible responses for this question were 0 to 7. This question was scored as an average mean by school for pre- and post-tests.

Data Analysis

All data were entered and analyzed using SAS 9.3 (SAS Institute, Cary NC) with a significance level of 0.05. Descriptive statistics were used to calculate frequencies and percentages for demographics by school. Means and standard deviations for each construct were computed for each school for pre- and post-tests. Changes in knowledge, behavior, total score, and environment within each school were evaluated using pre-post t-tests. The knowledge and behavior scores included individual analysis of the questions derived within for the knowledge and behavior construct, the environment construct was excluded from the total score as this question was analyzed separately as an average mean. The total score was calculated by a total sum of responses for both the knowledge and behavior construct, and dividing by the total possible correct responses. Pre and post-tests were matched via district, school, grade level, and gender. Difference between schools was assessed both pre- and post-test via ANOVA and Bonferroni post-hoc tests.

Results

Students of this study encompassed a diverse population, with participating schools coming from the greater Metropolitan St. Louis area. Socioeconomic status of the schools was determined by the percentage of the student population receiving Free and Reduced Lunches (FRL). School A ranked the highest in socioeconomic status (< 1% receiving FRL) and had the highest percent Caucasian student population (96.8%). School B, had the lowest socioeconomic status (91% receiving FRL) and had the largest percent African American student population (96.5%). School C was predominantly Caucasian student body population (90.4%) and had the second highest socioeconomic status (59% receiving FRL). School D was predominantly African American (86.8%) and had the second lowest socioeconomic status (83.9% receiving FRL). Demographic information can be found in Table 1.

Subsequent Bonferroni post-hoc analysis revealed significant differences between schools. Table 2 indicates the differences between each school for pre and post scores in knowledge,

Table 1: Demographic Characteristics of Schools and Students Participating in the FNP from 2011-2013.

	School A	School B	School C	School D
School Type	Private	Charter	Public	Public
Total enrollment in school	157	141	395	280
Percent eligible for free or reduced-price lunch	< 1	91.0	59.0	83.9
Grade level of participants	Fifth	Fifth	Fourth	Fifth
Race^a (%)				
Caucasian	96.8	1.4	90.4	10.4
African American	1.3	96.5	1.3	86.8
Other	1.9	1.4	8.0	2.8
Number of participants in assessments^b				
Male (%)	31.3	38.5	49.5	52.4

^a % of whole school population; ^b% of participating students

Table 2: Difference in Mean Scores for Each School Participating in the FNP for Pre- and Post-tests from 2011-2013.

	School A n = 32	School B n = 26	School C n = 202	School D n = 63	p-value*
	mean(SD)	mean(SD)	mean(SD)	mean(SD)	
Knowledge					
Pre Score	0.45(0.20) ^{bd}	0.23(0.13) ^{ac}	0.42(0.20) ^{bd}	0.28(0.14) ^{ac}	< 0.0001
Post Score	0.72(0.14) ^{bd}	0.35(0.18) ^{acd}	0.65(0.24) ^{bd}	0.52(.20) ^{abc}	< 0.0001
Behavior					
Pre Score	0.59(0.29)	0.45(0.30) ^c	0.69(0.29) ^{bd}	0.53(0.34) ^c	< 0.0001
Post Score	0.64(0.26)	0.57(0.37)	0.71(0.29) ^d	0.56(0.31) ^c	0.0016
Total Score					
Pre Score	0.48(0.19) ^{bd}	0.28(0.13) ^{ac}	0.48(0.17) ^{bd}	0.33(0.13) ^{ac}	< 0.0001
Post Score	0.70(0.13) ^{bd}	0.40(0.19) ^{acd}	0.66(0.20) ^{bd}	0.53(0.18) ^{abc}	< 0.0001
Environmental					
Pre Score	5.77 (2.05) ^d	5.62 (2.25) ^d	4.56 (2.56) ^d	3.51 (2.64) ^{abc}	< 0.0001
Post Score	5.78 (1.62) ^d	4.96 (2.53)	4.46 (2.54)	3.64 (2.51) ^a	0.0040

* Overall ANOVA F-test, Bonferroni post-hoc comparison, alpha = 0.05

a, b, c, d superscript letters within columns indicate statistical differences between column school and superscript school

behavior, environment and total score. School B differed from all of the other schools in the post-hoc on knowledge and total score. The ANOVA F-test of pre- and post-mean scores encompassing all schools demonstrated a significant difference for each pre- and post-test score including all four metrics ($p < 0.05$). Calculated pre- and post- means for the environment construct demonstrated the average for family dinners eaten together at home for each school.

The results for the pre-post scores for each school in overall knowledge, behavior, total score, and environmental are given in Table 3. Students across all schools demonstrated a significant knowledge change from pre- to post-intervention ($p < 0.05$). Behavior scores indicate there was no significant change in any school from pre- to post-intervention ($p > 0.05$). The total score indicated significant improvement from pre- to post-intervention in schools A, C, and D ($p < 0.05$). Consideration of the relatively similar mean differences between knowledge and total scores suggests that the majority of change was likely attributed to

knowledge improvement. Overall, the environmental construct did not have significant change for any school from pre- to post-intervention ($p > 0.05$).

Discussion

The aim of this study was to investigate the effectiveness of the FNP in improving nutrition knowledge and dietary behaviors among fourth- and fifth-grade students after participation in a six-lesson nutrition education intervention. The study used secondary analysis of retrospective, summative data from 4 schools from 2011-2013. The participating schools were located in the metropolitan St. Louis area, inclusive of East St. Louis, Illinois.

Results indicate that the FNP curriculum improved nutrition knowledge through short-term 6 week nutrition education intervention within all schools participating in this study. Results suggest that a comprehensive curriculum of nutrition and health education using interactive lectures, activities, and

Table 3: Difference in Pre-Post Scores for Each School Participating in the FNP from 2011-2013.

	School A n = 32	School B n = 26	School C n = 202	School D n = 63
	mean(SE)	mean(SE)	mean(SE)	mean(SE)
Knowledge				
Post-Pre Score	0.29(0.04)*	0.10(0.04)*	0.22(0.02)*	0.24(0.03)*
Behavior				
Post-Pre Score	0.09(0.07)	0.05(0.11)	0.02(0.03)	0.05(0.06)
Total Score				
Post-Pre Score	0.09(0.07)	0.05(0.11)	0.02(0.03)	0.05(0.06)
Environmental				
Post-Pre Score	-0.07 (0.40)	-0.42 (0.72)	-0.23 (0.26)	-0.21 (0.52)

* paired t-test, $P < 0.05$

demonstrations can result in favorable nutrition knowledge improvement in socioeconomically and ethnically diverse populations. The program was successful in building a basic foundation of general nutrition and health related knowledge among fourth- and fifth-grade students, an effective beginning to facilitate dietary behavior change [17-20]. Similar nutrition programs have been effective at inducing behavior change, providing insight that a multi-faceted approach within nutrition and health education curriculums is needed to better help facilitate change in behavior [21-25].

The FNP curriculum meets the criteria for Missouri Grade Level Expectations and Illinois Learning Standards. This creates opportunity for the curriculum to be integrated into the school's curriculum for longer intervention exposure. Longer interventions could possibly increase the likelihood of observing behavior change. Previous research has shown 12 week intervention programs lead to a change in behavior[26], demonstrating that students receiving longer duration and intensity of educational lessons tend to have more positive behavioral changes [27]. The students in this study participated in six-lessons resulting in a total exposure of 6 hours of nutrition education, a sufficient amount of time to increase knowledge, but perhaps not enough to initiate behavior change. Development of activities that continue to expose students to health and nutrition post the FNP as well as family involvement would be a reasonable next step to aid in true behavior change.

An important component to a nutrition program's ability to influence preadolescent dietary behavior is parental involvement. Children look up to their parents as role models and tend to follow their example. Parents and families can reinforce what has been taught in the classroom, and are a crucial component for implementation and maintenance of new health behaviors [8,28]. More structured components that specifically target parent involvement could significantly extend the reach of the FNP and strengthen behavior change potential.

An important finding was that although the FNP was able to achieve knowledge improvement over a diverse population of students, behavior change did not follow a similar trend. While increasing knowledge is essential in a nutrition education

curriculum, a combination of educational strategies directed at determinants of food choice, motivation, and environment are needed to facilitate dietary change [27]. This demonstrates the difficulty of implementing a 'one size fits all' program, advocating the need for a multifaceted approach towards nutrition and health programs for preadolescents. The examination of family dining patterns before and after the FNP revealed socioeconomically and ethnically diverse schools did change family dining habits differently. This suggests the need for an improved strategy to help affect widespread behavior change across a heterogeneous audience. It is presumed that students, who demonstrated a significant change in nutrition knowledge following the program, are limited in their ability to impact change in meal options without coupled parental involvement. Previous research suggests that increasing the amount of family meals has a direct correlation to healthier dietary and eating patterns [29-31]. Even though our study suggests family meals are occurring, the exclusion of parental involvement within the education lessons may have limited the opportunity for new dietary behavior changes to ensue in the home. As the FNP is a school outreach program, the curriculum was not designed to include parental involvement; however, increasing the awareness of the household decision-makers to the benefits of a healthy family diet could increase the likelihood of establishing healthier nutrition practices in the home.

This research demonstrates the importance of the FNP as a successful youth outreach program in providing a basic foundation of health and nutrition education among elementary aged students, which is the critical first step in order to affect future dietary behavior changes. Overall, this study illustrates that evaluating the effectiveness of health based school programs supports the need for program curriculums concentrated on health and nutrition education for the preadolescent population. The FNP goal was to share information about food and nutrition in an effort to help students to make healthier choices. The goal is fitting as eating behaviors have declined and diseases related to childhood obesity have increased over the last 20 years [32-34]. According to the results indicated in this study, the FNP was successful at improving nutrition knowledge.

Limitations

This study showed that the FNP was effective in improving nutrition knowledge among fourth- and fifth- grade students. Some limitations exist secondary to the limitations of a retrospective study utilizing pre-existing data, such as being the first assessment of the FNP curriculum, larger scale comparative data is not available. Additionally, data were not recorded at the student level, preventing this to be paired analysis. Future studies should allow for matching pre- and post- tests at the student level.

Additionally, there was slight variation in the wording on question four of the survey tool from a “heart healthy meal” to a “MyPlate meal”, limiting consistency of the survey tool from 2011 to 2012; however, the minimal variation in the wording did not effect from the overall meaning or the information being taught and analyzed within the curriculum. Lastly, the post-assessment was given immediately following the final lesson, possibly not allowing enough time to assess behavior change.

Implications for Research and Practice

The study demonstrates positive gains in improved nutrition knowledge using a school-based multicomponent, comprehensive program. With future explorations of the FNP, longer term studies need to be conducted to determine whether students are able to maintain their improved nutrition knowledge. Future research with the FNP could explore theory, self-efficacy, attitudes, behavior intent of students, along with possible incidences of decreasing overweight and obesity among the preadolescent population after the FNP intervention. The development and inclusion of supplementary programs that target parents as the primary audience will help raise awareness and increase the likelihood of implementing best nutritional practices within the home. In conjunction with the FNP, parental involvement will ensure a holistic approach to improve family health through the instruction of basic health knowledge among elementary aged students.

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