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The Efficacy of Short-Term Supplemental Nutrition Education on Nutrition Knowledge and Dietary Behaviors of Urban Middle School Children

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ACCEPTANCE

This thesis, THE EFFICACY OF SHORT-TERM SUPPLEMENTAL NUTRITION EDUCATION ON NUTRITION KNOWLEDGE AND DIETARY BEHAVIORS OF URBAN MIDDLE SCHOOL CHILDREN, by Julia E. Orr was prepared under the direction of the Master's Thesis Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree Master of Science in the Byrdine F. Lewis School of Nursing and Health Professions, Georgia State University. The Master's Thesis Advisory Committee, as representatives of the faculty, certify that this thesis has met all standards of excellence and scholarship as determined by the faculty.

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ABSTRACT
THE EFFICACY OF SHORT-TERM SUPPLEMENTAL NUTRITION EDUCATION ON NUTRITION KNOWLEDGE AND DIETARY BEHAVIORS OF URBAN MIDDLE SCHOOL CHILDREN
by
Julia E. Orr

Background: Overweight and obesity related diseases are on the rise among youth in the United States. Children and adolescents are not meeting the dietary guidelines, which suggests the need for nutrition intervention. Research is inconsistent with regard to the most effective method of educating urban youth.

Purpose: To determine the effect of a supplemental after-school nutrition education intervention on the knowledge and behaviors of urban school students.

Methods: Six, 45-minute nutrition lessons were provided to middle school students (ages 9-12) who attended the Boys and Girls Club of Metro Atlanta (BGCMA) at the Center of Hope in Thompsonville, GA. A pre- and posttest was administered to assess differences in students' nutrition knowledge and behaviors. Chi-square analysis was used to compare the number of correct answers for the entire intervention population and after stratification by gender and number of classes missed (0-2 versus >2). The Wilcoxon signed rank test was used to compare the median number of correct answers in pre- vs. posttest responses for all participants and by the number of classes missed. A p-value of <0.05 was considered to be significant.

Results: 15 African American students (9 female) between the ages of 9 and 12 enrolled in the study. 2 students (1 female) did not complete the study. A significant but negative change in knowledge was found in 1 of 15 nutrition questions for the entire cohort as well as in males. No significant differences were observed by the number of classes missed. A significant negative change in the median number of total answers correct on the pre-

vs. posttest was also observed (10 vs. 9, respectively; p=0.049). Approximately 60% of the participants reported that they were more likely to make positive, nutrition-related behavior changes as a result of the intervention.

Conclusion: We found a negative association between the nutrition education intervention and knowledge gain. The results of this study suggest that supplemental nutrition education alone does not have a significant effect on nutrition knowledge of urban youth.

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by
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ABBREVIATIONS

BGCMA	Boys and Girls Club of Metro Atlanta
BMC	Bone Mineral Content
BMI	Body Mass Index
CDC	Center for Disease Control
ESEA	The Elementary and Secondary Education Act
HBSC	Health Behaviors in School Aged Children
JADA	Journal of the American Dietetic Association
MM	Michigan Model
NHANES	National Health and Nutrition Examination Survey
SHEES	School Health Education Evaluation Study
SHPP	School Health Policies Program
WHO	World Health Organization

CHAPTER I.

Introduction

Nutrition related preventable health disparities, primarily obesity related type II diabetes and heart disease, are on the rise in American children and adolescents (1-2). Studies have shown that long-term school based programs are effective in changing students views, beliefs and behaviors toward healthy food. These changes include significant increases in fruit and vegetable consumption and water intake, decreased frequency of sweetened drinks, snacks, fast food, and overall decreased fat, percent energy from fat, saturated fat, and dietary cholesterol intake. Long-term programs incorporate at least twelve hours of instruction in a time span of eight weeks to twenty-one months (3–5). Current federal regulation only has requirements for specified "core-subject matter" as authorized in the Elementary and Secondary Education Act (ESEA) of 1965 (most recently reauthorized in 2010). Policy makers are still working to have physical and health education included as "core subjects" in ESEA (6). Current research finds the median number of hours spent on nutrition and dietary behavior education is less than five hours per year in US middle schools (7). The limited number of hours spent on nutrition education and the increasing rates of nutrition related health disparities in middle-school students suggest the need for effective nutrition education programs.

The problem investigated was whether or not short-term nutrition education through an afterschool program was effective in changing the knowledge and behaviors of middle school children. The purpose of this study was to determine the efficacy of a nutrition education component of the Boys and Girls Club of Metro Atlanta (BGCMA)

afterschool program in developing healthy, knowledge based habits in urban middle school children. The mission of BGCMA, as stated by the organization, is "to enable all young people, especially those who need us most, to reach their full potential as productive, caring, responsible citizens." The BGCMA provides: a safe place to learn and grow, ongoing relationships with caring adult professionals, life-enhancing programs, character development experiences, hope and opportunity (8).

Specific Aims

The specific aims of the study were:

1.Evaluate the efficacy of 8-10 hours of nutrition education on increasing the knowledge of urban middle school students participating in the Boys and Girls Clubs of Metro Atlanta.

2.Evaluate the efficacy of 8-10 hours of nutrition education on encouraging positive behavior change regarding healthier food choices of urban middle school students participating in the Boys and Girls Clubs of Metro Atlanta.

Null Hypothesis: 8-10 hours of nutrition education is insufficient to significantly change knowledge and behaviors of urban middle school children.

Alternative Hypothesis: 8-10 hours of nutrition education is sufficient to significantly change knowledge and behaviors of urban middle school children.

CHAPTER II.

Literature Review

Health disparities in middle school aged children

In an analysis of data from the National Health and Nutrition Examination Survey (NHANES) from 2007-2008 by Ogden et. al, 34.7% of all individuals between the ages of 6 and 19 have a BMI-for-age and gender greater than the 85th percentile and less than the 95th percentile (1) thus qualifying them as "overweight" (9). Further, the same study found 18.7% of the sampled population to have a BMI-for-age and gender of greater than the 95th percentile (1) thus categorizing them as "obese" (9). This population is a reflection of the current state of the health of children and adolescents in America. The study further analyzed the results by race and found rates of at risk for overweight and obesity to be higher in non-Hispanic black children than in the population as a whole at percentiles of 38.7% and 22.3%, respectively (1).

Consequently, obesity related diseases affecting the cardiovascular, metabolic, pulmonary, gastrointestinal, and psychosocial systems of many adults are now appearing in overweight and obese children and adolescents. Striking estimates of the prevalence of these diseases in children are reported at the following rates: hypertension, 2-4%; atherosclerosis, 8% (fibrous plaques); dyslipidemia, 5-10%; metabolic syndrome, 4%; asthma, 7-9%; and nonalcoholic fatty liver disease 3-8% (2). Likewise, obese adolescents are likely to have elevated blood glucose levels, a condition known as prediabetes, putting them at higher risk for the development of type II diabetes mellitus (10).

Nutrition Education in Schools

In a 2007 summary of the School Health Policies and Programs study (SHPP) conducted by the Center for Disease Control (CDC), 920 schools reported the number of hours of instruction spent on health education. The median number of hours reported for time spent on health education in middle schools was just under thiry hours per school year. However, these thirty hours were spent on fourteen topics with a variety of focuses in mental, physical and emotional health. Approximately two-thirds (67.3%) of all states and 85.1% of the 459 districts surveyed reported requiring the teaching of nutrition and dietary behavior to middle school students. However, the median number of hours spent addressing nutrition and dietary behavior in middle schools was only a total 4.2 hours throughout the entire school year (7).

Currently, the majority of literature supports school based intervention for nutrition education with ethnic minority students. Carol J. Stevens reviewed obesity prevention interventions involving both nutrition education and physical activity in middle school children, ages 10-14 (3). Eight studies were included in her review based on the key word search including: *"obesity, middle school-age children, intervention/prevention programs, Hispanic, African American,* and *Native America."(3).* The review only included studies with interventions greater than two months long and studies before 1998 were excluded. Stevens found that the majority of school-based programs integrate nutrition education into the daily or weekly schedules for middle-school children and reported increased efficacy in programs that integrated goal setting as motivation for children in the areas of dietary behavior and physical activity. The review found that creating one specific goal regarding dietary behavior and one pertaining to

physical activity was beneficial in changing the behavior of the individual children. Stevens further suggested that there is value in four specific areas when providing a health behaviors intervention. These four areas include: behavioral strategies, exposure, neighborhood safety, and parental involvement. Further, the behavioral strategies were focused on self-efficacy and motivation pertaining to health behaviors. Stevens' review suggested that certain behavioral, personal and environmental factors are related to obesity in children; however, her findings were inconclusive pertaining to ethnic minorities (3).

The dietary interventions of the studies included in Stevens' review are focused on two primary areas: decreasing consumption of high-fat, high-calorie foods along with increasing fruit and vegetable consumption. This review gives evidence to the effectiveness of long-term interventions (ie. two months to two years) and thus emphasizes the need for studies concerning short-term intervention programs (3). Stevens also noted that with the decline of health education, especially in lower income schools, a benefit from community based programming can be seen as it is altered to match the values and beliefs of the intended intervention group (3,11).

Fahlman et al (2008) found a significant change in both knowledge and behavior between pre- and posttest analysis based on a total of 8-10 hours of classroom based instruction and demonstration (5). This intervention was derived to further investigate the School Health Education Evaluation Study (SHEES) that suggests a minimum of ten hours of education are required to show the specific effects of an education intervention. The SHEES further suggests that an average of fifty hours of classroom learning are required to change behaviors (12). Fahlman et al investigated the use of the Michigan

Model (MM) Nutrition Curriculum created to address the issue of poor nutrition in Michigan public school students. The MM incorporates specific nutrition education into the health classes that are currently taught in 95% of Michigan middle schools. The study used a pre/post assessment quasi-experimental design in eleven intervention middle schools and compared the results to seven volunteered control schools. The pre- and post-assessments of 783 individual participants were analyzed for significant changes in knowledge, behavior change and efficacy expectations towards healthy eating. 87% of the participants who completed the study in the intervention group were African American compared to 25% in the control group. The study results revealed a significant within group difference between the pre- and post-assessment in the participants' consumption of fruits, vegetables, and "other" along with significant improvements between the pre- and post-assessment in the intervention group in the same three categories of consumption ($p \leq 0.05$). "Other" was defined as primarily junk food which students reported a statistically significant decrease in consumption. Evaluation of the twenty questions assessing nutrition knowledge revealed a significant improvement between pre- and post-assessment for students in the intervention group along with significant improvement in comparison to the control group (5). Currently, more research needs to be done to establish the efficacy of nutritional intervention based on less than ten hours of instruction.

The HEALTHY nutrition intervention was a five semester, middle school-based intervention comprised of four primary components including "nutrition, physical education, behavior change, and social marketing-based communications." Participants were all between the ages of 10 and 14 with a mean age of 11.3. 19% of the population

was African American with the majority of the intervention group of Hispanic ethnicity (56%). This long-term, school based intervention found a significant increase in fruit consumption and water intake in the intervention versus the control schools. The authors of this study suggested that interventions must extend beyond the school environment in order to effect dietary behaviors (4).

Other Nutrition Interventions

In a review of over 300 studies on the outcomes of nutrition education, researchers have concluded that interventions focused on behavior change, rather than knowledge only, have better outcomes. Nutrition education has been working within a framework that suggests that knowledge influences one's attitudes, which in turn changes behaviors. However, recent research focuses on a three-component model incorporating motivation, action and environment as essential phases of nutrition education. The initial motivational stage, the goal of education is to increase participants' awareness and desire focusing on why changes should be made (13).

A review published in the Journal of the American Dietetic Association (JADA) in 2011 concluded that behavior-based interventions are effective in increasing fruit and vegetable intake; however, additional approaches are necessary to ensure that the recommended intake is met and sustained. These behavioral interventions primarily utilized the transtheoretical model, the social contextual model, social learning theory and the stages of change to influence behavior change. The interventions demonstrated statistically significant increases in consumption, although the improvements seen were

small and not adequate to meet the dietary guidelines (14). These reviews suggest motivation is a fundamental element of successful intervention.

Teaching Methods

A variety of teaching methods have been found to be effective in improving nutrition knowledge and inducing behavioral change in youth and adolescents when closely linked to the personal, cultural and social aspects of the intervention population. The CDC implemented *School Health Guidelines to Promote Healthy Eating and Physical Activity* based on current research and best practice (15). Thus, the CDC has outlined curricula guidelines that are effective in helping students improve eating habits according to theories of behavior change concluded from scientific research. These theories have the following characteristics as outlined (verbatim) in the CDC's *School Health Guidelines to Promote Healthy Eating and Physical Activity*:

- focus on clear health goals and specific behavioral outcomes
- be research-based and theory-driven
- address individual values and group norms that support health-enhancing behaviors
- focus on increasing the personal perception of risk and harmfulness of engaging in specific health risk behaviors as well as reinforcing protective factors
- address social pressures and influences
- build personal competence, social competence and increase confidence in skills
- provide functional health knowledge that is basic and accurate and directly contributes to health-promoting decisions and behaviors

- use strategies designed to personalize information and engage students
- provide age-appropriate and developmentally appropriate information, learning strategies, teaching methods and materials
- incorporate learning strategies, teaching methods and materials that are culturally inclusive
- provide adequate time for instruction and learning
- provide opportunities to reinforce skills and positive health behaviors
- provide opportunities to make positive connections with influential others

The CDC further outlines methods and strategies for classroom instruction that should encourage student participation in helping them develop the attitudes and skill necessary to implement change in their eating habits (15). Methods resulting in positive behavioral changes in both children and adolescents include interactive tools incorporating demonstration, modeling, rehearsal, feedback and goal setting (16). By middle school, health education should primarily focus on self-assessment and personal goal setting, (15-18) as students are capable of linking physical activity and healthy eating behaviors with positive health outcomes (18).

Nutrition Intake in Children and Adolescents

A 2005-2006 survey by the World Health Organization (WHO) revealed specific areas needing nutrition intervention in children and adolescents. *The Health Behaviors in School Aged Children (HBSC) 2005/2006 Survey* is the only national survey of its type to look at the health behaviors in children and early adolescents (19). Over 9,000 students in grades six through ten completed the survey, 22% of which were African American, in

order to provide a representative national sample. Various areas of physical, social and behavioral health were examined on an international level. The following reported findings are intended to show the areas that can be improved by nutrition intervention based on data pertaining to the surveyed US population only.

Fruit Intake

Low fruit consumption correlates with a diet that is low in fiber and high in fat and sodium. HBSC data report a national average of 20% of students consuming fruit more than once a day. Therefore the US national average for children consuming fruit once a day or less is at 80%. Low fruit and vegetable consumption as a component of poor dietary habits increases the risk in children and adolescents for long-term health problems.

Breakfast

The national average for reported daily breakfast consumption in the HBSC was 45%. Reported causes for skipping breakfast were influenced by both economic and lifestyle determinants such as household income, food security, number or parents in the household, and job of the female head of household (19-20). Skipping breakfast has been associated with poorer nutrition related behaviors throughout the day and limits school performance. HBSC data report that breakfast consumption decreases with age among children and adolescents (19).

Soft Drinks and Snacks

According the HBSC data, 36% of students surveyed reported consuming soft drinks every day. Soft drinks contribute to increased energy intake, primarily in the form of sugar, with no contribution to nutrient needs of these individuals. When data were analyzed by region, the south Atlantic region reported daily soft drink consumption above the national average at 41%. Likewise, 32% of US students reported daily consumption of chips or fries as snacks contributing to the low-fiber, high-fat, high-sodium diet associated with inadequate fruit consumption (19).

In analysis of NHANES data from 2005-2006, children and adolescents who consumed four or more snacks in a day consumed 50% more calories. More frequent snacking directly correlated with a greater proportion of the individual's daily calories coming from sugar although it had no effect on BMI for males or females. Based on this analysis, snacks provided 31% of total sugars and 27% of discretionary calories. The foods primarily consumed as snacks by this age group were all high fat and/or high sugar foods with minimal contribution to vitamin and mineral intake. Listed below are the five most highly consumed snack foods by food group, as classified by the USDA:

Grains- Chips, cookies, pizza, white breads/rolls, crackers

Vegetables- Potato chips, pizza, tomato salsa and ketchup, French fries, lettuce

Fruits- Apples, citrus juice, bananas, non-citrus juice, oranges

Milk- Fluid milk, cheese, ice cream, pizza, candy

Meat/beans- Nuts and nut butters, hotdogs and luncheon meats, fried chicken, candy with nuts, tuna

The primary foods consumed in each food group are calorie dense, low nutrient foods. While these snack patterns were not associated with higher BMIs, evidence does suggest that habits established in childhood continue throughout adulthood where health implications related to overweight and obesity will begin to persist (21).

Fast Food

Forty-five percent of students reported eating fast food at least once a week, which is also associated with a diet that tends to be higher in calories and fat and rarely contributes to the intake of fruits, vegetables and micronutrient dense foods. The south Atlantic region again reported averages higher than the national average at 50% (19).

Calcium Intake

Recent research has greatly emphasized the importance of adequate calcium intake in children and adolescents for the prevention of osteoporosis and fractures later in life (22-23). Although some studies have failed to demonstrate a significant association between calcium intake and bone mineral content (BMC) in children under the age of eleven, research suggests that a calcium intake of >1000 mg/day will increase total body BMC and bone mineral density (22). However, many studies that have examined calcium intake in adolescents have shown less than adequate intake in adolescent participants (17,24).

In analysis of 2005-2006 NHANES data, milk consumption was related to race/ethnicity suggesting that African Americans consume less milk than non-Hispanic whites and Mexican Americans. Milk consumption was not, however, related to income.

This analysis also found that milk consumption substantially impacted total daily nutrient intake providing significant amounts of vitamins A, D, riboflavin and B_{12}, along with the minerals calcium and phosphorus (25).

Healthy People 2020

Every ten years, the US Department of Health and Human Services establishes a 10-year agenda for improving the nations health by establishing goals and monitoring overall progress to promote "a society in which all people live long, healthy lives" (26). Objectives are based on modeling, trend projections and findings from current interventions. Where data is not available to project a specific outcome, a 10% improvement rate is typically implemented. These objectives represent necessary areas of improvement in the nations overall health. The following are a verbatim list of objectives pertaining to food and nutrient consumption as is pertinent to the proposed intervention:

NWS-14 Increase the contribution of fruits to the diets of the population aged 2 years and older

Target: 0.9-cup equivalents per 1,000 calories

NWS-15 Increase the contribution of vegetables to the diets of the population aged 2 years and older

Target: 1.1-cup equivalents per 1,000 calories

NWS-16 Increase the contribution of whole grains to the diets of the population aged 2 years and older

Target: 0.6-ounce equivalents per 1,000 calories

NWS-17 Reduce the consumption of calories from solid fats and added sugars in the population aged 2 years and older

Target: 29.8% of total calorie intake from solid fats and added sugar

NWS-18 Reduce consumption of saturated fat in the population aged 2 years and older

Target: 9.5% total calorie intake from saturated fat

NWS-19 Reduce consumption of sodium in the population aged 2 years and older

Target: 2,300 mg sodium per day

NWS-20 Increase consumption of calcium in the population aged 2 years and older

Target: 1,300 mg of calcium per day (26)

CHAPTER III.

Methods

Subjects

Children between the ages of 9 and 12 enrolled in the Thomasville Center of Hope Boys and Girls Club of Metro Atlanta (BGCMA) were invited to participate in the study. All children who were able to provide informed consent from a parent and/or guardian were included in the study. Participation was voluntary.

Procedures

This study was a pre/posttest quasi-experimental design that was approved by the Georgia State University Institutional Review Board. The intervention began in March of 2012. Two graduate students in the Georgia State University Division of Nutrition conducted the pre-assessment prior to initiation of the program intervention using a non-validated test adapted from the 4-H Healthy Lifestyles program (Appendix A) (27). Six, 45 minute long lessons were provided once a week for six non-consecutive weeks due to the operating schedule of the BGCMA. The test was given again as a post-assessment (Appendix A) on the same day as the last lesson in May of 2012. Attendance was taken at the beginning of each class and maintained by the student PI. The pre- and post-assessments were administered and graded by the student PI.

The educational material was developed based on the aforementioned areas of compromised nutrition in children and adolescents in the literature review, primarily focusing on the appropriate consumption of fruits, vegetables, calcium, breakfast, soft

drinks, snacks and fast food. A summary of the class topics and activities is shown in Figure 1. During the first session, two graduate students from Georgia State University were introduced as the teachers, the pre-assessment was administered and the participants were educated on what nutrition is and why eating healthy food is important. The participants were also instructed on how to make a plate based on the "MyPlate" model, which allowed them to review the five food groups and the composition of a balanced meal. The second class used educational activities to teach the participants how to estimate portion sizes while focusing on the importance of breakfast. This class incorporated how to measure portions (ie. using measuring cups and hand-models) and participants were introduced to the food label. The third session focused on fruits and vegetables and included a discussion of the nutrients associated with each color of produce and how fruits and vegetables could be incorporated into their daily meals/snacks. Participants were able to taste test a variety of fruits in various forms (fresh, canned, dried, and frozen) to educate them on ways to increase fruit and vegetable consumption. Healthy snack options were also discussed in class three. Class four focused on healthy drink choices and hydration. Participants were educated on the importance of drinking water and milk and reasons to limit sugary beverages. Increasing calcium intake and decreasing sugar intake were emphasized. Using food labels, participants compared the amount of sugar (in teaspoons) in a variety of common drinks and snack foods. Further, participants were challenged to try to incorporate dairy into their diet everyday and to consume three servings at least one day of the following week. The fifth class followed up with the previous class's challenge and elaborated on what had been taught about food labels in the previous classes. The teachers reviewed the

meaning of serving size and servings per container, as well as how to use the nutrition label information to choose healthy foods. The nutrients of particular interest were fiber, sodium, sugar and saturated fat. Participants practiced using food labels to identify healthy foods and foods that were "high" in a particular nutrient. The final class reviewed food safety, in regards to hand washing and allowed students to ask questions that had not yet been answered. At the end of the class the post-assessment was given. Each week the teachers reviewed the lesson taught the previous week with the primary emphasis of each review being food groups, serving sizes, MyPlate, and fruit and vegetable intake.

Data Analysis

Descriptive statistics were used to summarize the demographic data. The Chi-square test was used to evaluate the change in the number of correct answers on the pre- and posttest for each question. The data was reanalyzed after stratification by gender and number of classes missed (0-2 versus greater than 2 classes missed). The Wilcoxon signed rank was also used to evaluate the change in median number of correct answers on the pre- versus posttest for participants who attended 0-2 classes compared to participants who missed greater than 2 classes. The p-value was set at <0.05. All data analysis was conducted using SPSS (Version 18, SPSS, Inc; Chicago, IL).

Figure 1. Discussion Topics and Activities Included in the 6-weeks of Nutrition Curriculum

BGCMA Nutrition Curriculum		
	Discussion Topics	**Activities**
WEEK 1: Nutrition and Health	Introductions; what students already know about nutrition; why a nutritious diet is important	Pretest
WEEK 2: Portion Sizes & Breakfast	Portion sizes; why breakfast is important; healthy breakfast options	Cereal Pouring/Portion Sizes; Portion Sizes Bingo
WEEK 3: Fruits, Veggies & Snacks	What fruits and vegetables are; vitamins and minerals; the importance of variety	Fruit taste test
WEEK 4: Rethink Your Drink	Hydration; milk/calcium; limiting sugary beverages	Sugar activity
WEEK 5: Food Labels and Physical Activity	How to read a food label; importance of physical activity; what counts as physical activity	Reading food labels
WEEK 6: Food Safety	Importance of food safety; how to wash hands	Posttest

BGCMA – Boys and Girls Clubs of Metro Atlanta

CHAPTER IV.

Results

Subjects

Fifteen children (9 female) participated in the study. All subjects were African American and currently enrolled in the Boys and Girls Club of Metro Atlanta at the City of Hope in Atlanta, GA. All participants were between the ages of 9 and 12 with a mean age of 10.27 ± 1.1 years. One male and one female were lost to follow up and did not complete the posttest. A total of 9 children (4 female) attended 4 or more of the 6 classes offered (Figure 2).

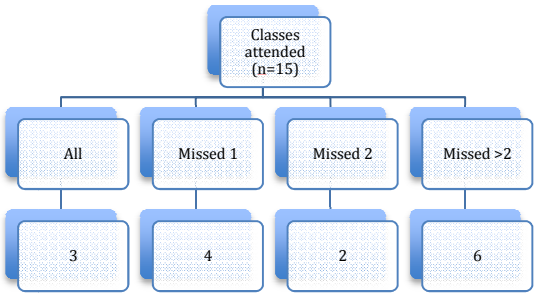

Figure 2. Subject Class Participation

Knowledge Gain

The number of correct answers selected on the pre- and posttest for each question is shown for the total cohort in Table 1. Significantly fewer participants answered question 6 (chocolate milk and soft drinks are about the same nutritionally) after the classes than before ($p = 0.003$). No significant differences for any of the other questions were observed. However, of the 15 questions asked, the percentage of students

selecting the correct answer after the classes was lower in 9 out of 15 (60%), higher in 5 out of 15 (33%) and the same for one question (7%).

The number of correct answers selected by participants for each question on the pre- and posttest after stratification by gender and number of classes missed are shown in Tables 2 and 3. The number of correct answers differed between the pre- and posttest for question 6 in boys only ($p=0.015$) as 78% of the males answered this question correct on the pretest compared to only 13% on the posttest. No consistent changes were seen in the percentage of correct answers on the pre- vs. posttest by gender. Of the 15 questions asked, the percentage of males selecting the correct answer after the classes was lower in 8 out of 15 (53%), higher in 6 out of 15 (40%) and the same for one question (7%). The percentage of females selecting the correct answer after the classes was lower in 8 out of 15 (53%), higher in 4 out of 15 (27%) and the same for three questions (20%).

No significant differences were observed when the data was stratified by the number of classes missed. Consistent changes were not seen in the percentage of correct answers on the pre- vs. posttest by number of classes missed. Of the 15 questions asked, the percentage of participants who missed 0-2 classes that selected the correct answer after the classes was lower in 6 out of 15 (40%), higher in 3 out of 15 (20%) and the same for six questions (40%). The percentage of participants who missed greater than two classes that selected the correct answer after the classes was lower in 8 out of 15 (53%), higher in 4 out of 15 (27%) and the same for three questions (20%).

The median number of correct answers selected (total score) by each subject on the pre- and posttests for the cohort and after subdivision by the number of classes missed is shown in Table 4. A significantly lower median score was observed on the pre- vs.

posttest (10 vs. 9, respectively; p=0.49). After stratification by the number of classes missed, no significant change in median score was seen.

Table 1. Number of Correct Answers Selected for each Question on the Pre- and Posttest by all Participants

	Correct Answers (%)		
Question	**Pretest (n=15)**	**Posttest (n=13)**	**P-value**
1	8 (53)	4 (31)	.276
2	15 (100)	13 (100)	---
3	14 (93)	13 (100)	1.000
4	15 (100)	11 (85)	0.206
5	10 (67)	8 (62)	1.000
6	11 (73)	2 (15)	**0.003**
7	7 (47)	5 (38)	0.718
8	3 (20)	3 (23)	1.000
9	5 (33)	5 (38)	1.000
10	13 (87)	7 (54)	0.096
11	12 (80)	10 (77)	1.000
12	8 (53)	9 (69)	0.460
13	10 (67)	7 (54)	0.700
14	13 (87)	10 (77)	0/639
15	11 (73)	10 (77)	1.000

Table 2. Number of Correct Answers Selected for each Question on the Pre- and Posttest by Gender

	Males			**Females**		
	Correct Answers (%)			**Correct Answers (%)**		
Question	**Pretest (N=9)**	**Posttest (N=8)**	**P-value**	**Pretest (N=6)**	**Posttest (N=5)**	**P-value**
1	2 (22)	1 (13)	1.000	6 (100)	3 (60)	1.000
2	9 (100)	8 (100)	---	6 (100)	5 (100)	---
3	8 (89)	8 (100)	1.000	6 (100)	5 (100)	---
4	9 (100)	6 (75)	0.206	6 (100)	5 (100)	---
5	6 (67)	6 (75)	1.000	4 (67)	2 (40)	0.567
6	7 (78)	1 (13)	**0.015**	4 (67)	1 (20)	0.242
7	4 (44)	2 (25)	0.620	3 (50)	3 (60)	1.000
8	1 (11)	3 (38)	0.294	2 (33)	0 (0)	0.455
9	3 (33)	3 (38)	1.000	2 (33)	2 (40)	1.000
10	7 (78)	5 (63)	0.620	6 (100)	2 (40)	0.061
11	7 (78)	7 (88)	1.000	5 (83)	3 (60)	0.545
12	5 (56)	4 (50)	1.000	3 (33)	5 (100)	0.182
13	5 (56)	3 (38)	0.637	5 (83)	4 (80)	1.000
14	7 (78)	7 (88)	1.000	6 (100)	3 (60)	0.182
15	6 (67)	5 (63)	1.000	5 (83)	5 (100)	1.000

Table 3. Number of Correct Answers Selected for each Question on the Pre- and Posttest by Number of Classes Missed

	Missed ≤ 2 Classes (N = 9)			**Missed >2 Classes (N= 6)**		
	Correct Answer (%)			**Correct Answer (%)**		
Question	**Pretest**	**Posttest**	**P-value**	**Pretest**	**Posttest**	**P-value**
1	6 (67)	3 (33)	0.347	2 (33)	1 (25)	1.000
2	9 (100)	9 (100)	---	6 (100)	4 (100)	---
3	8 (89)	1 (11)	1.000	6 (100)	4 (100)	---
4	9 (100)	7 (78)	0.471	6 (100)	4 (100)	---
5	4 (44)	6 (67)	0.637	6 (100)	2 (50)	0.133
6	6 (67)	1 (11)	0.050	5 (83)	1 (25)	0.190
7	6 (67)	4 (44)	0.637	1 (17)	1 (25)	1.000
8	2 (22)	2 (22)	1.000	1 (17)	1 (25)	1.000
9	4 (44)	5 (56)	1.00	1 (17)	0 (0)	1.000
10	8 (89)	6 (67)	0.576	5 (83)	1 (25)	0.190
11	8 (89)	8 (89)	1.000	4 (67)	2 (50)	1.000
12	6 (67)	7 (78)	1.000	2 (33)	2 (50)	1.000
13	5 (56)	5 (56)	1.000	5 (83)	2 (50)	0.500
14	7 (78)	7 (78)	1.000	6 (100)	3 (75)	0.400
15	7 (78)	7 (78)	1.000	4 (66)	3 (75)	1.000

Table 4. Median Pre- and Posttest Scores* for the Cohort and by Classes Missed

	N	Pretest Score	Posttest Score	P-Value
Total Cohort	15	10 (9.00, 12.00)	9 (7.50, 10.50)	**0.049**
Classes Missed				
0-2	9	10.00 (8.50, 12.50)	10.00 (8.50, 11.00)	0.121
>2	6	10.00 (8.75, 11.25)	7.50 (6.25, 9.50)	0.197

*Median number of correct answers (25%, 75%)

Lifestyle Changes

Based on responses to the behavioral change questions on the posttest the cohort reported that approximately 60% of the time they were more likely to make specific healthy lifestyle changes (Table 5). Participants reported that after the nutrition classes they were "more likely" to drink more water (66.7%) and eat a healthy breakfast daily (73.3%). Fewer participants noted that they were more likely to choose the regular size instead of the deluxe or biggie size and to spend less time watching TV, lying or sitting around (33.3% each).

Table 5. Self-Efficacy Report of Lifestyle Changes

Lifestyle questions assessing participants' likelihood to:	**Responses (%) (N=13)**		
	Less Likely	**Unsure**	**More Likely**
Drink more water	1 (6.7)	2 (13.3)	10 (66.7)
Eat a healthy breakfast daily	0	2 (13.3)	11 (73.3)
Eat 3 foods rich in calcium every day	1 (6.7)	4 (26.7)	8 (53.3)
Drink less sugary drinks	4 (26.7)	1 (6.7)	8 (53.3)
Choose the regular size instead of the deluxe or super size	3 (20)	5 (33.3)	5 (33.3)
Spend less time watching TV and sitting/lying around	4 (26.7)	4 (26.7)	5 (33.3)
Total	13 (16.7)	18 (23.1)	47 (60.3)

CHAPTER V.

Discussion

Overweight and obesity related diseases are on the rise in youth in the United States (1-2, 9-10). Likewise, children and adolescents are not meeting the dietary guidelines, which suggests the need for nutrition intervention (17,19–25). However, research is inconsistent in understanding the effects of nutrition education on urban youth (3). Thus, this study aimed to determine the efficacy of a nutrition education component of the BGCMA afterschool program in developing healthy, knowledge based habits in urban children.

The intervention did not have any statistically significant effect on knowledge gain of urban youth participating in the BGCMA afterschool program. With the exception of question number 6, no significant changes were seen in the pre- versus posttest analysis of the entire intervention population or when the data was stratified by gender or number of classes missed (0-2 versus greater than 2 class missed). However, participants answered question 6 correctly on the pretest more often than the posttest suggesting that no positive change was made. The results in fact suggest that participants answered more questions incorrect on the posttest, which may be attributed to a number of study limitations including uncontrolled testing conditions and the student's interaction with each other. Though not validated for this intervention, the pre- and post-assessments were age appropriate, specifically designed for this age demographic.

A significant change ($p < 0.05$) was seen in the comparison of median number of correct answers on the pre- versus posttest for the total cohort. This change indicated that participants answered more questions correctly on the pretest compared to the posttest suggesting no benefit from the intervention. Further, when stratified by the number of classes missed, no change was seen in the median number of correct answers for either group. These results propose that short-term, supplemental nutrition education alone is not effective in increasing the nutrition knowledge of urban youth.

Behavioral Interventions

The majority of previously published interventions provided a minimum of 12 hours of nutrition education over the span of 8 weeks to 21 months. Those interventions that proved effective in changing behaviors of students covered a variety of topics over this time span but only saw changes in a limited number of related behaviors (4-5, 14). Although there was no evaluation of actual behavior change in this study via food records, food frequency questionnaires, etc., similar results were seen in the students' proposed behavior change. The frequency analysis of students' responses to questions regarding the likelihood they will change their behavior as a result of the intervention suggests that the majority of students are willing to make some, though not all, of the surveyed changes concerning their nutrition related health. The majority of responses suggested students would be willing to change their behavior; however, some responses suggested that students were less likely to make changes in their behavior after the intervention. These mixed results in alignment with previous literature suggest the need for further research in the influence of nutrition education on behavior change in urban

youth. Therefore, the results of this study do not support the hypothesis that 6 hours of nutrition education is sufficient to significantly change knowledge and behaviors of urban middle school children.

Fahlam, et al. saw positive knowledge gain and behavior change in a pilot study implementing the Michigan Model (MM), a one-month intervention. This intervention trained health teachers in state middle schools in the intervention curriculum and thus trained professionals taught the course. The MM was similar in length to this intervention providing between 8 and 10 hours of nutrition education. However, the researchers found significant changes in fruit, vegetable and "other" consumption through the assessment of self-reported measures of eating behavior suggesting that minimal nutrition education provided in school can be beneficial in changing knowledge and behaviors of youth (5).

Research suggests that interventions focused on behavior change, rather than knowledge only, have better outcomes (13). However, the HEALTHY study from Siega-Riz et al, examined the effects of a 5-semester health education intervention focused on behavior change and evaluated by student self-reported dietary intakes. This study integrated "nutrition, physical education, behavior change, and social marketing based communications" and saw limited changes, only increasing self-reported fruit and water intake (4).

The current study aligns with the review published in the Journal of the American Dietetic Association (JADA) in 2011, which suggests that behavioral intervention alone is not enough to sustain changes in dietary intake. The review, which solely looked at fruit and vegetable intake, suggested that other approaches be incorporated with

behavioral interventions for sustaining intake at recommended levels. The review suggested combining social marketing and technology-based models of change along with behavioral economics approaches (14). The JADA review along with a review of nutrition interventions from Contento et al. both suggest that motivation of the individual is a determinant of successfully making dietary changes (13,14). The current study did not assess individual's motivation and may have been limited by not addressing the stages of change. Future studies assessing nutrition education should incorporate various behavioral models as previously suggested.

Changes in Intake

Participants in the current study reported increased likelihood that they will change their behaviors as a result of the nutrition education intervention. As reported in the HBSC, over half of the nation regularly skips breakfast, which has been associated with poorer nutrition related behaviors throughout the day (19). The intervention incorporated a lesson on the importance of consuming a healthy breakfast and taught students components of a healthy breakfast based on the MyPlate guidelines, as seen in Figure 1. The majority (73.3%) of participants who completed the post-assessment reported that they were more likely to eat a healthy breakfast after the intervention classes.

Calcium intake has been reported as less than adequate in adolescent populations and in African Americans as a whole (17, 24-25). Students learned the importance of calcium in bone health during the fourth class and were challenged to consume at least one dairy product every day with the goal of consuming three on at least one day of the

week. Students were excited to come back and report their increased intake. Further, 53.3% of the students suggested they would be more likely to eat 3 foods rich in calcium every day as a result of the intervention as evidenced by the post-assessment. Students who willingly consume 3 servings of calcium rich foods per day would meet the Health People 2020 target of 1,300 mg of calcium in populations ages 2 and up (26).

The national average of daily soda consumption in students based on the HBSC was 35%; however, the South Atlantic region surpassed the national average with 41% of students consuming soda daily (19). After the intervention, students did not report an increased likelihood of drinking less sugary drinks such as sweet tea and soda. Alterations should be made to lesson 4 of the nutrition intervention to emphasize the importance of decreasing sugary beverage consumption. Conversely, 66.7% of students reported they would likely increase their water intake as a result of the intervention, which may inadvertently decrease the consumption of sugary beverages. This too aligns with the Healthy People 2020 guidelines, which aim to decrease the consumption of solid fats and added sugars to 29.8% of total calories in populations ages 2 and up (26).

A large contributor of solid fats as addressed by the Healthy People 2020 guidelines is fast food. 45% of students reported consuming fast food at least once a week as reported by the HBSC. The South Atlantic region again ranked higher than the national average as 50% of students in the region reported weekly consumption (19). Though frequency of consumption was not addressed, participants reported the likelihood that they would choose the regular size when ordering at a fast food restaurant, rather than the deluxe or super size. However, the class as a whole was not more likely to reduce the size of their fast food meals.

Limitations

When researchers wrote the original curriculum, the expectation was that the intervention would provide 8-10 hours of nutrition education based on the positive results of the pilot study using the MM curriculum by Fahlam et al. However, the six classes only totaled 4.5 hours. Other studies that taught an overview of multiple nutrition topics did not define the amount of time spent on each lesson or the lessons total (4–5, 14). The time also failed to meet the recommended number of hours from previous short-term interventions. The original curriculum was written for 8-10 hours of nutrition education. With the limitation on time it is possible that too many topics were covered with not enough time spent on each topic, which was further limited by the excessive disruption.

The study design presented a number of limitations such as the small sample size and lack of control group. This study is now being viewed a pilot because of the number of students excluded from the analysis due to unexpected absences. Some students were working together to complete the pre- and post-assessments thus inadequately assessing individual knowledge. This can primarily be attributed to a lack of monitoring and discipline within the teaching environment. This type of intervention would also be more effectively evaluated if comparing an intervention population to a control population in a randomized control trial where the control group was not provided nutrition education in the active learning environment. Further, the survey instrument, including the pre/posttest along with the self efficacy survey, provided another limitation to the design as it was not a validated instrument and was designed for a specific, and extensive, 4H curriculum.

The poor learning environment may have altered the knowledge outcomes and the authenticity of the assessments. The disruptive learning environment may have affected knowledge outcomes by inhibiting students from learning at their fullest potential due to the many distractions. Distractions included but were not limited to students entering and leaving the classroom throughout class, fights between students, fire drills, shouting, and other disruptive behavior.

The limitations of this study suggest that in the afterschool setting, the children may be more successful with a familiar teacher trained in the nutrition curriculum in contrast to a nutrition professional without proper training in teaching or afterschool programs. The participants in this investigation were better behaved and more attentive when BGCMA staff was present thus suggesting that future interventions should consider training staff of the afterschool centers in the basic nutrition curriculum rather than bringing in guest teachers not trained in classroom management. In addition, validating an assessment tool for the six-week program would provide a more accurate assessment of nutrition knowledge gained from the curriculum. The testing environment should be altered to isolate children when the pre- and post-assessment are administered or enforce the presence of center staff specifically during the testing time.

Conclusions

Previous research along with the results of this study suggest that further research is necessary to understand how to effectively change health related knowledge and behaviors of urban middle school youth. This study supports previous evidence that suggests that well-designed school-based interventions may be the most effective method

to develop positive nutrition related knowledge and behavior changes in youth. Short-term supplemental nutrition education alone in the afterschool setting does not appear to be an effective method of teaching urban youth.

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APPENDIX A

PRE AND POST-TEST

EAT WELL
4-H HEALTHY LIFESTYLES
Pretest

You should wash your hands with cold running water and soap for at least 20 seconds.	TRUE	FALSE
Weight-bearing exercises, like walking or running, can help build and keep bones healthy.	TRUE	FALSE
People do not need to worry about getting enough calcium in their diets until after age 50.	TRUE	FALSE
Orange and green leafy vegetables are good for keeping your eyes and skin healthy.	TRUE	FALSE
Walking 2000 steps is equal to approximately 1 mile.	TRUE	FALSE
Chocolate milk and soft drinks are about the same nutritionally.	TRUE	FALSE
A cup of chocolate milk has the same amount of calcium as a cup of plain milk.	TRUE	FALSE
Four cups of water a day is enough to keep healthy.	TRUE	FALSE
A 12-ounce soda contains about 5 teaspoons of sugar.	TRUE	FALSE
If you eat more food (calories) than your body needs, the extra calories get stored as body fat.	TRUE	FALSE
A small order of French fries is considered a healthy snack.	TRUE	FALSE
One serving of meat is about the size of a deck of cards.	TRUE	FALSE
Drinking orange juice is better for you than eating an orange.	TRUE	FALSE
It is recommended that you should be physically active throughout the day enough to add up to 60 minutes, most days of the week.	TRUE	FALSE
It is okay to skip breakfast if you are going to eat a big lunch.	TRUE	FALSE

EAT WELL
4-H HEALTHY LIFESTYLES
Posttest

You should wash your hands with cold running water and soap for at least 20 seconds.	TRUE	FALSE
Weight-bearing exercises, like walking or running, can help build and keep bones healthy.	TRUE	FALSE
People do not need to worry about getting enough calcium in their diets until after age 50.	TRUE	FALSE
Orange and green leafy vegetables are good for keeping your eyes and skin healthy.	TRUE	FALSE
Walking 2000 steps is equal to approximately 1 mile.	TRUE	FALSE
Chocolate milk and soft drinks are about the same nutritionally.	TRUE	FALSE
A cup of chocolate milk has the same amount of calcium as a cup of plain milk.	TRUE	FALSE
Four cups of water a day is enough to keep healthy.	TRUE	FALSE
A 12-ounce soda contains about 5 teaspoons of sugar.	TRUE	FALSE
If you eat more food (calories) than your body needs, the extra calories get stored as body fat.	TRUE	FALSE
A small order of French fries is considered a healthy snack.	TRUE	FALSE
One serving of meat is about the size of a deck of cards.	TRUE	FALSE
Drinking orange juice is better for you than eating an orange.	TRUE	FALSE
It is recommended that you should be physically active throughout the day enough to add up to 60 minutes, most days of the week.	TRUE	FALSE
It is okay to skip breakfast if you are going to eat a big lunch.	TRUE	FALSE

Because of your nutrition education here at the Boys and Girls Club of Metro Atlanta, how likely are you to:

Drink more water.	Less Likely	Unsure	More Likely
Eat a health breakfast daily.	Less Likely	Unsure	More Likely
Eat three foods rich in calcium daily.	Less Likely	Unsure	More Likely
Drink less sugary drinks like sweet tea and soda.	Less Likely	Unsure	More Likely
Chose the regular size instead of the deluxe or super size.	Less Likely	Unsure	More Likely
Spend less time watching TV, and sitting and lying around.	Less Likely	Unsure	More Likely