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EFFECT OF NUTRITION EDUCATION ON DIETARY BEHAVIORS IN
ELEMENTARY SCHOOL-AGED CHILDREN

by

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A Thesis

Submitted in Partial Fulfillment of the

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Abstract

In this study, the effect of a multicomponent nutrition education program on dietary behaviors in elementary school-aged children was analyzed. Components involved were cooking, gardening, and general nutrition. Research questions were: 'Does nutrition education over a one-week program increase consumption of fruits and vegetables?', and 'Does nutrition education over a one-week program increase acceptance of novel foods?'. The hypothesis was: nutrition education administered in a one-week program will increase consumption of fruits and vegetables, as well as increase willingness to try new foods. Data collection used repeated measures of two surveys: the Fruit-Vegetable-Fiber Screener, and Food Neophobia Scale. Ten participants were enrolled, two were lost to follow up. A Paired T-test and Wilcoxon Signed Ranks Test found one question on each survey achieved statistical significance ($p \leq 0.05$); each question was directly related to Camp CHEF curricula. In conclusion, nutrition education in a summer camp setting has the potential to improve children's diets.

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Background

Camp CHEF (Cultivating Healthy Eaters for the Future) is an initiative conducted by the University of Memphis School of Health Studies each summer. This study is focused on the program conducted during summer of 2018. During camp sessions, elementary school-aged children were taught basics of nutrition knowledge, where food comes from through gardening lessons, and instruction was also provided on food preparation. The days children attended camp were assigned colors, with Monday highlighting red foods, Tuesday for orange/yellow foods, Wednesday for green foods, and Thursday for blue/purple foods.

Activities were structured around lessons learned throughout the week to maintain a level of engagement with the children which would be more difficult to attain through verbal teaching alone. The intent of this study is to analyze the effect that nutrition education administered over a one week setting had on dietary behaviors involving fruit and vegetable intake, as well as the trait of food neophobia.

Literature Review

Introduction

Forming healthy dietary behaviors early in life is an effective way to prevent or reduce complications connected with overweight and obesity.¹ Prevalence of overweight and obesity is on the rise in recent years, with one third of youth meeting criteria for overweight and 17.3% of children classified as obese.¹⁻⁴ Weight status for children is determined using Centers for Disease Control (CDC) growth charts, and children that fall between the 85th to 95th percentile of Body Mass Index (BMI) for age are classified as overweight; whereas children classified at the 95th percentile or above are considered obese.¹ There is evidence linking childhood obesity to an increased risk of chronic

illnesses such as non-insulin dependent diabetes mellitus and cardiovascular disease, as well as a decrease in quality of life.^{1,2}

School-Based Interventions

With the amount of time that children spend in school, School-Based Interventions (SBI) can be an effective way of shaping behaviors for the better.⁴ There is evidence that 60% of students participate in the National School Lunch Program, which is a program that provides students with lunches that meet nutrition standards aligned with the 2010 Healthy and Hunger-Free Kids Act.² The most comprehensive, and often the most successful programs, have multiple components and involve parental participation.^{1,4-7} Areas to target in a multicomponent program include domains such as: physical, cultural, social, and health education environments.⁷ As such, targets for a multicomponent intervention can include the classroom, school cafeteria, school administration, a garden, and the family.⁵

Benefits from SBI can include weight management, reduced risk of chronic disease, lower cholesterol, as well as improvements in bone, joint, and eye health, and the overall improvement in quality of life in the United States.³ Involving teachers in SBI is one way to improve outcomes.¹ This is done by empowering educators to teach nutrition and health topics in the classroom.¹

Working with teachers to develop a curriculum, and providing teachers with resources which can be used to teach these topics is one way to accomplish this objective.^{1,7} It has been shown that educators serving populations at lower socioeconomic statuses spent the least amount of time teaching nutrition, which makes these classrooms a priority for this component of an intervention to ensure these children are exposed to

nutrition education.¹ Focus of these curricula should encompass positive healthy changes over time rather than strict avoidance of certain foods.⁸

Health Disparities

According to the ‘Tennessee State Nutrition, Physical Activity, and Obesity Profile’, obesity is a growing problem in Tennessee with obesity rates rising from childhood to adolescence and from adolescence to adulthood.⁹ As of 2016, rates for overweight are 15.2% for childhood (reported from children enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children – WIC), 15.4% for adolescence, and 35.9% for adulthood.⁹ Included in the same report, rates of obesity as of 2016 were: 15.3% for childhood (reported from WIC), 16.9% for adolescence, and 31.2% for adults.⁹

Regarding chronic diseases mentioned in this paper, the death rates for all ages in Tennessee are 204.1/100k for cardiovascular disease, and 24.8/100k for diabetes.¹⁰ Deaths attributed to these diseases are often referred to as preventable deaths, and by starting children early with healthy habits there is a potential for reducing the risk of chronic diseases.⁷

Current Intake of Fruits and Vegetables in Children

In present times, more than two out of three adults that do not exceed two servings of either fruit or vegetables daily, and more than one third of adults have no leisure-time physical activity.⁸ This is evidence which suggests a high need for nutrition education. Children who learn healthy habits early can be expected to retain some of the healthy habits while growing into adulthood, and children who are not given proper nutrition education can grow to become these aforementioned-adults.⁸

A great way to increase exposure and acceptance of new foods is to get children involved with cooking at home.¹¹ When children are involved in the cooking process, children are often more likely to try novel foods including foods containing vegetables.¹² A novel food is any food that is new or unfamiliar to the child. In adults, there is a positive correlation between cooking skills and balanced food choices.¹² In a study conducted in Taiwan, cooking frequency was shown to have an inverse relationship with mortality.¹² Family meals are also a good opportunity to increase consumption of fruits and vegetables.^{11,12} Children have been shown to increase consumption with increased exposure to foods, and it stands to reason that higher exposure may lead to a greater chance of the child meeting recommended daily intakes for fruits and vegetables.^{8,13}

Under-consumption of vegetables is common in American children¹⁴ with average vegetable intakes of 1.2 and 1.1 cups per day for males and females respectively.⁵ Depending on caloric requirements, current recommendations from the “Dietary Guidelines for Healthy Americans 2015-2020”, for fruit consumption is to consume at least 1.5 cups per day, and recommendations for vegetables range from 1.5 to 2 cups per day.¹⁵ This was established based on caloric requirements per age, with a sedentary activity factor.¹⁵ Fruit and vegetable consumption provides a benefit to the children as well as the school in the form of improved cognition and academic performance.¹

Installing a salad bar in the cafeteria stocked with fresh fruits and vegetables is one way to increase availability of these foods to children.⁵ The salad bar can even be stocked specifically with foods children learn about in the classroom, and classroom discussion increases familiarity with these foods so children will be more receptive to

trying these foods.^{5,13} Every meal can be a chance to reinforce the habit of consuming fruits and vegetables², and school lunch provides a valuable opportunity to reinforce this habit.

Effect of Fruit/Vegetable Intake on Health Risks

The “western diet” American children often consume is high in fat and kilocalories, yet low in fiber; which is associated with an increased risk of obesity and chronic diseases.¹¹ Children whose diets contained a higher vegetable intake were found to have a lower BMI.¹¹ Popular culture acknowledges that fruits and vegetables are ‘good for you’, but not everyone knows why. Fruits and vegetables are foods which are relatively low in kilocalories, relatively high in fiber, and provide a variety of vitamins and minerals. Changing behaviors to consume a diet higher in fruits and vegetables has specifically shown a decrease in cardiovascular disease, as well as decreased risk of metabolic syndrome.⁷ Other potential benefits which may be connected to an increased consumption of fruits and vegetables include improved weight management, lower cholesterol, increased health for bones, joints, and eyes, as well as an improvement in quality of life.³

Barriers to Fruit/Vegetable Consumption

‘Food Neophobia’ is considered a “reluctance to eat novel foods” – Alliot X, da Quinta N, Chokupermal K, Urdaneta E.¹² Food neophobia is common in food items such as citrus fruits or cabbage, with an emphasis on bitter flavors triggering neophobia.¹⁶ Children with strong neophobic tendencies towards fruits and vegetables are more likely to consume a less varied diet¹²; inversely, children with low levels of food neophobia tend to have a diet with more variety and higher consumption of fruits and vegetables.¹⁷

Neophobic tendencies tend to increase after two years of age, and usually resolve during adolescence and adulthood¹⁶; however, adults with neophobic tendencies have been shown to also avoid fruits and vegetables¹⁷. Food neophobia affects food preferences as well as the development of positive eating habits.¹⁶ It can be managed through repeated positive exposures with novel foods^{12,16}, as well as involving children in family meal preparation¹².

Food insecurity, defined as “lacking access to food for an active, healthy life” – Holben D, Taylor C. is another barrier diminishing consumption of fruits and vegetables in 19.5% of American households¹⁸. Individuals whose childhood was impacted by food insecurity have been found to have a higher incidence of overweight/obesity and a less varied diet.¹⁸ The best preventive measures against this etiology of obesity is to ensure access to foods which are not only rich in fiber and micronutrients, but are also desirable for the individual and relevant to the cultural background of the family.¹⁸ This is an area where further research can explore the effect of community nutrition programs on childhood development and adulthood outcomes.

Additional Resources for School-Based Interventions

The implementation of SBIs requires pre-intervention as well as post-intervention assessment.⁵ This can be measured using surveys, Food Frequency Questionnaires (FFQs), and nutrition knowledge questionnaires.^{5,6,13} It is recommended for parents to fill out FFQs, but only to report foods the parents observed their child consume.⁶ Healthy People 2020 goals include increasing consumption of fruits, vegetables, and whole grains, and these are important items to assess in a FFQ.^{6,8}

When posing surveys to children, it is found to be beneficial if the researcher reads the questions aloud.¹³ The use of food models or pictures when asking about specific foods was also beneficial for the children.¹³ Supplemental materials for SBIs include computer generated surveys and games intended to assess and improve nutrition related knowledge.¹³

Summary

Obesity is a growing problem for American children¹⁻⁴, and multicomponent SBIs have the potential to prevent or reduce prevalence of overweight and obesity.⁵⁻⁷ Potential SBI benefits include increased cognitive and academic performance¹, as well as improvements in weight management, reduced risk of chronic disease, lower cholesterol, improved bone, joint, and eye health, and the overall improvement in quality of life.³ Camp CHEF is designed similar to a school-based setting, with basic nutrition education set up lecture style and activities throughout the day to reinforce concepts learned. Families, teachers, as well as registered dietitian nutritionists are all key members of the intervention team.^{1,5,7,8} The purpose of this study is to increase consumption of fruits and vegetables, as well as to increase acceptability of novel foods.

From this literature review, it is concluded that improving nutrition related knowledge can help achieve these desired outcomes.^{6,8} Consumption of fruits and vegetables is best assessed by distributing a nutrition screening for parents to fill out, as well as surveys and questionnaires for children to measure willingness to try new foods.

5,6,13

Research Question and Hypothesis

The research questions that this study was designed to answer are: ‘Does nutrition education over a one-week program increase consumption of fruits and vegetables?’, and ‘Does nutrition education over a one-week program increase acceptance of novel foods?’. Based upon the results of the literature review, the hypothesis formed is that nutrition education administered in a one-week program will increase consumption of fruits and vegetables, as well as increase willingness to try new foods.

Methodology

Study Participants

Participants for this study were enrolled through the Camp CHEF program at The University of Memphis. Camp CHEF was designed to enroll 20 participants each week, between the ages of seven to eleven years old. There were two one-week sessions. Children enrolled in Camp CHEF spent their day in small groups of five students, with one team captain leading each group.

Camp CHEF Curriculum

Team Captains supervised their group of students throughout the day, and Captains were responsible for leading the nutrition education portion of the program, titled “Eat the Rainbow”. Team Captains were Clinical Nutrition graduate students in their third semester. On each day, the team captain would review fruits and vegetables that were the same as the color of the day; as an example: Apples for Monday (red), Bananas for Tuesday (yellow), Kiwi for Wednesday (green), and Blueberries for Thursday (blue). The Team Captains then briefly reviewed the vitamins commonly

associated with fruits and vegetables of these colors, and the health benefits of these vitamins. This lesson plan of “Eat the Rainbow” was designed to introduce children to fruits and vegetables with an emphasis on different colors for each day of the week. Cooking activities were tailored to the daily color, which included lunch as well as at least one snack prepared by the children participating in Camp CHEF.

In the food preparation piece of Camp CHEF, foods discussed in the lessons were incorporated into snacks and meals. Some examples of recipes used are ‘Pesto Pasta Sauce’, and ‘TropiKale Smoothie’, both of which were designed for Wednesday. Children were supervised by their Team Captains during food preparation times and worked together with the other children in their groups to complete the recipes.

The gardening piece of Camp CHEF was coordinated by the garden staff at the University of Memphis, and in this course the children were outdoors for a minimum of one hour every day. On Monday, the children were taught about sustainable practices, as well as being introduced to the urban garden at the University of Memphis. On Tuesday, the children were taught how to identify different plants in a garden. The curriculum on Wednesday focused on how to grow plants in a garden, and what plants need to grow. Thursday was focused on the importance of pollinators for plant life. On Friday there was a field day that the children prepared recipes for a picnic and got to record themselves demonstrating a recipe as a ‘cooking show’, with the task to utilize featured ingredients in a recipe the groups created.

IRB Approval

Participants in this study were children, which are a potentially vulnerable population according to the Institutional Review Board (IRB). Parental consent forms and informed assent forms were sent to Parents/Caregivers after children were enrolled in Camp CHEF. Before recruitment, the research proposal was submitted to the IRB for approval.

Data Collection

To test the hypothesis that nutrition education would increase not only fruit and vegetable consumption, but also acceptance of novel foods, the primary tools used were questionnaires. The Block Fruit-Vegetable-Fiber Screener was used to measure the first objective, to increase consumption of fruits and vegetables (see Appendix A). This screener included the most popular sources of these food groups in the American diet.¹⁹ This screener has been shown to be reliable for estimation of fruit and vegetable intake when measured against full length food frequency questionnaires, with a correlation coefficient from a previous study of $r = 0.71$.¹⁹ Another strength of this screener is reliability in multiple races, which has been reported in a previous study to be statistically significant, reporting p values of 0.01.¹⁹ One weakness associated with this screener is that the screener was originally designed for an adult population; however, because the estimation of servings does not use age as a factor this screener can be used to measure intakes in pediatrics.

The Food Neophobia Scale (FNS), developed by Pliner & Hobden, was used to measure acceptability of novel foods.²⁰ The FNS is a ten-question survey in which respondents reported their answers to each question on a likert-like seven-point scale

ranging from “strongly disagree” to “strongly agree”, one to seven respectively (see Appendix B).²⁰ The FNS has been proven reliable with $\alpha = 0.8$ to 0.91 , and has been used successfully in adults as well as children as young as seven years old.²¹ Questions two, four, five, six, and eight had an inverse scoring, in which if the participant indicated a seven the question would be scored as a one (see Appendix B).²¹

These questionnaires were completed by parents of children attending Camp CHEF twice. The nutrition screening measured the month before camp and the month after camp. One month after conclusion of camp, both questionnaires were sent again to assess for any possible changes that may have occurred.

Statistical Analysis

As the outcome data collected in this study was repeated measures data on the same 10 participants, a Paired T-test was used to test for a statistically significant difference between these two data sets using the same grouping of participants.²² The Paired T-test is able to detect differences by finding the difference of means between two samples, and dividing by the standard error of the difference between means.²² The results from the FNS met the assumptions of the Paired T-test, in that the responses were normally distributed, on a ratio scale, samples were independent, and there were no outliers.

The responses to the Fruit-Vegetable-Fiber screener did not meet the assumption of normality to use a Paired T-Test, so the Wilcoxon Signed Ranks Test was used, which is a non-parametric test similar to a Paired T-test.²² In the initial survey (pre-camp) the responses for fruit juice, vegetable juice, and green salad were positively skewed. In the initial survey, the responses for frequency of fruit, potatoes, other vegetables, beans, and

dark bread were negatively skewed. In the post-camp survey, the responses for vegetable soup, fiber cereal, and the calculated estimated servings were positively skewed. In the post-camp survey, the responses for beans were negatively skewed.

Another statistical test that was used is Cohen's D to determine the effect size of the nutrition education.²² By definition, effect sizes < 0.2 are considered small, between 0.2 and 0.75 are considered moderate effect sizes, and > 0.75 is considered a large effect size, which is reported in standard deviation units.²² This helps to determine the practical significance of data found. All statistical tests will be performed using IBM SPSS Statistics 25.

Results

Two surveys were administered to measure outcome data. Ten participants were recruited for the study initially, and two were lost to follow up. Participants were between the ages of seven to eleven years old, eight were female and two were male. The first survey to be analyzed is the Block Fruit-Vegetable-Fiber Screener, which estimated intakes of fruits, vegetables, fiber cereals, beans, and dark bread. The second survey to be analyzed is the Food Neophobia Scale, which measures one's willingness to try new foods.²⁰

In Table 1 (see page 13), the results of the Fruit-Vegetable-Fiber screener are reported. The pre-assessment means were compared to the post assessment means for the Fruit-Vegetable-Fiber Screener, by means of the Wilcoxon Signed Ranks Test and Cohen's D for effect size. Numbers were based on mean scores from the nutrition screener; consumption is reported based on the following scale: a score of 0 is equivalent to less than once weekly, a score of 1 is equivalent to once weekly, a score of 2 is

equivalent to 2-3 times weekly, a score of 3 is equivalent to 4-6 times weekly, a score of 4 is equivalent to once a day, and a score of 5 is equivalent to 2+ servings per day. There was a significant increase observed in the estimated servings of fruits and vegetables per day ($p=0.42$, $d=1.13$). In figure 1 (see page 14) values are reported for mean servings per day of each category in the nutrition screening.

In Table 2 (see page 15), the results of the Food Neophobia Scale are reported. This is a likert-scale ranging from one to seven, with higher numbers indicating a higher level of food neophobia. There was a significant difference in question three ($p=0.04$, $d=0.82$) (see Appendix B). The total mean score showed a difference of -2.875, which shows decreased food neophobia overall; however, this did not achieve statistical significance ($p=0.586$). Mean of survey responses are reported in Figure 2 (page 16).

Table 1: Results from the Fruit-Vegetable-Fiber Screener administered to 10 parents of children enrolled in nutrition education provided in a summer-camp setting.

N=8	Wilcoxon Signed Rank Test <i>p</i>-Value	Cohen's D
Fruit Juice	0.114	1.06
Fresh/Canned Fruit	0.180	0.46
Vegetable Juice	0.180	0.50
Green Salad	0.098	0.64
Potatoes, any kind	0.705	0.14
Vegetable Soup	0.096	0.75
Other Vegetables	0.066	0.97
Fiber Cereals	0.257	0.45
Beans	0.783	0.13
Dark Bread	0.593	0.17
Estimated Daily Servings		
Fruit / Vegetables	0.042***	1.13

***denotes statistical significance ($p \leq 0.05$)

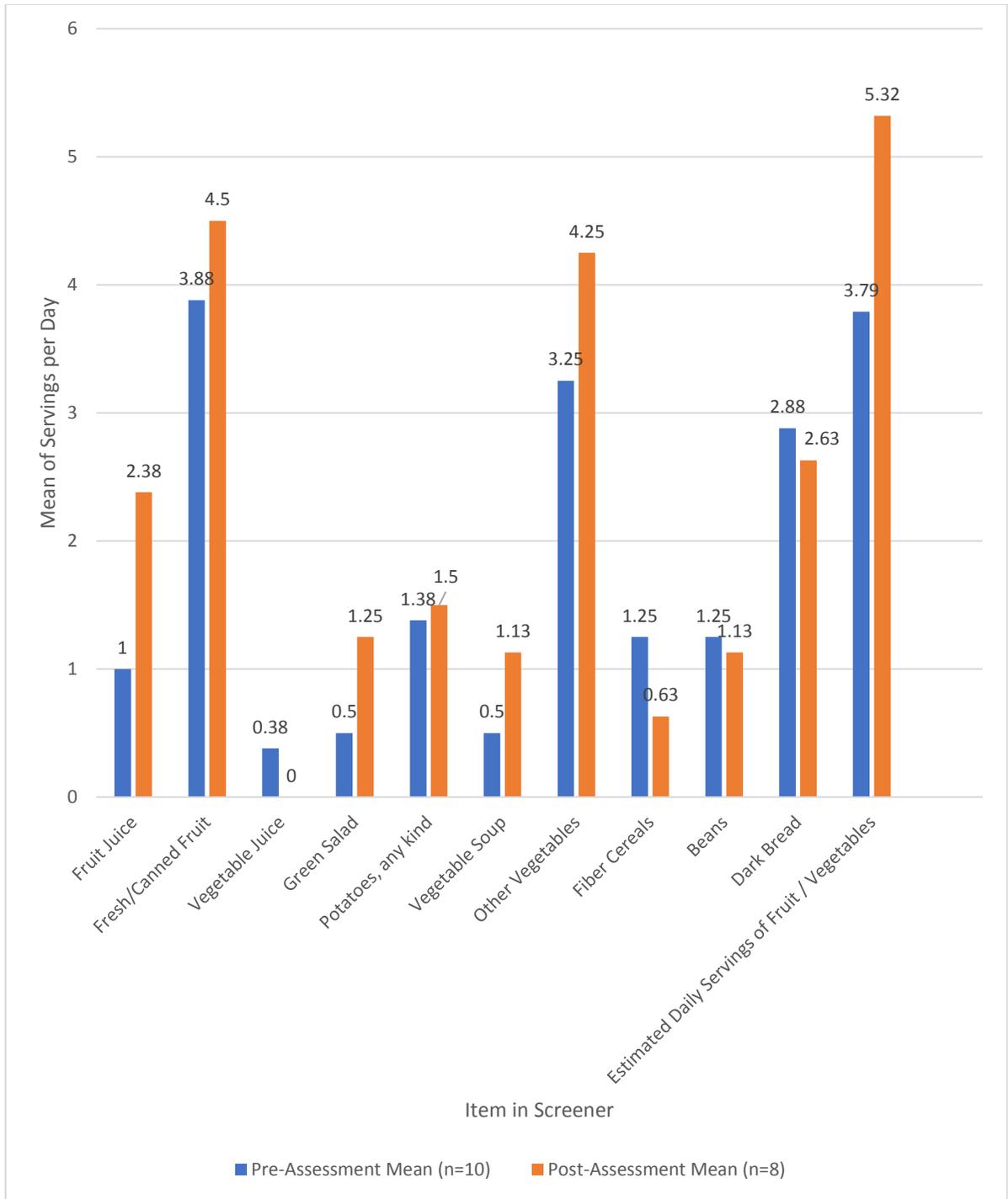


Figure 1: Pre vs. Post responses to the Fruit-Vegetable-Fiber Screener administered to parents of 10 children enrolled in nutrition education provided in a summer-camp setting

Table 2: Statistical analysis of the Food Neophobia Scale administered to 10 parents of children enrolled in nutrition education provided in a summer-camp setting

N=8	Paired T-Test <i>p</i> Value	Cohen's D
Question 1	0.718	0.18
Question 2	0.809	0.12
Question 3	0.04***	0.82
Question 4	0.265	0.48
Question 5	1	0
Question 6	1	0
Question 7	0.24	0.46
Question 8	0.121	0.64
Question 9	0.85	0.06
Question 10	0.155	0.63
Total (mean)	0.586	0.29

*** denotes statistical significance ($p \leq 0.05$).

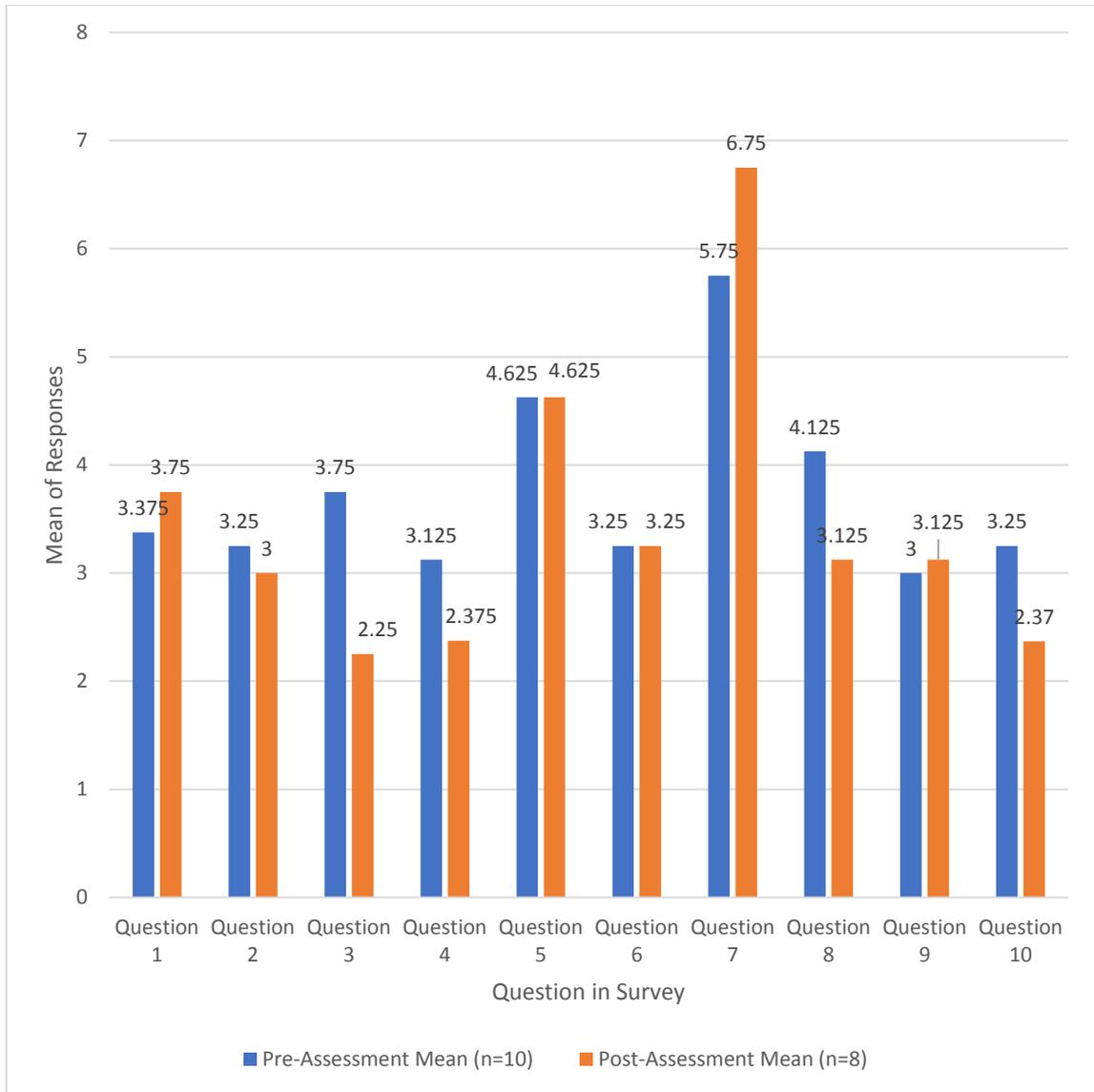


Figure 2: Pre vs. Post Assessment of the Food Neophobia Scale administered to parents of 10 children enrolled in nutrition education provided in a summer-camp setting

Discussion

This study analyzes the effect of nutrition education over a one-week summer camp setting on dietary behaviors in elementary school-aged children. As a review, this study is designed to answer the following research questions: ‘Does nutrition education over a one-week program increase consumption of fruits and vegetables?’, and ‘Does nutrition education over a one-week program increase acceptance of novel foods’? The nutrition education at Camp CHEF was a multi-component program, involving gardening, food preparation, and nutrition basics taught in a group setting. This study attempts to answer the research questions through the utilization of two surveys distributed on two separate occasions; before the intervention and once post-intervention, one month after the summer camp ended to measure changes. The surveys used were the Fruit-Vegetable-Fiber Screener from NutritionQuest, and the FNS developed by Pliner and Hobden.²⁰

Results Analysis

One question from each survey achieved statistical significance ($p \leq 0.05$). From the nutrition screener, the estimated number of servings of fruits and vegetables per day achieved statistical significance ($p=0.42$, $d=1.13$) This was also deemed to be a large effect size by the standards of Cohen’s D.²² This is a significant finding because the curriculum of Camp CHEF was centered on fruit and vegetable intake, so a statistically significant difference in the servings of fruits and vegetables per day directly shows that fruit and vegetable consumption increased after Camp CHEF; it also means that knowledge from camp was incorporated into the daily lives of the camp attendees. At Camp CHEF the children were taught where food comes from through gardening lessons,

how to prepare food, and were taught basics of nutrition education highlighting fresh fruits and vegetables. The range for the estimated servings of fruits and vegetables daily after camp is from a minimum of 3.47 to 8.28, with a mean of 5.32. The highest increases that contributed to the increased estimated servings of fruits and vegetables per day are in frequency of fresh or canned fruit, as well as the ‘Other Vegetable’ category. The ‘Other Vegetable’ category gave examples of String Beans, Peas, Corn, and Broccoli, and was a question that assessed all vegetables besides what had already been assessed in the nutrition screening (see Appendix A). Some responses decreased between the pre-camp and post-camp surveys, including: Vegetable Juice, Fiber Cereals, Beans, and Dark Bread; none of which were emphasized during the curriculum of Camp CHEF. These decreases in consumption were not statistically significant.

According to previous research noted in the literature review section, the American population commonly under-consumes vegetables, with two out of three adults not exceeding more than two servings per day; however, those who did consume enough vegetables had a negative correlation with BMI.^{8,11,14} The increase in estimated servings of fruits and vegetables per day was quite an impact on the children’s diets, and if the children can continue to consume an average of 5.32 servings of fruits and vegetables per day, this will contribute to a strong foundation of a healthy diet.

In the FNS, the question that achieved statistical significance was “I don’t trust the foods I never tried before” ($p=0.04$).²⁰ This question is also deemed to have a large effect size by the standards of Cohen’s D.²² This question directly measures how much a child will distrust a new food, and the significant difference indicates that the children in the study are more willing to trust new foods, which indicates a lower amount of food

neophobia. The curriculum of Camp CHEF introduced the children attending to different fruits and vegetables every day, and according to previous research children trust new foods more after increased exposure.^{8,13} Camp CHEF also allowed the children to be involved in the preparation of different fruits and vegetables, which according to previous research increases probability of trying these new foods.¹² The difference between the mean of total scores was not statistically significant ($p=0.586$), so food neophobia was not affected as much as fruit and vegetable consumption. Some questions showed regression in the measurement of food-neophobia, these were questions one, seven, and ten (see Appendix B). None of these survey items achieved statistical significance, with p -values ranging from 0.718 to 0.85. In the future, a different tool may be considered for the measurement of food neophobia as it is possible that some of the survey items were confusing for the participants, though participants did not report complaints of this.

Strengths and Weaknesses

Some strengths that can be attributed to this study are that team captains had a lot of time with participants over the course of the week of summer camp. Also, the graduate students conducting nutrition education had all completed a bachelor's degree in an accredited Didactic Program in Dietetics. The education level of the parents of participants was another strength, as many were faculty and staff of the University of Memphis. A final strength of this study is the students were able to apply the nutrition education in fun ways, such as selecting vegetables at lunch that coordinated with the color assigned to the current day.

Among the weaknesses of this study, the largest impairment is a small sample size of participants. Ten students originally enrolled in the study, but two were lost to follow-

up. This impacts statistical analysis, and with a larger sample size there is a possibility that more responses on the surveys would have achieved statistical significance. A larger sample size would increase normality of the data, and this would be beneficial for the nutrition screening as the abnormal distribution of data required the Wilcoxon Signed Ranks test, which has less statistical power than a Paired T-test. Another weakness of the study is regarding the Paired T-test used for statistical analysis. The study design is flawed in the nature that responses are unable to be paired between the repeated measures due to anonymity of responses. In the future, a study design that allows for the comparison of individuals based on their previous data while maintaining anonymity would add more statistical strength to the study.

Future Research

Further research in this field is necessary. Some possible contributions to the research base from a viewpoint of this study would be: creating a new valid and reliable tool to measure the trait of food neophobia, as well as conducting a study like this one with a larger sample size and possibly following the participants longer. Additionally, a study analyzing effect of community nutrition programs on childhood development and adulthood outcomes would be beneficial to this field.

Conclusion

In conclusion, this objective of this study is to improve the intake of fruits and vegetables as well as decrease the trait of food neophobia in elementary school-aged children. The estimated intake of fruits and vegetables increased from the pre-camp survey to post-camp survey ($p=0.42$, $d=1.13$). In the FNS, children were more likely to trust a new food as evidenced by the statistically significant change in question 3 ($p=0.04$,

$d=0.82$) (see Appendix B). Overall, based on the results of this study, nutrition education administered over the course of a one-week summer camp setting has the potential to improve children's diets; however, further research is required to validate this and to test long term effects of nutrition education.

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Appendix A

Dietary Fruit-Vegetable-Fiber Screener©

Name :

Age:

Sex: Male Female



Think about your eating habits over the past month. About how often do you eat each of the following foods? Remember breakfast, lunch, dinner, snacks and eating out. Mark one bubble for each food.

Fruits and Vegetables and Fiber	(0)	(1)	(2)	(3)	(4)	(5)	Score
	Less than 1 / WEEK	Once a WEEK	2-3 times a WEEK	4-6 times a WEEK	Once a DAY	2+ a DAY	
(1) Fruit juice, like orange, apple, grape, fresh, frozen or canned (Not sodas or other drinks.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	_____
(2) How often do you eat any fruit, fresh or canned? (Not counting juice.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	_____
(3) Vegetable juice, like tomato juice, V-8, carrot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	_____
(4) Green salad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	_____
(5) Potatoes, any kind, including baked, mashed or French fried	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	_____
(6) Vegetable soup, or stew with vegetables	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	_____
(7) Any other vegetables, including string beans, peas, corn, broccoli or any other kind	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	_____
(8) Fiber cereals like Raisin Bran, Shredded Wheat or Fruit-n-Fiber	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	_____
(9) Beans such as baked beans, pinto, kidney, or lentils (not green beans)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	_____
(10) Dark bread such as whole wheat or rye	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	_____
	Fruit-Vegetable Score (Sum for items 1-7) =						_____
	Fruit-Veg-Beans Score (Sum of items 1-10) =						_____

BLOCK DIETARY DATA SYSTEMS
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Appendix B

Food Neophobia Scale

1= Very Unlikely, 7= Very Likely

1. I am very particular about the foods I will eat.

1 2 3 4 5 6 7

2. I like foods from different countries.

1 2 3 4 5 6 7

3. I don't trust the foods I never tried before.

1 2 3 4 5 6 7

4. I like to try unusual foods.

1 2 3 4 5 6 7

5. If, for a food, I have the choice between different flavors (for example: an ice-cream, a candy,...), I like to choose a flavor that I do not know.

1 2 3 4 5 6 7

6. I will try a dish, even if I do not know what is in it.

1 2 3 4 5 6 7

7. I am good with the foods I already know.

1 2 3 4 5 6 7

8. I am willing to eat everything that one offers me.

1 2 3 4 5 6 7

9. I am afraid to eat things I have never had before.

1 2 3 4 5 6 7

10. I will not taste a food when I do not know what it is.

1 2 3 4 5 6 7



Institutional Review Board
Office of Sponsored Programs
University of Memphis
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May 14, 2018

PI Name: Danny Hirst
Co-Investigators:
Advisor and/or Co-PI: Sara Foley
Submission Type: Initial
Title: EFFECT OF NUTRITION EDUCATION ON DIETARY BEHAVIORS IN ELEMENTARY SCHOOL-AGED CHILDREN
IRB ID: PRO-FY2018-527

Expedited Approval: May 11, 2018
Expiration: May 11, 2019

Approval of this project is given with the following obligations:

1. This IRB approval has an expiration date, an approved renewal must be in effect to continue the project prior to that date. If approval is not obtained, the human consent form(s) and recruiting material(s) are no longer valid and any research activities involving human subjects must stop.
2. When the project is finished or terminated, a completion form must be submitted.
3. No change may be made in the approved protocol without prior board approval.

Thank you,
James P. Whelan, Ph.D.
Institutional Review Board Chair
The University of Memphis.