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Fruit and vegetable consumption in four elementary schools after implementation of nutrition education programs

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Fruit and Vegetable Consumption in Four Elementary Schools after Implementation of Nutrition Education Programs

by

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Dedication

To my loving family and friends for giving me their support and their encouragement to follow my heart and accomplish everything I set my mind to. Thank you for helping me become the person I am today.

Abstract

Nutrition education programs in schools often promote fruits and vegetables with the goal of increasing consumption among children. This study determined whether nutrition education programs increased fruit and vegetable intake in four elementary schools in Florida from October 2008 to October 2009. School A offered the U.S.D.A. Fresh Fruit & Vegetable Program; School B had a Student Wellness Advisory Council, OrganWise Guys and CATCH; School C had OrganWise Guys and CATCH; School D had no nutrition education programs. Students' favorite fruits and vegetables at breakfast and lunch were compiled. An increase in fruit intake was observed in three out of four schools; however, only one school had a positive increase in vegetable intake. Oranges were the most popular fruit chosen at breakfast and lunch. Corn was the most popular vegetable, followed by side salad. Nutrition education programs proved to have a positive impact on fruit and vegetable consumption in elementary schools.

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Chapter 1: Introduction

Children today are at risk of not receiving the vital nutrients they need to grow and develop healthy eating habits due to increased consumption of nutrient-poor snacks and reduced consumption of fruits and vegetables. Nutrition education tools and modeling practices have shown to be effective in altering children's dietary practices and promoting change (1). Higher intakes of fruits and vegetables can lead to prevention of chronic diseases and promote lifelong healthy eating habits. This study examined the most popular fruits and vegetables consumed by elementary students after students were educated by a combination of nutrition education programs and school nutrition programs.

There is a need to evaluate the effectiveness of nutrition education programs. The purpose of this study was to determine if the U.S.D.A. Fresh Fruit & Vegetable Program and nutrition education programs had an impact on fruit and vegetable selections by elementary school students in school meals. Comparing production records in three elementary schools for a year prior to implementation and the current year determined the effectiveness of a Student Wellness Advisory Council, OrganWise Guys, and the Coordinated Approach to Child Health (CATCH) on student fruit and vegetable intake. The three schools' production records were analyzed along with a school that had no nutrition education programs to find out which fruits and vegetables were most popular among elementary students. The study was designed to answer the following questions.

1. Did the consumption of fruits and vegetables in school meals vary from October 2008 to October 2009 after schools implemented the U.S.D.A. Fruit and Vegetable Program, Student Wellness Advisory Council, OrganWise Guys, and CATCH nutrition education programs in August 2009?

2. Which nutrition education programs led to the highest consumption of fruits and vegetables in school meals?

3. What percentage of students who consumed school meals chose fruits and vegetables as a meal component?

4. What were the most popular fruits and vegetables selected by elementary school students?

Chapter 2

Literature Review

The following literature review examines fruit and vegetable intake in elementary students through school, home, and other environmental factors. School meal offerings are based on government regulations, and including healthier options can change the choices students make on a daily basis. School-based initiatives through nutrition education programs allow fruit and vegetable consumption to be part of classroom and cafeteria learning. Access to nutrition education tools enhances learning for students and their families. Family members and peers have created change through role modeling fruit and vegetable intake.

Impact of School Meals on Children's Health

The National Health and Nutrition Examination Survey from 1999-2002 found that U.S. children are not meeting dietary recommendations, especially for vegetables and fruits (2). Eighty percent to 90% of children aged 4-13 have a low intake of fruits and vegetables, especially those dark green and orange in color (2). On an average school day in 2008, 30.5 million children ate school lunch (3). In 2007 about 10 million children ate school breakfast each day (4). U.S. Department of Agriculture (USDA) guidelines require school lunches to meet one third of the Recommended Dietary Allowances (RDA) and one fourth of the same nutrients for breakfast. USDA requires schools to follow the Dietary Guidelines including decreased levels of sodium and cholesterol and

an increase in fiber in foods served (5). Foods that are of minimal nutritional value cannot be part of school meals or served during meal times.

Condon and colleagues (2) analyzed data from the third School Nutrition Dietary Assessment Study to describe foods offered as part of school meals and consumption. The sample included 287 schools and 2,314 students from first through twelfth grades and collected data from January-June of 2005. School foodservice managers completed surveys on foods offered as part of a reimbursable meal. The children completed an in-person 24 hour dietary recall. Schools offered 100% fruit juice in 9 out of 10 menus. Fifty percent of schools offered fresh fruit and 96% offered one or more vegetable options. In one third of the elementary schools, a lettuce salad/salad bar was offered, and in 29% of the menus, dark green or orange vegetables were offered and 10% of meals contained legumes. Forty five percent of the students participating in school meals consumed fruit or 100% fruit juice at lunch, and 30% of non participants consumed fruit or fruit juice. School lunch participants consumed at least one vegetable at lunch, which was more than non participants. This amount remained high even when French fries were excluded (2).

The limitations of this study included only foods reported by the foodservice managers and the analysis did not include portion size (2). Suggestions to improve fruit and vegetable intake included offering more types and variety to meet Dietary Guidelines better. Students may also improve intake based on incentive programs and ability to taste test. When making changes to school meals, consideration needs to be given to effects on participation and foodservice costs (2).

Another program that looked at the impact of school meals took place in Summerville, Massachusetts was entitled: "Shape Up Summerville, Eat Smart Play Hard." The program evaluated the acceptability of school meal programs with a focus on preventing childhood obesity (6). Thirteen focus groups were held with students, parents, and school employees. Focus groups identified a key problem area as the ability to serve fresh produce. Schools lacked the proper equipment to prepare and serve fresh fruits and vegetables to the students. Staff received training throughout the year in preparation techniques and proper serving of fresh fruits and vegetables.

Fresh fruit was offered at each meal service. To add vegetables to the menus, side salads were offered once per week, and three times a week entrée salads were a menu offering. They also brought in a school breakfast coordinator at three of the elementary schools to model and promote healthy breakfast choices. Fresh fruits and vegetables were also donated by a local vendor so that students could participate in taste testing to improve acceptability (6).

Another key focus area was on communication. Taste testing and development of new recipes along with nutrition posters and announcements on health promotion messages took place to encourage students to try new foods. Students were given the opportunity to try 11 new fruits and vegetables, and parents received nine newsletters during the year with tips and recipes (6).

As a result of the intervention, school meal participation increased 3% in 2003-2004. Fresh produce expenses increased $27,000 and totaled $117,000. Schools received $35,000 in fresh fruit and vegetable donations to help with the cost increase. To keep up

with student demand, in the second year of the program $143,000 was spent on fresh produce (6).

Prior to this study (6) foodservice personnel (n=15) completed a survey regarding children's preferences for fruits, vegetables, and new foods. Of those surveyed, only 5% of foodservice personnel thought children liked vegetables and 10% thought children liked fruit. Eleven of the 15 respondents thought they could influence children to choose more fruits and vegetables, and 12 of the respondents thought they would be able to get the children to eat them. Of the fresh produce served, most students liked the fruits offered, but only one third of students liked the vegetables offered. Eighty percent of the students participated in the taste testing. After this intervention students' menu preferences included an increase in fresh fruits and vegetables as side dishes, and vegetarian choices over the standard entree. This indicated that the changes made in meal offerings did not decrease participation and at the same time improved the school's offerings of healthy foods to students (6).

Howerton and colleagues (7) reviewed seven school-based nutrition programs that improved fruit and vegetable consumption. Schools offered salad bars, offered free fruits and vegetables, and provided fresh produce items through breakfast and lunch school meals. Results from the intervention studies indicated a moderate increase in fresh fruit and vegetable consumption when provided during school time (7). No similar selection patterns were noticed in younger children's vs. older children's consumption of fresh fruits and vegetables. If energy-dense foods were not offered through vending or a la carte sales, there was a better chance to see an increase in fresh fruit intake in schools (7).

Gonzalez and colleagues (8) conducted The Early Childhood Longitudinal Study that included 10,285 fifth grade children from 2,065 elementary schools to review snack intake. Fifty percent of children were male, 60% were white, 18% were Hispanic, 11% were African American, 7% were Asian, and 50 % of students lived in households with income higher than $50,000. Sixty-five percent of schools were Title One eligible. Title One schools have 40% or more of students from low income families according to the U.S. Department of Education (9).

Students completed questionnaires on their daily intake of fruits and vegetables. The frequency of fruit and vegetable intake was calculated comparing restricted and unrestricted snacks and intake of fruits and vegetables that were available to students. Results indicated that students did not eat the recommended amounts of fruits and vegetables (8). Only 9% of students ate fruits and 16% of students ate vegetables three times per day. The fruits and vegetables that were consumed varied based on availability at schools. The type and number of snacks did not make a significant impact in defining the association between the availability of the snacks and fruits and vegetables consumed. There were slight differences in fruit and vegetable consumption between schools that did and did not have restrictive snack policies. The difference in consumption in fruits and vegetables was only 3% between the two groups. Limitations included dietary intake that was collected from children and subject to measurement error and bias. The results of this study are supportive of the Institute of Medicine (IOM) recommendations on nutrition standards (10). The IOM recommended that a restrictive snack policy should be part of the approach to improve children's dietary intake that will ultimately have a positive impact on intake.

Gray and colleagues (11) examined the intake of fruits and vegetables in 26 elementary schools in the Twin Cities of Minnesota. Ninety percent of students were white and 21% received free and reduced rate meals. They observed 1,668 students, and 1,168 students were still in the study at the end. Students wore a colored name tag, and were observed by researchers from a distance so their intake would not be affected. Results indicated that most students ate what was on their tray. Students in older grades consumed more of what they selected. Boys consumed more fruits than girls; however, there were no differences in the fruits and vegetables selected between genders (11).

Cullen and colleagues (12) conducted a cross-sectional study with fourth and fifth grade students (n=594) and their fruit and vegetable intakes. Fifth grade students who had access to a snack bar had significantly lower intake of fresh fruits and vegetables than fourth grade students who did not have access to a snack bar. The fifth grade students who consumed the school lunch had 0.8 servings of vegetables and fruits, and fifth grade students who chose from the snack bar consumed 0.4 servings of fruits and vegetables. The fourth and fifth grade students who consumed lunch from the school meal programs consumed similar amounts of fruits and vegetables.

Cullen and colleagues (12) also looked at the longitudinal changes in intake of fresh fruits and vegetables among fourth through sixth grade students. During the first year of the study, the students were in fourth grade and only had access to the school meal program. During the second year of the program they attended a middle school where there was a school meal program and a snack bar. The fifth grade students going to sixth grade had the same options the second year because they were still attending

middle school. This school district used food-based menus, which required them to have two fruit and vegetable servings at each lunch.

During both years of this study (12), students were instructed by data collectors on completion of food records that were completed during school hours for five consecutive days. Students had to provide the serving size of what they consumed and the source of food eaten at lunch including the school meal program, the snack bar, home or a combination. Students who went from fourth to fifth grade had a significant difference between the first and second year intakes. The servings of fruit consumed decreased by 33% and vegetables by 42%. The students who went from fifth to sixth grade also showed a significant difference in intake from year one to two. Vegetable intake decreased by 10%; however, fruit intake did not change. The intake stayed consistent between genders and ethnic backgrounds, except for Asians, who had a higher vegetable intake (12). These results indicated the importance of school meals as a good source of fruits and vegetables for students in elementary and middle school. Due to the serving line options available to older age groups, there was a decrease in fruit and vegetable consumption in children from elementary to high school. The authors (12) suggested that eating patterns students develop during middle school may contribute to the increased incidence of chronic diseases.

Fruit and Vegetable Preferences

Food preferences are key factors in children's food choices and taste, environment at home, and family support also affect preferences. Lakkakula and colleagues (1) looked at the association between low income African American children's preferences for fruits

and vegetables and their risk of becoming overweight. The study included 341 students in the fourth and fifth grade. Forty-three percent were boys and 68% were in the fourth grade. Sixty percent were at a healthy weight; 17% were at the risk of being overweight; and 20% were overweight. Students who were underweight were not in the study.

They used "Smart Bodies" in a randomized controlled intervention (1). Smart Bodies is a school-based curriculum that aims to increase nutrition knowledge and willingness to consume more fruits and fruit juices. The program was implemented in low income, urban elementary schools in Louisiana, and 72.5% to 97.5% of the students were eligible for free and reduced price meals at school. Questionnaires were completed by students and included information about their food preferences, specifically 38 fruits and vegetables (1).

Apples were the most familiar fruit, followed by oranges, bananas, and grapes (1). Carrots were the most familiar vegetable, followed by corn, green beans, cauliflower, and cucumbers. Grapes were the most liked and avocados the least-liked fruit. Seventy percent of the students who participated in the study had a strong preference for all fruits except tangerines, cantaloupes, mangos, apricots, papaya, and avocados. Strong preferences for vegetables included French fries, corn, and lettuce salads. The least-liked vegetables were garlic, onions, cabbage, and cauliflower. To determine the connection between weight status and familiarity of fruits and vegetables, students were placed into two groups based on their response of "I don't know." Students who had very low preferences for fresh produce were 5.5 times more likely to be at risk for overweight or

overweight when compared to those students who had high preferences for fresh vegetables.

This study found that children enjoyed fruits over vegetables and craved sweet-flavored foods (1). Children who had more accessibility to produce consumed more. Children also tended to choose those foods that they were familiar with. The authors (1) suggested that disliked foods can become a preference if they are introduced more than once.

Caine-Bish and Scheule (13) surveyed third through twelfth grade children (n=1,418) in an Ohio school district. Children were asked about favorite foods, items most frequently on the school menu, and lower calorie foods. A five-point rating scale was used for all 80 foods included in the survey. Smiley faces were used for younger students. Data were grouped and analyzed by elementary, middle, and high school. The only vegetables that were part of the students' top 20 favorite foods were potato-related products. A previous study with Guthrie and colleagues (14) found that third-graders chose the main entrée and milk over vegetables. However, fruits were part of the top 20 selections made by students. Among the favorite fruits were grapes, watermelon, and strawberries.

The results of this study (13) indicated that many of the higher fat foods such as French fries, tacos, chicken nuggets, and hamburgers were ranked high in student preferences. Many fruit choices were among the top 25%, which indicated that students do choose healthier items and not always high fat foods. They might not end up choosing them as frequently, possibly due to limited availability at home or meals eaten away from

home. Thus school meal menus should include as much variety as possible to provide students the opportunity to consume these items. Differences in food preferences were observed across the age levels. Vegetarian foods, ethnic foods, vegetables, and side dishes were more liked by high school students than younger students. The fruit and starch side dishes were liked more by elementary students than older students. To improve consumption of school meals, these fruit and vegetable preferences should be incorporated in the varied grade levels (13).

Impact of Nutrition Education Programs

Children's dietary habits are formed at a young age and have a vital impact on behavior as they grow. Schools are an effective setting for health promotion in children's populations. Bartholomew and colleagues (15) found that the following components are critical elements in determining the effective nutrition education in schools. First, nutrition education is most effective when it is behaviorally focused. Second, the educational strategies are directly relevant to a behavioral focus and come from appropriate research. Third, adequate time and effort are spent on the education lessons and activities. Fourth, children's families are involved to enhance total family involvement on the impact of nutrition education. Fifth, for students in secondary schools a self-assessment is completed. Sixth, the entire school environment is involved in the process. Contento and colleagues (16) stated that community involvement and partnerships are important to encourage nutrition education and create awareness (16). All of these criteria are key elements in successful nutrition education programs.

Second and third grade students in Alabama took part in a Social Cognitive Theory-based game to provide nutrition education (17). The study included 1,100 students from 64 elementary schools. "Pizza Please" was developed to provide nutrition information to elementary students through a questionnaire and interactive game. The interactive game included 12 mealtime questions. When a team answered correctly, they received a pizza topping for their pizza slice. The questionnaire included 16 nutrition and 24 dietary behavior questions. The responses were self-reported and the questionnaire required yes or no responses.

Nutrition educators provided weekly nutrition classes for the treatment group; the control group received no nutrition classes (17). The study took place during August through December of 2003. During six classes for the treatment group they discussed dairy, fruit, and vegetable consumption and reviewed the Food Guide Pyramid, nutrient functions, and nutrient food associations. An age-appropriate specific curriculum was provided to ensure all classes were taught the same material. The classes included relationships of behavioral factors, personal traits, and influences from the environment as part of utilizing Social Cognitive Theory. The nutrition educators did this by being role models during meal times, providing hands-on lessons, and providing practical knowledge to children which they used to select healthy choices (17).

Children in the treatment group had an increase in juice intake at breakfast, vegetables at lunch, and fruit at dinner (17). Overall nutrition knowledge was higher in the treatment group as well. In each area the treatment group scored significantly higher than the control group. The areas included overall dietary behavior, dairy consumption,

fruit and vegetable consumption, and overall nutrition knowledge. These results indicated a positive change in nutrition behavior and knowledge in the treatment group. National findings indicated that one fruit serving was consumed daily by 62% of children 6-11 years old, but in this study 65% the treatment group consumed one serving and 62% of the control group consumed one serving. For vegetables, the national findings indicated that one serving of vegetables was consumed by 82% of 6-11 year old children. This study (17) found a much lower intake of vegetables; 49% in the treatment group consumed one serving and 43% of the control group consumed one serving. In comparing the impact of nutrition education, students in the treatment group had higher intakes of fruits and vegetables and the control group decreased intake of fruits and vegetables. Due to the short length of the study, more behavior change may not have been seen. A minimum of 50 hours of nutrition education is what is suggested by the School Health Evaluation (18) to influence behavior change. This study (17) provided positive results with just six hours of nutrition education.

Another school-based nutrition education program, Partners of all ages reading about diet and exercise (PARADE) for children ages 7-9 (n=304), had a goal to improve fruit and vegetable consumption in children in mentoring or tutoring programs in St. Louis, Missouri (19). Eighteen percent of the children were African American. The nutrition education was part of a mentoring program where students received one-on-one tutoring during school hours one time per week. This intervention was also based on the Social Cognitive Theory. The program included computer storybooks with 8 lesson plans and parent newsletters.

There were eight vegetables and five fruits identified as moderately consumed that were made part of the eight storybooks used in the study (19). A telephone survey was given to all parents of participating children before and after the study. A food frequency questionnaire was conducted with the parents on their children's intake. Children in the intervention group consumed more peaches, grapes, spinach, and cantaloupe after the intervention took place (19). This study found that interventions can have an impact when focusing on areas of behavior change of fruits and vegetables consumed.

CATCH was developed to promote healthy eating and physical activity in children (20). This program incorporates health education and promotion; nutrition and physical education; psychological, counseling, and social services; family involvement; and a healthy school environment. CATCH was originally intended to decrease cardiovascular disease risk in young children but changed its focus to meet the needs of Coordinated School Health Programs. CATCH includes classroom nutrition lessons, physical activities, a family component, and a school foodservice program.

The goal of CATCH is to provide schools with training and low cost program materials to utilize in the school setting. McCullum-Gomez and colleagues (20) conducted a research study with foodservice staff. School foodservice staff were provided surveys on the program, specifically the food portions, and trainings were done between 2000 and 2002. Only 40% of the staff completed and returned the surveys. Most participants in the study were Hispanic women who were also foodservice managers. Most involved attended one training session on the CATCH program. About

42% used the Eat Smart foodservice guidelines, and those who had the guidelines available were more likely to be confident in preparing low-fat foods (20).

The Eat Smart guidelines that were implemented included changing to skim and low-fat flavored milk, leaner meats, and an increase of fruits and vegetables. The guidelines recommended reducing the amount of butter and extra fat used in the meals served. Results from this study showed that in 80% of CATCH schools, the Eat Smart guidelines were implemented where the foodservice staff had been trained in the program. The Eat Smart guidelines and the CATCH curriculum helped schools meet their goals. Effective communication was needed between the foodservice staff and other staff in the school to make all areas of the CATCH program work together. The CATCH program has been found to be more successful when staff has been properly trained (20).

Heath and Coleman (21) evaluated CATCH in El Paso, Texas schools (n=20). Some barriers that physical education teachers encountered when implementing the program were that many classroom teachers were focused on other areas of curriculum besides health and wellness and there were not enough indoor spaces to do the activities. Physical education teachers used the CATCH program from 10-100% of the time. Some barriers to implementing the foodservice guidelines were lack of student and parent interest, school meal patterns, and lack of ingredients to make lower fat meals (21). Due to lack of time in the school day and lack of support from administrative staff, teachers were not very supportive of this added program. This meant many teachers did not even look at the components of the program to see if they could find ways to implement it. Despite many classroom teachers not utilizing the program, at the end of the first year of

the program there was significant increase in moderate to vigorous physical activity levels in children. More changes were seen in physical activity than foodservice due to barriers in ability to provide meals lower in sodium and fat (21).

The National Cancer Institute and Produce for Better Health started "5-a-Day for Better Health" in 1991. The purpose of this nutrition promotion program was to increase fruit and vegetable consumption across the nation. At the start of the process nine interventions took place; four of them were in schools. Three of them reported a 9-12% increase in intake of fruits and vegetables (16). During 1994-1999 implementation, programs took place through 31 grants, and six of them were school-based with three fifth grade, one second grade and two targeting middle and high schools. The results in four out of six schools showed a positive change in intake of fruits and vegetables. Results were similar to other 5-a-Day studies and a significant difference was seen between the treatment groups and the control groups. One of the limitations included in these studies was a lack of standardized methodology for dietary assessment and dependence on self-reporting (22).

The goal of 5-a-Day Power Plus, a nutrition education intervention program, was to increase the intake of fruits and vegetables in fourth and fifth grade students in 20 schools in St. Paul, Minnesota (23). The program was guided by previous research on children's eating habits and social learning theory. The four areas reviewed in the study included changes in items chosen in school meals, behavior, parent involvement, and industry involvement. Each curriculum had sixteen 40-45 minute lessons that were

taught twice a week for eight weeks. The study included snack taste testing along with team competitions on intake of fruits and vegetables.

The 5-a-Day Power Plus included five education packets that were sent home with fourth grade students so that parents could be included in the study (23). The Food Services Department prepared snack packs that included fruits and vegetables for fifth graders. The students were asked to make snacks with these snack packs for their families. Besides the snacks prepared to take home for fifth grade students, Food Services used characters and messages from the curriculum used to increase consumption. They also increased the variety and appeal to the students in what was offered. On serving days that included a baked dessert they added extra fruit to the serving line. Industry was involved by providing educational trainings and educational materials to the staff and students (23).

Measures were developed and implemented to determine the level of participation in the different interventions (23). A random sample of 34 students was chosen in each school. These students were given a 24-hour dietary recall to complete and were observed during meal service on the day the 24-hour recall was completed. Parents completed a telephone survey and students completed a health questionnaire. The results indicated that these behavioral programs can improve the health behaviors in children. An increase in fruit and vegetable consumption was noticed in school meals. A bigger increase in fruit consumption than to vegetables may have been due to availability or in the way fruit was presented.

The 5-a-Day Power Plus program that took place in the classrooms helped students improve desire to consume more fruits and vegetables (23). Food Services offered the children additional opportunities to consume fruits and vegetables. Girls were more ready than boys to try vegetables. Girls tended to hold onto health messages since they were usually more concerned with their appearance than boys. Overall this program (23) used a creative multi-component program to increase fruit and vegetable consumption in fourth and fifth grade students.

A much higher intake of fruit and vegetables that changed from baseline data took place in the Alabama High 5 Project (24). The study included 28 schools which included 1,698 families. This project differed from other community interventions due to the fact that they had staff reach out to the community to implement the project. In other community interventions, classroom teachers had to implement the programs instead of trained nutrition professionals (24).

The Fresh Fruit & Vegetable Program (FFVP) was developed in 2002 by the U.S.D.A. (25). The purpose was to help fight childhood obesity by increasing fruit and vegetable intake in children. Wisconsin schools (n=25) were added to the program in 2005. Students (n=13,500) were given a fresh fruit and vegetable snack everyday from March 2006 through the 2006-2007 school year. Nutrition education programs were implemented to support the students eating fruits and vegetables. Jamelske and colleagues (26) evaluated the effectiveness of the FFVP in introducing fruits and vegetables to children. There were 25 schools selected for FFVP and ten control schools. The sample consisted of 577 girls and 550 boys, and 70% of the population was white.

Participants who completed a pre- and post-test survey were included in the final sample. The final sample included fourth grade students (n=490), seventh grade students (n=381), and ninth grade students (n=256).

A survey was given to students on fast food consumption, physical activity, lifestyle, parental limits on TV time/video games, and family dinners (26). The survey also asked participants about trying new fruits and vegetables and about current consumption of fruits and vegetables. The survey included pictures of 23 fruits and vegetables and asked students to identify them. Then students were given another 68 and then 39 fruits and vegetables to identify. Through a 3-day dietary recall, participants were asked about their consumption of fruits and vegetables.

The results of the study (26) showed that 40% of students would choose a fruit and 21% would choose a vegetable instead of chips or candy. In trying a new fruit at school, 33.8% of the students said they would, but only 20.8% said they would try a new vegetable in school. For home consumption 55.6% would try a new fruit and 32.9% would try a new vegetable. The results showed that students were more willing to try new foods at home and favored fruits over vegetables. Of students in the FFVP intervention schools, 24.8% showed willingness to try new fruits and vegetables, compared to only 12.8% in control schools. In the FFVP intervention schools, 32% were willing to try new fruits and vegetables and in the control schools only 15%. Sixty-two percent of intervention school students increased fruit and vegetable intake after a low initial consumption, compared to a 47% increase in intake of control school students. Over a three- month period the FFVP made a positive impact in attitude, behavior change, and

consumption of fresh fruits and vegetables. The increase in change can't just take place at school to be effective; it has to be offered at home as well. This study showed the short-term positive effects of the FFVP in schools.

Elementary student preferences of fruits and vegetables have been shown to be influenced by peers, family and staff through role modeling and school nutrition programs. Interventions have increased knowledge of nutrition which created awareness and encouraged students to try new fruits and vegetables to meet Recommended Dietary Intakes of critical vitamins and minerals. Supporting fruit and vegetable consumption with fun and interactive nutrition education programs has engaged students in changing their behavior on consumption of fresh fruits and vegetables. Many studies have taken place over the short-term, so future studies need to focus on the long-term to determine if the effects can be replicated and maintained. A higher fruit and vegetable consumption in elementary students can help fight childhood obesity and lead children to a healthy future.

Pearson and colleagues (27) reviewed 25 studies of family environment on children's dietary intake of fruits and vegetables. In 21 of the studies there was a positive association between family involvement and intake of fruits and vegetables in boys and girls. Most of the studies used a cross-sectional design, and half of the studies used self-reported data. The availability of vegetables impacted children's intake of vegetables. Children whose parents utilized role modeling had a higher incidence of vegetable consumption than other children in the study. Family encouragement was a positive

influence on fruit and vegetable intake. Household income and socioeconomic status did not affect fruit and vegetable intake in these studies (27).

Chapter 3

Methodology

Study Design

A descriptive research design was used for this study. The dependent variables were fresh fruits and vegetables consumed in participating elementary schools. The independent variables were four different nutrition education programs implemented in three schools. One school was a control school that did not offer nutrition education programs. These programs included Coordinated Approach to Child Health (CATCH), OrganWise Guys, Student Wellness Advisory Council, and the United States Department of Agriculture (U.S.D.A.) Fresh Fruit & Vegetable Program. This cross-sectional design allowed for collection during two four-week time periods for all participating schools (n=4). Total selection of fresh fruits and vegetables was compared using production data from October 2008 compared to October 2009.

Study Population

The subjects for this study were students in four elementary schools, grades pre-K to 6, Brevard County, Florida. Elementary School A obtained a grant from the U.S.D.A. Fresh Fruit & Vegetable Program and served a fresh produce snack three times a week to all students and staff. Elementary School B had a Student Wellness Advisory Council (SWAC). This is a group of students who promoted wellness to the students and staff of their school. Elementary School B also utilized OrganWise Guys and CATCH. OrganWise Guys is a science-based nutrition education and physical activity program

curriculum with a fun cast of engaging characters for elementary students. Elementary School C utilized two nutrition education programs: OrganWise Guys and CATCH. Elementary School D did not offer any nutrition education programs.

Table 1. Summary of Participating Schools (n=4)

School	***Nutrition Education Programs***
Elementary School A	U.S.D.A Fresh Fruit & Vegetable Program
Elementary School B	Student Wellness Advisory Council, OrganWise Guys, and CATCH
Elementary School C	OrganWise Guys and CATCH
Elementary School D	None

Methods

Daily production records for each school were selected for one four-week cycle for October 2008 and October 2009. The records from 2008 provided intake prior to the implementation of nutrition education programs. For each day in the study, production records provided the number of student meals consumed and the quantities of fruits and vegetables prepared and served in breakfast and lunch meal service.

The total number of students served was divided by the quantity of fruits and vegetables consumed to determine the percentage of the population who consumed fruits and vegetables. These records also showed the fruits and vegetables in each school that were more popular with children. Comparing schools indicated which type of nutrition education programs made the biggest impact on consumption of fruits and vegetables.

Data Analysis

A descriptive analysis was completed and compared using Excel. Fruit and vegetable consumption in October 2008 prior to implementation of nutrition education programs was compared to consumption in October 2009, after programs were implemented. The percentages of participating students in school meals were compared between the variables to determine the highest consumption of fruits and vegetables.

Chapter 4

Results and Discussion

Demographic Information

Students participating in the School Breakfast and Lunch program in October 2008 and October 2009 were included in this study from four participating schools. In October 2008, 26,107 students from all 4 schools participated in breakfast, compared to 22,206 in October 2009. In October 2008, 40,902 students from all four schools participated in lunch compared to 37,781 in the October 2009.

Produce Availability

Each school in the study was required to serve a variety bar daily. The variety bar for fruit for breakfast and lunch included fresh fruit, commodity fruit, and dried fruit (when available). A hot vegetable was served daily at lunch. Each day one vegetable and assorted fruit were offered on the menu. Schools were allowed to choose the fruits they served on the variety bar as long as they offered an assortment.

To improve student participation and healthy school offerings, the schools in this study provided fresh fruit daily. They also provided a side salad once per week, along with other healthy choice entrees offered daily. This is the same approach "Shape Up Summerville, Eat Smart, Play Hard" took (6). School A received the U.S.D.A. Fresh Fruit & Vegetable Grant for the 2009-2010 school year, valued at $41,000. Students were served a fresh fruit or vegetable snack three days per week for the entire school year.

School A showed a 7% increase in fruits served at lunch, the highest percentage increase in fruit from October 2008 to October 2009, due to the addition to the program.

Changes in Breakfast Consumption

School D, which had no nutrition education programs, had a 21% increase of fruit intake at breakfast from 2008 to 2009 (see Table 2). School B, which had a Student Wellness Advisory Council, OrganWise Guys, and CATCH, showed the next highest increase of 13%. School A, which had the U.S.D.A. Fresh Fruit & Vegetable Program, showed the smallest increase of 1, and School C, which had OrganWise Guys and CATCH, showed a negative change of 2%.

Changes in Lunch Consumption

For lunch intake of fruit, School A, which had the U.S.D.A. Fresh Fruit & Vegetable Program, showed a 7% increase from October 2008 to October 2009 (See Table 3). School D, which had no nutrition education programs, was the next highest with a 5% increase, followed by School B, which had a Student Wellness Advisory Council, OrganWise Guys, and CATCH program, with a 1% increase. School C, which had OrganWise Guys and CATCH, showed no change.

School B, which had a Student Wellness Advisory Council, OrganWise Guys and CATCH, had an 8% increase in vegetable intake from October 2008 to October 2009 (See Table 4). All other schools showed a negative change for vegetable intake from October 2008 to October 2009.

Table 2. Percentage Change in Fruit Consumption at Breakfast *

School	October 2008	October 2009	% Change
Elementary School A			
Week 1	0.40	0.37	(0.03)
Week 2	0.44	0.41	(0.02)
Week 3	0.43	0.45	0.02
Week 4	0.31	0.41	0.10
Elementary School B			
Week 1	0.48	0.53	0.06
Week 2	0.49	0.76	0.27
Week 3	0.48	0.55	0.07
Week 4	0.47	0.63	0.16
Elementary School C			
Week 1	0.13	0.15	0.02
Week 2	0.13	0.12	(0.01)
Week 3	0.17	0.09	(0.08)
Week 4	0.13	0.12	(0.01)
Elementary School D			
Week 1	0.56	0.70	0.14
Week 2	0.62	0.66	0.04
Week 3	0.42	0.78	0.36
Week 4	0.56	0.81	0.25

* Pre- and Post-Implementation indicates percentage of students who consumed fruits

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Table 3. Percentage Change in Fruit Consumption at Lunch*

School	October, 2008	October, 2009	% Change
Elementary School A			
Week 1	0.33	0.42	0.09
Week 2	0.37	0.42	0.05
Week 3	0.40	0.42	0.02
Week 4	0.39	0.48	0.09
Elementary School B			
Week 1	0.58	0.49	(0.09)
Week 2	0.37	0.55	0.18
Week 3	0.45	0.48	0.03
Week 4	0.53	0.47	(0.06)
Elementary School C			
Week 1	0.42	0.40	(0.02)
Week 2	0.36	0.38	0.02
Week 3	0.35	0.34	(0.01)
Week 4	0.37	0.35	(0.02)
Elementary School D			
Week 1	0.43	0.37	(0.06)
Week 2	0.31	0.41	0.10
Week 3	0.38	0.45	0.07
Week 4	0.40	0.44	0.04

*Pre- and Post-Implementation indicates percentage of students who consumed fruits

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Table 4. Percentage Change in Vegetable Consumption at Lunch

School	October, 2008	October, 2009	% Change
Elementary School A			
Week 1	0.13	0.22	0.09
Week 2	0.21	0.19	(0.02)
Week 3	0.22	0.11	(0.11)
Week 4	0.20	0.15	(0.05)
Elementary School B			
Week 1	0.13	0.28	0.15
Week 2	0.14	0.28	0.14
Week 3	0.24	0.22	(0.02)
Week 4	0.24	0.29	0.05
Elementary School C			
Week 1	0.13	0.17	0.04
Week 2	0.21	0.16	(0.05)
Week 3	0.17	0.10	(0.07)
Week 4	0.14	0.18	0.04
Elementary School D			
Week 1	0.13	0.14	0.01
Week 2	0.22	0.17	(0.05)
Week 3	0.20	0.11	(0.09)
Week 4	0.20	0.15	(0.05)

*Pre- and Post-Implementation indicates percentage of students who consumed vegetables

Fruit and Vegetable Preferences

In the Smart Bodies Intervention (1), the most popular fruits were apples, oranges, bananas, and grapes. For vegetables, carrots, corn, green beans, cauliflower, and cucumbers were the most popular. The students in this study showed some similarities in their favorite fruits and vegetables offered. One factor that can influence the offerings is cost of produce and product availability from October 2008 to October 2009; another is manager selection. During breakfast (Table 5), the most popular fruits were oranges, plums, and apples. School C did not offer oranges to students. Tables 5 to 7 indicate the top four of each fruit or vegetable during serving periods. Fruit preferences for lunch are shown in Table 6. Oranges were the most popular, followed by bananas, plums, and nectarines. Vegetable intake (Table 7) shows corn was the most popular vegetable, followed by side salads and green beans.

Caine-Bish and Scheule (13) surveyed third through twelfth grade children in an Ohio school district. Children were asked about favorite foods. The only vegetables that were part of their top 20 favorites were potato-related products. Grapes, watermelon, and strawberries were among the 20 favorite fruits in the study. Results of the study indicated that student favorite foods may result from available foods at home and on the go. The schools that were included in this study were required to serve at least one hot vegetable daily, and potato products were not allowed as a choice. Fruits available are seasonal and based on availability. Watermelon and strawberries are popular with students but the cost was too high to serve to the students in this study. Grapes were served when available as part of several healthy choice entrees that are offered daily.

Table 5. Top Four Fruit Preferences at Breakfast in Four Elementary Schools

School A 2008	**School A 2009**	**School B 2008**	**School B 2009**	**School C 2008**	**School C 2009**	**School D 2008**	**School D 2009**
Oranges	Apples	Oranges	Oranges	Plums	Apples	Plums	Plums
Plums	Nectarines	Applesauce	Applesauce	Applesauce	Peach Cups	Bananas	Peach Cups
Peach Cups	Plums	Bananas	Bananas	Peach Cup	Plums	Applesauce	Bananas
Bananas	Peach Cups	Peach Cups	Apples	Peaches	Applesauce	Peach Cups	Oranges

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Table 6. Top Four Fruit Preferences at Lunch in Four Elementary Schools

School A 2008	**School A 2009**	**School B 2008**	**School B 2009**	**School C 2008**	**School C 2009**	**School D 2008**	**School D 2009**
Oranges	Apples	Oranges	Apples	Oranges	Apples	Applesauce	Applesauce
Diced Pears	Bananas	Tangerines	Orange	Applesauce	Orange	Bananas	Mixed Fruit
Plums	Plums	Diced Pears	Pears	Diced Pears	Diced Peaches	Plums	Diced Pears
Banana	Diced Peaches	Applesauce	Applesauce	Pears	Applesauce	Diced Pears	Plums

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Table 7 Top Four Vegetable Preferences at Lunch in Four Elementary Schools

School A 2008	**School A 2009**	**School B 2008**	**School B 2009**	**School C 2008**	**School C 2009**	**School D 2008**	**School D 2009**
Side Salad	Corn	Corn	Corn	Corn	Corn	Corn	Corn
Corn	Green Beans	Side Salad	Carrot & Ranch	Green Beans	Carrot & Ranch	Side Salad	Carrot & Ranch
Green Beans	Carrot	Green Beans	Green Beans	Side Salad	Side Salad	Green Beans	Green Beans
California Blend	Carrot & Ranch	Carrot & Ranch	Peas & Carrots	Carrot & Ranch	Green Beans	Carrot & Ranch	Side Salad

Nutrition Education

Heath and Coleman (21) reported that CATCH was difficult to implement due to time in the classroom and lack of teacher and administrative support. In this study, School B had administrative support for this program and all nutrition education efforts, which helped encourage the teachers to be supportive of the program. Overall School B

did show positive changes in fruit and vegetable intake in breakfast and lunch. School C, which also implemented CATCH, did not show positive changes in fruit and vegetable intake. School C did not have staff and administration involvement, so the program was implemented by one staff member who taught several grade levels. If this program had more support school-wide, it might have produced more positive results.

Perry and colleagues (23) reported a 9-12% increase in fruit and vegetable intake in a 5-A-Day Program for Better Health study. School A utilized many 5-A-Day educational materials for students to learn about the fruits and vegetables offered in the USDA Fresh Fruit and Vegetable Program. School B staff and Student Wellness Advisory Council used the 5-A-Day materials to help make learning about fruits and vegetables fun and interactive. Using this program as part of the nutrition education initiative is another reason why School B showed such positive change in fruit and vegetable intake.

Jamelske and colleagues (26) showed that the U.S.D.A. Fresh Fruit & Vegetable Program increased students' selections of fruits and vegetables 40% and 21%, respectively, over chips or candy. Through nutrition education efforts and exposure to fruits and vegetables, the students in School A showed a positive change for fruit intake; however, for vegetable intake, they did not. Students tended to favor fruits over vegetables; however, over time and exposure to the program students' preferences may change.

Bartholomew and colleagues (15) found that several components are critical in determining effective nutrition education in schools. These components include

education that is behaviorally focused; educational strategies directly related to the behavior; adequate time spent on lessons and activities; involvement of families, not just students; completed self-assessments; and involvement of the entire school. The results of this study proved that School C, which did not have the entire school involved, did not produce results as positive as School B, with complete school and administration support. School B demonstrated a focus on nutrition education that increased healthy choices students made in school meals. School A, which also had an adequate time, behavior-focused and school-wide involvement, produced positive choices in fruit intake during lunch.

Chapter 5

Conclusion

In conclusion, this study did find an increase in fruit and vegetable intake after nutrition education interventions. However, the results also showed that School D, with no nutrition education, had a positive increase in fruit intake at breakfast. This result could be due to factors such as providing favorite choices on the serving line, promotion, and overall appearance of fruits on the serving line. School B, which has multiple nutrition education interventions, was the only school that showed a positive increase in fruit and vegetable intake at breakfast and lunch. Fruits were more accepted than vegetables and School A, which had the U.S.D.A. Fresh Fruit & Vegetable Program, showed the highest increase in fruit intake at lunch. School C did not show positive results; however, that result can be due to limitations of the study.

The first limitation was that data were collected during October. The school year starts in August, and some programs were not fully implemented until September. This may not have allowed enough time to see the true effect the programs had on the students' choices. For future studies it would be beneficial to compare the consumption near the end of a complete school year after fall implementation. Changes in food selections are made over time, and this would allow time for students to make changes in their food selections. It would also be beneficial to collect data for six months, for changes in preference and seasonal availability. Adding a plate waste component to the study would allow for actual consumption to be measured. In School C the nutrition

education program did not reach all students. If the programs had reached the entire School C student population, the outcome may have been more positive.

The rise of childhood obesity and chronic diseases in children indicates the need for more nutrition education intervention programs. Learning the importance of healthy choices will lay the foundation for positive change. Schools offering a variety of nutrition education curriculums and health promotion programs will lead to excitement in the school environment and knowledge about nutrition education. Students need the opportunity to learn healthy behavior changes that will have an impact on their food choices at school and home.

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