2016

Evaluation of a Technology Utilizing Nutrition Curriculum on Dietary Intake

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EVALUATION OF A TECHNOLOGY UTILIZING NUTRITION CURRICULUM
ON DIETARY INTAKE
BY
KELSI CHAPPELL

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE
IN
NUTRITION AND FOOD SCIENCES

UNIVERSITY OF RHODE ISLAND

2016

MASTER OF SCIENCE

OF

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2016

ABSTRACT

Objective: Evaluate the effectiveness of a 13-week combined technology enhanced Body Quest: Food of the Warrior (BQ) and Children, Youth, and Families at Risk (CYFAR) obesity prevention focused nutrition education curriculum to increase fruit and vegetable (FV) intake and decrease sugary sweetened snacks (SwS), salty snacks (SaS), and sugary sweetened beverages (SSB) intake.

Design: Quasi -experimental design.

Participants/Setting: N=129 (treatment 70, control 59) 3rd grade students in full-service, low-income, urban community schools in Providence, RI completed pre/post surveys on iPads.

Intervention: Treatment group received 13-week technologically enhanced CYFAR/BQ nutrition education intervention. The control group completed pre and post surveys.

Main outcome Measures: Self-reported dietary intake of fruit, vegetables, SwS, SaS, and SSB.

Analyses: ANCOVA and paired sample t-test.

Results: Controlling for baseline intake, the treatment group consumed more fruit than the control group post-intervention ($F= 8.778, p <0.05$, partial $\eta^2 = .065$). Fruit consumption increased from 3.8 +/- 1.6 - 3.9 +/- 1.8 in the treatment group. The treatment group reported significantly lower intake than the control group in SwS (2.97±1.61 to 2.19±1.41($p<.01$), SaS (2.73±1.60 - 2.11±1.26($p<.01$), and SSB (3.17±1.72 - 2.23±1.25($p<.001$)). No changes in any variables were reported in control group.

Conclusion: This program was associated with moderate increases in FV's and decreases in SSB, SwS, and SaS.

ACKNOWLEDGMENTS

I would like to thank my thesis committee for their guidance and support through this process; Dr. Alison Tovar, Dr. Adam Moore, my committee chair Dr. Emily Clapham and especial my mentor Linda Sebelia and my major professor Dr. Geoffrey Greene whom I could not have completed this without. I cannot thank Dr. Greene and Linda Sebelia for providing me with this amazing opportunity. It has been a true honor to be able to work alongside the CYFAR/SNAP team and witness the impact of these programs on the lives of men, women, and children in the Rhode Island community. I express sincere gratitude to both Linda Sebelia and Kate Balestracci for continuously challenging me, trusting me, and encouraged me to be the best student I can be. Without these two women, I am not sure where I would be. Thank you for giving me the knowledge and confidence to move forward in my career as a future Dietitian.

To my loving family and friends especially my mom, dad, Kateri, Matthew, and Molly thank you for believing in me and most importantly being my support system, you five are the reason this was possible for me, and I cannot thank you enough.

DEDICATION

This thesis is dedicated to my little Rowen, thank you for being my greatest motivation, my favorite stress reliever, and my biggest fan. Thank you for your patience when mommy needed to get work done and most importantly, thank you for eating your vegetables.

PREFACE

This thesis was prepared in manuscript format following the author guidelines for the *Journal of Nutrition Education and Behavior*. After submitting this thesis, the manuscript may be submitted for publication.

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MANUSCRIPT:

“Evaluation of a Technologically Utilized Nutrition Curriculum on Dietary Intake”

By

Kelsi Chappell

Prepared for submission to *Journal of Nutrition Education and Behavior*

INTRODUCTION

Obesity is considered an epidemic in the United States (US) [1,2]. National Health and Nutrition Examination (NHANES) data from 2011-2012 found that 34.2% of children ages 6-11 were obese or overweight, with 17.7% obese [3-5]. The early onset of obesity puts a child at increased risk of developing preventable diseases such as heart disease, Type 2 diabetes, and certain cancers [6-8]. These diseases account for 75% of all medical costs in the US [9,10,11]. The national epidemic of childhood obesity is reflected in Rhode Island, primarily among low-income children [12]. Thirty-one percent of RI children are overweight or obese and fewer than one in five meet the recommendations set for daily FV consumption [11]. Thirty-seven percent of the children living in Providence, RI live below the poverty line, 33% receive SNAP benefits and 88% are eligible for free or reduced meals [12,13]. Without drastic changes, by 2030, adult obesity rates are predicted to increase to 60% in 13 US states [10]. Establishing healthy dietary and physical activity habits among youth is essential or the burden on the US healthcare system will be astronomical and today's youth will likely "live sicker and die sooner" than generations preceding them [9,10,11,14].

Childhood obesity predisposes an individual to obesity into adulthood [7-8,11,14,15]. A number of adult diseases have their origin in childhood and overweight/obese children are twice as likely to die before the age of 55 than normal weight peers [10,11]. Evidence suggests 70% of obese children have elevated triglycerides, cholesterol, insulin, or blood pressure which are significant indications of the development of obesity related diseases such as cardiovascular disease, Type 2

diabetes, sleep disorders, certain types of cancer, and nonalcoholic fatty liver disease [6-8,15,16,17]. Reversing the current childhood obesity trends is possible with a combination of policies like The Federal *Fresh Fruit and Vegetable Program*, First Lady Michelle Obama's *Lets Move* campaign, and NFL Play60 paired with the implementation of successful nutrition interventions [18-20]. The ultimate solution to this problem is to increase physical activity and change eating habits by decreasing the consumption of high-fat, high-sugar energy-dense snacks and beverages and increasing the consumption of fruits and vegetables (FV) [21-27].

Healthy People 2020 set goals for individuals 2 years and older to increase dietary consumption of vegetables from current average intakes of 0.77 to 1.14 cups and fruits from current average intakes of 0.53 to 0.90 cups equivalent per 1,000 calories per day. [28]. Additionally, the USDA 2015 Dietary Guidelines for Americans suggest filling half your plate with FV and states that children ages 4-8 years should consume between 1.5 to 2 cups of fruit and 2 to 2 ½ cups of vegetables per day, dependent on caloric needs [29].

FVs contain nutrients essential for healthy body function and growth including, Vitamin A, C, and K, potassium, magnesium, and phytonutrients, all which are under consumed in the US [21,30]. Additionally, FV contain antioxidants [30]. Antioxidants can inhibit reactions of free radicals which may play an effective role in lowering incidences of certain cancers [30]. Lastly, FV contain a significant amount of fiber. Fiber helps maintain satiety, plays a pivotal role in weight management [31]. This suggests that an adequate intake of F/V paired with a lower intake calorie dense, high sugar, high fat foods, may result in an overall lower daily caloric intake [31].

A recent review analyzed eight randomized controlled studies (n=1026 participants) that successfully increased F/V consumption pre to post intervention [32]. The review found that high F/V consumption was associated with reduced weight gain but there was no difference in energy intake pre to post intervention [32]. These findings suggest that increased F/V consumption with or without additional advice to decrease the consumption of other foods, helped reduce the rate of weight gain and provided strong evidence that increased F/V intake can assist children with healthy weight management.

Despite efforts to increase F/V intake among youth, 60% of children in the US do not meet recommendations for fruits and 93% for vegetables [33]. Children from low socioeconomic backgrounds consume fewer F/V and can identify fewer F/V than their higher socioeconomic counterparts[34,35]. This is likely due to decreased accessibility and negative parental modeling. [35,36]. In addition to socioeconomics, race is also a factor [37]. White children are more likely to consume F/V than African American children [37]. Hispanic children are at greater risk for a low intake of FV than non-Hispanic children [37]. In Providence, RI fewer than 20% children consume the recommended amounts of F/V per day [12-13,35]. From 2010-2012, 54% of Native Americans, 39% of Black, 10% of White, 40% of Hispanic, and 22% of Asian children in Rhode Island lived in households with incomes below the poverty line [12,13].

In addition to low F/V consumption, soda, sports drinks, and juice consumption has risen over time indicating that today's youth drink more sugar beverages than ever before [37-44]. A 2013 NHANES study found a 4-5% increase

from 1999-2008 among children consuming a large amount of SSB defined as $\geq 2092 \text{ kJ day}^{-1}$ ($\geq 500 \text{ kcal day}^{-1}$) with low-income children having greater consumption compared to their higher income peers (odds ratio = 1.93; 95% confidence interval (CI) = 1.05–3.56) [41]. According to a meta-analysis study conducted by the World Health Organization (WHO), a higher intake of SSB is associated with a 55% higher risk (95% CI=32-82%) of being overweight or obese among children. [42]. In addition to SSB consumption, “snacking” on low quality foods has also increased. Jahns et al. conducted a longitudinal study to determine the number of snacking occasions between two age groups (2-11, 12-18) at two time points (2004, 2014) [43]. Snacking was defined as foods consumed 15-minutes or more prior to the start of a meal or 15-minutes or more after the conclusion of a meal [43]. Results showed overall increase in snacking over the 10-year span from 32%-41% [43]. A similar study by Piernas and Popkins found similarly trends in “snacking” among children ages 2-18 from 1997-2006 [44]. An increase in the intake of both sugary snacks and salty snacks (6% to 8.5% and 8% to 16.5%. respectively) was found [44].

Schools are an important venue for implementing obesity prevention programs through development of healthful dietary behaviors [45-47]. School-based nutrition education interventions that utilize cutting edge technology to target today’s youth, focus on multiple dietary behavior changes, and encourage children to become advocates of health by promoting behavior change among their friends and family, have the potential of creating lasting changes that could decrease overweight and obesity among children. However, there has been limited research on intervention

programs containing these elements, especially in low-income populations. The purpose of this study was to evaluate the effectiveness of a 13-week combined childhood obesity prevention curriculum on increasing fruit and vegetable intake and decreasing sugar sweetened beverages, sugar sweetened snacks, and salty snacks among 3rd grade participants in a full-service, low-income, urban community schools in Providence, RI.

METHODS

Design and Subjects

This study utilized data generated from the first year in-school component of the 5-year University of Rhode Island Children, Youth, and Families at Risk Grant (URI CYFAR) funded by the United States Department of Agriculture, National Institute of Food and Agriculture. The URI CYFAR, Integrating Nutrition Education in Full Service Community Schools in Providence, RI strives to encourage low-income children and their families to adopt healthy eating and health behaviors to improve overall health and decrease obesity risk. This grant, targets over 500, 3rd grade children and their parents in four Full Service Community (FSCS) ethnically diverse elementary schools. FSCS seek to meet the requirements of the No Child Left Behind Act, with the philosophy that all families and communities have strengths, and recognize non-school barriers children face and provide services to foster relationships between social service agencies, schools, and families [48]. In Providence, RI all FSCS are within a two-mile radius of one another with a pre-existing network of neighborhood-based partners. Partners include, the YMCA, Family Services, Providence Public Schools and Dorcas International Institute of Rhode Island. The

URI CYFAR study was IRB approved and this secondary data analysis was approved by the IRB. The goal of the URI CYFAR program is to encourage low-income children and their families to adopt healthy eating behaviors and skills that reduce obesity risk and result in overall better lifelong health.

The current study utilized a prospective, 2 x 2 quasi-experimental design conducted to evaluate changes in the dietary intake of fruits and vegetables, sugary sweetened snacks, and sugary sweetened beverages of 3rd graders. The treatment school received the combined Body Quest: Food of the Warrior (BQ)/CYFAR school-based childhood obesity prevention curriculum while the control group completed pre and post surveys only. The study was conducted during the 2014-2015 academic school year by 3rd grade students' ages 8-10 years old from an urban population in two low-income FSCS. Approximately, 85% of children at the treatment school and 90% of children at the control school qualify for free or reduced lunch [13].

Procedure

The URI CYFAR grant targets 3rd graders through an in-school program, after-school cooking/nutrition program, and a family/parent program. This study utilizes data from the first year of the in-school component only. In July of 2014, needs assessments were conducted to determine eligible elementary schools by the Providence School Department. The two participating schools were determined by the Providence School Department. School Principals and participating 3rd grade teachers were notified and informed about the intervention by the Providence School Department.

The treatment group included a total of three 3rd grade classrooms with roughly 26 students each (n=79) and the control group included three 3rd grade classes with roughly 21 students per class (n=64). For the purpose of this study, students who did not completed both pre and post survey evaluation and those who did not identify themselves as 3rd grade students were admitted. After exclusion there were a total of N=129 participants (treatment 70, control 59).

From September 2014 through January 2015, all three 3rd grade classes at the treatment school received the 13-week combined BQ/CYFAR nutrition curriculum while all three 3rd grade classes at control school did not receive the nutrition curriculum. To our knowledge, participants did not receive any other obesity prevention or nutrition education curriculum during the duration of the study. Due to holidays and school vacations the program was implemented the week of September 29, 2014 and concluded the week of January 12, 2014 for a total of 15-weeks. Lessons were not provided the weeks of November 24, 2014 or December 22, 2014. Pre and post surveys were administered immediately before the first lesson on week 1 and directly after the last lesson on week 13 to the treatment school. Concurrently, during the same calendar weeks (1 and 13) surveys were conducted in the control school. Surveys were administered on Apple iPads using surveymonkey.com. Although there was a follow up assessment conducted in May 2015, this study is restricted to pre and post only.

Intervention

The 13-week intervention was administered to the treatment school by a trained nutrition educator. Nutrition educators are trained URI-SNAP Education

employees with previous community teaching experience. The sessions were approximately 1-hour in length; 30 minutes of the evidence-based elementary school digital curriculum, “Body Quest: Food of the Warrior” and 30 minutes of the standard evidence-based CYFAR-nutrition curriculum (*Appendix C*). This multidimensional obesity prevention program consisted of 13 sessions that consisted of technologically enhanced interactive lectures, opportunities for discussion, and FV tastings provided by the Fresh Fruit and Vegetable Program (FFVP), a Nationally Funded program that provides FV to low-income schools in the United States. The BQ portion of the session followed the standard BQ nutrition education lessons and materials developed by Alabama Cooperative Extension System while the CYFAR portion utilizes standard URI Nutrition Education materials/lessons (*Table 1*). These lessons were all previously validated in studies conducted by the URI-SNAP Education nutrition educators. Both components followed the Experiential Learning Model. This model strives to establish behavior changes through the 6-step process; get started, experience, reflect, apply, sum up, and take home [49].

The novelty of the BQ curriculum lies in the combination of implementing a unique and innovated nutrition education program with advanced technology applications that presents nutrition messages using a modern, hands-on approach. The curriculum correlates with the national health education standards established by the Center for Disease Control and Prevention (CDC) and provides additional cross-curricular learning opportunities in literacy, math, science, social studies, and the arts [49]. The learning experience is enforced with bi-weekly lesson reinforcements, weekly physical activity components and weekly take home materials and messages

[49]. The Body Quest curriculum utilizes core materials to enhance students learning (food and character card decks, character posters, vow poster, vow take-home cards, battle cry, family discussion prompts, graduation certificates) which were provided by the program developers at Alabama Cooperative Extension System ACES and fully funded by the URI CYFAR (Children, Youth, and Families at Risk) Grant [50].

Card decks featuring warrior characters as well as healthy food options were used throughout the curriculum to introduce foods, provide nutrition information and support healthy eating behaviors [49]. The BQ curriculum utilizes vow cards along with other supplemental learning information to promote the importance of healthy eating, trying new foods, and sharing knowledge [49]. At the start of each lesson, the class recited the BQ vow that encourages being brave warriors by trying new F/V, sharing knowledge with family and friends, and having fun on the quest. Additionally, each week students participated in a short physical activity component (warrior workout). Resources were sent home, along with weekly CYFAR handouts to share information with families and promote behavior changes outside of the classroom.

The BQ curriculum utilizes technology. During weeks 1,3,5,7,9,11, and 13 education was reinforced through the use of iPad applications (*see Table 1 for modules*). The seven BQ iPad applications featuring anime-style characters applications provided an innovative “Experience, Reflect, Apply” learning opportunity to guide students on their “quest” for a healthier lifestyle [49]. The apps follow a game-approach to reinforce the weekly lesson with an interactive learning experience. Each application specifically focuses on one nutrition related message however they all incorporate spelling and literacy, nutrition based sleep hygiene, physical activity,

and family interaction. The first application is designed to encourage students to begin their quest to establish healthier lives and to introduce the animated BQ characters to the students. Sequential apps (1) encourage students to overcome any fears they may have of trying new FV, (2) introduce powerful food battle groups, (3) teach principles of making balanced meals, (4) educate on nutrients in FV, (5) educate on healthy snack options, and (6) encourages students to incorporate balance into all aspects of their lifestyle including what they eat and drink [49]. Each of the 6 applications are designated to one of the 6 warrior characters, *Body Doc*, *Muscle Max*, *Graino Supa*, *Shining Rainbow*, *Fiberlicious*, or *Super Slurper* [49]. Each warrior character acts as a role model by encouraging children to mimic their own strength and power. Each character promotes healthy foods, healthy eating habits, physical activity, personal hygiene, and an overall healthy lifestyle. In addition to warriors a “naughty” BQ character known as, trans-fat cat, is incorporated throughout the curriculum to educate children on unhealthy food choices and pressures to eat poorly [49]. Students were encouraged to become brave warriors themselves through, trying new FV and creating healthy behavior changes as well as acting as role models to encourage their families and friends to do so as well. Each week F/V tastings were provided by the federally funded FFVP to expose students to F/V, encourage trying new foods, and increase F/V preference. An overview of weekly sessions identifying the BQ lesson for each session, the URI Nutrition material and the iPad component can be found in Appendix C. The CYFAR Grant provided funding for 70 Apple iPads, 70 Applie iPad covers, 65 charges, and two lockable storage units to be left in the treatment school at the conclusion of the intervention [50]. Teachers were educated

on the iPads and encouraged to continue using the BQ applications with current students as well as encouraged to utilize them to enhance standard math, science, and language academic curriculums. Additionally, teachers were informed on the expectation that they would teach the program to upcoming 3rd grade students the following academic school year.

Data Collection

Dietary intake, self-efficacy for healthy eating, and attitude towards computer/iPads was assessed immediately prior to lesson 1 and immediately following the completion of lesson 13 to both treatment and control. Demographic information was collected at pre-evaluation only. Complete pre/post surveys are included in Appendix B. Surveys were conducted on apple iPads using SurveyMonkey.com. All questions were asked in both English and Spanish and were written to be appropriate for a third-grade literacy level. A URI SNAP-Ed Staff member read each question aloud at both the treatment and control schools for both pre and post assessment. The URI SNAP-Ed staff member conducting the survey provided examples and clarification to questions in addition to advising participants to read along and not go ahead. Additional URI SNAP-Ed staff members walked around the room to assist with technical problems to answer questions, and to insure participants were on the correct section. After the completion of an assessment, a URI SNAP-Ed staff member downloaded data stored on the SurveyMonkey.com database. Data were assessed for technological errors, such as unanswered questions due to internet/iPad malfunction. Incomplete surveys were discarded or re-administered if possible. Surveys were coded for anonymity to preserve confidentiality then demographic data were removed from

survey resulting in a database de-identified at the source. De-identified data were entered in an Excel spreadsheet by a URI SNAP-Ed staff member not involved in the study. Participant attendance was taken weekly in the treatment school by Nutrition Educator or the 3rd grade teacher and was entered into the excel spreadsheet with post data. The de-identified data was then provided to study researcher.

Demographics

Demographic data and Participation level/dosage of 4-H, school-based, and out-of-school activities was required by all CYFAR grantees [50]. In this study, questions were generated from the pre-approved CYFAR Common Measures, Youth Participant Demographic and Youth Participation Level instruments developed by the CYFAR team at the University of Arizona (2011) [50]. Participant's gender, age, grade, race, ethnicity, and primary language spoken at home was identified. The ethnicity question asking participants "Are you Hispanic?" was altered based on standard URI-SNAP Ed protocol to ask children, "Do you speak Spanish at home?"

Primary Outcomes

Nutrition quality of each child's diet was assessed using a 5-item food behavior instrument specifically developed for this study to evaluate primary hypothesized, daily F/V, SSB and energy dense snacks consumption (SwS and SaS). This instrument was modified from the original instrument utilized in the pilot study based on feedback from program staff indicating the children had difficulties with measurement. Therefore, the question asking children to identify "How many cups of F/V did you eat yesterday" was changed to "How many times did you eat F/V (or SSB, SwS, and SaS) yesterday?" Surveys were only administered to students on days

where “yesterday” was a typical school day not a weekend or holiday. All surveys asked each question in both English and Spanish. Possible answers for all 5 questions regarding dietary intake included 6 possible responses, 0 times, 1 time, 2 times, 3 times, 4 times, and 5 or more times.

Fruit

To assess daily fruit intake the specific item was, “How many times did you eat fruit yesterday?” For this question, children were directed not to include 100% fruit juices. Picture examples were provided illustrating examples of fruit.

Vegetables

To assess daily vegetable intake the specific item was, “How many times did you eat vegetables yesterday?” For this question were directed not to include French fries. Picture examples were provided illustrating examples of vegetables.

Sugar Sweetened Beverages (SSB)

To assess daily SSB intake the specific item was, “ How many times did you drink a sugary drink yesterday?” For this question children were directed to not include naturally sweetened beverages such as 100% orange juice or flavored milk products such as chocolate, coffee, or strawberry flavored milk products. Picture examples were provided illustrating examples of sugary drinks.

Sugar Sweetened Snacks (SwS)

To assess daily SwS intake the specific item was “How many times did you eat a sweet snack yesterday between your meals? Picture examples were provided illustrating examples of sweet snacks also note this questioned ask children to identify

number of times consumed between meals not those included with breakfast, lunch, or dinner.

Salty Snack (SaS)

To assess daily SaS intake the specific item was, “How many times did you eat a salty snack yesterday between your meals? Picture examples were provided illustrating examples of sweet snacks also note this questioned ask children to identify number of times consumed between meals not those included with breakfast, lunch, or dinner.

Exploratory Outcomes

Pre-approved common core instruments established by the CYFERnet Evaluation Team at the University of Arizona and Virginia Tech were designed to support CYFAR grantees with their program evaluation efforts [50]. In this specific study, two instruments utilized to assess exploratory data. These included the research based, 9-item, *Self Efficacy for Health Eating Instrument* and the research based, 9-item, *Computer Attitude Questionnaire* [50].

Self-Efficacy for Healthy Eating

This 9-item self-efficacy for healthy eating instrument assessed whether or not a child was likely to eat or to not eat specific foods, the survey directed students to “choose the answer that best shows how you feel” for a series of nine questions. The questions included, “How hard would it be for you to eat fruit for an after school snack?” “How hard would it be for you to eat vegetables for an after school snack?” “How hard would it be for you to choose water instead of soda or Kool-Aid when you are thirsty?” “How hard would it be for you to drink low-fat or fat-free milk instead of 2% or whole milk?” “How hard would it be for you to choose a small instead of a

large order of French fries?” “ How hard would it be for you to eat smaller servings of foods like chips, snack cakes, cookies, or ice cream?” “ How hard would it be for you to eat a snack like pretzels instead of chips?” “ How hard would it be for you to drink less soda?” and “ How hard would it be for you to drink less Kool-Aid?” A 3-point anchored response scale was applied, possible responses included, 0=“not hard at all”, 1=“a little hard” or 2=“very hard”. The sum of all 9-items was utilized as an average score, ranging 0 through 18. A lower score equated to a higher self-efficacy towards desirable eating behaviors.

Attitude Towards Computers/iPads

An additional 9-item instrument utilized questions from the validated *Computer Attitude Questionnaire (CAQ)* developed by Knezek G.A., Christensen, R., and Miyashita, K.T in 1995 [50]. For purposes of this study, which utilizes Apple iPad’s, “iPad” was added to questions. The nine statements included, “I enjoy computer/iPad games very much” “I would work harder if I could use computers/iPads more often” “ I know computers/iPads give me the chance to learn many new things” “I can learn many things when I use a computer/iPad” “I enjoy lessons on the computer/iPad” “ I think it is very important for me to learn how to use a computer/iPad”. The original CAQ utilizes, a 5-point Liker-type self reported questionnaire ranging from 1= “Strongly disagree” to 5= “strongly agree” [50]. For the purpose of this study the 5-point scale was reduced to a 3-point scale based on previous SNAP-Ed experience with appropriate questions design for specific population serviced. Negatively weighted question was reversed to ensure this alternate positioning does not skew scores. The specific scale applicable to this study

was 1= “no”, 2= “sometimes” or 3=“yes”. Students were also given the option to answer, “I don’t know”. After exclusion for “ I don’t know” responses, the sample size decreased to N= 77 (treatment n=47, control n=27). The sum of all 9-items was utilized as an average score ranging 9-27. A higher value indicated a more positive attitude towards computers/iPads.

Data Analysis

All data analyses were conducted on SPSS software (Version 23.0.0, IBM, Inc.). Distributions of baseline characteristics and demographics between the treatment and control group were compared using independent sample t-tests or Chi Squared analysis for categorical variables. There were no outliers in the continuous data, as measured by standardized residuals greater than ± 3 standard deviations, for any of the primary or exploratory variables assessed and data was normally distributed. Dietary outcomes differed between groups at baseline among three primary dietary outcomes, SSB (p= .008), F/V (p= .000, p=.045 respectively), as well as both Exploratory outcomes, Self Efficacy for Healthy Eating (p=.023) and Attitude Towards Computer/iPads (p=.004). In order to control for differences in pre-intervention variables, the primary analyses utilized in this study were a series of Univariate Analysis of Covariance (ANCOVA). ANCOVA was utilized to assess time by group interaction for the primary hypothesis of F/V, SSB, SwS, and SaS intake as well as for both exploratory variables. Within group differences from pre to post for both primary and exploratory variables were assessed using paired t-tests.

RESULTS

Table 2 displays the baseline characteristics and demographics of the subjects. All participants were 3rd grade students ages eight, nine or ten years old (72.9%, 23.3%, 3.9% respectively). One half of the participants in the treatment group reported speaking Spanish at home (21.5% yes, 30.4% sometimes) whereas roughly 90% of participants at the control group reported speaking Spanish at home (39.1% yes, 48.4% sometimes), suggesting difference by Hispanic population. The majority of the treatment group identified themselves as Black or African American (29.1.%), other (26.6%), or were unsure of their race (35.4%). Only 3.1% of the control group participants identified themselves as Black or African American (68.8% other, 28.1% unsure).

Primary Outcomes: Dietary Intake

Table 2 also presents between groups baseline comparison of select values related to dietary intake. At baseline, the treatment group reported a significantly higher consumption of sugary sweetened beverages (SSB) per day compared to the control ($p < 0.5$). There was also a significant between group difference ($p < 0.001$) at baseline between the treatment and control group for daily fruit and for vegetable intake ($p < 0.05$). There were no significant between group differences at baseline for sugary sweetened snack (SwS) or salty snack (SaS) intake.

Table 3 presents between and within group differences for the five primary dietary outcomes evaluated. After adjustment for pre-intervention fruit consumption, there was a statistically significant difference in post-intervention fruit consumption between the treatment and control group, $F = 8.8$, $p < 0.05$, partial $\eta^2 = .065$ using covariate adjusted values. Post intervention, the treatment group consumed fruit 2.65

times per day while the control group consumed fruit 1.78 times per day. No between group differences were found for vegetables, sugar sweetened beverages (SSB), sugar sweetened snacks (SwS) or salty snacks (SaS) consumption. The treatment group reported significant decreases in SwS and SaS and SSB from pre to post intervention but there was no change in the control for any of the dietary variables.

Exploratory Outcomes: Self Efficacy for Healthy Eating/ Attitude towards computer/iPads

There was no significant between group differences in self-efficacy for healthy eating reported at post when using ANCOVA ($F_{(1,124df)} = 0.1, p > .1$). There were no within group changes from pre to post ($p > 0.1$). The treatment group reported a score of 4.4 ± 4.3 at pre and 4.3 ± 3.3 at post; a lower score indicated higher self-efficacy for healthy eating.

There were no significant between group differences in attitude towards computers/iPads at post when using ANCOVA ($F_{(1,71df)} = 3.6, p > .05$). There were no within group changes from pre to post ($p > 0.1$). The treatment group reported a score of 24 ± 3.3 at pre and 22 ± 3.9 at post evaluation. The control group reported a score of 25 ± 2.8 at pre and 23 ± 3.1 at post evaluation; a higher score indicated a more positive attitude towards computer/iPad's.

DISCUSSION

Summary of Main Findings

This school-based intervention which combined the technology enhanced BQ curriculum with standard URI nutrition education materials provided participants with 13-hours of nutrition education in 1-hour sessions over the course of four months. To

our knowledge, this is the first time that the BQ curriculum has been supplemented with standard nutrition education materials provided by SNAP Ed staff. Although no between group differences were found, significant reductions in SSB, SwS, and SaS among the treatment group and not the control group indicates the intervention was associated with positive behavior changes. Between group differences in fruit were found, however, lack of within group changes for fruit as well as lack of between or within group changes for vegetables suggests the intervention was less effective for changing F/V consumption. Although sample was low-income and a large proportion reported speaking Spanish at home, high SE for healthy eating and positive attitudes towards computers/iPad's in both the treatment and control group were found. This suggests that children are confident in their ability to make healthy food choices and that computer/iPad utilization may be effective at educating this young, at risk population.

Research supports that even minimal increases in F/V intake and/or minimal decrease in energy dense foods and drink intake can result in health benefits [18,21,31,51]. In addition, studies have found an inverse relationship between F/V intake and energy dense snack intake [24]. It is important, therefore to look at these variables simultaneously.

Main Findings Compared to Prior Literature

This study found the treatment group increased fruit more than the control group but there was no within group change in F/V intake within groups. The lack of change in F/V observed in this study differs from that found in a meta- analysis of 21- studies, Baranowski et al. study assessing Squire's Quest and research using the BQ

curriculum all of which found significant increases in both F/V consumption among the treatment group [52,53]. These differences could be related to the different instruments utilized to assess intake by the studies. Future research is needed to determine what instrument will best assess dietary intake among children.

At post intervention, the treatment group reported fruit consumption of 2.9 times per day and vegetable consumption of 1.8 times per day. According to the USDA 2015 Dietary Guidelines, children should consume at least 1.5 to 2 cups of fruit and 2 to 2.5 cups of vegetables per day [29]. Although in this study children did not identify total number of cups consumed per day, if serving sizes was adequate, participants may be meeting this recommendation for fruit, however, this suggests more work is needed to increase children's consumption of vegetables [29].

Although no between group differences in SSB, SwS or SaS were reported in this study, the treatment group significantly decreased their intake of all three negative dietary variables while the control group did not. It is possible that the instrument utilized was more sensitive to change in SSB, SwS and SaS than it was for F/V intake. The findings reported by the treatment group in this study were similar to the findings discussed in the literature review to decrease SSB consumption [41]. A systematic review of interventions conducted in England designed to decrease SSB consumptions and increase water consumption among children found significant decreases in six out of eight studies assessed [41]. A study conducted in Brazil assessing soda and juice consumption among 9-11 year olds who received nine 1-hour long nutrition education classes found minimal between group differences in soda consumption between the treatment and control group but not for juice [54]. Although the HEAT curriculum

and BQ curriculum both discussed the importance of decreasing SSB and energy dense snack consumption, both interventions evaluated pre to post change in F/V intake only [53,55].

An interesting finding of this study is the high self-efficacy (SE) scores for healthy eating reported among participants. SE is an individual's belief that they have control over events that influence their lives [56]. SE for healthy eating is the belief that the individual controls what foods they eat and/or don't eat. Even though a within group decrease in SSB, SwS, and SaS was reported by the treatment group, no between or within change for SE was found. It is possible that the SE instrument did not measure what it intended to measure. Although, research supports that low-income children/families face food barriers preventing access and consumption to healthy food, both pre and post evaluation scores for SE for healthy eating were low (indicating a high SE score). Further research is needed to truly determine the effect high SE for healthy eating has on an individual's dietary intake. Struembler et al. assessed SE towards healthy beverage selection by asking participants if they "Will drink water instead of soda?" they found a pre to post increase from 70% to 77% [57]. This supports this study's findings of high SE.

The positive attitudes towards computer/iPad integration reported by children is similar to other findings. In the United States seven out of 10 children have access to a tablet and one in three own their own [58]. Due to the prevalence of iPad/tablet usage among children, it is no surprise that students reported wanting to utilize iPads/computers to learn. Although, further research is needed to evaluate both the

negative and positive effects on learning when technology is utilized, this study provides support that technology may be effective in promoting healthful behaviors.

Strengths/Limitations

A major strength of this study is that it integrated outcomes related to both positive and negative dietary behaviors. Additionally, the utilization of iPads enhanced learning by providing children with a fun and integrative way of learning. Nutrition educators noted that children were eager to get to the iPad application component of the curriculum suggesting the value of utilizing technology. Lastly, the iPad's allowed for easy data collection.

A major limitation of this study is the validity of the evaluation instrument. The 5-item food frequency questionnaire was easy for children to utilize, however, it is unclear as to whether this method provided researchers with an accurate measure of a child's true daily dietary intake, particularly of F/V. Although examples of F/V's and energy dense snacks and beverages were provided to participant this may have caused confusion if other items consumed were not shown. Additionally, it is possible that 3rd grade participants are too young to accurately self-report their dietary intake over the previous day.

Additional limitations include the potential that participants may have been influenced by social desirability. However, observations reported by researchers did not detect signs of this during pre or post assessment. This study was conducted among third grade students from a low-income community, which is both a strength and a limitation. Findings from this study can only be generalized to this population.

Lastly, utilization of iPads/technology in this study was expensive which may further limit generalizability.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Through the integration of technology, participants can effectively process and learn information in a fun integrated “game-approach” and further generalize and apply this information to their own lives at an appropriate speed. Future interventions may benefit from increasing intensity, providing greater than 13-hours of nutrition education and promoting family involvement in school-based programs [59,60]. In addition, future research should utilize more sensitive and valid dietary measures.

Table 1:13-week BQ/CYFAR Curriculum and iPad Application Lesson Schedule

Lesson	Lesson Content/ iPad Application		
	Body Quest: Food of the Warrior Curriculum	URI Nutrition Education Material	iPad Application
1	Introductory Lesson: The Quest Begins, Character Introduction	Five Food Groups	Pre-Surveys
2	Brave Heart: Trying New Fruit and Vegetables	Go, Slow, Whoa of Food Groups	Introductory app: Meet the Characters
3	Reinforcement of Week 2	Portion Size of Fruit and Vegetables	Lesson 1: Body Doc
4	Name the Battle Group: Eating a Variety of Fruits and Vegetables	Eating Foods From all Food Groups	
5	Reinforcement of Week 4	MyPlate	Lesson 2: Muscle Mass
6	Warrior Training, Balanced Meals, Adding Fruit and Vegetables	Minute to Win it	
7	Reinforcement of Week 6	Breakfast Inspectors	Lesson 3: Graino Supa
8	Armor Your Body, Function of Foods What Each Food Group Offers	Fast Food (Fat Kit)	
9	Reinforcement of Week 8	Fruit and Vegetables: Color Function	Lesson 4: Shining Rainbow
10	Battle Snacks	Snack Time Activity	
11	Reinforcement of Week 10	Fiber	Lesson 5: Fiberlicious
12	The Way of the Warrior, Influence Others to Eat Healthy	Think Your Drink	
13	Reinforcement of Week 12	Wrap Up	Lesson 6: Super Slurper Post-Surveys

Table 2: Baseline Demographics Characteristics and Dietary Behavior Outcomes by Intervention Group

Characteristic	Treatment (n=70)	Control (n=59)	Total (N=129)	Test (t)
Gender				
Male	55.7 %	52.5%	54.3%	-.358
Female	44.3%	47.5%	45.7%	(NS)
Age				
8 years old	74.3%	71.2 %	72.9%	.096
9 years old	20%	27.1 %	23.3%	(NS)
10 years old	5.7%	1.7%	3.9%	
Grade				
3 rd grade	100%	100%	100%	-1.048
Speak Spanish at Home?				
Yes	21.5%	39.1%	29.4%	-4.738
No	48.1%	12.5%	32.2%	***
Sometimes	30.4%	48.4%	38.5%	
Race				
Black or African American	29.1%	3.1%	17.5%	
White	8.9%	9.4%	9.1%	
Asian	1.3%	3.1%	2.1%	
American Indian or Alaskan Native	8.9%	4.7%	7%	
Hawaiian or Pacific Islander	0%	1.6%	0.7%	
Other	26.6%	68.8%	45.5%	
Unsure	35.4%	28.1%	32.2%	
Parent in Military				
Yes	7.1%	13.6%	9.1%	.419
No	78.6%	69.5%	76.2%	(NS)
Unsure	14.3%	16.9%	14.7%	
aDietary Behavior Outcome Variables				
SSB	2.18 +/- 1.7	1.50 +/- 1.3	1.85 +/- 1.6	2.7**
SwS	1.96 +/- 1.6	1.84 +/- 1.7	1.95 +/- 1.7	.43(NS)

SaS	1.75 +/- 1.6	1.52 +/- 1.7	1.63 +/- 1.6	.84(NS)
Fruit	1.68 +/- 1.6	1.73 +/- 1.4	1.8 +/- 1.7	3.8***
Vegetables	1.96 +/- 1.8	1.42 +/- 1.4	2.3 +/- 1.5	2.0*
SSB	2.18 +/- 1.7	1.50 +/- 1.3	1.85 +/- 1.6	2.7**
SwS	1.96 +/- 1.6	1.84 +/- 1.7	1.95 +/- 1.7	.43 (NS)
SaS	1.75 +/- 1.6	1.52 +/- 1.7	1.63 +/- 1.6	.841(NS)
^bSelf Efficacy for Healthy Eating (scale 0-18)				
	4.7+/-4.3	6.4+/-4	5.5+/-4.3	-2.3**
^cAttitude Towards iPads/Computers (scale (9-27)				
	24.2+/-3.3	22+/-3.9	23.3+/-3.7	2.9**
^a Scores 0 times -5 or more times per day ^b Low score indicates higher self-efficacy (0 = "not hard at all", 1= "a little hard" 2= "very hard" (Sum of 9 items) ^c High score indicates more positive attitude towards computers/iPads 1= "No", 2= "Sometimes", 3= "Yes" <i>Note: children who answered "I don't know" were admitted for this section only</i> p < .05 * p ≤ .01 ** p < .001 *** NS = Not statistically significant				

Table 3: Pre and Post Comparison of Dietary Intake by Intervention Group

Group	Pre (mean +/- SD)	Unadjusted Post (mean +/- SD)	Within (t)	Adjusted Post (covariant adjusted mean +/- SE)	Between (F)
Times of Fruit per day					
Treatment (n=70)	2.83 +/- 1.551	2.90 +/- 1.754	-0.330 (NS)	2.646 +/- .191	8.8**
Control (n=59)	1.66 +/- 1.281	1.47+/- 1.580	0.912 (NS)	1.776 +/- .209	
Times of Vegetables per day					
Treatment (n=70)	2.11 +/- 1.861	1.80+/- 1.509	1.317 (NS)	1.713 +/- .166	2.9 (NS)
Control (n=59)	1.42 +/- 1.329	1.19 +/- 1.358	1.162 (NS)	1.290 +/- .181	
Times of Sugar Sweetened Snacks (SwS) per day (between meals)					
Treatment (n=70)	1.97 +/- 1.606	1.19 +/- 1.407	3.497***	1.180 +/- .165	1.9 (NS)
Control (n=59)	1.93 +/- 1.741	1.51 +/- 1.535	1.945 (NS)	1.515 +/- .179	
Times of Salty Snacks (SaS) per day (between meals)					
Treatment (n=70)	1.73+/- 1.605	1.11 +/- 1.257	2.928**	1.091 +/- .147	.03 (NS)
Control (n=59)	1.51 +/- 1.675	1.10 +/- 1.296	1.772 (NS)	1.129 +/- .160	
Times of Sugar Sweetened Beverages (SSB) per day					
Treatment (n=70)	2.17 +/- 1.719	1.23 +/- 1.253	4.268***	1.176 +/- .157	2.4 (NS)
Control (n=59)	1.47 +/- 1.251	1.47 +/- 1.394	.000 (NS)	1.537 +/- .172	
Note: Scores 0 times -5 or more times per day p < .05 * p ≤ .01 ** p< .001 *** NS = Not statistically significant					

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APPENDICES

A. LITERATURE REVIEW

Introduction

This review will discuss childhood obesity, determinants of childhood obesity as well as determinants of healthy eating and dietary behaviors among children. Additionally, this review will evaluate school-based studies, which specifically focus on decreasing childhood obesity and/or changing dietary food behaviors among participants. Lastly, the integration of technology into education, specifically nutrition education will be discussed in this literature review.

Childhood Obesity

Due to its escalating prevalence, obesity is considered an epidemic in the United States (US) [1]. Although the recent increases in life expectancy, the early onset of obesity among children today, may reverse this trend [2]. Despite efforts to minimize this epidemic, the rate of childhood obesity has tripled over the last three decades [3]. Childhood obesity is a vast and growing health concern. The National Health and Nutrition Examination (NHANES) tracks trends in the prevalence of obesity in the US [4]. In 1980, NHANES found that 6.5% of children ages 6-11 were obese. According to data collected between 2013-2014, 34.2% of children ages 6-11 were obese or overweight with 17.2% obese [4]. The early onset of obesity puts a child at increased risk of developing preventable diseases such as heart disease, type 2 diabetes, and certain cancers [5-7]. Moreover, 70% of obese children will remain obese into adulthood [8,9]. These preventable diseases account for 75% of all medical

costs in the US [10]. It is important to address childhood obesity or healthcare burdens in the US will increase substantially [10,11].

The ultimate solution to this problem is to decrease screen time, increase physical activity and change eating habits by decreasing the consumption of high-fat, high-sugar energy-dense snacks and beverages and increasing the consumption of fruits and vegetables (F/V) [12-18]. The majority of today's youth don't meet the recommendations for F/V intake, nearly half watch more than three hours of television per day despite the recommendation to limit screen time to two hours or less per day, and, although 77% of 9-13 year olds get the recommended 60 minutes of physical activity per day, this drops to only 29% among the high school population [19-21]. These factors all combine to contribute to the overwhelmingly high prevalence of childhood overweight and obesity.

Over the past two decades, policy makers have targeted school as the primary venue for establishing dietary and lifestyle changes and providing nutrition education to children in order to combat childhood obesity [22]. Although many diverse approaches have been taken to target school-aged children, both statewide and nationally through the implementation of nutrition education interventions, policies and practices, there has been little impact on the prevalence of obesity in school-aged children [19-21].

Since participation rates in parent/caregiver programs are low, especially among low-income populations, school-based interventions may be the best venue for childhood obesity prevention programs [23]. Evidence suggests that successful behavior change is facilitated by an environment that supports the desired behavior

[24]. Establishing school-based programs where children apply what they have learned both in and out of school; encouraging children to share their knowledge with family and friends; and giving children and families access to materials outside of school for continued learning opportunities is critical in order to establish lasting dietary behavioral changes. Programs must be customized to target today's youth by providing high dosage, multidimensional, interactive and fun opportunities for learning [25-27].

Risks associated with Obesity

Childhood obesity is typically associated with the excess abdominal visceral fat, hepatic lipid depletion, and low to moderate levels of skeletal muscles, which sets the stage for the development of visceral fat into adulthood [28,29]. In children ages 2-20, overweight is defined as being between the 85th and 95th percentile and obesity is defined as being above the 95th percentile for BMI-for-age growth charts [30]. The early onset of obesity puts a child at increased risk of developing obesity related diseases previously only seen in adults such as heart disease, Type 2 diabetes, fatty liver disease, hypertension, high cholesterol, and certain cancers [5-7,29]. These diseases put a significant burden on the medical health care system [10,11].

Childhood obesity predisposes an individual to diseases in adulthood and causes physical, social, and emotional risks [8]. Obese children are twice as likely to die before the age of 55 than their peers whose BMIs are within healthy ranges [8,9,30]. Evidence suggests 70% of obese children have elevated triglycerides, cholesterol, insulin, or blood pressure which are indications for the development of obesity related diseases such as cardiovascular disease, Type 2 diabetes, sleep

disorders, certain types of cancer, and nonalcoholic fatty liver disease [31] . Weiss et al. studied biomarkers associated with cardiovascular disease among children with different BMIs. Subjects included, 438 obese, 31 overweight, and 20 non-obese children and adolescents ages 4-20 years old. Standard glucose-tolerance, blood pressure, plasma lipid, C-reactive protein, and adiponectin tests were performed on each subject [32]. Children taking medications to alter blood pressure, lipid metabolism, or glucose were excluded. Study protocol required children to consume a diet consisting of 250 g of carbohydrates per day and to avoid vigorous physical activity. Following a 12-hour overnight fast, triglyceride levels, high-density lipoprotein cholesterol and blood pressure tests were conducted [32]. Results showed that as the severity of obesity increased, the presence of metabolic syndrome also increased and similarly as insulin resistance increased, there was an increase in the prevalence of metabolic syndrome ($p < 0.001$). Additionally, C-reactive protein levels and adiponectin levels were elevated in obese subjects. Metabolic syndrome was found in 38.7 % of moderately obese subjects and 49.7% of severely obese subjects but was not detected in non-obese subjects even if they were overweight. [32].

Obesity affects mental health. Obese children are at greater risk of suffering from mental disorders such as low self-esteem, depression, behavior and learning impairments and bullying [33,34]. L J Griffiths et al. conducted a cohort study in England to determine if the effects of weight categories (underweight, average weight, and obese) at age 7.5 ($n=8210$) predicted bullying among boys and girls one year later [34]. One year later overt bullying was assessed in 7083 subjects [34]. Results of this study found that when comparing obese boys with average weight boys, obese boys

were 1.66 (95% CI 1.04-2.66) times more likely to be overt bullies and 1.54 (CI 1.12-2.13) times more likely to be overt victims of bullying [34]. When comparing obese girls with average weight girls, obese girls were 1.53 (CI 1.09-2.15) times more likely to be overt victims [33]. Future research needs to address these issues especially among low-income populations in order to evaluate the link between body composition and bullying [33-35].

Economic Costs of Obesity

The prevalence of childhood obesity far exceeds HealthyPeople2020 goal of less than 15% which puts a burden on the US Health Care System [10,11,36,37]. Currently, \$190 billion per year is spent on obesity [10,11,36]. Of that total, childhood obesity is responsible for \$14 billion in direct medical costs [36]. If obesity rates continue to rise at the current pace obese children will become tomorrows obese adults and by 2030 medical costs associated with treating preventable obesity-related diseases will cost a yearly \$549.5 billion, with childhood obesity alone costing \$66 billion [10,36-38].

Obesity Determinants

Although metabolism, genetics, socioeconomic, cultural, environmental, and medical factors contribute to obesity, key determinants are dietary and physical activity behaviors [5-7, 19-21,32-34]. Evidence suggests that healthy habits associated with diet and physical activity that are established during childhood trend into adulthood [8]. This indicates the importance of implementing obesity prevention interventions into schools. However, evidence is conflicting about the efficacy of these programs in reducing obesity. Interventions need to do more than educate about the importance of FV intake and physical activity in order to be effective in changing

behaviors. There are many interconnecting factors and contributors to the childhood obesity epidemic that must be considered.

For the low-income population and minorities, the obesity epidemic is particularly severe. Among youth ages 2-19 years, the prevalence of obesity among non Hispanic Asians (8.6%) was lower than non-Hispanic whites (14.7%), non-Hispanic blacks (19.5%), and Hispanics (21.9%) [39]. When comparing socioeconomic statuses (SES) similar trends are seen. According to data from the 2010 Pediatric Nutrition Surveillance System, one of every three children from low-income families is overweight or obese [40].

Multiple factors put low-income and minorities at greater risk for obesity. Due to their decreased access to physical activity, limited resources to healthy foods and lack of parental nutrition education and nutrition related knowledge, children from low-income families tend to be at greater risk [41-43]. SES significantly reflects dietary quality [44]. In data collected in 2010 by NHAES, children from higher socioeconomic status groups consumed a greater amount of F/V per day compared to their peers from lower socioeconomic status groups (0.65-0.59 CEPC respectively) [44]. Additionally, those from higher socioeconomic status groups reported higher consumption of lean protein, whole grains, low-fat milk and dairy products, and nuts. In comparison, those from lower SES groups consumed more energy dense snacks, processed foods, added fat, fried food, whole milk, sweetened beverages, candy, white breads, pastas, and rice products, and fast foods [44]. The prevalence of obesity among children whose primary adult head of household did not complete college is nearly

double those who live in a home where the head of house hold obtained a college degree (19% vs 9% girls, 21% vs 11% boys respectively) [44,45].

Race is also a determinant perhaps due to increased screen time reported by African American and Hispanic children compared to their Non-Hispanic white peers [45]. Not only does increased amount of screen time result in decreased physical activity it also results in increased exposure to food and drink advertisements promoting energy dense snacks and beverages [45].

Gender is also a determinant of obesity [45]. According to data collected by NHANES between 1999-2002 and 2007 -2010, the prevalence of obesity among children ages 2-17 increased from 15.4% to 18.6% among boys and 13.8% to 15.1% among girls [45]. Substantial differences between girls and boys also were found by race. Within the eleven years data was collected, obesity increased from 11%-15% among Non-Hispanic White females, 20% to 23% among non-Hispanic black females, and 17% to 18% Mexican-American/Hispanic females [45]. Obesity rates increased from 13% to 16% among Non-Hispanic White males, 16% to 21% among non-Hispanic black males, and 24% to 25% among Mexican-American/Hispanic males. According to these data, the prevalence of obesity among Mexican-American/Hispanic males is substantially higher among males than females (25%, 18% respectively) [45]. Non-Hispanic Black females were the only group with a higher prevalence of obesity among females compared to males (23%, 21% respectively) [45,46].

Dietary Habits In Children

Children who consume a diet high in nutrient rich foods such as FV and low in high-fat/high-sugary energy dense foods have lower body weights than children with poor diets [12-18]. Most children do not meet the United States Department of Agriculture Guidelines (USDA Guidelines) for FV intake and exceed the recommended limits set for sugar and fat intake [47]. There has been an increase in the consumption of fast food and high calorie snacks, which has paralleled the increase in obesity rates, particularly among low-income and minority populations [46-48].

Fruit and Vegetable Intake

In 2007-2010, 60% of children did not meet the recommendation for daily fruit intake and 93% did not meet the recommendation set for daily vegetable intake [19]. Because of the associated benefits associated with consuming a diet high in fruits and vegetables (F/V) and the evidence that supports dietary habits established in childhood tend to carry on into adulthood, a national effort has been initiated to improve F/V intake among youth [50]. Healthy People 2020 set goals for people ages 2 years and older to increase dietary consumption of vegetables from 0.77 to 1.14 cup and fruits from 0.53- 0.90 cup equivalents per 1,000 calories per day [51]. Based on a study by the CDC that analyzed 1- day 24-hour dietary recalls from the National Health and Nutrition Examination Survey between 2003-2010, total fruit intake increased among children from 0.55 cup equivalents per 1,000 calories (CEPC) to 0.62 CEPC [15,44]. Total vegetable intake did not change (0.54 CEPC to 0.53 CEPC) [44]. Additionally, over 30% of vegetables consumed were reported as white potatoes in the form of fries or potato chips [15,44]. Additionally, the USDA developed 2010 Dietary Guidelines for Americans suggest filling half your plate with FV and states that elementary age

children should consume anywhere from 1.5 to 2 cups of fruit and 2 to 2.5 or more cups of vegetables per day, dependent on caloric needs [47].

Data collected in 2014 by the Produce for Better Health Foundation (PBH) commissioned consumer research through the National Eating Trends database found a 7% decrease in the per capita consumption of both fruits and vegetables since 2009 [52]. There was a 7% decrease in the consumption of vegetables and a 2% decrease in the consumption of fruit. One possible explanation for this is the increase use of ready-to-eat or frozen foods, the decrease in side dishes, and use of fewer ingredients in meal preparation. Data did however support that children of all ages are consuming more whole fruit at meals since data collected in 2009 [52].

Many epidemiological and cohort studies support the claimed benefits of F/Vs. F/Vs contain many nutrients essential for healthy body function and growth including, Vitamin A, C, and K, potassium, magnesium, and phytonutrients, all which are under consumed in the United States today [12,13,47]. Children who do not consume at least two total servings per day of F/V are three times more likely to be deficient in vitamin A, Vitamin C, and fiber [13,14,47]. Additionally, F/V contain antioxidants. Antioxidants can inhibit reactions of free radicals including reactive species of oxygen [13]. The inhibition of these reactions has been associated to lower incidence of certain cancers [49]. A third mechanism is that high fiber and high water content foods plays an important role in weight management possibly related to the relationship between F/V consumption and decreased consumption of calorie dense, high sugar, high fat foods associated with a lower caloric intake [14]. One recent study analyzed eight randomized controlled studies (n=1026 participants) that

successfully increased F/V consumption pre to post intervention [23]. Seven of these studies provided sufficient data for inclusion in a meta-analysis of the effect on body weight, and five studies provided sufficient data for inclusion in a meta-analysis of the effect on energy intake [23]. The authors concluded that increased F/V consumption, with or without advice to decrease the consumption of other foods, did not lead to weight gain and that there was strong evidence that increasing F/V consumption will lead towards long term weight loss or weight management.

Despite efforts to provide nutrition education about the benefits of a diet rich in F/V, adequate intake is a concern. Sixty percent of children do not meet recommendations for fruits and 93% do not for vegetables [19]. Evans et al. conducted a systematic review and meta-analysis of 21 randomly selected studies (n=26,361 children) that evaluated school-based interventions on FV intake among children ages 5-12 [22]. They found an overall average fruit increase of 0.24 portions and a vegetable increase of 0.07 portions per day indicating the need for improvement [22].

Environment plays a significant role in children's eating behaviors. Focusing on both the school and home environment is critical in order to establish dietary behavior changes among children. Federal laws and policies currently support efforts to improve the school environment. Programs such as the School Breakfast and Lunch Program, the Federally Funded Fresh Fruit and Vegetable Program and the *Let's Move* Salad Bar have helped to increase exposure to F/V and decrease exposure to Sugar Sweetened Beverages (SSB), Sugar Sweetened Snacks (SwS), and Salty Snacks (SaS) during the academic school day [53-55]. Although school is critical, especially among low-income populations where children consume a large percentage

of their daily caloric intake from the food provided by these federally funded programs, establishing changes in the home environment is also important [41].

Sugar Sweetened Beverage, Sugar Sweetened Snacks and Salty Snack Intake

Parallel with the trends seen in the under-consumption of FV among today's youth is the over-consumption of energy dense foods and beverages [56-64]. The 2015 Dietary Guidelines recommend limiting intake of discretionary calories, which includes those from high sugar, high fat foods and SSB to 5%-15% of total calories [47]. The World Health Organization (WHO) recommends both adults and children limit intake from free sugar to less than 10% of total energy intake. WHO determined research findings support that a high-sugar diet is associated with parallel changes in body weight resulting in the increased risk of both cardiovascular disease, hyperlipidemia, hypertension and type 2 diabetes [65]. The WHO also evaluated data collected from five interventions designed to decrease sugar consumption through reducing the intake of SSB and high sugar foods. However, results indicated the interventions were not effective and there was no significant changes in BMI z-scores (0.09; 95% CI: 0.14, 0.32) [65]. However, the review found that children with higher consumption of sugar were more likely to be obese than those children who consumed lower amounts of sugar (OR 1.55; 95% CI: 1.32, 1.82) [65]. These data suggests that decreasing sugar consumption among children is difficult however, change is important.

Children; especially minorities and those from low-income communities eat diets high in fat and sugar [19,20,57,48]. The average 4-8 year old consumes roughly 21 teaspoons (84 grams) of sugar daily[68]. Boys consume more than girls (16.3, %

15,5 % respectively). This high sugar intake is likely due to the overconsumption of processed foods, SwS, SaS, SSB, and fast food. [63,65]. According to the American Heart Association children ages 4-8 who consume an average of 1,600 calories daily should limit calories from added sugar to no more than 130 calories or 3 teaspoons [62].

Roughly 41% of added sugar calories and 21% of total calories consumed come from beverages [65]. Soda, sports drinks, and juice consumption has risen over time in youth [56,57,60,63,64]. Seventy-six percent of children (ages 2 to 19) consume SSB daily [63]. Children ages 6-11 years old drink on average 212 +/- 4.1 calories per day from SSB [63,64]. Higher consumption of SSB suggests an increase risk of obesity in children [60,64]. A 2013 NHANES study found a 4-5% increase in children who consume a heavy amount of SSB defined as $\geq 2092 \text{ kJ day}^{-1}$ ($\geq 500 \text{ kcal day}^{-1}$) with low-income children having greater odds than their higher income peers (odds ratio = 1.93; 95% confidence interval (CI) = 1.05–3.56) [66]. On average children are consuming three or more SSB daily. Although further research is needed to determine whether decreasing consumption of SSB is associated with decreased obesity risk, Morenga et al. conducted a meta-analysis in 2013 and found a higher intake of SSB to be associated with a 55% higher risk (95% CI=32-82%) of being overweight or obese among children. [58].

An additional study by Piernas and Popkins et al. looked at the consumption of both energy dense foods and beverages among children ages 2-18 years old at two time points [60]. They found a significant increase in the intake of fruit drinks, regular soda, and sports drinks from 1977 to 2006 [60]. The authors noted a significant

increase in the consumption of SSB among children from low-income families as well as in Hispanic and Non-Hispanic Black children. [60].

In addition to the over consumption of energy dense, nutritionally poor beverages with high sugar content and little to no nutritional value, snacking habits among today's youth are suboptimal [59-61,66]. From 1989-1991 to 2003-2006 snacking among children has increased by about 1.1 more snacks per day [66]. Current trends in meal patterns show that most American children are consuming three meals and three snacks per day, with some children consuming up to six snacks per day [66]. A longitudinal study conducted by Jahns et al. examined trends in snacking behaviors among children in two age group categories (2-11, 12-18) [59]. Data were self-reported by participants and data were collected in 2004 and again in 2014. Snacking was defined as foods consumed within a 15-minute period distinct from breakfast, lunch, or dinner. [59]. Among all age groups, snacking increased over the 10-year span 32%-41% [59]. Snacking among children primarily consists of energy dense high fat and high sugar foods [59]. Snacking on unhealthful, energy dense snacks has been linked with an over consumption calories; children consume 200-1,000 calories daily from snacks alone.

Piernas and Popkins study conducted from 1977 to 2006 found similar results [60]. Over the three decades accessed, the amount of calories per snack increased significantly, suggesting that children today consume on average 27% of total daily calories from snacks [60]. There was a significant increase in the percentage of sugary and salty snacks (6% to 8.5% and 8% to 16.5%. respectively) [60]. Specifically, there

was an increase in total daily energy intake from SaS, 7% to 15% and a rise in candy 6% to 9% [60].

Both national and statewide, policies and practices have been implemented in schools to increase F/V and decrease accessibility of SSB and energy dense snacks. [67,68]. In Rhode Island, 90 % of schools display F/V near the cafeteria check out line, 76% serve locally grown produce, 81% have implemented attractive F/V displays and posters into school cafeterias, 49% offer a self-serve salad bar option, and 32% have school vegetable gardens [68-69]. In 2006, Rhode Island General Assembly passed legislation that prohibited the sales of high-sugar, high fat snacks and beverages in schools [68-69]. The national, *Healthy, Hunger-Free Kids Act* was implemented which set regulations to improve the nutrition quality of the school lunch and breakfast programs [70]. Although these policies along with a variety of interventions have been implemented to increase F/V consumption and decrease energy dense food and beverage consumption, diet quality among today's youth remains inadequate.

Key Determinants of Dietary Behaviors

In order to establish effective interventions to combat childhood obesity identifying barriers preventing healthy food intake and identifying the key determinants to eating healthy foods is critical.

Demographic Determinants

Demographic differences make it difficult to establish a “one size fits all” method to create nutrition behavior changes [71-79]. First, there are gender differences in dietary behaviors among children [71,72,75,77]. According to studies utilizing the

Child Food Neophobia Scale, a 10-point scale used to determine willingness to try certain foods, boys are less willing to try new foods, specifically F/V, and have significantly less variety of foods in their diet than girls. [77]. A study conducted by Borrmann et al. in Germany assessed portions of F/V consumed among 9,950 children ages 2-17 years old [72]. The study found that, on average, girls consumed 2.7 and boys 2.4 portions of F/V per day and only 12.2% of girls and 9.4% of boys met the recommended guidelines. Children from higher SES groups had better diets and consumed more F/V than those of lower SES groups. [72].

Socioeconomic (SES) status plays a significant role in diet quality. Children from low- SES families eat less F/V and consume larger amounts of energy-dense foods and drinks than their peers from higher SES [73,74,76]. Lower SES children have decreased access to F/V and increased access to high-fat foods, processed foods and fast food. Due to food insecurities prevalent in low-SES families, parents/caregivers may restrict costly healthful food or purchase calorically dense foods in fear of experiencing a shortage [74]. A low education level increases this risk [41]. Additionally, race is also a factor. White children have higher preference for F/V than Non-Hispanic Black children and FV consumption tends to be lower among Hispanic children compared to their non-Hispanic peers [39]. Marketing to children increasingly targets low-income and minority children. Companies such as Pepsi Cola, Dr. Pepper Snapple Group and Coca-Cola Co., target African American Black and Hispanic youth through their advertisements for sugary beverages [80,81]. It was estimated that black children watch 60% more television than their white peers and see more than twice the number of TV ads [80,81]. Black children saw four times as many

adds for Sprite, three times more adds for Coca Cola, and two to two and a half as many adds for sugary juice brands including Capri Sun, Energy Drinks, Sunny D, and Snapple than white children. The number of adds targeting Hispanic children has been on the rise. Ads for sugary sweetened beverages targeting Hispanic children rose 32% from 2010-2013 [80]. Total spending on advertisement of sugary-drinks and energy shots on Spanish television channels increased by over 40% from 2010 to 2013 [80,82]. In contrast, advertisements were decreased during the same time period by 18% on English- language television channels [82].

Psychological and Social Determinants

Besides demographic determinants, preference and taste are crucial contributors to intake among children. Children commonly identify vegetables as a least favorite food [75-77]. Bezbaruah looked at F/V intake among 345 children ages 6-11 [77]. Children identified taste as the most influential reason why they eat or do not eat F/V. Both F/V exposure and education are crucial [77] and determining predictors of FV consumption must be on the forefront when designing intervention programs.

Findings suggest that predisposition to sweet and salty tastes over bitter and sour tastes are a reason children prefer certain foods [76,77]. Children favor high-sugar high fat energy dense foods and dislike vegetables. However, predisposition for specific tastes can be altered over time with repeated exposure to foods [76]. Increasing familiarity, increasing F/V exposure, and continuous encouragement to try different F/V can lead a child to acquire tastes and accept a variety of F/V. This research supports the importance of both exposure and education in the school-based

setting as well as emphasizes the positive attributions of parent involvement in hopes to increase exposure to F/V not only in school but in the home environment as well [41, 78].

The home environment is important [78]. Policies have been implemented to make the school environment healthier especially for those children participating in the federally funded School Lunch, School Breakfast, and Fresh Fruit and Vegetable Programs [53,70]. However, work needs to be done to change the home environment in order to have an impact on childhood obesity. Parents/caregivers can positively or negatively influence a child's food choices. These influences can be both direct and indirect. Parent/caregivers are typically the gatekeepers who do all the food shopping and preparation and therefore choose what a child eats [78]. In addition children are likely to mimic the dietary habits of their parents [78]. Parents should be active in their children's meals time, praise children for eating F/V, encourage but not pressure F/V consumption, make F/V visually appealing, offer large portions of F/V, and allow children to self-regulate what to eat and how much to eat within what they offer [78].

Dietary Interventions in Children

Interventions must provide multi-dimensional opportunities for experiential learning to target children's current interests, adjust for children's different learning styles, and successfully establish changes among children and their families.

Interventions should also strive to increase opportunities for F/V exposure and physical activity exposure, increase F/V availability and F/V acceptance through repeated exposure and increase child and parent nutrition knowledge in order to be successful. Programs should be tailored to meet the needs of the population. Although

programs that provide high-dosages of nutrition education have been shown to be successful in creating behavioral changes among children diet quality remains inadequate and childhood obesity remains high [26,27]. The following studies evaluate interventions that target children.

One study that focused on F/V exposure unpaired with education, evaluated the *Fresh Fruit and Vegetable Program (FFVP)*, a federally funded program developed in 2011-2012 under the National School Lunch Act [53]. The FFVP provides roughly \$75 worth of fresh F/V per year to each child participant. Schools where >50% of children qualify for free or reduced meals are selected to participate in each state [53]. A total of 4,696 students from randomly selected schools just above and just below the FFVP funding cutoff were asked to self-report daily F/V intake. Total daily F/V intake among children participating in the FFVP was $\frac{1}{3}$ cup higher ($p=0.32$ cups per day). When assessing F/V consumed during the academic school day only, consumption was $\frac{1}{4}$ cup higher ($p=0.26$) among FFVP participants than in non-eligible schools [53].

The BASIC programs focused on high-doses of nutrition education without exposure to FV. This quasi-experimental study looked at F/V intake among 3rd grade students in 22 low-income schools in Iowa who received BASIC or BASICPLUS [83]. Simultaneously, BASIC consisted of eight 30-minute lessons taught by SNAP-Ed nutritionist and four 54-minute lessons taught by classroom teachers. The BASIC PLUS consisted of a social marketing campaign exposing parents to point-of-purchase signage, supermarket demonstrations, billboard and bus shelter signage, television, social media, and radio ads [83]. Participants in BASIC $n=530$ parents/caregivers (254

intervention 276 control) and BASIC PLUS n= 528 parent/caregivers (252 intervention 276 control) were administered pre and post surveys asking them to identify total number of servings their child ate daily of F/V. There was no differences between groups. Both groups increased total F/V consumption (BASIC $p<0.05$ BASICPLUS $p<0.01$) and fruit consumption (BASIC $p<0.05$ BASICPLUS $p<0.05$). In the BASIC PLUS intervention there was an increase in vegetable consumption ($p<0.05$) but there was no change in vegetables in the BASIC intervention group [83]. These findings support school-based programs and suggest that integrating technology and establishing parent awareness and involvement may be beneficial [83].

Delgado-Noguera M et al. conducted a systematic review of 19 interventions targeting increasing F/V consumption. The two computer-based interventions improved consumption of both fruits and vegetables from pre to post intervention among treatment schools [84]. Pooled analysis showed significant between group differences between treatment and control groups pre to post interventions (SMD 0.33, 95% CI 0.16, 0.50) [84]. In addition, 11 interventions that utilized a multicomponent approach were analyzed. These interventions included a classroom curricula, school environment modifications, teacher participation/involvement and parent involvement [84]. The results from these multicomponent studies were pooled. There were no differences in F/V intake between treatment and controls groups. However, there was a trend towards increased F/V in the treatment groups [84]. In the free/subsidized interventions that were neither computer based nor included multicomponent elements no pre to post increase in F/V intake was reported [84].

Baranowski et al. studied the effectiveness of a computer-based intervention on F/V consumption [85]. This study assessed changes in fruit, fruit juice, and vegetable (FJV) intake from pre to post intervention in 1,578 fourth grade students (treatment n=749 control n=740) from 26 elementary schools in Houston, Texas [85]. Participants were randomly assigned to treatment or control group. This study evaluated Squire's Quest, a 5-week, 10-session, psycho-educational, multidimensional intervention that is based on the social cognitive theory and utilizes a game approach to create dietary changes. Each session was 25-minutes in length [85]. The games were designed to increase FJV preference, increase asking behaviors at home, increase ordering behaviors while out, and increase skills associated with preparing FJV through the utilization of virtual recipes. At the conclusion of each session, participants were instructed to set goals to make the recipe illustrated during the session, eat another FJV serving at a meal or snack, or to ask a parent/caregiver to make a specific FJV available at home. Four days of dietary intake was assessed using multiple-pass 24-hour intake interview with participants in both the treatment and control groups prior to session 1 and at completion of session 10 [85]. The study found that the treatment school increased FJV intake by 1 serving more than the control [85]. Results from this study support that multimedia games may have the potential to change dietary behaviors among participants and the future exploration of the potential opportunities for establishing relationship with child game developers to create effective interactive learning opportunities.

An additional study was conducted evaluating the standard Body Quest: Food of the Warrior (BQ) curriculum (with Apple iPad utilization) a program that integrated

technology into its curriculum. The intervention was administered in the 2011-2012 academic school year. This study assessed F/V intake of participants during lunches served at school only [86]. A quasi-experimental design was utilized with a treatment group (n= 1,674) and a control (n= 803) [86]. All subjects were 3rd grade students from low-income schools in 60 Alabama counties [86]. Seventeen, 45-minute long lessons strictly following the BQ lesson plan (week 1-2 pre and week 16-17 post data collection) were taught by trained educators to the treatment group only. The control group completed only pre and post assessment. The intervention included 7 iPad applications to reinforce material taught each associated with different BQ warrior who promoted a healthy dietary behavior, such as fruits, vegetables, water, fiber, and whole grains. Additionally, the program provided fresh fruit and vegetable tastings and take home information for families. The *What's for Lunch checklist*, a validated survey used to assess previous SNAP-Ed curriculums in Alabama was used to assess intake [86]. Directly following lunch, students were asked to self-report whether or not they ate each food on the checklist and to identify percentage eaten. Both the treatment and control group filled out the form daily Monday-Friday during the 17-weeks BQ intervention, however the control group only filled out evaluation for 2 weeks at pre and 2 weeks at post assessment. Although all foods provided during lunch were listed, only F/V intake was evaluated [86]. When repeated measure ANCOVA was performed on post data, controlling for baseline differences, there was a significant difference in fruit intake ($p<0.001$) and vegetable intake ($p<0.05$) between the treatment and control group. An overall increase in fruit intake by 0.35 servings/week ($P<.01$) and an overall vegetable intake by 0.66 servings/week ($P<.001$) was shown

among the treatment group [86]. The study compared participants who simultaneously participated in the FFVP discussed above [57]. At baseline nonparticipants in the FFVP reported lower FV consumption (2.75 servings) compared to participants (3.16) however, they caught up by post evaluation (3.26 and 3.38 respectively) [86]. One major limitation of this study is it did not assess F/V intake at any other times outside of participants in school lunch period [86].

In contrast with studies that focus primarily on F/V, others focus solely on dietary consumption of sugar and fat. To our knowledge, in the US, fewer studies assessing school-based obesity prevention programs evaluate change in SSB and energy dense snack consumption compared to F/V consumption. In Brazil, a quasi-experimental design study assessing 9-11 years old (treatment n=559, control 284) who received nine 1-hour, nutrition lessons administered by a trained nutritionist evaluated variations in daily consumption of both soda and juice from pre to post intervention [87]. There was a difference between groups in daily soda consumption was found (-0.2 for treatment and -0.08 for control; $P=0.02$). No between group differences in juice consumption (-0.16 for treatment and 0.01 for control; $P=0.66$) was found. In addition, the intervention did not affect BMI [87].

Bostock and McCullough et al. published their systematic review of interventions designed to reduce consumption of sugar-sweetened beverages (SSB) and increase the consumption of water in children (ages 2-18) and the effect of body fatness[66]. This research utilized data collected from eight studies conducted between 2000 and August 2013 in England. All studies were greater than six months in length, consisted of a control and treatment group, evaluated SSB consumption and

BMI [66]. Of the eight interventions evaluated, six achieved significant ($p < 0.05$) reductions in SSB intake among the treatment group from pre to post intervention. When replacement drinks were home delivered a significant decrease in BMI was found at 12-18 month follow-up ($p = 0.001$ and 0.045 respectively) [66]. These findings suggested a 31% reduced risk of overweight/obesity when the provision of replacement drinks was paired with education [66].

In the United States, one particular study was conducted to increase water consumption among American Indian high school students in the Zuni high school [88]. The intervention combined high doses of health education on the importance of water consumption paired with the associated risks of high SSB consumption along with environmental changes to increase the accessibility of water and physical activity [88]. The environmental change component of this study included replacing all SSB in school vending machines with non-sugar alternatives such as diet soda [88]. Additionally, water coolers were installed in multiple locations throughout the school. This study found no change in BMI [88]. Within 3 years, of program implementation students attending Zuni high schools total SSB consumption drastically declined from 24 ounces/week/student to less than 1 ounce/week/student [88].

Another study evaluated the HEAT nutrition curriculum for 1st through 3rd grade participants from a high-risk culturally diverse community [89]. The study, Shape Up Summerville: Eat Smart. Play Hard (SUS), included a 3-year environmental change [89]. The objective of this intervention was to prevent childhood obesity by increasing both physical activity and F/V consumption. The curriculum consisted of 4 lessons taught by classroom teachers focused on increasing fruit, vegetable, whole

grain, and low-fat dairy consumption; decreasing consumption of snacks high in saturated fat and sugar; increasing physical activity; and decreasing sedentary time/screen time. All lessons contained Cool Moves, an innovated physical activity component. Year one results, indicated a change in BMI z-scores of children who participated in the intervention compared to BMI z-scores of children in two similar demographic communities not receiving the intervention [89]. On average SUS participants reduced weight by approximately one pound whereas no weight loss was found among control groups [89]. This study did not assess change in F/V intake or any other dietary variables.

Enhancing Education through the Integration of Technology

Behavioral changes are more likely to occur when skills are taught, applied, and rewarded over time [24]. Kaiser Permanente recently conducted a study concluding that high dosage and repetition is important when attempting to establish behavior changes among participants of an obesity prevention intervention [90]. Evidence supports that 50-hours is necessary in order for positive behavior changes to be established and that low doses of 10-hours are minimally or not effective in establishing change [91]. Computer-based interventions can increase dosage time and effectiveness. Integration of technological devices such as tablets, computers, and iPads into nutrition education has been shown to be effective [85,86].

Technology can bridge the gap between formal (in school) and informal (out of school) learning and help youth acquire the skills necessary for the 21st century. The use of mobile technology among children has skyrocketed upwards over the last five years [91]. A recent study found that 80% of American children ages 8-12 have access

to a tablet/iPad and 53% report owning their own [88]. Additionally, the gap between low and high-income children has significantly decreased. In 2011, only 22% of low-income children had access to a tablet/iPad where as in 2015 o nearly 65% had access [91].

Conclusion

The high prevalence and adverse consequences associated with childhood obesity warrant the need for the investment of both time and resources into developing successful preventative programs. Early intervention is necessary to create a positive impact on a child's future health as well as reduce future health care costs. This literature review has demonstrated the importance of customizing nutrition interventions to meet the needs of children today, the need to utilize a multi-dimensional learning approach, the importance of F/V exposure and family involvement and the impact that program duration has on outcome. Simultaneously, looking at both change in F/V consumption and change in SSB/energy dense food consumption is important considering that a child who consumes less SSB and energy dense snacks consumes more F/V. This review demonstrated that children are consuming excessive amounts of high-fat high sugar snacks and beverages paired with inadequate amounts of F/V and the negative consequences associated with these dietary trends. However, research in this area is limited, Zubieta et al. reviewed evidenced-based in-school nutrition interventions, but did not find evidence that these interventions were effective in treating childhood obesity [26]. To our knowledge, there are no studies that look at interventions that combine the BQ curriculum with a nutrition education program focused on F/V, SSB, and energy dense snacks.

This review indicates the need to implement and evaluating childhood obesity intervention programs. The FFVP worked to increase exposure of F/V however, did not provide nutrition education, the BASICPLUS intervention worked to increase F/V among the treatment group, however, the standard BASIC program only worked to increase fruit intake [53,83]. Both Squires Quest and BQ utilized technology[85,86]. Squires Quest increased FJV intake and BQ increased both F/V intake among the treatment school [85,86]. The BQ curriculum only looked at F/V intake during children's in-school lunch period [86]. As for programs designed to evaluate change in SSB and energy dense snacks, the systematic review conducted found that 6 out of 8 interventions significantly decreased SSB intake, the Zuni High School Study found that when SSB were replaced with water and education was provided, consumption decreased to less than 1 oz/week/student [66,88]. The HEAT, which discussed F/V, SSB, and high fat high sugar snacks, found participants reduced weight by approximately one pound [89]. No weight loss was found in control group. The HEAT study did not evaluate changes in any dietary variables [89].

Interventions most effective in increase F/V and/or decreasing SSB and energy dense snacks use multi-dimensional learning approaches through high dosages of innovated in-school curricula paired with opportunities for parent/family involvement. Childhood obesity is a multi-faced disease, a "one-size fits all" solution does not exist, thus a combination of efforts is needed.

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B. Evaluation Tool

CYFAR In-School Pre-Survey

Directions: Please select the appropriate response for each of the following questions.
(Instrucciones: selecciona la respuesta correcta para cada una de las siguientes preguntas.)

I am a...

(Soy de sexo...)

☐ Male (Masculino) ☐ Female (Femenino)

How old are you?

(¿Cuántos años tienes?)

☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11

What grade are you in school?

(¿En qué grado de la escuela estás?)

- ☐ 1st grade (1.er grado)
- ☐ 2nd grade (2.º grado)
- ☐ 3rd grade (3.er grado)
- ☐ 4th grade (4.º grado)
- ☐ 5th grade (5.º grado)
- ☐ 6th grade (6.º grado)
- ☐ 7th grade (7.º grado)
- ☐ 8th grade (8.º grado)

Do you speak Spanish at home?
(¿Hablas español en tu casa?)

- ☐ Yes (Si)
- ☐ No (No)
- ☐ Sometimes (A veces)

Are you...

(¿Eres...)

- ☐ American Indian or Alaska Native (indio americano o nativo de Alaska?)
- ☐ Asian (asiático?)
- ☐ Black or African American (negro o afroamericano?)
- ☐ Native Hawaiian or Pacific Islander (nativo de Hawái o de otras islas del Pacífico?)
- ☐ White (blanco?)
- ☐ Other (otro?)
- ☐ Not Sure (No estoy seguro)

CYFAR In-School Pre-Survey

Are either of your parents in the military (for example, the Air Force, Army, Guard, Marine Corps, Navy, or Reserve)?

(¿Alguno de tus padres está en las fuerzas armadas (por ejemplo, en la Fuerza Aérea, en el Ejército, en la Guardia Nacional, en la Infantería de Marina, en la Marina o en la Reserva)?)

- ☐ Yes (Sí)
- ☐ No (No)
- ☐ I don't know (No sé)

Which of these do they work for?

(¿En cuál de estas fuerzas armadas trabajan?)

- ☐ Air Force (Fuerza Aérea)
- ☐ Army (Ejército)
- ☐ Guard (Guardia Nacional)
- ☐ Marine Corps (Infantería de Marina)
- ☐ Navy (Marina)
- ☐ Reserve (Reserva)
- ☐ I don't know (No sé)

How long have you participated in 4-H?
(¿Cuánto tiempo participaste en el programa 4H?)

- ☐ Less than 1 year (Menos de 1 año)
- ☐ 1 year (1 año)
- ☐ 2-3 years (2 a 3 años)
- ☐ 4-5 years (4 a 5 años)
- ☐ 6-7 years (6 a 7 años)
- ☐ 8-9 years (8 a 9 años)
- ☐ 10 or more years (10 o más años)
- ☐ Does not apply to me (No es aplicable para mí)

CYFAR In-School Pre-Survey

How long have you participated in any in-school activities like sports, student government, drama or dance, academic clubs, pep clubs, band or symphony?

(¿Cuánto tiempo participaste en actividades escolares como deportes, gobierno estudiantil, teatro, danzas, clubes académicos, "pep clubs", bandas u orquestas sinfónicas?)

- ☐ Less than 1 year (Menos de 1 año)
- ☐ 1 year (1 año)
- ☐ 2-3 years (2 a 3 años)
- ☐ 4-5 years (4 a 5 años)
- ☐ 6-7 years (6 a 7 años)
- ☐ 8-9 years (8 a 9 años)
- ☐ 10 or more years (10 o más años)
- ☐ Does not apply to me (No es aplicable para mí)

How long have you participated in any other out-of-school activities like Boy Scouts, Girl Scouts, YMCA, Girls Inc., Junior Achievement, or youth groups at church, synagogue, or mosques?

(¿Cuánto tiempo has participado en actividades fuera de la escuela, por ejemplo, en actividades de organizaciones como las de "Boy Scouts" (niños exploradores), "Girl Scouts" (niñas exploradoras), "YMCA" (Asociación de Jóvenes Cristianos), "Girls Inc.", "Junior Achievement" o en los grupos juveniles de las iglesias, sinagogas o mezquitas?)

- ☐ Less than 1 year (Menos de 1 año)
- ☐ 1 year (1 año)
- ☐ 2-3 years (2 a 3 años)
- ☐ 4-5 years (4 a 5 años)
- ☐ 6-7 years (6 a 7 años)
- ☐ 8-9 years (8 a 9 años)
- ☐ 10 or more years (10 o más años)
- ☐ Does not apply to me (No es aplicable para mí)

Please answer the following questions about what you ate yesterday. (Responde a las siguientes preguntas sobre qué comiste ayer.)

These are some examples of sugary drinks: (Estos son algunos ejemplos de bebidas azucaradas:)

How many times did you drink a sugary drink yesterday?

For this question, do **NOT** include 100% fruit juice, chocolate milk, or diet drinks. (¿Cuántas veces bebiste una bebida azucarada ayer? Para responder a esta pregunta, **NO** incluyas el jugo de frutas 100 % natural, la leche chocolatada ni las bebidas dietéticas.)

- ☐ 0 times (0 veces)
- ☐ 1 time (1 vez)
- ☐ 2 times (2 veces)
- ☐ 3 times (3 veces)
- ☐ 4 times (4 veces)
- ☐ 5 or more times (5 veces o más)

These are some examples of sweet snacks: (Estos son algunos ejemplos de refrigerios dulces:)

How many times did you eat a sweet snack yesterday between your meals? (¿Cuántas veces comiste ayer un refrigerio dulce entre las comidas?)

- ☐ 0 times (0 veces)
- ☐ 1 time (1 vez)
- ☐ 2 times (2 veces)
- ☐ 3 times (3 veces)
- ☐ 4 times (4 veces)
- ☐ 5 or more times (5 veces o más)

These are some examples of salty snacks: (Estos son algunos ejemplos de refrigerios salados:)

Party Mix

How many times did you eat a salty snacks yesterday between your meals? (¿Cuántas veces comiste ayer un refrigerio salado entre las comidas?)

- ☐ 0 times (0 veces)
- ☐ 1 time (1 vez)
- ☐ 2 times (2 veces)
- ☐ 3 times (3 veces)
- ☐ 4 times (4 veces)
- ☐ 5 or more times (5 veces o más)

Each of these is an example of eating fruit 1 time: (Cada uno de estos es un ejemplo de comer fruta 1 vez:)

How many times did you eat fruit yesterday? For this question, doNOT include fruit juice.
(¿Cuántas veces comiste fruta ayer? Para responder a esta pregunta, **NO** incluyas el jugo de fruta.)

- ☐ 0 times (0 veces)
- ☐ 1 time (1 vez)
- ☐ 2 times (2 veces)
- ☐ 3 times (3 veces)
- ☐ 4 times (4 veces)
- ☐ 5 or more times (5 veces o más)

Each of these is an example of eating vegetables 1 time: (Cada uno de estos es un ejemplo de comer vegetales 1 vez:)

Salad

Potato

Black Beans

How many times did you eat vegetables yesterday? Do NOT include french fries. (¿Cuántas veces comiste vegetales ayer? NO incluyas las papas fritas.)

- ☐ 0 times (0 veces)
- ☐ 1 time (1 vez)
- ☐ 2 times (2 veces)
- ☐ 3 times (3 veces)
- ☐ 4 times (4 veces)
- ☐ 5 or more times (5 veces o más)

CYFAR In-School Pre-Survey

Directions: The next 9 questions ask about your eating habits and how hard you think it would be for you to eat more of some foods and eat less of other foods.

(Instrucciones: las siguientes 9 preguntas son para conocer tus hábitos alimentarios y saber qué tan difícil piensas que sería para ti comer más de algunos alimentos y comer menos de otros alimentos.)

	Not hard at all (No sería difícil)	A little hard (Un poco difícil)	Very hard (Muy difícil)
How hard would it be for you to eat fruit for an after school snack? (¿Qué tan difícil sería para ti comer fruta como refrigerio después de la escuela?)	☐	☐	☐
How hard would it be for you to eat vegetables for a snack? (¿Qué tan difícil sería para ti comer vegetales como refrigerio?)	☐	☐	☐
How hard would it be for you to choose water instead of soda or Kool-Aid when you are thirsty? (¿Qué tan difícil sería para ti elegir agua en lugar de un refresco o KoolAid cuando tienes sed?)	☐	☐	☐
How hard would it be for you to drink low-fat or fat-free milk instead of 2% or whole milk? (¿Qué tan difícil sería para ti beber leche baja en grasas o sin grasa en lugar de leche con 2 % de grasa o leche entera?)	☐	☐	☐
How hard would it be for you to choose a small instead of a large order of french fries? (¿Qué tan difícil sería para ti elegir una porción pequeña de papas fritas en lugar de una porción grande?)	☐	☐	☐
How hard would it be for you to eat smaller servings of foods like chips, snack cakes, cookies, or ice cream? (¿Qué tan difícil sería para ti comer porciones más pequeñas de alimentos como "chips", pastelillos, galletas o helados?)	☐	☐	☐
How hard would it be for you to eat a snack like pretzels instead of chips? (¿Qué tan difícil sería para ti comer un refrigerio como "pretzels" en lugar de "chips"?)	☐	☐	☐

	Not hard at all (No sería difícil)	A little hard (Un poco difícil)	Very hard (Muy difícil)
How hard would it be for you to drink less soda? (¿Qué tan difícil sería para ti beber menos refrescos?)	☐	☐	☐
How hard would it be for you to drink less Kool-Aid? (¿Qué tan difícil sería para ti beber menos KoolAid?)	☐	☐	☐

CYFAR In-School Pre-Survey

Directions: Choose the answer which best shows how you feel.

(Instrucciones: elige la respuesta que mejor representa lo que piensas.)

	No (No)	Sometimes (A veces)	Yes (Sí)	I Don't Know (No sé)
I enjoy doing things on a computer/iPad. (Me gusta hacer cosas en la computadora o el iPad.)	☐	☐	☐	☐
I am tired of using a computer/iPad. (Estoy cansado de usar la computadora o el iPad.)	☐	☐	☐	☐
When you use a computer or iPad, are you able to pay attention? (Cuando usas una computadora o un iPad, ¿puedes prestar atención?)	☐	☐	☐	☐
I enjoy computer/iPad games very much. (Me gustan mucho los juegos de la computadora o del iPad.)	☐	☐	☐	☐
I would work harder if I could use computers/iPads more often. (Podría trabajar más si pudiera usar una computadora o un iPad más a menudo.)	☐	☐	☐	☐
I know that computers/iPads give me the chance to learn many new things. (Sé que las computadoras y los iPad me dan la oportunidad de aprender muchas cosas nuevas.)	☐	☐	☐	☐
I can learn many things when I use a computer/iPad. (Cuando uso una computadora o un iPad, puedo aprender muchas cosas.)	☐	☐	☐	☐
I enjoy lessons on the computer/iPad. (Me gusta estudiar las lecciones en la computadora o en el iPad.)	☐	☐	☐	☐
I think that it is very important for me to learn how to use a computer/iPad. (Creo que aprender a usar una computadora o un iPad es muy importante para mí.)	☐	☐	☐	☐

How many other children live in your home?

(¿Cuántos otros niños viven en tu casa?)

- ☐ None (ninguno)
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ More than 4 (Más de 4)

On most nights, who makes dinner for you?

(¿Quién prepara la cena para ti la mayoría de las noches?)

- ☐ My mom (Mi madre)
- ☐ My dad (Mi padre)
- ☐ Myself (Yo mismo)
- ☐ My brother or sister (Mi hermano o hermana)
- ☐ Another adult that is not my mom or dad (grandparent, aunt, uncle, babysitter) (Otro adulto que no es mi madre o padre (abuelo, abuela, tío, tía, niñera))
- ☐ I do not eat dinner (Yo no como la cena)

CYFAR In-School Pre-Survey

You are finished! Thank you for completing the survey.
(¡Terminaste! Gracias por completar la encuesta.)

Directions: Please select the appropriate response for each of the following questions.

(Instrucciones: selecciona la respuesta correcta para cada una de las siguientes preguntas.)

I am a...

(Soy de sexo...)

☐ Male (Masculino) ☐ Female
(Femenino)

How old are you?

(¿Cuántos años tienes?)

☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11

Please answer the following questions about what you ate yesterday. (Responde a las siguientes preguntas sobre qué comiste ayer.)

These are some examples of sugary drinks: (Estos son algunos ejemplos de bebidas azucaradas:)

How many times did you drink a sugary drink yesterday?

For this question, do **NOT** include 100% fruit juice, chocolate milk, or diet drinks. (¿Cuántas veces bebiste una bebida azucarada ayer? Para responder a esta pregunta, NO incluyas el jugo de frutas 100 % natural, la leche chocolatada ni las bebidas dietéticas.)

- ☐ 0 times (0 veces)
- ☐ 1 time (1 vez)
- ☐ 2 times (2 veces)
- ☐ 3 times (3 veces)
- ☐ 4 times (4 veces)
- ☐ 5 or more times (5 veces o más)

These are some examples of sweet snacks: (Estos son algunos ejemplos de refrigerios dulces:)

How many times did you eat a sweet snack yesterday between your meals? (¿Cuántas veces comiste ayer un refrigerio dulce entre las comidas?)

- ☐ 0 times (0 veces)
- ☐ 1 time (1 vez)
- ☐ 2 times (2 veces)
- ☐ 3 times (3 veces)
- ☐ 4 times (4 veces)
- ☐ 5 or more times (5 veces o más)

These are some examples of salty snacks: (Estos son algunos ejemplos de refrigerios salados:)

Party Mix

How many times did you eat a salty snacks yesterday between your meals? (¿Cuántas veces comiste ayer un refrigerio salado entre las comidas?)

- ☐ 0 times (0 veces)
- ☐ 1 time (1 vez)
- ☐ 2 times (2 veces)
- ☐ 3 times (3 veces)
- ☐ 4 times (4 veces)
- ☐ 5 or more times (5 veces o más)

Each of these is an example of eating fruit 1 time: (Cada uno de estos es un ejemplo de comer fruta 1 vez:)

How many times did you eat fruit yesterday? For this question, do NOT include fruit juice.
(¿Cuántas veces comiste fruta ayer? Para responder a esta pregunta, **NO** incluyas el jugo de fruta.)

- ☐ 0 times (0 veces)
- ☐ 1 time (1 vez)
- ☐ 2 times (2 veces)
- ☐ 3 times (3 veces)
- ☐ 4 times (4 veces)
- ☐ 5 or more times (5 veces o más)

Each of these is an example of eating vegetables 1 time: (Cada uno de estos es un ejemplo de comer vegetales 1 vez:)

Salad

Potato

Black Beans

How many times did you eat vegetables yesterday? DoNOT include french fries. (¿Cuántas veces comiste vegetales ayer? NO incluyas las papas fritas.)

- ☐ 0 times (0 veces)
- ☐ 1 time (1 vez)
- ☐ 2 times (2 veces)
- ☐ 3 times (3 veces)
- ☐ 4 times (4 veces)
- ☐ 5 or more times (5 veces o más)

CYFAR In-School Post-Survey

Directions: The next 9 questions ask about your eating habits and how hard you think it would be for you to eat more of some foods and eat less of other foods.

(Instrucciones: las siguientes 9 preguntas son para conocer tus hábitos alimentarios y saber qué tan difícil piensas que sería para ti comer más de algunos alimentos y comer menos de otros alimentos.)

	Not hard at all (No sería difícil)	A little hard (Un poco difícil)	Very hard (Muy difícil)
How hard would it be for you to eat fruit for an after school snack? (¿Qué tan difícil sería para ti comer fruta como refrigerio después de la escuela?)	☐	☐	☐
How hard would it be for you to eat vegetables for a snack? (¿Qué tan difícil sería para ti comer vegetales como refrigerio?)	☐	☐	☐
How hard would it be for you to choose water instead of soda or Kool-Aid when you are thirsty? (¿Qué tan difícil sería para ti elegir agua en lugar de un refresco o KoolAid cuando tienes sed?)	☐	☐	☐
How hard would it be for you to drink low-fat or fat-free milk instead of 2% or whole milk?(¿Qué tan difícil sería para ti beber leche baja en grasas o sin grasa en lugar de leche con 2 % de grasa o leche entera?)	☐	☐	☐
How hard would it be for you to choose a small instead of a large order of french fries? (¿Qué tan difícil sería para ti elegir una porción pequeña de papas fritas en lugar de una porción grande?)	☐	☐	☐
How hard would it be for you to eat smaller servings of foods like chips, snack cakes, cookies, or ice cream? (¿Qué tan difícil sería para ti comer porciones más pequeñas de alimentos como "chips", pastelillos, galletas o helados?)	☐	☐	☐
How hard would it be for you to eat a snack like pretzels instead of chips? (¿Qué tan difícil sería para ti comer un refrigerio como "pretzels" en lugar de "chips"?)	☐	☐	☐

	Not hard at all (No sería difícil)	A little hard (Un poco difícil)	Very hard (Muy difícil)
How hard would it be for you to drink less soda? (¿Qué tan difícil sería para ti beber menos refrescos?)	☐	☐	☐
How hard would it be for you to drink less Kool-Aid? (¿Qué tan difícil sería para ti beber menos KoolAid?)	☐	☐	☐

CYFAR In-School Post-Survey

Directions: Choose the answer which best shows how you feel.

(Instrucciones: elige la respuesta que mejor representa lo que piensas.)

	No (No)	Sometimes (A veces)	Yes (Sí)	I Don't Know (No sé)
I enjoy doing things on a computer/iPad. (Me gusta hacer cosas en la computadora o el iPad.)	☐	☐	☐	☐
I am tired of using a computer/iPad. (Estoy cansado de usar la computadora o el iPad.)	☐	☐	☐	☐
When you use a computer or iPad, are you able to pay attention? (Cuando usas una computadora o un iPad, ¿puedes prestar atención?)	☐	☐	☐	☐
I enjoy computer/iPad games very much. (Me gustan mucho los juegos de la computadora o del iPad.)	☐	☐	☐	☐
I would work harder if I could use computers/iPads more often. (Podría trabajar más si pudiera usar una computadora o un iPad más a menudo.)	☐	☐	☐	☐
I know that computers/iPads give me the chance to learn many new things. (Sé que las computadoras y los iPad me dan la oportunidad de aprender muchas cosas nuevas.)	☐	☐	☐	☐
I can learn many things when I use a computer/iPad. (Cuando uso una computadora o un iPad, puedo aprender muchas cosas.)	☐	☐	☐	☐
I enjoy lessons on the computer/iPad. (Me gusta estudiar las lecciones en la computadora o en el iPad.)	☐	☐	☐	☐
I think that it is very important for me to learn how to use a computer/iPad. (Creo que aprender a usar una computadora o un iPad es muy importante para mí.)	☐	☐	☐	☐

Who usually does most of your family's food shopping? ¿Quién normalmente va de compras para su familia?

- ☐ Myself (Yo)
- ☐ My mom or dad (*Mi madre or padre*)
- ☐ Another adult that is not my mom or dad (grandparent, aunt, uncle, babysitter) (*Otro adulto que no es mi madre o padre (abuelo/abuela, tío/tía, niñera)*)
- ☐ My sister or brother (*Mi hermano o hermana*)

CYFAR In-School Post-Survey

You are finished! Thank you for completing the survey.
(¡Terminaste! Gracias por completar la encuesta.)

CYFAR In-School program

Week 6, Lesson 3: Balanced Meals

Materials needed:

Markers for white board

Decks of cards

Desk objects (pencils, etc)- kids provide

Minute to Win it game (meals and snacks)

Pieces for game

F&V- provided by FFVP

Handout: "2+2"

Family Warriors Strip: Talk with your child about creative ways to add fruits and vegetables to your meals and snacks.

Lesson:

GET STARTED (5 min)

NOTE: (Provide snack any time after iPads are done being used)

Introduction: (2 min)

- **DO**

- Review the warrior vow as a group (have them stand up and find a spot to do activity while reciting vow):
 - I will enter into the quest for health, strength and wisdom (butt kicks)
 - I will try new fruits and vegetables (left wrist stretch)
 - I will share what I learn with my family and friends (right wrist stretch)
 - I will learn to eat healthy foods every day (side twists, arms on waist)
 - I will have fun on my quest (toe raises)

Students sit down.

Warrior Reports (3 min):

- **SAY**

- We are going to get started today by getting their warrior reports. Put up their right arm and make a fist. I'm going ask a few

questions—if you can answer “yes” to the questions, they should put up 1 finger.

- **ASK**
 - **Have you eaten a green fruit or vegetable since I saw you last?**
 - call on 1 student to name a fruit or veg they ate
 - **Have you eaten a yellow or orange fruit or vegetable?**
 - Call on 1 student to share
 - **Have you tried a fruit or vegetable that you have never had? Or have you retried a fruit or vegetable that you thought you didn’t like?**
 - Call on 1 student to share
 - **Have you been trying your school lunch fruits and vegetables? Or have you been bringing any in from home?**
 - Call on 1 student to share
 - **Are you brave now when it comes to trying fruits and vegetables?**
- **DO**
 - For those who have all 5 fingers open, declare them “Brave and noble Body Quest Warriors”.
 - For students who did not open all 5 fingers, encourage them to keep working towards eating fruits and vegetables.

EXPERIENCE (30 min)

Balanced Meals: (10 min)

Need: Marker

- **DO**
 - Introduce the term “balanced meals”
- **ASK**
 - What do you think a balanced meal is?
 - *It is one that has a food from each of the battle groups. Ask student to name the four battle groups (5 food groups)*
- **SAY**
 - Let’s think about creating a balanced lunch.
- **DO**
 - Draw a plate (circle) on the board and separate it into MyPlate. Guide students to help you think of foods to create a balanced lunch.

Body Quest Balanced Meal Challenge (20 min):

Need: Deck of cards, pencils provided by students

- **SAY**
 - Now we are going to play a card game called the “Body Quest balanced Meal Challenge”.
- **DO**
 - Separate students into groups of 5-6 kids and give each group a Body Quest deck of cards with characters removed.
 - Place one object (pencil) for each player (minus 1) in the center of the playing area (so 6 players, place 5 objects in center)
- **SAY**
 - Goal of the game:
 - Be the first to collect four cards, one of each color (balanced meal). When someone gets four cards, one of each color, the goal of the other players is get the object in the center before the others do.
 - Assign a dealer for each group. Ask the dealers to shuffle the cards and deal 4 cards to each player. Have dealers place the remaining cards face down in a stack. Everyone can look at their own cards but don’t show anyone else.
 - Rules:
 - Dealer passes one card FACE DOWN to the person to the left. Then they take one card from the stack. Dealer immediately passes and draws another card, so there is constant drawing and passing.
 - Trying to get one from each battle group, the player on the left of the dealer passes one card and picks up the card left for them by the person to the right. This passing of cards goes all the way around until it gets back to the person on the dealer’s right hand side. That person places the last card face down in a new stack.
 - No one should ever have more than 4 cards in their hand; therefore, it is against the rules to pick up a new card before passing one.
 - When a player collects one card from each food group, they (as secretly as possible) take an object from the center.
 - When one player gets an object, every other player tries to get an object. The player without an object loses the round.
 - The player who collected all 4 colors first shares with the group what each food was in each food group to make it a balanced meal.
- **DO**

- Play a few rounds if time permits.

Collect decks of cards.

REFLECT (3 min)

SHARE: ASK: What was the hardest part of this game? Why do you think it was so difficult?

PROCESS: ASK: Why is it important to eat a variety of foods from all food groups?

GENERALIZE: ASK: How did this card game show you what a balanced meal would look like?

APPLY (15 min)

Minute to Win It with meals and snacks

Need: Minute to Win it meals/snack plates and pieces

- DO

- Give each table group 3 meal and 2 snack plates
- Have them create meals and snacks by one at a time coming to the front of the room to get a fruit or vegetable to add to a plate.
- Have students share their meals with the class

SUM UP (3 min)

- ASK

- Can anyone tell me something they learned today?

TAKE HOME

- Handout: "2+2"
- Family Warriors Strip: Talk with your child about creative ways to add fruits and vegetables to your meals and snacks.

CYFAR

In-School program

Week 7, Lesson 3: Reinforcement

Materials needed:

Markers for white board

Ipads for app

Ear buds

Breakfast Inspectors game

Pieces for game (including inspection sheets and breakfast inspector labels)

F&V- provided by FFVP

Handout: "Healthy Kids Choose....Breakfast"

Lesson:

GET STARTED (5 min)

NOTE: (Provide snack any time after iPads are done being used)

Introduction: (2 min)

- **DO**
 - Review the warrior vow as a group (have them stand up and find a spot to do activity while reciting vow):
 - I will enter into the quest for health, strength and wisdom (favorite muscle poses)
 - I will try new fruits and vegetables (toes touches)
 - I will share what I learn with my family and friends (squats)
 - I will learn to eat healthy foods every day (bicep stretch right)
 - I will have fun on my quest (bicep stretch left)

Students sit down.

Questions: (3 min)

- **ASK**
 - Did you tell someone in your family about what we learned last week? If so, what?
 - Does anyone want to share what fruit or vegetable they tried that they didn't like before or had never tried before?

EXPERIENCE (15 min)

Need: iPads and ear buds

iPads L3 app (Grano Supa): (15 min)

- **DO**
 - Pass out ear buds with kid's names on them
 - Let them play more than once and set time limit of 15 min, if time is running out, allow less time.

NOTE: while students are playing, set up inspector stations

Collect iPads and ear buds

REFLECT (3 min)

SHARE: ASK: What did Grano Supa talk about?

PROCESS:

GENERALIZE: ASK: Was it hard to make balanced meals?

APPLY (3 min)

- **ASK**
 - What did you have for lunch today?
 - Was there a way to get all 5 food groups on your tray?

GET STARTED (12 min)

Introduction: (2 min)

- **SAY**
 - Today we are going to talk about Breakfast
 - The word “breakfast” means that we are “breaking the fast.” Our bodies use energy even when asleep so, when we wake up, we have gone 8 or more hours without any food. After a long night without food, we need to fuel our bodies.

Importance of Breakfast: (2 min)

- **ASK**
 - Why is eating breakfast so important?
 - *It gives us energy to start our day and make it to lunch time*
 - *It helps us think, listen, concentrate and remember better.*
 - *It helps us feel calmer and not crabby*
 - *It helps us have energy throughout the morning (rather than in one big burst).*

What a healthy breakfast include(8 min)

Need: marker

- **SAY**
 - A really healthy breakfast includes 3 food groups
- **DO**
 - Do an example on the dry erase board of a healthy breakfast.
- **ASK**
 - Can anyone give me another example of a healthy breakfast?
- **SAY**
 - Some foods are better sources of long-lasting energy than others. Some foods release energy very quickly- giving the body a sudden burst- but then energy drops and we feel tired. This is because they don't give us the nutrients we need to have long-lasting energy.
 - These are “quick-energy” foods. These often contain added sugar like- candy, cookies, donuts, fruit punch, or pre-sweetened cereal.

- The quick rush of energy has to do with how quickly foods are digested.
- **DO**
 - On white board, draw what this looks like (see chart at end of lesson for example)
- **SAY**
 - Foods that break down slowly provide a steady source of energy over time. These are called “long-lasting” foods because they have a lot of nutrients, especially fiber, and provide energy over a longer period. These foods keep our energy level steady so that our bodies work better and our brains are more alert.
 - Examples include: whole-grain bread, low-fat yogurt, a banana, a snack bar with whole grains, cheese and crackers and nuts.
- **DO**
 - On white board, draw what this looks like

EXPERIENCE (15 min)

Breakfast Inspectors: (15 min)

Need: Breakfast inspector game and pieces

- **DO**
 - Divide students into groups of 2-3 students
 - Pass out Breakfast Inspector Ticket book
- **SAY**
 - Rules:
 - Your role as breakfast inspectors is to decide how nutritious the breakfasts are.
 - Each team will walk to the different stations and rate the five breakfasts based on these questions:
 - Does it have foods from **three of the five food groups**?
 - Does it give **long-lasting energy** instead of just **quick energy**?
 - As a team, decide whether the breakfast provides good nutrition and, if it does not, why it does not.

Come back together and sit in seats.

REFLECT (3 min)

SHARE: ASK: What breakfast didn't meet the requirements for a healthy breakfast?
ASK: What changes could you make to it?

PROCESS:

GENERALIZE: ASK: Why is breakfast important to eat?

APPLY (3 min)

- **ASK**
 - What did you have for breakfast today?
 - Is there a way to make it more healthy?

SUM UP (3 min)

- **ASK**
 - Can anyone tell me something they learned today?

TAKE HOME

- Handout: "Healthy Kids choose...Breakfast"

CYFAR

In-School program

Week 8, Lesson 4: What Each Food Group Offers

Materials needed:

Large paper of pre-made word web
Tape
marker
Decks of cards
Fast food (Crisco kit)
What's on your Tray board
Pieces for board
F&V- provided by FFVP
Handout: "Fast food Switcheroos/McMyths"
Family Warriors Strip: Talk with your child about how to create healthy meals together
that include a variety of foods.

Lesson:

GET STARTED (5 min)

NOTE: (Provide snack any time after iPads are done being used)

Introduction: (2 min)

- **DO**

- Review the warrior vow as a group (have them stand up and find a spot to do activity while reciting vow):
 - I will enter into the quest for health, strength and wisdom (left tricep stretch)
 - I will try new fruits and vegetables (right tricep stretch)
 - I will share what I learn with my family and friends (cross reaches)
 - I will learn to eat healthy foods every day (knee highs)
 - I will have fun on my quest (toe touches)

Students sit down.

Warrior Reports (3 min):

- **SAY**

- We are going to get started today by getting their warrior reports. Put up their right arm with a fist. I'm going to ask a few questions—if they can answer “yes” to the questions, they should put up one finger.

- **ASK**

- **If you are braver about trying new foods, raise finger**
 - call on 1 student to name a food they are brave for trying
- **If you ate two or more servings of fruit this week, raise finger**
 - What did you have?
- **If you ate two or more servings of vegetables this week, raise finger**
 - What did you have?
- **If you think eating fruits and vegetables is good for you, raise finger**
- **If you talked to your family about eating more fruits and vegetables, raise finger**

- **SAY**

- For those who have opened all 5 fingers, declare them “Brave and noble Body Quest Warriors”.
- For students who did not open all 5 fingers, encourage them to keep working towards eating fruits and vegetables.

- It is not always easy to make good choices, and it is unrealistic to expect that we will always make good choices when it comes to exercising, sleeping and eating. We can only do our very best, and sometimes we will fail along the way, but it is important to keep trying.

EXPERIENCE (15 min)

Introduction: (5 min)

- **ASK**
 - Does anyone know what a ***journey*** is? Has anyone ever heard that “life is like a journey”?
- **SAY**
 - Being healthy is like a journey. The road to good healthy has lots of twists and turns and ups and downs—it’s never a straight line to success; sometimes you have to fail first before you can succeed.
- **ASK**
 - What does it mean to make good food choices?
- **SAY**
 - You want to choose foods that do the following:
 - Give them energy
 - Improve their vision
 - Prevent disease
 - Help strengthen their teeth and bones
 - Help them develop strong muscles

Word Web: (10 min)

Need: pre-made word web, tape, marker, decks of cards

- **DO**
 - Place the pre-made word web on the board
 - Separate students into small groups and distribute the BQ card deck to small groups.
- **SAY**
 - Directions:
 - Tell students that they will be looking at the clues on their cards to determine which foods are good for strong muscles, which are good for strong teeth and bones, etc.
 - Ask students to work together to separate the cards into piles representing the categories on the word web.
 - Set aside additional cards that don’t fit in the categories

REFLECT (5 min)

SHARE: DO: encourage students to answer the questions, naming the foods on their cards. Write the foods on the word web. (see next page for outline of web)

ASK: What kinds of foods give you energy? Improve your vision? Etc.

PROCESS: ASK: Why is it important to know which foods give you energy, strong muscles, and other BQ powers?

GENERALIZE: ASK: If a younger child said to you “I want to be a baseball player” or “I want to be a school teacher”, what advice would you offer this child about the kinds of foods they need to eat to develop a strong brain and body to be successful? Are there any foods to limit?

Collect decks of cards.

Fast Food: (15 min)

Need: Fat kit with burger/fries, arteries/blood, Crisco

- **SAY**
 - o Now we are going to talk about fast food.
- **ASK**
 - o Which character likes fast food? (trans fat cat)
 - o What fast food restaurants do you eat at?
 - o Is the food you get at a fast food restaurant healthy for your bodies?
 - o What is fast food usually high in? (fat)
- **SAY**
 - o There are 2 types of fat in foods—healthy and unhealthy. Healthy fat is in foods like olive oil, vegetable oil, avocados, nuts and fish. Unhealthy fat is in foods like fast food or donuts or cakes or cookies. Let’s look at what the 2 types of fat do to our body
- **DO**
 - o Blood/arteries visual
- **SAY**
 - o Now we are going to measure out how much fat is in this double cheeseburger and French fries.
- **ASK**
 - o Do you think this Crisco is a healthy or unhealthy fat? (*unhealthy*)
 - o How many scoops of Crisco do you think go into this burger and fries? Let’s see.....
- **DO:**
 - o Crisco 16 teaspoon scoops....65g of fat = total fat for day

EXPERIENCE (15 min)

What’s on Your Tray: (15 min)

Need: What’s on your Tray and pieces

- **SAY**
 - We are going to compare 2 meals.
- **DO**
 - (follow directions for activity)
- **ASK**
 - Which meal would Trans Fat Cat like?

APPLY (3 min)

- **ASK**
 - How can you use what you learned to help your family get strong and healthy?

SUM UP (3 min)

- **ASK**
 - Can anyone tell me something they learned today?

TAKE HOME

- Handout: Fast food switcheroo/McMyths
- Family Warriors Strip: Talk with your child about how to create healthy meals together
- that include a variety of foods.

CYFAR

In-School program

Week 9, Lesson 4: Reinforcement

Materials needed:

Ipads for app
 Ear buds
 Eat Colors board
 Pieces for board
 Pictures of fruits and vegetables
 Fruit and Veggie Variety worksheet
 Food List sheets
 F&V- provided by FFVP
 Handout: "Eat your Colors for Good Health"

Lesson:

GET STARTED (5 min)

NOTE: (Provide snack any time after iPads are done being used)

Introduction: (2 min)

- **DO**

- Review the warrior vow as a group (have them stand up and find a spot to do activity while reciting vow):
 - I will enter into the quest for health, strength and wisdom (left wrist stretch)
 - I will try new fruits and vegetables (right wrist stretch)
 - I will share what I learn with my family and friends (balance on right leg)
 - I will learn to eat healthy foods every day (balance on left leg)
 - I will have fun on my quest (arm circles forward)

Students sit down.

Questions: (3 min)

- **ASK**

- Did you tell someone in your family about what we learned last week? If so, what
- Does anyone want to share what fruit or vegetable they tried that they didn't like before or had never tried before?

EXPERIENCE (15 min)

iPads L4 app (Shinning Rainbow): (15 min)

Need: ipads and ear buds

- **DO**

- Pass out ear buds with kid's names on them
- Let them play more than once and set time limit of 15 min, if time is running out, allow less time.

Collect iPads and ear buds.

REFLECT (3 min)

SHARE: ASK: What did Shinning Rainbow talk about?

PROCESS:

GENERALIZE: ASK: Do you eat a variety of colors of fruits and vegetables?

GET STARTED (18 min)

Introduction (10 min):

Need: Eat Colors board and pieces

- **SAY**
 - Today we are going to talk about fruits and vegetables and what each color does for our body
- **DO**
 - Introduce each color using the Eat Colors board (ask for other examples of f/v from each color)

Rhyme (5 min):

- **SAY**
 - To help us remember, we are going to repeat a rhyme: (students stand up near desk)
 - **Red** fruits and vegetables are good to eat,
They help you grow and help your heart beat! (put your hand over your heart)
 - Fruits and vegetables **orange and yellow**
Keep your eyes healthy and your skin all a-glow! (point to your eye and rub your arm)
 - Tasty fruits and vegetables, **green** and yummy,
They're delicious to eat and good for your tummy. (rub your stomach)
 - **Purple and blue** foods are super cool,
They help you think and do well in school! (touch your head with both hands)
 - **White and brown** fruits and vegetables- you can't go wrong,
They keep your body safe and strong! (show your muscles)
 - Repeat one more time.

Simon Says: (3 min)

F&V pictures

- **DO**
 - Play Simon Says with pictures of fruits and vegetables. Students do the appropriate action on the body when the colored fruit/vegetable comes up. [Example: "Simon says eat a blueberry" (kids put their hands on their head)]

EXPERIENCE (15 min)

Fruit and Veggie Variety Worksheet: (15 min)

Need: worksheet and food list sheet

- **DO**
 - Split students into pairs

- Pass out a worksheet for each student and have them write in the colors that belong to each body function.
- Now pass out one food list per pair and have them write in which foods go in each box.
- Have a few pairs share which foods go in each color for the 2 food lists.

REFLECT (3 min)

SHARE: ASK: Who had more fruits and veggies, Super Slurper or Fiberlicious?

PROCESS:

		Time
Warrior Vow	• Group exercise	2 minutes
Review	• Shared • Tried	5 minutes
iPad Application	• Shinning Rainbow	15 minutes
Reflect	• Application • Ask: Do you eat a variety?	3 minutes
URI CYFAR: Eat a Variety of Color Board	• f/v color function	10 minutes
Rhyme/Review	• f/v color function	5 minutes
Simon Says/Review	• f/v color function	3 minutes

GENERALIZE: ASK: Why is it important to have a variety of colors of fruits and vegetables?

APPLY (3 min)

- **ASK**

- How many colors have you eaten today?

SUM UP (3 min)

- **ASK**

- Can anyone tell me something they learned today?

TAKE HOME

- Handout: "Eat your Colors for Good Health"

CYFAR

In-School program

Week 10, Lesson 5: Battle Snacks

Materials needed:

Marker for white board
Decks of cards
Super Snack activity worksheet
F&V- provided by FFVP
Handout: Smart Snacking for Kids
Family Warriors Strip: Talk with your child about healthy snacks that are easy to prepare and include fruits and vegetables.

Lesson:

GET STARTED (10 min)

NOTE: (Provide snack any time after iPads are done being used)

Introduction: (2 min)

- **DO**
 - Review the warrior vow as a group (have them stand up and find a spot to do activity while reciting vow):
 - I will enter into the quest for health, strength and wisdom (inside of foot touch)
 - I will try new fruits and vegetables (outside of foot touch)
 - I will share what I learn with my family and friends (arms out front up and down)
 - I will learn to eat healthy foods every day (right side bend)
 - I will have fun on my quest (left side bend)

Students sit down.

Warrior Reports (3 min):

- **SAY**
 - We are going to get started today by getting their warrior reports. Put up their right arm with a fist. I'm going to ask a few questions—if they can answer “yes” to the questions, they should put up one finger.

- **ASK**
 - What foods have you been eating to give you energy? (*grains*)
 - call on 1 student
 - What have you been eating to improve your vision? (*orange/yellow f/v*)
 - What have you been eating to strengthen your teeth and bones? (*dairy*)
 - What quest are we on as BQ warriors? (*to good health*)
 - Does this quest ever end? Or does it go for the rest of our lives?
- **SAY**
 - For those who have opened all 5 fingers, declare them “Brave and noble Body Quest Warriors”.
 - For students who did not open all 5 fingers, encourage them to keep working towards eating fruits and vegetables.
 - It is not always easy to make good choices, and it is unrealistic to expect that we will always make good choices when it comes to exercising, sleeping and eating. We can only do our very best, and sometimes we will fail along the way, but it is important to keep trying.

Snacks (5 min)

- **ASK**
 - What sort of snacks do you like to eat?
 - What sort of crunchy snacks? Sweet snacks?
- **SAY**
 - Children are still growing and they need lots of healthy foods to help them grow---even snack foods in between meals.
- **DO**
 - Lead discussion about how healthy snacks give warriors extra energy and strength between meals.

EXPERIENCE (10 min)

Healthy snack options: (10 min)

Need: decks of cards

- **SAY**
 - In partners, we are going to select healthy snacks from our BQ warrior deck.
 - Look for.....
 - Using one card deck, select foods that would be healthy, crunchy snacks.

- **ASK**
 - What did you find?
- **SAY**
 - Find foods that you could snack on without cooking or preparation.
- **ASK**
 - What did you find?
- **SAY**
 - Select foods that would be a healthy, salty snack.
- **ASK**
 - What did you find?

Put cards to the side.

REFLECT (5 min):

SHARE: ASK: What surprised you about this activity?

PROCESS: ASK: When you are watching television, what sort of snacks do you eat?

ASK: When you go to the grocery store or gas station, what sort of snacks do you see for sale?

ASK: What is the hardest part about selecting healthy snacks?

GENERALIZE: ASK: Which of these healthy foods do you already like to snack on?

ASK: When you go home this afternoon, what healthy snacks could you find at home?

EXPERIENCE (15 min)

“Super Snacks”: (15 min)

Marker, Super Snacks handout, decks of cards (on desk already)

- **SAY**
 - A combination of healthy snack foods creates a “super snack”. These snacks strengthen more than one warrior power at a time.
- **DO**
 - Example on the board *(see below)*
- **SAY**
 - In your small groups, we are going to help Trans Fat Cat have a healthy super snack. We will create combinations of foods that would taste good together and would create a super snack. Use only 2-3 cards to make the snack. Create 3 snack ideas for Trans Fat Cat and write them on your worksheet.
- **ASK**
 - Ask a student from the group to come up and write one of their super snack up on the board.
- **DO**
 - Review super snacks

Collect decks of cards.

APPLY (5 min)

- **ASK**
 - How would you describe what you learned today to a friend who wasn't here?

SUM UP (3 min)

- **SAY**
 - I'm going to tell you an important secret, BQ warriors eat very special snacks, and not the stuff that we see advertised on TV. They choose fruits and vegetables, bread and cheese, and yogurt and fruit. BQ warriors choose snacks that will make them strong, give them energy, and protect their body, like armor.

TAKE HOME

- Handout: Smart Snacking for Kids
- Family Warriors Strip: Talk with your child about healthy snacks that are easy to prepare and include fruits and vegetables

CYFAR

In-School program

Week 11, Lesson 5: Reinforcement

Materials needed:

Ipads for app

Ear buds

High/low fiber board

Pieces for board
Handout: "Our Friend, Fiber"
F&V- provided by FFVP

Lesson:

GET STARTED (5 min)

NOTE: (Provide snack any time after iPads are done being used)

Introduction: (2 min)

- **DO**

- Review the warrior vow as a group (have them stand up and find a spot to do activity while reciting vow):
 - I will enter into the quest for health, strength and wisdom (balance on right leg)
 - I will try new fruits and vegetables (balance on left leg)
 - I will share what I learn with my family and friends (toe raises)
 - I will learn to eat healthy foods every day (fingers laced, arms stretched up)
 - I will have fun on my quest (chop arms in front of you)

Students sit down.

Questions: (3 min)

- **ASK**

- Did you tell someone in your family about what we learned last week? If so, what?
- Does anyone want to share what fruit or vegetable they tried that they didn't like before or had never tried before?

EXPERIENCE (18 min)

iPads L5 app (Fiberlicious): (18 min)

Need: iPads and ear buds

- **DO**

- Pass out ear buds with kid's names on them
- Let them play more than once and set time limit of 18 min, if time is running out, allow less time.

Collect iPads and ear buds.

REFLECT (3 min)

SHARE: ASK: What did Fiberlicious talk about?

PROCESS:

GENERALIZE: ASK: Do you eat a healthy snack?

GET STARTED (10 min)

Introduction (10 min):

- **SAY**
 - Today we are going to talk about Fiberlicious' favorite thing: fiber
- **ASK**
 - Can anyone tell me why fiber is good for us?
 - *It acts like a sponge and soaks up cholesterol so it doesn't hurt our heart*
 - *It acts like a brush and cleans our insides*
 - *It makes waste move out of our body*
 - *It keeps us feel full longer so we aren't too hungry before lunch*
 - Can anyone tell me what foods have fiber in them?
 - *Fruits, vegetables, whole grains, beans/nuts/seeds*

EXPERIENCE (15 min)

High/Low Fiber Food Activity: (15 min)

Need: High/Low fiber board and pieces

- **ASK**
 - How do we know which foods are high in fiber?
 - *Look at the Nutrition Facts Label. If it says 3g or more, it is a good source of fiber.*
 - *How much do kids need? Age + 5 = fiber amount (adults 25-35g)*
- **DO**
 - Pass out one food picture to each student.
 - Have each participant look at the nutrition facts label on the back of their food to find the amount of fiber that their food contains.
 - Have each participant come up to the board one at a time to place their food picture on the board. They should place it in the high fiber column if their food contains 3 or more grams of fiber, and the low fiber column if their food contains less than 3 grams of fiber.
 - When the board is full, go through each food and explain why it belongs in its corresponding column. If the food is in the wrong place, place it in the correct column and explain.

REFLECT (3 min)

SHARE: ASK: What kinds of food do you eat that have fiber in them?

PROCESS:

GENERALIZE: ASK: Why is it important to like foods with fiber in them?

APPLY (3 min)

- **ASK**
 - o What are some other fiber-filled foods you can add to your day?

SUM UP (3 min)

- **ASK**
 - o Can anyone tell me something they learned today?

TAKE HOME

- Handout: "Our Friend, Fiber"

CYFAR

In-School program

Week 12, Lesson 6: Influencing Others to Consume F&V

Materials needed:

Marker for white board

Blank paper

Pencil

Decks of cards

Think your Drink Kit

F&V- provided by FFVP

Handout: "Think Your Drink"

Family Warriors Strip: Ask your child to show you his or her Body Quest warrior drawing.

Hang the drawing in the kitchen as a reminder about healthy food choices.

Lesson:

GET STARTED (10 min)

NOTE: (Provide snack any time after iPads are done being used)

Introduction: (2 min)

- **DO**

- Review the warrior vow as a group (have them stand up and find a spot to do activity while reciting vow):
 - I will enter into the quest for health, strength and wisdom (knee highs)
 - I will try new fruits and vegetables (stretch leg to the left)
 - I will share what I learn with my family and friends (stretch legs to the right)
 - I will learn to eat healthy foods every day (arms bent up and raised up and down)
 - I will have fun on my quest (roll shoulders backwards)

Students sit down.

Questions: (3 min)

- **ASK**

- What are some things you have learned about eating good foods?
- What are some things you have changed about what you eat?
- What have you shared with your family and friends?
- What snacks did you have this week?

Persuade and Convince (5 min):

Need: marker

- **ASK**

- What does it mean to **persuade** someone or to **convince** someone of something?
- Why is it a good idea to persuade people to eat more fruits and vegetables?
- When have you been persuaded to do something?
- What was it that convinced you?

- **DO**

- Draw persuasion map on the board and guide students to help fill in map (see bottom of lesson plan for example)

EXPERIENCE (15 min)

Draw yourself as a BQ warrior: (15 min)

Need: paper and pencil, example of drawing

- **SAY**

- A BQ warrior is brave and strong and makes good food choices.
 - Food for energy
 - Food to be healthy
 - Food to be strong

- Food to be smart
- Food to have a healthy tummy, good eye sight, clear skin, strong heart

- **DO**

- Distribute paper and pencil and ask students to create their own drawings of themselves as BQ warriors.
- Show example of drawing and why I included specific details in my picture (persuasive and convincing words used)
- Once complete, invite students to share their drawings one at a time. Encourage them to talk about the benefits of eating fruits and vegetables (or other foods) (be persuasive!)

REFLECT (5 min):

SHARE: ASK: How did it feel to talk to your classmates about eating fruits and vegetables?

ASK: What have you learned from listening to your classmates talk about good eating?

PROCESS: ASK: When have you seen cartoon or pictures used to sell food?

ASK: What did you learn about talking in front of people? Did it help to have your drawing to show your classmates? How?

GENERALIZE: ASK: When are some other times you could use pictures and words to help tell a story?

APPLY (5 min)

- **ASK**

- How can you use your drawings to persuade your family and friends to eat more fruits and vegetables?
- What else could you use to persuade your friends and family members to be like a BQ warrior?

GET STARTED (1 min)

Introduction: (2 min)

- **SAY**

- Now we are going to switch gears and focus on Super Slurper's specialty—drinks.

EXPERIENCE (15 min)

Think Your Drink (15 min)

Need: Think Your Drink Kit

- **ASK**

- What drink does Super Slurper love best? (Water)
- Are all drinks healthy for us? (no)

- **SAY**
 - I'm going to pass out some drinks. One at a time I'd like you to come up and place them over the sugar packet you think they belong to. The next person who comes up can move around the drinks up there if they don't think they are in the correct spot.
- **DO:**
 - Pass out containers of drinks to students
 - One at a time have them come up and line them up (students guess) in order of least to most amount of sugar
 - Once all are lined up, go through and re-arrange in the correct order
 - Discuss natural vs added sugar; GO drinks, SLOW drinks, WHOA drinks and NO drinks

SUM UP (3 min)

- **ASK**
 - What have you learned from BQ warrior training?
 - What is what you have learned important?
 - How will you use your training and knowledge in the future?

TAKE HOME

- Handout: Think your Drink
- Family Warriors Strip: Ask your child to show you his or her Body Quest warrior drawing.
Hang the drawing in the kitchen as a reminder about healthy food choices.

CYFAR

In-School program

Week 13, Lesson 6: Reinforcement

Materials needed:

Ipads for app
 Ear buds
 Bookmark for the kids
 Certificate for the kids
 F&V- provided by FFVP

Lesson:

GET STARTED (5 min)

NOTE: (Provide snack any time after iPads are done being used)

Introduction: (2 min)

- **SAY**
 - Today is our last class ☺
- **DO**
 - Review the warrior vow as a group (have them stand up and find a spot to do activity while reciting vow):
 - I will enter into the quest for health, strength and wisdom (right lunge)
 - I will try new fruits and vegetables (left lunge)
 - I will share what I learn with my family and friends (arm circles forward)
 - I will learn to eat healthy foods every day (favorite muscle poses)
 - I will have fun on my quest (waist circles)

Students sit down.

Questions: (3 min)

- **ASK**
 - Did you show someone in your family your warrior picture?
 - Does anyone want to share what fruit or vegetable they tried that they didn't like before or had never tried before?

EXPERIENCE (15 min)

iPads L6 app (Super Slurper): (15 min)

Need: iPads and ear buds

- **DO**
 - Pass out ear buds with kid's names on them
 - Let them play more than once and set time limit of 15 min, if time is running out, allow less time.

Have them close their ipads but keep them at their desk

REFLECT (3 min)

SHARE: ASK: What did Super Slurper talk about?

PROCESS:

GENERALIZE: ASK: Do you drink water and low-fat or fat-free milk?

SUM UP (5 min)

Review what we learned over the last 13 weeks (5 min):

- **ASK**
 - Can anyone tell me something they learned over the last 13 weeks?
 - Has anyone made any changes in what they eat or drink over the last 13 weeks?
 - Does anyone have a favorite game or moment they would like to share from the class?

iPad post survey: (15 min)

Need: iPads already on their desk

- **DO**
 - Go through the post survey with students

If extra time:

- **DO**
 - Allow students to play apps until the end of the class. **Allow 5 minutes to wrap up at the end.**

Collect iPads and ear buds.

TAKE HOME

- Bookmarks
- Certificates

D. ADDITIONAL FIGURES AND TABLES

Table 4: Pre to Post Comparison of Self-Efficacy for Healthy Eating (How Hard it would be to Eat More of Certain Foods and Less of Other Foods) by Intervention Group

Variable/ Group	Pre (mean +/- SD)	Post (mean +/- SD)	Within (t)	Between (F)
Eat Fruit for an After School Snack				
Treatment (n=70)	0.20 +/- 0.531	0.23 +/- 0.365	1.062 p= 0.292	0.527 p=0.469(NS)
Control (n=59)	0.29 +/- 0.589	0.29 +/- 0.599	0.000 p= 1	
Eat Vegetables for an After School Snack				
Treatment (n=70)	0.57 +/- 0.734	0.59 +/- 0.732	-0.148 p= 0.883	0.120 p=0.730 (NS)
Control (n=59)	0.92 +/- 0.816	0.88 +/- 0.832	0.340 p= 0.735	
Choose Water Instead of Soda or Kool-Aid When Thirsty				
Treatment (n=70)	0.57 +/- 0.831	0.68 +/- 0.866	-0.815 p= 0.418	0.175 (NS) p=0.676
Control (n=59)	0.56 +/- 0.772	0.76 +/- 0.858	-1.334 p= 0.187	
Drink Low-Fat or Fat-Free Milk Instead of 2% or Whole Milk				
Treatment (n=70)	0.50 +/- 0.737	0.37 +/- 0.594	1.453 p= 0.151	02.141 (NS) p=0.146
Control (n=59)	0.47 +/- 0.728	0.56 +/- 0.794	-0.711 p= 0.480	
Choose a Small Instead of a Large Order of French Fries				
Treatment (n=70)	0.59 +/- 0.843	0.59 +/- 0.825	0.000 p= 1	0.719 (NS) p=0.398
Control (n=59)	0.98 +/- 0.841	0.83 +/- 0.894	1.267 p= 0.210	
Eat Smaller Servings of Foods Like Chips, Snack Cakes, Cookies, or Ice Cream				
Treatment (n=70)	0.64 +/- 0.840	0.86 +/- 0.896	-1.647 p= 0.104	14.543*** p=0.000
Control (n=59)	1.03 +/- 0.890	0.54 +/- 0.703	3.817*** p= 0.000	
Eat a Snack Like Pretzels Instead of Chips				
Treatment (n=70)	0.46 +/- 0.695	0.40 +/- 0.689	0.552 p= 0.583	0.426 (NS) p=0.518
Control (n=59)	0.66 +/- 0.883	0.49 +/- 0.796	1.182 p= 0.242	
Drink less soda				
Treatment (n=70)	0.54 +/- 0.863	0.66 +/- 0.832	-0.871 p= 0.387	0.804 (NS) p=0.372
Control (n=59)	0.78 +/- 0.911	0.73 +/- 0.762	0.402 p= 0.689	
Drink Less Kool-Aid				
Treatment (n=70)	0.51 +/- 0.797	0.59 +/- 0.828	-0.715 p= 0.477	1.268 (NS) p=0.262
Control (n=59)	0.71 +/- 0.767	0.59 +/- 0.812	0.866 p= 0.390	

Scores are based on the following responses 0= not hard at all, 1= a little hard, 2= very hard

** p < .05

***p ≤.001

NS = Not statistically significant

Figure 1: Changes in fruit and vegetable consumption using gender as a predictor for third grade students in treatment groups (n=70) participating in school-based 13-week combined Body Quest/ CYFAR nutrition education program.

Estimated Marginal Means of Fruit and Vegetable Intake

**p<.05

*** p<.001

Note: Survey question asked “How many times yesterday did you eat fruit?” and “How many times yesterday did you eat vegetables?” questions scaled 1=0 times, 2=1 time, 3 = 2 times, 4= 3 times, 5= 4 times, 6= 5 or more times

Gender was found to be a predictor of vegetable consumption among treatment males and females. From pre to post intervention a significant difference in vegetable consumption was detected ($F=4.006$ $p<.05$). From pre to post intervention, males in the treatment group increased their vegetable consumption from 2.8 ± 1.8 to 2.93 ± 1.7 while females reported a significant decrease in vegetable consumption from 3.48 ± 1.8 to 2.65 ± 1.3 , ($p<.05$). Treatment males also reported a pre to post increase in fruit intake while females a decrease.

Figure 2: Changes in energy dense snacks and beverage consumption using gender as a predictor for third grade students in treatment group (n=70) participating in school-based 13-week combined Body Quest/ CYFAR nutrition education program.

Estimated Marginal Means of Energy Dense Snack and Beverage Intake

Note. Ssb = sugar sweetened beverages, Sws= sugar sweetened snacks, Sas = salty snacks

**p<.05

*** p<.001