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THE EFFECT OF A FAMILY-BASED DIETARY INTERVENTION ON DIETARY FIBER DENSITY IN CHILDREN AGES 6-11

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Abstract

Background: Fiber intake has been shown to be higher in normal weight children compared to overweight and obese children. However, the effect of family-based interventions have been inconclusive.

Objective: To determine if a family-based weight management intervention, which has been successful at lowering BMI Z-score, has an effect on energy adjusted dietary fiber intake and other markers of dietary quality.

Methods: Sixty-six children ages 6-11 and their guardians participated in a 16 week nutrition and physical activity intervention. Guardians and children completed a food frequency questionnaire (FFQ) during the first and last sessions. The FFQ provided information about fiber, macronutrients and micronutrients.

Results: Children increased fiber from 8.65±2.00g/1000kcal to 9.48±2.26g/1000kcal ($p<0.001$). Energy decreased from 2122.77±506.13kcals to 1889.86±425.58kcals ($p<0.001$).BMI Z-score decreased from 2.06±0.40 to 1.99±0.40 ($p=0.003$). Iron decreased from 15.18±4.06mg to 13.92±3.85mg ($p=0.014$), sodium decreased from 2638.38±677.93mg to 2330.14±521.85mg ($p<0.001$), and saturated fat decreased from 10.34±1.64% to 9.96±1.69%.

Conclusion: The intervention was associated with an increase in fiber density and a reduction in energy intake, which was reflected in a decrease in BMI Z-score, without compromising micronutrient intake.

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PREFACE

This thesis is written with the manuscript format. The manuscript is being written for submission to the Pediatric Obesity Journal.

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Will be submitted to Pediatric Obesity

The Effect of a Family-based Dietary Intervention on Dietary Fiber Density in Children Ages 6-11

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Background

In the United States obesity affects 17.7% of children ages 6 to 11 (1). Obesity can lead to the development of health problems in children including hyperinsulimia, high blood pressure, high cholesterol, asthma, and metabolic syndrome (2,3). Dietary factors have been implicated in the development of obesity and health problems in children. For example, dietary fiber intake is significantly higher in normal weight compared to overweight and obese children, but in general children's fiber intake is below recommendations (4–6). Besides fiber, children are not consuming adequate amounts of calcium, vitamin D, iron, and potassium and are consuming excess sodium, saturated fat, and added sugar (7).

A review of clinical, school, and family-based interventions assessed BMI and BMI z-score to determine if the interventions were successful at decreasing obesity risk (8). Of 24 clinical-based interventions that assessed BMI, 21 recorded a decrease, and of 21 that assessed BMI z-score 18 recorded a decrease (8). Outcomes were not as favorable for school-based interventions; 6 out of 16 found a decrease in BMI and 4 out of 6 observed a decrease in BMI z-score (8). With family-based interventions, 16 out of 17 observed a decrease in BMI and 6 out of 7 reported a decrease in BMI z-score (8). The review concluded that family-based interventions had similar success in decreasing BMI and BMI z-score as clinical-based interventions (8).

Three of the family-based intervention studies have not only assessed weight but also dietary components, including dietary fiber (9–11). However, the effect of these interventions have been inconclusive. Two studies have seen no changes in dietary fiber intake, and one study found an increase in dietary fiber intake (9–11).

Adequate dietary fiber intake is important as it has been shown to help with healthy weight maintenance (12–14). The physiological basis for the effect of fiber on energy balance regulation include three possible mechanisms. The first is through reduction in eating rate, which has been associated with a reduction in energy intake (12). The second mechanism is related to energy lost in fecal matter (13). Isaksson et al. (13) found that more energy is lost in high-fiber rye diets than in low-fiber wheat diets. The final mechanism is substitution, high-fiber nutrient dense foods displace energy dense foods (14). One study found subjects consuming a high-fiber low calorie breakfast consumed the same amount of energy at lunch as a low-fiber high calorie breakfast group, resulting a net reduction in energy intake in the high-fiber group compared to the low-fiber group (14). In conclusion, increasing dietary fiber may be useful for maintaining a healthy body weight.

Fiber is primarily found in healthful foods such as fruits, vegetables, and whole grains. Thus fiber could be considered a marker of dietary quality (15). A healthful diet also provides adequate micronutrients, such as vitamin D, calcium, iron, and potassium, which are often low in the diets of children (7). A healthful diet should also be low in sodium, and saturated fat, which are often high in the diets of children (7). In addition, according to NHANES 2005-2008 data, individuals consuming lower amounts of calcium and vitamin D had higher rates of adiposity (16). Consuming low amounts of calcium and vitamin D can also lead to lower bone mineral density, low intakes of iron is related to poor cognitive function, excessive intake of sodium and inadequate potassium intake can lead to hypertension, and high intakes of saturated fat can lead to dyslipidemia and cardiovascular disease (17–21).

The purpose of this study was to determine if the family-based intervention program South County Food Fitness and Fun (SCFFF), which had been found to reduce BMI z-score in overweight and obese children over two years (22), was associated with an improvement in the density of dietary fiber intake and an improvement in dietary quality assessed by vitamin D, calcium, iron, potassium, sodium, and saturated fat.

D. Methodology

This study was a descriptive secondary analysis focusing on dietary changes (grams of fiber intake per 1000 kilocalories, intake of energy, calcium, vitamin D, potassium, sodium, and saturated fat) from baseline to post SCFFF assessments. In addition, anthropometrics including BMI z-score was assessed to determine if the program was successful in the prevention of excess weight gain. The study was approved by the University of Rhode Island Internal Review Board. All participating parents signed consent forms and all children signed assent forms.

Sample

SCFFF participants were eligible for the study if the child was between the ages of 6-11, had a BMI ≥85th percentile for age, at least one parent/guardian could attend, were referred by a physician, and had no medical condition requiring a specialized diet. The children resided in the South County region of Rhode Island. There was a total of 106 who signed consent and assent forms to participate in the intervention between February 2009 and June 2014. Out of the 106 who signed consent and assent forms, 85 attended the first session and completed the pre FFQ, while 21 never attended any session leaving 85 subjects. Out of 85 subjects 84 attended the first session and completed the pre FFQ while 1 missed the session and dropped out halfway through. At the final session 66

participants, 79% of those who completed the pre FFQ, attended and completed the post FFQ.

SCFFF Intervention

SCFFF is a group program for children and their parents teaching evidence based nutrition and physical activity behaviors that can help with weight management in children. Each group consisted of 6-12 children. The program consists of 16 seventy-five minute weekly sessions for children and their parents. The first and last session collected parental consent and child assent, obtained height and weight measurements of children, and parents and children completed an FFQ assessing the child's dietary intake. A pediatric dietitian led the nutrition sessions while an expert in physical activity led the physical activity portion. Educational sessions included 14 weeks of 30 minute nutrition sessions with children and parents separately. Children completed 30 minutes of supervised physical activity and parents received 30 minutes of physical activity education. At the end of the session the parents joined the children for 15 minutes of joint physical activity. Nutrition topics included MyPlate, increasing fruit, vegetables, and whole grains, choosing healthier fats, animal and plant based sources of protein, the energy sodium, fat, and sugar in fat and processed foods, the importance of dairy, and family meals, healthy snacks vs. treats, and decreasing sugar sweetened beverages.

Dietary Assessment

The 1995 Young Adult Harvard Food Frequency Questionnaire (FFQ), a 152 item questionnaire, was completed by the parents with assistance from their child (23). The FFQ was completed at the first and last session, 16 weeks apart. The FFQ output was scored by the Harvard T.H. Chan School of Public Health (HSPH) and provided 262

different variables including the primary variables energy (kcals), saturated fat (percentage of kcals), potassium (mg), calcium (mg), Vitamin D (mcg), and fiber (g/1000kcal). Added sugar (percentage of kcal) was included as an additional variable, by HSPH, after the first year of the study (n=47). Additional micronutrients, associated with fruit, vegetables, and whole grains, were assessed to explore diet quality (carotene, folic acid, vitamin E, vitamin C, vitamin B_6, phosphorus, magnesium, folate, and vitamin A) (24,25). Recommend intakes used for assessment were based on the Committee of the Dietary Guidelines for Americans and the National Academy of Science (26,27).

Anthropometric Measurements

Height and weight was obtained using a TANITA Corporation balance-beam physician's scale and stadiometer (model 08110136, Tokyo, Japan). The same pediatrician measured height and weight at the first and last session. The child's date of birth and gender were recorded during measurements. BMI z-score was computed using The Children's Hospital of Philadelphia Pediatric Z-score calculator, which is based on the Center for Disease Control (CDC) growth charts(28,29).

Analysis

All variables were assessed to determine if the data were normally distributed. Baseline dietary data was compared between non-completers (n=18) and completers of the second FFQ (n=66) using independent t-tests. The primary outcome analysis was a multivariate repeated measures Analysis of Variance assessing within subject changes between baseline and post intervention in fiber(g/1,000 kcal), energy intake (kcal) percentage of energy from saturated fat, calcium(mg), iron(mg), potassium(mg), sodium(mg), and vitamin D(mcg). Significant multivariate analyses were followed by

univariate analyses were conducted to determine changes between baseline and post intervention for each variable. Because of the reduction in sample size for added sugar, a second analysis including added sugar was conducted using the same procedure. A multivariate repeated measures Analysis of Variance was also conducted on exploratory variables related to fruit, vegetable and whole grain intake (carotene (IU), folic acid (mcg), vitamin E (mg), vitamin C (mg), vitamin B_6(mg), phosphorus (mg), magnesium (mg), folate (mcg), and vitamin A (IU)). Significant multivariate analysis was followed by univariate analyses to determine changes between baseline and post for each variable. A probability value of $p<0.05$ was utilized for the above analyses. Analysis of the children meeting recommendations was performed using paired t-tests with the Bonferroni procedure to correct alpha, thus $p<0.003$ was determined to be significant. Analysis of covariance was used to determine if gender and age affected outcomes. All data was analyzed using IBM SPSS Statistics Version 20 (IBM Corporation, Armonk, NY).

Results

The average age of participants was 8.6±1.3 years and they attended 90% of the classes on average. More participants were female (62.1%) than were male (37.9%). Height and weight increased from baseline to post, while BMI z-score decreased ($p=0.003$) indicating the program was successful for weight management. Information on anthropometrics can be found in table 1. Participants with post FFQ data (n=66) had higher calcium (1260.64±418.04mg vs 902.21±260.72mg $p=0.001$) and Vitamin D (6.95±3.10mcg vs 4.64±1.63mcg $p<0.001$) at baseline then subjects missing post (n=18). No other differences between completers and non-completers were found.

Nutrient Intake

There was a significant multivariate effect of time MANOVA (Wilk's Lambda=0.50; $F=7.39_{(8, 58)}$; $p<0.001$). The density of fiber increased between baseline and post intervention ($p<0.001$). There was a decrease in energy (kcal) ($p<0.001$), iron (mg) ($p=0.014$), sodium (mg) ($p>0.001$), and saturated fat (percent of energy) ($p=0.036$). There were no changes in calcium, vitamin D, and potassium between baseline and post. This data can be found in Table 2. Neither gender (Wilk's Lambda=0.92; $F=1.10_{(8, 56)}$; $p=0.27$) nor age (Wilk's Lambda=0.98; $F=0.14_{(8, 56)}$; $p<0.001$) were significant covariates.

There were no significant changes for additional nutrients (Wilk's Lambda=0.77; $F=1.85_{(9, 57)}$; $p=0.08$). Descriptive data are available in Table 3.

Looking at dietary adequacy as percentage of recommendations at baseline, fiber, potassium and vitamin E were below recommendations, sodium and saturated fat were above recommendations and added sugar met recommendations. The proportion of recommendations increased for fiber density ($p<0.05$). Sodium ($p<0.05$), and vitamin E ($p=0.05$) decreased from baseline to post. Results are displayed in Table 4.

Macronutrient Intake

Protein, as a percent of energy, increased ($p<0.001$) and fat, as a percent of energy, decreased ($p=0.016$) between baseline and post while carbohydrates did not change. Despite changes, macronutrients were in recommended ranges at both baseline and post intervention. Results are in Table 5.

Discussion

Children completing this family-based program decreased weight gain velocity, determined by BMI z-score, over 2 years (22). This study also found a significant decrease in BMI z-score from baseline to post, without affecting normal height and weight gain expected in children. This decrease in BMI z-score coincided with a decrease in energy intake. Despite the change in energy intake, children increased fiber density, decreased sodium and saturated fat, and maintained diet quality for calcium, vitamin D, iron, and potassium.

Children in this study were not meeting recommendations for fiber (14g/1000kcal) at baseline or post, however, they significantly increased intake by 0.84g/1000kcal to 9.5g/1000kcal (7). This increase is greater than previous studies. Of the 3 family-based intervention studies that looked at fiber intake two reported no change in intake (9,10). Program Obesity Zero (POZ), a non-randomized study of children ages 6-10, reported an increase in fiber of 0.20g/1000kcal (11). However, there was a difference in dietary assessment as SCFFF used FFQ while POZ used two 24-hour recalls (11).

Although children in SCFFF were only consuming 67.8% of recommended fiber at the end of the study, previous research in a large sample of children found a decrease in fiber density of about 3g/1000kcal was associated with a 21% increase in adiposity (5). Therefore, even though the increase in fiber density was small, it is possible that it contributed to the successful weight regulation observed in this study, though future research needs to be conducted.

Most other family-based studies have assessed dietary quality based on servings of food groups or types of foods (9,11,30). This study was one of the few that assessed

micronutrients. Sodium, saturated fat, and added sugar decreased, consistent with Dietary Guideline recommendations, indicating an improvement in quality (7). Other child intervention studies have not seen similar decreases in sodium, saturated fat and added sugar (9–11,31). The decrease in sodium and added sugar may be associated with a reduction in processed and convenience foods as well as sugar sweetened beverages, which are energy dense and may contribute to weight gain (32,33).

Participants in this study were meeting the recommendations for macronutrients and micronutrients, except for fiber, potassium, and vitamin E, both at baseline and follow-up (26,27). However, children were consuming higher amounts of dietary fiber, potassium, and vitamin E (4.8g/1000kcal, 1909mg, and 3.5mg respectively) than the national average (34). It may be beneficial for future intervention programs for overweight children to emphasize more the importance of increasing fruits, vegetables, whole grains, legumes, nuts and seeds which contain fiber, potassium, and vitamin E (35).

There are a few limitations to this study. The first is the FFQ is validated in children ages 9-18 self-completing the questionnaire (36). For this study, parents of children ages 6-11 complete the questionnaire, with the assistance of their children (36). The FFQ also assessed intake over the period of one year, but the time between the two assessments was only 4 months. However, FFQ instruments in general tend to be more representative of the previous month than the previous 12 months (37). Significant changes were observed in this study demonstrating the FFQ was sensitive to change over this period. Another limitation is that FFQs may overestimate fiber, vitamin C, calcium, and iron while under estimating saturated fat (38). The questionnaires were completed in

the presence of the study instructors which could bias results (39). The FFQ also did not quantify food groups which limits comparison with other studies. However, reporting on micronutrients allows us to assess overall diet quality which is a strength of this study (15). This study also lacked a control group; therefore, even though there were changes seen during the intervention, it isn't possible to determine if there were outside factors that were causing the changes. Changes in physical activity were not assessed, and may be another explanation for the decrease in BMI z-score. Another limitation is that added sugar was not available for the first year, but we found a significant reduction in a multivariate analysis of the subsample. Finally, there was no follow-up dietary data at the 1 year or 2 year follow-up to assess maintenance of dietary changes, though the decrease in BMI z-score at two years suggests that healthful changes have continued (22).

This successful family-based intervention was able to increase dietary fiber intake and retain diet quality while decreasing energy intake and BMI z-score. This study indicates that family-based interventions may be useful in helping combat childhood obesity without sacrificing dietary quality. Further research is needed to determine if dietary changes are retained over long term and if increasing fiber intake will effect BMI z-score in the long term in overweight and obese children.

Conflicts of Interest

The authors of the study have worked closely with the South County Food Fitness and Fun program and one author received support from the program.

Table 1. Changes in Anthropometric Measurements between Baseline and Post Intervention (n=66)

Nutrient	**Baseline**	**Post**	**Change**	**t-value**
Height (in)	54.55 ± 3.57	55.32 ± 4.10	0.77	-3.968***
Weight (lbs)	106.65 ± 25.76	109.08 ± 27.31	2.43	-4.016***
BMI z-score	2.06 ± 0.40	1.99 ± 0.40	0.07	3.073**

*p<0.05, **p<0.01, ***p<0.001
All results displayed are mean ± standard deviation unless otherwise designated.
Change= Mean Post – Mean Pre

Table 2. Changes in Mean Nutrient Intakes between Baseline and Post Intervention (n=66)

Nutrient	**Baseline**	**Post**	**Change**	**F-Value**
Fiber (g/1000kcal)	8.65 ± 2	9.48 ± 2.26	0.84	16.008***
Energy (kcal)	2122.77 ± 506.13	1889.86 ± 425.58	-232.91	19.568***
Calcium (mg)	1262.42 ± 415.65	1274.40 ± 432.11	11.98	0.058
Vitamin D (mcg)	6.96 ± 3.12	7.43 ± 3.46	0.47	1.152
Potassium (mg)	3096.98 ± 844.63	3028.29 ± 877.74	-68.68	0.565
Iron (mg)	15.18 ± 4.06	13.92 ± 3.85	-1.27	6.393*
Sodium (mg)	2638.38 ± 677.93	2330.14 ± 521.85	-308.24	17.672***
Saturated Fat (% of kcal)	10.34 ± 1.64	9.96 ± 1.69	-0.38	4.607*

*p<0.05, **p<0.01, ***p<0.001
All results displayed are mean ± standard deviation unless otherwise designated.
1. Change= Mean Post – Mean Pre
2. Multivariate analysis was not statistically significant thus univariate analyses were not conducted

Table 3: Changes in Mean Nutrient Intake between Baseline and Post Intervention for Micronutrients Related to Fruit and Vegetable Intake

Nutrient	**Baseline**	**Post**	**Change**
Folate (mcg)	467.21 ± 139.84	434.20 ± 123.19	-33.01
Folic Acid (mcg)	408.80 ± 287.52	377.03 ± 243.77	-31.77
Carotene (IU)	5865.91 ± 4280.35	6147.06 ± 4148.35	281.15
Vitamin A (IU)	8307.37 ± 4636.50	8478.20 ± 4656.90	170.83
Vitamin E (mg)	7.10 ± 2.11	6.26 ± 1.74	-0.85
Vitamin C (mg)	117.38 ± 60.87	102.49 ± 51.95	-14.89
Vitamin B_6 (mg)	1.95 ± 0.57	1.85 ± 0.50	-0.10
Magnesium (mg)	299.95 ± 74.68	293.70 ± 80.83	-6.25
Phosphorus (mg)	1603.24 ± 403.16	1574.06 ± 426.97	-29.18

*$p<0.05$
All results displayed are mean ± standard deviation unless otherwise designated.
Change= Mean Post – Mean Pre

Table 4: Dietary Adequacy as a Percentage of Nutrient Recommendations Being Met Based on the 2015 Dietary Guidelines and the National Academy of Science (7,27)

Nutrients	**Recommendation**		**Baseline (%)**	**Post (%)**	**T-Value**
	4-8(years)	**9-13 (years)**			
Fiber	14g/100kcal	14g/100kcal	61.77 ± 14.26	67.74 ± 16.13	-4.001*
Calcium	800mg	1300mg	128.34 ± 53.79	130.67 ± 56.98	-0.460
Vitamin D	5mcg	5mcg	139.20 ± 62.31	148.55 ± 69.12	-1.073
Potassium	3800mg	4500mg	75.40 ± 21.47	73.88 ± 22.89	0.689
Iron	10mg	8mg	169.86 ± 48.50	156.52 ± 48.58	2.313
Sodium	<1900mg	<2200mg	138.86 ± 35.68	105.92 ± 23.72	8.760*
Saturated Fat	<10%kcal	<10%kcal	103.45 ± 16.37	99.60 ± 16.91	2.146
Folate	200mcg	300mcg	196.50 ± 72.82	181.34 ± 62.29	2.121
Vitamin A	1333IU	2000IU	522.83 ± 307.97	533.03 ± 313.53	-0.419
Vitamin E	7mg	11mg	84.16 ± 32.44	73.05 ± 23.81	3.577*
Vitamin C	25mg	45mg	366.06 ± 227.78	319.47 ± 191.80	2.138
Vitamin B_6	0.6mg	1mg	263.12 ± 101.80	249.21 ± 93.48	1.793
Magnesium	130mg	240mg	179.31 ± 68.68	176.31 ± 68.68	0.637
Phosphorus	500mg	1250mg	228.39 ± 116.00	225.66 ± 119.66	0.401
Added Sugar (n=47)	<25%kcal	<25%kcal	43.83 ± 14.44	40.21 ± 13.53	2.180

*p<0.05 (with Bonferroni adjustment)
All results displayed are mean ± standard deviation unless otherwise designated

Table 5. Percentage of Macronutrient Intake

Macronutrient	**Baseline (%)**	**Post (%)**	**t-value**
Carbohydrates	53.73 ± 4.68	53.65 ± 5.21	0.133
Protein	17.50 ± 2.42	18.98 ± 2.44	-5.462***
Fat	30.10 ± 4.19	28.88 ± 4.44	2.472*

*p<0.05, **p<0.01, ***p<0.001
All results displayed are mean ± standard deviation unless otherwise designated.

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Appendix A: Literature Review

Introduction

Childhood obesity affects 17.7% of children ages 6 to 11 in the United States(1). Both environmental and genetic factors can play a role in the development of childhood obesity, which can lead to a variety of health problems in children (40–49). Adequate dietary fiber intake has been shown to reduce obesity risk (4–6). A healthful diet provides enough Vitamin D, calcium, iron and potassium, but should be low in sodium, saturated fat, and added sugars (7). These nutrients have been shown to be inadequate in children (7). Few studies have shown a change in fiber density intake during community-based weight management interventions for children or have looked at micronutrient distributions (9–11). This review will discuss the cause and effects of obesity in children, the effects of fiber intake on weight, micronutrient adequacy of children, and the effects of interventions on weight, fiber intake and diet quality in children.

Obesity

About 31.8% of all children ages 2-19 years old were overweight and obese in 2012, and 17.7% of 6-11 years olds were classified as obese(1). Obesity in children has been related to environmental and genetic factors. Environmental factors related to obesity include family dynamics, the type and amount of food outlets available, and screen time (40–46). Genetic factors have also been shown to play a role in obesity. Satiety mechanisms like the hormone leptin have been shown to effect obesity genetically (49). Obesity in children can lead to hyperinsulimia, high blood pressure, high cholesterol, asthma, and metabolic syndrome (2,3). Children who are obese are more likely to be obese adults and if overweight during childhood, obesity in adulthood is likely to be more severe (50).

Causes of Obesity

Environmental

Environmental causes of obesity are external factors that can influence a child's weight. Family, in particular parents and guardians, can have a profound impact on a child's dietary intake. Additional studies on food environment, sedentary activities, and sleep habits have shed further light on environmental causes of obesity.

Two studies conducted by Montano et al.(51) and Renzaho et al.(46), looked at parental and family influences on eating behavior. Montano et al.(51) looked at the longitudinal relations between parenting behavior scores (PBS) and dietary quality of meals of children ages 2 to 5. Seven hundred and thirty-one families were randomized into intervention and control groups. The intervention consisted of three sessions: initial interview, home-based assessment, and feedback session. They looked at the parent's positive behavior support of the child (PBS) and dietary quality by observing video recordings of family meals. The main finding was that nutritional quality was positively associated with PBS ($r=0.24$ $p<0.001$) (51).

Renzaho et al.(46) also looked at how family functioning related to dietary quality in children. There were 4,602 subjects surveyed with a child aged 1-12 years in Victoria, Australia. Diet was looked at in terms of consuming potato crisps, potato chips, french fries, consuming food away from home, and consuming sugar sweetened beverage. Independent variables considered were family functioning, psychological distress, demographic, and socioeconomic factors. Higher weekly consumption of potato chips/crisps was associated with single-parent households (IRR = 1.32; 95% CI: 1.10-1.59; $p<0.001$), living in public housing (IRR =1.54; 95% CI: 1.05–1.27; $p<0.05$),

speaking a language other than English at home (IRR = 1.19; 95% CI: 1.04–1.36; p<0.01), and being a male caregiver (IRR=1.19; 95% CI: 1.04–1.36; p<0.01)(46). There was also a positive association between poor dietary quality and poor family functioning (IRR=1.24; 95% CI: 1.10–1.40; p<0.001) as well as psychological distress (IRR=1.03; 95% CI: 1.01–1.04; p<0.001) (46). Besides living in public housing, findings were similar for consuming food away from home. For sugar sweetened beverages, higher intakes were associated with being a boy (IRR = 1.13; 95% CI: 1.04-1.23; p<0.01), being a male caregiver (IRR = 1.17; 95% CI: 1.06-1.29; p<0.01), being a single-parent household (IRR = 1.49; 95% CI: 1.34-1.67; p<0.001), living in public housing (IRR=1.69; 95% CI: 1.40-2.03; p<0.001) or having a private landlord (IRR= 1.26; 95% CI: 1.12-1.41; p<0.001)(46). There was a negative association between consumption of sugar sweetened beverages and parent education level (IRR = 0.71; 95% CI: 0.65-0.77; p<0.001), household income (moderate: IRR = 0.68; 95% CI: 0.58-0.80; p<0.001, high: IRR = 0.57; 95% CI: 0.49-0.66; p<0.001), and caregivers age (low: IRR= 0.83; 95% CI: 0.72-0.96; p<0.01, moderate: IRR = 0.84; CI: 0.72-0.97; p<0.01)(46). There was also a positive relationship between cups of sweet beverages consumed and poor family functioning (IRR = 1.28; 95% CI: 1.16-1.42; p<0.01) and parental psychological distress (IRR = 1.03; 95% CI: 1.02-1.04; p<0.01)(46).

Access to food and the food environment can have an effect on the weight of children. Griffiths et al. (41) and Larsen et al. (42) both looked at food access and how it relates to overweight and obesity. Griffiths et al. (41) investigated the exposure of food outlets and childhood obesity in Leeds, UK. The study analyzed 13,291 children ages 11 and 12. The food outlets were in a 2km proximity to the child's school and home. The

outlets were identified as supermarkets, takeaway, retail, and total outlets. There was an association between the number of supermarkets (OR 1.18 [1.05 to 1.35]), takeaway (OR=1.20 [1.06 to 1.36]), and retail (OR 1.23 [1.11 to 1.34]) and obesity (41). There is an association between the number of supermarkets in the commute from home to school and obesity (β = -0.10 [-0.17 to -0.02]) (41). Lastly, there was an association between the proximity to retail outlets (OR 0.67 [0.50:0.90]) and total outlets (OR 0.77 [0.61:0.98]) and childhood obesity(41). This suggests as the distance of the nearest outlet increases, the probability of the child being obese decreases.

Larsen et al. (42) also looked at different food outlets and their relationship to overweight and obesity. The study assessed 1,035 children in grades 5 and 6 in Toronto, Ontario. Food outlet categories were fast food, less healthy food retail, healthier food retail and supermarkets. Those included in the analysis were within 2km of the home. As in the previous study, proximity and density were assessed. Living in neighborhoods with higher amounts of fast food and less healthy food outlets was not associated with being overweight or obese in children (OR = 0.978; 95% CI: 0.953 - 1.003; p=0.088) (42). Also, the proximity of fast food (OR = 1.261; 95% CI: 0.871-1.825; p=0.220) and less healthy food (OR = 1.000; 95% CI: 1.000-1.001; p=0.322) outlets was associated with overweight and obesity (42). The proximity to supermarkets is associated with overweight and obesity (OR = 1.477; 95% CI: 1.060 - 2.059; p=0.021), as distance to the nearest supermarket increased the odds of being overweight or obese increased by 1.5 times (42). A higher density of healthier food outlets lowered the odds of being obese (OR = 0.904; 95% CI: 0.847 - 0.964; p=0.002) (42). Healthy food outlets and

supermarkets in higher density and in close proximity positively reduced obesity risk, but unhealthier food outlets did not affect risk.

Rathnayake et al. (45) conducted a study to determine the nutritional and behavioral determinants of adolescent obesity. The study was conducted on 200 girls who were 14 to 18 years old in Sri Lanka. To determine the children's dietary assessment a 3 day food diary was kept including 2 weekdays and 1 weekend day. Physical activity was assessed using the long version of the International Physical Activity Questionnaire. Non-obese students had higher levels of energy expenditure from physical activity (894.6 ± 730.6 kcal obese vs 1844.3 ± 996.3 non-obese, $p<0.001$) (45). Family income (OR 2.99 $p=0.027$), being the first born (OR 2.73 $p=0.012$), skipping breakfast (OR 3.00 $p=0.001$), consuming less than 4 fruits per week (OR 2.18 $p=0.045$), greater than 2 hours of screen time per day (OR 2.96 $p=0.008$), higher energy intake (OR 7.23 $p=0.0001$), and irregular menstruation (OR 4.34 $p=0.015$) were also associated with obesity (45).

Sleeping habits and their relationship to weight have been studied by Martinez et al. (44) and Bonuck et al. (40) both studies showed that a shorter sleep duration can lead to an increased weight. Martinez et al. (44) assessed 229 eighty to ten year old Mexican American children. Sleep duration was measured during 3 consecutive days at 3 different time points over 24 months. Anthropometrics and pubertal status were also assessed at the same three time points. The study found that longer sleep durations were associated with a lower BMI Z-Score ($\beta = -0.22$, $p<0.001$), lower waist to height ratio ($\beta = -0.25$, $p<0.001$), and lower weight gain ($\beta = -0.23$, $p=0.001$) at 24 months (44).

Bonuck et al. (40) conducted a longitudinal study that enrolled 1,899 pregnant woman and assessed sleep duration of their children at 18 months, 2.5 years, 4.75 years,

5.75 years, and 6.75 years. Height and weight were measured at ages 7, 10, and 15 years. Questionnaires on the child's snoring, observed apnea, and mouth breathing were given out at 6, 18 30, 42, 57, 69, and 81 months. Children who had the most sleep disordered breathing were twice as likely to become obese by age 7 (OR=2.15, 95% CI: 1.14-3.16), 10 (OR = 1.90, 95% CI: 1.14-3.16) and 15 (OR = 2.18 95% CI: 1.31-3.64) years of age (40). Short sleep duration at age 5.75 years increased odds of obesity at 15 years (40). In contrast, those with the longest sleep duration at 2.5 years were less likely to be obese at 15 years (OR = 0.50, 95% CI: 0.26-0.97) (40).

Genetic

Genetic causes of obesity are individual physiological factors that can influence a child's weight. Studies on twins have shown that 40% to 70% of the variance of BMI can be explained by genetics (47). However, specific genetic markers have not been identified; the 30 single nucleotide polymorphisms (SNPs) identified only explain 1.5% of the variation in BMI (48).

Llewellyn et al. (49) observed 2,258 children who were approximately 10 years old with a randomly selected twin from the Twin Early Development Study. The researchers genotyped (SNPs and selected those that were associated with increase obesity risk and from here assign a genetic predisposition score (PRS). They measured adiposity by BMI SD score (similar to BMI Z-score) and waist circumference SD score. In addition, they also measured satiety responsiveness by a 6-item version of the validated Child Eating Behavior Questionnaire. They found a positive linear association between PRS and BMI SD score (β-coefficient = 0.177; 95% CI: 0.136-0.218) as well as waist SD score (β-coefficient = 0.167; 95% CI: 0.126-0.208). PRS explained 3.1% of the

variation in BMI SD score and 2.8% in the waist SD score (49). Those with a higher PRS were more likely to be overweight or obese compared to those with lower scores (18.5% vs 7.2%; OR = 2.90; 95% CI: 1.98-4.25) (49). There was also a negative linear association between PRS and satiety sensitivity (β-coefficient = -0.060; 95% CI: -0.019 to -0.101), which explained about 0.4% of the variance in scores (49). When adding satiety sensitivity to the PRS and BMI SD score linear model there was a change by -0.013 in the β-coefficient which indicated that satiety responsiveness independently affected the association between genetic obesity risk and adiposity (p=0.006) (49). These results indicate that there are genetic markers and suggest that responsiveness to satiety hormones are affected by genetics

Despite the clear association between genetics and obesity, SNPs only explain 1.5% of the variance in obesity (48). Environmental factors currently explain more of the variance in obesity than specific genetic markers (48).

Consequences of Obesity

It is important to focus on decreasing obesity in children due to the adverse effects of obesity on health. Studies have indicated higher fat mass in children can lead to elevated blood pressure, diabetes, non-alcoholic fatty liver disease, metabolic syndrome, and asthma in children.

Silveira et al. (2) investigated metabolic abnormalities in obese children including non-alcoholic fatty liver disease (NAFLD), metabolic syndrome (MS), intra-abdominal adipose tissue (IAAT), and subcutaneous adipose tissue (SCAT) in sedentary obese children. Study participants (n=182) ranged in ages 6 to 16 years, had a BMI in the obese range, had no regular physical activity in three months prior to the study, and no disease

or limitation that limited physical activity. Anthropometrics included height and weight. Fat mass was determined using a Dual-energy X-ray absorptiometry. Blood samples were obtained after a 12 hour fast and were analyzed for triglycerides, total cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, insulin and glucose. Blood pressure was measured using an electronic device validated in pediatric populations. Ultrasound was used to determine SCAT and AFLD and MS was determined by the World Health Organization standards. Both genders had a high prevalence of MS. High SCAT was associated with elevated blood pressure. IAAT was positively associated with dyslipidemia and NAFLD. Although SCAT or IAAT were not associated with hyperinsulima, NAFLD was positively associated with hyperinsulima. In addition IAAT was more closely associated with MS and NAFLD than SCAT. The study found that both IAAT and SCAT were associated with higher undesirable outcomes such as elevated blood pressure, dyslipedmia, and NAFLD. This is similar to findings in adults, that a higher body fat mass is associated with MS and NAFLD.

Weinmayr et al. (3) assessed objective markers of asthma and allergic disease in relation to BMI in children ages 9-11 from 10 geographically different schools. A parental questionnaire, done through interviews with trained personnel, was used to determine occurrence and severity of symptoms of asthma, rhinitis, and flexural eczema. Adiposity was measured using BMI, height and weight were taken without shoes and age and sex specific percentiles were used to determine cutoff points for overweight and obesity. The OR for wheeze in relation to overweight and obesity was 1.14 (95% CI: 0.98-1.33), and 1.67 (5% CI: 1.25-2.21) respectively (3). Those who reported a dry cough at night and were woken with a tightness in the chest were more often obese. Also

wheeze was associated with exercise in those who were overweight and obese. There was a lower FEV1/FVC in relation with overweight and obesity (3). There was no association of rhinitis with overweight and obesity. Eczema was only associated with obesity in affluent areas. These results indicate that overweight and obesity are associated with asthmatic symptoms and airway obstruction.

Obesity can cause increased health problems. Studies show that elevated blood pressure, non-alcoholic fatty liver disease, and asthma symptoms are more common in children with excess body weight (2,3). As overweight and obese children are more likely to be overweight and obese adults these adverse health outcomes are likely to continue and progress (50). Helping to prevent or reverse obesity in children could reduce health risks in adulthood.

Fiber

Mechanism of Fiber in relation to Obesity

Adequate dietary fiber intake has been shown to reduce or maintain an individual's body weight, and a higher intake of fiber has been associated with lower body weight after controlling for energy intake (4–6). The physiological basis for the effect of fiber on energy balance regulation include several possible mechanisms. These mechanisms include eating rate, lower absorption of energy, and the displacement of higher calorie foods (12–14).

Viskaal-van Dongen et al.(12) analyzed eating rate using common foods. The 24 subjects were both men and women ages 18-35 with a normal BMI (18.5-25kg/m^2) who were restrained eaters and were in good physical and mental health. Subjects performed 7 test sessions that each lasted 30 minutes at lunch time. They fasted for 3 hours before the

start of the session. Each session was broken into two parts. In the first part they were given 50g of the food and instructed to eat at a normal rate without pausing between bites or sips and then stop after the last bite. In the second part they were given about 2 times a large portion size, which differed per food, and were instructed to consume until completely full. Results showed that eating rate ranged even within food groups of similar viscosity. Eating rate of solids ranged from 4.2 ± 3.7g/min to 128 ± 73g/min, while semi solid foods ranged from 50 ± 36g/min to 229 ± 247g/min and for liquid foods it ranged from 305g/min to 631g/min (12). Fiber content of foods was inversely associated with eating rate indicating that higher fiber foods had a lower eating rate (β = -0.087, p=0.022, R2 = 0.52) (12).

Isaksson et al. (13) measured the difference between a high fiber rye diet and low fiber wheat diet on energy and macronutrients lost in ileal secretions in ileostomy subjects. Ten subjects, primarily men (8) who had a proctocolectomy, due to ulcerative colitis, at least 8 years prior were assessed. Each subject consumed a low fiber wheat diet for two weeks and then a high fiber rye diet for two weeks, under two conditions, either seven small meals or three larker meals per day. Each subjected consumed both diets and both conditions in a cross-over design. On day 3 of each diet/consumption pair (low fiber/seven meals, low fiber/three meals, high fiber/seven meals, low fiber/three meals) ileal secretions were measured, bomb calorimetry was used to determine energy content of excretions as well as the proportions of macronutrients. There was no differences 7 meal per day or 3 meal per day conditions so results were combined. The high fiber rye diet provided more protein, dietary fiber, total dry matter, and ash than the low fiber wheat group, but energy content was the same. In the high fiber rye diet, higher amounts

of gross energy, macronutrients, ash, and total dry matter were excreted compared to the low fiber wheat diet (13). This study showed that the gross energy excretion increased from 1.4MJ/24 hours during the low fiber wheat diet to 2.4MJ/24 hour in the high fiber rye group ($p<0.001$). Research suggests that a higher fiber diet was associated with a decrease the amount of energy absorbed by the body regardless of energy intake (13).

Hamedani et al. (14) studied 32 health males and females between the ages of 20-26 years, with a BMI between 20.5 and 24.5kg/m^2. In a crossover design, subjects consumed either a high fiber cereal or a low fiber cereal that were similar in weight and volume, but different in energy content. Meals were consumed between 8 and 11 am, after a 10-12 hour fast, with a standardized meal the night before. The study's subjects were instructed to consume the breakfast meal within 10 minutes. A second meal was provided 180 minutes from the first meal, consisting of 500mL of water and ad libitum pizza. Subjects were instructed to eat until comfortably full. There were no differences in the amount of food consumed at lunch time. Because high-fiber food was lower in calories, total energy intake from both meals was lower in the high fiber group ($p=0.01$) (14). The high fiber group felt "fuller" immediately after breakfast compared to the low fiber group (70.0±3.3 and 64.3±2.6, respectively; $p=0.008$) (14).

These studies provide information behind the fiber mechanisms that regulate weight. Fiber can reduce eating rate, reduce energy absorption, and reduce total caloric intake in mostly healthy subjects (12–14).

Fiber Intake in Children

Studies conducted in children have shown that children consuming higher fiber diets have a lower weight status than those consuming a lower fiber diet (5,6). These

weight differences have sometimes been found without differences in energy intake and whether or not children were meeting the recommended dietary intake of fiber.

Balthazar and Oliveira (6) found that lower body weight was associated with higher intake of fiber when adjusting for energy intake. Researchers compared the differences in dietary composition and meal patterns between obese and normal weight children. The study consisted of 83 children ages 7-11 that were either obese($\geq 95^{th}$ percentile for age and sex specific BMI) or normal weight (BMI value between the 5^{th} and 85^{th} percentile). Food intake for both groups was determined using two non-consecutive 24 hour food recalls with photographs and kitchen utensils used as props during the interviews. There was no difference between the obese and normal weight group in macronutrients and energy intake. Macronutrients fell within normal range of Dietary Reference Intakes (DRIs). However, dietary fiber intake differed between the obese and normal weight group. The normal weight group consumed a higher intake of dietary fiber (20.7±11.4 grams) compared to the obese group (14.8±9.1 grams; $p=0.011$) (6). Primarily due to differences in intake of beans ($p<0.001$). Intake of micronutrients fell within normal ranges with the exception of Vitamin A and calcium. Although Vitamin A was low for both groups, the obese group who consumed higher amounts at 917.2±534.2 micrograms than the normal weight group consumed 512.6±316.3 micrograms ($p=0.028$) (6). It was hypothesized that this difference was associated with the consumption of higher amounts of processed foods which are fortified with vitamins. There was no significant difference in calcium intake between the two groups, but neither group consumed the Adequate Intake (AI), primarily related to inadequate consumption of dairy products (6). The normal weight group consumed 678.6±295.9 milligrams and

the obese group consumed 613.8±295.3 milligrams (p=0.320). The authors concluded that a low intake of dietary fiber was associated with the risk of obesity.

Davis et al. (5) observed an inverse relationship between dietary fiber intake and visceral adiposity in overweight Latino youth. There were 85 subjects, ages 8-13 years old with a BMI of $\geq 85^{th}$ percentile. Weight was measured using a beam scale, while height was measured using a wall mounted stadiometer. Body fat was determined using dual-energy X-ray absorpitometry and body mass was calculated from height and weight. Dietary intake was assessed using two 24-hour diet recalls and then NDS-R was utilized to analyze intake of dietary variables including dietary fiber, total sugars, and added sugar. Results showed that decreases in dietary fiber (g/100kcal) and insoluble fiber (g/1000kcal) were associated with a higher visceral adipose tissue using partial correlation (r=-0.27; p=0.02 and r=-0.27, p=0.03 respectively) (5). Energy, protein, fat, and sugar variables were not associated with any changes in adiposity (5). This study found that children who are consuming higher fiber density diets have lower visceral adipose tissue compared to those consuming lower fiber density diets.

Brauchla et al. (4) assessed the NHANES data from 2003-2006. They looked at the sources of dietary fiber along with the association of fiber intake and childhood obesity risk in children ages 2-18 years old in 4,755 children. Ages were split into two groups, 2-11 and 12-18. Mean dietary data from two 24 hour food recalls was utilized and anthropometrics were measured at the Mobile Examination Centers. Dietary fiber was assessed as fiber density in grams per 1000kcals and split into three tertiaries. Foods that contributed the highest amount of fiber were peanut butter, popcorn, meatless bean and cheese burritos, baked white potatoes, beans and franks, canned pasta with tomato

sauce and meat/meatballs, refried beans, and chili con carne. The fiber density on average was 6.4g/1000kcals overall, 6.68g/1000kcal for 2-11 year olds, and 6.15g/1000kcals for 12-18 year olds (4). The tertiles of dietary fiber intake were 4.5, 6.2, 8.8g/1000kcals for 2-11 year olds, and 4.3, 6.1 and 8.9g/1000kcals for 12-18 year olds (4). In all children the risk of overweight and obesity decreased by 17% from the medium to the lowest tertile (OR=0.83 p=0.043), and 21% from highest to lowest tertile (OR = 0.79, p=0.031) (4). This indicates that those consuming a higher fiber diet reduce their risk of overweight and obesity. The benefits of fiber intake seen here is also regardless of not meeting the 14g/1000kcal recommendation (7,27).

Dietary fiber has been shown to help with weight regulation. Studies have indicated that higher fiber diets can decrease eating rate, increase energy fecal excretion, and displace higher calorie, low fiber foods in the diet (12–14). Studies have also found that fiber intake helps reduce adiposity risk in children. Children who consume a higher fiber density are less at risk to be overweight or obese (4–6).

Dietary Inadequacies

According to the Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2015, children are not consuming adequate amounts of calcium, potassium, iron, Vitamin D and fiber and consuming excess sodium, saturated fat, and added sugar (7). Dietary fiber has been previously reviewed. Consuming inadequate amounts of calcium, potassium, and Vitamin D and excess amounts of sodium, saturated fat, and added sugar can also cause adverse health outcomes (7).

Consuming inadequate amounts of some nutrients can lead to adverse health effects. Low amounts of calcium and Vitamin D in the diet, especially in growing

children, is associated with low bone mineral density (17,18). Excess intake of sodium combined with a low intake of potassium are associated with high blood pressure (19). Excess saturated fat is associated with high cholesterol which is associated with coronary artery disease and insulin insensitivity (20,52). Diets high in added sugar are associated with excessive energy intake, elevated triglycerides, increased blood pressure, and cardiovascular disease (53,54).

Calcium

Calcium has had a positive impact on bone health, specifically bone mineral density. Cvijetic et al. (18) conducted a study on 18 adopted and 17 biological children who were around 14 years of age. Diet assessment to analyze calcium intake was done using a food frequency questionnaire during a personal interview. Bone mineral density was measured using a Dual x-ray absorptiometry. For adopted children calcium was the most significant predictor of bone mineral density in the spine (10.8%), femur (17.0%), and radius (66.1%, $p<0.001$) (18). In biological children calcium was also the greatest predictor of bone mineral density in the radius (54.5%, $p<0.001$) (18). This study shows that calcium is associated with bone mineral density in children.

Vitamin D

Vitamin D is necessary for calcium absorption. Tis is also important for bone health. A study by Pekkinen et al. (17) analyzed Vitamin D status and its association with intake and bone health. One-hundred and ninety-five Finnish children who were ages 7-19 years participated. A FFQ and 3-day food record was used to assess Vitamin D intake and Vitamin D serum levels were assessed. Dual x-ray absorptiometry was used to determine bone mineral content and bone area. There was a positive correlation between

Vitamin D intake and serum levels (r=0.217, p = 0.003) (17). Vitamin D was also positively associated with bone mineral density z-scores in the lumbar spine, total hip, and whole body areas (r = 0.192, p = 0.010, r = 0.176, p = 0.019, r = 0.296, p<0.001, respectively) (17). This study demonstrated that Vitamin D intake plays an important role in bone mineral density

Iron

Iron deficiency in childhood can lead to cognitive deficits. More et al. (21) assessed 103 females 12-15 years old in India. Iron deficiency was assessed by blood count. Cognitive function was assessed by mathematics score, one multicomponent test for memory, attention, verbal learning, and intelligent quotient (IQ) scores. There was a significant differences in mathematics scores between nonanemic noniron deficient females (62.15 ± 5.93) and both anemic iron deficient (47.76 ± 8.26, p<0.001) and nonanemic iron deficient females (52.64 ± 9.88, p<0.001) (21). Mental balance scores differed between nonanemic noniron deficient females (2.7 ± 0.47) and both anemic iron deficient (1.66 ± 0.55, p<0.001) and nonanemic iron deficient females (2.05 ± 0.74, p=0.002) (21). Attention and concentration scores also different between groups with nonanemic noniron deficient females scoring higher (16.2 ± 2.06) than anemic iron deficient (11.28 ± 3.83, p<0.001) and nonanemic iron deficient females (13.76 ± 3.41, p=0.004) (21). Verbal retention scores were different between groups as well, with nonanemic noniron deficient females scoring higher (4.9 ± 0.30) than anemic iron deficient (4.1 ± 0.64, p<0.001) and nonanemic iron deficient (4.23 ± 0.83, p=0.004). IQ levels were different as well, with nonanemic noniron deficient females scoring higher (107.82 ± 4.95) than anemic iron deficient (96.6 ± 7.28, p<0.001) and nonanemic iron

deficient (102.61 ± 6.33, p=0.003) (21). This studies demonstrates, by multiple cognitive tests, that adequate iron levels are associated with better cognitive function than females with lower iron levels.

Potassium and Sodium

Potassium and sodium both related to blood pressure. Zhang et al. (19)analyzed the NHANES data from 2005-2010 to assess this relationship in 10,563 adult participants who were over the age of 20. Hypertension status was determined by 3 readings taken at the same office visit. Sodium and potassium intake was assessed using the average of 2-24 hour dietary recalls. There was an increase in systolic blood pressure by 1.04mmHg (95% CI: 0.27-1.82) for every 1,000mg/day increase in sodium and decrease of 1.24mmHg (95% CI: 0.31-2.70) for every 1,000mg/day increase in potassium (19). There was also an association with the sodium-to-potassium ratio, with an increase of 0.5 units leading to an increase of 1.05mmHq (95% CI: 0.12-1.98) (19). For diastolic pressure, for every increase in potassium by 1,000mg/day there was a decrease of 0.75 mmHg (95% CI: 0.22-1.28), while sodium had no effect (19). This study indicated that helps lower blood pressure while sodium is associated with an increase in systolic blood pressure.

Saturated Fat

Masquio et al. (20) assessed saturated fat and cardiovascular and diabetes risks in obese adolescents. The study observed 60 adolescents who were over the 95th percentile for BMI and were greater than stage 5 for peripubertal Tanner Stage. Body fat, height, weight, blood lipids and dietary intake were obtained. Dietary Intake was obtained using a 3-day nonconsecutive food record. Subjects were provided with a 1 year clinical intervention that included nutrition, exercise training, and psychological counseling.

Subjects were able to reduce saturated fat intake. The decrease in saturated fat was associated with a decrease in body mass (r=0.33, p=0.010), BMI (r=0.33, p= 0.011), and body fat (r=0.31, p=0.016). A decrease in saturated fat was also associated with a decrease in low density lipoprotein cholesterol (LDL-C) (r=0.2580, p=0.047), insulin (r=0.363, p=0.006), and HOMA-IR)r=0.301, p=0.023). There was also an increase with adiponectin (r=-0.300, $p<0.05$) and A/L ratio (r=-0.313, $P<0.05$) with a decrease in saturated fat. These results demonstrate that decreasing saturated fat can have positive impacts on cardiovascular and diabetes markers.

Added Sugars

Lula et al. (53) assessed the intake of added sugars and periodontal disease in young adults using NHANES III data in 2037 subjects ages 18-25. Added sugar consumption was assessed using a food frequency questionnaire. Periodontal disease was determined by assessing if there was bleeding of the gums while probing. The overall prevalence of periodontal disease was 18.8%. Subjects in higher tertiles of sugar intake were more likely to have periodontal disease than those in the lower tertile (second tertile: PR, 1.52; 95% CI, 1.15-2.01; third tertile: PR, 1.54; 95% CI, 1.10-2.14) (53). This study indicates that added sugar can lead to periodontal disease.

Kell et al. (54) assessed added sugars, diastolic blood pressure, and triglycerides in children. The sample included 320 peripubertal children ages 7-12 years old. They were not taking any medications contraindicated by the study. Diet was assessed using two 24 hour dietary recalls. Blood pressure, blood lipids, and percent body fat were taken, along with physical activity status. There was a significant positive correlation between sugar and diastolic blood pressure ($\beta=0.0206$, p=0.0462) (54). Added sugars

were also positively associated with triglycerides (β=0.1090, p=0.0206) with total body fat contributing to the model (p=0.0104) (53). However systolic blood pressure and other lipid values did not have any association with added sugar. This study indicates that added sugar can raise two components, diastolic blood pressure and triglycerides, of this disease.

Reference Intakes for Nutrients

Figure 1 below shows current recommendations for calcium, Vitamin D, potassium, sodium, saturated fat, and added sugars. These recommendations are based on the 2015 Dietary Guidelines and the National Academy of Sciences recommendations (7,27).

Figure 1: Dietary Recommendations for children ages 2-18 based on the 2015 Dietary Guidelines and the National Academy of Science.

Ages	Fiber (14g/1000kcal)	Calcium (mg)	Potassium (mg)	Vitamin D (mcg)	Sodium (mg)	Iron (mg)	Saturated Fat (%kcal)
Male: 4-8	20	800	3800	5	<1900	10	<10
Female: 4-8	17	800	3800	5	<1900	10	<10
Male: 9 - 13	25	1300	4500	5	<2200	8	<10
Female: 9-13	22	1300	4500	5	<2200	8	<10

Dietary Interventions

Many studies have utilized dietary interventions for treating obesity in children. There has been a wide variety of school-based and/or community-based studies conducted within the United States and other countries. The following review focus on interventions on elementary school aged children.

Waling et al. (10) evaluated the impact of a one year food and physical activity intervention on energy and macronutrient intakes in overweight and obese children. One hundred and five children, 8-12 years old, meeting inclusion criteria of BMI $\geq$25kg/m^2 and internet access were randomized into intervention or control groups. After one year 66 children provided data for the analysis (63% retention rate). The intervention group received 14, 1.5 hour, group classes related to food, physical activity, and self-esteem at Umea University in Sweden. Children and parents were welcomed to join the classes. The control group attended one session to be informed of the anthropometric and food record measurement process, but had no further contact with the study personnel besides follow-up measurements. Diet was assessed by a 2 week diet history at baseline and a 4 day food record at the end of the study. Total energy expenditure (TEE) was measured using a SenseWear armband during the same time diet was assessed. At baseline there were no significant differences between the interpretation and control groups. Both groups had a higher saturated fatty acid intake than recommended and lower intake of polyunsaturated fatty acids (PUFA) than recommended. Post intervention energy intake decreased in both groups. The control group had a greater increase in total fat and PUFA intake reported in grams than the intervention group. However, both intervention and control saw an increase in energy adjusted PUFA intake. There was no difference in dietary fiber density between groups. Within groups, the control group decreased their dietary fiber density from 2.04 ± 0.49 g/MJ to 1.64 ± 0.36g/MJ (p=0.002), while the intervention group did not change with 1.96 ± 0.45g/MJ at baseline and 1.90 ± 0.55 g/MJ (p=0.711) (10). . In conclusion, the intervention resulted in a decrease in intakes of fat, saturated fatty acids, and cholesterol compared to control. This study, similar to SCFFF,

was community-based and investigated fiber, energy intake, and macronutrients. However, it was conducted in Sweden and there may be dietary differences compared to the United States.

Rito et al. (11) evaluated the effectiveness of Program Obesity Zero on diet and weight for length using a single group, non-experimental design. Four hundred and eighty-two 6-10 year old overweight participants with BMI $\geq 85^{th}$ percentile were recruited, and a total of 199 completed the 6-month study (41% retention rate). This study focused on five behavioral changes: 1. decreasing the consumption of foods high in fat, salt, and sugars, 2. increasing fruit, vegetable, and whole-grain consumption, 3. decreasing television viewing, 4. increasing physical activity levels, and 5. increasing knowledge, positive attitudes about nutrition, healthy diet, and related behavior change. Participants received: individual counseling with the child and at least one parent, a 3-hour family 'healthy cooking' workshop, and a school-based intervention with child sessions totaling 6-hours and parent sessions totaling 3-hours. Height, weight, and waist circumference were measured using standardized procedures and dietary intake was assessed using two 24-hour recalls (one at baseline and another at 6-months). BMI-for-age percentile ($p<0.001$), and waist circumference ($p<0.001$) were significantly lower between baseline and follow-up and there was a significant increase in fiber intake from 16.7 grams to 19.2 grams ($p=0.005$) (11). There were no differences in energy intake. In conclusion, this study demonstrated the effectiveness of a multi-component comprehensive approach to reducing overweight and obesity (11). However, this study was school-based in contrast to SCFFF which is community based and only looked at

macronutrients and energy intake and didn't look at micronutrient or total dietary quality intake.

Cohen et al. (9) focused on improving diet, physical activity level, and weight status of rural children based on the successful model by the Shape-Up Somerville study (55). The Shape-Up Somerville study was a non-randomized control trial of 3 communities (55). Children in grades 1-3 were recruited, and interventions within the community were developed to increase the child's everyday physical activities (55). The intervention led to decrease in BMI z-score for at least 2 years after the study concluded (55). In the Cohen study, 1,302 students in grades 1 to 6 in elementary schools in selected California, Kentucky, Mississippi, and South Carolina rural counties agreed to participate and 432 students completed pre and post dietary assessment (33% retention rate). Their mean age was 8.6 years, they were from high poverty areas and were predominately nonwhite. The study was a community and school based randomized controlled intervention. Each state had two counties participating, one control and the other intervention. The intervention was primarily through school with a food service educational component. Intervention schools were provided the Shape Up: During- and After- School curricula, the Eat Well Keep Moving curricula, and the 5-2-1 messages (5 servings of fruits and vegetables a day, no more than 2 hours of television or other screen time a day, and at least one hour of physical activity a day). The 2007 Block Food Screener for ages 2-17 was used to measure dietary intake differences between intervention and control schools at baseline and follow-up. At follow-up the intervention group had a higher consumption of fruits and vegetables (intervention: 1.57±0.12cups/1000kcal, control: 1.35±0.13cups/1000kcal, p=0.01), and a lower

glycemic index diets (intervention: 49.5±0.62, control: 50.6±0.70, p=0.03) than control group. There was no difference in fiber intake between groups (intervention: 8.12±0.33g, control: 7.73±0.39g, p=0.16) or within groups (9). This study, focused on a school-based approach even though it had a community component, while SCFFF is a solely community-based program. The study also focused on intake of fruits, vegetables, whole grain, legumes, and dairy and not specific micronutrients, though like the SCFFF study it looked at percentage of energy from saturated fat, and added sugars.

Siega-Riz et al. (31) looked at the dietary intakes of middle school students before and after a HEALTHY study intervention. The study followed 3908 children from the 6th grade (ages 10-11) through the 8th grade (ages 13-14). The children resided in Texas, Oregon, California, Pennsylvania, and North Carolina. The study was a cluster-randomized design, with 3 intervention schools and 3 control schools. Each semester the intervention children would have a different intervention theme including: consuming water versus sweetened beverages, increasing physical activity and reducing sedentary behavior, consuming high quality vs low quality foods, understanding energy balance, and strength, balance, and making choices for life. These themes were broken up over 5 semesters. Both a self-reported dietary intake using the Block Kids Questionnaire, and a semi-quantified food frequency questionnaire were used to assess dietary intake. Anthropometrics, sociodemographics, blood pressure, glucose, insulin, lipids, hemoglobin A1c, quality of life, and physical activity level were also assessed. Intervention schools had a higher intake of fruit consumption (138 g vs 122g, p=0.0016) and water intake (438g vs 429g, p=0.008) at follow-up than control (31). There were no

significant differences in fiber or energy, macronutrients, grains, vegetables, legumes, sweets, sweetened beverages, and high- or low-fat milk consumption between groups.

Results of interventions on weight and fiber intake have been mixed. There has been either a slight increase or no change in total fiber (9–11,31). Because most successful interventions have been associated with a reduction in energy intake, it is necessary to look energy adjusted fiber density.

Conclusion

This literature review has demonstrated that fiber intake is related to a reduced risk of obesity in children. Due to high prevalence of overweight and obesity in children, and the adverse health effects of this excess body weight, it is important to focus on ways to help prevent obesity by making appropriate dietary changes (1). Two out of the three interventions in children, that reported on dietary fiber, had a positive impact on their dietary fiber intake (9,11). However, it is clear that additional research assessing fiber density and micronutrient intake in a community-based weight management intervention is needed. This review also found that children are not consuming adequate amounts of calcium, vitamin D, iron and potassium, but are consuming excess amounts of sodium, and saturated fat, (7). Though interventions assessing micronutrient intake are limited. The purpose of this study is to examine changes in dietary quality based on fiber intake as well as, calcium, vitamin D, iron, potassium, sodium and saturated fat.

Appendix B: South County Food Fitness and Fun Curriculum

Lesson # 1 – Getting to Know You and MyPlate (Week 2)

I. Audience: children ages 7 – 10

II. Objectives:

1. Participants will get to know each other and will be introduced to the course.
2. Participants will become familiar with MyPlate.

III. Discussion Topics:

1. Hand participants their journals and explain that they are expected to keep them for the class. Ask that after each class, the participants write one thing they learned from the lesson in addition to one change that they might be able to make in their eating habits.
2. Have participants each state their favorite foods and try to guess the food groups to which they belong.
3. Show the participants the MyPlate poster and ask them if they had every heard of 'myplate' before. Ask them to discuss how their plates compare to the guidelines of 'Myplate'.
4. Explain how to set up a plate according to Myplate guidelines: stress the importance of making half of the plate fruits and vegetables, as well as the importance of incorporating all food groups during meals.
5. Explain how the concepts of Myplate can be applied even when using other dishes, such as bowls.

IV. Activity: Play the MyPlate Game Show.

1. Prior to the workshop, write up a series of about 10-12 multiple choice questions (using A, B, or C) relating to 'MyPlate'. Questions should test the participant's knowledge of MyPlate. For example: What food group should make up half of your plate? What food group is a 'sweet potato' from? What portion of your plate should be grains? Name a food, other than milk, from the dairy food group?
2. Split the participants into two even teams, designate a 'captain' of each team, and give the paddles 'A, B, and C' to the captian.
3. Ask the participants the question and allow the teams 10 seconds of group discussion. After 10 seconds, have the captains of each team give their answer by raising the 'A, B, or C' paddle.
4. Keep score as the participants answer each question using a dry erase board and marker, the team with the most points at the end of the game, wins.

V. Challenge for Next Meeting: Have participants take home a blank myplate sheet and choose one meal they had during the week to draw in and color on the blank sheet. Stress the importance of trying to set up that meal according to Myplate guidelines

VI. Materials Needed:

1. Dry Erase Board with markers and eraser
2. Journals/notebooks (10-12)
3. Pens and Pencils
4. My Pyramid Game Show materials: game instructions, two or three sets of paddles with the letters A, B, or C on them.
5. Blank Myplate coloring sheets
6. Prizes

Lesson # 2 – "Go" With Grains (Week 3)

I. Audience: children ages 7 – 10

II. Objectives:
1. Participants will learn that foods from the grains group are important in providing energy to their bodies.
2. Participants will learn what foods belong in the grains group.
3. Participants will be introduced to whole grain foods.

III. Discussion Topics:
1. Review challenge from the last meeting. Have the participants discuss if their meals followed the Myplate guidelines: why or why not?
2. Ask participants what a grain is and where they think grains come from. Show them a picture of a field where some type of grain is grown.
3. Have various types of processed grains on hand to show the participants what they look like before they are made into foods that can be eaten.
4. Ask participants to list some foods they think are grains. As various foods are listed, hold the named grain food model up (if available) to show the class what the food looks like.
5. Introduce whole grains to the group and have them list some whole grain foods they know. Emphasize the fact that eating whole grain foods are more beneficial to their bodies than eating simple grain foods because in removing parts of the grain, part of the nutrients to help keep their bodies healthy are also being removed.
6. Ask the participants if they know how to tell if a food is whole grains. Show them the yellow 'whole grain' stamp that can be found on some food items.
7. Review what potion of our plates should consist of grains.

IV. Activity: Grain Art –
1. Give participants a blank sheet of paper and pencils or markers. Have participants draw a field.
2. Give participants bags of grains. Have the participants glue the grains onto their pictures to create their own 'grain field'.
3. Once the grains are glued, participants can paint their fields as they wish using water color paints.

V. Challenge for the Next Meeting: Find a Grain – Ask the participants to go home and find pictures of different unprocessed grains. These pictures may be from magazines, encyclopedias, or the internet. Have them print/cut the pictures out (if possible) and bring them in to show the rest of the participants during the next class.

VI. Materials Needed:
- Journals/notebooks/pens/pencils
- Myplate poster

- Color photo/picture of grain field
- Samples of unprocessed grains
- Plastic food models of grain foods
- Collection of various grains to be used in the Grain Art Activity (rice, oatmeal, barley, quinoa…)
- Blank sheets of paper for kids to draw fields on, printer paper will work but a sturdier paper will work better if available.
- Washable paint, paint brushes, glue

Lesson # 3 – Feel Fantastic with Fruit (Week 4)

I. Audience – children ages 7 – 10

II. Objectives:

1. Participants will learn how eating foods from the fruit group is important in helping to keep their bodies healthy and free from illness.
2. Participants will be introduced to and get to try different kinds of fruit.

III. Discussion Topics:

1. Review challenge from the last meeting. Have participants share the picture of the grain they found with classmates.
2. Ask participants if they enjoy eating fruit and if they can name three different types of fruit.
3. Asks participants what their favorite fruit is.
4. Discuss the importance of having a variety of fruit in the diet, and talk about incorporating all different colored fruits into the diet. Then have participants name fruits by color.
5. Ask participants why they think fruit it good for them. Discuss how different fruits have different health benefits and how they provide the body with important vitamins and minerals.
6. Have participants discuss what portion of their plates should be fruits.
7. Have participants think of some fun and creative ways to eat fruit.

IV. Activity : Fruit Taste Test:

1. Cut various fruits into small portions to place in Dixie cups. Fruits used included: apple, banana, mango, pineapple, watermelon, berries, cantaloupe.
2. Place one piece of fruit in each Dixie cup and cover with aluminum foil so that participants cannot see the fruit.
3. Have one participant put on the darkened sunglasses so that they are unable to see what they are eating. Pick up the fruit from the Dixie cup using the toothpick and hand to participant wearing the glasses.
4. Have the participant try the fruit given to him/her and attempt to guess which fruit they have just eaten.
5. Do multiple rounds and aim to have each participant try each fruit at least once.

V. Challenge for the Next Meeting: Fruit Pizza Recipe – Ask the participants to make a fruit pizza with their parents at home. Have them note in their journals whether they liked the pizza that they made.

VI. Materials Needed:

- Journals/notebooks/pens/pencils
- MyPlate poster
- Plastic food models of various fruit
- Small sunglasses with lens' blackened out
- Different types of fruit to try in the taste test
- Taste test materials: toothpicks, Dixie cups, aluminum foil

- Prizes

Lesson # 4 – Find Variety in Vegetables (Week 5)

I. Audience – children ages 7 – 10

II. Objectives:

1. Participants will learn the importance of having vegetables in the diet.
2. Participants will learn how different colored vegetables help keep different parts of the body in top shape.

III. Discussion Topics:

1. Review challenge from the last meeting, ask participants if they made the fruit pizza, and what they thought of it.
2. Ask participants why they think vegetables are good for them and if they can name three different kinds of vegetables that they eat. Have participants share what their favorite type of vegetable is.
3. Ask the participants if they can guess what parts of the body different colored vegetables help to stay healthy. Have the participants take guesses before displaying the poster.
4. Display a large poster to help illustrate the following:
    i. White and red – the heart and blood
    ii. Yellow and Orange – the eyes and skin
    iii. Green – the bones and muscles
    iv. Purple – the brain (and memory)

    As they discuss what colored vegetables help which parts of the body stay healthy, have them name two or three different vegetables of that color.
5. Have participants think of ways to eat foods from the vegetable group as a snack.

IV. Activity: Pot your own Vegetable:

1. Have kids pick out which vegetable they would like to grow from a variety of seeds.
2. Give each participant a cardboard plant holder and plastic cup.
3. Have each participant put the cardboard plant holder in the plastic cups, and then fill with soil.
4. Have each participant bury seed in their soil. Once buried, have participants water their plant using the gallons of water.
5. Explain to each participant how to care for their plant, provide sunshine and water once a day.
6. Have participants record their vegetables progress. Warn that the vegetables may take a couple weeks to sprout.

V. Challenge for the Next Meeting: Ask the participants to take care of their newly planted vegetables. Provide directions for care of the potted vegetable

and have the participants report back on their vegetable's progress for next week.

VI. Materials Needed
- Journals/notebooks/pens/pencils
- Myplate poster
- Plastic food models of various vegetables
- Poster of "vegetable-colored" person
- Plant pots, bottoms and potting soil
- Vegetable seeds
- 2 gallon-jugs of water

Lesson # 5 – Muscle up with Meats and Beans (Week 6)

I. Audience – children ages 7 – 10

II. Objectives:
1. Participants will learn how eating foods from the meats and beans group is important for building strong muscles and strong bodies.
2. Participants will become familiar with different types of beans.

III. Discussion Topics:
1. Review challenge from the last meeting, ask participants if any of their vegetables have begun to sprout.
2. Ask the participants if they think it's important for us to eat meat and poultry.
3. Explain that the meat and beans group is represented by the protein group on MyPlate.
4. Explain that foods from the meats and beans group are important because they give us the building blocks of our muscles. Have the participants name two different foods from the protein group.
5. Tell them that nuts and beans are also part of the protein group but instead of coming from animals, these foods come from plants, and explain why choosing beans and nuts is important.
6. Ask the participants to give examples of different kinds of foods they eat from the protein group.
7. Have the participants think of some creative ways to have foods from the protein group as a snack.

IV. Activity: Name That Bean!
1. The objective of this game is to set up a relay race. To set up the game, divide the beans and names of the beans into two groups. Each group should be comprised of the same number and type of beans.
2. On one side of the room, place the bags of beans on the ground (in two groups). On the other side of the room, place the name of the beans in a scattered pile (in two groups)

3. Divide the participants in two groups. Line one team up behind the first group of bean names, and the other team behind the other group of bean names
4. Have the first participant in line pick up a name of the bean, run over to the bagged beans, and guess which bean belongs to the name they have.
5. The participant should place the bean name next to the bean, and run back to the line to tag the next participant in line. Continue until all of the bagged beans have names next to them.
6. At the end, give participants a chance to work as a team and change any answers they think may be wrong.
7. Count up how many each team got correct, showing the participants which bean goes with which name as you count. Team with most correct, wins.

V. Challenge for the Next Meeting: Ask the participants to cut out pictures of foods in the protein group over the week. Have them build their own "Strong Man" or "Strong Woman" by pasting the pictures to the muscle man or muscle woman outline provided to them in class. Have them bring their strong person in to the next meeting to show their classmates how many foods they could find. Tell participants to provide at least three pictures found in the protein group that are not meat.

VI. Materials Needed
- Journals/notebooks/pens/pencils
- MyPlate poster
- Materials for the "Name That Bean" activity –7-10 different kinds of dried beans, note cards with names of beans
- Stong Man handout

Lesson # 6 – Slam Dunk with Dairy (Week 7)

I. Audience – children ages 7 – 10

II. Objectives:
1. Participants will learn how calcium helps bones and bodies grow.
2. Participants will learn that dairy foods are a good source of calcium and that yogurt and milk are the best sources.

III. Discussion Topics:
1. Go over challenge from the last meeting.
2. Ask participants if they know how many servings a day they should be having of dairy foods and why.
3. Explain that dairy foods are especially important for kids their age because these foods are high in calcium which plays a very important role in helping their bones and bodies grow. Also describe what could happen to bones if they don't get the calcium they need. Emphasize the fact that

milk and yogurt are the best sources of bone-building calcium from the dairy group.

4. Using the bags of flour provided, explain to the participants how their bones need more and more calcium as they grow. Show the participants how the amount of calcium in their bones changes as they grow from infants to adults.
5. Have the participants come up with some ways to have foods from the dairy group as a snack.

IV. Activity: Yogurt Taste Test

1. Pick out about 8 yogurts to have children test. Most yogurts should be 'healthy' containing less than 15g sugar. Choose 1 or 2 smoothie type yogurts and 1 or 2 Greek yogurts
2. Prepare Dixie cups for each participant containing a spoonful of each yogurt. Hand out the Dixie cups, one type of yogurt at a time, to each participant. Have the participants try the yogurt, and see if they can guess the type or flavor.
3. Ask the participants what they think of the yogurt they just tried, what they liked and did not like. Show the participants which yogurt they were eating, and explain how much sugar each one contains and compare the amount of protein found in greek yogurt.
4. Continue until each participant has tried each yogurt. At the end, have each participant tell which their favorite yogurt was.

V. Challenge for the Next Meeting: Have participants create an advertisement that illustrates the concept of having 4 servings of dairy a day. The advertisement can be cut out pictures from magazines, the computer, or something that they have drawn themselves.

VI. Materials Needed:

- Journals/notebooks/pens/pencils
- MyPlate poster
- Plastic food models of various dairy foods
- 8-10 different kinds of yogurt for the tasting, Dixie cups, spoons
- 'Calcium, it's in your bones' materials: plastic bags with different amounts of flour in each bag that represents calcium in the bones of different age groups.

Lesson # 7 – Find the Fat (Week 8)

I. Audience – children ages 7 – 10

II. Objectives:

1. Participants will learn why fat and oils are needed by the body.
2. Participants will learn how too much fat and oils in foods can be harmful to their bodies.

III. Discussion Topics:

1. Review challenge from the last meeting, have the participants show their advertisements to the class if they completed one.
2. Ask the participants if they know what fat is and, together, discuss what it does for the body (energy, skin, nails, cushion, and insulation).
3. Have the participants decide which foods have the most amount of fat in them.
4. Explain to the participants that some foods have too much fat in them which isn't good for the body. Emphasize the fact that they should be trying to get the right amount of fat their bodies need by eating healthier foods and that in eating the wrong foods; they are getting too much fat.
5. Show the participants fat-cracker sandwiches of their favorite snack foods which would visually represent the amount of fat present in each food.

IV. Activity 1: Fat Cracker Sandwiches
1. Have participants pick a partner
2. The partners will then pick their favorite fast food item from the menu provided, preferably one they often get at a fast food restaurant.
3. Hand out two crackers to each team of partners. Have participants look at the amount of fat (in grams) that is found in the fast food restaurant item they picked. Divide this number by four. That is how many teaspoons of Crisco the partners should put on their crackers. (1 tsp of Crisco = 4g of fat: example- 32 g of fat = 8 tsp of Crisco)
4. Once the partners pile the appropriate number of tsps of Crisco on their cracker, have them place the other cracker on top to make a 'fat sandwich'.
5. When all of the participants are finished, discuss as a class each 'fat sandwich' and what food items they each represent.

V. Challenge for the Next Meeting: Fatty Foods Experiment
1. Have participants pick three foods, can be any food (apple, cheese, ect.)
2. Have participants put this food item on a paper bag and leave overnight
3. Have participants label the bag with what food they chose and bring in the next week to show how much fat came out of the food.

VI. Materials Needed:
- Journals/notebooks/pens/pencils
- MyPlate poster
- To make sandwiches – Crisco, crackers, measuring spoons
- Handouts of fast food nutritional information

Lesson # 8 – Buckle Down with Breakfast (Week 10)

I. Audience – children ages 7 – 10

II. Objectives:
1. Participants will learn how eating a good breakfast helps to jumpstart their bodies for the day ahead of them.
2. Participants will learn how not eating breakfast can affect them negatively.

III. Discussion Topics:
1. Review challenge from the last meeting.
2. Review the importance of eating breakfast everyday and how it helps us to have better moods and how we are better able to concentrate and remember things.
3. Discuss some barriers to getting breakfast in the morning and possible solutions.
4. Have each child state a reason why breakfast is said to be the most important meal of the day.

IV. Activity 1: Act It Out! (7 min)
1. This activity can be done individually or in teams of two.
2. Have the children pick out moods that can happen when they skip breakfast: 'Cant focus, tired, angry, dizzy'
3. Have participants act out their mood, one at a time, until the other classmates guess what mood they are portraying.
4. As you play, stress the importance of eating breakfast to combat these negative moods.

V. Activity 2: Breakfast Bingo (10 min)
1. Hand out the bingo boards and pieces
2. Play bingo with participants. The bingo game provides pictures of different items you can have at breakfast. Stress which items are healthier breakfast choices, and which items should be eaten less often.

VI. Challenge for the Next Meeting: Ask the participants to try to have breakfast every day for the next week. Have them write down what they ate on their Breakfast Eating Calendar.

VII. Materials Needed:
- Journals/notebooks/pens/pencils
- MyPlate poster
- Breakfast Bingo Cards
- Bingo Counters
- Breakfast Eating Calendar

Lesson # 9 – The Snack-Treat Face-Off (Week 11)

I. Audience – children ages 7 – 10

II. Objectives:
1. Participants will learn the importance of snacking and some "smarter" foods to snack on.
2. Participants will learn how treats are different from snacks and why treats should be saved for special occasions.

III. Discussion Topics:

1. Review challenge from the last meeting. Have participants discuss if they ate breakfast everyday, and how they felt after eating breakfast/if they had skipped breakfast.
2. Ask the participants if they can tell you the difference between a snack and a treat.
3. Together, have the participants come up with some healthy snack ideas as well as actual snacks that they have tried.
4. Explain why snacks are important for everyone, but especially for growing participants. Snacks give extra opportunities to get healthy foods into the body to help participants grow the best they can. They also help keep them from becoming too hungry in between meals.
5. Discuss why treats should only be had on special occasions and ask the participants to name examples of treats and of what might be a special occasion.

IV. Activity: The Snack vs. Treat Relay
1. Break the kids into two groups
2. Give each group the same number of boxes/ wrappers. The boxes and wrappers are examples of common 'snacks' and 'treats'.
3. Set up the 'treat' and 'snack' bins a short distance away, opposite of the two teams.
4. Have the kids line up, and as it is their turn, pick up a box or wrapper. They will then run down to the bins and determine if the box or wrapper they have is a 'snack' or 'treat'. They will then place the box or wrapper in the appropriate bin, and run back to tag their next team member who will repeat.
5. Whichever team gets the most correct, wins. If it is a tie, the fastest team wins.
6. As you are counting out how many each team got correct, discuss the reasons that each box/wrapper is considered a treat or a snack.

V. Materials Needed:
- Journals/notebooks/pens/pencils
- MyPlate poster
- Four small buckets or baskets, two labeled with "Snack" and two labeled with "Treat"
- Snack and treat paper food models
- First place prizes, second place prizes

Lesson # 10 – Make it count with Meal Time (Week 12)

I. Audience – children ages 7 – 10

II. Objectives:
1. Participants will learn how meal time can be a great time to learn about themselves as well as each other.

2. Participants will learn the "plate method" of eating healthy.

III. Discussion Topics:
1. Review challenge from the last meeting.
2. Ask the participants how they can tell when they are hungry/full.
3. Discuss the importance of eating when you are hungry and not waiting too long for the next meal (snacks can come back into discussion here).
4. Explain how it is important to think about MyPlate when they are filling their plates. Fruits and vegetables should take up about half of the plate, grains should be in one quarter of the plate, and meats or beans should be in the other quarter of the plate.
5. Have participants tell you their favorite place to eat lunch or dinner and to tell you why. Ask the participants how they have fun while they eat and if they know the best way to have fun (eating with other people).

IV. Activity: Family-Style Dinner (Cook-Out Theme) –
1. Set up a family meal for participants. Family meal will consist of turkey and cheese sandwiches, salad, and milk.
2. To make sandwiches, put turkey and cheese on whole wheat bread. Grill on Panini maker and cut sandwiches into halves. Put on a big plate and allow participants to serve themselves. Provide salad in a big bowl, and provide a variety of light dressings.
3. Have participants serve themselves and encourage discussion during mealtime.
4. When the meal is finished, talk to the participants about how they felt while eating, when they knew if they were full.

V. Challenge for the Next Meeting: "Fill Your Plate" activity sheet.

VI. Materials Needed:
- Journals/notebooks/pens/pencils
- MyPlate poster
- "Portion Distortion" handout
- "Food For a Day: Putting it all together" poster
- "Fill Your Plate" handout
- Family Style Dinner foods: whole wheat bread, turkey, cheese, milk, mixed salad, light dressings
- Plates, glasses, forks, spoons, napkins, bowls, serving spoons
- Panini Maker

Lesson # 11 – The Fast Food Fix (Week 13)

I. Audience – children ages 7 – 10

II. Objectives:
1. Participants will learn what fast-food is and why eating too much fast-food isn't good for their bodies.

2. Participants will learn how to make their visits to fast-food restaurants a little healthier.

III. Discussion Topics:

1. Review challenge from the last meeting.
2. Have the participants define what fast-food means to them and discuss together why eating fast-food all the time isn't the healthiest way to eat.
3. Show participants how fast-food portions have changed over time.
4. Ask the participants about their favorite kinds of fast food "fixes".
5. Ask them if they know of any healthier options from different restaurants that they could choose instead of these food items.

IV. Activity: Scavenger Hunt fast food

1. Divide the group into 2 groups.
2. Each group has to go on a scavenger hunt around the studio finding papers with question and answers on them.
3. Make sure you tell them where in the studio they should look. Separate the groups as much as possible (i.e: front and back of studio)
4. Once they have all the papers, they need to put the stack of papers in order based on the answers. They have to work together as a group.
5. They will find out quickly if there are missing papers and need to look more.
6. The group that completes the scavenger hunt and answers all the questions CORRECTLY first, wins.

V. Challenge for the Next Meeting: Explain to the participants that they will be giving a whole new meaning to the word "fast-food". Have participants go home and create a poster of a fast-food (healthy snack) that they would try to sell to the rest of the class.

VI. Materials Needed:

- Dry Erase Board with markers and eraser
- Journals/notebooks
- Pens and Pencils
- MyPlate poster
- Portion distortion poster
- Prizes, first place, second place
- 2 sets of scavenger hunt papers

Lesson # 12 – Think Your Drink (Week 14)

I. Audience: children ages 7 – 10

II. Objectives:

1. Participants will learn how some beverage choices are better than others.
2. Participants will learn that soda beverages are mostly sugar and shouldn't be consumed regularly.

III. Discussion Topics:

1. Go over challenge from the last meeting.
2. Ask the participants to name the two most important beverages they think they should be drinking every day.
3. Have the participants explain why having too much juice and soda isn't the best for their bodies.
4. Discuss the difference between a beverage that is 10% juice and a beverage that is 100% juice.
5. Explain that both soda and juice have a lot of sugar in them but that juice is the healthier choice of the two. However, emphasize that participants of their age group should only be drinking one to two cups of juice a day because that's all they need.
6. Discuss alternatives to drinking soda and juice when their "daily allowance" has run out.

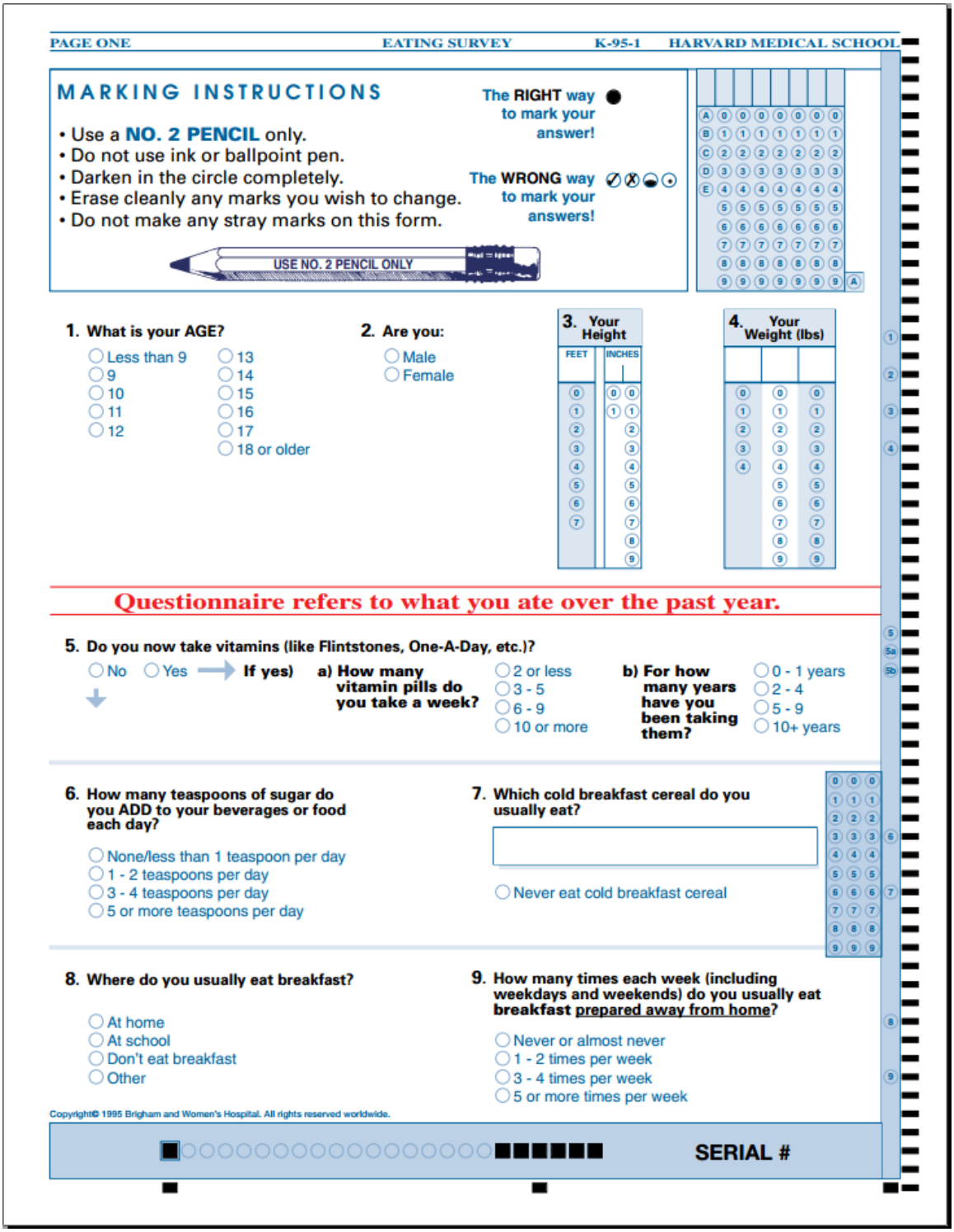
IV. Activity 1: "How much sugar?"

1. Show them various empty bottles of beverages.
2. Have them guess from most to least amount of sugar in the beverages. Ask them to line them up from least to most amount of sugar content.
3. Next, groups of two will tape together the amount of sugar for various beverages. They can pick their favorite beverage. They have to look at the amount of sugar in beverage (check serving size) and divide by 4 for one packet or 1 teaspoon of sugar. They might need help with the math.
4. Then they will show the amount of sugar of their beverage to the other groups and ask them to comment.
5. You will also have bags of sugar (not packs of sugar) for each empty bottle to show them more clearly.

V. Materials Needed:

- Dry Erase Board with markers and eraser
- Journals/notebooks
- Pens and Pencils
- MyPlate poster
- 10% juice and 100% juice containers
- Materials for "How much sugar?" activity: five to eight empty juice/soda bottles, sugar packets, tape
- Incentive prizes

Appendix C: 1995 Youth Adolescent Food Frequency Questionnaire



PAGE ONE EATING SURVEY K-95-1 HARVARD MEDICAL SCHOOL

MARKING INSTRUCTIONS

- Use a **NO. 2 PENCIL** only.
- Do not use ink or ballpoint pen.
- Darken in the circle completely.
- Erase cleanly any marks you wish to change.
- Do not make any stray marks on this form.

The **RIGHT** way to mark your answer!

The **WRONG** way to mark your answers!

USE NO. 2 PENCIL ONLY

1. What is your AGE?

○ Less than 9 ○ 9 ○ 10 ○ 11 ○ 12 ○ 13 ○ 14 ○ 15 ○ 16 ○ 17 ○ 18 or older

2. Are you:

○ Male ○ Female

3. Your Height (FEET / INCHES)

4. Your Weight (lbs)

Questionnaire refers to what you ate over the past year.

5. Do you now take vitamins (like Flintstones, One-A-Day, etc.)?

○ No ○ Yes → **If yes)**

a) How many vitamin pills do you take a week? ○ 2 or less ○ 3 - 5 ○ 6 - 9 ○ 10 or more

b) For how many years have you been taking them? ○ 0 - 1 years ○ 2 - 4 ○ 5 - 9 ○ 10+ years

6. How many teaspoons of sugar do you ADD to your beverages or food each day?

○ None/less than 1 teaspoon per day
○ 1 - 2 teaspoons per day
○ 3 - 4 teaspoons per day
○ 5 or more teaspoons per day

7. Which cold breakfast cereal do you usually eat?

○ Never eat cold breakfast cereal

8. Where do you usually eat breakfast?

○ At home
○ At school
○ Don't eat breakfast
○ Other

9. How many times each week (including weekdays and weekends) do you usually eat breakfast prepared away from home?

○ Never or almost never
○ 1 - 2 times per week
○ 3 - 4 times per week
○ 5 or more times per week

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10. How many times each week (including weekdays and weekends) do you usually eat lunch prepared away from home?

- ○ Never or almost never
- ○ 1 - 2 times per week
- ○ 3 - 4 times per week
- ○ 5 or more times per week

11. How many times each week do you usually eat after-school snacks or foods prepared away from home?

- ○ Never or almost never
- ○ 1 - 2 times per week
- ○ 3 - 4 times per week
- ○ 5 or more times per week

12. How many times each week (weekdays and weekends) do you usually eat dinner prepared away from home?

- ○ Never or almost never
- ○ 1 - 2 times per week
- ○ 3 - 4 times per week
- ○ 5 or more times per week

13. How many times per week do you prepare dinner for yourself (and/or others in your house)?

- ○ Never or almost never
- ○ Less than once per week
- ○ 1 - 2 times per week
- ○ 3 - 4 times per week
- ○ 5 or more times per week

14. How often do you have dinner that is ready made, like frozen dinners, Spaghetti-O's, microwave meals, etc.

- ○ Never/less than once per month
- ○ 1 - 2 times per week
- ○ 3 - 4 times per week
- ○ 5 or more times per week

15. How many times each week (including weekdays and weekends) do you eat late night snacks prepared away from home?

- ○ Never/less than once per month
- ○ 1 - 2 times per week
- ○ 3 - 4 times per week
- ○ 5 or more times per week

16. How often do you eat food that is fried at home, like fried chicken?

- ○ Never/less than once per week
- ○ 1 - 3 times per week
- ○ 4 - 6 times per week
- ○ Daily

17. How often do you eat fried food away from home (like french fries, chicken nuggets)?

- ○ Never/less than once per week
- ○ 1 - 3 times per week
- ○ 4 - 6 times per week
- ○ Daily

DIETARY INTAKE

How often do you eat the following foods:

Example If you drink one can of diet soda 2 - 3 times per week, then your answer should look like this:

E1. Diet soda (1 can or glass)

- ○ Never
- ○ 1 - 3 cans per month
- ○ 1 can per week
- ● 2 - 6 cans per week
- ○ 1 can per day
- ○ 2 or more cans per day

BEVERAGES

FILL OUT ONE BUBBLE FOR EACH FOOD ITEM

18. Diet soda (1 can or glass)

- ○ Never/less than 1 per month
- ○ 1 - 3 cans per month
- ○ 1 can per week
- ○ 2 - 6 cans per week
- ○ 1 can per day
- ○ 2 or more cans per day

19. Soda - not diet (1 can or glass)

- ○ Never/less than 1 per month
- ○ 1 - 3 cans per month
- ○ 1 can per week
- ○ 2 - 6 cans per week
- ○ 1 can per day
- ○ 2 or more cans per day

20. Hawaiian Punch, lemonade, Koolaid or other non-carbonated fruit drink (1 glass)

- ○ Never/less than 1 per month
- ○ 1 - 3 glasses per month
- ○ 1 glass per week
- ○ 2 - 4 glasses per week
- ○ 5 - 6 glasses per week
- ○ 1 glass per day
- ○ 2 or more glasses per day

21. Iced Tea - sweetened (1 glass, can or bottle)

- ○ Never/less than 1 per month
- ○ 1 - 3 glasses per month
- ○ 1 - 4 glasses per week
- ○ 5 - 6 glasses per week
- ○ 1 or more glasses per day

22. Tea (1 cup)

- ○ Never/less than 1 per month
- ○ 1 - 3 cups per month
- ○ 1 - 2 cups per week
- ○ 3 - 6 cups per week
- ○ 1 or more cups per day

23. Coffee - not decaf. (1 cup)

- ○ Never/less than 1 per month
- ○ 1 - 3 cups per month
- ○ 1 - 2 cups per week
- ○ 3 - 6 cups per week
- ○ 1 or more cups per day

24. Beer (1 glass, bottle or can)

- ○ Never/less than 1 per month
- ○ 1 - 3 cans per month
- ○ 1 can per week
- ○ 2 or more cans per week

25. Wine or wine coolers (1 glass)

- ○ Never/less than 1 per month
- ○ 1 - 3 glasses per month
- ○ 1 glass per week
- ○ 2 or more glasses per week

26. Liquor, like vodka or rum (1 drink or shot)

- ○ Never/less than 1 per month
- ○ 1 - 3 drinks per month
- ○ 1 drink per week
- ○ 2 or more drinks per week

Example If you eat:

3 pats of margarine on toast
1 - 2 pats of margarine on sandwich
1 pat of margarine on vegetables

5 - 6 pats total all day

then answer this way →

E2. Margarine (1 pat) - not butter

- ○ Never
- ○ 1 - 3 pats per month
- ○ 1 pat per week
- ○ 2 - 6 pats per week
- ○ 1 pat per day
- ○ 2 - 4 pats per day
- ● 5 or more pats per day

DAIRY PRODUCTS

27. What TYPE of milk do you usually drink?

- ○ Whole milk
- ○ 2% milk
- ○ 1% milk
- ○ Skim/nonfat milk
- ○ Don't know
- ○ Don't drink milk

28. Milk (glass or with cereal)

- ○ Never/less than 1 per month
- ○ 1 glass per week or less
- ○ 2 - 6 glasses per week
- ○ 1 glass per day
- ○ 2 - 3 glasses per day
- ○ 4+ glasses per day

29. Chocolate milk (glass)

- ○ Never/less than 1 per month
- ○ 1 - 3 glasses per month
- ○ 1 glass per week
- ○ 2 - 6 glasses per week
- ○ 1 - 2 glasses per day
- ○ 3 or more glasses per day

SERIAL #

PAGE FOUR — Questionnaire refers to what you ate over the past year. — HARVARD MEDICAL SCHOOL

30. Instant Breakfast Drink (1 packet)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

31. Whipped cream
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

32. Yogurt (1 cup) - Not frozen
- ○ Never/less than 1 per month
- ○ 1 - 3 cups per month
- ○ 1 cup per week
- ○ 2 - 6 cups per week
- ○ 1 cup per day
- ○ 2 or more cups per day

33. Cottage or ricotta cheese
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

34. Cheese (1 slice)
- ○ Never/less than 1 per month
- ○ 1 - 3 slices per month
- ○ 1 slice per week
- ○ 2 - 6 slices per week
- ○ 1 slice per day
- ○ 2 or more slices per day

35. Cream cheese
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

36. What TYPE of yogurt, cottage cheese & dairy products (besides milk) do you use mostly?
- ○ Nonfat
- ○ Lowfat
- ○ Regular
- ○ Don't know

37. Butter (1 pat) - NOT margarine
- ○ Never/less than 1 per month
- ○ 1 - 3 pats per month
- ○ 1 pat per week
- ○ 2 - 6 pats per week
- ○ 1 pat per day
- ○ 2 - 4 pats per day
- ○ 5 or more pats per day

38. Margarine (1 pat) - NOT butter
- ○ Never/less than 1 per month
- ○ 1 - 3 pats per month
- ○ 1 pat per week
- ○ 2 - 6 pats per week
- ○ 1 pat per day
- ○ 2 - 4 pats per day
- ○ 5 or more pats per day

39. What FORM and BRAND of margarine does your family usually use?
- ○ None
- ○ Stick
- ○ Tub
- ○ Squeeze (liquid)

WHAT SPECIFIC BRAND AND TYPE (LIKE "PARKAY CORN OIL SPREAD")?

Leave blank if you don't know.

40. What TYPE of oil does your family use at home?
- ○ Canola oil
- ○ Corn oil
- ○ Safflower oil
- ○ Olive oil
- ○ Vegetable oil
- ○ Don't know

MAIN DISHES

41. Cheeseburger (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ One per week
- ○ 2 - 4 per week
- ○ 5 or more per week

42. Hamburger (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ One per week
- ○ 2 - 4 per week
- ○ 5 or more per week

43. Pizza (2 slices)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

44. Tacos/burritos (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ One per week
- ○ 2 - 4 per week
- ○ 5 or more per week

45. Which taco filling do you usually have:
- ○ Beef & beans
- ○ Beef
- ○ Chicken
- ○ Beans

46. Chicken nuggets (6)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

47. Hot dogs (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ One per week
- ○ 2 - 4 per week
- ○ 5 or more per week

48. Peanut butter sandwich (1) (plain or with jelly, fluff, etc.)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ One per week
- ○ 2 - 4 per week
- ○ 5 or more per week

49. Chicken or turkey sandwich (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ One per week
- ○ 2 or more per week

50. Roast beef or ham sandwich (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ One per week
- ○ 2 or more per week

51. Salami, bologna, or other deli meat sandwich (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ One per week
- ○ 2 or more per week

52. Tuna sandwich (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ One per week
- ○ 2 or more per week

53. Chicken or turkey as main dish (1 serving)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

54. Fish sticks, fish cakes or fish sandwich (1 serving)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

55. Fresh fish as main dish (1 serving)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

56. Beef (steak, roast) or lamb as main dish (1 serving)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

57. Pork or ham as main dish (1 serving)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

58. Meatballs or meatloaf (1 serving)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

59. Lasagna/baked ziti (1 serving)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

60. Macaroni and cheese (1 serving)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

61. Spaghetti with tomato sauce (1 serving)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

62. Eggs (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 eggs per month
- ○ One egg per week
- ○ 2 - 4 eggs per week
- ○ 5 or more eggs per week

63. Liver: beef, calf, chicken or pork (1 serving)
- ○ Never/less than 1 per month
- ○ Less than once per month
- ○ Once per month
- ○ 2 - 3 times per month
- ○ Once per week or more

64. Shrimp, lobster, scallops (1 serving)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

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65. French toast (2 slices)

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

66. Grilled cheese (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

67. Eggrolls (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

MISCELLANEOUS FOODS

68. Brown gravy

- ○ Never/less than 1 per month
- ○ Once per week or less
- ○ 2 - 6 times per week
- ○ Once per day
- ○ 2 or more times per day

69. Ketchup

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

70. Clear soup (with rice, noodles, vegetables) 1 bowl

- ○ Never/less than 1 per month
- ○ 1 - 3 bowls per month
- ○ 1 bowl per week
- ○ 2 or more bowls per week

71. Cream (milk) soups or chowder (1 bowl)

- ○ Never/less than 1 per month
- ○ 1 - 3 bowls per month
- ○ 1 bowl per week
- ○ 2 - 6 bowls per week
- ○ 1 or more bowls per day

72. Mayonnaise

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 6 times per week
- ○ Once per day

73. Low calorie/fat salad dressing

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 6 times per week
- ○ Once or more per day

74. Salad dressing (not low calorie)

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 6 times per week
- ○ Once or more per day

75. Salsa

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 6 times per week
- ○ Once or more per day

76. How much fat on your beef, pork, or lamb do you eat?

- ○ Eat all
- ○ Eat some
- ○ Eat none
- ○ Don't eat meat

77. When you have chicken or turkey, do you eat the skin?

- ○ Yes
- ○ No
- ○ Sometimes

BREADS & CEREALS

78. Cold breakfast cereal (1 bowl)

- ○ Never/less than 1 per month
- ○ 1 - 3 bowls per month
- ○ 1 bowl per week
- ○ 2 - 4 bowls per week
- ○ 5 - 7 bowls per week
- ○ 2 or more bowls per day

79. Hot breakfast cereal, like oatmeal, grits (1 bowl)

- ○ Never/less than 1 per month
- ○ 1 - 3 bowls per month
- ○ 1 bowl per week
- ○ 2 - 4 bowls per week
- ○ 5 - 7 bowls per week
- ○ 2 or more bowls per day

80. White bread, pita bread, or toast (1 slice)

- ○ Never/less than 1 per month
- ○ 1 slice per week or less
- ○ 2 - 4 slices per week
- ○ 5 - 7 slices per week
- ○ 2 - 3 slices per day
- ○ 4+ slices per day

81. Dark bread (1 slice)

- ○ Never/less than 1 per month
- ○ 1 slice per week or less
- ○ 2 - 4 slices per week
- ○ 5 - 7 slices per week
- ○ 2 - 3 slices per day
- ○ 4+ slices per day

82. English muffins or bagels (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 4 per week
- ○ 5 or more per week

83. Muffin (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 muffins per month
- ○ 1 muffin per week
- ○ 2 - 4 muffins per week
- ○ 5 or more muffins per week

84. Cornbread (1 square)

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more per week

85. Biscuit/roll (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 4 per week
- ○ 5 or more per week

86. Rice

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

87. Noodles, pasta

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

88. Tortilla - no filling (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 4 per week
- ○ 5 or more per week

89. Other grains, like kasha, couscous, bulgur

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

90. Pancakes (2) or waffles (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

91. French fries (large order)

- ○ Never/less than 1 per month
- ○ 1 - 3 orders per month
- ○ 1 order per week
- ○ 2 - 4 orders per week
- ○ 5 or more orders per week

92. Potatoes - baked, boiled, mashed

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

FRUITS & VEGETABLES

93. Raisins (small pack)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ 1 per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

94. Grapes (bunch)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

95. Bananas (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 4 per week
- ○ 5 or more per week

96. Cantaloupe, melons (1/4 melon)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ 1 per week
- ○ 2 or more times per week

97. Apples (1) or applesauce
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 6 per week
- ○ 1 or more per day

98. Pears (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 6 per week
- ○ 1 or more per day

99. Oranges (1), grapefruit (1/2)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 6 per week
- ○ 1 or more per day

100. Strawberries
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

101. Peaches, plums, apricots (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 or more per week

102. Orange juice (1 glass)
- ○ Never/less than 1 per month
- ○ 1 - 3 glasses per month
- ○ 1 glass per week
- ○ 2 - 6 glasses per week
- ○ 1 glass per day
- ○ 2 or more glasses per day

103. Apple juice and other fruit juices (1 glass)
- ○ Never/less than 1 per month
- ○ 1 - 3 glasses per month
- ○ 1 glass per week
- ○ 2 - 6 glasses per week
- ○ 1 glass per day
- ○ 2 or more glasses per day

104. Tomatoes (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 6 per week
- ○ 1 or more per day

105. Tomato/spaghetti sauce
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

106. Tofu
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

107. String beans
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

108. Beans/lentils/soybeans

- ○ Never/less than 1 per month
- ○ Once per week or less
- ○ 2 - 6 times per week
- ○ Once per day

109. Broccoli

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

110. Beets (not greens)

- ○ Never/less than 1 per month
- ○ Once per week or less
- ○ 2 or more times per week

111. Corn

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

112. Peas or lima beans

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

113. Mixed vegetables

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

114. Spinach

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once a week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

115. Greens/kale

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

116. Green/red peppers

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once a week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

117. Yams/sweet potatoes (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once a week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

118. Zucchini, summer squash, eggplant

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

119. Carrots, cooked

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

120. Carrots, raw

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

121. Celery

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

122. Lettuce/tossed salad

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 6 times per week
- ○ One or more per day

123. Coleslaw

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

124. Potato salad

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

Think about your usual snacks. How often do you eat each type of snack food.

Example If you eat poptarts rarely (about 6 per year) then your answer should look like this:

E3. Poptarts (1)

- ● Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 - 6 per week
- ○ 1 or more per day

SNACK FOODS/DESSERTS

125. Fill in the number of snacks (food or drinks) eaten on school days and weekends/vacation days.

Snacks	School Days					Vacation/Weekend Days				
	NONE	1	2	3	4 OR MORE	NONE	1	2	3	4 OR MORE
Between breakfast and lunch	○	○	○	○	○	○	○	○	○	○
After lunch, before dinner	○	○	○	○	○	○	○	○	○	○
After dinner	○	○	○	○	○	○	○	○	○	○

126. Potato chips (1 small bag)

- ○ Never/less than 1 per month
- ○ 1 - 3 small bags per month
- ○ One small bag per week
- ○ 2 - 6 small bags per week
- ○ 1 or more small bags per day

127. Corn chips/Doritos (small bag)

- ○ Never/less than 1 per month
- ○ 1 - 3 small bags per month
- ○ One small bag per week
- ○ 2 - 6 small bags per week
- ○ 1 or more small bags per day

128. Nachos with cheese (1 serving)

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

129. Popcorn (1 small bag)

- ○ Never/less than 1 per month
- ○ 1 - 3 small bags per month
- ○ 1 - 4 small bags per week
- ○ 5 or more small bags per week

130. Pretzels (1 small bag)

- ○ Never/less than 1 per month
- ○ 1 - 3 small bags per month
- ○ 1 small bags per week
- ○ 2 or more small bags per week

131. Peanuts, nuts (1 small bag)

- ○ Never/less than 1 per month
- ○ 1 - 3 small bags per month
- ○ 1 - 4 small bags per week
- ○ 5 or more small bags per week

132. Fun fruit or fruit rollups (1 pack)

- ○ Never/less than 1 per month
- ○ 1 - 3 packs per month
- ○ 1 - 4 packs per week
- ○ 5 or more packs per week

133. Graham crackers

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ 1 - 4 times per week
- ○ 5 or more times per week

134. Crackers, like saltines or wheat thins

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ 1 - 4 times per week
- ○ 5 or more times per week

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135. Poptarts (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 poptarts per month
- ○ 1 - 6 poptarts per week
- ○ 1 or more poptarts per day

136. Cake (1 slice)

- ○ Never/less than 1 per month
- ○ 1 - 3 slices per month
- ○ 1 slice per week
- ○ 2 or more slices per week

137. Snack cakes, Twinkies (1 package)

- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ Once per week
- ○ 2 - 6 per week
- ○ 1 or more per day

138. Danish, sweetrolls, pastry (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 4 per week
- ○ 5 or more per week

139. Donuts (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 donuts per month
- ○ 1 donut per week
- ○ 2 - 6 donuts per week
- ○ 1 or more donuts per day

140. Cookies (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 cookies per month
- ○ 1 cookie per week
- ○ 2 - 6 cookies per week
- ○ 1 - 3 cookies per day
- ○ 4 or more cookies per day

141. Brownies (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 4 per week
- ○ 5 or more per week

142. Pie (1 slice)

- ○ Never/less than 1 per month
- ○ 1 - 3 slices per month
- ○ 1 slice per week
- ○ 2 or more slices per week

143. Chocolate (1 bar or packet) like Hershey's or M & M's

- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 6 per week
- ○ 1 or more per day

144. Other candy bars (Milky Way, Snickers)

- ○ Never/less than 1 per month
- ○ 1 - 3 candy bars per month
- ○ 1 candy bar per week
- ○ 2 - 4 candy bars per week
- ○ 5 or more candy bars per week

145. Other candy without chocolate (Skittles) (1 pack)

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

146. Jello

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

147. Pudding

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

148. Frozen yogurt

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

149. Ice cream

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

150. Milkshake or frappe (1)

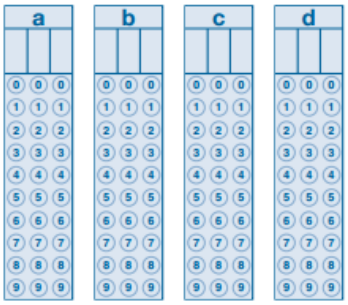
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 or more per week

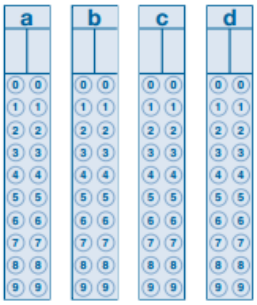
151. Popsicles

- ○ Never/less than 1 per month
- ○ 1 - 3 popsicles per month
- ○ 1 popsicle per week
- ○ 2 - 4 popsicles per week
- ○ 5 or more popsicles per week

152. **Please list any other foods that you usually eat <u>at least once per week</u> that are not listed (for example, coconut, hummus, falafel, chili, plantains, mangoes, etc. . .)**

FOODS	HOW OFTEN?
a) _____	a) _____
b) _____	b) _____
c) _____	c) _____
d) _____	d) _____





THANK YOU FOR COMPLETING THIS SURVEY!

SERIAL #

Appendix D: NHANES 2011-2012 Comparisons

TABLE 6: NHANES 2011-2012 Nutrient Intake for Children Ages 2-19(34)

Nutrient	Intake
Fiber (g/1000kcal)	7.5 ± 0.13
Calories (kcal)	1983 ± 22.8
Calcium (mg)	1082 ± 20.5
Vitamin D (mcg)	6.0 ± 0.15
Potassium (mg)	2279 ± 21.5
Sodium (mg)	3137 ± 47.8
Saturated Fat (g)	25.4 ± 0.49
Vitamin A (mcg RAE)	597 ± 10.2
Vitamin C (mg)	79.8 ± 4.35
Vitamin E	7.2 ± 0.15
Vitamin B6 (mcg)	1.79 ± 0.032
Folate (mcg)	164 ± 3.3
Folic Acid (mcg)	213 ± 4
Iron (mg)	14.3 ± 0.21
Magnesium (mg)	244 ± 2.8
Phosphorus (mg)	1318 ± 17.3

Intake reported in mean ± standard error
No data available for added sugar or carotene.

When comparing the data to the NHANES 2011-2012 dietary intakes of children 6-11 all nutrients consumed by the study group were higher aside from Vitamin E at both baseline and post and iron at post (34). Even though iron consumption was less than the national average (13.91 vs 14.3mg) at post, they were still getting 156.52% of the RDA (10mg) (34). Though potassium was only meeting about 75% of requirements with participants consuming 3000mg this was greater than the national average of 2280mg (34). The intervention may benefit with incorporating more target information on increasing these two nutrients along with potassium as they seem to be nutrients of

concern for this population. Information of NHANES 2011-2012 data can be found in Table 5(34). There was no available data for added sugar and carotene.

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