LASTER, LEIGH ELLEN R., M.S. Diet Quality of Mothers and Their Preschoolers Enrolled in an Obesity Prevention Trial. (2013)
Directed by Dr. Cheryl A. Lovelady. 79 pp

Children of obese parents are more likely to become obese than children of normal weight parents. However, there is little information regarding diet intake of children of obese parents. The objectives of this study were to determine: 1) diet quality of preschoolers and their overweight/obese mothers; 2) if maternal and child diet quality were correlated; and 3) predictors of child's diet quality. Data are from baseline measurements from a randomized controlled behavioral intervention. Participants were English-literate, postpartum mothers and their preschoolers (n = 177 mother-child dyads) living in North Carolina. Visits took place in the Triangle and Triad regions of North Carolina between September 2007 and November 2009.

The Healthy Eating Index (HEI)-2005 was used to measure diet quality of mothers and preschoolers. Descriptive statistics, χ^2, analysis of variance, Pearson correlations, and stepwise regression model were used. Only 11% of children and 7% of mothers had HEI-2005 scores $\geq$ 80, indicating a healthy diet. Most children did not meet recommendations for fruits, vegetables, whole grains, meat and beans, sodium, saturated fat, and energy from solid fat and added sugars. Child diet quality was correlated with maternal diet quality (r = 0.44, p <0.001). However, children and mothers differed in the proportion that met food group recommendations. Children versus mothers: total fruit (50% vs. 14%), whole fruit (46% vs. 28%), total vegetables (6% vs. 18%), dark green and orange vegetables and legumes (7% vs. 19%), total grains (57% vs. 71%), milk (63% vs. 22%), and meat and beans (33% vs. 60%). Variables significantly associated with

child diet quality were included in a forward stepwise regression model. Child's gender, the mother's method of currently feeding her infant, household income and mother's diet quality remained in the final model (adjusted $r^2 = 0.24$, $p < 0.0001$). Diet quality was lower for males, children of mothers who formula fed their infants only, and children in households with lower income. Diets of children of overweight/obese mothers need improvement in several areas. Mother's diet quality and household income are important contributors to child's diet quality, and should be considered in efforts to improve diets of these children.

DIET QUALITY OF MOTHERS AND THEIR PRESCHOOLERS ENROLLED IN AN OBESITY PREVENTION TRIAL

by

Leigh Ellen R. Laster

A Thesis Submitted to
the Faculty of the Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Master of Science

Greensboro
2013

Approved by

Dr. Cheryl Lovelady
Committee Chair

To my family and friends who were a part of this journey. Your continued support, love, and encouragement is a blessing that I am forever grateful for.

APPROVAL PAGE

This thesis has been approved by the following committee of the Faculty of The Graduate School at University of North Carolina at Greensboro.

Committee Chair _____
Dr. Cheryl Lovelady

Committee Members _____
Dr. Lauren Haldeman

_____
Dr. Truls Østbye

_____
Date of Acceptance by Committee

9/10/12
Date of Final Oral Examination

ACKNOWLEDGEMENTS

I would like to first and foremost thank my faculty advisor, Dr. Cheryl Lovelady, for all of her guidance, help, and advice along this process. I would also like to thank my thesis committee members, Dr. Lauren Haldeman and Dr. Truls Østbye, for their guidance and suggestions for strengthening my thesis. Also, I would like to acknowledge and thank the many research staff that worked on the KAN-DO study. Additionally, this study would not have been possible without funding from the National Institutes of Health and the participation of the mothers and their children in the study.

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CHAPTER I

INTRODUCTION

One of the critical periods of development is childhood, particularly during preschool (two to five years old). This is an age when food preferences and eating habits are developed.[1] The establishment of eating behaviors makes it an ideal time period for preventive measures to be applied, particularly in the face of rising rates of childhood obesity.

Obesity rates in children and adolescents have almost tripled in the past 30 years, with an estimated 17% obese.[2] According to the 2009-2010 National Health and Nutrition Examination Survey (NHANES) approximately 12% of preschoolers two to five years old were obese.[3] Children who are overweight or obese are more likely to stay or become obese in adulthood, and are at higher risk for developing chronic diseases at an earlier age.[4] Being overweight or obese puts an individual at greater risk for conditions such as type II diabetes, certain cancers, coronary heart disease, hypertension, dyslipidemia, stroke, liver and gallbladder disease, respiratory problems, and gynecological problems.[5]

The impact of being overweight or obese extends beyond deleterious health consequences and imparts a tremendous financial burden. In the United States in 2008, medical care costs for obesity totaled approximately 147 billion dollars.[6] Along with the health and economic concerns of obesity, children who are obese or overweight face

emotional challenges. They are more likely to suffer discrimination, have lower self-esteem, and face other social and psychological problems.[7]

Although the primary cause of obesity is a result of excess energy intake, there are a number of other factors such as environment, behavior, socioeconomic status, and genes that also impact weight. Children of obese parents are more than four times as likely to be obese than children of normal weight parents.[8] It is unclear whether this increased risk represents environmental or genetic factors, or a combination of numerous factors.

The American Medical Association together with the Department of Health and Human Services Health Resources and Service Administration and the Centers for Disease Control and Prevention (CDC) recommend family-based practices in preventing obesity including eating family meals, limiting meals consumed outside of the home, consuming the US Department of Agriculture (USDA) recommended fruits and vegetables, and limiting screen time.[9] Parents serve not only as role models for behaviors, but also as authoritative figures for young children. Family-based interventions are important for preventing childhood obesity and for encouraging healthy behaviors in adults; however, few studies have been conducted that examine the association between parent and offspring dietary intake, particularly in families with an overweight or obese parent.

The Dietary Guidelines for Americans (DGA) provide scientific-based advice and recommendations for reducing risk for developing chronic diseases and improving overall health.[10] The Healthy Eating Index (HEI)-2005 is a tool to measure diet quality

according to the major dietary recommendations of the 2005 DGA.[11] It consists of 12 components that sum to a total score ranging from zero to 100. The components are: total fruit (range 0-5); whole fruit (range 0-5); total vegetables (range 0-5); dark green and orange vegetables and legumes (range 0-5); total grains (range 0-5); whole grains (range 0-5); milk (range 0-10); meat and beans (range 0-10); oils (range 0-10); saturated fat (range 0-10); sodium (range 0-10); and energy from solid fats, alcoholic beverages, and added sugars (SoFAAS) (range 0-20). A score is assigned for each component based on the amount of intake per 1,000 kilocalories. It provides a measure of diet quality, as opposed to diet quantity. It can be used in a variety of ways including measuring the efficacy of interventions and analyzing individual diet quality for research.

The Kids and Adults Now! Defeat Obesity (KAN-DO) trial was a family-based randomized controlled behavioral intervention aimed at promoting healthy weight attainment in preschool children of overweight or obese mothers. Participants received information on parenting, emotional regulation, and healthy behaviors, such as diet, meal habits, and physical activity. Four hundred women who had recently delivered a baby (two to six months postpartum) and who had a preschooler (two to five years old) already in the home were enrolled at baseline. Additional money became available after the beginning of the intervention that made it possible to collect diet intake information for preschoolers as well as their mothers. Of the 400 mothers enrolled at baseline, 177 mother-child pairs completed two 24-hour dietary recalls at baseline.

The first purpose of this study was to determine the diet quality of mothers and preschoolers enrolled in the KAN-DO trial as measured by HEI-2005 scores. Secondly,

it examined the association between maternal diet quality and child diet quality. Based on previous research, the hypothesis was that children and mothers would have HEI-2005 scores correlated with each other.[12-15] Additionally, this study determined predictors of child's diet quality.

The following thesis will provide a review of the literature, including current dietary intake of preschoolers, diet quality measures, and parent-child dietary associations. Next, the study design and methodology will be introduced. A detailed description of the participants, intervention, and measures collected will be included, as well as results. This will be followed by a discussion of the major findings, future research, and an overall conclusion.

CHAPTER II

REVIEW OF LITERATURE

It is important to understand the dietary intakes and patterns among preschool-aged children in determining strategies for obesity prevention. When evaluating diet quality and the association between maternal and child diet quality, current diet intake of preschoolers, measures of diet quality, and previous research examining parent-child diet intake and/or quality must be considered.

Diet Intake of Preschoolers

The Feeding Infants and Toddlers Study (FITS) 2008 is one of the most recent comprehensive assessments of diet intake of infants, toddlers, and preschoolers in the United States.[17] A total of 3,273 infants, toddlers, and preschoolers from zero to 47 months of age were surveyed for one 24-hour dietary recall using the 2008 Nutrition Data System for Research (NDSR).[18] This sample included 1,461 preschoolers aged two and three years old.

FITS 2008 is unique in that it provides comprehensive food and intake patterns for young children; however, it does not include information on preschoolers aged four to five years, Hispanics and non-Hispanic blacks were underrepresented, and it does not include anthropometric measurements from participants. Despite its limitations, this study finds that around age nine to 11 months dietary patterns begin to emerge that are similar to the unhealthy eating habits of older children and adolescents.

Thirty percent of preschoolers did not consume a serving of vegetables at least once per day.[18] Among those who did consume vegetables, the most frequently consumed were fried potato products followed by cooked green beans, cooked corn, cooked broccoli, and mashed/whipped potatoes. Researchers found a significant portion (87%) consumed fruit and/or 100% fruit juice daily, with the majority (62%) consuming fresh fruit. Despite the positive results for fresh fruit consumption, sweetened beverage, dessert, and salty snack consumption was high, with 86% consuming these foods daily. More three year olds consumed these foods than two year olds.

Researchers also reported that 76% consumed more than the recommended DGA for saturated fat, 78% exceeded the Institute of Medicine's upper limit for sodium, and the mean usual potassium intake was 1,853±13.1 mg – almost half the adequate intake of 3,000 mg.[19] The mean energy intake was 1308±7 kcal/d for preschoolers.

Reedy and Krebs-Smith used data from the 2005-2006 National Health and Nutrition Examination Survey (NHANES), a national representative sample, to determine the top food sources of energy, and data from the 2003-2004 NHANES to analyze energy from solid fats and added sugars consumed by children and adolescents.[20] The top five sources of energy for two to three year olds (n = 497) were whole milk (104±8.2 kcal/d), fruit juice (93±9.4 kcal/d), reduced-fat milk (91±10.7 kcal/d), pasta (86±9.4 kcal/d), and grain desserts (68±6.6 kcal/d). For four to eight year olds (n = 899), the top five sources of energy were grain desserts (136±10.8 kcal/d), yeast breads (98±5.1 kcal/d), pasta (97±11.4 kcal/d), reduced-fat milk (95±7.2 kcal/d), and pizza (95±12.3 kcal/d). This study did not examine the top five sources of energy by gender or weight status for these

age groups. Another important conclusion from this study is that almost 40% of the total energy in the diets of two to 18 year olds (n = 3,553) consisted of energy dense non-nutritive foods in the form of added sugars and solid fats.

O'Connor et al. used nationally representative data from the 1999-2002 NHANES to examine beverage patterns of preschoolers (n = 1,160).[21] On average, preschoolers consumed less than the recommended amount of milk, and only 8.6% of preschoolers drank low-fat or skim milk. Researchers also examined the association between sweetened beverage intake and weight status. They did not find a significant association between sweetened beverage intake and obesity or overweight in preschoolers. However, they did find that sweetened beverage consumption was positively associated with daily energy intake. Researchers suggested that the small percentage of overweight or obese children (24.1%) in the study might not have been enough to detect a statistically significant result between sweetened beverage consumption and weight status. This study provides greater detail about beverage patterns and intakes, specifically in preschoolers between the ages of two to five years.

Although not a nationally representative study, a study by LaRowe et al. provides valuable insight into the diet intake and anthropometrics of preschoolers two to five years old in a population with high rates of obesity.[22] They found that mean fruit and vegetable intake was lower than recommended and that added sugar intake was higher than recommended among rural American Indian preschoolers (n = 135). Children aged two to three years and four to five years consumed 54.8±3.2 g/d and 59.1±3.5 g/d of added sugars, respectively. This was more than 300% of the USDA's MyPyramid

recommendation for daily intake. Children aged two to three years consumed on average 0.36±0.05 cups/day of fruit and 0.45±0.04 cups/day of vegetables. Children aged four to five years consumed on average 0.33±0.05 cups/day of fruit and 0.48±0.04 cups/day of vegetables. They also found that 78.5% of two to three year olds and 87.6% of four to five year olds met the recommendation for total grains, but more than a third of the sample did not meet the recommendation for whole grains. When comparing normal weight to overweight preschoolers, overweight preschoolers consumed significantly more sweetened beverages per day (5.28±0.08 oz/day vs. 8.0±0.10 oz/day, $p<0.01$). This was in contrast to results of O'Connor et al., which had a smaller sample of obese or overweight children and did not include only American Indian preschoolers.

Some studies have found associations between specific dietary components and health outcomes.[21, 23] A longitudinal study by Wosje et al. identified dietary patterns associated with fat and bone mass in children between the ages of 3.8 to 7.8 years old.[23] Data were collected every four months for four years (13 total visits), with children at year one between the ages of 3.8 and 4.8 years (n = 295); year two between >4.8 and 5.8 years old (n = 325); year three between >5.8 and 6.8 years old (n = 315); and year four between >6.8 and 7.8 years old (n = 292). They found that high intakes of dark-green and deep-yellow vegetables and processed meats, and low intakes of fried foods were associated with low fat mass and high bone mass in young children. High intakes of non-whole grains, cheese, processed meats, eggs, fried potatoes, discretionary fats, and artificially sweetened beverages were associated with high fat mass and high bone mass for at least three of the four years of the study. In this sample, processed meat was the

largest contributor of protein intake, which accounts for it being present in both dietary patterns. This is one of the few studies to examine the association between diet consumption and anthropometric measurements.

Diet Quality

Understanding the diet patterns of preschoolers is critical to understanding the increasing rate of childhood obesity. While analyzing specific nutrients or food groups is important, the Healthy Eating Index (HEI)-2005 provides a score for individual components (total fruit; whole fruit; total vegetable; dark green and orange vegetables and legumes; total grains; whole grains; milk; meat and beans; oils; saturated fat; sodium; and calories from solid fats, alcoholic beverages and added sugars) that sum together for an overall score ranging from zero to 100 to determine diet quality. The previous 1995 HEI classified diets with scores greater than 80 as 'good', scores between 50 and 80 as 'needs improvement', and scores below 50 as 'poor'.[24] The developers of the HEI-2005 recommend looking at individual components of the score rather than assigning a classification based on overall score.[11] The USDA generally considers a healthy diet as one represented by an HEI-2005 score of 80 or greater.[25]

Few studies examine quality of preschoolers' diets using the HEI-2005. One study examined the consumption of whole grains and nutrient intake and diet quality in a nationally representative sample of preschoolers aged two to five years (n = 2,278).[26] Almost 68% consumed 0 to 0.59 servings of whole grains per day. They found a significant positive association between consumption of whole grains and HEI-2005 scores. The average total HEI-2005 score was 52.98±0.33, with the highest consumers of

whole grains having an average HEI-2005 score of 57.50±2.46. Researchers also found a significant positive association between whole grain consumption and energy, carbohydrates, iron, vitamin A, vitamin B_1, vitamin B_6, folate, magnesium, and phosphorus. A significant inverse association was found between high consumption of whole grains and intakes of protein, added sugars, total fat, saturated fatty acids, monounsaturated fatty acids, cholesterol, and vitamin C. Individual components of the HEI-2005 score were not reported, although researchers report specific nutrient intakes that comprise parts of the HEI-2005, such as saturated fats and added sugars. This study provides insight into how overall diet quality may be impacted by specific dietary components or nutrients.

One study reported individual components of the HEI-2005 using data from the 2001-2004 NHANES to estimate the population's diet quality.[27] The researchers' purpose was to describe a method of estimating a population's distribution of HEI-2005 components when most of the sample completed one 24-hour dietary recall and a subsample completed two 24-hour dietary recalls. Estimated HEI-2005 component scores for total vegetable, whole grains and calories from SoFAAS were grouped by age. They estimated that for children aged two to three years (n = 937) the average score for the vegetable component (range 0-5) was 2.18±0.07, and for children four to eight years (n = 1,701) was 2.17±0.07. None of the children two to three years old or four to eight years old consumed the recommended daily amount of vegetables that would qualify for a score of 5, and over half scored less than 2.5 (69±4% for two to three year olds and 71±4% for four to eight year olds). They also had below average intakes of whole grain

as evidenced by a whole grains score (range 0-5) of 0.95±0.05 and 0.85±0.05 for children two to three years old and four to eight years old, respectively. Also, researchers found higher than recommended consumption of added sugars and solid fats for young children. The SoFAAS score (range 0-20) was 9.75±0.33 and 8.41±0.36 for children two to three years old and four to eight years old, respectively. Total HEI-2005 scores were not reported. This is one of the few studies to report HEI-2005 component scores for preschoolers.

Using the 1995 HEI Kourlaba et al. analyzed preschoolers' (two to five years old) diet quality in 2,287 children in Greece.[24] Researchers found that the majority of children (81.5%) had a diet considered 'needing improvement' with an HEI score between 50 and 80. Only 0.2% of children had a diet quality considered 'good', with a score of 80 or greater, and 18.3% had a diet considered 'poor', with a score less than 50. Children who had a diet classified as poor were more likely to be younger and less likely to be active. Although the majority of preschoolers in the sample had a diet classified as needing improvement or poor, 80% of mothers described their child's diet quality as "good/very good/healthy". Both mothers who had a correct perception and those who had an overestimation of child's diet had children with inadequate vegetable and fruit intake. The median vegetable intake for children of mothers who had a correct perception of child's diet was 0 servings/day (interquartile range 0-0.5) and for children of mothers who overestimated the quality of child's diet was 0.33 servings/day (interquartile range 0-0.67). Mothers who indicated that they choose food for their children based on what they believe to be healthy were more likely to overestimate their

child's diet quality (86% overestimation rate). It appears there is a high rate of maternal misperception about their child's diet quality and a need for increased education about how to choose healthy foods for one's children.

Parent-Child Diet Associations

Although it is acknowledged that parental practices influence child's diet, little is known about the association between parent diet quality and child diet quality. Some studies have found correlations between dietary components of parents and children [12, 13, 28] with few analyzing diet quality.[14, 15] Beydoun and Wang is one of the only studies using nationally representative data from the USDA's Continuing Survey of Food Intake by Individuals 1994-1996 to examine the association between parent and child (two to 18 years old) diet quality.[14] A total of 4244 parent-child dyads were included: 1156 mother-son, 1128 mother-daughter, 982 father-son and 978 father-daughter. The models were adjusted for age and gender of parent and child, parental ethnicity, education, employment status, smoking status, self-rated health, physical activity, number of chronic conditions, household poverty income ratio category, geographical region, degree of urbanization, child BMI, and child physical activity.

The adjusted correlation between both parents and child diet quality was $r = 0.26$ ($p<0.01$). However, mother-daughter association for total HEI-2005 score was the weakest out of the four dyads. By age, there was a stronger correlation ($r = 0.31$, $p<0.05$) between parent-child diet quality for children between two to ten years old than children older than ten years old ($r = 0.19$, $p>0.05$). Mother-child multivariate correlations were significantly stronger than father-child for intakes of calcium and dairy products.

Overall, there was a moderate correlation between parent and child diet quality. Non-Hispanic blacks had a weaker correlation for parent-child diet quality than Non-Hispanic white, Hispanic, and "other" ethnicities. Hispanic and "other" ethnicities had significantly higher correlations of soft drink intake and overall diet quality than Non-Hispanic white or Non-Hispanic black.

Beydoun and Wang also looked at the agreement between parent and child diet quality for the highest quintile of diet quality. They found that the odds for children having a healthy diet in the highest quintile (HEI score: 61-81) increased by three-folds when their parents had an HEI score in the highest quintile (HEI score: 62-86). There was a higher odds for children aged two to ten years compared to children older than ten years (4.05 vs. 1.55, $p<0.05$ for age), suggesting that younger children's diets are more strongly associated with parent diet than older children.

Other studies support the findings that maternal diet quality accounts for variance in young children's diet quality using other methods. Fisk et al. used the principal components analysis (PCA) technique to calculate a 'prudent' diet score among 1,640 three year olds and their mothers in the United Kingdom.[15] This sample included 12% overweight and 3% obese children, while maternal median BMI was 25.3 kg/m^2. Food frequency questionnaires (FFQ) were used to determine usual intake. A high 'prudent' diet was considered one consistent with healthy diet recommendations (high intake of recommended foods and low intake of foods considered discretionary). Maternal diet quality accounted for almost a third of the variance in their three year old child's diet quality. There was a high correlation between maternal and child 'prudent' diet scores (r

= 0.55, $p<0.001$). Higher 'prudent' diet scores for children were associated with lower birth order, less TV time per day, living in a food secure household, eating more meals rather than snacks, eating fewer times per day, living in a less food-deprived household, and a lower BMI. Children with higher 'prudent' diet scores were more likely to have mothers with higher 'prudent' diet scores, education, and social class, and who lived in a less-deprived area, did not smoke, and had a lower BMI.

Oliveria et al. found weak to moderate correlations between father and child nutrient intakes, and moderate correlations between mother and child nutrient intakes in three to five year old children in the Framingham Heart Study.[12] Maternal and child nutrient intakes were correlated for protein (r = 0.29, $p\leq0.01$), carbohydrates (r = 0.37, $p\leq0.001$), total fat (r = 0.46, $p\leq0.001$), saturated fatty acids (r = 0.48, $p\leq0.001$), monounsaturated fatty acids (r = 0.43, $p\leq0.001$), polyunsaturated fatty acids (r = 0.33, $p\leq0.01$), cholesterol (r = 0.37, $p\leq0.001$), sodium (r = 0.30, $p\leq0.001$), and calcium (r = 0.29, $p\leq0.01$). The method of reporting food intake may have been biased towards mothers, as they were the parent completing food diaries for children; however, the completion of about nine food records per person strengthens these findings.

Raynor et al. examined the relationship between child and parent liking of food items, and parent intake and child intake of fruits, vegetables, low-fat dairy, snack foods, and sweetened beverages in overweight or obese four to nine year olds (n = 135).[13] As well as measuring parent and child intake, researchers measured child liking and parent liking by having each complete hedonic ratings of foods. Almost 93% of parents were mothers, and the average BMI was 33.8±8.6 kg/m^2. Parent intake was significantly

positively correlated with child's intake of fruits (r = 0.226, $p<0.01$), vegetables (r = 0.298, $p<0.01$), low-fat dairy (r = 0.447, $p<0.01$), snack foods (r = 0.238, $p<0.01$) and sweetened beverages (r = 0.222, $p<0.01$). Child and parent hedonic rating of vegetables was the only food group significantly associated with child's consumption of the food group. No other food groups showed an association between hedonic ratings and consumption. This study suggests that parent intake influences child intake in overweight or obese children.

A study by Skinner et al. that looked at food preferences, but not intake, determined that mother's and children's food preferences were moderately but significantly correlated for liked, disliked or never tried foods in a longitudinal study across five years, from toddler to elementary ages (n = 70).[28] This suggests that mother's food preferences play a role in children's food preferences from age two to eight years. No information was collected on dietary intake.

Conclusions

Previous studies have found that preschoolers are not meeting dietary recommendations as measured by both diet quality and nutrient intake. Few studies exist that look at diet intake of preschoolers of obese or overweight parents. It is important to understand the dietary patterns of preschoolers as rates of childhood obesity have increased and as children of overweight or obese parents are at risk for developing obesity themselves. Prior studies suggest a correlation between parent-child diets; however, it is unclear if this applies to children of obese or overweight parents. While the HEI-2005 provides a measure of diet that analyzes overall diet quality, rather than

specific food or beverage components, there are few studies that have looked at HEI-2005 scores in preschoolers.

Therefore, the purpose of this study was to determine diet quality of obese or overweight mothers and their preschoolers as measured by HEI-2005 scores. Another purpose was to determine if there was an association between diet quality of mothers and preschoolers. Also, this study determined predictors of child's diet quality.

CHAPTER III

DIET QUALITY OF MOTHERS AND THEIR PRESCHOOLERS ENROLLED IN AN OBESITY PREVENTION TRIAL

Introduction

The period of two to five years of age is a critical time of development during which food preferences and eating habits are established.[1] Studies have found that preschoolers are not meeting the recommendations for a healthy diet.[17-20] Food groups of particular concern are vegetables, fruits, milk, and whole grains.[18, 21, 22, 29] Additionally, preschoolers are exceeding the recommended amounts for sodium and energy from non-nutrient dense foods (added sugars and solid fats).[19, 20, 22]

This is of particular concern as eating habits impact one's health and risk of developing chronic health conditions.[10] With rising rates of obesity, and an estimated 12% obese preschoolers, it is important to determine strategies for preventing obesity.[3] The Healthy Eating Index (HEI)-2005 measures diet quality by providing a score from zero to 100, based on a standardized intake per 1,000 kcalories. It encompasses the major recommendations of the 2005 Dietary Guidelines for Americans for 12 components: total fruit, whole fruit, total vegetables, dark green and orange vegetables and legumes, total grains, whole grains, milk, meat and beans, oils, saturated fat, sodium, and energy from solid fats, alcoholic beverages and added sugars (SoFAAS).[11] The USDA generally considers an HEI-2005 score of 80 or greater as indicative of a healthy diet.[25]

Despite the usefulness of HEI-2005 for measuring diet quality, few studies examine the quality of preschooler's diets using the HEI-2005. One study using a nationally representative sample of preschoolers found the average HEI-2005 score was 52.98 ± 0.33.[26] Another study estimating the population's distribution of HEI-2005 components determined that none of the children two to three years old or four to eight years old met the recommendations for the vegetable component with a maximum score of five.[27] These studies, together with previous studies examining consumption patterns of preschoolers, suggest that the diets of preschoolers need improvement in several areas, such as vegetables and whole grains.

Family-based strategies are recommended by the American Medical Association together with the Department of Health and Human Services Health Resources and Service Administration and the Centers for Disease Control and Prevention to prevent obesity.[9] These strategies include eating family meals, limiting meals consumed outside of the home, limiting screen time, and consuming the USDA recommended amounts of fruits and vegetables. The position of parents as authoritative figures and role models is important particularly for young children. While research suggests that children of obese parents are more likely to become obese themselves, it is unclear what contributes to this increased risk.[8] There is a gap in the literature regarding children of overweight or obese parents. Particularly, the diets of children of overweight/obese parents are not well characterized.

Previous research has found that parent-child diets are related with one another in terms of dietary nutrient intake; however, it is unclear whether this holds true for children

of overweight/obese parents.[12, 13, 28] One of the studies to analyze HEI-2005 correlations between parents and children found moderate correlations (r = 0.26, p <0.01) between diet quality, with higher correlations for younger children (r = 0.31 for children two to 10 years old vs. r = 0.19 for children >10 years old).[14] Other studies have examined correlation between parent-child using other measures of diet quality or nutrient intakes.[12, 13, 15, 28] Overall, these studies suggest that parent and child diets are moderately associated with one another. However, it is unclear whether these results are applicable for overweight/obese mothers and their children.

The purpose of this study was to determine the diet quality of obese or overweight mothers and their preschoolers (two to five years old) as measured by HEI-2005 scores. Other objectives of this study were to examine the association between diet quality of mothers and preschooler, and to determine predictors of child's diet quality.

Study Design and Methodology

Study Design and Participants

The Kids and Adults Now!-Defeat Obesity (KAN-DO) trial was a randomized controlled behavioral intervention aimed at promoting healthy weight attainment of preschool children, with a secondary goal of weight loss and improved health behaviors in mothers. The trial included information for mothers on parenting and emotional regulation, as well as education about healthy behaviors, such as diet, eating patterns and habits, and physical activity. The rationale and design of the study have been previously published.[30]

Participants were English-literate postpartum women (two to six months postpartum at baseline) in the Triangle and Triad regions of North Carolina who had a preschooler in the home aged two to five years and who had a self-reported pre-pregnancy and current body mass index [body weight (kg)/height (m)^2, BMI] $\geq$ 25 kg/m^2. They also had a mailing address, access to a telephone, were at least 18 years of age, and no medical complications in either preschooler or mother that would prevent physical activity. Women were recruited through postcard mailings from state birth certificate records; a purchased search for public phone numbers from the birth registry sample; and from posting flyers and brochures in health care centers, day care centers, and community areas such as libraries, community bulletin boards and stores. Posted flyers and brochures listed a toll-free phone number for interested women to call and be screened for eligibility.

Interested and eligible mother-child dyads were scheduled for an in-person individual baseline appointment at the most convenient of two study sites (University of North Carolina at Greensboro or Duke University). At the baseline appointment, staff described in detail the study and requested written consent for participation. Randomization of participants occurred after successful completion of baseline measurements. Participants received monetary incentives for completing assessments. The Institutional Review Boards of both the University of North Carolina at Greensboro and Duke University Medical Center approved recruitment and enrollment protocols. Student researchers completed CITI training and were certified on research ethics and proper protocol. This is a secondary data analysis of the study participants.

Intervention

Participants randomized to the intervention arm were mailed eight interactive family kits over the course of eight months. Each kit was followed by a 20-30 minute telephone counseling session that utilized motivational interviewing techniques. Researchers also requested that women attend one group session with counselors and study nutritionists at a convenient time during the eight-month intervention. This session enabled women to take part in role-playing, group discussion, and review the content of the family kits. A free meal and childcare were provided.

The kits focused on a specific skill, such as establishing a family routine and a supportive home environment, improving mother-child feeding relationships, managing stress, and acting as a positive role model for healthy eating and physical activity behaviors. There was also information about healthy eating behaviors and physical activity changes for the mother and preschooler. Information pertaining to healthy eating behaviors included decreasing intake of sugary drinks and fast food, increasing fruit and vegetable intake, and preparing meals at home. Information pertaining to physical activity changes included increasing physical activity time and time spent playing outdoors, and decreasing sedentary behavior. Two of the kits focused on parenting, three focused on nutrition, two focused on physical activity, and one focused on maintenance of healthy behaviors including nutrition, physical activity and parenting.

The kits included illustrated print materials for the mother and an activity for the preschooler that included key concepts from the mother's materials. These were structured to encourage mothers and preschoolers to work together to successfully

implement the healthy behavior. Incentives (i.e., rewards chart, yoga mat, pedometer, portion plate) were provided with kits to reinforce each month's topic.

Approximately one week after the kits were mailed, trained telephone counselors called each woman to review the kit information, address motivation, self-efficacy and barriers to change. Counselors utilized motivational interviewing techniques to reinforce the concepts from each kit.

Participants in the control arm received monthly newsletters from the Reading is Fundamental program (www.rif.org) about encouraging reading habits for preschoolers.

Measurements

Baseline assessments were completed when mothers were two to six months postpartum. At baseline, dietary intake and anthropometrics were measured. Additionally, questionnaires were administered.

Questionnaires

Prior to the baseline visit, questionnaires were mailed to mothers and they were encouraged to complete these prior to the scheduled assessment visit. These questionnaires included questions on demographic characteristics and current and past breastfeeding experience. Mothers were asked how they were currently feeding their baby (breastfeeding exclusively, formula-feeding, or mixed). They were also asked at baseline how the preschooler was fed at each month from one to 12 months of age. A lactation score was calculated to measure the preschooler's exposure to breastfeeding. For each month that the child was breastfed exclusively, a score of two was given. If the child was fed a combination of formula and breast milk, a score of one was assigned, and

a score of zero was given if the child was only formula fed. Scores could range from zero to 24. Low breastfeeding exposure was classified as scoring less than 12, and high breastfeeding exposure was classified by scoring ≥12. These values were chosen based on the halfway measure of the scale from zero to 24. Additionally, a value of 12 indicated breastfeeding exclusively for less than 6 months.

Anthropometrics

Weights and heights of preschoolers and mothers were collected at the baseline visit. Heights and weights were measured utilizing a Seca portable stadiometer (Columbia, MD) and a Tanita BWB-800 scale (Arlington Heights, IL), respectively. The measured heights and weights were used in calculating participants' BMI. BMI percentiles were based on the Centers for Disease Control and Prevention (CDC) guidelines based on age and gender. Underweight is defined as a BMI $<5^{th}$ percentile, normal weight is defined as a BMI $\geq5^{th}$ percentile to $<85^{th}$ percentile, overweight is defined as a BMI $\geq85^{th}$ percentile to $<95^{th}$ percentile and obese is defined as $\geq95^{th}$ percentile.[31] BMI z-scores are measures of the amount of standard deviation from the average BMI for age and gender.

Dietary Intake

Participants completed two 24-hour dietary recalls via telephone interview within two weeks following the baseline visit for all mothers and a subset of preschoolers. The Nutrition Data System for Research (NDSR) software system from the University of Minnesota (versions 2008 and 2009, Nutrition Coordinating Center, Minneapolis) was used to conduct the dietary recalls. Mothers provided information for themselves and

their preschoolers. In addition, at the assessments, mothers who indicated their preschooler attended daycare were given a "Preschooler Daycare Intake Record" form to provide to daycare personnel so that items consumed at daycare were included in the preschooler's dietary recall. Participants were also provided with a validated serving size booklet to accurately estimate food intake.

The multiple-pass method was employed to ensure participant recall. Participants first briefly described dietary intake for the previous day. Then the interviewer reviewed the list and ensured that no foods or beverages were forgotten. The interviewer guided participants with the aid of the serving size booklet to estimate portion sizes. After all foods and beverages were entered, the interviewer reviewed the list for a final time.

Data from the 24-hour dietary recall were used to calculate the Healthy Eating Index (HEI)-2005 score. The HEI-2005 score measures diet quality based on the major diet-related recommendations of the 2005 Dietary Guidelines for Americans (DGA).[11] Recommendations for foods from the 12 MyPyramid food patterns along with the Adequate Intake (AI) and Tolerable Upper Intake Level (TUL) for sodium were standardized for amounts per 1,000 kilocalories. Energy from solid fats, alcoholic beverages, and added sugars (SoFAAS), as well as saturated fat intake were expressed in percentages and used for the discretionary energy allowances specified in the DGA. To determine HEI-2005 scores from the data generated in NDSR, servings were converted to cups or ounces based on the component. It was necessary to convert milk products, meat products and legumes into ounce equivalents based on the item. After these were converted to ounce equivalents these could be included in calculating the component

score. Scores for oil were generated based on average daily intake of grams of polyunsaturated fatty acids and monounsaturated fatty acids. Scores for solid fat were generated based on the average daily intake of grams of saturated fat and trans fat. Because only alcohol consumed as a beverage is included in calculating the SoFAAS component, carbohydrates from alcohol found in food or recipes was manually excluded. This method of calculating HEI-2005 scores based on the NDSR has been previously described and validated by Miller et al.[32]

The HEI-2005 is divided into adequacy and moderation components. The adequacy components include total fruit, whole fruit, total vegetables, dark green and orange vegetables and legumes, total grains, whole grains, milk, meat and beans, and oils. The moderation components include saturated fat, sodium, and energy from SoFAAS.

The total HEI-2005 score is a sum of the component scores, and produces a score ranging from zero to 100. A maximum score for each adequacy component is obtained by intake at the recommended level or better. Total fruit, whole fruit, total vegetables, dark green and orange vegetables and legumes, total grains, and whole grains components have maximum scores of five. Milk, meat and beans, and oils components have maximum scores of 10. A score of zero is equated with no intake, with scores being prorated linearly.

For moderation components (saturated fat, sodium, and energy from SoFAAS) increasing intake is associated with decreasing scores. A maximum score of 10 points for the saturated fat component equates to intake of 7% of energy from saturated fat. A score of zero is given for intakes ≥15% of energy. A maximum score of 10 points for the

sodium component equates to intake ≤0.7 g of sodium to coincide with the more stringent recommendation of less than 1,500 mg/day. A score of zero is given for intake ≥2.0 g. For the energy from SoFAAS component a maximum score of 20 points is associated with ≤20% of energy and a score of zero is given for intake ≥50% of energy from SoFAAS. This component is meant to be a measure of dietary intake from less nutrient-dense foods.

Statistical Analysis

JMP software version 9.0 (SAS, Cary, NC) was used for statistical analyses. For aim one, descriptive baseline characteristics and average HEI-2005 scores were reported. Pearson correlation was used to determine if maternal diet quality was associated with child's diet quality. Because the component scores were not distributed normally it was not possible to analyze correlations between mother and child component scores. Instead, percentages of children and mothers meeting the recommendations for each component were calculated. Chi-square analysis was performed to determine if there was a significant difference between the proportion of mothers and children meeting the component recommendations.

To determine if other variables were associated with child's diet quality, regression analyses was performed with child HEI-2005 score, a continuous variable, as the outcome variable and the following baseline characteristics: education, household income, maternal race, maternal BMI category, marital status, parity, work status, maternal current breastfeeding status, smoking status, child age, child BMI category,

child breastfeeding exposure, and gender. The association between child BMI z-score and child HEI-2005 score was determined using Pearson correlation.

Variables found significant from the analysis of variance ($p = 0.05$) were entered into a regression model to determine predictors of child's diet quality. Forward stepwise regression (with a significance level of 0.50) was used to select which variables to include in the final model. The use of this large alpha level is suggested to avoid over-fitting the data.[33] All variables included in the final model are considered potential predictors of child diet quality, regardless of their *p*-value. Results are reported as means and standard deviations. Significance was set at $p < 0.05$.

Results

The KAN-DO study had a total of 400 mother-child dyads randomized at baseline. After the intervention began more funding became available to complete dietary recalls for children, so only a subset of children have dietary data available. There were 177 mother-child dyads that completed two 24-hour dietary recalls at baseline (see Figure 1). Baseline characteristics are reported in Table 2. Over half the mothers were white/other (Asian, American Indian/Alaskan Native, or other non-black race), married, had graduated from college, had a household income greater than $60,000, and did not work outside the home for pay. Most children were between two and three years old, normal weight, and over half were male.

At baseline the mean ± standard deviations of HEI-2005 scores were 67.6 ± 9.9 and 64.0 ± 12.1 for children and mothers, respectively (see Table 3). Maternal and child HEI-2005 scores were correlated with each other ($r = 0.44$, $p < 0.0001$). More than half

of children met the recommendations for total grains, milk, and oils; and more than half of the mothers met the recommendations for total grains, meat and beans, and oils. However, only 6% of children met the recommendation for total vegetables compared with 19% of mothers. Children and mothers also differed in the percentage that met the recommendation for total fruit (49.7% vs. 13.6%), milk (62.7% vs. 21.5%), and meat and beans (33.3% vs. 59.9%), respectively. Few participants met the recommendations for dark green and orange vegetables and legumes, whole grains, sodium, saturated fat, and energy from SoFAAS.

Mother's race, education, household income, marital status, smoking status, current breastfeeding status, and child breastfeeding exposure were significantly associated with child HEI-2005 score (see Table 4). Diet quality was higher for those with high breastfeeding exposure (breastfed longer as determined by lactation scores ≥12), of mothers that were white/other race, married, and non-smokers. Also, diet quality was higher for children of women with more education and a greater household income. However, child BMI z-score and child BMI category were not associated with child diet quality.

Variables listed above that were significantly associated with child's diet quality were entered into the stepwise regression model to determine predictors of child's diet quality. Because education was highly correlated with household income, education was excluded from the model. Child's gender, the mother's method of currently feeding her infant, household income and mother's diet quality remained in the final model (adjusted $r^2 = 0.24$, $p < 0.0001$). The effect sizes of the variables in the final model were as follows:

mother diet quality (β-coefficient = 0.29, SE = 0.06, p <0.0001), household income ≤$15,000 relative to higher incomes (β-coefficient = -2.33, SE = 1.10, p = 0.04), and household income $15,001-60,000 relative to incomes ≥$60,001 (β-coefficient = -1.73, SE = 0.72, p = 0.02), male children relative to female children (β-coefficient = -1.14, SE = 0.67, p = 0.09) and children of mother's formula feeding only relative to mother's breastfeeding or combination feeding (β-coefficient = -0.94, SE = 0.72, p = 0.19).

Discussion

Despite mother's weight status, the majority of children in this sample were considered normal weight at this age. Only 7% of the preschoolers were classified as obese, which is less than the national report of 12% obese preschoolers. However, the percent of overweight preschoolers was comparable to the 15% observed nationally.[3] While this sample had less obese children, the diets of these children were similar to what has been reported in the literature. The majority of children did not meet the recommendations for vegetables, whole grains, sodium, saturated fat, and energy from solid fat and added sugar consistent with previous studies.[18-20, 22] However, this sample differed from previous studies in that almost 50% met the recommendation for total fruit, but two-thirds of children did not meet the recommendation for meat and beans.

This is one of the few studies to examine the percentage of children and mothers meeting the recommendations using HEI-2005 component scores. Previous studies have focused on average HEI-2005 component scores[24, 26, 27], however, in this sample of overweight or obese mothers and their preschoolers the distribution of component scores

was u-shaped or skewed (see Appendix C). Therefore, reported average of each component is not as informative as the percent meeting the recommendations.

This sample of children of overweight or obese mothers had a higher diet quality than previous studies, with an average total HEI-2005 score of 68 compared to O'Neil et al.'s finding of an average total HEI-2005 score of 53 for a nationally representative sample of preschoolers.[26] This may be due to the exclusion of non-English literate individuals. In this study, participants had a higher income and education, and there were few Hispanic participants. While the average HEI-2005 score is higher, only 11% of children and 7% of mothers had a HEI-2005 score of 80 or higher. Significant improvements need to be made in the diets of these children and their obese or overweight mothers.

Similar to previous studies, diet quality of mothers and children were correlated, with higher correlations for younger children than older.[13, 14] A higher correlation was seen in this sample of two to five year olds ($r = 0.44$) than Beydoun & Wang found for children two to 10 years old ($r = 0.31$). While overall diet quality was correlated, there were differences in the percent of mothers and children that met the recommendations for components such as vegetables, fruits, milk, and meat and beans. A lower percentage of mothers compared to children met the recommendations for total fruits, whole fruits, and milk. Conversely, a lower percentage of children compared to mothers met the recommendations for meat and beans, total vegetables, dark green and orange vegetables and legumes, and total grains. A low percentage of both mothers and children met the recommendations for whole grains, sodium, saturated fat, and energy from SoFAAS.

Limitations

One of the limitations of this study is the possibility for bias by having mothers report the intake of their children. Mothers may have been more likely to report or recall foods their children consumed that were similar to their own food consumption. This may have influenced the correlation between mother and child diet quality. However, as the children were too young to accurately report their food intake it was necessary to capture food intake by relying on mothers. When the child was away from the mother during the previous 24 hours a Preschooler Daycare Intake Record form was completed by the daycare provider to accurately capture foods consumed by the preschooler. However, foods recorded from the daycare provider were not labeled accordingly in the data set and could not be controlled for in analyses.

Another limitation of this study is the possibility of under- or over-reporting foods during the 24-hour dietary recalls because of social desirability. Participants may have been more likely to report foods considered healthy, such as fruits and vegetables, and/or to under-report foods considered unhealthy, such as candy and fried foods. However, the results of the dietary analysis show very low intake of fruits and vegetables and higher intakes of SoFAAS. As with all measures of diet intake there are limitations for determining usual intake. Increased number of days for dietary recalls would have strengthened the data for dietary intake, however, this would have increased participant burden.

While the HEI-2005 has been developed to understand diet quality based on the Dietary Guidelines for Americans, there are some limitations to this method of determining diet quality. The scores for components are cut off between certain values that do not reflect actual intake. If one were to consume greater than the recommendation for vegetables, this is not reflected in one's score. The HEI-2005 score also uses the more stringent recommendation for sodium of 1500 mg/day of sodium rather than the 2300 mg/day recommendation, which was met by very few mothers and none of the children.

Conclusions

These results suggest that mother's diet quality is an important predictor of child's diet quality, and that interventions aimed at improving diets of preschoolers should also focus on improving their mother's diets. Even though overall diet quality in the mothers and the children were associated with one another, significant differences were found between the proportions of mothers and children meeting the recommendations for specific food groups. Overweight/obese mothers should increase consumption of total fruits, whole fruits, and milk; while preschoolers should increase consumption of meat and beans, vegetables and total grains. Both mothers and preschoolers should increase consumption of whole grains, and decrease consumption of sodium, saturated fat, and energy from SoFAAS.

The differences found between the percent of mothers and children meeting the recommendations may relate to food consumption in separate environments as well as differences in food preferences. While about half of mothers were not working for pay,

those who were working outside of the home may not be preparing the same foods for their children as themselves.

Additionally, the results indicate that children in households with the lowest income have lower diet quality, with a 10-point difference in scores for those at the lowest income level compared to those at the highest income level. There is continued need for food assistance programs for low-income households to achieve optimum diet quality and health. While participation in programs such as the Special Supplemental Nutrition Program for Women, Infants, and Children, and the Supplemental Nutrition Assistance Program was not assessed, the association between household income and child diet quality suggests that without the available funds to purchase healthy foods, nutrition education alone is not enough to increase diet quality. This highlights the continued need for programs that minimize disparities, particularly in the face of poor diet quality and low income.

Future Research

The findings from this study contribute to understanding diets of children of obese or overweight mothers. The differences found between mothers and children who met the recommendations provide insight for future interventions in planning nutrition education for families with obese or overweight mothers. There may be a need for separate targeted messages for mothers and children, such as more emphasis on increasing milk consumption for mothers and more emphasis on increasing meat and beans consumption for children. Continued emphasis on fruit, vegetable, and whole

grain intake with a reduction in discretionary calories is important as these continue to be areas needing improvement in both children and mothers.

The results from the stepwise regression model suggest that improving mother's HEI-2005 score will positively impact the diet quality of their children. Additionally, the positive association between low income and low diet quality is an important consideration both for public policy and future research.

CHAPTER IV

EPILOGUE

During my first semester of my master's coursework I began working with Dr. Cheryl Lovelady and KAN-DO staff on the KAN-DO study. Baseline measurements, the intervention, and follow-up one measurements were already completed. I was able to participate in follow-up two measurements during the first year of my master's coursework and into the summer. Because I was not involved with the study from the beginning, it was necessary to do a lot of catch-up work to get a complete understanding of the intervention and the study participants. In addition to the literature included in my review, there were a number of articles I read related to the KAN-DO study, childhood obesity, and food consumption patterns of young children and mothers to aid in my understanding.

In addition to analyzing the dietary data from baseline and follow-up one measurements from the KAN-DO study, I began administering 24-hour dietary recalls for mothers and five-year-old children enrolled in a separate but similar study. Along with another graduate student, over 100 dietary recalls were collected using the same protocol used in the KAN-DO study. This was an invaluable experience as it allowed me to get firsthand experience of the NDSR system and the challenges of working with this population. Finding time for the participants to complete the recalls was one of the hardest things. Collecting two 24-hour dietary recalls for both mother and child was

challenging for most participants, and made me aware of the busy lives of women with children. In my nutrition classes, it was stressed that collecting dietary information with three 24-hour dietary recalls was considered ideal. However, administering these dietary recalls with these participants made me realize that collecting three dietary recalls would have greatly increased participant burden and would have presented an even greater challenge.

A large part of my role in the KAN-DO study and my thesis involved analyzing the dietary information of participants and transforming the raw data into HEI-2005 scores for the preschoolers. Another graduate student had previously calculated diet quality scores of mothers. I enjoyed the methodical process of managing the data and calculating the HEI-2005 scores, albeit it was a frustrating task at times. It was a very exciting moment when all the scores were computed for both baseline and follow-up because it allowed insight into the diets of our participants. A challenging part of this process was working with numerous files and between two software platforms (Microsoft Excel and JMP) to merge data from mothers with data from preschoolers, as well as inserting variables of interest. This made me acutely aware of the importance of continually checking that data was correctly merged and that the correct file was being used.

After all the data was successfully combined, I was then able to complete statistical analyses. Some of the methods I had learned about in previous courses, but the more complex modeling statistics were new to me. To feel comfortable analyzing and reporting the data, I had to rely both on Dr. Lovelady's experience as well as my own

reading in statistic textbooks and in the JMP manual. Seeing the process from start to finish with the collection of dietary recalls to analyses of data was an incredible learning experience.

From my own experience collecting dietary recalls via phone and recollections from research staff there are several things that I would do differently. While the home-based intervention allowed participants to read the mailed kits at their own convenience, it seems that this may not have effectively engaged some participants. Meeting face-to-face with participants at their homes to administer the intervention material and collect dietary recalls may aid in increasing participant engagement and involvement. Additionally, because the results for the HEI-2005 component scores suggest high variability, more in-depth and personalized dietary counseling may have been beneficial to encourage lasting changes. Also, from collecting dietary recalls and being exposed to participants' schedules I learned firsthand that each participant has incredibly different schedules, challenges, and stressors that impact their health and diet. In the future, I would take the many facets of participants' lives into account when counseling on healthy behavior changes.

I feel much more prepared to work with overweight/obese mothers, collect dietary information, and manage large datasets. I learned to be flexible with participants and be able and willing to meet participants' needs and wants. Also, administering dietary recalls increased my knowledge of eating behaviors, food products, and preparation materials. Despite the enormity of the foods and beverages in the NDSR database, the continually expanding and evolving food and beverage industry meant modifying

ingredients and researching new products to ensure that the most accurate food/beverage item was selected. Additionally, I learned the importance of checking and re-checking data and statistics to ensure that results are correct. I also learned in regards to myself that I enjoy having a mixture of work that involves communicating with people as well as analyzing data. I would like to continue working with the female population on healthy eating behaviors and weight management, and feel more prepared to understand the unique challenges and dietary behaviors from doing this project.

REFERENCES

1 Nicklaus S, Boggio V, Chabanet C, Issanchou S. A prospective study of food variety seeking in childhood, adolescence and early adult life. *Appetite*. 2005; **44**: 289-97.

2 Centers for Disease Control and Prevention. Overweight and obesity: Childhood: Data and statistics. Reviewed August 28, 2011. Updated August 28, 2011. (Also available from: http://www.cdc.gov/obesity/childhood/data.html, accessed January 11, 2012).

3 Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity in the United States, 2009-2010. *NCHS Data Brief*. 2012: 1-8.

4 World Health Organization. Why does childhood overweight and obesity matter? (Also available from: http://www.who.int/dietphysicalactivity/childhood_consequences/en/index.html, accessed January 11, 2012).

5 Centers for Disease Control and Prevention. Overweight and obesity: Health consequences. 2011. Reviewed April 27, 2012. Updated April 27, 2012. (Also available from: http://www.cdc.gov/obesity/causes/health.html, accessed January 11, 2012).

6 Centers for Disease Control and Prevention. Overweight and obesity: Economic consequences. Reviewed April 27, 2012. Updated April 27, 2012. (Also available from: http://www.cdc.gov/obesity/causes/health.html, accessed January 11 2012).

7 Centers for Disease Control and Prevention. Overweight and obesity: Basics about childhood obesity. Reviewed April 27, 2012. Updated April 27, 2012. (Also available from: http://www.cdc.gov/obesity/childhood/basics.html, accessed January 11 2012).

8 Abu-Rmeileh NM, Hart CL, McConnachie A, Upton MN, Lean ME, Watt GC. Contribution of Midparental BMI and other determinants of obesity in adult offspring. *Obesity (Silver Spring)*. 2008; **16**: 1388-93.

9 Barlow SE, Committee E. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics*. 2007; **120 Suppl 4**: S164-92.

10 U.S. Department of Health and Human Services and U.S. Department of Agriculture. Dietary Guidelines for Americans, 2005. 6th Edition, Washington, DC: US Government Printing Office, 2005.

11 Guenther PM, Reedy J, Krebs-Smith SM. Development of the Healthy Eating Index-2005. *J Am Diet Assoc*. 2008; **108**: 1896-901.

12 Oliveria SA, Ellison RC, Moore LL, Gillman MW, Garrahie EJ, Singer MR. Parent-child relationships in nutrient intake: the Framingham Children's Study. *Am J Clin Nutr*. 1992; **56**: 593-8.

13 Raynor HA, Van Walleghen EL, Osterholt KM*, et al.* The relationship between child and parent food hedonics and parent and child food group intake in children with overweight/obesity. *J Am Diet Assoc*. 2011; **111**: 425-30.

14 Beydoun MA, Wang Y. Parent-child dietary intake resemblance in the United States: evidence from a large representative survey. *Soc Sci Med*. 2009; **68**: 2137-44.

15 Fisk CM, Crozier SR, Inskip HM*, et al.* Influences on the quality of young children's diets: the importance of maternal food choices. *Br J Nutr*. 2011; **105**: 287-96.

16 Heitmann BL. The influence of fatness, weight change, slimming history and other lifestyle variables on diet reporting in Danish men and women aged 35-65 years. *Int J Obes Relat Metab Disord*. 1993; **17**: 329-36.

17 Briefel RR, Kalb LM, Condon E*, et al.* The Feeding Infants and Toddlers Study 2008: study design and methods. *J Am Diet Assoc*. 2010; **110**: S16-26.

18 Fox MK, Condon E, Briefel RR, Reidy KC, Deming DM. Food consumption patterns of young preschoolers: are they starting off on the right path? *J Am Diet Assoc*. 2010; **110**: S52-9.

19 Butte NF, Fox MK, Briefel RR*, et al.* Nutrient intakes of US infants, toddlers, and preschoolers meet or exceed dietary reference intakes. *J Am Diet Assoc*. 2010; **110**: S27-37.

20 Reedy J, Krebs-Smith SM. Dietary sources of energy, solid fats, and added sugars among children and adolescents in the United States. *J Am Diet Assoc*. 2010; **110**: 1477-84.

21 O'Connor TM, Yang SJ, Nicklas TA. Beverage intake among preschool children and its effect on weight status. *Pediatrics*. 2006; **118**: e1010-8.

22 LaRowe TL, Adams AK, Jobe JB, Cronin KA, Vannatter SM, Prince RJ. Dietary intakes and physical activity among preschool-aged children living in rural American

Indian communities before a family-based healthy lifestyle intervention. *J Am Diet Assoc*. 2010; **110**: 1049-57.

23 Wosje KS, Khoury PR, Claytor RP*, et al.* Dietary patterns associated with fat and bone mass in young children. *Am J Clin Nutr*. 2010; **92**: 294-303.

24 Kourlaba G, Kondaki K, Grammatikaki E, Roma-Giannikou E, Manios Y. Diet quality of preschool children and maternal perceptions/misperceptions: the GENESIS study. *Public Health*. 2009; **123**: 738-42.

25 Task Force on Childhood Obesity. Solving the problem of childhood obesity with a generation. Published May 2010. (Also available from: http://www.letsmove.gov/white-house-task-force-childhood-obesity-report-president, accessed January 28 2012).

26 O'Neil CE, Nicklas TA, Zanovec M, Cho SS, Kleinman R. Consumption of whole grains is associated with improved diet quality and nutrient intake in children and adolescents: the National Health and Nutrition Examination Survey 1999-2004. *Public Health Nutr*. 2011; **14**: 347-55.

27 Freedman LS, Guenther PM, Krebs-Smith SM, Dodd KW, Midthune D. A population's distribution of Healthy Eating Index-2005 component scores can be estimated when more than one 24-hour recall is available. *J Nutr*. 2010; **140**: 1529-34.

28 Skinner JD, Carruth BR, Wendy B, Ziegler PJ. Children's food preferences: a longitudinal analysis. *J Am Diet Assoc*. 2002; **102**: 1638-47.

29 Fox MK, Reidy K, Novak T, Ziegler P. Sources of energy and nutrients in the diets of infants and toddlers. *J Am Diet Assoc*. 2006; **106**: S28-42.

30 Ostbye T, Zucker NL, Krause KM*, et al.* Kids and adults now! Defeat Obesity (KAN-DO): rationale, design and baseline characteristics. *Contemp Clin Trials*. 2011; **32**: 461-9.

31 Centers for Disease Control and Prevention. About BMI for Children and Teens. 2011. Reviewed September 13, 2011. Updated September 13, 2011. (Also available from: http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html/#What%20is%20BMI%20percentile, accessed July 24 2012).

32 Miller PE, Mitchell DC, Harala PL, Pettit JM, Smiciklas-Wright H, Hartman TJ. Development and evaluation of a method for calculating the Healthy Eating Index-2005 using the Nutrition Data System for Research. *Public Health Nutr*. 2011; **14**: 306-13.

33 Harrell F. Regression Modeling Strategies with Applications to Linear Models, Logistic Regression, and Survival Analysis. New York, NY: Springer New York, 2001.

APPENDIX A

TABLES

Table 1. Variable Descriptions

Variable Name	Description	Type
Mother's Characteristics		
Baseline age	Age of mother, in years, at beginning of intervention (when 2-6 months postpartum)	Continuous
Race	Self-reported race of mother	Categorical: white/other, black
BMI category	BMI status based on CDC classifications of BMI and collected measurements of weight and height	Categorical: overweight, obese
Education	Self-reported education level of mother	Categorical: $\leq 12^{th}$ grade, Some college or vocational, College graduate, Graduate school
Household income	Self-reported income of household	Categorical: Up to $15,000, $15,001-$30,000, $30,001-$60,000, $60,001+
Marital status	Self-reported marital status of mother	Categorical: Single (includes living together, divorced, widowed), Married
Parity	Self-reported number of times mother has given birth	Categorical: Second, Third, Fourth or more
Work status	Self-reported work status of mother	Categorical: Full time, Part time, Not paid for work
Smoking status	Self-reported cigarette smoking status of mother	Categorical: Current smoker, Non-smoker
Current breastfeeding status	Self-reported current infant feeding of mother	Categorical: Breastfeed (BF) only, Combination BF & FF, Formula feed (FF) only
Child Characteristics		
Age (months)	Age of child, in months, at beginning of intervention	Continuous

Age (years)	Age of child, in years, at beginning of intervention	Categorical: Two, Three, Four, Five
Gender	Gender of child	Categorical: Male, Female
BMI Category	Calculated BMI of child from study measurements based on CDC classification of BMI percentiles for child for age and gender	Categorical: Underweight, Normal, Overweight, Obese
BMI z-score	Calculated BMI z-score of child from study measurements based on the standard deviation from average BMI for age and gender	Continuous
Child breastfeeding exposure	Self-reported breastfeeding duration/intensity of child based on lactation scores	Categorical: Low (<12 lactation score), High (≥12 lactation score)

Table 2. Baseline Characteristics of Participants

Variable	(n = 177) % (n)
Mother's Characteristics	
Age, years (mean ± SD)	32.2 ± 4.7
Race	
White/other	79.1 (140)
Black	20.9 (37)
BMI Category	
Overweight	42.9 (76)
Obese	57.1 (101)
Education	
≤ 12th grade	11.3 (20)
Some college or vocational	20.3 (36)
College graduate	42.9 (76)
Graduate school	25.4 (45)
Household Income*	
Up to $15,000	11.3 (20)
$15,001 -- $30,000	10.2 (18)
$30,001 -- $60,000	23.7 (42)
$60,001 +	53.7 (95)
Marital Status	
Single	13.6 (24)
Married	86.4 (153)
Parity	
Second	67.8 (120)
Third	22.6 (40)
Fourth or more	9.6 (17)
Work Status	
Full time	26.0 (46)
Part time	16.9 (30)
Not paid for work	57.1 (101)
Smoking Status	
Current smoker	5.6 (10)
Non-smoker	94.4 (167)
Current Breastfeeding Status	
Breastfeed (BF) only	48.0 (85)
Formula feed (FF) only	36.7 (65)
Combination BF & FF	15.3 (27)
Child Characteristics	
Age, months (mean ± SD)	42.3 ± 12.4

Age, years	
Two	35.0 (62)
Three	35.6 (63)
Four	16.9 (30)
Five	12.4 (22)
Gender	
Male	58.2 (103)
Female	41.8 (74)
BMI Category	
Underweight	0.6 (1)
Normal	76.8 (136)
Overweight	15.3 (27)
Obese	7.3 (13)
*Missing information for 2 participants	

Table 3. Baseline Mother and Child HEI-2005 Scores (n = 177)

Category	Score Range	Child's Average HEI ± SD	Mom's Average HEI ± SD	Recommended Amount per 1,000 kcal	% Children Meeting Recommendation	% Mothers Meeting Recommendation
Total Fruit	0 - 5	3.7 ± 1.7	1.9 ± 1.8	≥ 0.8 c	49.7	13.6**
Whole Fruit	0 - 5	3.3 ± 2.0	2.2 ± 2.0	≥ 0.4 c	45.8	27.7**
Total Vegetables	0 - 5	1.7 ± 1.4	3.0 ± 1.5	≥ 1.1 c	6.2	18.1**
Dark Green and Orange Vegetables and Legumes	0 - 5	0.9 ± 1.5	2.1 ±1.9	≥ 0.4 c	6.8	19.2**
Total Grains	0 - 5	4.4 ± 0.9	4.7 ± 0.6	≥ 3.0 oz	56.5	71.2**
Whole Grains	0 - 5	2.5 ± 1.9	2.8 ± 1.9	≥ 1.5 oz	23.7	27.7
Milk	0 - 10	8.6 ± 2.5	6.3 ± 3.0	≥ 1.3 c	62.7	21.5**
Meat and Beans	0 - 10	7.4 ± 2.6	8.7 ± 2.1	≥ 2.5 oz	33.3	59.9**
Oils	0 - 10	9.9 ± 0.4	9.9 ± 0.4	≥ 12 g	92.7	95.5
Sodium	0 - 10	4.5 ± 2.6	3.2 ± 2.7	≤ 700 mg	0	1.1
Saturated Fat	0 - 10	5.8 ± 3.4	5.5 ± 3.5	≤ 7% of total kcal	10.7	10.2
Energy from Solid Fat and Added Sugar	0 - 20	14.8 ± 4.5	13.5 ± 4.8	≤ 20% of total kcal	16.4	10.2
Total HEI-2005 Scores	0 - 100	67.6 ± 9.9	64.0 ± 12.1	≥ 80*	10.7	6.8
*A score of 80 or greater is generally regarded as healthy **Chi square test for differences in proportions between % children and % moms meeting recommendation, $p<0.05$						

Table 4. Child Diet Quality and Demographic Characteristics at Baseline (n = 177)

Variable	Child Average HEI Score (SD)	*p*-value**
Gender		0.05
Male	66.4 (10.3)	
Female	69.3 (9.2)	
Child Age (years)		0.70
Two	68.7 (8.8)	
Three	67.4 (10.6)	
Four	67.1 (11.9)	
Five	65.9 (8.2)	
Child BMI Category		0.27
Normal	68.2 (10.0)	
Overweight	66.1 (9.3)	
Obese	64.2 (10.3)	
Child Breastfeeding Exposure		0.005
Low (<12 lactation score)	65.7 (9.1)	
High (≥12 lactation score)	70.0 (10.4)	
Mother Race		0.02
White/other	68.5 (10.0)	
Black	64.4 (9.2)	
Mother BMI Category		0.84
Overweight	67.8 (10.0)	
Obese	67.5 (9.9)	
Mother Education		0.001
≤ 12th grade	63.1 (11.0)	
Some college or vocational	63.7 (9.6)	
College graduate	68.8 (9.3)	
Graduate school	70.9 (9.3)	
Household Income*		<0.0001
Up to $15,000	59.5 (9.0)	
$15,001 - $30,000	65.9 (11.0)	
$30,001 - $60,000	66.4 (10.5)	
$60,001+	70.3 (8.7)	
Mother Marital Status		0.0005
Single	61.2 (8.6)	
Married	68.6 (9.8)	
Mother Parity Status		0.35
Second	67.4 (9.6)	
Third	69.3 (9.6)	
Fourth or more	65.3 (12.5)	

Mother Work Status		0.26
Full time	66.8 (9.7)	
Part time	70.3 (10.9)	
Not paid for work	67.2 (9.7)	
Mother Smoking Status		0.01
Current smoker	58.2 (10.0)	
Non-smoker	68.2 (9.7)	
Current Breastfeeding Status		0.008
Breastfeed (BF) only	69.7 (10.0)	
Formula feed (FF) only	64.7 (9.6)	
Combination BF & FF	68.1 (9.2)	
*Missing information for 2 participants **Regression analysis		

Table 5. Predictors of Child Diet Quality

	Adjusted r^2	β-Coefficient	*p* value
Model	0.24		<0.0001
Child Gender			0.09
Female		Ref	
Male		-1.14	
Household Income			0.04
Up to $15,000		-2.33	
≥$15,001		Ref	
Household Income			0.02
$15,001-$60,000		-1.73	
≥$60,001		Ref	
Current breastfeeding status			0.19
FF only		-0.94	
BF only + Combination BF & FF		Ref	
Mother HEI-2005 Score		0.29	<0.0001

Stepwise regression model variables entered that were not significant in the final model: child breastfeeding exposure, mother race, marital status, smoking status, and current breastfeeding status.

APPENDIX B

FIGURES

Figure 1. Sample Size

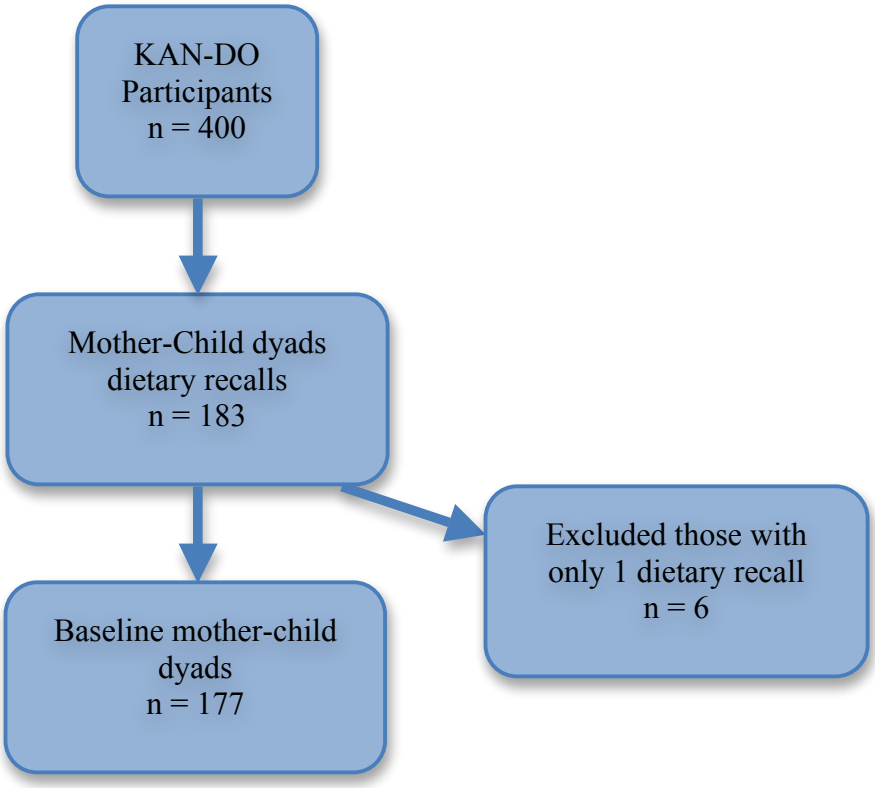
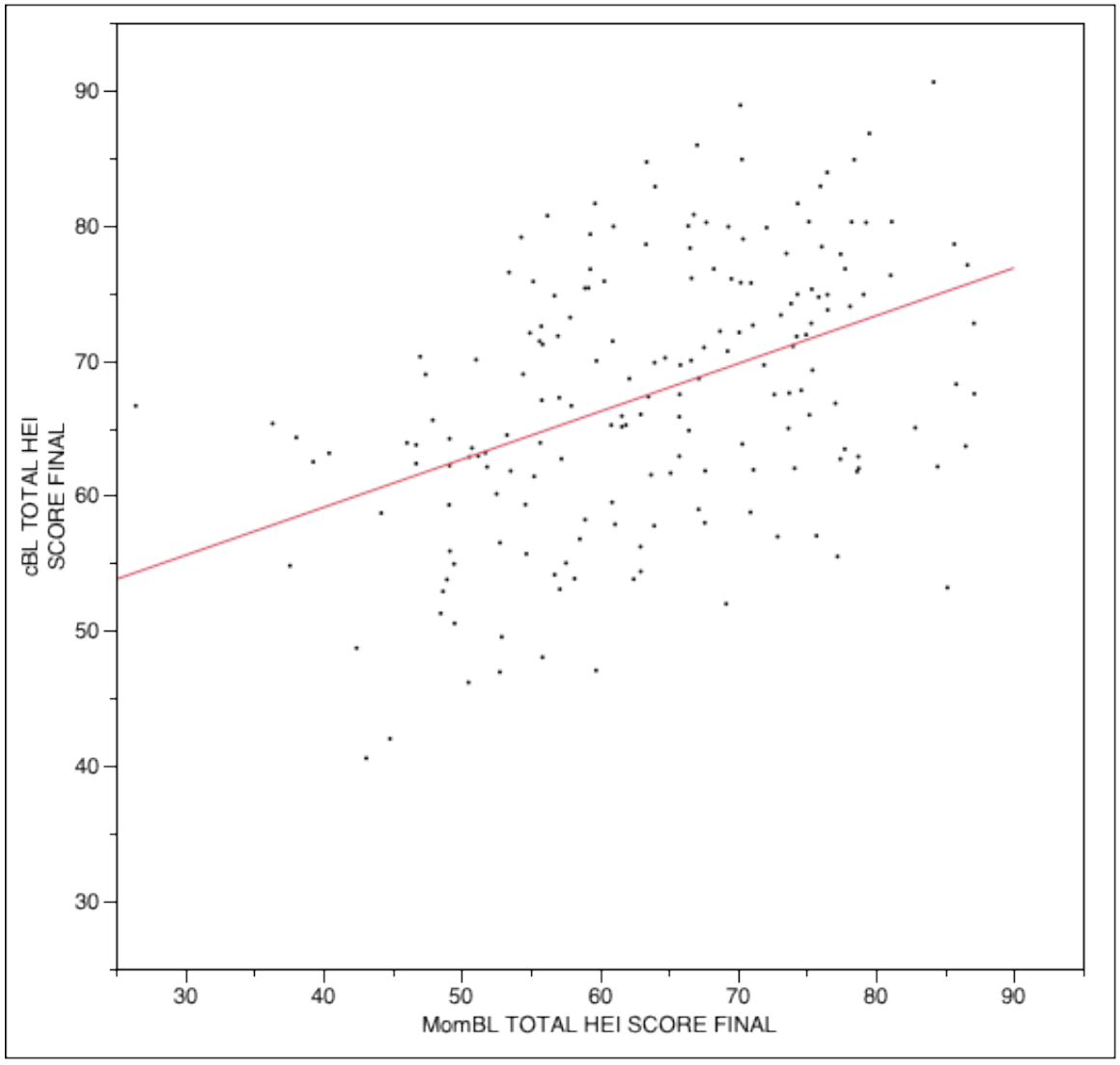


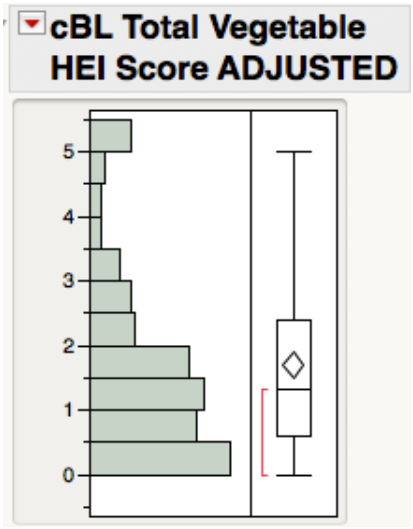
Figure 2. Correlation Between Mother and Child Diet Quality Scores at Baseline

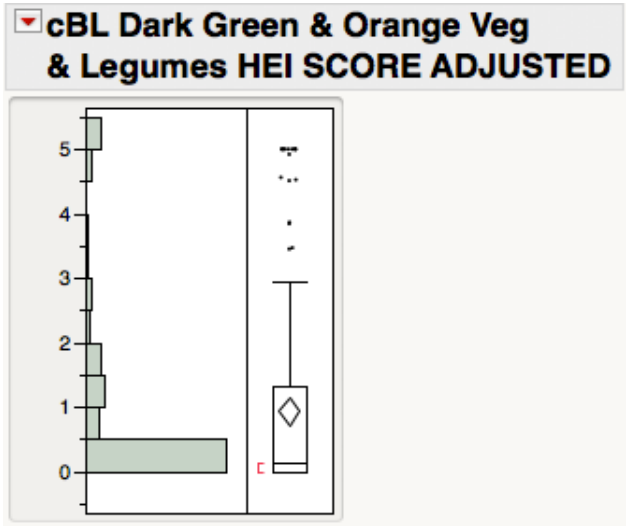


APPENDIX C

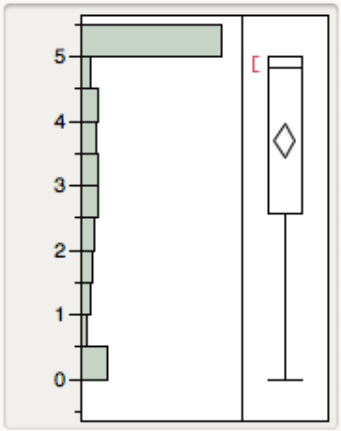
GRAPHS

Distributions of Children Component HEI Scores at Baseline (n = 177)

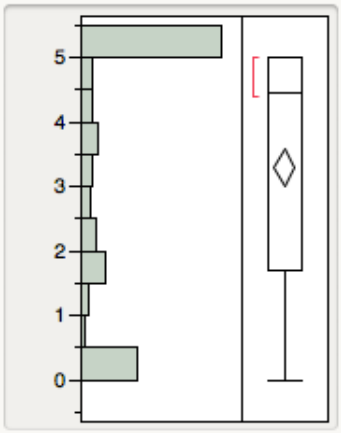




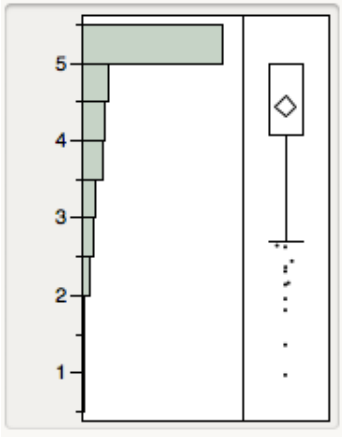
cBL Total Fruit
HEI Score ADJUSTED



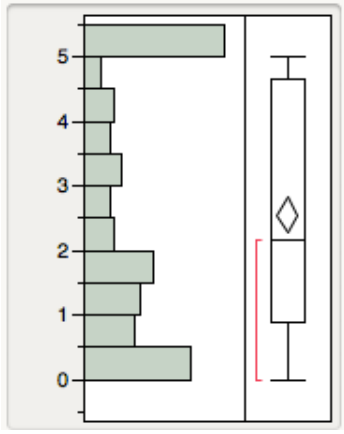
cBL Whole Fruit
HEI Score ADJUSTED



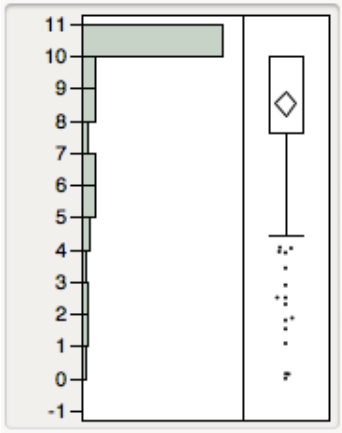
cBL total Grains
HEI Score ADJUSTED



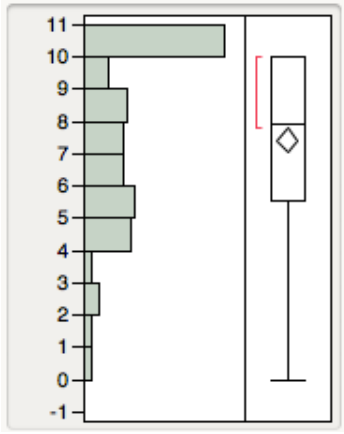
cBL Whole Grains
HEI Score ADJUSTED



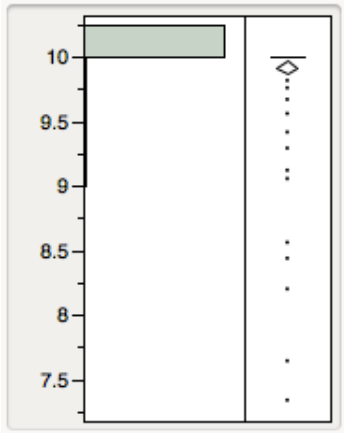
cBL Milk (Dairy)HEI Score ADJUSTED



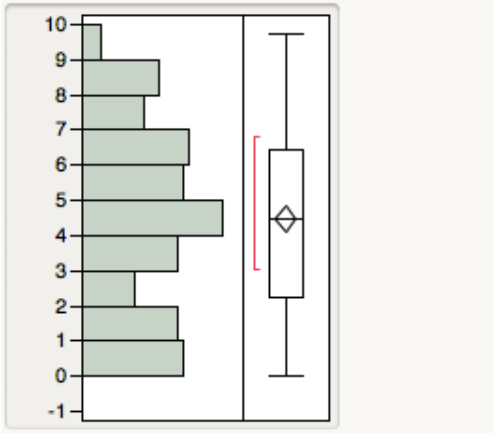
cBL Meat & Beans HEI Score ADJUSTED



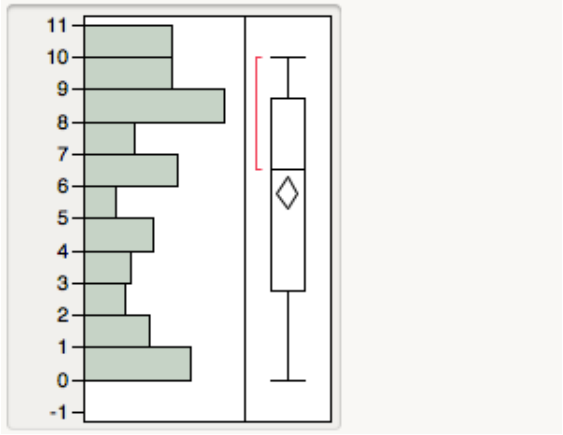
cBL Oils HEI Score ADJUSTED



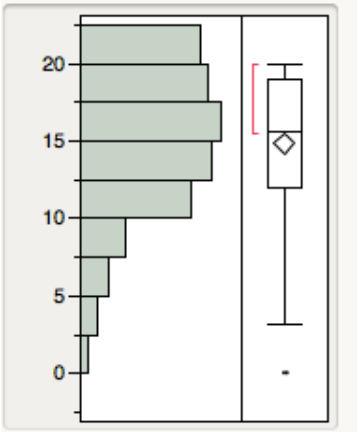
cBL Step 2 Sodium SCORE



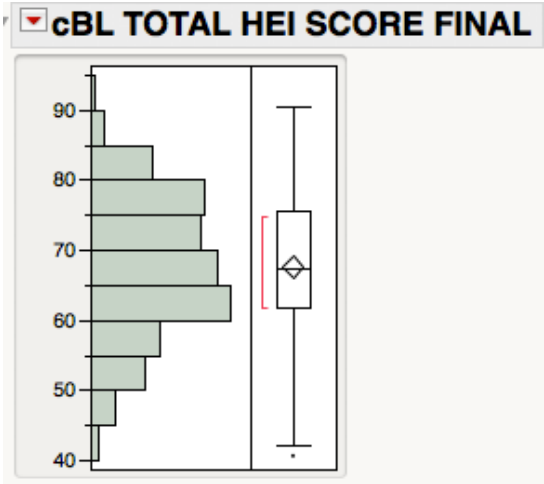
cBL Step 2 Sat Fat Score FINAL



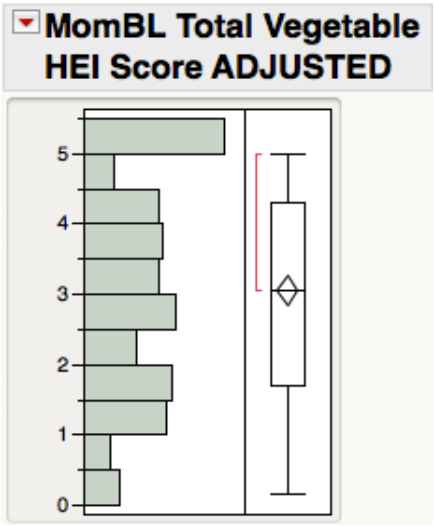
cBL Step 2 FINAL Score for SoFAAS



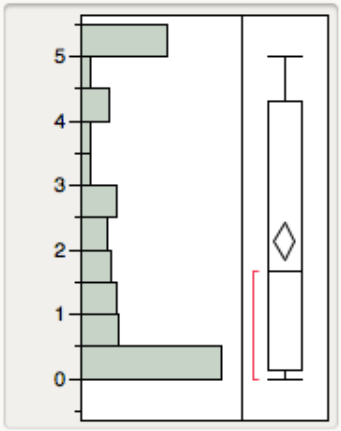
Distribution of Child HEI Total Score at Baseline



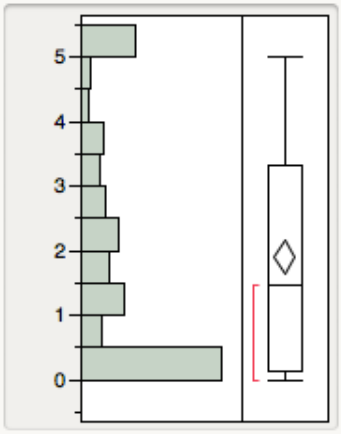
Distributions of Mother Component HEI Scores at Baseline (n = 177)



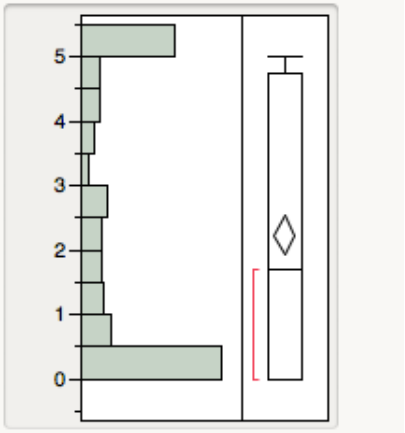
MomBL Dark Green & Orange Veg & Legumes HEI SCORE ADJUSTED



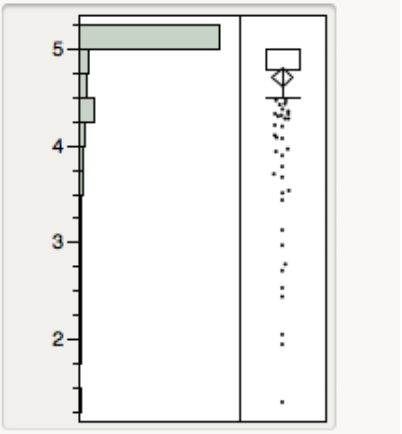
MomBL Total Fruit HEI Score ADJUSTED



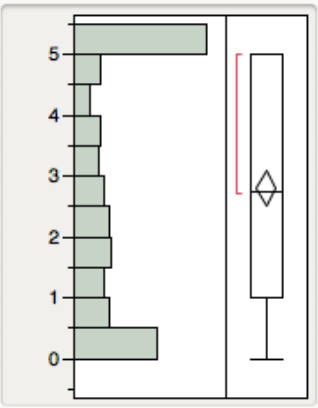
MomBL Whole Fruit HEI Score ADJUSTED



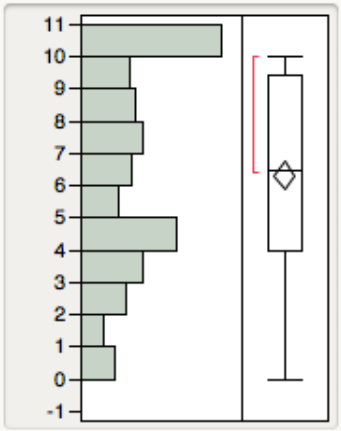
MomBL Total Grains HEI Score ADJUSTED



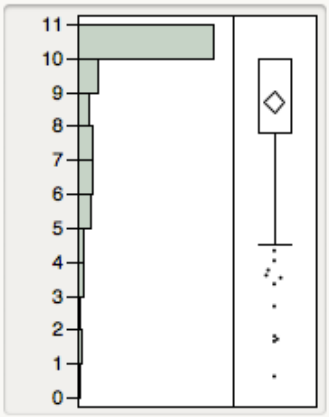
MomBL Whole Grains HEI Score ADJUSTED



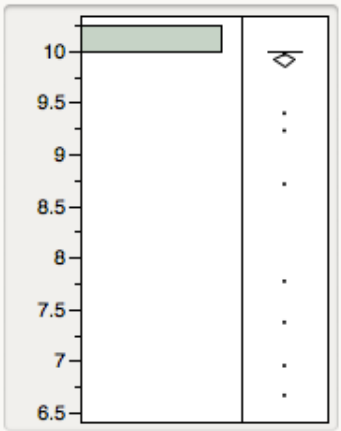
MomBL Milk (Dairy) HEI Score ADJUSTED



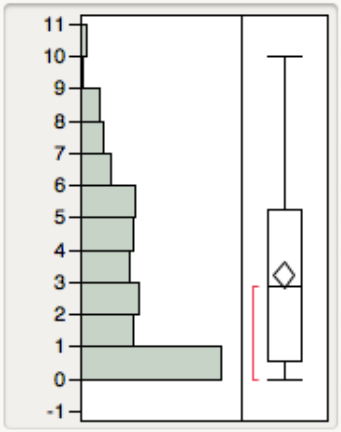
MomBL Meat & Beans HEI Score ADJUSTED



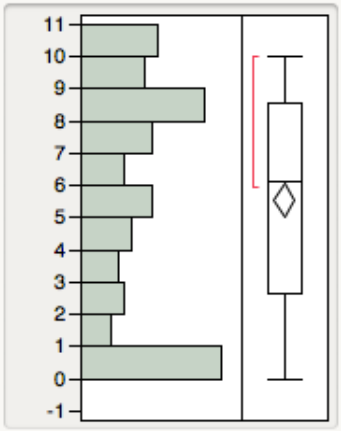
MomBL Oils HEI Score ADJUSTED



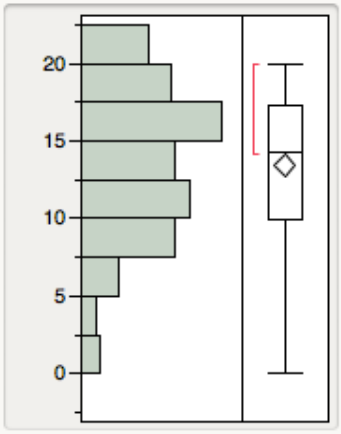
MomBL Step 2 Sodium SCORE



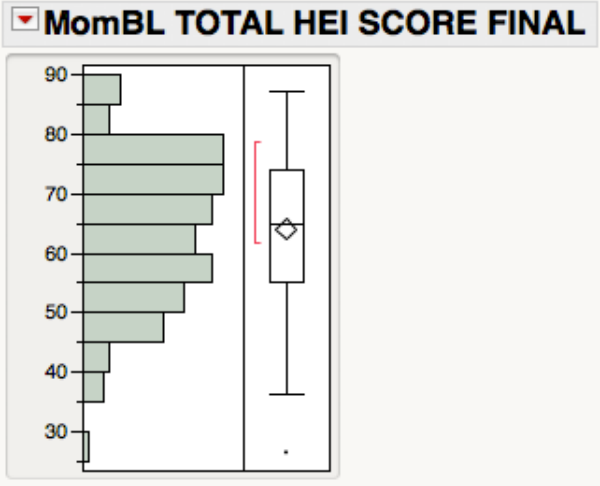
MomBL Step 2 Sat Fat Score FINAL



MomBL Step 3 FINAL Score for SoFAAS



Distribution of Mother Total HEI Score at Baseline



APPENDIX D

CONSENT FORMS

Form M0345

DUKE UNIVERSITY HEALTH SYSTEM

THE UNIVERSITY of NORTH CAROLINA GREENSBORO

Consent To Participate In A Research Study
KAN-DO: A Family-Based Intervention to Prevent Childhood Obesity
Cheryl Lovelady, PhD, RD, LDN, FADA
UNCG IRB Registry number: 07-0021 (078021)

Introduction

The Duke University Medical Center (DUMC) and The University of North Carolina at Greensboro (UNCG) are conducting a research study about the importance of preventing children from becoming overweight. As a woman who recently delivered a baby and is the parent of a child between 2 and 5, you and your preschooler are eligible to participate in this study. This study is being sponsored by a grant from the National Institutes of Health (NIH). Portions of Dr. Østbye's, Dr. Lovelady's and the research team's salaries are being paid by this grant.

Research studies include only people who choose to take part. Please read this consent form carefully and take your time making your decision. As your study staff discusses this consent form with you, please ask him/her to explain any words or information that you do not clearly understand and answer any questions you may have. We encourage you to talk with your family and friends before you decide to take part in this research study. The nature of the study, risks, inconveniences, discomforts, and other important information about the study are listed below.

Purpose of the Study

The goal of the study is to determine whether the KAN-DO intervention can encourage healthy eating, increased physical activity, and healthy weights among participating women and their children.

How the Study Works

Women who recently had a baby in the Raleigh/Durham/Chapel Hill or Greensboro/Winston-Salem/High Point regions of North Carolina, and also have a child aged 2-5, are English speaking, and are age 18 or older will be eligible to participate. A total of 400 women and 400 children will be enrolled in the study. The study will take place over the course of about 2 years.

If you agree to be in the study, we will ask you and your child to visit us at Duke (for the Triangle families) or UNCG for the Triad families). We will have you sign this consent form and we will give you a copy for your records. At that visit, we will weigh and measure you and your child. We will measure your waist and hip circumference. You will be asked to complete a 30-minute paper and pencil survey about your family's health and parenting behaviors. When you and your child attend a one-hour session at either DUMC or UNCG, you will be fitted for an activity monitor that you will both wear for one week, and then return via pre-paid envelope or in person. After your visit, you will be called by The University of North Carolina – Greensboro for a detailed 20-30 minute survey about your diet on two separate days within a two-week period. Immediately following that survey, you may also agree to do another detailed 20-30 minute survey about your child's diet on two separate day (this is optional and you can decide today if you would like to do this). After completing the phone dietary survey(s), you will be randomly assigned to one of two groups using a process like the flip of a coin.

DUKE UNIVERSITY HEALTH SYSTEM
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KAN-DO: A Family-Based Intervention to Prevent Childhood Obesity
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If you are assigned to **Group 1,** you will receive a monthly newsletter about boosting reading skills in your child. You will complete another set of assessments, including a one hour office visit, paper survey, phone dietary survey, weigh-in, and activity monitor, about 10 months from now. You will be contacted again after another year (about 2 years from now) for a shorter paper survey. We will ask you to bring your preschooler and "newborn" (now 2 years old) to this visit so you can all be weighed and measured.

If you are assigned to **Group 2**, you will also complete another set of assessments (including a one hour office visit, paper survey, phone dietary survey (or surveys if you decide to complete a phone surveys about your preschooler's diet), weigh-in, and activity monitor) in about 10 months. You will be contacted again after another year (about 2 years from now) for a shorter paper survey and weigh-in of you, your preschooler, and your "newborn" who will be about 2 years old. In addition, as part of **Group 2,** you would be asked to do the following:

1. receive a family kit in the mail once a month designed to help you prevent your child's chance of becoming overweight; the kit includes information and activities about healthy eating, physical activity, and parenting strategies. The kit's activities will take about an hour to complete each month. We encourage healthy behaviors. However, we will discourage the use of dietary supplements such as pills, herbal preparations, or other supplements unless prescribed by your doctor. There is very little information available on the safety and effectiveness of dietary supplements, and, in some cases, they can be dangerous;
2. participate in one 90 minute group classes emphasizing physical activity, healthy eating, and parenting strategies, and;
3. receive eight phone calls from a wellness coach during the study period to talk about how your family might incorporate the parenting skills and lifestyle changes that are part of the KAN-DO program. These phone calls, each about 20 minutes, will be audio recorded for quality assurance. Digital files of these recordings are saved on a password protected external hard drive, used only by counseling staff, and will be destroyed 6 years after the study has ended.

Please initial one of the following statements:

_____ I agree to take part in the phone surveys regarding my preschooler's diet (two phone surveys in the next few weeks, and another two phone surveys in about 9 months)

_____ I do not agree to take part in the phone surveys regarding my preschooler's diet.

Benefits of participation

Expected benefits to Group 1 participants may include increased bonding between the mothers and preschoolers due to the reading intervention. Expected benefits to Group 2 participants may include increased health and well-being, achieving and maintaining a healthy weight in the children and weight loss for the mothers, and an increase in physical activity and improved nutrition and dietary habits. The

indirect benefit of the study is a better general understanding of successful interventions to increase weight loss and healthy weight-related behaviors in mothers and their children.

Risks or discomforts

When promoting increased physical activity, there is a small risk of injury or other adverse (bad) events. We have taken precautions to minimize these risks, however, there may be unforeseen problems that we have not anticipated. In case of injury during physical activity that is directly related to this study, please inform us immediately by calling the Duke study coordinator at 1-866-681-0860 or the UNCG study coordinator at 1-866-99-KAN-DO and describing the event, and what actions you have taken as a result (for instance, if you called a doctor).

Immediate necessary medical care is available at Duke University Medical Center in the event that you are injured as a result of your participation in this research study. However, there is no commitment by Duke University, Duke University Health System, Inc., or your Duke physicians to provide monetary compensation or free medical care to you in the event of a study-related injury. Further information concerning this or your rights as a research subject may be obtained from the Duke University Health System Institutional Review Board (IRB) Office at (919) 668-5111. For Triad participants, contact the UNCG Office of Research Compliance at (336) 256-1482.

Remuneration and/or expense reimbursements

As part of this study, if you are assigned to Group 2, you will be asked to participate in one group classes about healthy habits in the home. You will not be charged fees for these activities and food will be provided. In addition, the free kits mailed to families in Group 2 include information and activities for adults and children. Families may receive prizes for completing activities in the family kits.

All women, regardless of group assignment, will receive a total of $100 for completing all of the assessments ($30 for the first set, $30 for the second and $40 for the third). Free parking is available whenever visits to the study site are required. Mileage reimbursement is available to families living more than 20 miles away at the current federal mileage reimbursement rate.

If you agree to take part in the optional surveys about your preschooler's diet, you will be paid an additional $10 for the first set of assessments, and $10 for the second set of assessments.

Additional costs to participate

Transportation to and from study activities will be the responsibility of the participant. The sponsor of the study, the National Institutes of Health, is providing the newsletter, classes, mailed materials and wellness coach consultations to women free of charge.

DUKE UNIVERSITY HEALTH SYSTEM

THE UNIVERSITY of NORTH CAROLINA
GREENSBORO

Consent To Participate In A Research Study
KAN-DO: A Family-Based Intervention to Prevent Childhood Obesity
Cheryl Lovelady, PhD, RD, LDN, FADA
UNCG IRB Registry number: 07-0021 (078021)

Participation

You and your child may choose not to be in the study, or, if you and your child agree to be in the study, you or your child may withdraw from the study at any time. If you withdraw from the study, no new data about you or your child will be collected for study purposes unless the data concern an adverse event (a bad effect) related to the study. If such an adverse event occurs, we may need to review your or your child's medical record. All data that have already been collected for study purposes, and any new information about an adverse event related to the study, will be sent to the study sponsor.

Your decision not to participate or to withdraw yourself or your child from the study will not involve any penalty or loss of benefits to which you are entitled, and will not affect your access to health care at Duke or anywhere else. If you do decide to withdraw yourself or your child, we ask that you contact Dr. Østbye in writing and let him know that you are withdrawing from the study. His mailing address is DUMC Box 2914, Durham, NC 27710.

Confidentiality

As part of this study, you will be asked questions about your weight and weight history, your eating patterns and habits, and your level of physical activity, in surveys conducted by telephone and in-person. We will also weigh you and your child three times. Data stored electronically will be in files and computers protected by password access. Any hardcopy records will be kept in locked metal filing cabinets at the study sites.

Study records that identify you or your child will be kept confidential as required by law. Federal Privacy Regulations provide safeguards for privacy, security, and authorized access. Except when required by law, you or your child will not be identified by name, social security number, address, telephone number, or any other direct personal identifier in study records disclosed outside of Duke University Health System (DUHS) or The University of North Carolina – Greensboro (UNCG). For records disclosed outside of DUHS or UNCG, you and your child will be assigned a unique code number. The key to the code will be kept in a locked file in Dr. Østbye's office. If you are randomly selected for Group 2, audio-recordings of your phone calls with the wellness coach will be stored electronically on a password protected external hard drive.

If the researchers have reason to believe a child is being abused (or has been abused), study staff are required by North Carolina state law to file a report with the appropriate agencies. If the researcher has reason to believe you may be a harm to yourself or others, our study physician will contact you for appropriate follow-up. In addition, your records may be reviewed in order to meet federal or state regulations. Reviewers may include, for example, representatives from the National Institutes of Health, the Duke University Health System Institutional Review Board or the University of North Carolina-Greensboro Office of Research Compliance. If any of these groups review your research record, they may also need to review your or your child's research record.

DUKE UNIVERSITY HEALTH SYSTEM
THE UNIVERSITY of NORTH CAROLINA GREENSBORO

Consent To Participate In A Research Study
KAN-DO: A Family-Based Intervention to Prevent Childhood Obesity
Cheryl Lovelady, PhD, RD, LDN, FADA
UNCG IRB Registry number: 07-0021 (078021)

The study results will be retained in your research record for six years after the study is completed At that time, information identifying you or your child will be removed from such study results at DUHS or UNCG. This information may be further disclosed by the sponsor of this study, the National Institutes of Health. If disclosed by the sponsor, the information is no longer covered by the federal privacy regulations.

The study results will be retained in your child's research record for six years after the study is completed or until your child reaches the age of 21, whichever is longer. At that time either the research information not already in your child's medical record will be destroyed or information identifying your child will be removed from such study results at DUHS. Any research information in your child's medical record will be kept indefinitely.

Dr. Cheryl Lovelady and her staff from the Nutrition Department at UNCG will conduct two interviews regarding your food intake, one in the next two weeks, and another in approximately 10 months. UNCG will have access to some information about you (your name and telephone number) so that they can contact you. UNCG will be conducting the surveys on Duke's behalf and acting as agents of Duke, and therefore are held under the same confidentiality standards as Dr. Østbye's study team.

Questions

Immediate necessary medical care is available at Duke University Medical Center in the event that you are injured as a result of your participation in this research study. However, there is no commitment by Duke University, Duke University Health System, Inc., or your Duke physicians to provide monetary compensation or free medical care to you in the event of a study-related injury. For questions about the study or research-related injury, contact Dr. Truls Østbye at (919) 661-0331 or Dr. Cheryl Lovelady at (336) 256-0310 during regular business hours.

For questions about your rights as a research participant, Triangle participants should contact the Duke University Health System Institutional Review Board (IRB) Office at (919) 668-5111. Triad participants should contact Eric Allen in the UNC-Greensboro Office of Research Compliance at (336) 256-1482.

STATEMENT OF CONSENT

"The purpose of this study, procedures to be followed, risks and benefits have been explained to me. I have been allowed to ask questions, and my questions have been answered to my satisfaction. I have been told that I may contact the Duke University Health System Institutional Review Board (IRB) Office at (919) 668-5111 if I have questions about my rights as a research subject, to discuss problems, concerns, or suggestions related to the research, or to obtain information or offer input about the research. I have read this consent form and agree to be in this study, with the understanding that I may withdraw at any time. I have been told that I will be given a signed copy of this consent form."

Form
M0345

DUKE UNIVERSITY HEALTH SYSTEM

THE UNIVERSITY of NORTH CAROLINA
GREENSBORO

Consent To Participate In A Research Study
KAN-DO: A Family-Based Intervention to Prevent Childhood Obesity
Cheryl Lovelady, PhD, RD, LDN, FADA
UNCG IRB Registry number: 07-0021 (078021)

_____ _____
Signature of Subject Date

_____ _____
Signature of Person Obtaining Consent Date