EFFECTIVENESS OF A NUTRITION AND LIFESTYLE INTERVENTION IN FIRST-GRADE CHILDREN

By

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Bachelor of Science in Nutrition

University of Central Arkansas

Conway, Arkansas

2012

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
July 2014

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LIFESTYLE INTERVENTION IN

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ACKNOWLEDGEMENTS

I would like to thank everyone who has helped me along the way with this project. Specifically to:

- **Dr. Amanda Harrist, Dr. Glade Topham and the FiSH team:** Thank you for allowing me to utilize your data, time and resources.
- **Dr. Lenka Shriver**: Thank you for helping me find this project and helping to kick-start it (also for putting up with me bugging you enough to help me find something to work on my thesis).
- **The FiSH undergraduate research assistants (Karlie Jager, Danielle King, Lucy Lehockzy & Heather Shaw):** Thank you for your help in sorting and coding data, and your willingness to volunteer your time for these projects.
- **Dr. Gail Gates**: Without your assistance and mentorship, this thesis would not have been written. Thank you for your patience, encouragement and positivity throughout the past two years, which has kept me going even during the frustrating times.
- **Lastly, to my family and my husband, Charlie**: Thank you for continuing to encourage me through this process, and being supportive no matter what.

Name: CHELSIE TULL

Date of Degree: JULY 2014

Title of Study: EFFECTIVENESS OF A NUTRITION AND LIFESTYLE INTERVENTION IN FIRST-GRADE CHILDREN

Major Field: NUTRITIONAL SCIENCES

Abstract: Childhood overweight and obesity rates remain high in the United States, and especially in the state of Oklahoma. The purpose of this study was to determine the effectiveness of a nutrition intervention in changing the food choices and decreasing the weight of children. First-grade students and their families were recruited from rural elementary schools surrounding the Stillwater, Oklahoma area. Subjects were split into two intervention groups that both participated in a nutrition and lifestyle intervention utilizing the Stoplight Diet as a guide for healthy eating choices. BMI was assessed at each wave of the study. Before the intervention, food records were collected for at least two full days on a 24-hour recall sheet. A dietary intervention, called the Stoplight Diet, was taught to each intervention group for 12 consecutive weeks at each child's school. Post-intervention, foods were recorded for two more days. Foods were then coded into three categories: green, yellow and red; green being healthiest, red being least healthy. Complete food records were returned by parents for 61 children. There was an overall significant decrease in red foods, an increase in yellow foods, but no significant change in the consumption of green foods after the intervention. Analyses were run to determine effectiveness of each intervention group in reducing BMI and changing foods consumed, and further, whether gender or parent demographics had any influence on foods consumed and BMI status. Gender, intervention designation, and parent demographics had no significant impact on BMI or food choices. Although the Stoplight Diet was not effective in improving BMI classification of overweight or obese children, there was a significant change in food choices made, which can help to attain a healthier lifestyle for children and lead to long-term positive health outcomes over time.

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CHAPTER I

INTRODUCTION

Childhood obesity is a growing problem in the United States, and especially in the state of Oklahoma, according to the Centers for Disease Control (Centers for Disease Control and Prevention, 2011 B). According to Frantzen et al. (2013), childhood obesity has reached the epidemic level, and is most common in children who are minorities, and in those who come from low-income homes. Data from the 1999-2000 National Health and Nutrition Examination Survey (NHANES) indicated that about 36% of children ages 6 to 11 were classified as overweight or obese (Oza-Frank, et al. 2013). According to a study published in 2014, this rate has not changed significantly over a ten-year span (Ogden, et al., 2014). According to data from the 2011-2012 NHANES survey, 22.8 percent of American children ages 2 to 5 years old, 34.2 percent of children ages 6 to 11 years old, and 34.5 percent of children ages 12 to 19 are considered overweight or obese, (Ogden, et al. 2014). Further research is warranted to advance our understanding of childhood obesity prevention and treatment (Ogden, et al. 2014).

Though some weight issues are genetic, diet and physical activity represent the strongest correlates of obesity and overweight (Gidding et al. 2005). A change in physical

activity levels and food intake can prevent or reverse childhood overweight and obesity. Adequate amounts of physical activity and a well-balanced, nutrient-dense diet are important to set the foundation for a healthy, long life ahead (Gidding, et al. 2005).

Consequences of Childhood Overweight and Obesity

Overweight and obesity can have many detrimental health effects on people of all ages, but the effects become magnified when present in children. Children undergo rapid changes in physical, mental and emotional growth, all factors that can be affected by overweight and obesity (Gidding, et al. 2005). Physiological detriments of obesity are abundant. Health complications can develop from excess body fat and body weight and can develop into serious diseases that a child may have to live with his or her entire life. These complications include heart disease, hypertension, stroke, kidney disease, diabetes, atherosclerosis, and cancer (Gidding, et al. 2005). These conditions cause not only physical and emotional burden, but also financial strain on families, and if not treated properly and promptly, can be deadly (Gidding, et al. 2005).

The psychological toll on an obese or overweight child is also an extreme detriment. Negative body esteem and body image, as well as low self-esteem can lead to long-term physiological consequences for children (Shriver, et al. 2013). Studies suggest that children may get teased and tormented by their peers, which can seriously hinder self and body esteem, and can often lead to mental disorders (eating disorders, depression, anxiety), emotional issues (shyness, hyperactivity, social withdrawal) and behavior issues. Feelings of shame are reported to be significantly higher in children and

adolescents who are obese (Sjoberg, et al. 2005). More importantly, the feelings of shame significantly increase the risk for depression in children (Sjoberg, et al. 2005).

A high level of self-confidence is often dependent on positive body esteem. Because the media controls a large part of how adolescents perceive themselves, it is essential for children to view themselves in a positive manner in order to develop a healthy body image and esteem. Negative self and body esteem can keep them from doing things they want or need to do in order to succeed and have a healthy, positive outlook on life. Esteem issues often affect behavior and academic performance, and there are social implications as well. Studies show that children often don't feel accepted and liked by their peers if they don't first have a positive image of themselves. This image is usually directly correlated with body weight (Shriver, et al. 2013).

Obese children have a harder time interacting with their peers, due to peer judgment of their weight. Obese children are less likely to be selected as playmates and are less popular than children of a normal body weight (Swindle, 2009). They are not necessarily disliked by their peers, but are more likely to be overlooked (Swindle, 2009). This is noteworthy, because children begin to develop important social skills at a young age that they will carry with them for the rest of their lives. Any hindrances to this can cause them to feel socially awkward and left out as adolescents and young adults, and can impair communication skills with others through adolescence into adulthood (Swindle, 2009).

Parental Influences on Childhood Obesity

Parents have a large impact on the development and maintenance of a healthy weight and dietary intake of their children. The parental influence comes through genetics, parental modeling of healthy eating, as well as their own and their child's body image. The beliefs that parents have about their children's body image and likelihood of becoming overweight or obese directly may impact their feeding practices, including controlling what and how much their child eats, monitoring their child's intake, and in some cases, pressuring the child to eat or not eat certain foods and beverages (Birch, et al. 2001).

A recent study indicated that among 2-6 year old children in the U.S., the intake of foods high in sugar and saturated fat increased substantially over a 10-year span (Ford, et al. 2013). Children are not inclined to choose healthier foods such as fruits and vegetables, on their own. Most of the time, when given a choice, children will pick out foods with high sugar and fat content, instead of a more nutrient-dense option, because they tend to have a more appealing taste (Gidding, et al. 2005). According to the USDA's "Nutrition Insights" in 2001, most children ages 2 to 9 have diets that qualify under "needs improvement" or "poor" when measured on the Healthy Eating Index, and older children have a worse diet than younger children do (USDA, 2001). Only 25 percent of children ages 7 to 9 met dietary recommendations for fruit, and only 22 percent met the recommendations for vegetables. Since the aforementioned articles have shown that children are less likely to choose healthy food, the decision to emphasize healthy food choices is put on parents.

Because nutrition starts at home, the most effective method used to combat childhood obesity is to involve parents. Including parents in a lifestyle changing intervention offers the most promise to effectively prevent childhood overweight and obesity (Jurkowski, et al. 2013).

Treatment Strategies

Recommendations for children who are overweight or obese are to increase physical activity and to alter food intake (Gidding, et al. 2005). Numerous dietary interventions for children have been developed in the last three decades, with many programs focusing on reduction of calories and/or dietary fat (Sothern, et al. 1999; Fisher & Birch, 1999). However, such programs may have a negative tone because they restrict or reduce children's intake rather than encouraging them to make better choices (Rollins, et al. 2014). In contrast, the authors of the Stoplight Diet do not recommend parents put their children on diets (Epstein & Squires, 1988). Dieting can lead to negative consequences, and even trigger eating disorders, since children are still developing mentally and emotionally, and need positive influences on their self-esteem and self-worth. Putting children on a diet shows them how to restrict food, and not enjoy what they are eating, but a positive change needs to be made to change the eating habits of children so they can grow into healthy adults and make wise dietary choices. The stoplight approach merges nutrition with education and play. As Gidding, et al. (2005) argue, parents must first be properly educated on good nutrition and eating habits for their children before they can successfully work with their child and help him or her maintain healthy weight and prevent overweight or obesity.

More research has been done to develop effective treatment and prevention strategies for childhood overweight and obesity. A 10-year longitudinal study was conducted to find predictors of overweight incidence during the transition from adolescence to young adulthood using data from Project EAT (Eating and Activity in Teens and Young Adults) (Quick, et al. 2013). Investigators looked at a group of 2,134 adolescents beginning during the 1998-99 school year, and wrapped up in 2008-09, when the adolescents had reached young adulthood. All subjects completed a survey at baseline, and again at the end of the study, which assessed personal, behavioral and socio-environmental factors related to obesity. BMI was taken at both points to measure prevalence of obesity. At baseline, about 25% of adolescents were considered overweight. At the end of the study, this number rose to 51% of young adults. Certain factors were higher among overweight and obese individuals than their peers of normal weight. These factors included: body dissatisfaction, weight concern, unhealthy weight control behaviors (such as fasting and purging), dieting, binge eating, weight-related teasing, and parental weight concern. Factors that stood out in the diet that helped prevent obesity between each gender were: normal weight females tended to consume more whole grains than their overweight peers, and in males, increased vegetable intake protected against incidence of overweight. Conclusions from researchers suggest that in order for the prevalence of obesity and overweight to decrease as children reach adolescence and adulthood, it is important for them to have a higher positive body image, to decrease unhealthy weight control behaviors, and to limit negative discussion on weight. Parents directly influence most of these factors (Quick, et al. 2013).

Purpose

The purpose of this study was to assess the effectiveness of a lifestyle intervention that was easy for children to comprehend, and was applicable to an entire family unit. Specifically, to find whether the Stoplight Diet was an effective dietary intervention for children and their families, in terms of making healthier food choices. A secondary purpose of the study was to find whether a Family, Food and Lifestyle intervention or a Family, Food and Lifestyle plus Family Dynamics intervention was more effective in changing the eating habits in a sample of first grade children participating in the Families and Schools for Health (FiSH) project. This is important, because the results from this study could be applied to future generations of children to help battle obesity and overweight. Not only is it beneficial for children to understand healthy eating patterns, but it is also good for parents to gain an understanding in order to make it a true family change that benefits the overall health of all family members.

Objectives

The specific objectives of this study are:

1. To find whether differences exist between intervention groups in proportion of food colors, according to the Stoplight Diet, consumed pre- and post-intervention.
2. To assess whether differences in the change in BMI occurred, and ratio of green to yellow and red foods chosen between each gender.
3. To examine whether differences exist among children's BMI classifications pre- and post-intervention in relation to proportion of each color of food chosen.

4. To examine whether differences occurred between intervention groups in children's BMI pre- and post-intervention.
5. To find the relation between parental education and income level and the child's consumption of red, yellow or green foods and BMI.

CHAPTER II

REVIEW OF LITERATURE

The Stoplight Diet

The Stoplight Diet was specifically designed for children in the late 1980's (Epstein & Squires, 1988). In this approach, foods are sorted into one of the three following color designations: green, yellow and red, to correlate with the colors of a traffic light. The concept of a traffic light is easy to comprehend and therefore appropriate for children. The diet encourages children to make their own food choices, and to independently assess which foods go into which category. This is important, especially since they won't always eat around parents, and must be forced to make their own decisions in certain situations. By helping them to understand healthier food choices, parents can be confident that children will make better food choices when away from home.

Green foods are those that can be eaten at any time and in any quantity, because they are nutrient-dense and low calorie items. Foods are classified as green if they have no more than 20 calories per serving. Green foods include but are not limited to: all non-starchy vegetables, some fruits, water, and zero-calorie beverages such as diet sodas,

unsweetened coffee and tea, and flavored water. Yellow foods are the most abundant in the diet, and contain necessary macro- and micronutrients, but should be consumed in moderation and variety. Yellow foods include, but are not limited to: certain fruits, starchy, non-fried vegetables, low to medium-fat meats, low to medium-fat milk and dairy products, and grains. Red foods are very energy-dense and not very nutritious. They are typically very high calorie items, and should be consumed in moderation. Red foods include, but are not limited to: desserts, potato chips, fried vegetables, high-fat meats, processed foods and fast foods.

The dietary recommendations made by the Stoplight Diet mirror the recommendations set by the Dietary Guidelines for Americans (CDC, 2014). The Dietary Guidelines for Americans recommend for anyone over the age of 2 to consume a diet rich in fruits and vegetables, whole grains, and low-fat dairy products, all of which are green and yellow foods in the Stoplight Diet. The Dietary Guidelines for Americans also recommend that solid fats, added sugars, refined grains, and excess sodium and cholesterol be consumed minimally, which goes along with the instructions for red foods in the Stoplight Diet (CDC, 2014).

Food restriction is not encouraged in the Stoplight Diet. Red foods are never completely restricted, but before consuming red foods, participants are encouraged to stop and think about how many red foods they consumed that day or week, and if they really want what they are about to eat. When certain food items are restricted, it creates a heightened desire for that particular food, and over-eating is more likely to occur when a restricted item becomes available. By allowing the freedom of choice with red foods in particular, the diet will be more balanced overall. Food and meal times are a central focus

of our day-to-day lives and are meant to be enjoyable. When a food is considered ‘bad” or is restricted, it promotes feelings of guilt and shame after the food is consumed, whereas diets like the Stoplight Diet, that emphasize moderation, are more likely to be successful in helping people to lose weight and maintain weight loss (Johnson, 2012).

Unlike many popular diets, the stoplight approach is not focused on calorie counting. It is a quality over quantity method of choosing healthier, more nutrient-dense foods in order to improve health and help lose excess weight and body fat, while in turn, gaining lean body mass. A calorie range is suggested as a guideline to the diet, but is not the goal in sight. The Stoplight Diet is intended to be a lifestyle change for the whole family. A child can feel isolated and punished if they are the only ones in the family put on a diet, while parents and siblings who may not have a weight problem are allowed to eat whatever they want. Therefore, the stoplight method was designed as a family lifestyle change to better the health of the entire family, instead of singling out one family member.

A study by Snellings, et al. (2007) used the stoplight approach with the school lunch program in high schools. The school lunch program in the three high schools which were analyzed in this study, like most others around the country, allowed students to pick what they wanted to purchase for lunch, instead of providing one standardized meal to buy, as most elementary schools do. The findings of the study showed that high school students purchased foods in a relative proportion to what was offered. The conclusion that can be drawn from this study is that more green and yellow foods will be chosen by adolescents if there are more green and yellow foods available to them. This conclusion can be applied to younger children as well, with foods that are available in their homes,

purchased by parents. Children can only eat what is offered to them, and don't have an ultimate control over what types of food come into the house, which is why parental support and participation is strongly encouraged.

A study conducted in the United Kingdom measured the effectiveness of the traffic light approach in a sample of 5-7-year-old children. Sixty-nine children were given the same pre-and post-test three weeks before and three weeks after a nutrition education session, respectively. The tests examined the children's knowledge of nutrition, attitude toward green, yellow and red foods, and their eating behaviors. Knowledge was assessed using pictures of various foods from each color group. Children were to sort each picture into what color they thought it belonged to. The attitude section used the same images and the question "How much would you like to eat?" to which they responded on a scale of 1-5, with 1 being not at all, and 5 being very much. The section on behavior measured the propensity by which the children asked for or refuse to eat each color of food, and which foods were left on their plate at the end of meals. Results showed that after the nutrition education, knowledge increased, positive attitudes increased, while requests for red foods decreased. However, the positive attitude toward green foods decreased, as well as requests for green foods. Investigators concluded that the study was beneficial overall, but suggest that there may have been a misunderstanding by many of the children, which accounts for the results concerning green foods (Ellis & Ellis, 2007).

The author of The Stoplight Diet conducted another study in 2001 using a few principles of the diet. The study compared two groups of families, all with at least one obese parent and a non-obese child. Since children of obese parents tend to become obese as they get older, this study was aimed at the prevention of obesity for the children.

Families were split into two groups: one received diet instructions to increase fruit and vegetable intake, and the other was instructed to decrease consumption of high-sugar and high-fat foods. Adults were given instructions to add caloric restrictions to their own diets, and to have their children follow the same guidelines with food intake, but with no caloric restriction. After one year, the results showed that the group that increased fruit and vegetable intake subsequently decreased high fat and sugar foods as well, and lost more weight overall than the other group. The authors concluded that a focus on increasing healthier foods is more effective than decreasing unhealthy foods. This goes along with the stoplight approach, which also focuses on increasing healthier foods, rather than placing a focus on more unhealthy foods (Epstein, et al. 2001 A).

Physical activity plays a key role in the decrease of childhood obesity. Researchers examined whether increasing physical activity or decreasing sedentary activity was more effective in decreasing weight and BMI in obese 8 to 12-year-old children. Children were randomly split into two groups and given similar treatments, with the exception of the physical activity component. All participants followed the Stoplight Diet through the duration of the study, as a complement to physical activity. Children in the physical activity group increased physical activity throughout the day outside of physical activity done at school. The group that decreased sedentary activity was asked to limit sedentary activities after school such as watching television, talking on the phone, playing video games, etc. The study took place over two years, with follow-up sessions periodically throughout its duration. Results showed that decreasing sedentary activities decreased body fat percentage, percent overweight and increased aerobic physical fitness more than just adding physical activity did (Epstein, et al. 2000).

In another study, researchers found that introducing a combination of the Stoplight Diet and physical activity to children and their families was shown to decrease body weight and percent overweight and improve physical fitness in obese girls. Children participated in a supervised exercise program three times per week, in which they ran or walked three miles. Another group participated in the study, with a diet-only intervention, and saw decreases in weight only from baseline to 2 months, and remained the same from 2 to 6 months, concluding that a combination of diet and exercise are necessary for weight loss in obese children (Epstein, et al. 1985).

Another study utilizing physical activity in addition to a dietary intervention as a weight loss method recruited 53 families with children between the ages of 8-12, both parent and child being between 20 and 80 percent over their ideal body weight for age, height and gender. Each family was randomly assigned to one of three groups: diet, diet plus exercise, or a control group. Subjects in the two intervention groups attended 15 program sessions. The diet that was used in each intervention was the Stoplight Diet for a nutritionally balanced, and calorie-controlled diet, with the overall goal to decrease sugar and saturated fat intake, while increasing nutrient-dense foods. The diet plus exercise group was given an exercise regimen to participate in, which helped to expend calories and therefore, lose excess weight. The control group for both parents and children showed an increase in percent overweight, while the two intervention groups both showed decreases. The parent diet group began with approximately 35% overweight and decreased to about 30% overweight; the child diet group began with almost 45% overweight, and decreased to just below 30% overweight. The parent diet plus exercise decreased percent overweight from just above 35% to right around 20%, while child

results for the same group were almost identical to the diet only intervention (Epstein, et al. 1984). While the child interventions were similar regardless of whether exercise was a component in their intervention, the results from the parents are indicative of the children's futures. The lifestyle changes introduced in the diet and exercise group are important for children to learn and incorporate as they become adults to either prevent overweight and obesity or to help combat it, if they are overweight or obese as adults.

Importance of Involving Parents in Childhood Obesity Prevention

Some treatment strategies for childhood obesity incorporate group family therapy with individual sessions, while others just do one or the other. A study by Goldfield, et al. (2001), examined which method was more cost-effective: group family treatment, or a mixed treatment strategy utilizing group and individual sessions. Cost-effectiveness was defined as the reduction in BMI and percentage overweight per dollar spent for recruitment and treatment of overweight. Thirty-one families including an obese child were randomized into groups and given treatment for one year. The Stoplight Diet was used with all of the families as a means of altering the diet of each family. Physical activity for each group began at 30 minutes per week and gradually increased throughout the year to 180 minutes per week. The only difference in treatment strategies was that children in the mixed therapy group received 15-20 minutes of individual therapy in addition to the group therapy with their parent. Results showed that the group intervention was more cost-effective than the mixed-treatment intervention was. Investigators believe this is because involving the entire family is more effective than singling out any particular family member, when trying to create a lifestyle change to combat obesity (Goldfield, et al. 2001).

Another study that treated both parent and child as a part of the intervention followed up with each family 10 years after initial treatment to follow up. Inclusion criteria allowed any overweight child to participate if he or she was between the ages of 6 and 12 and had at least one parent willing to also participate in the intervention. Subjects were divided into four intervention groups. Studies 2 and 4 were exercise groups, and study 3 was the only one that did not require the participating parent to be obese. One hundred eighty-five families participated in the study, and 158 of them were available for follow-up at the 10-year mark. All families were instructed on the Stoplight Diet, and used it throughout their intervention. Study 1 split participants into three groups that either targeted weight loss for the child, for the parent, or had a non-specific target. Study 2 randomized families into diet and lifestyle change (exercise regimens) or diet only. Study 3 assessed effects of weight status of the parents (either two obese, two non-obese, or one obese, one non-obese parent) and children's self-control on weight loss. Finally, in study 4, children were randomized into three exercise groups: aerobic, lifestyle exercise, and calisthenics. Results after 10 years showed that certain interventions from each study were more effective in changing the percentage of overweight in parents and children. The most effective strategy in study 1 was parent-child targeting of weight loss; in study 2, a diet + lifestyle change showed a slightly bigger decrease in overweight; in study 3, children of non-obese parents had a lower percentage of overweight; and in study 4, the lifestyle exercise group had the lowest percentage of overweight after 10 years (Epstein, et al. 1994). This study implied that in order for children to have and maintain a healthier weight, a full diet and lifestyle change incorporating the whole family is most effective.

According to the Academy of Nutrition and Dietetics Evidence Analysis Library (N.D.), the Stoplight Diet (also known as the traffic light diet) is an effective tool in decreasing weight and other markers of childhood obesity. This diet and lifestyle change approach has "demonstrated modest sustained weight loss in children over five and even 10 years after the intervention" (AND Evidence Analysis Library, N.D.). When used as a part of a clinically supervised, multicomponent weight loss method, the Stoplight Diet has been proven to be associated with short and long-term weight reduction in 6-to-12 year old children.

Gender Differences

Males and females have many differences concerning overweight and obesity, and the way in which each gender loses excess weight. Males tend to have an easier time dropping excess weight than females do (Forrester & Jeffery, 1986). In addition to being more successful in weight loss, males tend to be treated less aggressively for overweight and obesity than females do, as reported by both patients and physicians (Forrester & Jeffery, 1986). These differences cause speculation that perhaps parents treat overweight and obesity differently in their children of different genders.

A study by Epstein, et al. (2001 B) examined gender differences in children in a weight control program. Sixty-seven families participated in the randomized study, and were split into two groups: one that aimed to increase physical activity, and another that combined increasing physical activity with decreasing sedentary activity. The study followed the children and their families over the course of a year. At 12 months, boys in the combined treatment group showed a significantly better change in overweight than

girls did: a decrease in 15.8% in overweight, compared to the girls with just a decrease in 1% in overweight. In the individual treatment group, both genders saw a more similar decrease: boys with a decrease in 9.3% of overweight, and girls with a decrease of 7.6%. Investigators concluded that boys adhered to the program better than girls did, and that gender may influence response to weight loss programs (Epstein, et al. 2001 B). These findings suggest that gender differences may exist in terms of the effectiveness of obesity prevention programs and thus, further research is needed in this area to develop more specific guidelines on overweight and obesity prevention in childhood for each gender.

However, a study by Maynard, et al. (2001), which examined childhood body composition in relation to BMI noted that significant body composition differences between genders didn't exist until the onset of puberty, around age 12 or 13. Researchers collected data from 387 children, ages 8 to 18, and took annual measurements of height and weight, total body fat and fat-free mass. They found that the annual increases found in BMI classification during childhood were attributed to lean body mass, rather than body fat percentage, and that major differences weren't seen until puberty (Maynard, et al. 2001).

Parent Demographics Related to Childhood Nutrition

Income

Lower income families and those in rural areas tend to have a limited access to healthier food choices (Watt, et al. 2013). Low-income families are more likely to live in food deserts and experience periods of food insecurity. Food insecurity is defined as uncertain availability of nutritionally adequate and safe foods (Rigby, et al. 2012). A food

desert is an area that has a limited supply of fresh fruits and vegetables, which results in overly inflated prices, and generally has a large amount of fast food restaurants. Because of this, they are more likely to purchase inexpensive, energy-dense foods. These are usually high in calories, fat, added sugars, and are highly processed (Watt, et al. 2013).

A study by Pan, et al. (2013) examined the incidence and reversal of childhood obesity in children from low-income families. Participants included 1.2 million children enrolled in federally funded health and nutrition programs. They were followed over the course of two years, where height and weight were taken to measure for obesity. Thirty-six percent of children that were considered obese at baseline were still obese at the end of the study (Pan, et al. 2013).

Education

Parental education seems to have a correlation with childhood obesity levels (Fernandez-Alvira, et al. 2012). In this study, food frequency questionnaires as well as demographic information was taken from parents of 14,426 children aged 2 to 9 years. It was found that parents who had received less education tended to feed their children high-sugar and high-fat foods more frequently, whereas parents who were more highly educated tended to feed their children foods with lower sugar and fat contents more often. Researchers concluded that there is a strong association between low parental education levels and an unhealthy child diet, which could affect childhood obesity rates (Fernandez-Alvira, et al. 2012).

Another study comparing parental education levels to prevalence of childhood obesity found that children of a lower social status were three times more likely to be

overweight or obese than children of a higher social status (Lamerz, et al. 2005). Researchers gave questionnaires to parents of 1,979 six-year-old children at their mandatory physical exams before they entered school. In addition to the questionnaire, BMI was taken for each child to determine overweight and obesity. The findings suggested there was a strong relationship between parental education and prevalence of childhood obesity (Lamerz, et al. 2005).

Other Nutrition-Related FiSH Publications

Four other studies related to nutrition have used the FiSH data to analyze different aspects of the larger study. One analyzed self-esteem data (Swindle, 2009), and another analyzed food intake from a small subsample of children at baseline, according to USDA guidelines and also compared food intakes to maternal education (Bridges, 2010). One analyzed the relation between body esteem, depression and BMI, and found that feelings of low self-esteem and depression predicted a higher BMI in girls, but not in boys (Lee, 2006). The last study analyzed weight status in relation to physical activity and body esteem. The investigator found that body esteem was not affected by physical activity, however, overweight and obese children did have much lower body esteem scores than did their peers of normal weight (Moulton, 2011).

A published study also using FiSH data examined the relationship between parenting style (authoritative, authoritarian and permissive) and feeding practices. Researchers used the Child Feeding Questionnaire (CFQ) and found that restriction, pressure to eat and monitoring indicated authoritarian parenting styles, whereas responsibility, restriction, monitoring and modeling indicated an authoritative parenting

style and lastly, modeling and restriction indicated permissive parenting styles (Hubbs-Tait, et al. 2008).

Summary

Childhood obesity is a widespread epidemic across the United States. People who are overweight or obese when they are children are very likely to grow up to be obese adults, and suffer many health consequences as a result. Childhood obesity is preventable through proper diet and lifestyle changes in most cases; however, the typical lifestyle of most Americans does not support healthy habits. Because children don't have a huge impact on what foods enter their households, a change in their lifestyles best begins at home, with parents and siblings involved.

People with lower education levels and income, and those who live in food deserts, are more likely to turn to processed or fast foods to feed their families, because they are cheaper and more convenient options. However, these foods are higher in saturated fats and sugar, which contribute to overweight and obesity.

The Stoplight Diet is an approach to change the lifestyle of families, in order to prevent or reverse childhood obesity, and make healthy changes overall. The concept is simple for children to understand, and is designed to engage the whole family unit. When weight loss is approached as a family unit, and as a lifestyle change, instead of singling out one family member by putting him or her on a diet, the intervention is more effective and is more likely to continue being successful even after the initial intervention has ended. The purpose of this study was to assess the effectiveness of the FiSH lifestyle

intervention, based on the Stoplight Diet, and examine potential differences by gender and parent demographics, in a sample of 1st grade children in rural Oklahoma.

CHAPTER III

METHODOLOGY

Subjects

This analysis was part of a larger study, called Families and Schools for Health (the FiSH project). FiSH was an interdisciplinary research project at Oklahoma State University, including the departments of Human Development and Family Science, Nutritional Sciences, and Psychology. The FiSH project was funded by a grant from the United States Department of Agriculture (USDA).

Two cohorts of subjects were initially recruited during their first grade school year in 2005 and 2006. Families were recruited through their child's school during registration at the beginning of the school year. Participation was voluntary, and confidentiality agreements and parental consent forms were signed for those who had an interest in participating in the study. Participants were followed and continued to participate in the study throughout their second and third grade school years. Data were collected between fall 2005 and spring 2010. There were five waves in the initial FiSH study, separated by semester. Cohort 1 (wave 1) began in fall of 2005, followed by wave 2 in the spring of 2006, wave 3 in the spring of 2007, wave 4 in the spring of 2008, and

wave 5 in the spring of 2009, which was the beginning of the subjects' fourth grade school year. Participants for cohort 2 began the study in wave 3, and were one year behind cohort 1. The majority of the data analyzed in this study was for children in cohort 2.

There were initially 1,189 children recruited for the larger study, along with their parents, from 29 different rural elementary schools surrounding the Stillwater, Oklahoma area during their first grade school year. A total of 148 children and their parents signed up for the nutrition interventions. For this study, data from food records, BMI measures and demographic information were used from 61 children who provided at least two days of complete food records prior to and after the intervention.

FiSH Interventions

The goal of the FiSH project was to develop an effective intervention strategy for decreasing overweight and obesity in children while simultaneously increasing their body esteem and self-esteem, and encouraging healthier food choices for the entire family. The interventions utilized parents, teachers and peers to achieve results. The primary hypothesis of the FiSH study was "Interventions aimed at improving the family and peer contexts of overweight children will positively impact their healthy lifestyle and weight outcomes" (Harrist, et al. 2004).

There were five possible conditions for this study. For the nutrition component of this study, participants were split up into three groups by school: a Family, Food and Lifestyle (FL) intervention group, a Family Dynamics plus Family, Food and Lifestyle (FL + FD) intervention group, and a control group. Some of the intervention schools had

a Peer Group (PG) intervention added on to the nutrition and lifestyle interventions, as well, which gave the study the total of five possible conditions. Data from the Peer Group interventions were not analyzed in this study, because the intervention did not have a significant nutrition focus. The intervention for the PG emphasized children's interactions with, and attitudes toward each other.

The nutrition intervention lasted for 12 consecutive weeks, which included 12 weekly education sessions for parents and children in both the FL and FL + FD groups. For the FL group, each session lasted about 90 minutes with parents and children split up for the first hour, then parents and children would come back together for the last 30 minutes. Sessions for the FL + FD group also lasted 90 minutes, but parents and children were split up during the entire session, with 45 minutes focused on FD and the last 45 minutes focused on FL.

All sessions were similar in nature, but the lessons for each session (FL or FL + FD) were slightly different. Trained graduate research assistants led the sessions for each school. Each intervention group received education on the Stoplight Diet during week 2, and principles of the diet were reinforced throughout the remaining weeks. Parents in each group were given a food record sheet during week 1, with instructions on how to fill it out, (see Appendix A) as well as an example of a "good" record filled out correctly, and a "bad" record, filled out incorrectly (see Appendix B). During each session, children were provided with snacks and a game to play that helped to reinforce lessons learned that week, and previous weeks.

Measures

At baseline, at least two consecutive days of food records were requested from each child, and reported by parents or guardians. In addition to food records, sociometric interviews and anthropometric data were gathered from each child, as well as demographic information from each parent (Harrist, et al. 2007). Food records were completed again immediately following the intervention to determine changes, if any, in the diet. Food records were not taken after the end of wave 2, and therefore, each child only had a total of four records analyzed.

Body Mass Index

Body Mass Index (BMI) is a number calculated using height and weight that represents a relation to body fat percentage. The number is calculated by taking the child's height in inches and weight in pounds, then using the formula: BMI = weight/height x height x 703. The resulting number is plotted on the BMI chart (see Appendix C) to get a BMI-for-age percentile. The charts compare each gender and age (2 to 20 years) to BMI (CDC, 2011 A).

BMI was collected at baseline, and every year that each child participated in the study. Change in BMI was assessed by looking at the differences from baseline and BMI classification at the beginning, at the end of each wave, and at the end of the study. Children were divided into BMI classifications based on BMI at baseline (CDC, 2011 A):

- Underweight – Less than the 5^{th} percentile
- Healthy weight – 5^{th} to 84^{th} percentile
- Overweight – 85^{th} to 94^{th} percentile

- Obese – Greater than or equal to the 95th percentile

Food Records

Food records were assessed for children whose parents had completed at least four complete days of food records. Only two records were analyzed per child, pre- and post-intervention, for a total of four records per child. A complete record was defined as having no missing information (all meals were accounted for-breakfast, lunch and dinner), along with a specific description of the food consumed, as well as preparation method, if applicable.

Parent Information

Parents filled out information packets at baseline. Information included household monthly income and education level of each parent living in the household. Income and education levels were completed on the questionnaire by each parent. For education, parents had the option of choosing one of the following as his or her highest level of education: 8th grade, 9th grade, 10th grade, 11th grade, 12th grade (high school graduate), some vo-tech school, vo-tech graduate, some college, or college graduate. Income was provided in ranges and indicated monthly household income for the whole family. Options were: $0-100, $100-499, $500-999, $1000-1499, $1500-1999, $2000-2499, $2500-2999, $3000-3499 or $4000+.

Data Coding

Food records were coded according to the guidelines set by the Stoplight Diet (Epstein & Squires, 1988), and assigned the designation red, yellow, or green. A coding

guide was developed to help clarify and update information from the Stoplight Diet (See Appendix D). Four undergraduate research assistants were trained on coding procedures by the primary investigator. Upon completion of coding, ten percent of the records were re-coded by the primary investigator to check for accuracy. Since the completed records did not meet reliability standards (100 percent accuracy) in the subsample that was re-coded), all records were then re-coded by the primary investigator.

The number of foods from each color was tallied for each day, and added up to create a total number of foods consumed each day. If foods on the records were not specific enough, certain assumptions were made, and this standard was set for all records. Assumptions and adjustments that had to be made are as follows:

- Any time "milk" was listed, but the type was not specified, it was assumed that it was 2%, and was coded red.
- If a meat product was listed, but the parent did not specify the preparation method, it was assumed that it was baked. For example, if "chicken" was listed by itself, it was coded yellow, for baked chicken.
- For salad dressings, ice cream, condiments (such as mayonnaise): if the type was not listed (such as fat free, low fat), then the food was counted as full fat, and coded as such.
- Combination foods were addressed in the Stoplight Diet, but not all were accounted for. In the case that a combination food was listed on a food record, but not on the coding guide, the food was broken down and coded by individual ingredients. The ingredients were tallied by color, and the color of the majority of ingredients was the color designated for that particular food.

- Example: Peanut butter and jelly sandwich
    - Peanut butter – yellow
    - Jelly – red
    - Bread – yellow

When added up, this equals two yellows and one red, making the food a yellow food. In the case of a combination food ending in a tie (i.e. two yellow, two red), both colors were used.

Analysis

The foods for both pre-intervention days were totaled by color, and averaged across the two days. The same technique was utilized for the post-intervention days. T-tests were used to analyze differences between groups in the number of green, yellow and red foods, and BMI category; Spearman rank order correlations examined the relations between BMI classifications and proportion of green, yellow and red foods.

T-tests were used to compare genders for change in BMI, and ratio of green, yellow and red foods. Pearson correlation coefficients were used to identify the relation between parental concern scores and BMI, and ratio of green, yellow and red foods. Spearman rank order correlation coefficients were used to examine relations between parental income and education and ratio of green, yellow and red foods, as well as BMI.

CHAPTER IV

FINDINGS

The purpose of this study was to examine whether the Stoplight Diet was an effective tool in changing the diets and/or reducing the proportion of overweight and obese children in the sample of 1st grade children. Of the 148 children who participated in the intervention and the children who were a part of the control group, 200 returned at least one legible, complete food record. Out of the 200 subjects that returned records, 61 turned in two pre-intervention and two post-intervention records that were analyzed in this study. Thirty-three of the children with completed food records participated in the FL intervention and 28 participated in the FL + FD intervention. Three children in the control group had at least two post-intervention records, but they did not have pre-intervention records, and were not included in the analysis. Parents and children in both groups had an average attendance of about eight sessions out of the 12-week program. This means that on average, a family missed four sessions, but attended 75 percent of the program sessions.

Objective 1: To find the differences between intervention groups in proportion of food colors consumed pre- and post-intervention

For both intervention groups, there was no significant change in percentage of green foods consumed between pre- and post-intervention. However, there was a significant increase in yellow foods, and a decrease in red foods consumed over time (Table 4.1).

There was not a significant difference in proportion of colors of foods consumed between the Family Dynamics and the Family, Food and Lifestyle + Family Dynamics groups pre- and post-intervention (Table 4.1). Pre-intervention, about half the foods consumed were red, 35.6-41.5 percent were yellow and about eight percent were green. Post-intervention, the percentage of red foods decreased by about six percent, and yellow foods increased by about five percent.

Table 4.1 Proportion of Green, Yellow and Red Foods Consumed by Intervention Groups Before and After the Intervention

Food Colors	**Pre-Intervention** Mean ± SD	**Post-Intervention** Mean ± SD	**Time** (*p*)	**Time x Intervention** (*p*)
Green			.094	.779
FL	8.2±7.3	9.8±7.7		
FL+FD	8.7±6.1	10.8±7.4		
Yellow			.009	.718
FL	35.6±13.9	40.9±14.1		
FL+FD	41.5±10.1	45.6±13.8		
Red			.002	.874
FL	56.2±16.2	49.4±18.6		
FL+FD	49.8±10.5	43.6±14.4		

Objective 2: To find the differences in the change in BMI, and ratio of green to yellow, and red foods chosen between each gender

There were no significant differences between genders in BMI changes (Table 4.2). Over the five-wave course of the intervention, BMI was recorded for each child. During this time, several subjects were not accounted for, due to dropping out of the study, moving to a different school or district, or parent refusal to allow the child to have

his or her BMI measured. This explains the decrease in the number of subjects (N) in each wave.

Table 4.2 Differences in Change in BMI Percentile By Gender

Change in BMI[a]	**N**	**Male** Mean ± SD	**N**	**Female** Mean ± SD	***p***
Wave 2 – Wave 1	30	2.8±11.7	24	1.0±7.3	.521
Wave 3 – Wave 1	29	4.7±14.3	24	1.4±11.2	.360
Wave 4 – Wave 1	21	0.7±9.7	20	4.1±11.1	.300
Wave 5 – Wave 1	18	2.0±13.4	15	3.1±8.3	.793

[a] Signifies change in BMI percentile from baseline after each wave.

There were no significant differences between males and females in the change in percentage of green, yellow or red foods between pre- and post-intervention. Both genders had an increase in the consumption of green and yellow foods and a decrease in red foods (Table 4.3).

Table 4.3 Differences in Food Choices By Gender

Food Colors[a]	**Male** (N = 32) Mean ± SD	**Female** (N = 26) Mean ± SD	***p***
Green	0.6±1.00	3.1±0.07	.280
Yellow	3.7±0.15	6.3±0.11	.473
Red	-4.3±0.18	-9.4±0.12	.208

[a] Signifies differences in average food choices pre- and post-intervention

Objective 3: To find the relations between children's BMI classifications and changes in the proportion of each color of food consumed pre- and post-intervention

When BMI was measured at baseline (wave 1), 25 percent of children were classified as obese and 16.7 percent were overweight. These numbers shifted quite a bit throughout the study period (Table 4.4). At the end of the study (wave 5), 26.5 percent of children were classified as obese and 20.6 percent of children were classified as overweight.

Table 4.4 BMI Classifications Throughout the Study Period

BMI Classification	Wave 1		Wave 2		Wave 3		Wave 4		Wave 5	
	n	%	n	%	n	%	n	%	n	%
Underweight	3	5.0	1	1.8	2	3.7	0	0.0	0	0.0
Healthy Weight	32	53.3	31	55.4	31	57.4	21	50.0	18	52.9
Overweight	10	16.7	11	19.6	5	9.3	8	19.0	7	20.6
Obese	15	25.0	13	23.2	16	29.6	13	31.0	9	26.5

There were no significant correlations between BMI classifications and change in colors of food consumed (Table 4.5). However, there was a trend for a positive correlation between percent of change in yellow foods chosen and BMI classification in waves 1 and 4. More overweight children tended to have a greater percentage of increase in yellow foods. There was also a trend for a negative correlation between change in consumption of red foods and BMI in wave 4. More overweight children tended to have a smaller decrease in percentage of red foods chosen.

Table 4.5 Relations Between BMI Classification and Changes in the Proportion of Each Color of Food Chosen Pre- and Post-Intervention

BMI Classification		**Change in the percentage of foods consumed pre- and post-intervention**		
		Green	**Yellow**	**Red**
Wave 1 N = 60	r	.043	.227	-.187
	p	.743	.081	.151
Wave 2 N = 56	r	.123	.134	-.177
	p	.365	.326	.191
Wave 3 N = 54	r	.010	.193	-.126
	p	.945	.162	.366
Wave 4 N = 42	r	.097	.274	-.283
	p	.543	.080	.070
Wave 5 N = 34	r	-.093	.054	.003
	p	.603	.762	.986

Objective 4: To find the differences between intervention groups in children's BMI pre- and post-intervention

There were no significant differences between the intervention groups in changes in BMI percentiles throughout the waves (Table 4.6).

Table 4.6 Change in BMI Percentiles from Baseline Between Intervention Groups

Change in BMI	**Intervention**	**n**	**Percentile Change** Mean ±SD	***p***
Wave 1-Wave 2	FL	33	3.19±11.3	.171
	FL + FD	23	-0.55±7.3	
Wave 1-Wave 3	FL	31	3.64±15.4	.812
	FL + FD	23	2.78±8.6	
Wave 1-Wave 4	FL	22	0.82±10.8	.233
	FL + FD	20	4.74±10.2	
Wave 1-Wave 5	FL	17	0.01±11.6	.133
	FL + FD	17	5.87±10.5	

Objective 5: To find the relationship between parental education and income level and the child's consumption of red, yellow or green foods and BMI

Forty-nine of the parents filled out information on their income. A frequency analysis was conducted to determine monthly household income (Table 4.7). According to the 2014 poverty guidelines, 44.9 percent of parents would be classified at or under the federal poverty line, for a typical family of four (FamiliesUSA.org, 2014). A possible

reason for the low amount of parents filling out demographic information could be that the parents were not present during the week when this information was collected.

Table 4.7: Parent Monthly Income

Monthly Income	n	Percentage
$0-100	7	14.3
$100-499	1	2.0
$500-999	2	4.1
$1000-1999	5	10.2
$1500-1999	7	14.3
$2000-2499	7	14.3
$2500-2999	2	4.1
$3000-3499	4	8.2
$3500-3999	5	10.2
$4000 plus	9	18.4

Education levels were assessed for both parents (Table 4.8). Fifty-one primary and 46 secondary parents filled out their education levels. Of primary parents, approximately 47 percent were college graduates, whereas only two percent had not completed high school. The remaining parents had completed either a vo-tech degree or

had taken some college courses. Out of the secondary parents, almost 33 percent had college degrees, and approximately 15 percent had not completed high school.

Table 4.8 Parent Education Levels

Highest Level of Education Completed	**Primary Parent**		**Secondary Parent**	
	n	**%**	**n**	**%**
9th grade	0	0.0	2	4.3
10th grade	1	2.0	2	4.3
11th grade	0	0.0	3	6.5
High School Graduate	4	7.8	4	8.7
Some Vo-Tech Courses	4	7.8	5	10.9
Some College Courses	13	25.5	8	17.4
Vo-Tech Graduate	5	9.8	7	15.2
College Graduate	24	47.1	15	32.6

Parental education and income were analyzed to find the relation to child BMI, and consumption of each color of food. There was no significant correlation between income and food choices or BMI category, nor was there a significant correlation

between the education level of the primary parent and BMI at baseline. However, there was a significant finding that more educated secondary parents had children whose red food intakes showed a greater increase between pre- and post-intervention (Table 4.9). A possible explanation for this may be that secondary parents (primarily fathers) are more permissive parents and do not stick to quite a strict regulation of healthy eating that perhaps primary parents (mothers) do.

Table 4.9 Parent Demographics in Relation to Child BMI and Child Food Choices

		Household Income (N = 49)	**Highest Education Primary Parent** (N = 51)	**Highest Education Secondary Parent** (N = 46)
Child BMI at baseline (percentile)	r	.060	.059	-.110
	p	.680	.678	.469
Change in Green Food (%)	r	.165	-.042	-.202
	p	.257	.769	.178
Change in Yellow Food (%)	r	.025	-.103	-.164
	p	.865	.474	.276
Change in Red Food (%)	r	.020	.189	.338
	p	.889	.184	.021

CHAPTER V

DISCUSSION

The findings of this study suggest that proper training of and adherence to the Stoplight Diet may lead to healthier lifestyle and diet choices for children, although these dietary changes were not associated with improvements in body weight. This is the first study to utilize the Stoplight Diet in children of all BMI classifications, and therefore, weight statuses. All other published studies incorporating the Stoplight Diet into their weight loss intervention for children focused on overweight or obese children. These studies found that overweight or obese children were able to drop to a healthier weight status more quickly than the children in our study, most of which were of a healthy BMI classification.

Summary of Findings

Objective 1: To find the differences between intervention groups in proportion of food colors consumed pre- and post-intervention

This study found that the Stoplight Diet was effective in reducing the amount of red foods consumed by first-grade children, and increasing the amount of yellow foods

consumed. Green foods, however, did not significantly change over the intervention period. There were no significant differences between intervention groups, meaning that the additional content related to healthy family relationships provided by each intervention method (FL or FL + FD) did not predict a greater change in food choices for children. The difference between each intervention group was that in the FL group, parents and children spent the majority of the intervention session split up, and came together for the last half hour of the session; whereas in the FL + FD group, parents and children spent their entire sessions split up. The nutrition lessons provided to each group were similar. Since parents were also involved in the intervention, regardless of whether or not they were with their child the whole time, the intervention was still family-oriented. This may have been a contributing factor to the shift in food consumption, as families were involved together as a unit, rather than one family member making his or her own food choices.

Studies examining the Stoplight Diet generally found success in improving the diets of children and adolescents. An intervention utilizing the Stoplight Diet with high school students' lunchtime food choices found that consumption of green and yellow foods increased when a greater proportion of green and yellow foods was offered to them (Snellings, et al. 2007). This shows that the Stoplight Diet can be effective in helping students make healthy food choices, when healthier options are made available. This result is different from our study in that we don't know what types of foods were available to the children, unless they were eating the school-provided lunch. Concerning foods that come into the home, however, parents have the ultimate say on what is purchased and provided at mealtimes.

Children around the same age as the FiSH study participants were given a nutrition pre-test before an education session on the Stoplight Diet, and knowledge was re-assessed with a post-test, in a study by Ellis and Ellis (2007). Researchers found that the children's overall knowledge of nutrition increased while requests for red foods decreased (Ellis & Ellis, 2007). The participants in our study received 12 nutrition education sessions, where the Stoplight Diet was an integral part of the curriculum. While the FiSH study did not measure children's knowledge levels, it can be assumed that knowledge of nutrition did increase for children as well as parents, and similarly, there was a decrease in red foods among both intervention groups, which may indicate that children were requesting healthier foods after learning about them, or that parents began to regulate more strictly what foods were available to their children.

Objective 2: To find the differences in the change in BMI, and ratio of green to yellow, and red foods chosen between each gender

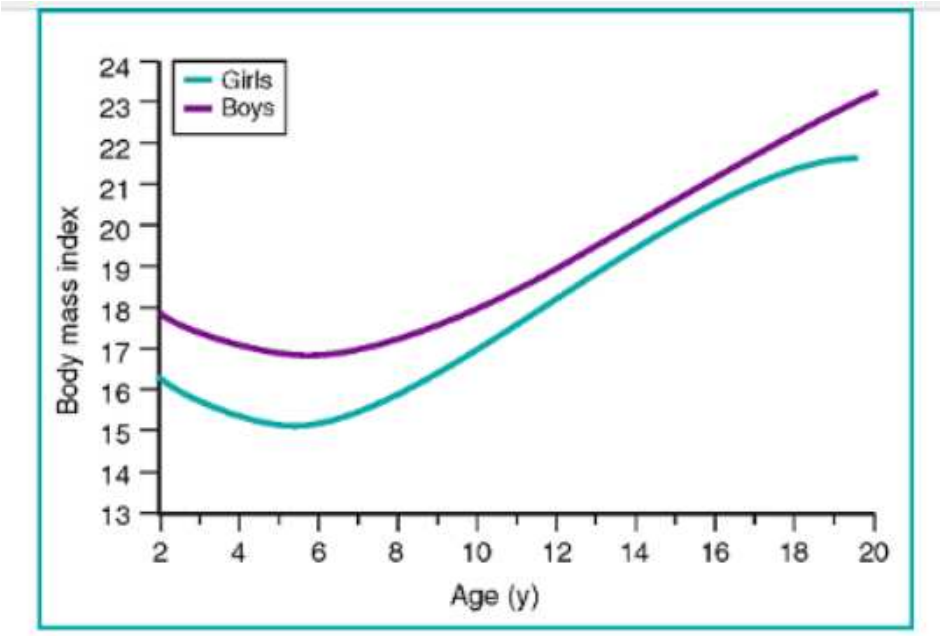
Significant differences were not found in changes in BMI or food choices between the males and females who participated in this study. Our lack of differences by gender was not as conclusive as other studies that reviewed how each gender responds to weight loss. Research suggests that with overweight or obese children, boys tend to stick to diet and exercise plans easier than girls (Epstein, et al. 2001B). Forrester and Jeffery (1986) found that in adults, males had an easier time losing excess weight than females did. Perhaps the difference in gender is more notable at an older age or in people who are overweight. Approximately half of the children in our study were of normal weight or were considered underweight, leaving the other half classified as overweight or obese. Since they were not all overweight, gender differences may not be quite as noticeable.

First grade children also may be more similar in terms of body composition regardless of gender since they are still young (Maynard, et al. 2001; Malina, 1999). In addition, the FiSH study did not assess exercise. If an exercise intervention had been included, or measured for, we may have seen a significant difference between the girls and boys with weight loss and/or BMI percentile change.

Objective 3: To find the relations between children's BMI classifications and changes in the proportion of each color of food consumed pre- and post-intervention

There were no significant relations between change in type of food consumed and change in BMI. BMI status isn't expected to change significantly immediately following the intervention, because it takes time to adjust to a lifestyle change, and with children, growth must be included as a factor as well. Children's BMI classifications will be most likely to change when they hit a growth spurt, since height is a relevant piece of the BMI equation. BMI was measured at each wave, but the last wave was following their fourth grade school year. Significant growth spurts generally occur around the onset of puberty, around age 11 to 13 (Yousefi, et al. 2013). Once a child undergoes his or her pubertal growth spurt, it is thought that at that time their BMI classification is more likely to change. This is because BMI takes a steady but gradual increase throughout childhood and adolescence, and height takes a more rapid increase during puberty age, allowing weight to catch up with height, and therefore leveling out BMI (Figure 1) (Carroll, 2006).

Figure 5.1: Child BMI Changes Over Time (Carrol, 2006)



Objective 4: To find the differences between intervention groups in children's BMI pre- and post-intervention

As previously mentioned in objective 1, there were no significant differences between intervention groups in food choices, so it is logical to find that the results for change in BMI for each intervention group were similar, as well. This can also be accounted for by the fact that the interventions were similar in nature, and by the explanation given under objective 3 on the change in child BMI over time.

Several studies by the author of the Stoplight Diet found success in decreasing childhood overweight and obesity by utilizing the diet as a part of the study intervention method, but also combined focuses such as emphasizing the increase of healthy foods (Epstein, et al. 2001 A), emphasizing a decrease in sedentary activity (Epstein, et al. 2000), emphasizing diet and exercise (Epstein, et al. 1985; Epstein et al. 1984). Our

results may have been similar to the aforementioned studies had physical activity levels been measured throughout the study period.

The compiled studies by Epstein, et al. (1994), also found that the Stoplight Diet was an effective tool in reducing excess weight for overweight or obese children. A focus on increasing green foods, rather than a focus on decreasing red foods was found to be more effective in helping children achieve weight loss, and maintaining it over time (Epstein, et al. 1994).

The Academy of Nutrition and Dietetics' Evidence Analysis Library has concluded that the Stoplight Diet is proven to be associated with short and long-term weight loss in children ages 6 to 12 (AND, N.D.). While short-term weight loss wasn't achieved quickly in this study, it is thought that when study participants apply the principles of the Stoplight Diet in the future, then the overall incidence of overweight and obesity will decrease.

Because our study encompassed a variety of children in different weight classes, it is thought that perhaps the Stoplight Diet is best suited for overweight or obese children, since the aforementioned research shows a strong correlation between the diet and helping overweight or obese children decrease weight. The analyses in this study did not differentiate among BMI classifications in order to maintain an adequately large sample size and, furthermore, to be able to analyze the diets of children of all weight statuses.

Objective 5: To find the relationship between parental education and income level and the child's consumption of red, yellow or green foods and BMI

Income was not found to have a significant impact on food choices, which is contrary to reviewed literature, that states that lower income families are more likely to consume red foods than higher income families (Watt, et al. 2013). A reason for this may be that our sample only included 49 of the families' incomes, and may not have been representative of the original recruited population.

Parent education levels also did not yield a significant impact on food choices, except that children with more highly educated secondary parents had an increase in red foods post-intervention. The secondary parent in this questionnaire was overwhelmingly the father, as mothers were typically the ones who filled out the surveys. Four studies examining the influence of parental demographics on food choices and body weight found that parents with lower levels of education and lower salaries had more overweight and obese children than those with a higher education and income level (Watt, et al. 2013; Pan, et al. 2013; Fernandez-Alvira, et al. 2012; Lamerz, et al. 2005). This seems to be the trend across the United States (Frantzen, et al. 2013).

The recruited families for this study were all from rural towns surrounding the Stillwater, Oklahoma area. The population of Stillwater is approximately 46,000 people, and the populations of the towns in this study ranged between approximately 1,000 to 3,000 people (United States Department of Commerce, 2014). Many of these surrounding cities would qualify as food deserts, as the population isn't high enough to support large grocery stores. Almost 45 percent of the parents who filled out income information were

at or below the federal poverty line (Families USA, 2014), which supports the theory that their communities may be lacking appropriate resources for healthier food options such as fresh fruits and vegetables. However, our results indicated there was no significant difference between children's BMI and food choices based on their parent's income or education levels. This difference in results may be attributed to our limited sample size.

Limitations

The first limitation of this study is the fact that the data were collected several years ago, and the researchers who collected the data and conducted the intervention were not the same investigators in this particular study. This opens up room for error.

Dietary assessment has known limitations given the burden and time commitment it causes subjects. In this study, many parents did not fill out the food records properly. Because of this, several adjustments had to be made. For example, food records were not included in the analyses if at least two full days were not filled out. A record was counted as a full day if it contained foods eaten at breakfast, lunch and dinner, but it was possible that the record was complete if the child actually skipped a meal. Multiple adjustments were made when parents did not include appropriate details in the food records (See: Appendix D).

A third limitation encompasses the aforementioned limitations. Because the food records and interventions took place in the spring semester of 2007, any questions regarding food records could not be directed toward parents who filled out the food records. If this data had been collected more recently, errors could be corrected by contacting each parent within a timely manner to clarify.

Another limiting factor for this study was that out of the 148 families who volunteered for the nutrition intervention, only 61 could be used in the analysis. Since roughly five percent of the recruited children were actually represented in this study, this doesn't give an accurate representation of the study population. It is likely that children from more motivated families turned in four food records. Though there were 61 children who had usable food record data for wave 1, many of them did not remain in the study to finish it. By the end of wave 5, BMI data for only 34 children were available.

Out of the 148 children and their parents who volunteered for the intervention portion of this study and subjects in the control group, at least one food record was returned by 200 of the children, but only 61 children returned at least two food records before and after the intervention. Therefore, food records from 139 children were not used, because they didn't have complete records, or did not return post-intervention records. This represents a high number of subjects that did not adhere to the study protocol by providing requested records. Due to the high amount of records that were incomplete, it seems that perhaps the education sessions on how to fill out the food records may not have been made clear to parents. Even fewer parents filled out demographic questionnaires, so not all of the analyses included every child. Only 49 parents provided information on income.

Since adherence to the program was low, as evidenced by the low return rate for food recordsand participation in measurements through all waves, the efficacy of the Stoplight Diet is more difficult to determine. If more participants had stayed with the program throughout each wave, perhaps more conclusive results could have been drawn.

Another limitation for this is also that no control records were used. If there had been a control group, effectiveness of the Stoplight Diet would have been determined more accurately. A control group allows for natural changes in diet over time to be measured, and compared with those of the intervention groups.

Finally, another limitation is possibly the age of the Stoplight Diet. The book was published in 1988 (Epstein & Squires, 1988). More current research has been done since then, and the methods and foods used in this book may need to be improved upon, to update it.

Conclusion

When properly adhered to, the Stoplight Diet may be an effective intervention for children and their families to change their diets. Though variables such as gender, intervention type, and demographics were not significant in this study, in larger populations, they may be contributing factors to childhood overweight and obesity. In this analysis, we found that the Stoplight Diet was successful in changing eating habits of children and their families. There was a general shift in food colors between pre- and post-intervention with an increase in yellow foods and a decrease in red foods.

The improvement in eating habits is an important outcome, because it will positively impact children's health long term (CDC, 2014). Proper nutrition during childhood and adolescence promotes optimal growth and development, and can help to prevent a multitude of diseases and health problems including high cholesterol, hypertension, cardiovascular disease, cancer, diabetes, obesity, osteoporosis, stroke, nutrient deficiencies, and poor oral health (CDC, 2014).

The type of interventions given (Family, Food and Lifestyle or Family, Food and Lifestyle + Family Dynamics) did not have a significant effect on nutrition choices. Furthermore, there was not a significant difference between each gender and food choices or BMI. Parent demographics and concern also did not have a significant impact on food choices or BMI.

There was not a significant change in children's weight or BMI classifications after the intervention period, or throughout the remainder of the study. Therefore, according to the analyses in this study, the Stoplight Diet may not be an effective short-term weight reduction tool for the children in the study who were overweight or obese. However, the improved eating habits and insights gained from this program may help children make healthy food choices in the future, which might aid in future weight reduction or maintenance of a healthy weight.

Future Research Implications

Further research is needed in order to draw more solid conclusions regarding the efficacy of the Stoplight Diet in this population. An intervention similar to the one completed in this particular study could be useful with some modifications. Strict adherence to the data collection protocol would generate a larger sample size. A larger sample size would be beneficial to the study because it would be more representative of the childhood population.

Another modification would be to ensure that a control group is accounted for throughout the study, to have something to compare to intervention groups. Because there

were no data for participants in the control group for this study, it is unclear if findings came about as a natural shift in diet, or if they were a result of a successful intervention.

Adding an emphasis of exercise to the intervention, in addition to teaching the Stoplight Diet program, as well as having participants record activity levels for each day would also be beneficial for future studies. As the reviewed literature shows, weight loss programs that combine physical activity and dietary changes are more effective than just those on diet alone.

Finally, more research should be conducted to find out why families were so resistant to increasing consumption of green foods, and more options should be explored on methods to increase consumption of green foods. Perhaps an intervention that focuses on increasing green rather than decreasing red would be more effective in changing the proportion of green foods consumed.

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APPENDICES

Appendix A

Food Record Instructions

How to fill Daily Food Chart

"Time" column:

Fill in the time you had the particular food or drink.

"Food or Drink" column:

Fill in the name of the food or drink and provide as many details as possible, for example:

- Indicate whether the food was regular, low-fat, fat-free, whole grain
- Write the way of preparation: baked, boiled, fried, etc.
- Add any spreads and condiments you used, e.g. ketchup, ranch dressing, mayo
- List the brand if available

"Amount" column:

Fill in the amount of the particular food or drink you consumed in commonly used units of measurement, such as cups, fluid ounces, ounces, tablespoons, teaspoons.

Other columns

How to complete the color, protein, grains, dairy and fruit/vegetables columns will be discussed during the sessions.

APPENDIX B

Example food charts

Blank food chart provided to each family

Daily Food Chart

Name_____ Date_____

Time	Food or Drink	Amount	Color	Basic Four Food Groups: Protein	Grains	Dairy	Fruit/Veg

Daily Totals				
Daily Goals				

Example of an incomplete or non-specific food record

Daily Food Chart

Name_____ Date_____

Time	Food or Drink	Amount	Color	Basic Four Food Groups: Protein	Grains	Dairy	Fruit/Veg
Morning	Milk	1 glass					
Morning	Cereal	1 bowl					
Lunch time	Pasta with sauce and meat	1 plate					
Lunch time	Green beans	Small bowl					
Lunch time	Juice	Small bottle					
Afternoon	Bread with jelly and peanut butter	2					
Evening	Chicken	2 pieces					
Evening	Potatoes and gravy	Half plate					
Evening	Carrots	Small bowl					
Evening	Milk	1 glass					
Night	Ice cream	1 cone					

Daily Totals				
Daily Goals				

Example of a complete food record

Daily Food Chart

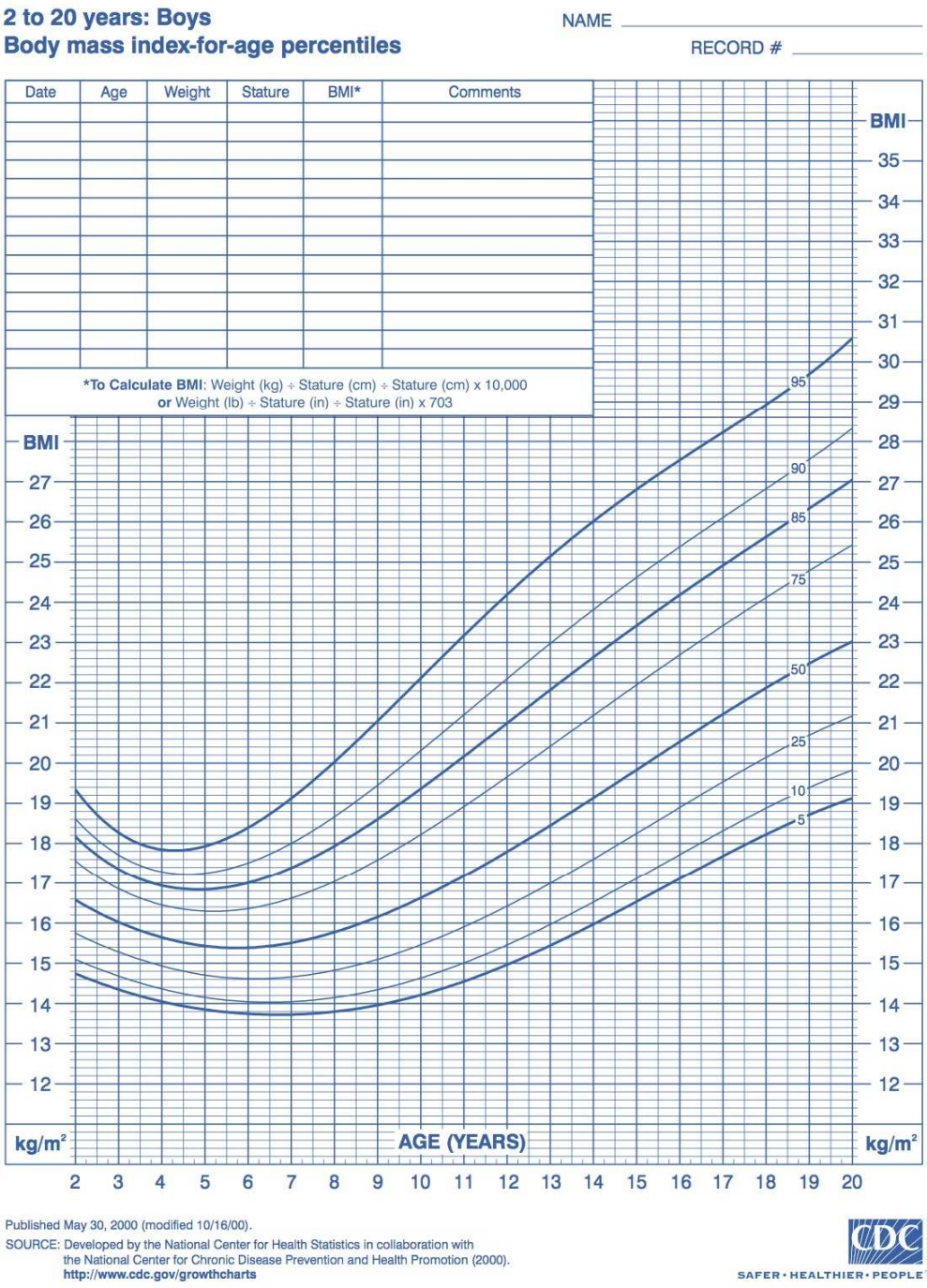
Name_____ Date_____

Time	Food or Drink	Amount	Color	Basic Four Food Groups: Protein	Grains	Dairy	Fruit/Veg
8:15	1% milk	2 cups					
8:15	Cheerios cereal	1 cup					
12:00	Spaghetti pasta	2 cups					
12:00	Marinara sauce with beef	1 cup					
12:00	Green beans boiled	½ cup					
12:00	Orange 100% juice	6 fl ounces					
3:30	Whole wheat bread	2 slices					
3:30	Strawberry jelly – Smuckers brand	1 tablespoon					
3:30	Peanut butter – Skippy Chunky brand	1 tablespoon					
6:00	Fried chicken home made	Leg & half breast					
6:00	Mashed potato	½ cup					
6:00	Gravy	2 tablespoons					
6:00	Carrots cooked	½ cup					
6:00	1% milk	1 cup					
9:00	Braum's chocolate ice cream	¼ cup					

Daily Totals				
Daily Goals				

APPENDIX C

BMI Charts



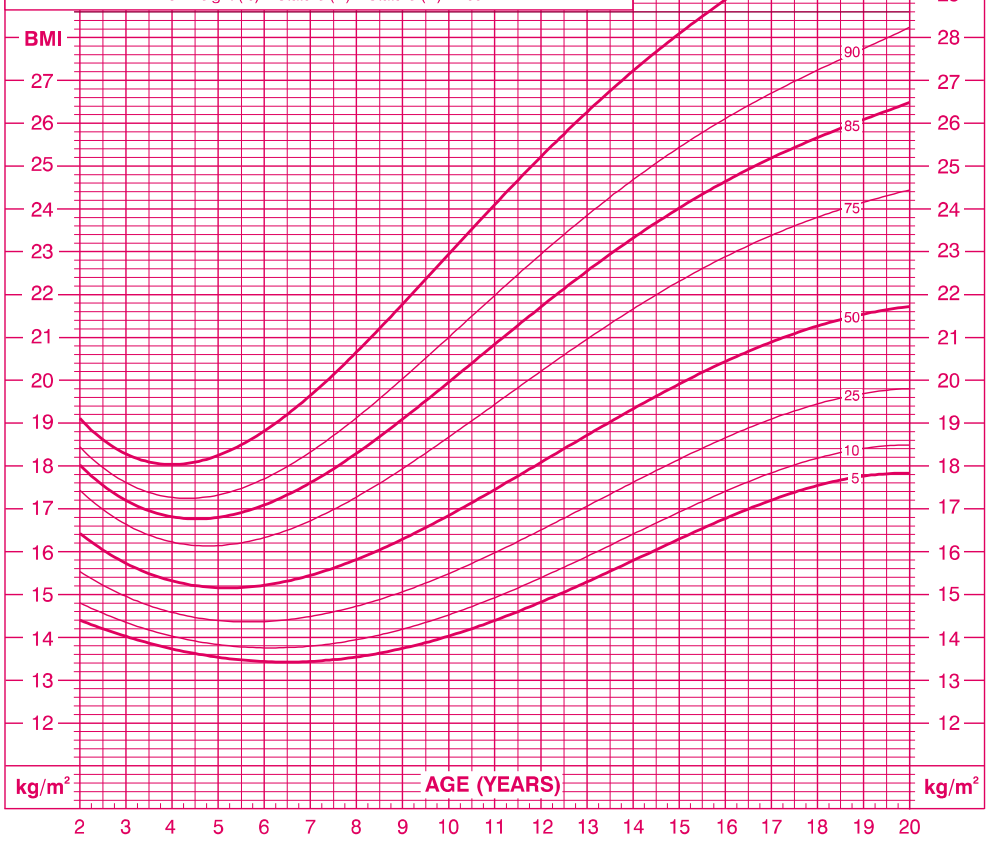
2 to 20 years: Girls
Body mass index-for-age percentiles

NAME _____

RECORD # _____

Date	Age	Weight	Stature	BMI*	Comments

***To Calculate BMI:** Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703



Published May 30, 2000 (modified 10/16/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

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APPENDIX D

Coding Guide for the Stoplight Diet

Coding Guide

Each food is listed under its food group category.

A few things to note while coding

- Some parents are not specific enough on certain items, which can be challenging when deciding where to code it. To cover for this, adjustments have been made so coding can be uniform.
    - Any time “milk” is listed and it does not specify what type of milk (skim, 1%, 2%, or whole), it will be assumed it is 2%, and will be coded red, since 2% is the most common type of milk consumed.
    - If they just list a meat, and don’t say how it was prepared, we will assume it was baked. I.e., “chicken”, we will code it yellow under baked chicken.
- Another thing to note is combination foods. There are millions of them and this list does not cover them all. One of the most commonly eaten foods in a first-grader’s diet that they left out is sandwiches. To adjust for this, I’ve come up with a way to figure out how to do it. Tally up all of the components of the sandwich (and hopefully they were provided for you) and add up the color groups within each. Whatever the majority color group is, will be what that item is coded as. Follow this rule for ANY combination food that isn’t listed in the guide.
    - Example: Peanut butter and jelly sandwich on wheat bread

        - Peanut butter- yellow
        - Jelly- red
        - Bread- yellow
        - We have 2 yellows, 1 red, so since the majority is yellow, the food will be counted as yellow.

- One other thing to consider is cereal. Because this is a 2-ingredient meal (typically just cereal and milk), don't use the system above; for this we will code milk as its own color and cereal as its own color, so you will have two colors for this.
- The only things listed under "pasta" in the grains section are plain noodles as well as macaroni and cheese. To find spaghetti, lasagna, etc., look under "combination foods"
- For salad dressings: non-creamy refers to low or non-fat; anything creamy is full fat. If this isn't specified, mark it as full fat.

Food	Green	Yellow	Red
Protein			
Eggs (plain or made with cooking spray)			
Boiled		x	
Omelet		x	
Poached		x	
Scrambled		x	
Fried		x	
Omelet with cheese		x	
Omelet with vegetables		x	
Eggs (cooked in fat--oils or butter)			
Fried in fat			x
Scrambled in fat			x
Fish (Baked, grilled, boiled			
Not fried, not breaded)			
Anchovies		x	
Bass		x	
Clams		x	
Cod		x	
Crab		x	
Flounder		x	
Haddock		x	
Halibut		x	

Herring		x	
Lobster		x	
Oysters		x	
Perch		x	
Salmon		x	
Sardines		x	
Scallops		x	
Scrod		x	
Shrimp		x	
Sole		x	
Tuna canned in water		x	
Whitefish		x	
Fish-Breaded and fried			
Any of the above-mentioned breaded/fried			x
Crab cake			x
Fish sticks			x
Tuna canned in oil			x
Poultry (non-fried, skinless, unbreaded)			
Chicken breast		x	
Chicken drumstick		x	
Turkey		x	
Fried chicken (nuggets, tenders, popcorn, etc.)			x
Fried turkey			x
Capon			x

Duck			x
Goose			x
Nuts			
Peanut butter		x	
Almonds		x	
Brazil		x	
Cashews		x	
Macadamia		x	
Mixed		x	
Peanuts		x	
Pecans		x	
Pistachios		x	
Soybeans		x	
Walnuts		x	
Red meat			
Beef			
Ground beef		x	
Roast		x	
Steak		x	
Brisket			x
Corned beef			x
Creamed beef			x
Dried beef (beef jerky)			x
Lamb			
Lamb Chops		x	

Roast		x	
Steak		x	
Organ meats			
Heart		x	
Kidney		x	
Liver		x	
Tongue		x	
Pork			
Canadian bacon		x	
Pork Chops		x	
Ham		x	
Roast		x	
Bacon			x
Kielbasa			x
Sausage			x
Veal			
Chop		x	
Cutlet		x	
Roast		x	
Steak		x	
Hot dogs		x	
Grains			
Breads			
Bagel		x	

Biscuit		x	
Bun (hot dog or hamburger)		x	
Cracked wheat		x	
Croutons		x	
Breadcrumbs (used for baking)		x	
Dinner roll		x	
English muffin		x	
French		x	
Italian		x	
Rye		x	
Breadsticks		x	
Tortilla shell		x	
White bread		x	
Wheat bread		x	
Banana bread			x
Cornbread			x
French toast			x
Pancake			x
Croissant			x
Danish pastry			x
Date-nut bread			x
Donuts			x
Muffin			x
Stuffing			x

Sweet roll			x
Pop-Tart or toaster strudel			x
Waffle			x
Cereals (Unsweetened)			
All-bran		x	
Bran Chex		x	
Cheerios		x	
Corn Chex		x	
Cornflakes		x	
Cream of wheat, plain		x	
Farina		x	
Grape nuts		x	
Oatmeal, plain, or with fruit		x	
Puffed rice		x	
Puffed wheat		x	
Rice Chex		x	
Rice krispies		x	
Shredded wheat		x	
Special k		x	
Wheat Chex		x	
Wheaties		x	
Barley			x
Breakfast bars			x
Buck wheat			x

Cream of wheat, sweetened			x
Granola			x
Life cereal			x
Oatmeal, sweetened			x
Raisin bran			x
Sugar coated (frosted flakes, cap'n crunch, etc.)			x
Crackers			
Cheez-its		x	
Goldfish		x	
Graham crackers		x	
Matzo		x	
Oyster crackers		x	
Ritz		x	
Rye crisp		x	
Saltines		x	
Soda crackers		x	
Triscuits		x	
Vegetable thins		x	
Wheat thins		x	
Zweiback		x	
Pasta			
Noodles, plain		x	
Chow mein			x
Macaroni and cheese			x

Rice, boiled or steamed		x	
Quinoa		x	
Fried rice			x
Rice-a-roni			x
Fruits & Vegetables			
Non-Starchy Vegetables			
Asparagus	x		
Green beans	x		
Italian beans	x		
Wax beans	x		
Bean sprouts	x		
Beets	x		
Broccoli	x		
Brussels sprouts	x		
Cabbage	x		
Carrots	x		
Cauliflower	x		
Celery	x		
Collards	x		
Cucumber	x		
Eggplant	x		
Endive	x		
Kale	x		
Lettuce	x		

Mushrooms	x		
Okra	x		
Onions	x		
Parsley	x		
Peppers	x		
Radishes	x		
Rutabaga	x		
Salad, tossed	x		
Sauerkraut	x		
Spinach	x		
Squash	x		
Tomatoes	x		
Tomato juice	x		
V8 juice	x		
Zucchini	x		
Starchy vegetables/legumes			
Artichokes		x	
Chick peas		x	
Kidney beans		x	
Lentils		x	
Lima beans		x	
Navy beans		x	
Pinto beans		x	
Pickled beets		x	

Corn		x	
Peas		x	
Potatoes (no butter or fat-- baked, mashed, boiled)		x	
Potatoes au gratin			x
Baked potato with butter			x
French fries			x
Hash browns			x
Mashed potatoes with butter or fat			x
Coleslaw			x
Baked beans			x
Potato salad			x
Creamed vegetables (creamed corn, etc.)			x
Scalloped potatoes			x
Sweet potatoes			x
Tater tots		x	
Pumpkin		x	
Succotash		x	
Fruits			
Apple		x	
Applesauce, unsweetened		x	
Apricot		x	
Banana		x	
Blackberries		x	
Blueberries		x	

Cantaloupe		x	
Casaba		x	
Cherries		x	
Grapefruit		x	
Grapes		x	
Honeydew melon		x	
Lemon		x	
Mango		x	
Nectarine		x	
Orange		x	
Papaya		x	
Peach		x	
Pear		x	
Pineapple		x	
Plums		x	
Pomegranate		x	
Raspberries		x	
Strawberries		x	
Tangerine		x	
Watermelon			x
Avocado			x
Dates			x
Figs			x
Prunes			x

Raisins			x
Fruit Juices			
Apple		x	
Grapefruit		x	
Orange		x	
Orange-grapefruit		x	
Pineapple		x	
Tangerine		x	
Apricot			x
Cranberry			x
Grape			x
Peach nectar			x
Pear nectar			x
Prune			x
Mixed fruit			x
Dairy			
Cheese			
American		x	
Blue		x	
Brick		x	
Cheddar		x	
Cottage		x	
Mozzarella		x	
Parmesan		x	

Romano		x	
Roquefort		x	
Swiss		x	
Milk			
Buttermilk		x	
One percent		x	
Powdered		x	
Skim milk		x	
Chocolate			x
Cocoa/hot chocolate			x
Two percent			x
Whole			x
Yogurt			
Low-fat plain		x	
Skim plain		x	
flavored			x
Ice cream			
Bars			x
Regular (scoops or cone)			x
Shake			x
Ice cream float			x
Soft serve			x
Miscellaneous Dairy			
Cheese spread			x

Eggnog			x
Ice milk			x
Instant breakfast			x
Pudding			x
Sherbet			x
Frozen yogurt			x
Combination Foods			
Cabbage roll		x	
Chop suey		x	
Chow mein		x	
Fish loaf		x	
Meatloaf		x	
Cheese pizza		x	
Soup, non-creamy		x	
Bean soup		x	
Beef noodle soup		x	
Vegetable beef soup		x	
Chicken gumbo		x	
Chicken noodle soup		x	
Chicken rice soup		x	
Chicken vegetable soup		x	
Clam chowder		x	
Onion soup		x	
Tomato soup		x	

Turkey noodle soup		x	
Turkey vegetable soup		x	
Vegetable soup		x	
Wonton soup		x	
Soups (creamy or high fat)		x	
Cheese soup			x
Chunky soups			x
Creamy (Cream of chicken, cream of mushroom, etc.)			x
Minestrone soup			x
Split pea soup			x
Tomato soup with whole milk			x
Spaghetti with plain tomato sauce (no meat)		x	
Spanish rice		x	
Vegetable beef stew		x	
Chicken a la king			x
Chicken salad			x
Chili and beans			x
Deviled crab			x
Egg roll			x
Egg salad with mayo			x
Lasagna			x
Macaroni and cheese			x
Ramen noodles			x
Pot pie			x

Pork and beans			x
Tuna noodle casserole			x
Tuna salad with mayo			x
Spaghetti with meat sauce			x
Condiments and Spices			
Herbs and spices	x		
Horseradish	x		
Lemon juice	x		
Mustard	x		
Soy sauce	x		
Vinegar	x		
Worcestershire sauce	x		
A1 steak sauce		x	
Barbecue sauce		x	
Ketchup		x	
Olives		x	
Pickles		x	
Relish		x	
Drinks			
Club soda	x		
Coffee, black, unsweetened	x		
Mineral water	x		
Seltzer water	x		
Diet sodas	x		

Tea, unsweetened	x		
Water	x		
Hawaiian punch			x
Hi-c			x
Capri sun			x
Kool-Aid			x
Lemonade			x
Orangeade			x
Sodas, regular			x
Tang			x
Sweet tea			x
Tonic water			x
Broth	x		
Salad dressing			
French, non-creamy		x	
Italian, non-creamy		x	
Oil and vinegar		x	
Blue cheese			x
Mayonnaise			x
Russian			x
Ranch			x
Thousand island			x
Italian, French creamy			x
Fats and Oils			

Butter			x
Margarine			x
Oils			x
Frozen desserts			
Fudgesicles			x
Popsicles			x
Jell-O			x
Pies			x
Hot fudge, caramel, dessert sauces			x
Seeds (sunflower, etc.)			x
Snacks			
Pork rinds			x
Cheetos			x
Corn chips			x
Cracker jacks			x
Popcorn with butter			x
Popcorn without butter		x	
Potato chips			x
Jelly, jam, preserves			x
Honey			x
Maple syrup			x
White sugar			x
Fast Foods			
Single hamburgers (kids meal size)		x	

Cheese pizza		x	
Roast beef sandwich		x	
French fries, tater tots			x
All McDonald's breakfast			x
Double hamburgers, cheeseburgers, 1/4 pounders			x
All other fast foods			x

VITA

Chelsie Nicole Tull

Candidate for the Degree of

Master of Science

Thesis: EFFECTIVENESS OF A NUTRITION AND LIFESTYLE INTERVENTION IN FIRST-GRADE CHILDREN

Major Field: Nutritional Sciences

Biographical:

Education:

Completed the requirements for the Master of Science in Nutritional Sciences at Oklahoma State University, Stillwater, Oklahoma in July 2014.

Completed the requirements for the Bachelor of Science in Nutrition at University of Central Arkansas, Conway, Arkansas in May 2012.

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Dietetic Intern at Oklahoma State University 2012-present
Nutritional Services Ambassador at Baptist Health Little Rock, AR in 2011

Professional Memberships:

Academy of Nutrition and Dietetics student member
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