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THE EFFECTIVENESS OF A STRUCTURED, LONG-TERM, MULTI-
COMPONENT, FAMILY-BASED WEIGHT MANAGEMENT PROGRAM IN
REDUCING BODY MASS INDEX Z-SCORES AND IMPROVING LIFESTYLE
HABITS IN OVERWEIGHT/OBESE CHILDREN AND ADOLESCENTS

by

D. Pauline Williams

A dissertation submitted in partial fulfillment
of the requirements for the degree

of

DOCTOR OF PHILOSOPHY

in

Nutrition, Dietetics, and Food Science

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ABSTRACT

The Effectiveness of a Structured, Long-term, Multi-component, Family-Based
Weight Management Program in Reducing Body Mass Index z-Scores
and Improving Lifestyle Habits in Overweight/Obese
Children and Adolescents.

by

D. Pauline Williams, Doctor of Philosophy

Utah State University, 2011

Major Professor: Dr. Nedra K. Christensen
Department: Nutrition, Dietetics, and Food Science

Few studies have evaluated structured, long-term, family-based, weight management programs in children. This study's purpose was to determine if completion of such a program resulted in reduced body mass index (BMI) z-scores and improved lifestyle habits.

An observational study overtime from 2008-2010 was conducted with 89 overweight/obese children. Subjects were divided into two groups, compliers (completed ≥ 7 intervention classes) and non-compliers (completed <7 intervention classes.) The LiVe program, a 12-month structured, multi-component, family-based program, served as the study intervention. Anthropometric measurements and a written survey on lifestyle

habits were used to obtain changes over 12 months in anthropometric, nutrition, activity, and behavior habits for subjects.

Descriptive statistics, chi square, analysis of co-variance, and a mixed model logistic regression were used to determine anthropometric and lifestyle habits change over time as well as differences between age, gender, and compliance groups. No demographic differences were seen between compliance groups. Compliers had a significant decrease in BMI z-score (-0.1903 $p=.0004$) and BMI percentile (-2.02 $p=.0235$) over time. Compliers had a higher probability of meeting vegetable intake (pre 0.31%, post 55.67%; $p<.0001$), and physical activity guidelines (pre 13.58%, post 56.58%; $p=.0032$) post intervention. Males were more likely than females to meet the physical activity guideline ($p=.0007$). Both compliers and non-compliers had a higher probability of meeting fruit ($p=.0015$) and sugar-sweetened beverage intake guidelines ($p=.0337$) at 12 months. No significant differences in age and gender were seen for changes in anthropometric or lifestyle habits except as noted above.

Long-term, family-based, structured weight management programs are effective in reducing BMI z-scores and improving lifestyle habits in children. Continued development and evaluation of these programs is warranted to address childhood obesity treatment methods.

DEDICATION

For my parents, Dwight and Carol Williams, who encouraged life-long learning, taught me perseverance, and supported and encouraged me in doing hard things.

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D. Pauline Williams

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CHAPTER 1

INTRODUCTION

Background

The prevalence of pediatric overweight/obesity (overweight), in the United States and Utah is increasing at an accelerated rate. Current data from the National Health and Nutrition Examination Survey, (NHANES) show the prevalence of overweight at 19% among US children 6 to 11 years old and 17% among adolescents 12-19 years old. This represents a nearly 50% increase since the mid 1980's.¹ Utah is following national trends. The number of Utah children at an unhealthy weight increased dramatically from 1993 to 2006 and held steady from 2006 to 2008. In 2008, an estimated 21.5 percent of Utah elementary school students were overweight or at risk of becoming overweight.² In 1994 16.9% of Utah 3rd graders were at an unhealthy weight compared to 19.7% in 2008 – a 17% increase.³ If the number of elementary school students at an unhealthy weight continues to increase at the current rate, by 2016 a total of 30.3% of elementary school students will be at an unhealthy weight.⁴ A high BMI in childhood is a predictor of obesity in adulthood.⁵ Studies suggest that 80 percent of overweight adolescents will become overweight adults.⁶

Various researchers and associations, such as the American Academy of Pediatrics (AAP) and American Dietetic Association (ADA) have published evidenced-based lifestyle recommendations for the prevention and treatment of obesity in children.⁷⁻¹³ Increasing the proportion of overweight/obese youth meeting evidenced-based lifestyle recommendations is a potential strategy in combating obesity. To

accomplish this strategy we must first, understand what recommendations overweight/obese youth are or are not meeting, second design programs that incorporate guidelines and recommendations, and third evaluate these programs.

We currently know very little about the lifestyle habits of overweight children enrolled in structured weight management programs and there is a paucity of studies, which evaluate structured, multi-component, long-term, family-based, weight management programs.¹⁴ Weight management programs are varied in time, educational techniques, instructor background, and topic focus. Continued development and evaluation of programs designed to treat child and adolescent overweight is warranted to address the public health issue of childhood obesity.¹⁵

Hypothesis and Objectives

Hypothesis

Participation in a structured, long-term, multi-disciplinary, family-based weight management program will result in decreased body mass index (BMI) z-scores and an increase in percent of overweight children meeting lifestyle recommendations for weight management.

Objectives

The study objectives include:

1. Determine if overweight youth, referred to a structured weight management program, are adhering to lifestyle recommendations.

2. Determine if completion of a structured weight management program results in an increase in percent of overweight children adhering to lifestyle recommendations.
3. Determine if completion of a structured weight management program results in decreased body mass index (BMI) z-scores.
4. Identify any differences in lifestyle habits, BMI-z-scores or changes in habits and BMI z-scores between age and gender.

The accomplishment of these objectives will be presented in chapters two and three.

Literature Review

Childhood obesity is a complex with disease with many possible causes and treatments. This literature review looks at the following areas related to childhood obesity:

1. Background
 - a. Prevalence
 - b. Health risks
2. Interventions to treat overweight
 - a. Diet (balanced macronutrients, traffic light, food pyramid)
 - b. Activity
 - c. Treatment format
3. Factor associated with overweight

- a. Nutrition (beverages, fruit juice, sugar containing beverages, dairy and calcium, fruits and vegetables, fat, total energy)
- b. Behaviors (frequency, snacking, breakfast)
- c. Activity (physical activity, participation in sports, sedentary activity)
- d. Home environment and parent child relationship

Background

Prevalence

The prevalence of pediatric overweight, in the United States and Utah is increasing at an accelerated rate. Recent data from the National Health and Nutrition Examination Survey, (NHANES) show the prevalence of overweight at 19% among US children 6 to 11 years old and 17% among adolescents 12-19 years old. This represents a nearly 50% increase since the mid 1980's.¹ Utah is following national trends. The number of Utah children at an unhealthy weight increased dramatically from 1993 to 2006 and held steady from 2006 to 2008. In 2008, an estimated 21.5 percent of Utah elementary school students were overweight or obese and 29.1% of high-school age children were overweight or obese.² In 1994 16.9% of Utah 3rd graders were at an unhealthy weight compared to 19.7% in 2008 – a 17% increase.³ If the number of elementary school students at an unhealthy weight continues to increase at the current rate, by 2016 a total of 30.3% of elementary school students will be at an unhealthy weight.⁴

A high BMI in childhood is a predictor of obesity in adulthood.⁵ Studies suggest that 80 percent of overweight adolescents will become overweight adults.⁶

Health risks

Conditions and illnesses previously only seen in adults are now seen in overweight children. Health risk associated with obesity include type 2 diabetes, dyslipidemia, hypertension, sleep apnea, orthopedic problems, depression, and non-alcoholic fatty liver disease.^{6,8}

Interventions to Treat Overweight

Various treatments are used in overweight programs. Just as overweight is not caused by one item, we should not assume that treatment should include only one area. The most effective weight management programs use a combination of interventions in treatment.¹³ Areas of intervention include diet, activity, behavior, and adjunct therapy.

Dietary Therapy

Macronutrient Distribution. The dietary reference intakes (DRI) recommend a macronutrient distribution of 45-65% of calories from carbohydrate, 20-35% of calories from fat, and 10-35% of calories from protein.¹⁶ Young children may need slightly more fat, up to 40%.¹⁶ A controversial and very popular intervention in adult weight management includes altering the proportion of protein and carbohydrate. Studies looking at the amount of protein and carbohydrate in the diet in obese adolescents have found no benefit of a higher protein diet, with the same energy intake, in weight management of adolescents.¹⁷ Structured meal plans prescribing caloric content and nutrient distribution may be difficult for children and adolescent to maintain. Savoye et al reported an 83% dropout rate, in children randomly assigned to a structured meal plan

group assessing a weight management program.¹⁸ Children in the same program not assigned to a structured meal plan had a 40% drop out rate.¹⁸

Traffic Light Diet. Leonard H. Epstein developed the Traffic Light or Stop Light Diet for use in family-based childhood overweight research.¹³ Epstein and colleagues use the Traffic Light Diet as a component in a core package of intervention programs. The diet divides food into five categories: 1) fruits and vegetables, 2) grain, 3) milk/dairy, 4) protein, and 5) other. Each food category is then coded according to the traffic light colors as follows. Green: foods containing less than 20 calories per serving. Yellow: foods commonly eaten that are nutrient dense (contain a number of vitamin/minerals compared to calories). Red: foods that are high in fat and simple sugars and have a large number of calories for nutrients provided. In addition to categorizing foods in groups and “colors”, the Traffic Light Diet also reduces caloric intake to 900-1500 calories.¹³

Children, in intervention programs, using the Traffic Light Diet and alterations of the concept of the Traffic Light Diet have demonstrated weight loss.¹⁹⁻²² A 10-year follow up study, using the Traffic Light Diet, showed maintenance of weight loss over the long term.²⁰

The Traffic Light Diet is a visual way of helping children and families understand the nutrient density (nutrients per calorie) of foods. However, research surrounding the Traffic Light Diet always uses the diet as one piece of full weight loss program. Other interventions, in addition to or separate from the Traffic Light Diet may be promoting weight loss and maintenance.

Food Pyramid. The 2005 USDA Food Guide was designed to promote healthy eating and physical activity. The 2010 Dietary Guidelines refer to the food guide as a tool

to balance calories and manage weight.²³ The food guide is often used in research as a comparison tool for assessing intake to standards. Adolescents in a multi-component weight program, emphasizing the food guide, showed a decrease in BMI z-scores.²² As with the Traffic Light Diet, the food guide is used, as one piece of full weight loss program and other factors may be affected changes in BMI.

Dietary Guidelines for Americans. The 2010 Dietary Guidelines for Americans devote an entire chapter to intervention and guidance that can help consumers balance calories and manage weight. Evidenced based topic areas provide tips and guidance for children and adolescents in achieving and sustaining a healthy weight. The areas include adequate daily physical activity, limiting screen time, consuming breakfast, limiting intake of sugar sweetened beverages, prudent consumption of fruit juice, and increased intake of vegetable, fruit, and low-fat dairy products within the food guide parameters.²³

Activity

Weight management programs that include physical activity as part of the intervention show significant improvements in weight status and fat mass. Gutin et al compared adolescents in a weight program who participated in physical activity as part of the program to adolescents who received didactic physical activity training.²⁴ Those in the physical activity group showed more significant changes in percent body fat and cardiovascular fitness than participants who received only physical activity education.²⁴ Adolescents encouraged to set physical activity goals, track time spent in physical activity, and report physical activity showed decreased BMI z-scores compared to

adolescents who only received a discussion about physical activity.²² Successful weight programs include actually physical activity, not just discussions of physical activity.

Treatment format

Individual or Group. Little evidence exists to determine if there is a difference in effectiveness between individual or group weight management programs. A study looking at 31 families randomized to group intervention or individual plus group intervention showed no significant difference in decline in BMI between treatment programs. The group intervention was more cost effective, however.²⁵ A Brazilian study comparing individual and group based programs showed both were effective in weight management. The group based program participants had greater increases in physical activity and showed larger decreases in blood cholesterol levels.²⁶

Multicomponent Interventions. Multicomponent programs focus on more than one area of education and behavior change. Areas may include: nutrition, physical activity, environment, and eating behaviors. There is a paucity of studies, which evaluate multicomponent programs, suggesting more research is needed to assess this intervention strategy.¹⁴ The Centers for Disease Control (CDC) reviewed six databases to identify programs that evaluated weight or body fat in the pediatric populations. Only seven studies were identified, three of which used a multicomponent strategy. Of those three programs, two showed weight loss, while one did not.¹⁴ Multicomponent strategies have been used in schools with success.^{27,28} Schools in the Mid-Atlantic area, showed a 50% reduction in the incidence of overweight, for 4 through 6 graders, with a multicomponent

School Nutrition Policy Initiative.²⁷ A high school program focusing on nutrition, physical activity, and behavior also shows promising changes in eating and activity.²⁸

Family-Focused Programs. Parents have a strong influence on children's attitudes and behaviors regarding weight.²⁹⁻³¹ The home environment is a key factor in determining eating and physical activity habits.^{32,33} However, the CDC indicates there is a need to review more programs that include parental involvement to further evaluate their success.¹⁴

Duration of Intervention. Guidelines from the dietetic and medical associations provide recommendations for length of treatment for their individual disciplines, but not for a multi-disciplinary program. The ADA recommends intensive Medical Nutrition Therapy for at least three months or until initial weight-management goals are achieved.¹³ A greater frequency of contacts between the patient and practitioner may lead to more successful weight loss and maintenance.¹³ The AAP recommends frequent office visits, with the primary care physician; weekly visits for a minimum of 8 to 12 weeks seem to be most efficacious. Subsequently, monthly visits are recommended to help maintain new behaviors.¹⁰ Overweight and obesity are chronic, often life-long, conditions, thus follow-up weight-management plans should be implemented after the intensive phase of treatment; however, the length a time for follow-up, in pediatric programs, has not been suggested by major associations. The National Health Lung and Blood Institute (NHLBI) recommends a six-month treatment program for adults, but does not have recommendations for children.³⁴ The growth and development issues in children and adolescents argue for more flexibility in length of treatment. Also, weight loss may not be

appropriate for all children, so the practitioner should use their clinical judgment when applying the NHLBI criteria for adults to children.¹³

Structured, long-term Programs. There is little in the literature assessing the effectiveness of structured, long-term, weight management programs. However, available studies show beneficial effects of these types of programs on body composition, fitness, and lipid profiles.^{15,18,35,36} Participants in structured 6 to 12-month weight programs showed a reduction in BMI, BMI z-score, and percent body fat while control groups showed no significant reduction or an increase in BMI and body fat.^{15,18,35} Continued development and evaluation of programs designed to treat child and adolescent overweight is warranted to address the public health issue.¹⁵

Factors Associated With Overweight

Preventing and treating overweight starts with an understanding of the possible causes of overweight. Many areas may affect weight status and include: diet content, eating and diet behaviors, activity, and home environment and child/parent relationship.

Nutrition

Measuring the diet content of children can be difficult; children may not accurately remember or be able to relay the types and amounts of food they eat. Various methods can be used to assess diet content in children such as food frequencies, diet recalls, surveys, and photos of plate before and after a meal. Even though diet content can be difficult to measure, a review of multiple studies allows the opportunity to see trends in diet content and the effect on BMI and weight gain.

Beverages. Beverage intake has been studied for its effect on weight gain and BMI in children and adolescents. Beverage intake generally refers to fruit juice, sugar-sweetened beverages, and milk; coffee, tea, and alcohol are often excluded, as the intake is minimal in the pediatric population.

Age, gender, and race affect amount and type of beverage consumption. Younger children's (ages 6-11) beverage of choice is milk.³⁷ Older children (ages 11-19) tend to drink less milk and more orange juice, soda, ice tea, and punch than younger children.^{37,38} A three-year prospective cohort study of 9- to 14-year-olds found that milk intake declined significantly each year in the study and soda intake rose significantly.³⁸ Boys tend to have a higher overall beverage consumption than girls. The type of beverages consumed also varies, between genders, and thus has a different impact on weight.³⁷ In boys, intakes of diet soda and sugar-added beverages have been significantly associated with weight gain. In girls, the intakes of milk and sugar-added beverages have been associated with weight gain.³⁸ White teenagers tend to drink more milk than African-American teenagers. White adolescent boys are the heaviest consumers of soda, drinking more than African-American or Hispanic adolescent boys.³⁷ Hispanic adolescent girls drink more soda than white or African-American adolescent girls.³⁷ In a school based intervention program, participants who increased fruit intake, while decreasing soda juice intake also had a decrease in BMI z-scores.³⁹

The beverage of choice may affect total caloric intake. Berkey found that milk, fruit juice, and sugar-added beverages were all associated with increased total daily caloric intake.³⁸ However, when looking at the per serving effect of the beverages on total energy intake, fruit juice and sugar-added beverages were considerably larger than their

own energy content. For example a serving of milk provides between 80 (skim) to 160 Kcal (chocolate); yet a serving of milk increased total energy intakes by 160-180 Kcals – close to the actual energy of the milk beverage. Fruit juice provides 80 Kcals per serving but increased total energy intake (of all types of food) by 270-280 Kcals – much more than the energy intake from the beverage itself.³⁸

Fruit Juice. A prudent intake of fruit juice – no more than 4-6 oz/day for children and 8-12 oz/day for adolescents is recommended to prevent and treat overweight.^{8,9} The intake of fruit juice appears to be a weak predictor of BMI and weight. A regression model of the USDA Continuing Survey of Food Intake by Individuals (CSFII) found no association with any beverage consumption and BMI and two studies of children in the Women, Infants, and Children (WIC) program, in Georgia and North Dakota, along with a longitudinal study in the southern US showed no association between fruit juice intake and BMI.^{37,40,41} However, separate study showed juice intake increased overall daily energy intake; a serving of fruit juice, with 80 Kcal, resulted in the consumption of an additional 270-280 Kcal of other foods daily.³⁸ The increased caloric intake could lead to increased weight gain.

Sugar Sweetened Beverages. Professional associations and healthcare companies advocate that the intake of sugar-sweetened beverages be limited to 0-12 oz/month.^{8,10,38} A dose response has been seen between soda intake and BMI – the greater the soda intake the higher the BMI z-score. Adolescents consuming at least one serving of sugar-added beverages gained significantly more BMI in a three-year period than those consuming less than 0.5 servings per day; the higher the intake of sugar-added beverages, the higher the increase in BMI.³⁸ Sixth and seventh graders who drank three or more sodas a day

had a higher BMI z-score, more percent body fat, and were more likely to be overweight (BMI >85 percentile) than their peers who drank less than three sodas a day. The more sodas a participant consumed, the higher the BMI z-score and percent body fat.³⁷

Interestingly – BMI is positively correlated with the intake of diet beverages.^{37,38} The correlation may be attributed to the consumption of diet beverages to decrease weight.

Dairy and Calcium Intake. A diet rich in calcium is recommended for prevention of obesity.¹⁰ Two to three cups of milk or equivalent daily are recommended for youth ages 4-18 to meet calcium needs.⁷ Children who drink milk have average calcium intake near the dietary recommended intakes.¹⁶ Milk avoiders have lower calcium intakes than milk drinkers even when the avoiders eat other dairy products.⁴² Black et al found average dietary calcium intake of milk avoiders between 420-478 mg/day – well below the dietary recommended intake of 800-1300 mg/day for children ages 4-18.¹⁶ Milk drinkers also tend to have lower intakes of soft drinks and fruit drinks.³⁸ Children who drank more milk and less diet soda were leaner.³⁸

The effect of dairy and calcium on BMI, in the literature, is mixed. Milk drinkers have higher energy intakes than non-milk drinkers, yet milk drinkers ages 2-11, have comparable BMI z-scores to their non-milk drinker counterparts, while milk drinkers ages 12-18 have higher BMI z-scores than their non-milk drinker counterparts.^{38,43-45} A Canadian study found no difference in milk intake between obese and non-obese adolescents while another study showed children who drank more than three servings of milk daily had higher BMI increases than those who drank only one to two servings a

day.^{40,46} Calcium has been negatively correlated to percent body fat; an increase of one serving (8 oz) of milk or yogurt a day (about 300 mg calcium/day) can lead to a decrease in body fat of 0.4% a statistical, but not necessarily clinical difference.^{42,47} A longitudinal study of 5- to 9-year-old girls showed those who met the AI (adequate intake) for calcium had higher energy intakes, than girls who did not meet the AI, but the girls were not heavier than those with low calcium intakes.⁴³

Fruit and Vegetable Intake. Fruits and vegetables are low in calories, nutrient dense, and high in fiber and satiety value making them potential tools for weight management. The AAP and health care organizations encourage consumption of diets with fruits and vegetables in amounts recommended by the USDA food guide.^{8,10} The food guide recommends 2-1/2 to 6-1/2 cups of fruits and vegetables daily for youth depending on age, gender, and activity level.⁷ Even though fruit and vegetable availability in the US has increased in the past decade, intake by children is inadequate. Only 21% of female and 25% of male high school students consumed sufficient fruits and vegetables.⁴⁸ Fruit and vegetable intake has been independently associated with weight reduction behaviors such as decreased caloric intake, increased physical activity, and decreased screen time, but may not be linked directly to weight reduction.⁴⁸⁻⁵⁰ A potential reason for no direct link is one-third of the available vegetables in the US consist of potatoes, in the form of French fries and potato chips, which may skew vegetable's effects on weight in epidemiologic studies.¹³

While fruit and vegetable intake appears to promote weight reduction behaviors, the intake of fruit and vegetables may not be linked to weight reduction. An analysis of the CFSII data found no association between dietary intake of fruits and vegetables and

BMI.⁴⁹ A study looking at the food patterns of pre-school children in the WIC program also found no significant relationship between the total intake of fruits and vegetables and weight change.⁵⁰

Fat Intake. Fat is a nutrient of interest in weight management, because of its high energy density. Food frequencies or self-reports of food intake are often used to assess fat intake. These methods may not capture very small changes in fat intake, which may affect weight.¹³ Also many studies review total fat and saturated fat intake, but may not look at the affect other fats, such as poly or mono unsaturated, may have on weight. Dietary recommendations suggest a fat intake of 25-30% of calories with less than 10% coming from saturated fat.¹⁶ Adolescent's fat intake is on the high end of the recommendation – averaging about 33% of caloric intake. Only about 25% of youth meet the dietary recommendations for fat of less than 35% of calories from total fat and less than 10% of calories from saturated fat.⁵¹

Some studies show that dietary fat and percent of calories from fat are positively correlated to BMI, while others show no relationship between fat intake and BMI.⁵²⁻⁵⁴ A study in WIC children found that total fat intake was not associated with weight change, but intake of “fat foods” was positively associated with weight gain.⁵⁰ A high fat diet ($\geq 30\%$ of calories from fat), in girls ages 5-7, was associated with a greater increase in skinfold thickness and BMI than the same age girls consuming a low fat ($< 30\%$ calories from fat) diet.⁵⁵ Fat intake early in life may be a predictor of later BMI. A longitudinal study of 2 to 8 year olds indicated fat intake between ages 2 and 8 was a positive predictor of BMI at age 8.⁵²

On the other hand, both small and large studies have found no relationship between fat intake and BMI z-scores.^{53,54,56} A cohort study of nearly 10,000 youth found higher caloric intakes associated with increased BMI, but no association for energy adjusted dietary fat.⁵³ Smaller studies have also found no relationship between fat intake and BMI z-score change.⁵⁶ A study of over and normal weight five year olds showed similar fat intakes at 35% of calories suggesting no relationship between fat intake and weight.⁵⁴

Total Energy Intake. Energy intake is a key component of energy balance and weight. Studies show a link between caloric intake and obesity. A study in Spain looking at diet patterns and weights found geographic areas that had a higher prevalence of child obesity also had higher calorie intakes.⁵⁷ A longitudinal study of 10,000 boys and girls ages 9-14 reported larger BMI increases over a year's period in those with larger caloric increase over time.⁵³ Analysis of toddlers from CFSII data showed a positive relationship between total energy intake and weight percentile. In this same study, portion size was positively associated with total energy intake.⁵⁸

Assessing energy intake in children can be a confounding process. As children grow they require more energy and their weights change on a consistent basis. The method used for assessing energy intake may change the conclusion of a study. Energy can be reported as energy intake per weight or total energy intake per day. For example a study looking at preadolescent boys and girls reported that obese boys and girls consumed more energy than non-obese boys and girls. However, in the same study when weight was considered (looking at Kcal/Kg rather than crude Kcal intake) the non-obese subjects consumed more energy than the obese subjects.⁵⁹ Analysis of data from

NHANES from 1970-1994 showed very little increase in energy intake, despite the increase in overweight during the same time period, suggesting physical activity should be reviewed along with energy intake and method of reporting energy intake.⁶⁰

Behavior

Meal patterns for children have changed over the past 20 years. The percent of children skipping breakfast, eating school lunch, snacking and eating dinner at home have all decreased.⁶⁰ During that same time period percent of overweight children has increased. These two changes bring to question the effect of meal patterns on weight.

Eating Frequency. In the late 1970's a relationship between how often a person ate and body fat was identified. Those people who ate more frequently – “nibbler or grazers” – were leaner than those who ate one to two big meals a day.⁶¹ More recent studies, which have looked at the relationship between eating frequency and weight, have been inconsistent. Some studies show an association between eating occasions and weight and others show no or only small associations.⁶⁰⁻⁶² A study of 16-17 year olds that recorded frequency of eating events and BMI showed a small significant negative relationship between BMI and eating frequency in both males and females.⁶¹ A study of toddlers showed no difference in BMI percentile and the number of meals eaten in the day.⁵⁸ Data from the Bogalusa study, which collected data on 10 year olds for 20 years, did not support an association between meal patterns and weight or BMI.⁶⁰ The Child and Adolescent Trail for Cardiovascular Health (CATCH trial) showed a positive association between the number of eating frequencies and calories consumed.⁶²

Family Meals. A higher frequency of family dinners has been associated with reduced odds of being overweight.⁶³ The American Medical Association recommends family meals five to six times a week as an obesity treatment option.⁶⁴ Regular family meals give parents the opportunity to provide nutritious and healthy foods, monitor and limit children's food intake, and model healthy eating behavior.⁶³

Breakfast. Consumption of breakfast has declined since the late 1960's. As many as 30% of children and adolescents skip breakfast.⁶⁰ Breakfast eaters do better in school, have better diet quality, and pediatric obesity experts recommend daily breakfast intake.^{8,10,65} Overweight children are more likely to skip breakfast than normal weight children and older children who skip breakfast eat more later on in the day, than breakfast eaters.^{13,62,65,66} This raises the question, does skipping breakfast lead to higher BMI's and weight gain, or are overweight children skipping breakfast in an effort to decrease caloric intake and manage weight? A prospective study following adolescents over a three-year period showed breakfast skippers were heavier than breakfast eaters at baseline. In three years those who only ate breakfast 1-2 days a week gained more weight than those who ate breakfast daily, but those who never ate breakfast gained less weight than those who ate breakfast daily.⁶⁵ Other studies have found no relationship between breakfast frequency and BMI.⁴⁹

Snacking. The research on snacking can be complicated, as the definition for snacking is poorly defined. Is a snack defined as a particular food or a time of eating? Often snacks are thought of as being high in fat and calories, but snacks could be fruit, vegetables or other nutrient, but not energy, dense foods. Because of the illusive definition confounding evidence is seen. For example the Bogalusa study indicated that

childhood snacking decreased from 1973 to 1994.⁶⁰ However, data from CSFII showed snacking increased from 1977 to 1996.⁶⁷ In a study of girls from overweight and non-overweight families, the girls from overweight families tended to snack more frequently and consume snacks that were more energy dense and higher in fat, than girls from non-overweight families.⁶⁸ In this same study, snacking frequency and the type of snack i.e. energy dense was a predictor of increasing BMI.⁶⁸ Alternately, in a cohort of initially non-obese girls, followed for four years, consumption of energy dense snacks did not seem to influence weight or body fat.⁶⁷ Without a definitive definition for the term snacking, no conclusions should be drawn about the relationship of snacking and weight.

Emotional Eating. The relationship of emotional eating and weight appears complicated. Eating is a coping strategy used by people of all weights.⁶⁹ Emotional eating is seen in both normal and overweight children. Loss of control overeating, however, appears prevalent in overweight children and adolescents.⁷⁰ Negative emotions and stress have a demonstrated relationship to overeating in all children of all weights.⁶⁹ It is possible that stress induced eating can lead to excess calories and weight gain

Activity

Physical Activity. The increase in the prevalence of childhood overweight clearly suggests a shift toward positive energy balance.⁷¹ Diet and physical activity are the two most easily modifiable components of the energy balance equation. Physical activity can be reported in a number of ways: logs of time spent in activity, pedometer measurements, indirect calorimetry, heart rate, or doubly labeled water.¹³ The spontaneity of children's

activities makes it difficult to capture typical physical activity since it may vary from day to day.^{13,71}

An Australian study of children ages 5-10.5 used doubly labeled water to determine basal metabolic rate and accelerometers to assess energy expenditure.⁷¹ These measurements were then compared to BMI and body fat. Physical activity was negatively correlated with both body fat and BMI in both boys and girls. A prior study, also in Australia, for the same age group, found the amount of physical activity was inversely associated with body fat in boys, but not in girls.⁷²

A longitudinal study, assessing how a modification in activity over one year affected BMI found a strong association between increased physical activity and decreased BMI.⁷³ For each hour of additional activity, girl's BMI decreased 0.06 kg/m² and boy's BMI decreased 0.22 kg/m².⁷³ Overweight boys showed a stronger effect for physical activity in decreasing BMI than their normal weight counterparts.⁷³

Duration alone may not explain the effects of physical activity on weight; the type of activity may also affect weight. Overweight boys and girls are less likely to engage in vigorous physical activity than normal weight children.⁶⁶ In a small cohort of pre-adolescent children, time spent in vigorous activity was significantly correlated with body fat, but time spent in moderate activity had no correlation suggesting a threshold for intensity.⁷¹ A longitudinal study of over 10,000 youth found aerobic/dance were correlated to decreased BMI (adjusted for growth) for both girls and boys. Strength-training activities were correlated to decreased BMI in girls.⁷³ Walking was associated with decreased BMI in overweight boys and girls, but not normal weight boys and girls.⁷³

The minimum daily physical activity recommendation for normal and overweight children is 60 minutes.^{8,10,74} While the evidence strongly leans toward an association between physical activity and decreasing BMI, one study found no correlation between time spent in activity or intensity of activity and BMI z-score.⁵⁶

Participation in Sports and Physical Education. Participation in sport activities can be different than physical activity. Sports often encompass formal events and competition, while physical activity can include day-to-day activities as well as playful fun. Overweight children may or may not feel comfortable participating in sports activities. Forty four percent of high school students are not enrolled in physical education classes.⁷⁵ Almost half of high school students do not participate in sports activities.⁷⁵ Sports, physical activity, and participation in physical education all decline with age.⁷⁵⁻⁷⁷

Overweight students tend to be less physical active than their normal weight counterparts and participate in fewer community-based physical activities, such as sports leagues.⁷⁵ In Pima Indians, a group prone to develop obesity, percent body fat and weight were negatively correlated with sports participation.⁷⁶ Not participating in sports outside of school was a predictor of increased BMI in pre-adolescents over a year's time.⁷⁷

Sedentary Time. More than two hours of "screen" time (television viewing, computer use, and video games) has been implicated with higher BMI z-scores in children and professionals recommend less than 2 hours "screen" time daily.^{8,10,68,73,78,79} Obese children targeted for reduction of sedentary behaviors have a higher weight loss than those targeted for increase in physical activity.¹⁹

Television viewing tips the energy balance by promoting snacking and intake of calories while displacing physical activity.⁷⁹ In addition children who watch television have an increased exposure to commercials that promote energy dense foods.⁶⁸ In both overweight and non-overweight families, girls who watched more television consumed more snacks while watching television.⁶⁸ Overweight girls have higher fat intakes from snacks, watch more television, and consume more snacks overall than normal weight girls.⁶⁸

Berkey et al studied boys and girls over time to determine the effect of changes in sedentary behavior and weight.⁷³ For each hour of television, video, and video games watched, there was an increase of 0.05 kg/m² in BMI for girls.⁷³ In contrast, a prospective study of 6- to 9-year-olds, who were mostly normal weight, showed no correlation between sedentary activities, such as television viewing and change in BMI z-scores over a year's time.⁵⁶ There does not seem to be a difference between boys and girls in amount of television watched, but there is a difference among ethnic groups. Hispanic youth tend to watch more television than non-Hispanic youth.⁷⁸

Although most video games are sedentary, some, such as Dance Dance Revolution and Nintendo Wii Sports are active. Active video games can increase energy expenditure in children. A study of 25 children ages 10-13, with varying BMI percentiles, showed a 2- to 3-fold increase in energy expenditure while playing active video games compared to television viewing.⁸⁰ Energy expenditure, heart rate, and respiratory measures while playing active video games were equivalent to walking at a moderate intensity.⁸⁰

Parent Child Relationship and Home Environment

Parent Child Relationship. Parents, peers, teachers, and extended family members can influence attitudes about weight. Parents may have the strongest influence on children's attitudes and behaviors regarding weight.²⁹⁻³¹ Girls in families with obese genetic diet and activity influences are more likely to become obese themselves.²⁹ Parents BMI, energy intake and physical activity behaviors influence children's weight.³⁰ Parents with disinhibited or restrained eating may foster higher BMI in their children as they role model unhealthy eating behaviors.³¹

Comments About Weight. Negative comments, by siblings and parents, about weight, shape, and eating are positively correlated with larger body size in childhood.⁸¹ These findings do not necessarily suggest that negative comments lead to weight gain, but may suggest that overweight children are subject to negative comments, teasing, and criticism about their weight. Weight based teasing has long-term effects and has been associated with suicidal ideations, poor self-esteem, and increased risk for eating disorders.⁸¹

Home Environment. The home environment is a critical factor in influencing weight status. Mothers of obese children report more psychological distress, higher family conflict, and mealtime challenges than mothers of normal weight children.³² Children who come from homes with low levels of cognitive stimulation have a two-fold increased risk of developing obesity compared to children from homes with high cognitive stimulation. This risk remains even when corrected for maternal obesity, socioeconomic status, marital status, and race.³³ Children in homes with high cognitive stimulation watched less television and were more physically active. Socioeconomic

status has an inverse relationship on weight. Lower socioeconomic status may have an influence on decreased physical activity and less healthy eating patterns.³³

Sleep. Short sleep duration, especially less than eight hours, has been positively associated with obesity in children.^{11,12,82} As sleep duration increases, BMI decreases.¹² The odds ratio of becoming obese increases significantly when children have less than nine hours of sleep.⁸² The recommended sleep time, to prevent obesity, seems to be about 10 hours a day, without a clear upper limit.^{12,82}

Literature Review Conclusion

Obesity is a complex disease with many causes and possible treatments making it difficult to determine the effectiveness of any single intervention. There is a lack of outcomes for structured, multi-component, long-term family based studies.¹⁴ This study will focus on the effectiveness of a structured weight management program in decreases BMI, BMI z-scores, and changing lifestyle habits.

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CHAPTER 2

ADHERENCE TO LIFESTYLE RECOMMENDATIONS
OF OVERWEIGHT CHILDREN ENROLLING
IN A STRUCTURED WEIGHT
MANAGEMENT PROGRAM¹

Abstract

Background: Lifestyle guidelines for preventing and treating childhood obesity have been suggested by various groups. This study's purpose was to determine if overweight/obese youth enrolling in weight management programs are meeting lifestyle recommendations and identify any differences between age and gender.

Methods: Measurements and a written survey were used to obtain anthropometric, demographic, nutrition, activity, and behavior habits for 89 overweight/obese youth, ages 4-18 years, at entry into a weight management program. Reported habits were compared to lifestyle guidelines.

Results: Participants were primarily female (61.8%), white (61.8%), and between 7-18 years (85.4%). Participants' mean body mass index (BMI) percentile was 97.5 (SD ± 2.8) and mean BMI z-score, 2.27 (SD ± 0.61). Adequate daily vegetable, fruit, and dairy intakes were reported by 7.9%, 51.7%, and 31.5% of participants respectively. For beverages, 82.0% reported meeting fruit juice limit guidelines while 42.7% reported meeting sugar-sweetened beverage intake limits. For physical activity, 34.8% met daily

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recommendations, while 51.7% met daily screen time limits. Daily breakfast consumption was reported by 67.4% and 73.0% ate family meals together more than five times per week. Adequate sleep time was reported by 53.9%. Significant differences for age and gender were found in two areas, boys were more active than girls ($p=.003$) and older children slept less than younger children ($p=.03$).

Conclusions: Children meet juice, breakfast, and family meals intake guidelines, but fall short of recommendations for vegetable, dairy, and sweetened beverage intake, physical activity, screen time, and sleep. Interventions should target lifestyle areas where children fall short.

KEY WORDS: Childhood obesity, weight management, lifestyle guidelines

Introduction

The prevalence of pediatric overweight/obesity (overweight), in the United States (US) has been steadily increasing over the past 30 years; however, more recent statistics suggest a stabilization of obesity rates.¹⁻³ Despite a possible stabilization results from the 2007-2008 National Health and Nutrition Examination Survey (NHANES) show the prevalence of overweight at 18% for US children 12-19 years old, 20% for 6-11 year olds, and 10% for 2 to 5 year olds.¹

In 2007 the American Academy of Pediatrics (AAP) and American Dietetic Association (ADA) published evidenced-based lifestyle guidelines for preventing and treating overweight children.^{4,5} Other groups, including researchers and healthcare companies, have also suggested lifestyle recommendations for overweight children.⁶⁻¹⁰

Increasing the proportion of overweight youth meeting evidenced-based lifestyle recommendations can be a strategy in combating obesity. We currently know very little about the lifestyle habits of overweight children referred for structured weight management programs.¹¹ Are parents and children following evidenced-based guidelines and recommendations? Is there just one area where families fall short or are there many areas? Determining which recommendations overweight children meet or do not meet can provide useful information about what areas educators and professionals should target in weight management programs. This study's purpose was to determine if overweight youth, referred to a structured weight management program, are meeting lifestyle recommendations and identify any differences between age and gender.

Guidelines and Recommendations for Pediatric Overweight/Obesity

Associations and groups set guidelines based on both available evidence and expert opinion. Expert opinion is included as effective strategies, for treating pediatric overweight, remain poorly defined.^{4,5} Overweight/obesity guidelines cover three broad areas: nutrition, activity, and behavior. Table 2-1 summarizes current guidelines from various associations, healthcare companies, and researchers.

Nutrition

The AAP and health care organizations encourage consumption of fruits and vegetables in amounts recommended by the US Department of Agriculture Food Guide.^{4,7} The food guide recommends 2-1/2 to 6-1/2 cups of fruits and vegetables daily

for youth depending on age, gender, and activity level.⁶ Fruits and vegetables are low in calories, nutrient dense, and high in fiber and satiety value making them potential tools for weight management.

A diet rich in calcium is recommended for prevention of obesity.⁴ Daily intake of two to three cups of milk or its equivalent is recommended for youth ages 4-18 to meet calcium needs.⁶

Fruit juice and sugar-sweetened beverage intake recommendations are stated as maximum daily limits. A prudent intake of fruit juice – no more than 4-6 oz./day for children and 8-12 oz./day for adolescents is recommended.^{7,8} Intake of sugar-sweetened beverages should be limited to 0-12 oz./month.^{4,7,12}

Activity

The minimum daily physical activity recommendation for normal and overweight children is 60 minutes.^{4,7,13} Time spent in physical activity has been negatively correlated to body fat and BMI in boys and girls.¹⁴⁻¹⁶ The intensity of activity also affects weight with more vigorous activity significantly correlated with reduced body fat.^{14,16,17}

More than two hours of “screen” time per day (television viewing, computer use, and video games) is associated with higher BMI z-scores in children supporting recommendations of less than 2 hours “screen” time daily.^{4,7,16,18-20} Girls have shown a BMI increase of 0.05 kg/m² for each hour of television and video games watched.¹⁶

Behavior

Overweight children are more likely to skip breakfast than normal weight children.^{17,21,22} This raises the question: does skipping breakfast lead to higher BMI's and weight gain, or are overweight children skipping breakfast in an effort to decrease caloric intake and manage weight? Regardless, those who eat breakfast do better in school and pediatric obesity experts recommend daily breakfast intake.^{4,7,22}

The American Medical Association (AMA) recommends family meals five to six times a week as an obesity treatment option.²³ Regular family meals give parents the opportunity to provide nutritious and healthy foods, monitor and limit children's food intake, and model healthy eating behavior.²⁴ A higher frequency of family dinners has been associated with reduced odds of being overweight.²⁴

Short sleep duration, especially less than eight hours a night, has been positively associated with obesity in children.^{9,10} As sleep duration increases, BMI decreases.¹⁰ The recommended sleep time to prevent obesity seems to be about 10 hours a day, without a clear upper limit.¹⁰

Methods

Subjects

Children and adolescents enrolled in the "LiVe Healthy Habits for Kids" (LiVe) weight management program, between January 2008 and January 2010, were invited to participate in the study. Inclusion criteria included enrollment in the LiVe program, age 4-18 years, BMI percentile of ≥ 85 , parental permission, and adolescent consent. Pregnant

or breastfeeding adolescents were excluded. During the two-year period 146 potential subjects enrolled in the LiVe program, of those, 89 met the inclusion criteria and consented to study participation. The LiVe program is a long-term (12-month), family based, multi-disciplinary program including classes and individual counseling on nutrition, activity, and behavior recommendations as suggested in the literature and by various associations and groups.⁴⁻¹⁰

Instruments

A calibrated digital scale was used to measure weight (Scale-Tronix model 5702, White Plains, NY); scales were calibrated to an accuracy of 100g. Height was measured with a wall-mounted stadiometer (Ayronon Stadiometer model 5100, Prior Lake, MN). Body mass index (BMI), BMI percentile, and BMI z -scores were calculated from the Centers for Disease Control and Prevention (CDC) growth charts.^{25,26}

A written survey of food intake, physical activity, breakfast consumption, family meals, sedentary time, and sleep habits was developed and tested in 2006-2007 by the authors. The survey was piloted with a small cohort of 11 parents and 16 children ages 4-17. The pilot testing was used to test readability, ease of use, and wording of survey questions. The survey was then refined through two separate focus groups of 16 parents (of children under age 12) and 17 children over age 12. The focus groups provided information on the format of the survey and validity of questions in eliciting the desired information. Survey questions and formatting were revised following each pilot test and focus group ensuring content and face validity. The survey tool was reviewed by 13

experts in pediatric nutrition and/or weight management. The final survey had a Flesch-Kincaid grade level readability of 4.2.

Procedures

Parental permission was obtained for all subjects; assent was obtained for subjects 12 years and older. Demographic, anthropometric, diet, activity, and behavior data were collected prior to program entrance to limit the influence of any program interventions on habits. All data collection personnel were trained to measure height and weight consistent with the US Department of Health and Human Services training guidelines.²⁷ Weight was measured on a calibrated digital scale after removal of shoes and bulky clothing; weight was recorded to the nearest 0.1 Kg. Height was measured on a wall mounted stadiometer; hair ornaments and braids were removed. Height measurements were taken with as many of the four body points (heels, buttocks, shoulders, and head) touching the wall as possible. Height measurement was repeated three times and read to the nearest 1 mm. Children age 12 or older completed the survey independently; parents completed the survey for children under age 12. Researchers explained how to complete the survey, provided samples and visuals of food portions as needed, and clarified any questions respondents had regarding the survey.

Data Analysis

Statistical tests to analyze demographic, anthropometric, and survey results included descriptive statistics for demographic and anthropometrics; *t*-tests, The Binomial test, and two-way contingency tables for analysis of differences between age

and gender; and frequencies to determine the proportion of subjects meeting guidelines and recommendations. Analyses were performed using the Statistical Package for the Social Sciences Graduate Pack 12.0.1, 2003 (SPSS/PC; SPSS Inc., Chicago, Illinois).

Frequencies were used to compare participants' lifestyle habits to guidelines and recommendations in ten areas: vegetable intake, fruit intake, 100% fruit juice intake, sugar-sweetened beverage intake, dairy intake, physical activity, screen time, breakfast consumption, family meals, and sleep. These ten areas were chosen for prevalence in the literature and association and healthcare company guidelines. Table 2-1 summarizes the ten recommendations used in this study. Participants' responses were divided into three categories: less than recommendation (<90% of recommendation), within recommendation ($\geq 90\%$ - $\leq 110\%$ of recommendation), and more than recommendation (>110% of recommendation). If a recommendation was expressed as a range, the midpoint was used as the reference. For example, the juice recommendation for 2-6 year olds is no more than 4-6 oz./day, thus 5 oz. was used as the reference point.

Results

Demographics

The Binomial Test was used to test for differences in proportions of age, gender, and income groups. We anticipated equal proportions of boys and girls would enroll in the study; however, the observed proportion of 0.62 for girls versus boys differed significantly from the hypothesized value of 0.50, $p = .033$. Participants were grouped by age 4-6 years and 7-18 years to match predominant recommendation divisions. A lower

enrollment in the younger age group (n=13) than in the older age group (n=76) was expected due to the narrower age range of 4-6 years versus 7-18 years. The observed proportion of 0.18 (young to older age group), was not significantly different from the expected proportion of 0.20, $p=.125$. Income was analyzed using data on the number of participants receiving the state assisted insurance benefits of Medicaid and the Children's Health Insurance Plan (CHIP). The observed proportion of subjects on state assisted insurance was 0.21, which did not differ significantly from the expected proportion of 0.24, $p=.317$ for the geographic area (the state of Utah) of the sample.

Anthropometrics

An independent samples *t*-test was conducted on BMI *z*-scores for age and gender groups to determine any differences. The BMI *z*-scores were significantly higher for the younger age group (mean 2.98, SD ± 0.91) than the older age group (mean 2.15, SD ± 0.44), $p=.006$. No significant differences in gender were seen. Demographic and anthropometric characteristics of participants are shown in Table 2-2.

Lifestyle Habits

Nutrition

When compared to weight management guidelines 7.9% of study participants met vegetable intake recommendations. Nationally 21-25% of adolescents report adequate vegetable intake.²⁸ Adequate fruit intake was reported by 51.7% of participants while 31.5% of participants reported adequate dairy intake. A majority of participants, 82.0%,

met the guideline for fruit juice intake limits. Less than half, 42.7%, met sugar-sweetened beverage intake limit guidelines.

Activity

Of study participants, 34.8% met or exceeded the minimum daily physical activity recommendation of 60 minutes.^{4,13} A significant difference in gender was noted in activity. A greater percentage of girls (83.3%) did not meet the recommended level of daily physical activity compared with boys (45.4%), $p=.003$. The maximum screen time limit of two hours daily was met by 51.7% of subjects.^{4,13}

Behavior

Daily breakfast intake was reported by 67.4% of children. A high proportion of subjects reported participating in family meals with 73.0% meeting or exceeding the recommendation of the AMA of family meals five to six times a week as an obesity treatment option.²³ As compared to recommendations, adequate sleep was reported by 53.9% of respondents. A significant difference in age was noted in sleep. A higher proportion of older children (62.3%) did not meet the recommended sleep time compared with younger children (23.0%), $p=.03$.

Gender and Age

Two-way contingency table analyses were conducted to evaluate whether any gender or age-based differences existed among the three recommendation categories for the ten guideline areas. Other than physical activity and sleep, as reported above, no significant differences, at the 0.05 level, were found for either gender or age among the

ten areas. Table 2-3 shows the percent of participants, by age group, meeting recommendations in the ten areas.

Discussion

Increasing the proportion of youth that meet lifestyle recommendations for nutrition, activity, and behavior is a strategy to combat obesity. Identifying which recommendations overweight youth meet and which they do not provides a base for educators and practitioners as they develop weight management programs and educational interventions.

A high proportion of subjects in this study reported vegetable and dairy intake below recommendations, while about half reported suboptimal fruit intake. When coupled with evidence that vegetable intake is independently associated with weight reduction behaviors²⁸⁻³⁰ and that dairy and calcium intake^{31,32} has been inversely associated with body fat, these results indicate weight management programs and education interventions should include information and activities to encourage increasing vegetable and dairy intake and possibly fruit intake.

Subjects in this study appeared to either consume much less than or much more than the maximum recommendation for fruit juice and sugar-sweetened beverages. Educators could consider specialty sessions on sugar-sweetened beverages and juices for participants with high intakes. This would require some sort of targeted survey or questioning to determine which participants had high soda, sports drink, juice, or other sugared beverage intake.

Increased physical activity duration and intensity are both inversely correlated to BMI and body fat.¹⁴⁻¹⁶ A high proportion of subjects reported not meeting physical recommendations and exceeding sedentary activity maximums. Weight programs and schools should include physical activity in curriculums to help students achieve a minimum of 60 minutes of cumulative physical activity daily. Education and activities should focus on both duration and intensity. As obese children targeted for reduction of sedentary behaviors have a higher weight loss than those targeted for increased physical activity, educators should strongly consider interventions that help children reduce sedentary time, particularly screen time.³³

Breakfast intake and family meals have been recommended as interventions to combat obesity, and participants in this study seemed to heed that message. Educational interventions targeting breakfast and family meals may not be needed, as children are meeting the recommendation; however, children and families should be praised for current practices. Reducing the amount of time spent addressing breakfast and family meals may allow educators and practitioners to focus more time on areas where children are not meeting recommendations such as vegetable intake and physical activity.

Teenagers are notorious for not sleeping enough and participants in this study appeared no different. Short sleep duration has been positively associated with obesity in children.^{9,10} Targeting sleep habits, especially in older youth, may be an effective weight management tool.

Other than physical activity, no differences in habits between genders were seen in this study, suggesting interventions could target mixed gender educational groups.

Professionals may consider a separation of genders for physical activity interventions as a higher proportion of girls than boys reported inactivity. Although no differences were seen in habits between age groups, differences in age-based learning abilities may be best served with age-based educational clusters.

Study Limitations

Dietary intake, activity, and behavior habits were self-reported, which may not fully reflect actual intake and activity levels. Subjects in this study were selected from the state of Utah; demographic characteristics and habits may not be representative of populations in other areas of the country. Subjects were enrolled in a structured weight management program and may not be characteristic of other overweight groups such as schools, community groups, and private medical practices.

Conclusions

Professionals treating overweight/obese children may have heard the phrase “We are doing everything we are supposed to, I don’t know why my child keeps gaining excess weight.” Are children doing everything they’re supposed to? Are they heeding the recommendations of healthcare professionals and associations? Is there just one area that requires change or many? A majority of participants in this study met the guidelines for juice intake, breakfast, and family meals, but not for other nutrition, activity, and behavior areas.

Educational interventions, surrounding weight management, should target lifestyle habits where children fall short of research-based recommendations. These areas

may include: vegetable, dairy, and sugar-sweetened beverage intake, physical activity (particularly for girls), screen-time, and sleep (especially in older children). Promoting healthy weight control behaviors can be a tool in combating the increase in childhood obesity. Further research is needed to determine if achievement of lifestyle recommendations improves weight management and health related issues.

Human Subjects Approval

Statement

The study was approved by the Institutional Review Boards of Utah State University and Intermountain Healthcare.

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**Table 2-1. Recommendations for lifestyle habits
in overweight children and adolescents***

Area	Recommendation		Reference
	2-6 years	7-18 years	
Nutrition			
Vegetables	1-2.5 cups [†]	1.5-4 cups [†]	4, 6, 7
Fruit	1-1.5 cups [†]	1-2.5 cups [†]	4, 6, 7
100% fruit juice	4-6 oz	8-12 oz	6, 7, 8
Dairy products	2-3 cups [†]	2-3 cups [†]	4, 6
Sugar-added beverages	0-12 oz/month	0-12 oz/month	4, 7, 12
Activity			
Physical activity	60 minutes	60 minutes	4, 5, 7, 13
Screen time	<2 hours	<2 hours	4, 5, 7, 13
Behavior			
Breakfast	Daily	Daily	7, 13
Family meals	5-6 per week	5-6 per week	7, 13
Sleep	10-11 hours (5-12 years of age)	8-1/2-9-1/2 hours (13-18 years of age)	7, 9, 10

* Daily recommendation unless otherwise specified

[†] Specific to age, gender, and activity level

Table 2-2. Demographic and anthropometric characteristics of participants at enrollment *

	2-6 years	7-18 years	All ages
	(n=13)	(n=76)	(n=89)
Demographic			
Gender n(%)			
Male	4 (30.8)	30 (39.5)	34 (38.2)
Female	9 (69.2)	46 (60.5)	55 (61.8)
Ethnicity n(%)			
Asian	0 (0)	4 (5.3)	4 (4.5)
Black	1 (7.7)	2 (2.6)	3 (3.4)
Hispanic	2 (15.4)	9 (11.8)	11 (12.4)
White	9 (69.2)	46 (60.5)	55 (61.8)
Mixed race	0 (0)	8 (10.5)	8 (9.0)
Qualifies for state medical insurance n(%)			
Yes	4 (30.8)	11 (14.5)	15 (16.9)
No	8 (61.5)	50 (65.8)	58 (65.2)
Family status n(%)			
Live w/ both parents	6 (46.2)	48 (63.2)	54 (60.7)
Live w/ one parent	6 (46.2)	12 (15.8)	18 (20.2)

Other	0 (0)	4 (5.3)	4 (4.5)
Anthropometric			
Weight Kg	35.8 ± 8.1	66.4 ± 24.0	61.9 ± 24.8
mean ± SD (range)	(23.0-51.0)	(31.4-137.0)	(23.0-137.0)
Height cm	118.4 ± 7.1	148.9 ± 13.9	144.5 ± 17.0
mean ± SD (range)	(107.1-128.0)	(116.5-176.0)	(107.1-176.0)
BMI Kg/m ²	25.27 ± 3.75	29.04 ± 6.14	28.48 ± 5.99
mean ± SD (range)	(18.77-30.69)	(19.71-45.86)	(18.77-45.86)
BMI %tile	98.77 ± 0.59	97.33 ± 3.00	97.54 ± 2.83
mean ± SD (range)	(97-99)	(83-99)	(83-99)
BMI z-score	2.98 ± 0.91	2.15 ± 0.44	2.27 ± 0.61
mean ± SD (range)	(1.83 – 5.36)	(1.08–2.91)	(1.08 -5.36)

*Total may not equal 100% as not all subjects responded to all questions

**Table 2-3. Percent of children meeting
nutrition, activity, and behavior lifestyle recommendations at enrollment***

Lifestyle Recommendation	Age 4-6 (n=13)			Age 7-18 (n=76)		
	%Less than recomme ndation	%Within recomme ndation	%More than recomme ndation	%Less than recomme ndation	%Within recomme ndation	%More than recomme ndation
Nutrition						
Vegetable intake	84.6	7.7	7.7	93.4	1.3	3.9
Fruit intake	53.8	15.4	30.8	47.4	26.3	23.7
100% Fruit juice intake	76.9	0	23.1	80.3	0	17.1
Dairy intake	53.8	15.4	30.8	71.1	15.8	11.8
Sugar-added beverage intake	38.5	0	61.5	42.1	0	56.6
Activity						
Physical activity	61.5	23.1	7.7	65.8	17.1	15.8
Screen-time	23.1	15.4	61.5	36.8	15.8	46.1
Behavior						
Breakfast consumption	30.8	69.2	0	30.3	67.1	0
Family meals	15.4	7.7	76.9	27.6	15.8	55.3
Sleep	23.1	69.2	7.7	50	25	5.3

*Total may not equal 100% as not all subjects responded to all questions

CHAPTER 3

A STRUCTURED LONG-TERM WEIGHT MANAGEMENT PROGRAM IS
EFFECTIVE IN REDUCING BMI Z-SCORES AND IMPROVING ADHERENCE TO
LIFESTYLE GUIDELINES IN CHILDREN

Abstract

Objective: Determine if completion of a structured, long-term, family-based, weight management program reduces body mass index (BMI) z-scores and improves lifestyle habits in children.

Design: Observational study over time from 2008-2010.

Setting: Five outpatient clinics in Utah.

Participants: Eighty-one overweight/obese children; divided into two groups compliers (completed ≥ 7 intervention classes) and non-compliers (completed <7 intervention classes.)

Intervention: Twelve-month structured, multi-component, family-based program.

Main Outcome Measures: Change in BMI z-score and anthropometric measures over time, probability of adhering to weight management lifestyle guidelines pre and post intervention.

Analysis: Chi square, Analysis of Co-variance, Mixed model logistic regression.

Results: Compliers had a significant decrease in BMI z-score (-0.1903 $p=.0004$) and BMI percentile (-2.02 $p=.0235$) overtime. Compliers had a higher probability of meeting vegetable intake (pre 0.31%, post 55.67%; $p=<.0001$), and physical activity

guidelines (pre 13.58%, post 56.58%; $p=.0032$) post intervention. Both compliers and non-compliers had a higher probability of meeting fruit ($p=.0015$) and sugar-sweetened beverage intake guidelines ($p=.0337$) at 12 months.

Conclusion and Implications: Long-term, family-based, structured weight management programs are effective in reducing BMI z-scores and improving lifestyle habits in children. Continued development and evaluation of these programs is warranted to address childhood obesity treatment methods.

Introduction

The prevalence of pediatric overweight/obesity (overweight), in the United States (US) has been steadily increasing over the past 30 years; however, more recent statistics suggest a stabilization of obesity rates.¹⁻³ Despite a possible stabilization of rates, results from the 2007-2008 National Health and Nutrition Examination Survey (NHANES) show the prevalence of overweight at 18% for US children 12-19 years old, 20% for 6-11 year olds, and 10% for 2 to 5 year olds.¹

In adults, structured weight management programs have shown positive clinical outcomes for weight reduction.^{4,5} However, few studies have evaluated structured, multi-component, long-term, family-based, weight management programs in children.^{4,6-9} Weight management programs vary in duration, educational techniques, instructor background, and topic focus, which make it difficult to compare programs to each other. Evaluation of programs designed to treat child and adolescent overweight is warranted to identify effective practices for treating childhood obesity.⁹

The “LiVe Healthy Habits for Kids” (LiVe) program is a structured, family based, multi-disciplinary, long-term weight management program conducted by a regional healthcare company. Program participants and their families enroll in the program for 12 months. They attend classes and/or individual counseling sessions on nutrition, activity, and behavior throughout the year long program. Participants receive a certificate of completion if they attend nine classes or sessions during the 12 month program, although they may attend as many classes in a 12 month period if desired. The program fee is \$225 per family for the class option and \$425 per family for the individual counseling option. Payment for the program varies by participant and includes self-pay at the beginning of program, insurance payment at the beginning of program, self-pay with insurance reimbursement at completion of program, and scholarships for those qualifying for state insurance benefits such as Medicaid or the Children’s Health Insurance Plan (CHIP).

This observational study over time was conducted to determine if completion of a structured, multi-component, long-term, pediatric weight management program results in decreased body mass index (BMI) z-scores and an increase in the proportion of participants meeting lifestyle recommendations.

Methods

Subjects

Participants were recruited from children enrolled in the LiVe program, at five different sites, between January 2008 and January 2010. During the two year period 146 children registered for the LiVe program of which 89 met study criteria and gave

permission and assent for the research study. The most common reason for not enrolling in the research was subjects had recently met with a dietitian for overweight counseling prior to registering for the program. The interaction with the dietitian could influence pre-data as some intervention had recently taken place, thus these potential subjects were not enrolled in the study. Relying on means and measures of variability from an earlier pilot study, it was determined there was a 99% chance that the multivariate analysis would correctly reject the null hypothesis at a .05 significance level with 15 participants. Prior study power estimates for the subsequent univariate analyses included: 90% power to detect a significant difference in weight (pre vs. post) at the .05 level and 99% power to detect a significant difference in behavior at the .05 level.

Selection Criteria

Inclusion criteria included enrollment in the LiVe program, age 4-18 years, BMI percentile of ≥ 85 , parental permission, and adolescent assent. Participants could withdraw consent at any point in the study without affecting their enrollment in the program. Pregnant or breastfeeding adolescents were excluded.

Data Collection

Demographic, anthropometric, and lifestyle habit data were collected at program entrance and 12 months post. Each participant was assigned an identification (ID) number to protect personal information.

Demographic Data

Demographic information was collected for each participant from program registration records and surveys. Information included, date of birth, gender, ethnicity, qualification for government assisted insurance, family living situation (i.e. both parents, one parent/divorced, other), method of fee payment for weight program (self-pay, insurance before/after, scholarship).

Anthropometric Data

Height and weight were measured for each subject prior to program entrance and 12 months post. Weight was measured on a calibrated digital scale (Scale-Tronix model 5702, White Plains, NY) after removal of shoes and bulky clothing; weight was recorded to the nearest 0.1 Kg. Height was measured on a wall mounted stadiometer (Ayrnton Stadiometer model 5100, Prior Lake, MN); hair ornaments and braids were removed. Height measurements were taken with as many of the four body points (heels, buttocks, shoulders, and head) touching the wall as possible. Height measurement was repeated three times and read to the nearest 1 mm. BMI, BMI percentile, and BMI z-scores were calculated from the Centers for Disease Control and Prevention (CDC) growth charts for height, weight, age, and gender.^{10,11}

Survey of Lifestyle Habits

A written survey of food intake, physical activity, breakfast consumption, family meals, sedentary time, and sleep habits was developed and tested in 2006-2007 by the study authors. The survey was piloted with a small cohort of 11 parents and 16 children

ages 4-17. The pilot testing was used to test readability, ease of use, and wording of survey questions. The survey was then refined through two separate focus groups of parents and children. The focus groups provided information on the format of the survey and validity of questions in eliciting the desired information. Survey questions and formatting were revised following each pilot test and focus group ensuring content and face validity. The survey tool was reviewed by 13 experts in pediatric nutrition and/or weight management providing content validity. The final survey had a Flesch-Kincaid grade level readability of 4.2.

To establish standards of comparison for lifestyle habits, 10 guidelines were chosen based on their prevalence in literature and guidelines published by professional associations and groups. The comparative lifestyle standards used in this study include: vegetable intake (1-4 cups/day), fruit intake (1-2.5 cups/day),¹²⁻¹⁴ fruit juice intake (4-12 oz),^{12,14,15} dairy intake(2-3 cups/day)^{12,13}, sugar added beverages (0-12 oz/month)^{13,14,16}, physical activity (\geq 60 minute/day), screen time (<2 hours/day)^{13,14,17,18}, breakfast frequency (daily), family meal frequency (5-6 times/week),^{14,17} and sleep time (8.5-11 hours/day).^{14,19,20} Guidelines are listed here in ranges, but in the analysis specific guidelines based on age, gender, and activity levels of individual subjects were used.

Intervention

The LiVe program served as the intervention for the study. Study participants were asked to attend a minimum of nine classes, including three core classes, one each, on nutrition, physical activity, and behavior, during the 12 month period of enrollment. Classes were offered every three to four weeks and lasted 60 minutes. Children,

parents/caregivers, and siblings attended classes together. Classes were facilitated by dietitians and taught by dietitians, physical therapists, and social workers as topic appropriate. All classes included active learning as well as traditional lecture type instruction. Physical activity was a component in every class in various forms such as games, jump rope, yoga, or dancing.

The LiVe curriculum consists of 13 lesson/modules covering the areas of nutrition, activity, and behavior. All lessons, handouts, and supporting activities, for the program, were written by eight registered dietitians carrying either a specialty certification in weight management or pediatric nutrition. All lesson plans were reviewed by every dietitian on the curriculum team. The physical activity lesson plans received additional review by three pediatric physical therapists and one exercise physiologist. The three behavior lessons received additional review by two behavioral health dietitians. The 13 lesson topics and descriptions, provided to participants, are shown in Table 3-1.

Study Groups

To compare the effectiveness of completing a long-term structured weight management program, participants were divided into two study groups, those who complied with the intervention and those who did not comply with the intervention. Participants attending a minimum of seven of the nine required classes, in the 12-month period, were placed in the compliance group. Those attending six or fewer classes during the year were placed in the non-compliance group. Of the 89 enrolled subjects, 39 complied with the intervention of those 36 provided post data; 42 did not comply with the intervention, of those 24 provided post data. Seven had missing data for program

compliance, and one subject was dropped from the data set due to a diagnosis of cancer during the study; 81 subjects were used in the data analysis. The program non-completion rate for the intervention used in this study was consistent with similar weight management programs for the pediatric population.⁴

Data Analysis

Analyses were performed using Statistical Analysis Software 9.2 for Windows, 2008 (SAS Institute, Cary, NC, USA). A *chi-square* test was used to determine any demographic differences between compliance and non-compliance groups. *Analysis of co-variance* was used to determine mean change in anthropometric measures over time by compliance group. As children still need to grow, a slowed rate of growth or weight maintenance can be considered successful. BMI z-scores were used to assess change in weight status, while still allowing for appropriate growth. A *mixed model logistic regression* adjusted for age and gender was used to determine the probability of participants meeting established weight management lifestyle guidelines.

Results

Demographic Comparison of Study Groups

No significant differences between compliance groups were seen for gender, ethnicity, qualification for state insurance assistance, or family living situation. There was a significant difference in age between compliance groups. The average age in the compliance group was 9.28 ± 2.79 years, the average age in the non-compliance group

was 10.81 ± 2.77 years ($p=.0157$). Table 3-2 shows demographic information for both groups.

Anthropometrics

Participants in the compliance group had a significant decrease in BMI z-score (-0.1903 $p=.0004$) and BMI percentile (-2.02 $p=.0235$) over the 12-month period while non-compliant participants did not have a significant change in BMI z-score or BMI percentile over the 12 months. Non-compliers had a significant increase in BMI in 12 months (1.02 Kg/m^2 $p=.0212$), while compliers had no-significant change in BMI in 12 months (0.20 Kg/m^2 $p=.5655$). Both compliers and non-compliers had a significant increase in height and weight over the 12-month period, as expected with child growth. However, compliers gained less weight over time than non-compliers. Participants in the compliance group gained 4.14 Kg in a 12-month period while non-compliers gained 6.58 Kg. The difference between the change in the two groups is suggestive, but not conclusive of a difference between groups $p=0.06$. No significant differences were seen between age and gender in anthropometric measures. Table 3-3 shows the mean change in anthropometric measures by compliance group in 12 months.

Lifestyle Habits

Completion of the weight management program had a significant effect on increasing the probability that subjects would meet the vegetable intake ($p<.0001$), and physical activity guidelines ($p=.0032$) post intervention compared to pre intervention. Males were more likely than females to meet the physical activity guideline ($p=.0007$).

Both compliance groups had a higher probability of meeting fruit intake ($p=.0015$) and sugar-sweetened beverage intake guidelines ($p=.0337$) post intervention than pre intervention. No significant differences in age and gender were seen, in the probability of meeting lifestyle guidelines, except as noted for physical activity above. Table 3-4 shows the probability of subjects meeting the ten chosen lifestyle standards pre and 12 months post.

Discussion

Various factors such as family involvement, program duration, and individual or group settings may affect program outcomes.

Family Involvement

Parents have a strong influence on children's attitudes and behaviors related to weight, suggesting parental involvement is essential for weight management success.²¹⁻²³ The home environment is a key factor in determining eating and physical activity habits.^{24,25} The intervention in this study included parents and siblings in classes to encourage whole family involvement. The CDC indicates there is a need to review more programs that include parental involvement to further evaluate their success.⁶

Duration of Program

The optimum length of weight management programs, for children, is not well defined. The National Health Lung and Blood Institute (NHLBI) guidelines for adults recommends a six-month treatment program, but does not have recommendations for children.²⁶ The growth and development issues in children and adolescents argue for

more flexibility in length of treatment. Also, weight loss may not be appropriate for all children, so practitioners should use their clinical judgment when applying the NHLBI criteria for adults to children.¹⁸

Participants in this 12 month program study and in other long-term (6 to 12 months) weight programs have shown a reduction in BMI, BMI z-score, and percent body fat while control groups showed no significant reduction or an increase in BMI and body fat.^{4,7,9} Overweight and obesity are chronic, often life-long, conditions, thus follow-up weight-management plans should be implemented after the intensive phase of treatment; however, a length a time for follow-up has not been suggested by major groups. Guidelines from the medical and dietetic associations provide recommendations for length of treatment for their individual disciplines, but not for a long-term multi-component program. The American Pediatric Association (APA) recommends frequent office visits, with the primary care physician with weekly visits for a minimum of 8 to 12 weeks being the most efficacious. Subsequently, monthly visits are recommended to help maintain new behaviors.¹³ The American Dietetic Association (ADA) recommends intensive Medical Nutrition Therapy for at least three months or until initial weight-management goals are achieved and indicate that a greater frequency of contact may lead to more successful weight loss and maintenance.¹⁸

The duration of weight management programs may affect dropout rates. In this study 42 (52%) of enrolled subjects did not complete at least seven of the nine required courses. Of the 42 non-completers 29 dropped out after three or fewer sessions. The dropout rate for this study was consistent with similar weight management programs for

the pediatric population.⁴ Savoye indicated an 83% dropout rate within six months, when defined meal plans were used, which suggest multiple components may affect attendance. Further studies are needed to identify adequate time for behavior change, while maximizing attendance and to methods to motivate participants to complete weight management programs.

Individual Counseling vs. Group Sessions

Little evidence exists to determine if there is a difference in effectiveness between individual counseling or group sessions in the pediatric population. Studies looking at group intervention or individual intervention have shown no significant difference in decline in BMI between treatment programs; however, the group interventions were more cost effective.^{27,28} The program used in this research had both individual and group components; however, the sample size in the individual group was too small to determine any differences between group or individual weight management programs.

Strengths and Limitations

Strengths

This study was conducted with free-living subjects over a long period which can show effects of real-life situations. Participants had indicated motivation to make changes by enrolling in and paying for a weight management program.

Limitations

Dietary intake, activity, and behavior habits were self-reported, which may not fully reflect actual intake and activity levels. Subjects in this study were from a limited geographic area (one state) which may not be representative of other pediatric populations.

Implications for Research and Practice

This study showed completion of a structured long-term program had a beneficial effect on reducing BMI z-scores and improving adherence to lifestyle guidelines for weight management prevention and treatment. The reasons behind why a participant did or did not complete the program are not well understood. Although there were no demographic differences between the two study groups, with the exception of age, there may have been some variables not collected in this study that affected compliance. Variables that may have an impact on completion of a program include stress, social status, self-esteem, family size, relationship of parents, working status of parents, education of parents, and parents' lifestyle habits. Further quantitative and qualitative analysis of these variables could bring a greater understanding of ways to help overweight children and families complete weight management interventions.

Obesity is a complex disease with many causes, thus the realm of effective treatments may also be complex and varied making it difficult to determine the effectiveness of any single intervention. This study showed long-term structured weight management programs involving families and covering multiple topics can be an

effective treatment method for weight management in children and adolescents. There is little in the literature assessing the effectiveness of structured, family-based, long-term, multi-component, weight management programs for the pediatric population.^{4,6-9}

Continued development and evaluation of programs designed to treat child and adolescent overweight is warranted to address the public health issue of childhood obesity. Specific areas for further exploration include duration or length of program, reasons and methods to motivate participants to complete programs, and differences between group and individual counseling programs.

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Table 3-1. Curriculum lesson titles & topic descriptions provided to participants

Topic	Description
<i>Nutrition Core</i>	Get the basic of healthy eating with the “Stoplight” guide and food pyramid. You’ll play games to test your food knowledge and even make and taste a healthy dish.
<i>Nutrition: Nutrients and the Body</i>	Find out how to fuel your body right. Is it all about carbs or fat? We’ll let you know. You’ll be amazed when you find out how much sugar is in a soda or fat in French fries.
<i>Nutrition: Family Meals</i>	Desperate for healthy family meal ideas? We’ve got you covered for breakfast, lunch, dinner, and even eating out. You’ll leave with your own list of meal ideas and a taste of a healthy meal or snack.
<i>Nutrition: Label Reading</i>	Labels are covered in numbers, percent’s, and words you’ve never heard. In this class we’ll dissect labels so you can use them to make healthy choices every day.
<i>Nutrition: Meal Planning</i>	You know you should eat together more as a family, but how do you make that happen? Planning is the key and we’ve got a mix of planning ideas.
<i>Physical Activity Core</i>	Make physical activity part of your day. Get ideas for playful fun, learn about the benefits of being active, find alternatives to TV and video games, and find out what sleep has got to with it.
<i>Physical Activity:</i>	Get your heart pumping with one of our pediatric physical

<i>Cardiovascular Activities</i>	therapists. You'll run, skip, walk, dance, jump – all to help your heart.
<i>Physical Activity: Flexibility Activities</i>	Can you bend like a pretzel or stretch like a cat? You will after this class as our instructors use yoga, Pilates, and stretching to help you get flexible.
<i>Physical Activity: Strength and Endurance Activities.</i>	We all have muscles and you can work yours at our strength and endurance class. After squats, push-ups, jumps, and endurance bands your muscles will feel great when you're done.
<i>Physical Activity Instructor's Choice</i>	What will class be? family yoga, samba dancing, swimming, or something else? Whatever our instructors choose it will be fun, fit, and active.
<i>Behavior Core</i>	After this class you'll be able identify things that build up and tear down your self-esteem and recognize and use positive self-talk. Remember there is no perfect shape or size.
<i>Behavior: Eating Environment</i>	Your environment (home, school, friends, neighbors) can affect what you eat. Find out what your eating cues are and learn to make home a “no weight tease zone.”
<i>Behavior: Emotional Eating</i>	Emotions are part of life, but eating to deal with emotions doesn't have to be. We'll help you learn to eat when you are hungry and stop when you are full and give you a list of ways to work through your emotions.

Table 3-2. Demographic characteristic of participants by compliance group

Demographic	Compliant with Intervention	Non-compliant with intervention
Gender n (%)		
Male	18 (46.2)	13 (31.0)
Female	21 (53.8)	29 (69.0)
Age years mean \pm sd	9.3 \pm 2.77	10.8 \pm 2.79
Ethnicity n (%)		
Asian	3 (8.3)	1 (2.6)
Black	0 (0)	3 (7.7)
Hispanic	4 (11.1)	7 (18.0)
White	26 (72.2)	24 (61.5)
Mixed race	3 (8.3)	4 (10.3)
Qualifies for state medical insurance n (%)		
Yes	4 (13.3)	10 (23.8)
No	26 (86.7)	32 (76.2)
Family status n (%)		
Live w/ both parents	27 (81.8)	26 (61.9)
Live w/ one parent	4 (12.1)	14 (33.3)
Other	2 (6.1)	2 (4.8)

Table 3-3. Change in anthropometric measures over 12 months by compliance group

Anthropometric Measure	Compliant with Intervention			Non-Compliant with Intervention		
	Pre n=39	Post n=36	Average Change in 12 months n=36	Pre n=42	Post n=24	Average Change in 12 months n=24
BMI z-score	2.36 ± 0.72	2.17 ± 0.70	-0.19 ± 0.05 (<i>p</i> =.0004)	2.18 ± 0.49	2.12 ± 0.52	-0.05 ± 0.06 (<i>p</i> =.4129)
BMI (kg/m ²)	27.77 ± 5.37	28.15 ± 6.16	0.20 ± 0.35 (<i>p</i> =.5655)	29.23 ± 6.80	29.04 ± 5.71	1.02 ± 0.43 (<i>p</i> =.0212)
BMI percentile	97.9 ± 2.08	95.92 ± 7.21	-2.02 ± 0.87 (<i>p</i> =.0235)	97.19 ± 3.44	96.79 ± 4.03	-0.09 ± 1.07 (<i>p</i> =.9283)
Weight (kg)	55.61 ± 20.62	60.37 ± 22.27	4.14 ± 0.8 (<i>p</i> <.0001)	68.38 ± 27.65	68.17 ± 22.87	6.58 ± 0.99 (<i>p</i> <.0001)
Weight percentile	95.03 ± 9.51	93.17 ± 11.61	-1.69 ± 0.93 (<i>p</i> =.0754)	96.62 ± 5.18	96.21 ± 6.64	-0.05 ± 1.14 (<i>p</i> =.9627)
Height (cm)	139.13 ± 16.60	144.14 ± 16.21	4.72 ± 0.38 (<i>p</i> <.0001)	149.83 ± 15.44	151.14 ± 14.25	5.72 ± 0.47 (<i>p</i> <.0001)
Height percentile	72.23 ± 30.23	71.97 ± 29.72	-0.82 ± 1.87 (<i>p</i> =.6616)	74.79 ± 23.47	73.38 ± 25.26	0.19 ± 2.29 (<i>p</i> =.9330)

Table 3-4. Probability of meeting weight management lifestyle guidelines at enrollment and 12 months post by compliance group

Probability of meeting lifestyle guideline						
Lifestyle guideline	Compliant with intervention		Non-Compliant with intervention		Time Effect	Intervention Effect (Time*Compliance)
	Pre	Post	Pre	Post		
	(95% CI)	(95% CI)	(95% CI)	(95% CI)		
Vegetable Intake	0.31% (0.04-2.11)	55.67% (18.8-87.16)	12.69% (2.61-44.11)	13.19% (2.19-50.77)	p=<.0001	p=<.0001
Fruit Intake	72.41% (47.76-89.29)	97.14% (88.60-99.33)	82.32% (58.41-93.93)	91.35% (65.10-93.36)	p=.0015	p=.0913
Juice Intake	95.69% (86.80-98.68)	93.02% (79.81-97.82)	82.57% (60.33-93.22)	86.12% (52.53-97.21)	p=.8281	p=.3901
Dairy Intake	15.59% (5.70-34.20)	13.09% (4.59-32.01)	34.44% (15.77-59.59)	16.85% (4.09-49.03)	p=.2040	p=.3666
Sugar Sweetened	62.24% (45.13-	82.34% (64.45-	57.59% (40.29-	82.39% (48.29-	p=.0337	p=.8522

Beverage Consumption	76.77)	92.33)	73.22)	95.91)		
Physical Activity	13.58% (4.97- 32.12)	56.58% (30.47- 79.49)	39.80% (18.94- 65.16)	25.46% (6.70- 61.90)	p=.1093	p=.0032
Screen Time	48.61% (28.91- 68.73)	69.39% (47.25- 85.16)	44.27% (25.13- 65.27)	57.92% (25.54- 84.68)	p=.0951	p=.6995
Breakfast Frequency	88.25% (71.07- 95.82)	93.46% (80.69- 97.99)	75.02% (51.31- 89.54)	78.67% (44.45- 94.45)	p=.3307	p=.6146
Family Meals	76.44% (53.99- 89.97)	83.87% (63.68- 93.91)	86.20% (66.73- 95.11)	58.93% (62.55- 99.63)	p=.2100	p=.5754
Sleep Time	47.15% (26.16- 69.19)	54.80% (32.57- 75.27)	45.74% (24.52- 68.62)	54.73% (22.90- 83.11)	p=.4370	p=.9499

CI=confidence Interval

CHAPTER 4

CONCLUSION

Childhood obesity prevalence has been steadily increasing over the past 30 years with a possible stabilization, but not decrease of obesity rates in the last two years.¹⁻³ Results from the National Health and Nutrition Examination Survey (NHANES) show the prevalence of overweight at 18% for US children 12-19 years old, 20% for 6-11 year olds, and 10% for 2 to 5 year olds.³ Conditions and illnesses previously only seen in adults such as type 2 diabetes, dyslipidemia, hypertension, sleep apnea, orthopedic problems, depression, and non-alcoholic fatty liver disease are now seen in overweight/obese children.^{4,5} The incidence of these chronic conditions in children should make finding effective treatments a high priority.

This study showed completion of structured long-term program involving families and covering multiple topics had a beneficial effect on reducing BMI z-scores and improving adherence to lifestyle guidelines for weight management prevention and treatment. Participants who completed the LiVe weight management program (the intervention) had a significant decrease in BMI z-score (-0.1903 $p=.0004$) and BMI percentile (-2.02 $p=.0235$) over the 12-month period while participants who did not complete the program had no significant change in BMI z-score or BMI percentile over the 12 months. Both groups of subjects, compliers and non-compliers, had a significant increase in height and weight over the 12 month period, as expected with child growth. However, compliers gained less weight over time than non-compliers; 4.14 Kg and 6.58 Kg, respectively.

In addition to decreases in BMI z-score, subjects who completed the weight management program had a significant increase in the probability of meeting vegetable intake ($p < .0001$), and physical activity guidelines ($p = .0032$) post intervention compared to pre intervention. The mixed model regression analysis used to determine probabilities showed the improvement in the above lifestyle habits were due to completion of the weight management program.

The reasons behind why a participant did or did not complete the program are not well understood. Although there were no demographic differences between the two study groups, with the exception of age, there may have been some variables, not collected in this study that affected compliance. Variables that may have an impact on completion of a program include stress, social status, self-esteem, family size, relationship of parents, working status of parents, education of parents, and parents' lifestyle habits. Further quantitative and qualitative analysis of these variables could bring a greater understanding of ways to help overweight children and families complete weight management interventions.

Obesity is a complex disease with many causes, thus the realm of effective treatments may also be complex and varied making it difficult to determine the effectiveness of any single intervention. There is a paucity of studies, which evaluate structured, multi-component, long-term, family-based, weight management programs.⁶ Weight management programs are varied in time, educational techniques, instructor background, and topic focus making it difficult to compare programs to each other. However, the effectiveness of broad categories of programs can and should be studied.

Continued development and evaluation of programs designed to treat child and adolescent overweight is warranted to address the public health issue of childhood obesity.⁷ Specific areas for further exploration include duration or length of program, methods to motivate participants to complete structured programs, and differences between group and individual counseling programs.

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APPENDICES



Date _____
Child's Name _____
ID _____
For Parents PRE

Please **circle** one choice for each question below

- 1 How many days a week does your child eat breakfast?
0 1 2 3 4 5 6 7

- 2 On average how many cups of vegetables does your child eat each day?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more

- 3 On average how many cups of fruit does your child eat each day?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more

- 4 On average how many cups of 100% juice does your child drink each day?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more

- 5 On average, how many ounces of **regular** (not diet) soda, punch, lemonade, fruit drinks or sports drink does your child drink daily?
0 4 8 12 16 20 24 28 32 36 40 44 48 or more

- 6 On average, how many cups of milk, yogurt, or cheese does your child eat each day? (1-1/2 ounces of cheese, about 1-1/2 cheese sticks, is equivalent to one cup of milk or yogurt)
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more

- 7 On average, how many **minutes** of physical activity does your child get each day?
0 15 30 45 60 75 90 120 150 180 or more

- 8 On average, how many **hours** per day does your child watch T.V. or play video or computer games?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more

- 9 On average, how many meal does your family eat together each week?
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 or more

- 10 On average, how many hours of sleep does your child get each night?
2 4 6 8 10 12 14 or more

Please answer the next set of questions using the scale below
Circle one choice for each question

never					always
1	2	3	4	5	

		Never			Always	
	Does your child ever eat when they...					
11	want a reward?	1	2	3	4	5
12	are stressed?	1	2	3	4	5
13	are angry?	1	2	3	4	5
14	are bored?	1	2	3	4	5
15	are sad?	1	2	3	4	5
16	are nervous or worried?	1	2	3	4	5
17	Does your child watch television during meal time?	1	2	3	4	5
18	Do you or other family members make comments about your child's weight?	1	2	3	4	5
19	Do peers or friends make comments about your child's weight?	1	2	3	4	5
20	Does your child feel like family members would like them more if they lost weight?	1	2	3	4	5
21	Does your child feel like friends would like them more if they lost weight?	1	2	3	4	5
22	Do you feel your child has the support they need to help them manage their weight?	1	2	3	4	5



Date _____

Your Name _____

ID _____

For Kids 12 and over

PRE

Please **circle** one choice for each question below

- 1 How many days a week do you eat breakfast?
0 1 2 3 4 5 6 7
- 2 On average how many cups of vegetables do you eat each day?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more
- 3 On average how many cups of fruit do you eat each day?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more
- 4 On average how many cups of 100% juice do you drink each day?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more
- 5 On average, how many ounces of **regular** (not diet) soda, punch, lemonade, fruit drinks or sports drink do you drink daily?
0 4 8 12 16 20 24 28 32 36 40 44 48 or more
- 6 On average, how many cups of milk, yogurt, or cheese do you eat each day? (1-1/2 ounces of cheese, about 1-1/2 cheese sticks, is equivalent to one cup of milk or yogurt)
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more
- 7 On average, how many **minutes** of physical activity does you get each day?
0 15 30 45 60 75 90 120 150 180 or more
- 8 On average, how many **hours** per day do you watch T.V. or play video or computer games?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more
- 9 On average, how many meal does your family eat together each week?
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 or more
- 10 On average, how many hours of sleep do you get each night?
2 4 6 8 10 12 14 or more

Please answer the next set of questions using the scale below
Circle one choice for each question

never					always
1	2	3	4	5	

		Never			Always	
	Do you ever eat when you...					
11	want a reward?	1	2	3	4	5
12	are stressed?	1	2	3	4	5
13	are angry?	1	2	3	4	5
14	are bored?	1	2	3	4	5
15	are sad?	1	2	3	4	5
16	are nervous or worried?	1	2	3	4	5
17	Do you watch television during meal time?	1	2	3	4	5
18	Do other family members make comments about your weight?	1	2	3	4	5
19	Do peers or friends make comments about your weight?	1	2	3	4	5
20	Do you feel like family members would like you more if you lost weight?	1	2	3	4	5
21	Do you feel like friends would like you more if you lost weight?	1	2	3	4	5
22	Do you feel you have the support you need to help manage your weight?	1	2	3	4	5
		Never			Always	



Date _____
Child's Name _____
ID _____
For Parents POST

Please **circle** one choice for each question below

- 1 How many days a week does your child eat breakfast?
0 1 2 3 4 5 6 7

- 2 On average how many cups of vegetables does your child eat each day?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more

- 3 On average how many cups of fruit does your child eat each day?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more

- 4 On average how many cups of 100% juice does your child drink each day?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more

- 5 On average, how many ounces of **regular** (not diet) soda, punch, lemonade, fruit drinks or sports drink does your child drink daily?
0 4 8 12 16 20 24 28 32 36 40 44 48 or more

- 6 On average, how many cups of milk, yogurt, or cheese does your child eat each day? (1-1/2 ounces of cheese, about 1-1/2 cheese sticks, is equivalent to one cup of milk or yogurt)
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more

- 7 On average, how many **minutes** of physical activity does your child get each day?
0 15 30 45 60 75 90 120 150 180 or more

- 8 On average, how many **hours** per day does your child watch T.V. or play video or computer games?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more

- 9 On average, how many meal does your family eat together each week?
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 or more

- 10 On average, how many hours of sleep does your child get each night?
2 4 6 8 10 12 14 or more

Please answer the next set of questions using the scale below
 Circle one choice for each question

never					always
1	2	3	4	5	

		Never			Always
	Does your child ever eat when they...				
11	want a reward?	1	2	3	4 5
12	are stressed?	1	2	3	4 5
13	are angry?	1	2	3	4 5
14	are bored?	1	2	3	4 5
15	are sad?	1	2	3	4 5
16	are nervous or worried?	1	2	3	4 5
17	Does your child watch television during meal time?	1	2	3	4 5
18	Do you or other family members make comments about your child's weight?	1	2	3	4 5
19	Do peers or friends make comments about your child's weight?	1	2	3	4 5
20	Does your child feel like family members would like them more if they lost weight?	1	2	3	4 5
21	Does your child feel like friends would like them more if they lost weight?	1	2	3	4 5
22	Do you feel your child has the support they need to help them manage their weight?	1	2	3	4 5
		Never			Always



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Date _____

Your Name _____

ID _____

For Kids 12 and over

POST

Please **circle** one choice for each question below

- 1 How many days a week do you eat breakfast?
0 1 2 3 4 5 6 7

- 2 On average how many cups of vegetables do you eat each day?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more

- 3 On average how many cups of fruit do you eat each day?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more

- 4 On average how many cups of 100% juice do you drink each day?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more

- 5 On average, how many ounces of **regular** (not diet) soda, punch, lemonade, fruit drinks or sports drink do you drink daily?
0 4 8 12 16 20 24 28 32 36 40 44 48 or more

- 6 On average, how many cups of milk, yogurt, or cheese do you eat each day? (1-1/2 ounces of cheese, about 1-1/2 cheese sticks, is equivalent to one cup of milk or yogurt)
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more

- 7 On average, how many **minutes** of physical activity does you get each day?
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0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 or more

- 9 On average, how many meal does your family eat together each week?
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 or more

- 10 On average, how many hours of sleep do you get each night?
2 4 6 8 10 12 14 or more

Please answer the next set of questions using the scale below
Circle one choice for each question

never					always
1	2	3	4	5	

		Never					Always					
	Do you ever eat when you...											
11	want a reward?	1	2	3	4	5						
12	are stressed?	1	2	3	4	5						
13	are angry?	1	2	3	4	5						
14	are bored?	1	2	3	4	5						
15	are sad?	1	2	3	4	5						
16	are nervous or worried?	1	2	3	4	5						
17	Do you watch television during meal time?	1	2	3	4	5						
18	Do other family members make comments about your weight?	1	2	3	4	5						
19	Do peers or friends make comments about your weight?	1	2	3	4	5						
20	Do you feel like family members would like you more if you lost weight?	1	2	3	4	5						
21	Do you feel like friends would like you more if you lost weight?	1	2	3	4	5						
22	Do you feel you have the support you need to help manage your weight?	1	2	3	4	5						
		Never					Always					



Fecha _____

Nombre de niño/nia _____

ID# _____

Por Padres PRE 09

Por favor trazar un círculo alrededor de una elección por cada pregunta en esta forma

- 1 ¿Cuántos días de la semana desayuna su niño(a)?
0 1 2 3 4 5 6 7

- 2 ¿En promedio cuántas tazas de verduras come su niño(a) diario?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o mas

- 3 ¿En promedio cuántas tazas de frutas come su niño(a) diario?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o mas

- 4 ¿En promedio cuántas tazas de 100% jugo de frutas toma su niño(a) diario?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o mas

- 5 ¿En promedio cuántas onzas de soda **regular** (no de dieta), ponche, limonada, jugo de frutas o bebidas deportivas toma su niño(a) diario?
0 4 8 12 16 20 24 28 32 36 40 44 48 o mas

- 6 ¿En promedio, cuántas tazas de leche, yogur, o queso come su niño(a) diario? (1-1/2 onzas de queso o 1-1/2 palitos de queso equivale a una taza de yogur o leche)
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o mas

- 7 ¿En promedio, cuántos **minutos** de actividad física hace su niño (a) diario?
0 15 30 45 60 75 90 120 150 180 o mas

- 8 ¿En promedio cuántas **horas** diario (a) mira la tele, juega en la computadora o en la tele, y manda mensajes del texto su niño?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o mas

- 9 ¿En promedio, cuántas comidas come su familia junta cada semana?
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 o mas

- 10 ¿En promedio, cuántas horas duerme su niño(a) cada noche?
2 4 6 8 10 12 14 o mas

Por favor responder a la próxima serie de preguntas usando la escala por abajo
Traza un círculo alrededor de una elección por cada pregunta

Nunca					Siempre
1	2	3	4	5	

		Nunca				Siempre
11	¿Come su niño(a) cuando quiere una recompensa?	1	2	3	4	5
12	¿está estresado(a)?	1	2	3	4	5
13	¿está enojado(a)?	1	2	3	4	5
14	¿está aburrido(a)?	1	2	3	4	5
15	¿está triste?	1	2	3	4	5
16	¿está nervioso(a) o preocupado(a)?	1	2	3	4	5
17	¿Mira su niño(a) la tele durante la hora de comer?	1	2	3	4	5
18	¿Usted o otros miembros de la familia hacen comentarios sobre el peso de su niño(a)?	1	2	3	4	5
19	¿Hacen comentarios pares o amigos sobre el peso de su niño(a)?	1	2	3	4	5
20	¿Se siente su niño(a) que los miembros de la familia lo/la querrían mas si su niño(a) perdería	1	2	3	4	5
21	¿Se siente su niño(a) que los amigos lo/la querrían mas si su el/ella perdería peso?	1	2	3	4	5
22	¿Usted se siente que su niño(a) tiene la apoya que necesita para manejar su peso?	1	2	3	4	5
23	¿Cuándo su niño(a) está activo(a), con que frecuencia el/ella tiene un latido de corazón rápido, una respiración dificultosa, y/o suda?	1	2	3	4	5
		Nunca				Siempre



Fecha _____

Nombre _____

ID _____

Por niños que tienen más de 12 años PRE 09

Por favor trazar un círculo alrededor de una elección por cada pregunta en esta forma

- 1 ¿Cuántos días de la semana desayuna usted?
0 1 2 3 4 5 6 7

- 2 ¿En promedio cuántas tazas de verduras come usted diario?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o más

- 3 ¿En promedio cuántas tazas de frutas come usted diario?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o más

- 4 ¿En promedio cuántas tazas de 100% jugo de frutas toma usted diario?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o más

- 5 ¿En promedio cuántas onzas de soda **regular** (no de dieta), ponche, limonada, jugo de frutas o bebidas deportivas toma usted diario?
0 4 8 12 16 20 24 28 32 36 40 44 48 o más

- 6 ¿En promedio, cuántas tazas de leche, yogur, o queso come usted diario? (1-1/2 onzas de queso o 1-1/2 palitos de queso equivale a una taza de yogur o leche)
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o más

- 7 ¿En promedio, cuántos **minutos** de actividad física hace usted diario?
0 15 30 45 60 75 90 120 150 180 o más

- 8 ¿En promedio cuántas **horas** diario mira usted la tele, juega en la computadora o en la tele, y manda mensajes del texto?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o más

- 9 ¿En promedio, cuántas comidas come su familia junta cada semana?
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 o más

- 10 ¿En promedio, cuántas horas duerme usted cada noche?
2 4 6 8 10 12 14 o más

Por favor responder a la próxima serie de preguntas usando la escala por abajo
Traza un círculo alrededor de una elección por cada pregunta

nunca					siempre
1	2	3	4	5	

		Nunca			Siempre	
	¿Come usted cuando					
11	quiere una recompensa?	1	2	3	4	5
12	está estresado(a)?	1	2	3	4	5
13	está enojado(a)?	1	2	3	4	5
14	está aburrido(a)?	1	2	3	4	5
15	está triste?	1	2	3	4	5
16	está nervioso(a) o preocupado(a)?	1	2	3	4	5
17	¿Mira usted la tele durante la hora de comer?	1	2	3	4	5
18	¿Hacen comentarios otros miembros de la familia sobre su peso (de usted)?	1	2	3	4	5
19	¿Hacen comentarios pares o amigos sobre su peso (de usted) ?	1	2	3	4	5
20	¿Se siente usted que los miembros de su familia lo/la querrían mas si usted perdería peso?	1	2	3	4	5
21	¿Se siente usted que los amigos lo/la querrían más si usted perdería peso?	1	2	3	4	5
22	¿Se siente usted que tiene la apoya que necesita para manejar su peso?	1	2	3	4	5
23	¿Cuándo usted está activo(a), con que frecuencia tiene un latido de corazón rápido, una respiración dificultosa, y/o suda?	1	2	3	4	5
		Nunca			Siempre	



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Fecha _____

Nombre de niño/niña _____

ID# _____

Por Padres POST 09

Por favor trazar un círculo alrededor de una elección por cada pregunta en esta forma

- 1 ¿Cuántos días de la semana desayuna su niño(a)?
0 1 2 3 4 5 6 7
- 2 ¿En promedio cuántas tazas de verduras come su niño(a) diario?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o mas
- 3 ¿En promedio cuántas tazas de frutas come su niño(a) diario?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o mas
- 4 ¿En promedio cuántas tazas de 100% jugo de frutas toma su niño(a) diario?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o mas
- 5 ¿En promedio cuántas onzas de soda **regular** (no de dieta), ponche, limonada, jugo de frutas o bebidas deportivas toma su niño(a) diario?
0 4 8 12 16 20 24 28 32 36 40 44 48 o mas
- 6 ¿En promedio, cuántas tazas de leche, yogur, o queso come su niño(a) diario? (1-1/2 onzas de queso o 1-1/2 palitos de queso equivale a una taza de yogur o leche)
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o mas
- 7 ¿En promedio, cuántos **minutos** de actividad física hace su niño (a) diario?
0 15 30 45 60 75 90 120 150 180 o mas
- 8 ¿En promedio cuántas **horas** diario (a) mira la tele, juega en la computadora o en la tele, y manda mensajes del texto su niño?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o mas
- 9 ¿En promedio, cuántas comidas come su familia junta cada semana?
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 or more
- 10 ¿En promedio, cuántas horas duerme su niño(a) cada noche?
2 4 6 8 10 12 14 o mas

Por favor responder a la próxima serie de preguntas usando la escala por abajo
 Traza un **círculo** alrededor de una elección por cada pregunta

Nunca				Siempre
1	2	3	4	5

		Nunca				Siempre
11	¿Come su niño(a) cuando quiere una recompensa?	1	2	3	4	5
12	está estresado(a)?	1	2	3	4	5
13	está enojado(a)?	1	2	3	4	5
14	está aburrido(a)?	1	2	3	4	5
15	está triste?	1	2	3	4	5
16	está nervioso(a) o preocupado(a)?	1	2	3	4	5
17	¿Mira su niño(a) la tele durante la hora de comer?	1	2	3	4	5
18	¿Usted o otros miembros de la familia hacen comentarios sobre el peso de su niño(a)?	1	2	3	4	5
19	¿Hacen comentarios pares o amigos sobre el peso de su niño(a)?	1	2	3	4	5
20	¿Se siente su niño(a) que los miembros de la familia lo/la querrían mas si su niño(a) perdería	1	2	3	4	5
21	¿Se siente su niño(a) que los amigos lo/la querrían mas si su el/ella perdería peso?	1	2	3	4	5
22	¿Usted se siente que su niño(a) tiene la apoya que necesita para manejar su peso?	1	2	3	4	5
23	¿Cuándo su niño(a) está activo(a), con que frecuencia el/ella tiene un latido de corazón rápido, una respiración dificultosa, y/o suda?	1	2	3	4	5
		Nunca				Siempre



Fecha _____

Nombre _____

ID _____

Por niños que tienen más de 12 años

POST 09

Por favor trazar un **círculo** alrededor de una elección por cada pregunta en esta forma

- 1 ¿Cuántos días de la semana desayuna usted?
0 1 2 3 4 5 6 7
- 2 ¿En promedio cuántas tazas de verduras come usted diario?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o más
- 3 ¿En promedio cuántas tazas de frutas come usted diario?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o más
- 4 ¿En promedio cuántas tazas de 100% jugo de frutas toma usted diario?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o más
- 5 ¿En promedio cuántas onzas de soda **regular** (no de dieta), ponche, limonada, jugo de frutas o bebidas deportivas toma usted diario?
0 4 8 12 16 20 24 28 32 36 40 44 48 o más
- 6 ¿En promedio, cuántas tazas de leche, yogur, o queso come usted diario? (1-1/2 onzas de queso o 1-1/2 palitos de queso equivale a una taza de yogur o leche)
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o más
- 7 ¿En promedio, cuántos **minutos** de actividad física hace usted diario?
0 15 30 45 60 75 90 120 150 180 o más
- 8 ¿En promedio cuántas **horas** diario mira usted la tele, juega en la computadora o en la tele, y manda mensajes del texto?
0 1/2 1 1-1/2 2 2-1/2 3 3-1/2 4 o más
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0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 or more
- 10 ¿En promedio, cuántas horas duerme usted cada noche?
2 4 6 8 10 12 14 o más

Por favor responder a la próxima serie de preguntas usando la escala por abajo
Traza un círculo alrededor de una elección por cada pregunta

nunca					siempre
1	2	3	4	5	

		Nunca					Siempre						
	¿Come usted cuando												
11	quiere una recompensa?	1	2	3	4	5							
12	está estresado(a)?	1	2	3	4	5							
13	está enojado(a)?	1	2	3	4	5							
14	está aburrido(a)?	1	2	3	4	5							
15	está triste?	1	2	3	4	5							
16	está nervioso(a) o preocupado(a)?	1	2	3	4	5							
17	¿Mira usted la tele durante la hora de comer?	1	2	3	4	5							
18	¿Hacen comentarios otros miembros de la familia sobre su peso (de usted)?	1	2	3	4	5							
19	¿Hacen comentarios pares o amigos sobre su peso (de usted) ?	1	2	3	4	5							
20	¿Se siente usted que los miembros de su familia lo/la querrían mas si usted perdería peso?	1	2	3	4	5							
21	¿Se siente usted que los amigos lo/la querrían más si usted perdería peso?	1	2	3	4	5							
22	¿Se siente usted que tiene la apoya que necesita para manejar su peso?	1	2	3	4	5							
23	¿Cuándo usted está activo(a), con que frecuencia tiene un latido de corazón rápido, una respiración dificultosa, y/o suda?	1	2	3	4	5							
		Nunca					Siempre						

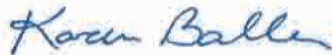
11/29/10

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This is to confirm copyright permission to use your article "Adherence to Lifestyle Recommendations of Overweight Children Enrolling in a Structured Weight Management Program" on page 263 from CHILDHOOD OBESITY Volume 6 Issue 5 in your dissertation.

Please see attached.

Thank you,



Karen Ballen
Manager, Reprint Department
kballen@liebertpub.com
Tel: (914) 740-2194
Fax: (914) 740-2108

To Permissions Editor:

I am preparing my dissertation in the Nutrition and Food Science department at Utah State University (USU). I hope to complete my degree in the Spring of 2011.

An article, "Adherence to Lifestyle Recommendations of Overweight Children in a Structured Weight Management Program," of which I am the first author and which appeared in your journal *Childhood Obesity*, October 2010, Volume 6, Number 5, pages 263-269 reports an essential part of my dissertation research.

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Sincerely,
 Pauline Williams
 801-422-4876
pauline_williams@byu.edu

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Signed 

Date 11/29/10

Fee \$ 250

November 20, 2010

97

Pauline Williams
5125 Pebblestone Cir.
West Jordan, UT 84081

Dear Katie, Margaret, Amelia, and Shannon:

I am preparing my dissertation in the Nutrition and Food Science department at Utah State University. I hope to complete my degree in the Spring of 2011.

I would like to include the article, "Adherence to Lifestyle Recommendations of Overweight Children in a Structured Weight Management Program," of which I am the first author and you are a co-author in my dissertation.

Please indicate your approval of including this article in my dissertation by signing in the space provided.

If you have any questions, please call me or send an e-mail message. Thank you for your assistance.

Thank you,
Pauline Williams

I hereby give permission to Donna Pauline Williams to reprint the above article in her dissertation with a footnote on the first page of the chapter indicating co-authors.

SIGNATURES

Catherine M. McDonald
Catherine M. McDonald, PhD, RD, CD

Date: 12-9-10

Margaret A. Braae
Margaret A. Braae, MHSc, RD, CD

Date: 11-26-10

Amelia B. McBride
Amelia B. McBride, MS, RD, CD

Date: 11-24-10

Shannon M. Sundberg
Shannon M. Sundberg, MS, RD, CD

Date: 12-9-2010

November 20, 2010

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Pauline Williams
5125 Pebblestone Cir.
West Jordan, UT 84081

Dear Joy:

I am preparing my dissertation in the Nutrition and Food Science department at Utah State University. I hope to complete my degree in the Spring of 2011.

I would like to include the article, "Adherence to Lifestyle Recommendations of Overweight Children in a Structured Weight Management Program," of which I am the first author and you are a co-author in my dissertation.

Please indicate your approval of including this article in my dissertation by signing in the space provided.

If you have any questions, please call me or send an e-mail message. Thank you for your assistance.

Thank you,
Pauline Williams

I hereby give permission to Donna Pauline Williams to reprint the above article in her dissertation with a footnote on the first page of the chapter indicating co-authors.

SIGNATURES


Joilyne D. Musselman, RD, CD

Date: 12/1/10

VITA

D. Pauline Williams, MPA, RD, CD

(2011)

REGISTRATION AND CERTIFICATION

- 1992-present **Registered Dietitian**, Commission on Dietetic Registration
- 1992-present **Certified Dietitian**, State of Utah Division of Occupational and Professional Licensing
- 2006-present **Child and Adolescent Weight Management Certificate**, Commission on Dietetic Registration

PROFESSIONAL EXPERIENCE

- 2010-Present **Assistant Teaching Professor, Director Dietetic Internship**; Brigham Young University; Provo, UT
- 2005-2010 **Clinical Nutrition Manager**; Primary Children's Medical Center, Intermountain Healthcare; Salt Lake City, UT.
- 2001-2010 **Instructor**; Brigham Young University; Provo, UT.
- 2000-2005 **Assistant Professor, Extension – Family and Consumer Science Extension Agent**; Utah State University Extension; Salt Lake County, UT.
- 1998-2000 **Senior Auditor**; Office of the Legislative Auditor General – State of Utah; Salt Lake city, UT.
- 1992-present **Consulting Dietitian**; Private schools, daycares
- 1992-1998 **Clinical Dietitian**; Utah Valley Regional Medical Center; Provo, UT.
Assistant Interim Manager; Utah Valley Regional Dialysis; (1 yr)

EDUCATION

- 2011 **Doctor of Philosophy Candidate – Nutritional Science**; Utah State University, Logan, UT.
- 1998 **Master of Public Administration**; Brigham Young University, Provo, UT. Graduated with Distinction.
- 1992 **Bachelor of Science – Clinical Dietetics**; Brigham Young University, Provo, UT.

ACADEMIC COURSES

Academic Courses Taught

Date	School	Class	Number Students
2010-present	Brigham Young University	NDFS 638 Advanced Clinical Dietetics	8
2010-present	Brigham Young University	NDFS 520R Supervised Practice Dietetics	8
2010-present	Brigham Young University	NDFS 466 Advanced Dietetics Practice (3 credits)	33
2010-present	Brigham Young University	NDFS 490, Professionalism Seminar (2 credits)	33
2010-present	Brigham Young University	NDFS 405, Nutrition Assessment Lab (0.5 credits)	18
2001-present	Brigham Young University	NDFS/FSN 100, Essentials of Human Nutrition (3.0 credits)	317

Support of Academic Programs

Year	Credit Course #students	#Guest Lectures/#Students	#Mentoring Students	#Interns/#hours	#Student Research
2000-present	165	6/121	2	34/2904	51

RESEARCH, SCHOLARSHIP, AND CREATIVE ACCOMPLISHMENTS

Refereed Journal Articles

Williams, D. P., Christensen, N. K., McDonald C. M., Braae M. A., McBride A. B., Sundberg S. M., Musselman J. D. (2010) Adherence to lifestyle recommendations of overweight children in a structured weight management program. *Childhood Obesity*. 2010;6(5):263-269.

Christensen, N.K., Williams, D. P., Pfister, R., Pace, M., & Palmer, M. (2007) Knowledge and Behavior Improvement Through a Skin Cancer Action Approach Exhibit. *Journal of Extension*, 45, 4, 4RIB5.

Williams, D. P., Christensen, N., Pfister, R., & Murphy, D. (2006). Participation in a 4-H food camp to promote nutrition knowledge and culinary skills. *Journal of NEAFCS*, 17-20, 22.

Christensen, N. K., Williams, D. P., & Pfister R. (2004). Cost savings and clinical effectiveness of an extension service diabetes program. *Diabetes Spectrum*, 17(3), 171-175.

Williams, D. P., LeBlanc, H. R., & Christensen, N. K. (2004). Diabetes stepping up to the plate: An education curriculum focused on food portioning skills. *Journal of Extension*, 42(3).

Beto JA, Bansal VK, Ing TD, Daugirdas JT for the Council on Renal Nutrition National Research Question Collaborative Study Group (1998). Variation in Blood Sample Collection for Determination of Hemodialysis Adequacy. *Am J Kidney Dis*, January.

Book Chapters

Williams, D. P. & Christensen, N. K. (2005). Principles of nutrition. In Osborn, L., First, L., and DeWitt, T. *Comprehensive Pediatrics*.

Christensen, N. K. & Williams, D. P. (2005) *Nutrition in children with chronic disease*. In Osborn, L., First, L., and DeWitt, T. *Comprehensive Pediatrics*.

Multi-Media Materials (peer reviewed)

Williams, D. P. (2002). Diabetes and nutrition video. *Utah Department of Health Diabetes Control Program, USU Extension diabetes series*.

Williams, D. P. & Wolf, M. (2001). How to safely can salsa. *Web guide – www.usuextension.slco.org*

Williams, D. P. & Christensen, N. K. (2001). Diabetes – stepping up to the plate. *Series curriculum*.

Peer Reviewed Publications, Abstracts, and Posters

Peer Reviewed Publications	Years	Number
Peer Reviewed Journals (not refereed)	2002-present	1
Conference Proceedings Abstracts, and Posters	2000-present	11
Other: Commissioned Articles, Fact Sheets	2001-present	3

Peer Reviewed Journal Articles

Williams, D. P., Christensen, N.K., & Pfister, R. (2002). The role of extension in diabetes education. *Journal of the Utah Academy of Arts and Sciences*. 79, 64-69.

Peer Reviewed Conference Proceedings, Abstracts, Posters, Fact Sheets

McGuire, D., Christensen N.K., & Williams, D. P. (2008) The Effectiveness Of Active Learning Health Fairs As A Tool For Dietetic Associations To Improve Nutrition/Health Knowledge And Behaviors. American Dietetic Association. Philadelphia, PA. Abstract and Poster.

Williams, D. P., Braae, M. A., Coombs, S., McBride, A. B., Beggs, J., & Conway, T. (2007) An Electronic Note Improves Charting Compliance. *Utah Dietetic Association*. Layton, UT. Abstract and Poster

Christensen, N. K., Williams, D. P., & USU Dietetic Students. (2005). Trade your hat: A skin cancer awareness program through Utah State University Extension. *Utah Dietetic Association*. Salt Lake City, UT. Abstract and Poster

Williams, D. P., Christensen, N. K., and USU Dietetic Students. (2005). The effect of knowledge and food skills through participation in a food camp; a Utah State University Extension program. *Utah Dietetic Association*. Salt Lake City, UT. Abstract and Poster

Williams, D. P., Pace, M., Palmer, M., LeBlanc, H., & McKendrick, S. (2005). Trade Your Hat: A Skin Cancer Awareness Program. *Extension Annual Planning and Professional Development Conference*. Logan, UT. Abstract.

Williams, D. P. (2004). The glycemic index. Logan, UT: Utah State University Extension. FN/2004-01. Fact Sheet.

Chandler, T., Inglet, E., Pearson, K. Richey, K., Talbot, A., Van Gils, A., Christensen, N. K., & Williams, D. P. (2004) Effectiveness of an Extension Service heart healthy education program on knowledge and lifestyle habits. *Utah Dietetic Association Conference*. Salt Lake City, UT. Abstract and Poster.

Hendricks, A., Holding, J., Lamb T., Trout, A., Waddoups, E., Christensen, N. K. & Williams, D. P. (2004) Nutrition placemats increase self-perceived knowledge of participants in senior centers. *Utah Dietetic Association Conference*. Salt Lake City, UT. Abstract and Poster.

Williams, D. P. (2003). Walk through Utah. *Utah State University Extension Family and Consumer Science Professional Development Training*. Provo, UT. Abstract.

Williams, D. P. & Christensen, N. K. (2002). Limiting glucose rises through portion sizes – Diabetes education program. *Utah State University Extension Annual Conference abstract*. Logan, UT. Abstract.

Christensen, N. K., Williams, D. P., & USU Dietetic Students. (2002). Comparison of Diabetes Education Food Guide Pyramid vs. Individual Meal Planning. *Utah Dietetic Association*. Lehi, UT. Abstract and Poster.

Christensen, N. K., Williams, D. P., and USU Senior Dietetic Students. (2001). The role of extension in diabetes education. *Utah Dietetic Association Conference*. Lehi, UT. Abstract and Poster.

Scholarly and Professional Presentations

Topic	Location	Number Presentations	Participants
Diabetes and Nutrition	National/Regional	2	196
Diabetes and Nutrition	State/Local	5	123
Nutrition General	State/Local	16	1343
Other	National/Regional	1	19
Other	State/Local	2	186
Total:		26	1876

External/Internal Competitive Funding

Type	Grants Awarded	Funded Amount	Grants unfunded	Requested Amount
External	9	\$53,841.00		
Internal	3	\$20,356.00	1	\$20,391.15
In-Kind Donations	3	\$13,082.00	-	-
Totals:	15	\$87,279.00	1	\$20,391.15

Awards and Honors for Research

McGuire, D., Christensen N.K., & Williams, D. P. (2009) The Effectiveness Of Active Learning Health Fairs As A Tool For Dietetic Associations To Improve Nutrition/Health Knowledge And Behaviors. *First Place Poster Session – Professional Category*. *Utah Dietetic Association*. Sandy, UT Poster.

Williams, D. P., Braae, M. A., Coombs, S., McBride, A. B., Beggs, J., & Conway, T. (2007) An Electronic Note Improves Charting Compliance. *First place Poster Session – Professional Category. Utah Dietetic Association*. Layton, UT. Abstract and Poster

Chandler, T., Inglet, E., Pearson, K., Richey, K., Talbot, A., Van Gils, A., Christensen, N. K., & Williams, D. P. (2004). Effectiveness of an Extension Service heart healthy education program on knowledge and lifestyle habits. *First place Poster Session – Undergraduate Category. Utah Dietetic Association Conference. Salt Lake City, UT.*

Williams, D. P., Christensen, N. K., & Pfister, R. (2002). The Role of Extension in Diabetes Education. *Best Paper Award – Journal of the Utah Academy Division of Health, Physical Education, and Recreation.*

Christensen, N. K., Williams D. P., & USU Senior Dietetic Students. (2001). The role of extension in diabetes education. *First Place, Poster Session, undergraduate category. Utah Dietetic Association.*

PROGRAM DEVELOPMENT & HONORS

Presentations Taught and Programs/Events Developed

Presentations

Type of Presentation	Number of Presentations	Number of Participants
Food and Nutrition	109	3,571
Food Preservation, Storage, and Safety	48	935
Other Family and Consumer Science	5	148
4-H Youth and Volunteer Development	17	306
Total:	179	4,960

Programs/Events Developed

Program or Event	Number of Programs/Events	Number of Participants/Exhibits
Health Programs	28	2,188
4-H Contests, activities/exhibits	31	323/3,901
Food Preservation, Safety, and Storage	7	315
Total:	66	2,514/3,901

Educational Material Produced

Type	Number of Articles/Appearances
Newspaper Articles Written	6
Newspaper Articles Facilitated	53
Other Print Materials	6
Radio Appearances	15
Television Appearances	110
Newsletter Articles Written	62
Newsletter Articles Facilitated	9
Newsletters Edited	14
Web Based Articles	62
Multimedia	3
Total:	340

Presentations/Programs Facilitated

Type of Presentation/Program	Number of Presentations	Number of Participants
Diabetes and Nutrition	5	23
Nutrition Therapy	16	587
Food Preservation, Storage, and Safety	5	57
Other	7	78
Total:	33	745

Awards and Honors for Programming

Regional and National

Williams, D. P., Albertson, M. K., Scott, P. & Perfetto, B. (2003). *First Place Newsletter- National*. National Extension Association of Family and Consumer Sciences.

Williams, D. P. (2002). *New Professional Award*. National Extension Association of Family and Consumer Sciences – Western Region.

Williams, D. P. (2002). *Public Policy Challenge Level III*. National Extension Association of Family and Consumer Sciences.

State and Local

Lewis, T. & Williams, D.P. (2008). *Health Care Hero*. Utah Business Magazine.

Williams, D. P. (2004). *Peer Recognition*. Utah Extension Association of Family and Consumer sciences.

Williams, D. P. (2004). *Taggart Ballard Award of Excellence*. Utah State University Extension.

Belliston, J. T., Holmes, D. L., Guy, S. M. and the FOCIS testing team (2004). *Technology Team Award*. Epsilon Sigma Phi Iota Chapter. Member of team.

Williams, D. P., Albertson, M. K., Scott, P. & Perfetto, B. (2003). *First Place Newsletter*. Utah Extension Association of Family and Consumer Sciences.

Williams, D. P. (2003). *Peer Recognition*. Utah Extension Association of Family and Consumer Sciences.

Williams, D. P. (2002). *New Professional Award*. Utah Extension Association of Family and Consumer Sciences.

SERVICE

University and Corporate Service

2010-present	Member, Outcome Assessment Team, College of Life Science
2010-present	Member, Undergraduate Committee, Department of Nutrition, Dietetics, and Food Science
2006-2010	Chair, Intermountain Pediatric Nutrition Weight Management Team
2006-2007	Member, Intermountain Healthcare Pediatric Care Process Model Team
2006-2010	Member, Intermountain Adult Weight Management Standardization Team
2006-2008	Co-chair, Intermountain Clinical Nutrition Manager Team
2004-2005	Member, Extension Food Safety Specialist search committee
2004	Member, Health Issues Team
2002	Member, FNP September conference planning committee
2002	Member, FOCIS Standing Committee on Reporting
2001	Member, Cooperative Extension Review Committee

Professional Service

Regional and National

2006-present Expert Reviewer www.KidsHealth.org

- 2003-2004 External Marketing Committee, National Association of family and Consumer Science
- 2003 Volunteer, Galaxy II Conference
- 1990-present Member, American Dietetic Association
- 2000-2005 Member, National Extension Association of Family and Consumer Science
- 1998-present Member, Beta Gamma Sigma, Business Honor Society

State and Local

Utah Dietetic Association

- 1990-present Member
- 2004-2007 President Elect, President, and Past President
- 2000-2003 Update Newsletter Editor
- 2000-2001 Awards Committee
- 1999-2001 Legislative Network Coordinator
- 1997-1998 Legislative Network Coordinator Elect

Utah Extension Association of Family and Consumer Science

- 2000-2005 Member
- 2002-2005 Public Information Chair

Utah Nutrition Council

- 2000-present Member
- 2002-2003 Chair
- 2001-2002 Chair Elect

Other

- 2007-present Chair, Utah Action for Healthy Kids
- 2004-2005 Member, SLFIT (Salt Lake Fit)
- 2003-present Member, Utah Action for Healthy Kids Core Committee
- 2002-2005 Member, Utah Food Safety Coalition
- 2001-2005 Member, Diabetes, Community Collaboration, Access to Information Subcommittee

Community Service

- 2007-present State of Utah Division of Occupational Professional Licensing Certified Dietitian Board
- 2004-2006 Jordan School District Wellness Policy Committee Member
- 2000-2002 Judge Utah State Fair canning exhibits
- 2001-present Deseret News Sterling Scholar Judge

Awards and Honors for Service

Williams, D. P. & Proctor, D. (2004). *Living Well Award – Western Region*. National Extension Association of Family and Consumer Sciences

Williams, D. P. (2004). Certificate of Recognition, Outstanding Contribution to Action For Healthy Kids State Team. *Action for Healthy Kids*.

Williams, D. P. (2000). Recognition of Service Award. *American Dietetic Association*.

Williams, D. P. (2000). Emerging Dietetic Leader of the Year Award. *Utah Dietetic Association*.