EFFECT OF AN AFTER SCHOOL GARDENING PROGRAM ON DAILY PHYSICAL ACTIVITY IN YOUTH

By

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EFFECT OF AN AFTER SCHOOL GARDENING

PROGRAM ON DAILY PHYSICAL

ACTIVITY IN YOUTH

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PREFACE

This study was conducted to provide new information regarding physical activity assessment of children and physical activity programs to increase daily physical activity in youth. Currently one out of every ten children is overweight, and 40 to 70 percent of overweight children become obese adults. Physical activity interventions for children may prevent further rise in overweight children and obese adults. The specific objective for this research was to determine if a gardening project increased physical activity throughout the day among children in third through fifth grade participating in the Delaware County Oklahoma New Communities Project (ONCP) using an Activity Videotape questionnaire. Data were analyzed using the Statistical Analysis System (SAS) for windows, version 8 (SAS Inst. Inc., Cary, NC) means, frequency, and t-test procedures.

I sincerely thank my advisor, Dr. Janice Hermann, for her incredible guidance and support in the completion of this research. I would also like to thank Dr. Brenda Smith and Dr. Youmasu Siewe for taking time to be a part of my committee. Finally, I want to thank my family and friends for all their prayers and support in my studies.

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CHAPTER I

INTRODUCTION

Background

Currently, 10 percent of children two to five years of age, 15 percent of children six to 12 years of age, and 15 percent of children 12 to 19 years of age are overweight. This is more than double the rates for overweight from 1976 to 1980 (Jain, 2004). With the alarming and continual rise in overweight and at risk for overweight children comes the elevated risk of developing hyperlipidemia, hypertension, abnormal glucose tolerance, insulin resistance, respiratory problems, orthopedic problems, psychological stresses and numerous other health problems. Because 40 to 70 percent of overweight children become obese adults, overweight children also have an increased risk throughout life for cardiovascular disease, type 2 diabetes, gallbladder disease, osteoarthritis, and cervical and breast cancer (American Dietetic Association, 2004; Gillis et al., 2002; American Heart Association, 2003). Along with the physical and psychological effects of being an overweight child are the related hospital costs, reaching $127 million per year in 2003 (Goran et al., 2003).

The most immediate health issue for overweight children is type 2 diabetes, which is especially prevalent in overweight African American, Hispanic

American and Native American children. Insulin resistance syndrome is often a precursor to type 2 diabetes and includes the clustering of obesity, atherosclerosis, hyperglycemia, hyperinsulinemia, dyslipidemia, and hypertension (Goran et al., 2003; Henrikson, 2002).

Physical activity may have a preventative role in the development of insulin resistance syndrome. Ku et al. reported that more active children had lower insulin secretion and greater insulin sensitivity when compared to less active children and that intensity of activity may be important in modifying insulin action (Henrikson, 2002; Ku et al., 2000; Wennlöf et al., 2003). In addition, long-term exercise improves whole body glucose tolerance, while short-term exercise has an acute lowering effect on glucose and insulin levels (Henrikson, 2002).

Current recommendations are that children should get at least 30 to 60 minutes of physical activity each day (Centers for Disease Control, 2003a). The 1995 Youth Risk Behavior Survey reported that 25 percent of adolescent males and 50 percent of adolescent girls do not meet these physical activity guidelines. The 1992 National Health Interview Survey reported that by age 21 less than 50 percent of Americans participate in three or more vigorous physical activity sessions each week (Trost et al., 1999a). The Youth Media Campaign Longitudinal Survey in 2002 reported that over 60 percent of children between nine and thirteen years of age are not active in organized sports during non-school hours and 22.6 percent are not active at all outside of school (Centers for Disease Control, 2003b). It is evident that interventions are needed to encourage

physical activity in children and adolescents to help decrease the prevalence of overweight.

Dietary modifications are needed alongside physical activity to deal with overweight youth (American Dietetic Association, 2004). Children are exceeding the recommended intake for total fat and saturated fat by 68 and 75 percent, respectively. Sixty-three percent of elementary-aged children are not eating the recommended number of fruit servings and 78 percent are deficient in their vegetable intake (American Dietetic Association, 2004).

One trend responsible for a significant amount of the dietary inadequacies of children is fast food. In 1997, more than 30 percent of total food dollars were spent on fast food (American Dietetic Association, 2004). Children consuming fast food tend to have higher intakes of saturated fat, total fat, cholesterol, and sodium and lower intakes of fiber, calcium and iron than children who do not. In older children, milk consumption has decreased while soda consumption has increased, decreasing the intake of calcium, folate, phosphorus, vitamin A and vitamin C (American Dietetic Association, 2004).

Sedentary behavior often results in increased energy intake. The most common sedentary behavior is television watching which has increased from around 2 hours each day in 1970 to 4.8 hours each day in 1990 (Bloomgarden, 2002). Children consume a significant amount of their total energy intake while watching television, with advertisements playing a significant role in their food choices (Matheson et al., 2004; Olivares et al., 1999). Consequently, children

who spend more time watching television (4-5 hours) have more body fat than those who watch less (1-2 hours) (Hussey et al., 2001; McFarland et al., 2004).

Physical activity and nutrition interventions are needed as early as kindergarten to prevent increases in overweight and inactive children. Preventative interventions are most effective in combating sedentary behavior since inactivity and related learned behaviors are difficult to reverse (Economos et al., 2003). However, it is apparent that interventions are needed in all youth age groups, preventative or not.

Purpose

The Delaware County Oklahoma New Community Project (ONCP) is a holistic approach to health education including personal health behaviors, physical activity, nutrition, food preparation and food safety. The Delaware County ONCP provides health educational programs to children in kindergarten through eighth grade in an after school setting. One part of the Delaware County ONCP is the incorporation of gardening as a unique way to actively involve children in physical activity, nutrition, food preparation and food safety. The purpose of this project was to evaluate if a gardening project increased physical activity throughout the day among children participating in the Delaware County ONCP.

Objective

To determine if a gardening project increased physical activity throughout the day among children in third through fifth grade participating in the Delaware County ONCP using an Activity Videotape questionnaire.

Null Hypothesis

H_o1: There will be no significant difference in total activity scores among children in third through fifth grade participating in the Delaware County ONCP before and after starting a gardening project using an Activity Videotape questionnaire.

Assumptions and Limitations

One limitation of this study is that youth from only one school are participating in the program. The results from this study cannot be generalized to the population as a whole.

An assumption of this study is that youth will honestly answer the questions on the Activity Videotape questionnaire. If the children assent to participate in the study, it is assumed that they will take a serious approach to the Activity Videotape questionnaire.

CHAPTER 2

LITERATURE REVIEW

Child and Adolescent Health Issues

Obesity has become an important public health issue in the past 30 years, affecting all ages and many nations. Obesity is classified based on body mass index (BMI), which is calculated by dividing weight in kilograms by the square of height in meters. For adults (20 years of age or older), a BMI of 25 to 29.9 is considered “overweight” and a BMI of 30 or more is considered “obese” (Hedley et al., 2004). For children (2 to 20 years of age), the Centers for Disease Control and Prevention developed growth charts (Figures 1 and 2) to determine if a child is overweight (Fowler-Brown & Kahwati, 2004). These sex-specific BMI-for-age growth charts define “at risk for overweight” as at or above the 85th percentile but less than the 95th percentile and “overweight” as at or above the 95th percentile (Hedley et al., 2004). By these standards, 30 percent of adults are obese and 35 percent are overweight, while 10 percent of children two to five years of age, 15 percent of children six to 12 years of age, and 15 percent of children 12 to 19 years of age are overweight (Hedley et al., 2004; Jain, 2004).

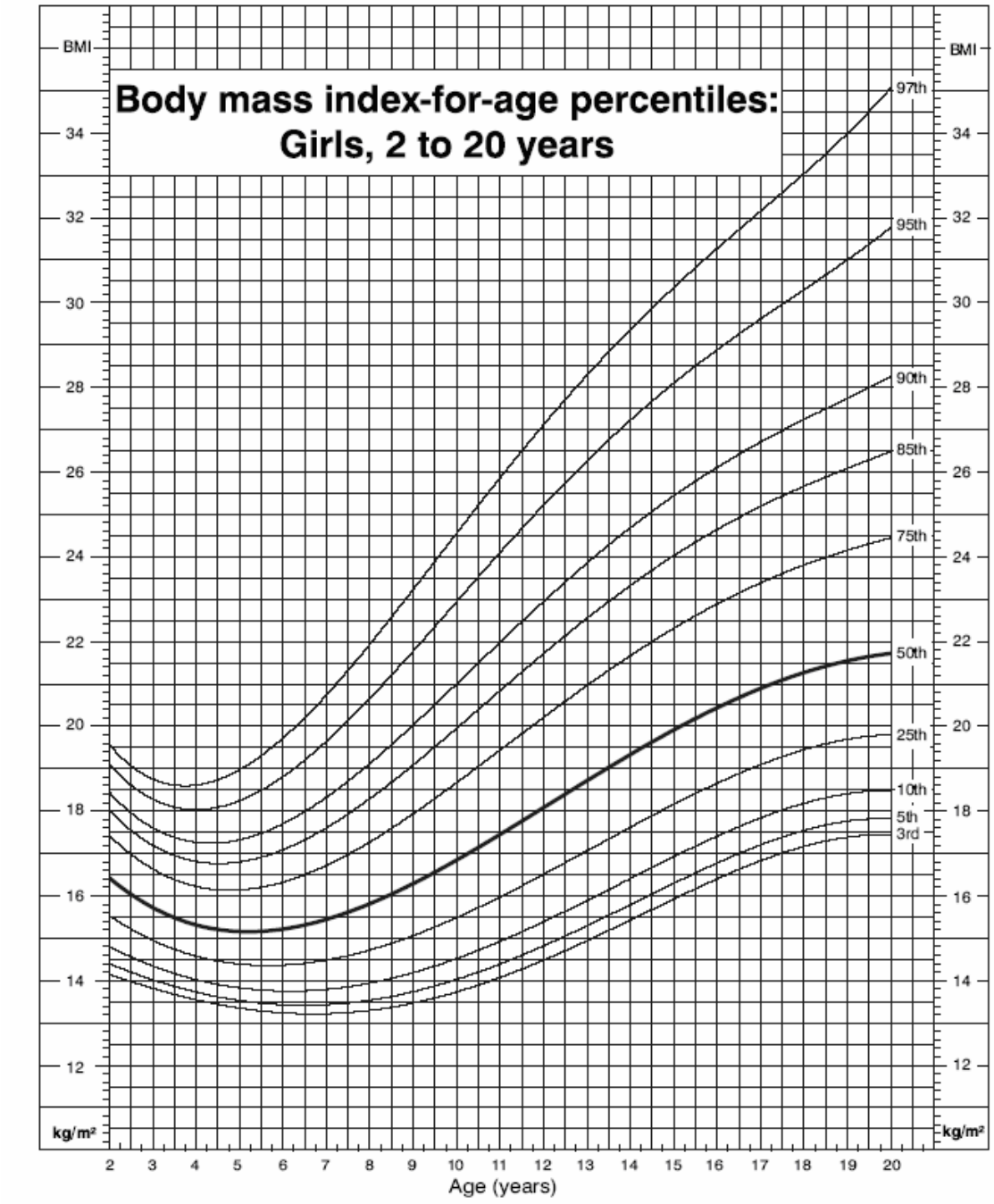

Figure 1. Growth charts for girls 2-20 years of age (Centers for Disease Control and Prevention, 2000b).

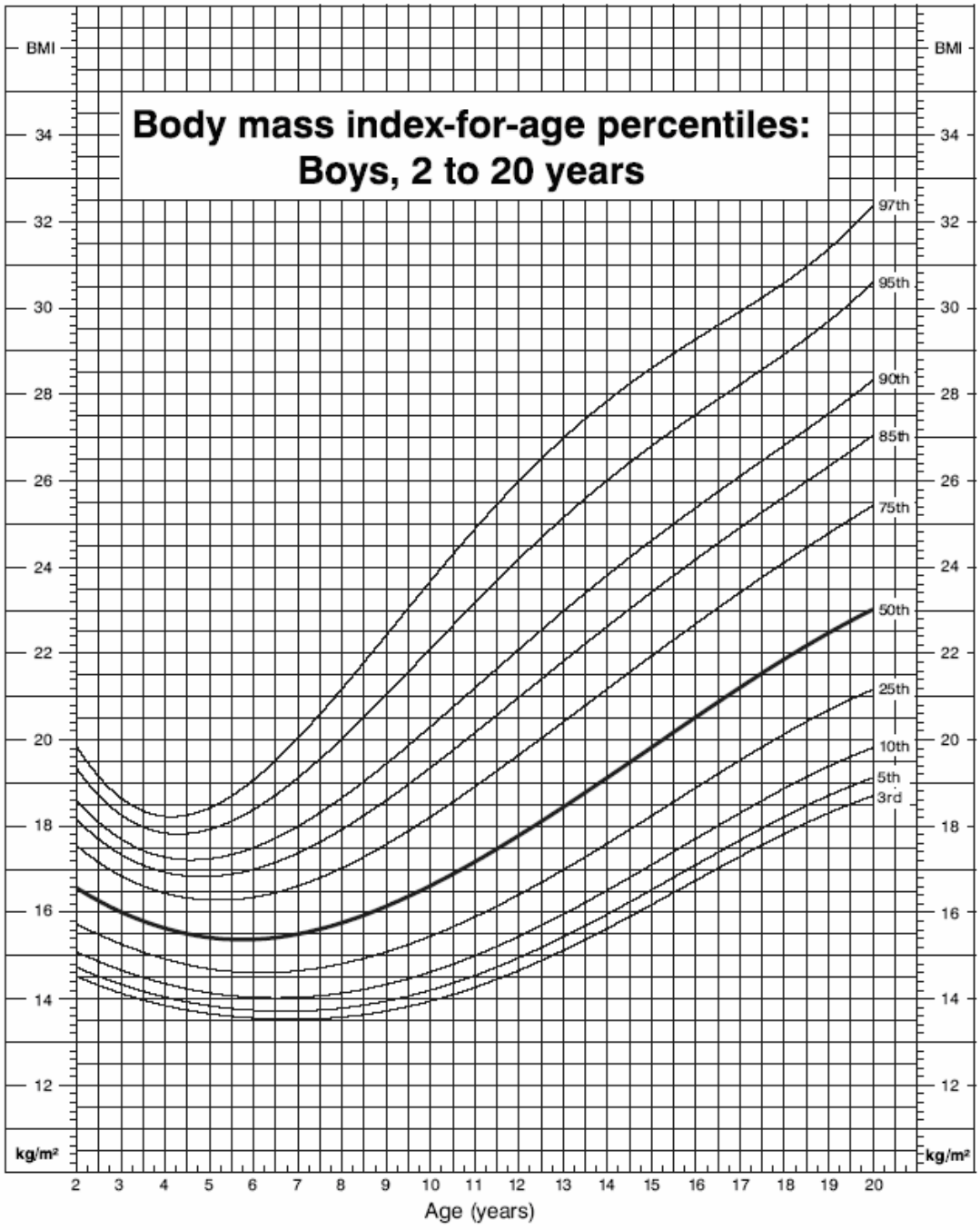

Figure 2. Growth charts for boys 2-20 years of age (Centers for Disease Control and Prevention, 2000b).

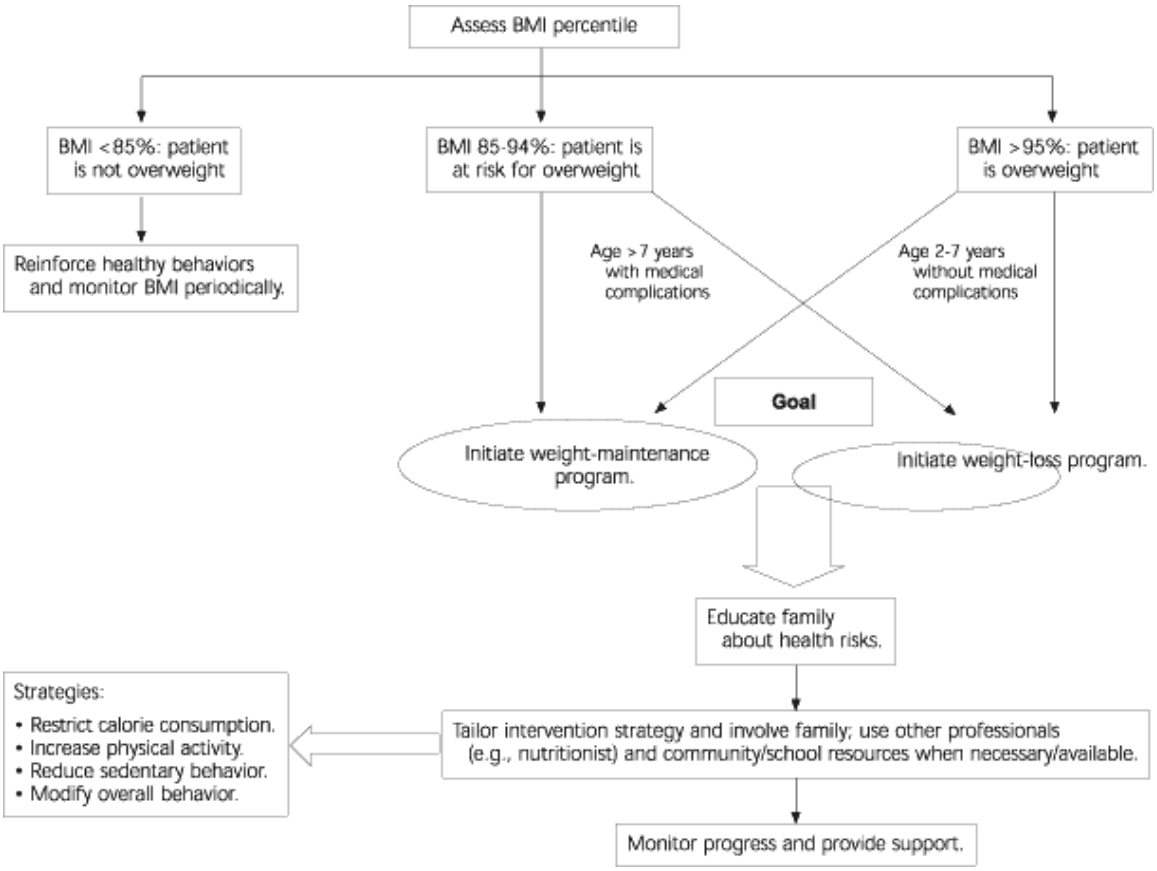

Figure 3. Algorithm for assessing and managing overweight in children and adolescents (Fowler-Brown & Kahwati, 2004).

The rising number of children considered overweight is very unsettling since 40 to 70 percent of overweight children become obese adults (Gillis et al., 2002). There are specific treatment goals based on the child's age, BMI, and presence or absence of medical complications (Figure 3) (Fowler-Brown & Kahwati, 2004). Weight maintenance (BMI gradually decreases as the child grows taller) is recommended for all children at risk for overweight between two and seven years and children older than seven years without medical complications. Weight maintenance is also recommended for overweight children between two and seven years without medical complications (Fowler-Brown &

Kahwati, 2004). Weight loss is suggested for all overweight children over seven years and overweight children between two and seven years with mild medical complications (mild hypertension, dyslipidemia, insulin resistance) (Fowler-Brown & Kahwati, 2004; Marcason, 2004). Overweight children between two and seven with acute medical complications (pseudotumor cerebri, sleep apnea, obesity hypoventilation syndrome, orthopedic problems) should be referred to a pediatric center specializing in overweight (Marcason, 2004). Weight loss is also recommended for children at risk for overweight who are older than seven years with mild medical complications (Fowler-Brown & Kahwati, 2004; Marcason, 2004). Children with BMIs below the 85th percentile should adhere to a healthy lifestyle even though they are not considered at risk for overweight or overweight (Fowler-Brown & Kahwati, 2004).

There are immediate and long-term health issues associated with childhood overweight (Jain, 2004). Immediate consequences can be psychological (low self-esteem), medical (hypertension; dyslipidemia; abnormalities in left ventricular mass or function; endothelial function abnormalities; hyperinsulinemia; insulin resistance; asthma; type 1 and 2 diabetes; low-level systemic inflammation; structural abnormalities of the foot; polycystic ovary syndrome; obstructive sleep apnea; decreased growth hormone levels; orthopedic, hepatic and respiratory disorders) or other health consequences (gallstones; irregular or early menarche) (Jain, 2004; Bloomgarden, 2002). Long-term consequences of childhood obesity can be psychological (low educational attainment and income) and medical (increased

mortality, increased risk of cardiovascular disease and eating disorders in adulthood) (Jain, 2004).

Many of the aforementioned disorders were only found in adults in the past, but with the explosion of overweight in children, these disorders are becoming common in children. Incidence of type 2 diabetes in children and adolescents has increased 10-fold between 1982 and 1994 (Goran et al., 2003). Impaired glucose tolerance, a precursor to type 2 diabetes was found in 25 percent and 21 percent of overweight children and adolescents, respectively. Four percent of the sample in this study had undiagnosed type 2 diabetes. The Bogalusa Heart study, a community-based study of risk factors for cardiovascular disease in white and black youth five to 17 years of age, reported that overweight or at risk for overweight children were 2.4 times more likely to have adverse levels of cholesterol, 7.1 times more likely to have adverse levels of triglycerides, and 4.5 times more likely to have adverse blood pressures (Goran et al., 2003).

Increased amount and location of body fat seem to be the clearest factors contributing to the increased risk of type 2 diabetes and cardiovascular disease. The Bogalusa Heart study reported that centrally located body fat is significantly correlated to fasting insulin (Goran et al., 2003). Central adiposity is also related to unfavorable lipids, lipoproteins and blood pressure. In this case, visceral fat plays as important role, linking central fat and cardiovascular disease factors (Goran et al., 2003). A common clustering of disorders among overweight children is termed “syndrome x” or “insulin resistance syndrome” and refers to obesity, hypertension, hyperglycemia, insulin resistance, dyslipidemia and

atherosclerosis. Insulin resistance syndrome is often a precursor to type 2 diabetes (Goran et al., 2003; Henrikson, 2002).

Interventions are needed to reverse the increasing numbers of overweight children and adolescents. Increasing physical activity and improving nutrition are shown to improve weight status, therefore decreasing risk of developing cardiovascular disorders and type 2 diabetes (Yoshinaga et al., 2004; Burke et al., 2004; Fowler-Brown & Kahwati, 2004).

Dietary Recommendations for Children and Adolescents

The Food and Nutrition Board of the National Academies of Science establish the Dietary Reference Intakes (DRI's), which provide guidelines for consumption of all nutrients. The DRI's were first released in 1997 for calcium and related nutrients and the latest release was in 2004 for water, sodium and potassium (Mullen & Shield, 2004). In 2002 the DRI's for macronutrients, energy and fiber were released, updating the Recommended Daily Allowances (RDAs) from 1989 (American Dietetic Association, 2004). In January 2005, the United States Department of Health and Human Services (HHS) and the United States Department of Agriculture released the sixth edition of the Dietary Guidelines for Americans (DGA's) (U.S. Dept. of Health and Human Services & U.S. Dept. of Agriculture, 2005).

According to the recommendations, carbohydrates should account for 45 to 65 percent of total calories for children and adults. Fiber intake should be 14 grams per 1,000 calories. Protein should account for 5 to 20 percent of total

calories for children ages one to three years and 10 to 30 percent of total calories for children ages four to 18 years. Total fat should account for 25 to 35 percent of total calories for children aged four to 18 years (American Dietetic Association, 2004; U.S. Dept. of Health and Human Services & U.S. Dept. of Agriculture, 2004; Mullen & Shield, 2004; U.S. Dept. of Health and Human Services & U.S. Dept. of Agriculture, 2005). Saturated fat should not exceed ten percent of total calories for children and adults (Patrick et al., 2004). Cholesterol intake should not exceed 300 milligrams (mg) for adults and children. Added sugars should not exceed 25 percent of total calories for children and adults (U.S. Dept. of Health and Human Services & U.S. Dept. of Agriculture, 2004).

Dietary fat is important in young children's growth and development because it is a concentrated source of energy which is important for younger children who have limited gastric capacities (American Dietetic Association, 2004). Children on low-fat diets may have inadequate consumptions of certain macronutrients, but conversely, children on high-fat diets are at a higher risk for developing overweight and cardiovascular disease. The DRI's outline a gradual transition from a high-fat diet in infancy (30-40% of total calories) to an Acceptable Macronutrient Distribution Range for adults (20-35% of total calories) (American Dietetic Association, 2004).

Some of the specific recommendations of the Dietary Guidelines Advisory Committee include increased consumption of vitamin E, calcium and potassium for most Americans, increased consumption of vitamins A and C and magnesium

for many Americans and decreased consumption of sodium (Table 1) (U.S. Dept. of Health and Human Services & U.S. Dept. of Agriculture, 2004).

Table 1. Dietary Reference Intakes for selected micronutrients (Mullen & Shield, 2004 (U.S. Department of Health and Human Services, 2004)

Gender Age	Vitamin A (ug/d)	Vitamin C (mg/d)	Vitamin E (mg/d)	Calcium (mg/d)	Magnesium (mg/d)	Sodium (mg/d)	Iron (mg/d)
Children 1-3 yr	300	15	6	500	80		7
Children 4-8 yr	400	25	7	800	130	<1900	10
Males 9-13 yr	600	45	11	1300	240	<2200	8
Males 14-18 yr	900	75	15	1300	410	<2300	11
Females 9-13 yr	600	45	11	1300	240	<2200	8
Females 14-18 yr	700	65	15	1300	360	<2300	15

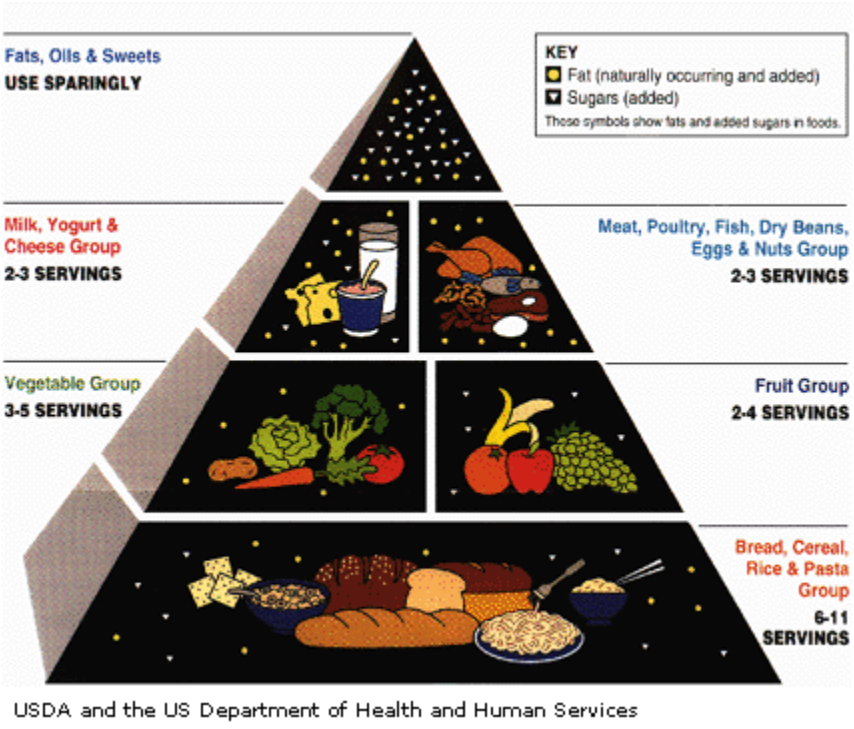

Figure 4. Food Guide Pyramid (U.S. Dept. of Health and Human Services & U.S. Dept. of Agriculture, 1992).

The Food Guide Pyramid (Figure 4), developed in 1992 by the United States Department of Agriculture recommends eating six to 11 servings of grain (preferably whole grain) products each day (U.S. Dept. of Health and Human Services & U.S. Dept. of Agriculture, 2004). Two to four servings of fruit and three to five servings of vegetables should also be consumed each day. Two to three servings from each the dairy group (preferably low-fat) and the meat and other protein group should be consumed daily. Fats, oils, and sweets should be used sparingly. Following the guidelines set forth in the Food Guide Pyramid will help children and adults meet the recommended intakes for macronutrients, vitamins, and minerals (U.S. Dept. of Health and Human Services & U.S. Dept. of Agriculture, 2004).

Current Dietary Status of Children and Adolescents

The United States Department of Agriculture's Center for Nutrition Policy and Promotion uses the Healthy Eating Index (HEI) to assess diet quality. The HEI score for children two to nine years of age indicated that most children (64-88%) had diets that "needed improvement" or were "poor" (American Dietetic Association, 2004). The macronutrient composition of children's diets is comparable to diets of young adults and average intakes of most vitamins and minerals for children two to 11 years of age exceed the 1989 RDAs. However, the food choices of most children do not meet the recommended food group servings from the Food Guide Pyramid. Sixty-three percent of children from two to nine years of age are deficient in servings of fruit while 78 percent do not meet

the recommended number of servings of vegetables. Only 12.7 percent of children aged six to 11 years consume two or more servings of whole grains each day (American Dietetic Association, 2004).

The most current reports on energy intake in children found that energy intake has remained very stable over the past few decades (Mullen & Shield, 2004). This does not seem possible since the rates of overweight in children have significantly risen over this time period. Underreporting in surveys is likely masking an increased energy intake among American children. However, if the caloric intake has not increased over the past decades, the obesity epidemic may be explained by the decrease in physical activity when compared to past decades. If the caloric content of the diets are consistent but the physical activity component has decreased in the current generation, the current generation is likely to experience greater weight gain (Mullen & Shield, 2004). The role of physical activity in overweight children will be further discussed in the following section.

Sixty-eight to 75 percent of American children do, however, exceed the current dietary recommendations for total and saturated fats (American Dietetic Association, 2004). From 1994 to 1996, only 36 percent of people two years of age or older consumed less than ten percent of their daily calories from saturated fat and only 33 percent of people two years of age or older consumed less than 30 percent of total daily calories from fat (U.S. Dept. of Health and Human Services, 2004).

Carbohydrate consumption has increased, mainly from increased intakes of refined carbohydrates. These foods tend to have high glycemic indices, which may be important in appetite regulation (Mullen & Shield, 2004). Alviña and Araya (Alviña & Araya, 2004) reported that children showed greater satiation after consuming a meal of low glycemic index carbohydrates than when compared to a meal of equal carbohydrate content with high glycemic index carbohydrates. The metabolic effects of short-term satiety maybe over-expressed in overweight children, causing lesser satiety than in non-overweight children and resulting in higher energy intakes and fat deposits (Alviña & Araya, 2004).

The type of beverages consumed by children is likely to be a major contributor to the current weight status of children. Children consuming one regular carbonated beverage a day average a ten percent increase in total calorie intake than non-consumers (James et al., 2004). Berkey et al. (Berkey et al., 2004) reported that consuming sugar-added beverages by children nine to 14 years of age resulted in BMI increases during the year of study. Beverage consumption patterns have shifted from four times more milk consumption than soft drink consumption in 1945 to 2.5 times more soft drink consumption than milk consumption in 1997 (American Dietetic Association, 2004). With soda being consumed more than milk, a dilutional effect has been noted for calcium, phosphorus, folate, vitamin A and vitamin C (American Dietetic Association, 2004).

Fast food consumption has replaced home-cooked family meals in many households. In 1997, more than one-third of total family food expenditures were

spent on fast foods (American Dietetic Association, 2004). Children who consume fast foods have higher intakes of fat, saturated fat, cholesterol and sodium and lower intakes of fiber, calcium and iron than children who do not consume fast food (American Dietetic Association, 2004).

In 1994, 78 percent of children participated in the National School Lunch Program each day (American Dietetic Association, 2004). These children are more likely than non-participants to consume more vegetables, milk, milk products, meat and meat substitutes and fewer soft drinks and fruit drinks, resulting in greater intakes of calcium, riboflavin, phosphorus, magnesium, zinc, thiamin, vitamin B6 and vitamin B12 than non-participants (American Dietetic Association, 2004).

Another factor that may contribute to the overweight status in children is parental influence on dietary habits. By restricting preschool children's access to food, greater consumption of these foods results when access is granted, even after a meal is consumed (Stang et al., 2004). Overweight girls with mothers who restrict intake are more likely to overeat in the absence of hunger and have a lower ability to self-regulate energy intake (Shunk & Birch, 2004; Stang et al., 2004). Also, parents who perceived their daughters as being overweight were more likely to exert more control over or restriction of the types and/or amounts of food consumed by the overweight child (Stang et al., 2004). Shunk and Birch (Shunk & Birch, 2004) reported that girls at risk for overweight at age five had increased levels of dietary restraint, disinhibited overeating (loss of cognitive control over eating), weight concern and body dissatisfaction at age nine. The

findings from this study suggest that parental restraint leads to disinhibited overeating, while other studies entertain the possibility that disinhibited overeating precedes and triggers parental restraint (Shunk & Birch, 2004).

Weight status of preschool girls is positively correlated with parental BMI's (Stang et al., 2004). Also, children's preferences for high fat and energy dense foods have been positively associated with parental obesity (American Dietetic Association, 2004). When parents exhibit disinhibited eating and dietary restraint patterns, increases in adiposity are found in both parents and children, especially within female family members (Stang et al., 2004). Since there is such a strong relationship between mother-daughter disinhibited and restrained eating, this may account for a large percent of the heritability of obesity between female family members (Stang et al., 2004).

Parents influence children's dietary habits by affecting availability and accessibility of foods, meal structure, adult food modeling, food socialization practices and food-related parenting style (American Dietetic Association, 2004). If parents exhibit a controlled dietary environment, it is shown to have negative effects on children's weight status and their ability to listen to internal cues for hunger (Shunk & Birch, 2004; American Dietetic Association, 2004). In this case, dietary counseling may be necessary to re-teach the child to be responsive to hunger and satiety cues, increase acceptability of healthful foods and learn appropriate portion sizes (Stang et al., 2004). If parents take a less rigid approach to a child's dietary practices, having a variety of healthful foods available, this will allow the child to determine when and how much they eat

(American Dietetic Association, 2004). This approach allows the child to be responsible for his or her intake, decreasing the need for overeating and eating in the absence of hunger (Stang et al., 2004).

Physical Activity Recommendations for Children and Adolescents

The National Association for Sport and Physical Education recommends that elementary school-aged children should be physically active at least 30 to 60 minutes each day (Centers for Disease Control and Prevention, 2003a). The American Heart Association recommends all children age two and older participate in at least 30 minutes of moderate-intensity activity every day and at least 30 minutes of vigorous-intensity activity three to four days of the week (American Heart Association, 2004). The President's Health and Fitness Initiative, European Youth Heart Study, 2005 Dietary Guidelines and United States Department of Health and Human Services (HHS) recommend all children participate in at least 60 minutes of physical activity each day (American Dietetic Association, 2004; Ekelund et al., 2004; U.S. Dept. of Health and Human Services, 2001; U.S. Dept. of Health and Human Services & U.S. Dept. of Agriculture, 2005).

In order to improve the health of the United States, the HHS created Healthy People 2010, which provides a set of disease prevention and health promotion objectives to achieve this decade (U.S. Dept. of Health and Human Services, 2004). The purpose of Healthy People 2010 is to improve quality and

extend years of life as well as eliminate health problems (U.S. Dept. of Health and Human Services, 2004).

In the realm of physical activity and children, Healthy People 2010 aims to have 35 percent of adolescents engaging in moderate-intensity physical activity for at least 30 minutes on five or more days of the week (U.S. Dept. of Health and Human Services, 2000). Another goal is to have 85 percent of adolescents engaging in 20 or more minutes or vigorous activity three or more days each week. Healthy People 2010 also has goals to decrease television watching to two hours or less for 75 percent of adolescents (U.S. Dept. of Health and Human Services, 2000).

Healthy People 2010 has many goals for physical education in public and private schools. Healthy People 2010 would like for 25 percent of middle and junior high schools and 5 percent of senior high schools to require daily physical education for all students (U.S. Dept. of Health and Human Services, 2000). Another aim is to have 50 percent of adolescents spend at least half of physical education class time being physically active (U.S. Dept. of Health and Human Services, 2000).

Collectively, all the recommendations aim to have children being active at least one hour on most days of the week since children should not have extended periods of inactivity (American Dietetic Association, 2004; American Heart Association, 2004; Centers for Disease Control and Prevention, 2003a; U.S. Dept. of Health and Human Services & U.S. Dept. of Agriculture, 2005). Time spent being active could be increased by reducing time spent in sedentary

activity (American Heart Association, 2004). In schools, the physical education curriculum should help children and adolescents understand how to adopt and maintain a healthy lifestyle (U.S. Dept. of Health and Human Services, 2000). If these goals and recommendations are attained, the rates of obesity should at least be stabilized, and most likely will decrease.

Current Physical Activity Levels of Children and Adolescents

According to the Youth Media Campaign Longitudinal Survey (YMCLS), 61.5 percent of children nine to 13 years of age do not participate in organized physical activity outside of school and 22.6 percent are not active at all during free-time (Centers for Disease Control and Prevention, 2003b). Only 50 percent of people aged 12 to 21 years participate in regular vigorous activity while 25 percent do not participate in any vigorous activity at all. In 1997, only 20 percent of high school-aged students participated in 30 minutes of moderate physical activity five days a week (U.S. Dept. of Health and Human Services, 2001). A child's activity level is especially important because it tracks into adulthood. For example, children between three and four years of age who are less active tend to continue being less active than their peers as they age (U.S. Dept. of Health and Human Services, 2000).

Low physical activity levels and fat mass are cyclically related. The European Youth Heart Study reports that children between nine and ten years of age who were moderately active for less than one hour a day were "significantly fatter" than children who were moderately active two or more hours a day

(Ekelund et al., 2004). Ball et al. (Ball et al., 2001) and Goran et al. (Goran et al., 1997) report that children between the ages of three and six years of age with high percentages of body fat tend to have low physical activity levels. So, children who have increased body fat tend to have low physical activity levels and children who are not physically active tend to have high percentages of body fat.

Since children spend a large portion of their day in school, increasing the percentages of schools requiring daily physical education would allow more children to be active each day. In 1994, only 17 percent of middle and junior high schools and two percent of senior high schools required daily physical education (U.S. Dept. of Health and Human Services, 2000). In 1999, only 29 percent of high school-aged students participated in daily physical education and only 38 percent of those students in daily physical education classes were active more than 20 minutes in each class (U.S. Dept. of Health and Human Services, 2000). In 2000, only eight percent of elementary schools, 6.4 percent of middle and junior high schools, and 5.8 percent of senior high schools provide daily physical education or its equivalent for the entire school year (150 minutes per week for elementary schools and 225 minutes per week for middle, junior high and senior high schools) (Centers for Disease Control and Prevention, 2000a).

Inactivity is becoming more common, with children spending more time watching television and playing videogames. Twenty-five percent of American children watch at least four hours of television each day and 40 percent of preschool-aged children have a television in their rooms (American Dietetic

Association, 2004). In 1998, a study found that children eight to 16 years of age who watched greater than four hours of television had more body fat than those who watched no more than two hours a day (Hussey et al., 2001). McFarland et al. (McFarland et al., 2004) reported that children between five and six years of age who spend more than three hours a day watching television and less time participating in vigorous physical activity than their peers have a higher risk of becoming overweight (McFarland et al., 2004). Watching television has many negative consequences outside of decreasing time spent being active, including encouraging poor eating habits and violent behavior and increasing the risk for developing lipid abnormalities and smoking (Hancox et al., 2004).

Epstein et al. (Epstein et al., 2002) studied the effect of changing amount of time spent in sedentary behaviors on physical activity and energy intake in non-obese children between eight and 12 years of age. Increasing sedentary behaviors resulted in increased energy intake and decreased energy expenditure. No significant energy balance changes were observed when sedentary behaviors were decreased. These results suggest that changing activity (or inactivity) patterns may be necessary to prevent obesity and modify energy balance (Epstein et al., 2002).

Halford et al. (Halford et al., 2004) studied the effects of television advertisements for foods on food consumption in overweight and lean children between nine and 11 years of age. The majority of the overweight children recognized all the food ads presented, which correlated with a higher food intake following exposure to the ads. These results suggest that television viewing may

increase the risk for overweight not only by increasing inactivity, but also by increasing energy intake (Halford et al., 2004).

Potential Impact of Physical Activity

Forty percent of the deaths in the United States could be prevented by modifying behavior patterns (U.S. Dept. of Health and Human Services, 2001). Sedentary behavior is responsible for 17 percent of these deaths (U.S. Dept. of Health and Human Services, 2001). Incorporating physical activity into daily life can improve health (reduce obesity, arthritis symptoms, blood pressure and insulin resistance; raise high-density lipoprotein (HDL) cholesterol; reduce the risk of developing diabetes, certain cancers and cardiovascular disease; improve glucose intolerance; prevent or retard osteoporosis), cognition and psychological well-being (American Heart Association, 2004; U.S. Dept. of Health and Human Services, 2001; Gavarry et al., 2003; Goran et al., 2003).

Exercise has significant positive effects on insulin action. One study showed physically active adolescents consistently had lower fasting insulin levels over a period of six years when compared to sedentary peers (Goran et al., 2003). Another study showed increased physical activity in a biracial sample of females five to 11 years of age was associated with greater insulin sensitivity, independent of race and body composition (Goran et al., 2003). The Diabetes Prevention Program in the United States demonstrated that reducing body weight by seven percent and incorporating at least 150 minutes of physical activity in each week over a three year period could reduce the incidence of type 2

diabetes in individuals at a high risk for developing the disease (Henrikson, 2002). These results indicate the importance of physical activity in the prevention of insulin resistance syndrome and the onset of type 2 diabetes (Wennlöf et al., 2003).

During a single exercise session, plasma glucose and insulin levels are significantly lowered (Henrikson, 2002). Glucose transport is also enhanced during and persists 20 hours post-exercise. Endurance exercise improves glucose tolerance and whole body insulin-mediated glucose removal in insulin-resistant subjects with impaired glucose tolerance or type 2 diabetes. One study showed that six weeks of training by insulin-resistant children with type 2 diabetic parents was associated with improvements in skeletal muscle glucose metabolism (Henrikson, 2002).

High levels of physical activity and fitness are associated with a decreased prevalence of cardiovascular disease (CVD) risk factors (total cholesterol:HDL cholesterol ratio, insulin:glucose ratio, triglyceride, systolic blood pressure, and sum of four skin folds) and lower CVD morbidity and mortality. The European Youth Heart Study reported that children nine and 15 years of age with low fitness have multiple CVD risk factors (Wedderkopp et al., 2003). Other studies show that regular exercise improves physical fitness in untrained children and lowers blood pressure in children and adolescents with hypertension (Wedderkopp et al., 2003). It has been estimated that reducing the population mean diastolic blood pressure by two mmHg would result in a 17 percent

decrease in hypertension, 15 percent decrease in stroke and six percent decrease in coronary heart disease in the population (Burke et al., 2004).

There is ample evidence that physical activity improves cognition and behavior in children and adolescents with and without clinical disorders. Four large-scale studies (Vanves project, Trois Rivieres study, South Australia study and Project SPARK) examined the effects of significantly increasing time spent by students in physical education (PE) class at the expense of time spent in academic classes (Sibley & Etnier, 2003). While one study showed no change in academic performance, the other three showed significant academic improvement with increased PE. These studies show that physical activity not only has the well-documented health benefits, but also improves academic performance in a school setting (Sibley & Etnier, 2003).

Many smaller studies also show the positive effects of exercise on cognition. One study showed that sixth grade children's mathematics computation accuracy was enhanced after 50 minutes of exercise (Tomporowski, 2003). Another study with sixth grade children showed that academic performance was significantly higher after 30 to 40 minutes of exercise when compared to only 20 minutes of exercise (Tomporowski, 2003).

Exercise also has positive effects on children diagnosed with attention-deficit hyperactivity disorder (ADHD) and autism. One study of boys between the ages of seven and 11 years with ADHD showed that behavior significantly improved following exercise, whereas there were no behavioral changes in the non-exercise group (Flohr et al., 2004). Another study with two children with

ADHD showed that classroom on-task attentional behavior was significantly improved following five minutes of cycling (Tomporowski, 2003). Multiple studies report that self-stimulatory behavior in autistic children decreased following physical activity. In one study, the effects of jogging were compared to ball play in three autistic children between the ages of seven and 11 years. Jogging always decreased stereotypical behaviors, while ball play had no effect. The positive effects of jogging were replicated in five autistic boys between the ages of 14 and 15 years who showed significant decreases in stereotypical behaviors and increases in on-task behaviors following 20 minutes of jogging. These reductions in stereotypical behaviors in autistic children are maintained for approximately 90 minutes post-exercise (Tomporowski, 2003).

Physical activity has positive effects on children with behavior disorders. Disruptive behaviors by sixth grade children were significantly decreased on days following jogging sessions when compared to days without exercise (Tomporowski, 2003). One study tested the effect of 45-minute runs on the attention and impulse control of six children between the ages of eight and 11 years. The classroom attention was improved in five of the six children and impulse control was improved in four children. Another study reported 15 minute jogging sessions decreased disruptive behavior in six emotionally disturbed middle school students (Tomporowski, 2003).

There are proposed physiological and learning/developmental mechanisms to explain the relationship between physical activity and cognition. The suggested physiological mechanisms include increased cerebral blood flow,

alterations in brain neurotransmitters, structural changes in the central nervous system and modified arousal levels and are based on the physical changes exercise has on the body (Sibley & Etnier, 2003). The learning/developmental mechanisms are that “movement and physical activity provide learning experiences that aid, and may even be necessary for, proper cognitive development” (Sibley & Etnier, 2003).

Physical activity has many benefits, from improving health to enhancing cognition. Children as young age three and four years of age are forming activity habits that will track with them to adulthood. Providing daily physical activity for children will aid them academically and allow them to adopt a healthier lifestyle.

Predictors of Physical Activity

It has been established that the children of this generation fall short of the recommended amount of daily physical activity. This is a serious problem since physical activity habits developed in childhood tend to track into adulthood, putting this generation’s children at a higher risk for developing chronic diseases later in life (Trost et al., 1999a). There are several predictors and motivators of physical activity in children, including socioeconomic status, ethnicity, parental physical activity level, gender and psychosocial influences. After identifying which factor(s) determine each child’s physical activity status, health professionals will be better able to promote healthier lifestyles in each child (Pate et al., 1996).

Many minority ethnic groups in the United States have high rates of overweight, high levels of inactivity, low levels of physical activity and increased

incidence of type 2 diabetes (Gordon-Larson et al., 2000; Goran et al., 2003). HHS reports that 15 percent of Mexican-American and 14 percent African-American children aged six to 19 years were either obese or overweight, compared to the national incidence of 11 percent (U.S. Dept. of Health and Human Services, 2004). Gordon-Larson et al. (Gordon-Larson et al., 2000) evaluated a multi-ethnic sample of children and found inactivity the highest and activity the lowest for non-Hispanic black and Hispanic children between the ages of 11 and 21 years. Within these groups, females and older adolescents showed an exaggeration of these trends (Gordon-Larson et al., 2000). Ward et al. (Ward et al., 1997) reported lack of physical activity and low physical fitness levels are significant in developing and/or maintaining overweight in African-American girls. Goran et al. (Goran et al. 2003) reported African-American and Hispanic-American children are more insulin resistant than Caucasian children, independent of adiposity.

Socioeconomic status is also influential in adolescent activity patterns. Higher levels of maternal education and high family income are associated with increased likelihood of moderate to vigorous physical activity and decreased likelihood of inactivity (Gordon-Larson, 2000). Conversely, Harrell et al. (Harrell et al., 2003) reports that children of parents with more education are more likely to participate in sedentary activities when compared to other children. Kuh and Cooper (Kuh and Cooper, 1992) studied males and females aged 36 years and found that those who frequently participated in sports had higher levels of education and had more mothers with a secondary education.

A child's activity level is significantly influenced by his or her parents. When both parents were highly active, so were the children. Increased family support of exercise also improved compliance (McMurray et al., 1993). Parental modeling of exercise is more influential to children when compared with only encouragement (McMurray et al., 1993). Shea and Economos (Shea & Economos, 2003) report that participation in active family outings positively predicted participation in moderate to vigorous activity, controlling for age, gender, asthma, ethnicity and sports participation.

Male children are reportedly more activity than female children at all ages (Thompson et al., 2003). The European Youth Heart Study found that boys are 21 percent more active than girls at nine years of age and 26 percent more active at 15 years of age (Riddoch et al., 2004). Pate et al. (Pate et al., 1997) reported that females were twice as likely to be classified as low-active when compared to males. Economos et al. (Economos et al., 2003) reported that there was no gender difference in moderate activity participation in their study of children between seven and eight years of age. However, males did engage in more vigorous activity than females in this study (Economos et al., 2003).

Thompson et al. (Thompson et al., 2003) compared activity levels of children based on chronological and biological age. Chronological age comparison showed boys having higher activity levels than girls, but when compared using biological age, based on peak height velocity, gender differences were not apparent. Peak height velocity of girls was achieved 1.7

years before that of boys in this study. These findings demonstrate the effects puberty can have on physical activity behavior (Thompson et al., 2003).

Assessment of Physical Activity

In the previous sections America's obesity epidemic has been discussed, specifically the physical activity element involved in overweight. In order to assess physical activity levels and determine the success of activity programs, physical activity must be measured (Sirard & Pate, 2001). This is challenging in children because of their decreased ability to recall previous activities and the highly transitory nature of their physical activity (Welk et al., 2000).

Measures of physical activity can be broken into three categories: primary measures, secondary measures, and subjective measures (Sirard & Pate, 2001). The primary measures, or standards, are direct observation, doubly labeled water (DLW) and indirect calorimetry. The secondary measures of physical activity include heart rate monitors, pedometers and accelerometers. These measures provide an objective assessment of physical activity. Subjective measures include self-report, interview, proxy-report and diary. Subjective measures can be validated by secondary or primary measures whereas secondary measures can only be validated against primary measures (Sirard & Pate, 2001).

The DLW and indirect calorimetry measures are the gold standard assessments of physical activity. The DLW measurement gives highly accurate estimates of energy expenditure and indirect calorimetry measures short term

energy expenditure (Welk et al., 2000; Sirard & Pate, 2001). The DLW technique is non-invasive, has low reactivity and is very accurate (Sirard & Pate, 2001). The drawbacks to using the DLW technique include increased cost, accuracy of dietary record needed to calculate energy expenditure and the duration of measurements (at least three days). Indirect calorimetry must be performed in a laboratory setting because of the non-portable gas analysis equipment that is needed (Sirard & Pate, 2001). The Stanford Seven-Day Physical Activity Recall for young adults (subjects between 17 and 35 years) was validated against both DLW and indirect calorimetry (Washburn et al., 2003). DLW was administered on day one and urine was collected for the next two weeks. To determine the resting metabolic rate, the subjects completed a 12 hour fast and refrained from exercise for 48 hours (Washburn et al., 2003). While the results of this study are highly specific and very useful for future research, these methods are not advisable for use with younger children because of the cumbersome nature of the data collection (Sirard & Pate, 2001).

Direct observation is the most practical of the primary measures of physical activity, especially for children. There are multiple observational techniques used (CARS, FATS, APEE, SOFIT) with little disparity between the techniques (Sirard & Pate, 2001). The Children's Activity Rating Scale (CARS) has been used to validate multiple accelerometers (Roberts et al., 2004; Finn & Specker, 2000). This observational technique consists of rating the activity level of each child in one minute increments for a predetermined length of time (Sirard & Pate, 2001). The drawbacks of direct observation include the high

experimenter burden and the potential reactivity of the study participants to the observers (Sirard & Pate, 2001).

Heart rate monitors are an objective method of measuring physical activity. Heart rate is linearly related to oxygen consumption and energy expenditure during physical activity (Welk et al., 2000). Heart rate monitors correlate highly with direct observation in physically active conditions, but were only weakly correlated under inactive conditions (Welk et al., 2000) because during sedentary activities, heart rate can be affected by physiological and environmental stresses and medications (Sirard & Pate, 2001). There are methods (FLEX HR, absolute HR value) that attempt to distinguish between activity-induced elevated heart rates and heart rates that are elevated for other reasons (Sirard & Pate, 2001). Heart rate monitoring using these correction methods is a valid measure of physical activity in free-living, non-obese young people (Sirard & Pate, 2001; Janz et al., 1992). Heart rate monitoring has been used to validate several self-report questionnaires (Moore et al., 2004; Sallis et al., 1996; Weston et al., 1997; Tremblay et al., 2001), interviewer-administered questionnaires (Simons-Morton et al., 1994; Sallis et al., 1996) and accelerometers (Janz et al., 1994). Because heart rate monitors and accelerometers are both categorized as secondary measures of physical activity, it is not recommended to validate one with the other (Sirard & Pate, 2001).

Pedometers are another objective measure of physical activity, recording the number of steps taken over time. Pedometers are a low cost monitoring tool, non-reactive and re-usable, but they cannot provide accurate detail on frequency

or intensity of physical activity (Sirard & Pate, 2001; Ozdoba et al., 2004). Pedometers and accelerometers provide similar results when measuring unrestricted movement, but differed greatly when measuring prolonged sedentary activities (Tudor-Locke et al., 2002). Pedometer measurements correlate to direct observation during ambulatory and sedentary activity, but not during slow ambulatory activity or with obesity. Correlations between pedometers and self-reported activity are inconclusive (Tudor-Locke et al., 2002). The Digiwalker pedometer was found unreliable when compared to an MTI/CSA accelerometer and two self-report questionnaires in young African-American girls (Treuth et al., 2003a). Conversely, Caputo et al. (Caputo et al., 2004) found the Digiwalker pedometer and TriTrac accelerometer to be significantly correlated over a period of three days in fifth grade children.

Accelerometers provide another alternative for objectively measuring total body movement. Accelerometers convert recorded accelerations to a digital signal, or “counts,” to assess the frequency, duration, intensity and energy expenditure of physical activity (Sirard & Pate, 2001; Welk et al., 2000). There are different types of accelerometers: uniaxial, biaxial and triaxial. Accuracy of the results depends on the type of accelerometer as well as the placement of the accelerometer on the body. Accelerometers are unable to assess upper body activities, cycling or locomotion on a gradient. If these activities are performed while wearing the accelerometer, they must be accounted for, raising the risk of inaccurate measurements because of the additional measurement error (Sirard & Pate, 2001; Welk et al., 2000). While there are limitations, accelerometers are

valid measures of physical activity and useful in studies lasting at least seven days (Penpraze et al., 2003; Trost et al., 2000).

Many studies use accelerometers to test the validity of self-report or interviewer-administered questionnaires. Two of the uniaxial accelerometers tested are the Caltrac and CSA models. The Caltrac accelerometer has been used to validate the Previous Day Physical Activity Recall (PDPAR) (Weston et al., 1997), Physical Activity Checklist Interview (PACI), Self-Administered Physical Activity Checklist (SAPAC) (Sallis et al., 1996), Assessment of Young Children's Activity Using Video Technology (ACTIVITY) (Tremblay et al., 2001), Child/Adolescent Activity Log (CAAL) (Garcia, et al., 1997), Weekly Activity Checklist, Yesterday Activity Checklist (Sallis et al., 1993), Physical Activity Checklist for Older Children (PAQ-C) (Kowalski et al., 1997) and Weight-Bearing Activity Questionnaire for Kids (WBAQK) (De Ridder et al., 2002). Different versions of the CSA accelerometer were used to validate the PDPAR (Trost et al., 1999b), 3-Day Physical Activity Recall (3DPAR) (Pate et al., 2003) and modified Personal and Environmental Associations with Children's Health (PEACH) questionnaire (Hausken et al., 2004).

Accelerometers have also been compared to primary as well as other secondary measures of physical activity. The Actiwatch biaxial accelerometer significantly correlated with the CARS direct observation system (Finn & Specker 2000). The TriTrac triaxial Accelerometer significantly correlated with the Digiwalker pedometer (Caputo et al., 2004). Roberts et al. (Roberts et al., 2004) compared a uniaxial and triaxial accelerometer and report that intensity levels

were more differentiated and additional activity may be captured by using the triaxial accelerometer.

Self-report questionnaires are the most convenient way to assess activity patterns for a large population. This type of physical activity measurement is non-reactive, practical, applicable to many populations and accurate (Kriska & Casperson 1997). The drawback to this measure of physical activity is the subjectivity of the answers, including the inability to accurately recall information, which is especially evident in children (Sirard & Pate 2001; Welk et al., 2000). The previous day recall instruments, such as the PDPAR, seem to provide the most accurate results with children and are positively correlated with both the pedometer (8^{th}-11^{th} grade students) and accelerometer (5^{th} grade, 8^{th}-11^{th} grade students). Data should be collected on multiple occasions if using a previous day recall instrument in order to account for day-to-day variability in activity (Sirard & Pate 2001; Welk et al., 2000). Multiple self-report questionnaires have been validated with both primary and secondary measures (listed above).

Interviewer-administered questionnaires have many of the same benefits and limitations as self-report questionnaires. The interview format may improve results, but the interviewer may also provide a bias. There is also increased burden and cost to the researcher if using the interview method (Sirard & Pate, 2001).

Proxy-reports are physical activity reports of children completed by parents or teachers. This method eliminates recall errors based on a child's limited cognitive ability, but also introduces the bias of the person completing the

report (Sirard & Pate, 2001). Two proxy-reports (parent and teacher) measuring physical activity of children six years of age were validated with a heart rate monitor and are effective in assessing moderate to vigorous activity in young children (Manios et al., 1998). Another proxy report (parent) for children five to six years of age and 10 to 12 years of age was compared to a uniaxial accelerometer, and provided a reliable measure of type, frequency, and duration of children's physical activity (Telford et al., 2004). This study indicated that the proxy report did not provide an accurate estimate of each individual child's physical activity (Telford et al., 2004).

Not many studies choose to use the diary method for measuring physical activity because of the increased burden on the respondent. This method can be highly accurate with adults, but much less so with children. Scerpella et al. (Scerpella et al., 2002) tested the validity of the Godin-Shephard questionnaire in female gymnasts seven to 11 years of age with multiple other measures including daily log diaries. The questionnaire moderately correlated to the daily log (Scerpella et al., 2002).

There are many ways to measure physical activity. The DLW technique and indirect calorimetry give the most accurate results, but are not cost-efficient. Accelerometers, pedometers, and heart rate monitors work well in some situations, but are inaccurate in others. Direct observation, interviewer-administered questionnaires, and proxy-reports are good for use with children; however they all introduce an additional bias to the research. Any type of questionnaire allows the respondent to provide the information and is very cost-

efficient, but many times the information provided is inaccurate, especially with young children. Deciding which of these methods to use is largely determined by the population to be studied (age, size, etc.).

Policies Related to Physical Education in Schools

According to the Healthy People 2010 report, in 1994, 17 percent of middle and junior high schools and two percent of high schools provided daily physical education for all students (U.S. Dept. of Health and Human Services, 2000). In order to improve these percentages, Healthy People 2010 includes some objectives related to school physical education. One of these is to increase the proportion of schools that require daily physical education. Another goal is to increase the percentage of students in grades 9-12 who participate in daily school physical education from 29 percent (1994) to 50 percent by 2010. Healthy People 2010 also aims increase the percentage of students who spend at least 50 percent of physical education class being physically active from 38 percent (1999) to 50 percent by 2010 (U.S. Dept. of Health and Human Services, 2000).

The National Association for Sport and Physical Education (NAPSE) conducted the *Shape of the Nation Report* in 2001 to evaluate the status of physical education in the American educational system (NAPSE, 2001). Currently, there is no federal law mandating physical education be provided to students. Each state may set some guidelines, but individual school districts develop more specific guidelines for their schools. Both the 1997 and 2001 reports state that most states do not require daily physical education for all

students in kindergarten through 12th grade, a recommendation from the 1996 Surgeon General's Report (NAPSE, 2001).

Currently Illinois is the only state that requires daily physical education for all students in kindergarten through 12th grade (NAPSE, 2001). Alabama requires daily physical education for students in kindergarten through 8th grade. At the elementary level, state mandated requirements for physical education range from 30 to 150 minutes per week (150 minutes per week is recommended). At the middle school level, the state requires 80 to 275 minutes of physical education per week (225 minutes is recommended). Most students only participate in physical education for one year between grades 9 and 12. The time requirements for this age range from zero to 225 minutes per week (225 minutes per week is recommended) (NAPSE, 2001).

The physical education of Oklahoma students is based on the National Standards for Physical Education, developed by NAPSE (Council of Chief State School Officers, 2001). Assessment of students is determined by the local school districts. In 2001, physical education was provided in 98 percent of elementary schools, 85 percent of middle schools and 65 percent of high schools and physical education grades were included in the grade point average (Council of Chief State School Officers, 2001).

In 2001, Oklahoma did not have a policy requiring or encouraging districts or schools to follow any national or state health education standards or guidelines (Council of Chief State School Officers, 2001). There was also no policy requiring students to be tested on health education topics in any grade.

Oklahoma did require newly-hired staff teaching physical education be certified, licensed or endorsed by the state to teach physical education. Oklahoma also required physical activity and fitness be taught as a part of classroom instruction (Council of Chief State School Officers, 2001).

The Oklahoma Department of Education received a grant from the CDC to promote physical activity and nutrition (Council of Chief State School Officers, 2001). “Fit and Healthy Schools” was implemented in five middle schools and one elementary school in Oklahoma. These schools received special training to provide a fitness assessment for students (Fitnessgram) and Polar Heart monitors were provided to measure exercise intensity (Council of Chief State School Officers, 2001). Another program, Schools for Healthy Lifestyles, is a community-based health promotion program focusing on education in nutrition, cardiovascular risk reduction, injury prevention and physical fitness (Oklahoma State Board of Health, 2003). This program was established five years ago and has been implemented in more than 20 schools in the Oklahoma City area and is expanding to cover more of the state at the elementary level (Oklahoma State Board of Health, 2003).

Physical education programs in schools are the perfect intervention point for reducing the numbers of overweight children in the United States. Many states have programs addressing this epidemic, Oklahoma included. If each state can achieve the goals set by the Healthy People 2010 initiative, the United States will most likely have a healthier and happier youth.

Programs promoting Physical Activity

Many researchers have surveyed physical activity in youth and found many children are not getting the recommended amount of physical activity, female children are less likely to be sufficiently active and physical activity declines with age during adolescence (Stone et al., 1998). It is imperative that children become more active because children who are less active tend to remain less active as they age. During the 1990's there was a strong effort to develop community and school based programs to promote physical activity in children. Currently there are many programs, in schools, communities, and family-based, appropriate for children of all ages (Stone et al., 1998).

Mo-suwan et al. (Mo-suwan et al., 1998) evaluated the effect of a school-based exercise program on the obesity indices of children in kindergarten. The exercise program consisted of a 15 minute walk in the morning before class started and a 20 minute aerobic dance session after the afternoon nap three times a week for 30 weeks. The researchers reported their exercise program prevented BMI gain in girls and could reverse the progression of overweight in children in kindergarten (Mo-suwan et al., 1998).

Take 10! and Physical Activity Across the Curriculum (PAAC) are two programs that integrate physical activity into the classroom of elementary schools (Gibson & Donnelly, 2004; Peregrin, 2001). Both programs teach academic lessons (reading, phonics, math, etc.) through moderate intensity physical activity throughout the day, in 10 minute sessions. This way academic learning is not compromised and the need for special equipment or clothing for physical activity

is not an issue. Follow-up research for the PAAC indicated 20 out of 27 teachers who participated in the pilot program were still integrating physical activity in their lessons seven months after the end of the pilot. Teachers using the Take 10! program indicated it was a great way to refocus students when there was a distraction in the classroom and that students actually requested to participate in the program (Gibson & Donnelly, 2004; Peregrin, 2001).

The Be a Fit Kid program, Jump into Action and Pathways interventions in elementary school-aged children addressed increasing physical activity as well as improving health education. The Be a Fit Kid nutrition and exercise program pilot study met for two hours three times a week for three months at school (Slawta et al., 2004). Immediate improvements were reported in fitness, body composition and nutrition knowledge, and these improvements were maintained by 75 percent of the children six months after the intervention (Slawta et al., 2004). Jump into Action, a type 2 diabetes prevention program for Mexican-American children, proposed that increasing knowledge of physical activity and nutrition would result in positive behavior changes (Holcomb et al., 1998). After completion of the four month intervention, increases in both knowledge and positive behaviors were observed (Holcomb et al., 1998). The Pathways intervention focused on physical activity and dietary variables in American Indian children (Stevens et al., 2003). During the three year program, modified foods were served in the cafeteria, physical activity was increased at school and the classroom curriculum was modified to teach healthy eating and lifestyle habits. At

the end of the intervention, knowledge of physical activity and nutrition, healthy food choices and physical activity participation increased (Stevens et al., 2003).

In 2003, school health report cards were implemented in three school districts (Cambridge, MA; Allentown, PA; Citrus County, FL) and the state of Arkansas (Scheier, 2004a). These report cards informed parents of their child's BMI and a description of the corresponding risk category. A health and fitness information sheet, offering healthy eating and activity ideas, was sent home along with the BMI percentage. Physical Education (PE) teachers and nurses were trained to measure height and weight (to calculate BMI) in private rooms during PE class (Scheier, 2004a). Some experts were concerned that the school health report cards could falsely "label" or "diagnose" some children as overweight, or that some children who had a normal BMI but possess other risk factors would not be identified in the "at risk" category. These concerns could be alleviated if parents followed the recommendations included with the BMI and associated risk category of allowing a pediatrician to fully evaluate their child if the child was reported to be overweight, at risk for overweight or underweight (Scheier, 2004a; Scheier, 2004b).

Active Winners is a community-based intervention to increase physical activity for elementary and middle school-aged children. The effect of the Active Winners program was evaluated on two separate populations in South Carolina (Stone et al., 1998; Pate et al., 2003). The first study took place in 1997 and included an after school and summer program (Stone et al., 1998). The children (5^{th} and 6^{th} grade) participated in the program four days a week for 18 months.

There was no increase in physical activity or fitness, but there was an increase in intention to exercise for females (Stone et al., 1998). The other study, performed in 2003, included an after school and summer program, but also had home, school and community components to increase physical activity in children (5^{th} grade) (Pate et al., 2003). This intervention also took place over 18 months in children. The results showed the home, school and community components were not implemented as planned, which could have been part of the reason there were no significant changes in physical activity in the children (Pate et al., 2003).

There are various other community-based programs to increase physical activity; however the results are similar to those of the Active Winners intervention. The Family Health Project promoted diet and physical activity for 12 weeks with children in fifth and sixth grade (Stone et al., 1998). This program had no effect on physical activity or fitness, but did increase knowledge of cardiovascular health. The Class of 1989 and Minnesota Heart Health Program study aimed to increase physical activity and cardiovascular health behaviors in children in sixth through twelfth grade. This program showed the decline in physical activity over time was smaller after the intervention for all grades (Stone et al., 1998).

HealthWorks! and Shapedown are weight management programs that serve overweight children (5-18 years of age) using a family-based behavioral approach with group and individual treatment (Hipsky & Kirk, 2002; Shapedown). At least one parent must commit to attending sessions with the child. The goals of these programs are to have both the child and the family adhere to a healthier

lifestyle. The specific goals for the child include normalizing their weight within their genetic build, enhancing self-esteem and building peer relationships (Hipsky & Kirk, 2002; Shapedown).

HealthWorks initially assessed the children with anthropometric measurements (height, weight, and circumferences), dual x-ray absorptiometry (DXA) to determine lean body mass and fat tissue, extensive lab panels, urinalysis, psychological examination, fitness test and nutrition and dietary habit report (Hipsky & Kirk, 2002). A care team (physician, psychologist, registered dietician, nurse, exercise physiologist) determines the treatment plan, including nutrition, physical activity and self-esteem goals, following the initial assessment. One adult in the family commits to recording daily behaviors and reviewing the goals with the participant. The participants are reassessed after six months in the program to compare the current measurements with those from the initial assessment (Hipsky & Kirk, 2002). There are no reports on the impact of this program at this point.

Shapedown consists of a two and a half hour session each week for 10 weeks (Shapedown). Each session is broken into three group sessions: children's group, parent's group and parent and children group. The group sessions focus on communication and relationships with regard to healthy nutrition and physical activity habits. Before the first session and during the last session, the Shapedown provider (e.g. registered dietician) measures the height, weight and triceps skin fold thickness of each participant. Each participant also completes a fitness test (strength, flexibility, endurance) and the Youth

Evaluation Scale (YES) questionnaire before the initial session and during the last session (Shapedown).

Several studies have shown the effectiveness of Shapedown. Segal et al. (Segal et al., 2004) reported all subjects (age 6-16 years) participating in this study of the Shapedown program reduced their BMI, body size, and estimated percent body fat as well as enhancing their body image. Thomas-Doberson et al. (Thomas-Doberson et al., 1993) reported an adaptation of the Shapedown program for overweight adolescents (average age 13.9 years) with type 1 diabetes improved body image and self-esteem.

There are numerous programs trying to fight the rise in overweight among children. The most effective programs seem to be those based in schools and with family. School-based programs can reach all school-aged children, whereas the family-based, and possibly the community-based programs, might only be available to those who can afford to pay for the intervention.

CHAPTER III

METHODOLOGY

Purpose

The purpose of this project was to evaluate if a gardening project increased physical activity throughout the day among children participating in the Delaware County Oklahoma New Communities Project (ONCP). The Delaware County ONCP is a holistic approach to health education including personal health behaviors, physical activity, nutrition, food preparation and food safety to children in kindergarten through eighth grade in an after school setting. The after school program was from 3:15 to 4:45 Monday through Friday.

One part of the Delaware County ONCP was the incorporation of a gardening project as a unique method to actively involve children in physical activity, nutrition, food preparation and food safety. The Delaware County ONCP was open to all children participating in the school's Century Twenty-one after school program. The children participating in the Delaware County ONCP after school garden received health education instruction one day a week and could participate in the garden on the remaining four days. Garden activities included planting, watering, weeding, fertilizing, mulching, harvesting and preparing produce for consumption.

The objective of this study was to determine if a gardening project increased physical activity throughout the day among children in third through fifth grade participating in the Delaware County ONCP using an Activity Videotape questionnaire (Tremblay et al., 2001).

Description of Instrument

The Activity Videotape questionnaire evaluated the effect of an after school gardening project on physical activity throughout the day. The Activity Videotape questionnaire assessed the previous day's physical activity (7:00 AM to 7:00 PM). The questions in the Activity Videotape questionnaire are listed in table 2. Questions 1, 2, 3, 5, 7 and 10 segmented the 12-hour period studied into six distinct time periods. The minutes for each time period are listed in table 3. For each time period, three physical activity intensities (nonmoving, moving, and fast-moving) were presented on the Activity Videotape. Each activity intensity was described by a short (3-5 second) video clip of children participating in an activity demonstrating the intensity. After all intensities of activity were described for questions 1, 2, 3, 5, 7, and 10, a still picture of each activity intensity was shown on the screen. Each activity intensity was surrounded by a different colored border. To answer the question, the child identified the color of the intensity that best described their activity in the defined time segment.

The Activity Videotape questionnaire was self-administered and required a VHS video player and monitor to be used. The administration and playing of the video lasted approximately 25 minutes.

The Activity Videotape questionnaire answer sheet (Appendix A) provided to the children was numbered from one to ten, with differently colored dots in rows beside each number. As the children watched the video, they circled the colored dot that best corresponded to the intensity in which they participated during the time segment described by the question. The color for each activity intensity varied between questions to decrease systemic answering or bias.

Table 2. Activity Videotape Questionnaire.

1. Yesterday after you woke up, but before you went to school, which of the following three types of activities did you do?
2. Yesterday after you arrived at school, but before class started, which of the following three types of activities did you do?
3. Yesterday during morning recess, which of the following three types of activities did you do?
4. Did you have a physical education or gym class today?
5. Yesterday during afternoon recess, which of the following three types of activities did you do?
6. Yesterday, compared with your classmates, do you think you took part in more than, less than, or about the same amount of fast-moving activities as your classmates?
7. Yesterday after school, which of the following three types of activities did you do?
8. Yesterday, if you are on a sports team or take part in any organized activity program like gymnastics or swimming, did you have a game or practice?
9. Yesterday did you and your family or a family member take part in a fast-moving activity?
10. Yesterday evening after supper, which of the following three types of activities did you do?

Table 3. Description of time periods and corresponding questions.

Question	Time Period
1	**7:00-8:00 AM**
2	**8:00-8:30 AM**
3	**10:00-10:15 AM**
5	**12:00-12:25 PM**
7	**3:15-4:45 PM**
10	**6:00-7:00 PM**

Questions 1, 2, 3, 5, 7 and 10 were scored by multiplying the minutes spent in the time segment by the numeric value of the intensity (0 for nonmoving, 2 for moving and 4 for fast-moving). For example, question 1 addressed the time period “after waking up, but before going to school,” and a value of 60 minutes was assigned to this segment. The numerical value of question 1 for a nonmoving activity would be 0 (60 x 0), a moving activity would be 120 (60 x 2) and a fast-moving activity would be 240 (60 x 4). The total Activity Videotape questionnaire score (total activity score) was calculated by adding the numerical value of the scored questions (1,2,3,5,7,10).

Questions 4, 6, 8 and 9 were non-scored questions because they were not related to the objective measures and were not included in the total activity score, but provided alternate information about the physical activity of the child.

Subjects

Students in third through fifth grade from a rural dependent school in Oklahoma participated in this study. To be included in this study, the student had to be participating in the Delaware County ONCP after school program. Participation was voluntary and no material incentive was provided to participants. This study was approved by the Oklahoma State University Institutional Review Board for Human Subjects (Appendix B). Written informed consent was obtained from the administration and the parents and verbal assent was obtained from the children (Appendices C, D and E). Students participating

in the Delaware County ONCP completed the Activity Videotape questionnaire before and after starting a gardening project, approximately eight weeks apart.

Statistical Analysis

Data were analyzed using the Statistical Analysis System (SAS) for windows, version 8 (SAS Inst. Inc., Cary, NC) means, frequency, and t-test procedures. Significance level was set at $p \leq 0.05$. Mean total minutes and mean minutes in the after school time period before and during the gardening project were compared at each activity intensity using the SAS t-test procedure. Mean total activity scores and mean activity scores for the after school time period before and during the gardening project were compared using the SAS t-test procedure.

CHAPTER IV

RESULTS

Subject Characteristics

Ten students in third through fifth grade completed the Activity Videotape questionnaire before the Delaware County ONCP gardening project. Twelve students completed the Activity Videotape questionnaire during the Delaware County ONCP gardening project.

Research Findings

The percentage of children participating in each activity intensity throughout the day before and during the gardening project is shown in table 4. The percentage of children participating in non-moving activities decreased for all time periods during the gardening project compared to before the gardening project. The percentage of children participating in moving activities increased for all time periods except during “recess” and “lunchtime” during the gardening project compared to before the gardening project. The percentage of children participating in fast-moving activities increased for all time periods except for “after waking up, but before going to school,” and “after school, but before dinner” during the gardening project compared to before the gardening project.

Table 4. Percentage of Children Participating in Each Activity Intensity for each Scored Time Period Before and During the Gardening Project.

Time Period	Intensity	Before (%)	During (%)
After waking up, but before going to school	Non-moving	40	25
	Moving	40	58
	Fast-moving	20	17
After arriving at school, but before class begins	Non-moving	60	17
	Moving	20	58
	Fast-moving	20	25
During recess	Non-moving	30	17
	Moving	50	50
	Fast-moving	20	33
During lunchtime	Non-moving	90	67
	Moving	0	0
	Fast-moving	10	33
After school, but before dinner	Non-moving	50	25
	Moving	10	50
	Fast-moving	40	25
After dinner	Non-moving	70	33
	Moving	10	33
	Fast-moving	20	33

The percentage of responses for the non-scored questions before and during the garden project is shown in table 5. The majority of children participated in a gym class on the days questioned. Most children reported they participated in the “same amount of fast-moving activities as their classmates.” The majority of children reported that they did “participate in a game or practice” on the days questioned. The majority of children also reported that they did not “participate in a fast-moving activity with their family” on the days questioned.

The comparison of mean activity intensities before and during the garden project is shown in table 6. For statistical purposes, activity intensity was coded. Non-moving activity was coded equal to one, moving activity was coded equal to two and fast-moving activity was coded equal to three. Therefore, as the means

increased, the activity intensity increased. For all time periods mean activity intensity non-significantly increased during compared to before the gardening project.

Table 5. Percentage Responses to Non-Scored Questions Before and During the Gardening Project.

Question	Answer	Before (%)	During (%)
Did you have a gym class today?	Yes	90	100
	No	10	0
Did you take part in more, less, or the same amount of fast moving activities as your classmates?	less	10	8
	same	70	58
	more	20	33
Did you have a game or practice yesterday?	Yes	70	100
	No	30	0
Did you and your family participate in a fast-moving activity yesterday?	Yes	40	17
	No	60	83

Table 6. Comparison of Mean Activity Intensities for Scored Questions Before and During the Gardening Project.

Time Period	Before Mean ± SD	During Mean ± SD
After waking up, but before going to school	1.8 ± 0.8	1.9 ± 0.7
After arriving at school, but before class begins	1.6 ± 0.8	2.1 ± 0.7
During recess	1.9 ± 0.7	2.2 ± 0.7
During lunchtime	1.2 ± 0.6	1.7 ± 1.0
After school, but before dinner	1.9 ± 1.0	2.0 ± 0.7
After dinner	1.5 ± 0.8	2.0 ± 0.9

The mean total minutes in each activity intensity and mean total activity score for the six scored questions before and during the gardening project are shown in table 7. Although not significant, the mean total minutes in non-moving activities decreased from 156.0 to 81.7 minutes during compared to before the gardening project. The mean total minutes in moving activities significantly, $p \leq$

0.01, increased from 52.5 to 125.0 minutes during compared to before the gardening project. The mean total minutes in fast-moving activities non-significantly increased from 71.5 to 73.3 minutes during compared to before the gardening project. Although not significant, the mean total activity score increased 391.0 to 543.3 during compared to before the gardening project.

Table 7. Comparison of Mean Total Minutes Spent in Each Activity Intensity and Total Activity Score Before and During the Gardening Project.

	Before Mean ± SD	During Mean ± SD
Total non-moving minutes	156.0 ± 99.4	81.7 ± 87.1
Total moving minutes	52.5 ± 42.0	125.0 ± 52.1*
Total fast-moving minutes	71.5 ± 88.1	73.3 ± 54.6
Total activity score	391.0 ± 366.1	543.3± 271.5

*Significant difference between before and during the gardening project, $p \leq 0.01$.

The mean minutes in each activity intensity and mean activity score for the after school time period (question 7) before and during the gardening project are shown in table 8. In the after school time period, the minutes of non-moving activity non-significantly decreased from 45.0 to 22.5 minutes during compared to before the gardening project. The mean minutes of moving activity significantly, $p \leq 0.05$, increased in the after school time period from 9.0 to 45.0 minutes during compared to before the gardening project. The mean minutes of fast moving activity non-significantly decreased in the after school time period from 36.0 to 22.5 minutes during compared to before the gardening project. In addition, in the after school time period, the mean activity score non-significantly increased from 162.0 to 180.0 during compared to before the gardening project.

Table 8. Comparison of Minutes Spent in Each Activity Intensity and Activity Score for the After School Time Period Before and During the Gardening Project.

	Before	During
	Mean ± SD	Mean ± SD
Non-moving minutes	45.0 ± 47.4	22.5 ± 40.7
Moving minutes	9.0 ± 28.5	45.0 ± 47.0*
Fast-moving minutes	36.0 ± 46.5	22.5 ± 40.7
Activity score	162.0 ± 179.0	180.0 ± 132.9

*Significant difference between before and during the gardening project, $p \leq 0.05$.

DISCUSSION

This project evaluated if a gardening project increased physical activity throughout the day among children participating in the Delaware County Oklahoma New Communities Project (ONCP) using an Activity Videotape questionnaire. The results of this project indicated that mean total activity scores did not significantly increase among children in third through fifth grade during compared to before the gardening project. However, the mean total minutes in non-moving activities non-significantly decreased and the mean total minutes in moving activities significantly increased during compared to before the gardening project. A substantial amount of the overall change in the mean total minutes in non-moving and moving activities could be attributed to changes in the after school time period. Approximately, one-third of the decrease in total non-moving activity and one-half of the increase in total moving activity can be attributed to changes in the amount of time in non-moving and moving activities in the after school time period. These results indicate that the gardening project primarily impacted physical activity during the after school time period. Therefore, further

research is needed to identify viable interventions or lifestyle changes that will result in sustained increased physical activity throughout the day.

The lack of change in physical activity in time periods other than the after school time period could be seasonal. It seems logical that children would be less likely to play outside in extreme weather conditions. However, Finn and Ullmann (Finn & Ullmann, 2004) showed that weather changes did not affect minutes in vigorous (fast-moving) physical activity of preschool children in northern Iowa. We do not have data on the physical activity patterns of the children participating in this study during a non-winter time period, so we are unable to know if the children in this study are more active during other seasons.

The results of this study also indicated that the majority of students participating in this study were not active with their families. Shea and Economos (Shea & Economos, 2003) reported that participation in active family outings positively predicted participation in moving and/or fast-moving activities. McMurray et al. (McMurray et al., 1993) noted that children of active parents tended to be more active themselves. One time period in this study that could serve as an opportunity for children to be active with their parents is the after dinner time period. For example, parents and children could take a walk around their neighborhood or play in the yard. This allows the children to see healthy behavior modeled to them by perhaps the most influential people in their lives at this time.

In this study the children's activity was evaluated using the Activity Videotape questionnaire (Tremblay, et al., 2001). The Activity Videotape

questionnaire uses an “all or none” style. Children are instructed to choose the activity intensity that best describes their activity during the time period questioned. If a child thinks “moving” describes his or her activity intensity, then the child is considered “moving” for the whole time period. This becomes a problem for large time periods (one or more hours) because children are not consistently participating in the same activity intensity for the entire time period, yet are counted as doing so. Because of this, the results of individual questions and overall scores need to be interpreted with caution.

The Activity Videotape questionnaire is also a form of a self-report questionnaire and most studies suggest that children are unable to accurately recall information from previous days (Sirard & Pate, 2001; Welk et al., 2000) Direct observation may have been a better method to assess the physical activity levels of children participating in the after school gardening program; however, the high experimenter burden of direct observation may still have been a limitation.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Purpose

The Delaware County Oklahoma New Community Project (ONCP) is a holistic approach to health education including personal health behaviors, physical activity, nutrition, food preparation and food safety. The Delaware County ONCP provides health educational programs to children in kindergarten through eighth grade in an after school setting. One part of the Delaware County ONCP is the incorporation of gardening as a unique way to actively involve children in physical activity, nutrition, food preparation and food safety. The purpose of this project was to evaluate if a gardening project increased physical activity throughout the day among children participating in the Delaware County ONCP.

Objective and Null Hypothesis

The objective of this project was to determine if a gardening project increased physical activity throughout the day among children in third through fifth grade participating in the Delaware County ONCP using an Activity Videotape questionnaire.

The null hypothesis was that there would be no significant difference in total activity scores among children in third through fifth grade participating in the Delaware County ONCP before and after starting a gardening project using an Activity Videotape questionnaire.

Summary

The results of this study showed there was no significant difference in mean total activity scores among children in third through fifth grade participating in the Delaware County ONCP before and after starting a gardening project using an Activity Videotape questionnaire; therefore the null hypothesis was accepted.

Conclusions

The results of this project indicated that mean total activity scores did not significantly increase among children in third through fifth grade during compared to before the gardening project. However, the mean total minutes in non-moving activities non-significantly decreased and the mean total minutes in moving activities significantly increased during compared to before the gardening project.

A substantial amount of the overall change in the mean total minutes in non-moving and moving activities could be attributed to changes in the after school time period. Approximately, one-third of the decrease in total non-moving activity and one-half of the increase in total moving activity can be attributed to changes in the amount of time in non-moving and moving activities in the after school time period. These results indicate that the gardening project primarily

impacted physical activity during the after school time period. Therefore, further research is needed to identify viable interventions or lifestyle changes that will result in sustained increased physical activity throughout the day.

Recommendations

Children will voluntarily participate in activities they enjoy. Development of physical activity programs should focus on this fact. Therefore the challenge is to develop a program with activities that all children will enjoy and that can be easily incorporated into daily life. A program encouraging children to walk could easily be incorporated into daily life. Also, programs teaching children different sports might encourage children to participate in a sport outside of school. Children respond well to incentives, such as “If you walk this number of miles by this date, you will receive this.” Many times if you can get a child started participating in physical activities, they will see they feel better and actually enjoy the activity and eventually will want to participate with or without an incentive.

Currently, there are no completely accurate measures of physical activity, especially for children. The most accurate measures (doubly labeled water and indirect calorimetry) are not practical for use in children. Self-report measures of physical activity are fairly accurate at best, but they are very practical for use in all age groups. More studies need to be conducted to find accurate and practical measures of physical activity so physical activity programs can be developed with the specificities of the population in need.

It might also be helpful for schools to have alternate activities for different seasons. During extreme weather conditions, children may be less likely to play outside, so alternate physical activities should be available. During these times, children could play in a gym or an indoor swimming pool. If these facilities are not available for use, games such as hide and seek can be played indoors to provide physical activity.

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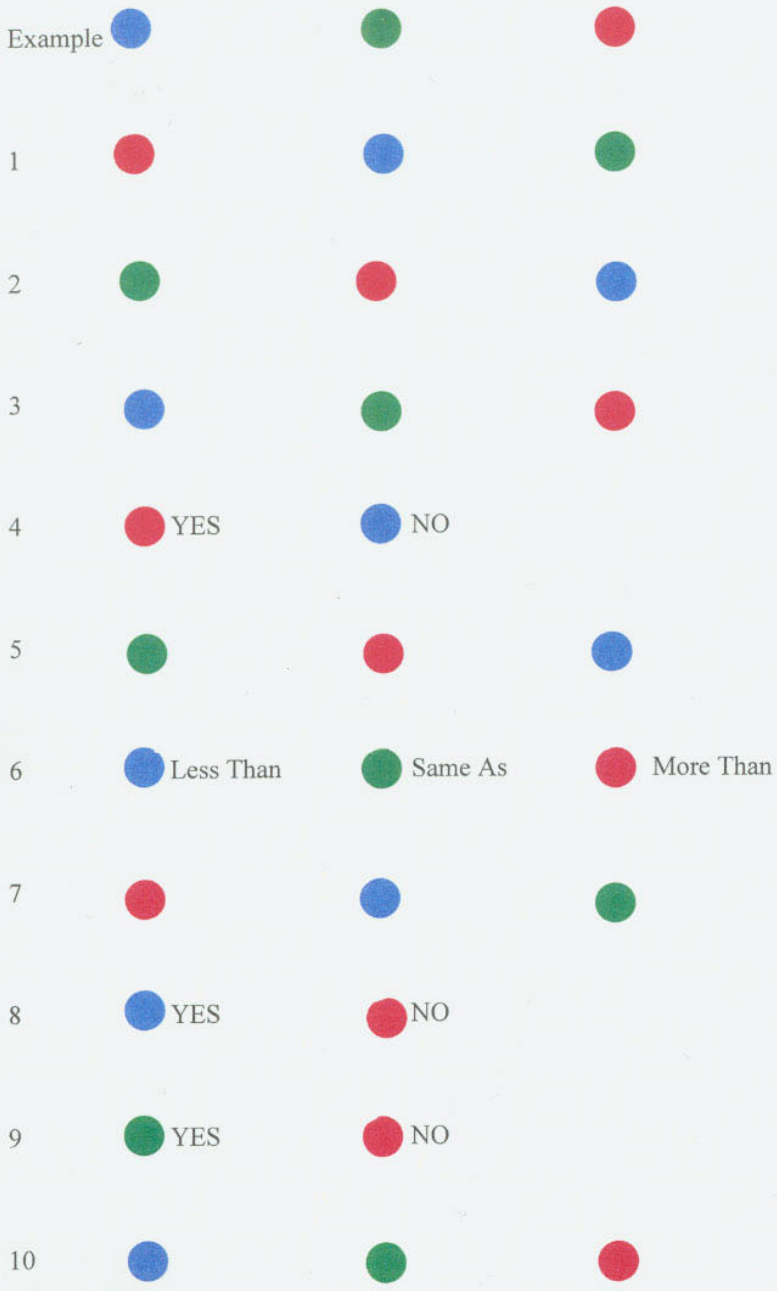
APPENDIX A

ACTIVITY ANSWER SHEET

Check One: _____ Beginning _____ Ending What grade are you in: _____



APPENDIX B

Oklahoma State University Institutional Review Board

Date: Monday, March 08, 2004

IRB Application No: HE0424

Proposal Title: Oklahoma New Communities Project: Youth Questionnaire

Reviewed and Processed as: Expedited (Spec Pop)

Status Recommended by Reviewer(s): Approved **Protocol Expires: 3/7/2005**

Principal Investigator(s):

Janice Hermann
313 HES
Stillwater, OK 74078

Kristin Lowe
301 HES
Stillwater, OK 74078

Sarah Walker
301 HES
Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact me in 415 Whitehurst (phone: 405-744-1676, colson@okstate.edu).

Sincerely,

Carol Olson

Carol Olson, Chair
Institutional Review Board

APPENDIX C

Administration Consent to Participate

I am the Superintendent/Principal at Leach School and have been approached by a representative of the Oklahoma Cooperative Extension Service with regard to conducting a before and after questionnaire related to food, nutrition and physical activity and a video questionnaire related to physical activity with youth in my school. I have examined the questionnaire and video questionnaire to be used and agree that the protocol to be used is appropriate for administration in this school. I understand that my consent for this program may be withdrawn at any time by contacting Dr. Janice Hermann (405) 744-6824.

_____	_____	_____
(Print Name)	(Signature)	(Date)

APPENDIX D

Informed Consent To Participate

Oklahoma Cooperative Extension Service is providing a food, nutrition and physical activity education program at your child's school, conducted by Barbara Denney, Delaware County Oklahoma Cooperative Extension Service Project Coordinator and supervised by Janice Hermann, Oklahoma Cooperative Extension Service Nutrition Education Specialist. The purpose of this program is to provide food, nutrition and physical activity education to youth. In order to evaluate the Oklahoma Cooperative Extension Service education program your child will be asked to complete a before and after questionnaire related to food, nutrition and physical activity and a video questionnaire related to physical activity.

I understand that the information on the questionnaires are anonymous and that no one will be able to connect my child's name with the information on the questionnaires. I understand that Dr Janice Hermann, Oklahoma Cooperative Extension Service Nutrition Education Specialist will keep the questionnaires in a secure location, and that the questionnaires will be destroyed 1 year after completion of the program. I understand that my child's participation in completing the questionnaires is voluntary, that there is no penalty for refusing to complete the questionnaires. I understand that my child can refuse to complete the questionnaires by verbally telling the Oklahoma Cooperative Extension Service Project Coordinator. Information concerning the education program or the before and after questionnaires can be obtained by contacting Barbara Denney, Delaware County Oklahoma Cooperative Extension Service Project Coordinator at (918) 253-4330 or Dr. Janice Herman, Oklahoma Cooperative Extension Service Nutrition Education Specialist at (405) 744-6824. Information concerning subject's rights may be obtained by contacting Carol Olson, Director of Oklahoma State University Institutional Review Board at (405) 744-0405.

I have read and fully understand this consent form. I am currently eighteen years or older and the parent or legal guardian of the youth named on this consent form. I understand that this signed consent form will be filed separately from the before and after questionnaires and this is the only place my child's name will appear. I sign my name freely and acknowledge that a copy of this consent has been afforded to me.

_____

Print Name (Parent or Legal Guardian) Signature (Parent or Legal Guardian)

_____ _____

Date Time

_____

Student's Name

I certify that I have personally explained this form to the parent or legal guardian before requesting the parent or legal guardian to sign it.

_____

Oklahoma Cooperative Extension Service Project Coordinator

APPENDIX E

Youth Assent Script

I would like you to complete two questionnaires to help me evaluate our food, nutrition and physical activity program. Your parent(s) has(have) given their permission for you to complete the questionnaires. However, you do not have to complete the questionnaires if you do not want to. I have another activity for you to do, if you do not want to complete the questionnaires

VITA

Kristin Beth Lowe

Candidate for the Degree of

Master of Science

Thesis: EFFECT OF AN AFTER SCHOOL GARDENING PROJECT ON DAILY PHYSICAL ACTVITIY IN YOUTH

Major Field: Nutrition

Biographical:

Personal Data: Born in Tulsa, Oklahoma, on June 16, 1979, the daughter of Dean and Carol Lowe

Education: Graduated from Owasso High School, Owasso, Oklahoma in May 1997; received Bachelor of Science degree, with Honors in Physiology from Oklahoma State University, Stillwater, Oklahoma in May 2001. Completed the requirements for the Master of Science degree with a major in Nutrition at Oklahoma State University in May, 2005

Experience: Employed by St. Francis Hospital during summers and breaks; employed by Riverfield Country Day School from 2002 to 2004; employed by Shapedown! Pediatric Weight Management Program during the fall of 2004.

Name: Kristin Lowe Date of Degree: May, 2005

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: EFFECT OF AN AFTER SCHOOL PROGRAM ON DAILY PHYSICAL ACTIVITY IN YOUTH

Pages in Study: 83 Candidate for the Degree of Master of Science

Major Field: Nutrition

Scope and Method of Study: The purpose of this study was to evaluate if a gardening project increased physical activity throughout the day among children participating in an after school program. Children in third through fifth grade participating in an after school program completed an Activity Videotape questionnaire before and after starting a gardening project.

Findings and Conclusions: The results of this project indicated that mean total activity scores did not significantly increase among children in third through fifth grade during compared to before the gardening project. However, the mean total minutes in non-moving activities non-significantly decreased and the mean total minutes in moving activities significantly increased during compared to before the gardening project. Future research is needed to identify viable interventions or lifestyle changes that will result in sustained increased in physical activity throughout the day in children.