EFFECT OF AN AFTER SCHOOL EDUCATION AND GARDENING PROGAM ON NUTRITION AND PHYSICAL ACTIVITY BEHAVIORS IN SCHOOL AGE YOUTH, GRADES 3 - 8

By

SARAH JAYNE WALKER

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Thesis Approved:

Janice Hermann, PhD, RD/LD

Thesis Adviser

Stephany Parker, PhD

Brenda Smith, PhD

A. Gordon Emslie, PhD

Dean of the Graduate College

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CHAPTER I

INTRODUCTION

By definition of the Centers for Disease Control and Prevention gender specific BMI- for- age growth charts (Figures 1 & 2); underweight is less than the fifth percentile, normal weight is between the fifth and eighty-fifth percentile, at-risk of overweight is between the eighty-fifth and ninety-fifth percentile and overweight is greater than the ninety-fifth percentile (Centers for Disease Control and Prevention, 2004a).

The prevalence of overweight increased in children and adolescents ages 6-19 between the third National Health and Nutrition Examination Survey (NHANES III 1988-1994) and the NHANES 1999-2002 report (Ogden et al., 2002; Hedley et al., 2004). Overweight in children ages 6-11 increased from 11.3% (NHANES III) to 15.8% (NHANES 1999-2002). In adolescents ages 12-19, overweight increased from 10.5% (NHANES III) to 16.1% (NHANES 1999-2002) (Ogden et al., 2002; Hedley et al., 2004). Hedley et al. (2004) reported 31.2% of children ages 6-11 and 30.9% of adolescent's ages 12-19 had a BMI $\geq$ 85th percentile for age based on the NHANES 1999-2002 data. Significant differences were observed in the rate of overweight adolescents by race/ethnicity. Approximately 23% of non-Hispanic blacks and Mexican American youth ages 12-19 were overweight compared to 12.7% of overweight non-Hispanic whites ages 12-19. These results are consistent with the results of the National Longitudinal Survey of Youth (NLSY) (Ogden et al., 2002; Strauss & Pollack, 2001).

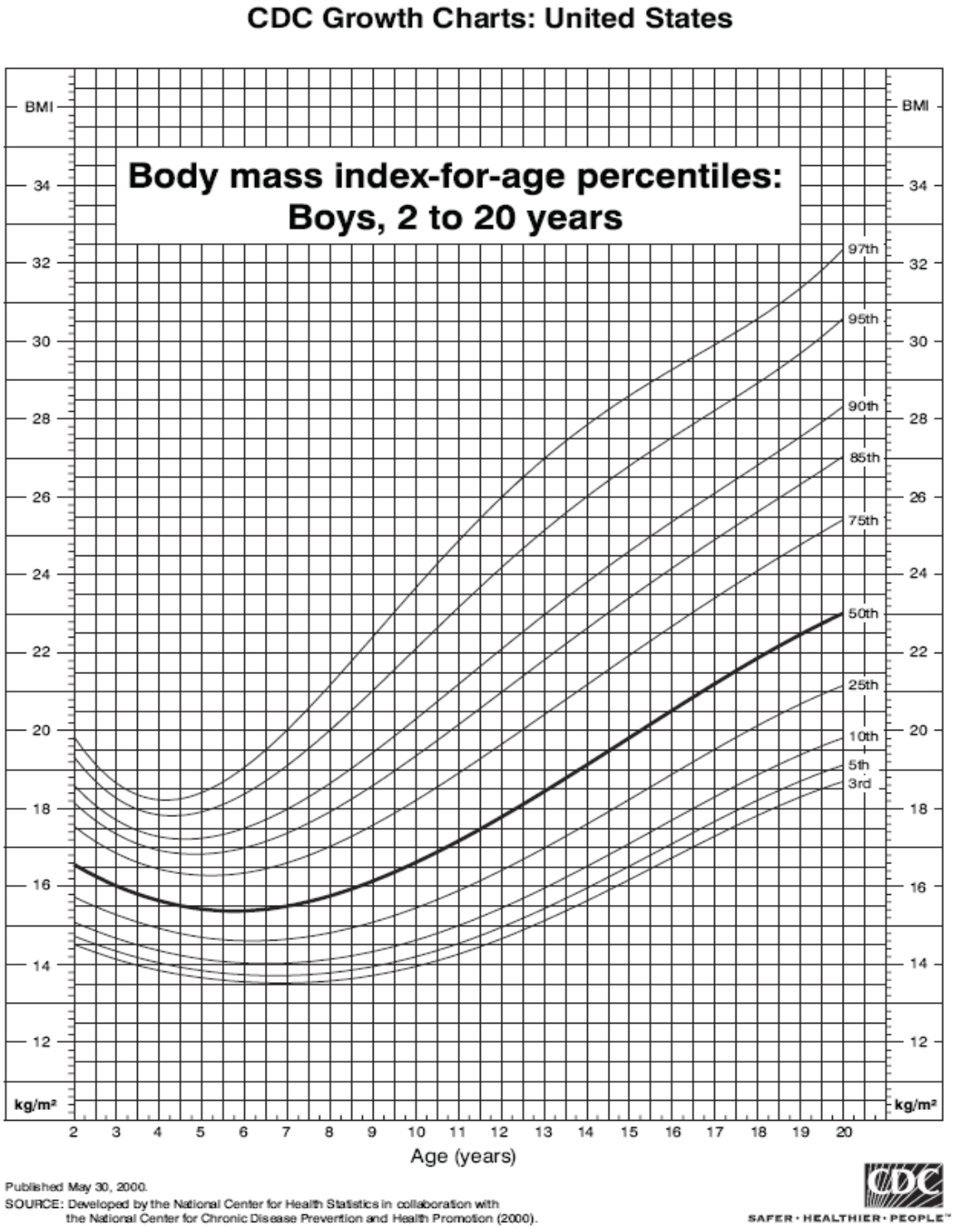

Figure 1. BMI-for-age growth chart: boys 2-20 years of age (Centers for Disease Control and Prevention, 2004a)

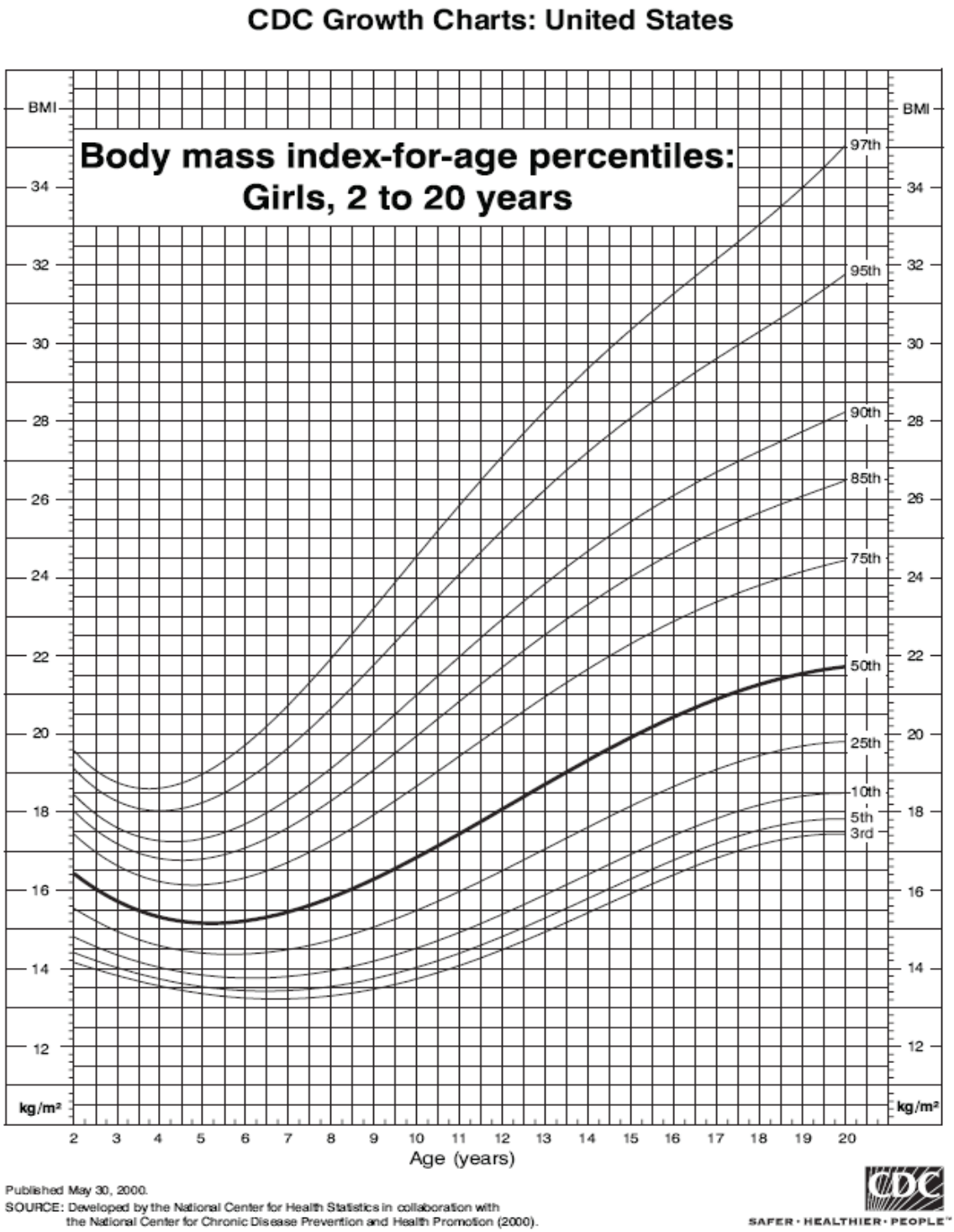

Figure 2. BMI-for-age growth chart: girls 2-20 years of age (Centers for Disease Control and Prevention, 2004a)

The NLSY from 1986-1998 reported 38.4% of African Americans, 37.9% of Hispanics, and 25.8% of white (non-African American, non-Hispanic) children between the ages of 4-12 years of age were at risk of overweight with a BMI for age > 85% (Strauss & Pollack, 2001). Based on the NLSY data 21.5% of African Americans, 21.8% of Hispanics, and 12.3% of white (non-African American, non-Hispanic) children had BMI for age > 95%, putting them in the overweight category (Strauss & Pollack, 2001). Strauss & Pollack (2001) observed that from 1986-1998 the prevalence of overweight among NLSY participants increased more than 120% in African American and Hispanics and more than 50% among white children. Over time a significant difference was reported in overweight prevalence by region. Southern states had a significantly higher (17.1%) prevalence of overweight compared to western states (10.8%) (Strauss & Pollack, 2001). The results of these studies indicate that overweight and at risk of overweight are increasing drastically overtime.

Genetics, inadequate nutrition, and lack of physical activity have been considered possible factors for the increasing prevalence of overweight among children. Blasi (2003) and LeBlanc (2003) state genetics alone cannot be to blame for the alarming increase of children who are overweight and at risk of overweight. An increase in calorie consumption paired with a decrease in physical activity is the main reason for an increase in children who are overweight (Blasi, 2003; LeBlanc, 2003).

Overweight is a leading cause of hypertension and type 2 diabetes in children (Blasi, 2003). If overweight in children continues to increase the health of our nation could be in danger. Children who are overweight have an increased risk for developing heart disease and other chronic illnesses in adulthood. It has been shown that being

overweight can negatively affect a child's self-esteem and relationship with peers (Blasi, 2003).

Children need to learn healthy nutrition and physical activity behaviors early in life. Nutrition education should begin as early as preschool and continue throughout high school (Briggs et al., 2003). Schools play a critical role in providing a place to help children learn healthy behaviors and teach them to effectively develop decision making skills to promote a positive lifestyle (Briggs et al., 2003). Current research reports nutrition education in schools can have a positive impact on the increase in overweight by improving the health behaviors of children and faculty through proper education and training (Briggs et al., 2003). Including nutrition and physical education in schools may create behaviors that will continue through adulthood (Carter, 2002).

Nutrition programs in schools can be justified as providing a positive influence for academic achievements in students. Good nutrition can be associated with a decrease in discipline and emotional problems and an improved readiness to learn (Briggs et al., 2003). Schools are convenient locations for nutrition and physical activity interventions to take place because they allow students the opportunity to practice healthy behavior changes (Wechsler et al., 2000). A school garden is one example of comprehensively teaching nutrition, physical activity, science, and environmental studies (Briggs et al, 2003). The schools health education, food service, and physical activity programs may be the most influential because they are less costly and reach a larger audience (Wechsler et al., 2000).

PURPOSE

The purpose of this study is to determine the impact of an after school education and gardening program on nutrition and physical activity behaviors among youth in 3rd through 8th grade participating in the Delaware County Oklahoma New Communities Project.

OBJECTIVES

1. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on eating something before school starts.
2. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on washing hands before eating.
3. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on eating bread or grain foods every day.
4. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on eating or drinking milk or dairy foods every day.
5. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on eating fruits every day.
6. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on eating vegetables every day.
7. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on choosing snacks from the Pyramid food groups.

8. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on drinking pop every day.
9. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on eating candy, desserts, or chips every day.
10. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on drinking water when thirsty.
11. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on using food nutrition labels.
12. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on being physically active every day.

NULL HYPOTHESIS

Ho1. There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I eat something before schools starts," after an education and gardening program.

Ho2. There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I wash my hands before I eat," after an education and gardening program.

Ho3. There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I eat bread or grain foods everyday," after an education and gardening program.

Ho4. There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I drink milk or eat dairy foods every day," after an education and gardening program.

Ho5. There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I eat fruits every day," after an education and gardening program.

Ho6. There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I eat vegetables every day," after an education and gardening program.

Ho7. There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I eat snacks from the Pyramid food groups," after an education and gardening program.

Ho8. There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I drink pop every day," after an education and gardening program.

Ho9. There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I eat candy, desserts or chips every day," after an education and gardening program.

Ho10. There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "When I am thirsty, I drink water," after an education and gardening program.

Ho11. There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I use food nutrition labels," after an education and gardening program.

Ho12. There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I am physically active every day," after an education and gardening program.

ASSUMPTIONS AND LIMITATIONS

It is assumed the participants will answer the pre and post test questionnaire honestly. The results of this study are based on this assumption.

A limitation of this study is the small sample size of the participants. The Oklahoma New Communities Project is a grant funded after school program conducted in a small rural school. Another limitation of this study was no control group consisting of students in the school who did not participate in the after school program. The order of the lessons and how many times a topic was covered was not known to the researchers, creating an additional limitation for interpreting results.

DEFINITIONS

Oklahoma New Communities Project –The Oklahoma New Communities Project (ONCP) is a Cooperative State Research, Education and Extension Service (CSREES) Children, Youth, Families at Risk (CYFAR) grant funded program.

Oklahoma New Communities Project County Coordinator – The Oklahoma New Communities Project County Coordinator is hired to implement the ONCP at the county level.

CHAPTER II

REVIEW OF LITERATURE

CHILDHOOD OVERWEIGHT

Prevalence of childhood overweight

The prevalence of overweight increased in children and adolescents ages 6-19 between the third National Health and Nutrition Examination Survey (NHANES III 1988-1994) and the NHANES 1999-2002 report (Ogden et al., 2002; Hedley et al., 2004). Overweight in children ages 6-11 increased from 11.3% (NHANES III) to 15.8% (NHANES 1999-2002). In adolescents ages 12-19, overweight increased from 10.5% (NHANES III) to 16.1% (NHANES 1999-2002) (Ogden et al., 2002; Hedley et al., 2004). Hedley et al. (2004) reported 31.2% of children ages 6-11 and 30.9% of adolescent's ages 12-19 had a BMI $\geq$ 85th percentile for age based on the NHANES 1999-2002 data. Significant differences were observed in the rate of overweight adolescents by race/ethnicity. Approximately 23% of non-Hispanic blacks and Mexican American youth ages 12-19 were overweight compared to 12.7% of overweight non-Hispanic whites ages 12-19. These results are consistent with the results of the National Longitudinal Survey of Youth (NLSY) (Ogden et al., 2002; Strauss & Pollack, 2001).

The NLSY from 1986-1998 reported 38.4% of African Americans, 37.9% of Hispanics, and 25.8% of white (non-African American, non-Hispanic) children between the ages of 4- 12 years of age were at risk of overweight with a BMI for age > 85% (Strauss & Pollack, 2001). Based on the NLSY data 21.5% of African Americans, 21.8% of Hispanics, and 12.3% of white (non-African American, non-Hispanic) children had BMI for age > 95%, putting them in the overweight category (Strauss & Pollack, 2001). Strauss & Pollack (2001) observed that from 1986-1998 the prevalence of overweight among NLSY participants increased more than 120% in African American and Hispanics and more than 50% among white children. Over time a significant difference was reported in overweight prevalence by region. Southern states had a significantly higher (17.1%) prevalence of overweight compared to western states (10.8%) (Strauss & Pollack, 2001). The results of these studies indicate that overweight and at risk of overweight are increasing drastically overtime.

Anthropometric Assessment of Childhood Overweight

Lee & Nieman (2003) define anthropometry as the measurement of the physical dimensions and gross composition of the body. Anthropometrics are appropriate measurements to use in the evaluation of one's nutritional status. (Lee & Nieman, 2003; Mei et al., 2002). Different types of anthropometric measurements used to assess body composition and weight are height-weight indices, skinfold measurements, bioelectric impedance, and the dual-energy x-ray absorptiometry (DEXA) (Lee & Nieman, 2003). However, there is controversy when it comes to deciding on the standards of measurement and methods used to assess body composition and weight because not all

types of anthropometric measurements are practical for everyday use in a community or clinical setting (Lee & Nieman, 2003).

Skinfold measurements are reasonable measurements to use when estimating body fatness (Mei et al., 2002). Skinfold measurements are used most in clinical and community settings to indirectly estimate one's percent body fat (Lee & Nieman, 2003). Muscle mass and technique must be considered when interpreting the results of skinfold measurements (Lee & Nieman, 2003).

Body mass index (BMI) is the most common height-weight index (Lee & Nieman, 2003). BMI is calculated by taking weight in kilograms over height in meters squared. BMI is a practical anthropometric measurement because it is easy to perform, non-invasive and inexpensive (Mei et al., 2002).

Research has been conducted evaluating the use of BMI in measuring body fat of different ethnicities. Lohman et al. (1999) used BMI to assess body composition of American Indian children. Lohman et al. (1999) indicated there is difficulty assessing overweight with BMI alone because it reflects fat mass and fat free mass. The study suggested combinations of more direct methods along with BMI be used when evaluating body composition (Lohman et al., 1999).

Malina & Katzmarzyk (1999) conducted a study evaluating BMI sensitivity and specificity of indicating overweight and at risk of overweight in six different groups of adolescents comprised of different ethnicities. All adolescents not at risk of overweight or overweight were classified correctly; however, those who were at risk of overweight or overweight may have been classified incorrectly (Malina & Katzmarzyk, 1999).

Therefore, Malina & Katzmarzyk (1999) reported BMI had a high specificity but a lower sensitivity.

Mei et al. (2002) compared the validity of BMI-for-age, Rohrer Index (RI), and weight- for- height in screening for overweight and underweight in children ages 2-19. When average skinfold was used as the standard, BMI-for-age was significantly better at detecting overweight than RI or weight- for- height. When using percent body fat as the standard, BMI-for-age was significantly better at detecting overweight than RI but not significantly different than weight for height (Mei et al., 2002).

Overall, BMI-for-age is considered to be an acceptable screening tool for indicating at risk of overweight and overweight in adolescents (Malina & Katzmarzyk, 1999). The Centers for Disease Control and Prevention recommends BMI-for-age be used to screen for overweight and at risk of overweight persons ages 2-20. BMI-for-age can be used to identify those who are in need of further assessment. A further assessment can help determine if a child has an increased health risk related to overweight (Centers for Disease Control and Prevention, 2004b).

ETIOLOGIC FACTORS

Genetics

Genetics is considered to be a major contributing factor to childhood overweight (Kibbe & Offner, 2003). Twin studies have shown genetic factors can contribute approximately 50-70% to the development of obesity (Keiss et al., 2001). Schomerus-Koeppen et al. (2001) examined the relationship of genetics and overweight of 4-year-old

twin pairs. Schomerus–Koeppen et al. (2001) reported approximately 60% of overweight was related to genetics while approximately 40% of overweight was related to shared and non shared environmental factors.

Children may be at risk of becoming overweight due to gene disorders. Genetic disorders can cause mutations of cell receptors thought to help control weight. Leptin and other cell receptor deficiencies have been noted in small populations around the world (Farooqi, 2005). Syndromes such as Bardet-Biedl, Albright's hereditary osteodystrophy, Fragil X, Borjeson-Forssman-Lehmann,Cohen, and Aloström are classified as pleiotropic syndromes because these syndromes are associated with other observable abnormalities in addition to obesity. Chromosomal abnormalities can cause obesity syndromes such as Prader-Willi and WAGR (Wilms tumour, anorexia, ambiguous geitalia and mental retardation). Knowledge of these obesity related genetic disorders may help to understand a few of the cases of overweight in children. Proper assessment can help ensure proper treatment (Farooqi, 2005).

Parental Obesity

Salbe et al. (2002a) examined parental obesity as a risk factor for overweight in Pima Indian children at ages five and ten. Height and weight measurements were taken or reported from parents and children. Salbe et al. (2002a) reported children's birth weight was not significantly correlated to children's body weight or percent body fat at ages five or ten. However, parental BMI was significantly correlated with children's percent body fat and children's body weight at ages five and ten. A child's percent body fat and body weight at age five and maternal BMI when the child was age ten, were the most

significant determinants of the child's percent body fat and body weight at age ten. Overweight at age five was the greatest predictor of being overweight at age ten (Salbe et al., 2002a).

Agras et al. (2004) conducted a prospective study of 150 children from birth to 9.5 years of age examining 17 different risk factors for childhood overweight. The top five primary risk factors for childhood overweight were parental overweight, child temperament and tantrums over food, parental concerns about thinness, and hours of sleep the child received. Of these, the greatest risk factor for childhood overweight was parental overweight. Agras et al. (2004) divided the parents into two groups, those with a BMI > 27.5 and those with a BMI < 27.5. Among these divisions the risk factors for childhood overweight were different. The greatest risk factor of childhood overweight among parents with a BMI >27.5 was not being concerned with the child's weight combined with the child being overly emotional. The greatest risk factor for parents with a BMI < 27.5 was a child who had tantrums over food which could possibly lead to overfeeding.

Ethnicity

Ethnicity may play a role in overweight. McConahy et al. (2002) observed a significant difference in energy intake between Hispanic two year old children compared with Caucasian and African American two year old children. The Hispanic children consumed significantly more energy than Caucasian and African American children (McConahy et al., 2002). Hispanic children also had a significantly higher body weight compared to Caucasian children (McConahy et al., 2002). In a study examining

overweight and ethnicity in relationship to hypertension among adolescents ages 10-19, Sorof et al. (2004) reported ethnicity as a significant predictor of overweight. Hispanics had the highest percentage of overweight adolescents (31%) followed by African Americans (20%), whites (15%) and Asians (11%) (Sorof et al., 2004). Weight differences among ethnicities can also be observed large national database surveys such as NHANES 1999-2000 and the NLSY 1986-1998 (Ogden et al., 2002; Strauss & Pollack, 2001).

Environmental Influences

Although genetics and ethnicity play a role in overweight; these factors alone cannot account for the rapid increase in childhood overweight observed over the last thirty years (Hill et al., 2003). Environmental risk factors such as sedentary activities, decreased physical activity, high calorie and high fat diets, and socioeconomic status may contribute to the development of overweight at an early age (Keiss et al., 2001; Agras et al., 2004).

Diet There are many studies examining the relationship between children's diets and the increase of childhood overweight. The current status of American children's diets will be discussed in a later section.

Lack of Physical Activity Along with diet, physical activity is an important factor related to childhood overweight (Kibbe & Offner, 2003). A decrease in physical activity can promote weight gain through positive energy balance. The current status of American children's physical activity patterns will be discussed in a later section.

Parental Influence Gable and Lutz (2000) examined direct and indirect factors of the household environment and parental habits that may contribute to childhood overweight of parents with children between the ages of three and ten. Parents who tried to control their child's food intake had children who were more likely not to participate in extracurricular activities and spend more time watching television. Parents who reported having a greater availability of junk food in the home had children who consumed more junk food. A positive relationship was seen between children who consumed more junk food and time spent watching television. Overweight children were more likely than non-overweight children to have parents who had lower knowledge of child nutrition. Overweight children also engaged in less hours of active play, spent more time watching television and participated less in extracurricular activities (Gable & Lutz, 2000).

Socioeconomic Status Few studies have examined the effect of socioeconomic status (SES) on overweight in children. Inconsistent evidence has been found relating childhood overweight to SES (Wang, 2001). Disagreement is common about the relationship between SES and overweight (Wang, 2001).

Results of a study conducted by McConahy et al. (2002) found a significant difference between energy intake of children one to two years of age who were below 130% of the poverty level and children one to two years of age who were above 350% of the poverty level. Children below 130% of the poverty level had a significantly higher energy intake compared to children above 350% of the poverty level (McConahy et al., 2002).

Wang (2001) compared anthropometrics and demographic data of children ages 6-9 and adolescents ages 10-18 in the United States, China, and Russia. Wang (2001)

reported SES was related to overweight in children and adolescents among the three countries but the relationship was different. Among U.S. adolescents the low income group had the highest prevalence of overweight or at risk of overweight (Wang, 2001). Russia's low income and high income had the highest prevalence of overweight and at risk of overweight in children and adolescents. In China the highest income group had the highest rate of adolescents and children who were overweight. Ethnicity was found to be related to overweight and at risk of overweight in children and adolescents, but became insignificant when residence and income were adjusted. This suggests the prevalence of overweight among different ethnicities may be due to SES among different ethnic groups (Wang, 2001).

Hass et al. (2003) examined the effect of SES, race, and health insurance status of Caucasian, African American, Latino and Asian/Pacific Islander overweight children ages 6-11 and adolescents 12-17 years of age in the United States. Socioeconomic status consisted of parent education level, household income, participation in the Aid to Families with Dependent Children, and if the house was a single parent family. Hass et al. (2003) reported children ages 6-11 had a greater risk of being overweight if their parents had an education less than or equal to 12 years and household income was below 120% of the poverty line. In adolescents the risk factors for overweight were not having health insurance or having public health insurance. These results suggest overweight in children may be related to family circumstances. However, in adolescents, overweight may be related to personal factors such as an adolescent's time away from home (Hass et al., 2003). Gable and Lutz (2000) reported children who were overweight were more likely to live in a single parent household.

Dietary Recommendations for Children and Adolescents

The Dietary Reference Intakes (DRI) were created by the Institute of Medicine's Food and Nutrition Board. In 2002 the DRI's for energy, carbohydrate, fiber, cholesterol, and protein were released, updating the 1989 Recommended Dietary Allowances (RDA) (National Academy of Sciences, 2002). The DRI's provide an Acceptable Macronutrient Distribution Range (AMDR) for carbohydrate, fat, and protein for all persons over one year of age. The AMDR is a range for a particular macronutrient that is associated with decreased risk of chronic disease while providing essential nutrients (National Academy of Sciences, 2002). The AMDR for children and adolescents recommends approximately 45-55 percent of daily calories come from carbohydrate with no more than 25 percent of daily calorie intake coming from added sugars (National Academy of Sciences, 2002). Protein serves as the major structural component of all cells in the body. The AMDR for protein is 10-30 percent of total calories consumed for males and females ages 4-18. Fat is a necessary component in the development of children. It promotes satiety while providing energy in children, whose stomach capacity is limited (American Dietetic Association, 2004). The AMDR for fat decreases from 30-40 percent to 25-35 percent of total calories consumed as children reach the age of four. The AMDR for fat remains at 25-35 percent of total calories consumed for males and females until the age of 19. (National Academy of Sciences, 2002).

In conjunction with the DRI's are the Dietary Guidelines for Americans. The Dietary Guidelines were created by the United States Department of Agriculture (USDA)

and the United States Department of Health and Human Services (HHS) and pertain to all American's over the age of two. The newest edition was released in early 2005 and is updated every five years (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2005).

The 2005 Dietary Guidelines expand on the previous Dietary Guidelines with a strong emphasis on consuming adequate amounts of fruits and vegetables, whole grains, and low fat dairy products (Children's Nutrition Research Center, 2004). Fiber rich foods are encouraged for American's of all ages. Fiber is important for bowel function and can also promote satiety, while helping to maintain blood glucose levels and reduce the risk of coronary heart disease (National Academy of Sciences, 2002). The DRI's for fiber vary for boys and girls among different age groups. The Dietary Guidelines recommend children and adolescents make at least half of their grain consumption whole grains and choose a wide variety of fruits and vegetables to receive the recommended amount of fiber. Consuming five or more servings of fruits and vegetables may help maintain a healthy weight because fruits and vegetables are generally low in fat and calories and provide many essential nutrients (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2000).

Children between the ages of two and eight are encouraged to drink two cups of low fat or fat free dairy products every day, while children over the age of nine are encouraged to drink three cups of low fat or fat free dairy products every day (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2005). Dairy products are a good source of calcium. It is necessary for children to consume adequate amounts of calcium to ensure proper bone growth.

On April 19, 2005 the U.S. Department of Agriculture's MyPyramid was introduced to the public. MyPyramid was created to take the place of the Food Guide Pyramid which was released in 1992. MyPyramid incorporates the recommendations of the Dietary Guidelines while emphasizing the ability of American's to create an individual personal plan involving diet and physical activity (U.S. Department of Agriculture, 2005a). Unlike the Food Guide Pyramid, MyPyramid does not have visible serving sizes for each food group. The MyPyramid food groups are proportionality represented by the widths of the color bands, while moderation is represented by the narrowing of the bands to the tip of the pyramid (U.S. Department of Agriculture, 2005a). MyPyramid offers interactive food plans based on activity level and age which are available on their website at MyPyramid.gov.

The U.S. Department of Agriculture released the MyPyramid for Kids (figure 3) on September 28, 2005. The MyPyramid for Kids is targeted towards children ages 6-11. The pyramid design is similar to the USDA's MyPyramid with the addition of child-friendly graphics and age appropriate nutrition information. "Eat Right. Exercise. Have Fun" is the slogan for the new MyPyramid for Kids. The key messages of MyPyramid for Kids and MyPyramid are represented by the design of the pyramid and focus on; physical activity, choosing healthy foods from each food group, eating more of some foods groups than others, eating foods from every food group every day, making the right choices for you and taking it one step at a time (U.S. Department of Agriculture, 2005b).

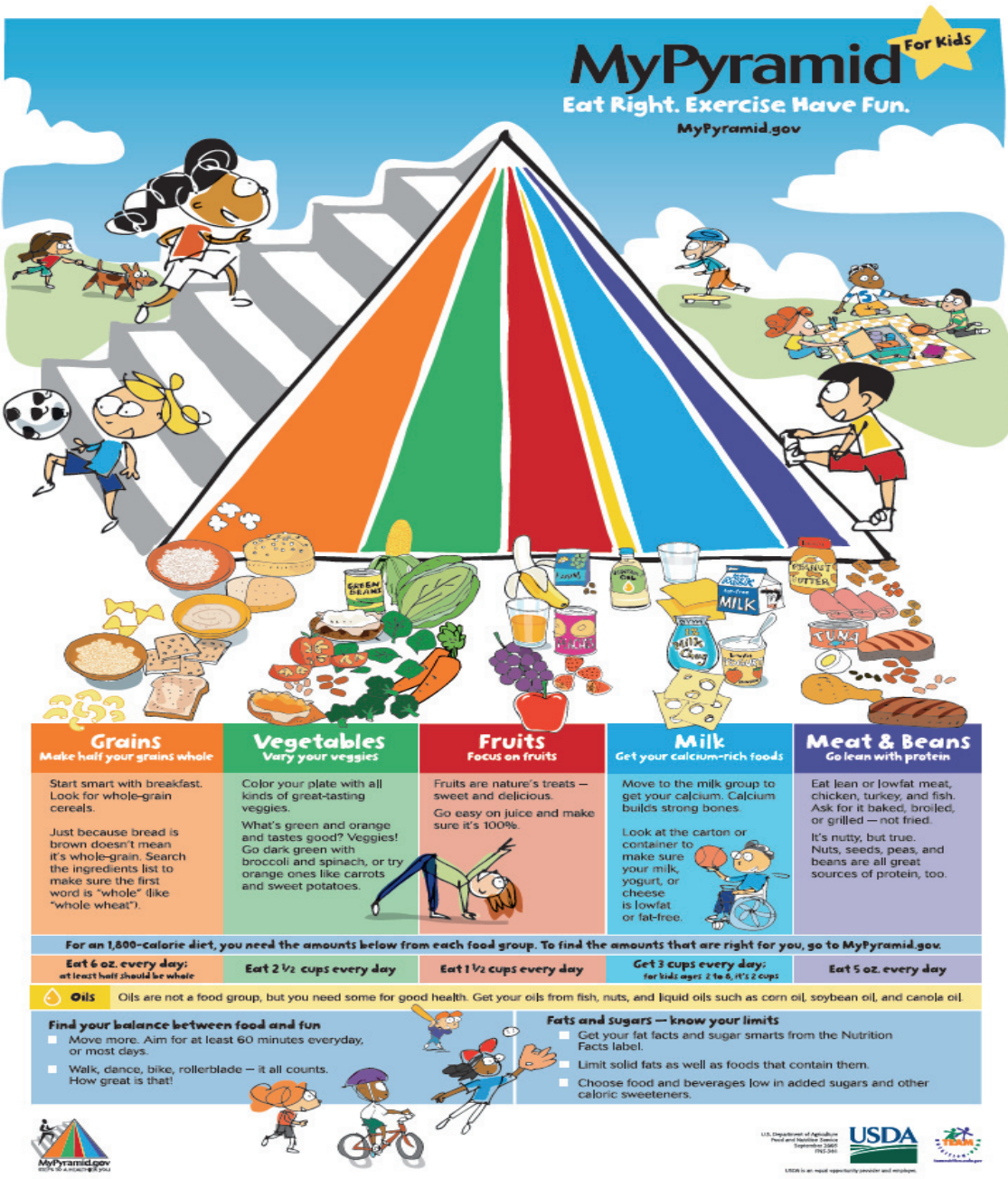

Figure 3. MyPyramid for Kids (U.S. Department of Agriculture, 2005b).

Current Dietary Status of Children and Adolescents

The quality of America's diet is measured by the Healthy Eating Index (HEI). The HEI was developed by the USDA's Center for Nutrition Policy and Promotion (CNPP) as a way to assess and monitor America's diet (Basiotis et al., 2002). The HEI 1999-2000 data is compiled from the NHANES 1999-2000 data which is nationally representative of the food consumption patterns of American's. The HEI has an overall score of 100 measuring ten components of the diet with each component having a high score of ten. According to the HEI a diet is classified as good if the overall HEI score is greater than 80, a diet is classified as needs improvement if the overall HEI score is between 51 and 80, a diet is classified as poor if the overall HEI score is less than 51. The majority (74%) of American's have a diet that needs improvement while only 10% of American's have diets classified as good. The diet quality of America has not changed since 1996 but has improved 4% since 1989. Basiotis et al. (2002) reported those with the highest HEI scores were children between the ages of two and three. Unfortunately, it is reported that children's diet quality declines as their age increases (Basiotis et al., 2002).

In order to determine the overall diet quality of America's children one must examine their food consumption patterns. Various studies have examined dietary changes in American children over time. Enns et al. (2002) compared three different surveys, The Nationwide Food Consumption Survey (NFCS) 1977-78, The Continuing Survey of Food Intakes by Individuals (CSFII) 1994-96, 1998 and the CSFII 1989-91. Trends were observed in food and nutrient intakes for children ages 6-11. Enns et al. (2002) reported overtime milk intake decreased and soft drink consumption increased. Children drank milk four times more than other beverages in 1977-78 while in 1994-96, 1998 milk was

only consumed 1.5 times more than soft drinks. Soda is a beverage that is high in energy and refined sugars. Enns et al. (2002) reported on average from the CSFII 1994-96, 1998 children consumed 21-23 teaspoons of added sugars per day. This amount of sugar can provide between 1,800-2,000 calories (Enns et al., 2002).

Results presented from Enns et al. (2002) were similar to the Bogalusa Heart study (Nicklas et al., 2004). The Bogalusa heart study examined food consumption patterns of ten year old children from 1973-1994 (Nicklas et al., 2004). The percentage of ten year old children participating in the study had a significant decrease in the consumption of milk, sweetened beverages, vegetables, eggs, beef, desserts, candy, condiments, and fats/oils. The percent of children consuming cheese, fruit/fruit juices, mixed meats, and poultry increased significantly over time (Nicklas et al., 2004). The total mean gram intake of fats/oils, breads and grains, desserts, candy, eggs, milk and pork decreased over time while, mean gram intakes of fruit/fruit juice, mixed meats, poultry, salty snacks, condiments, cheese, and sweetened beverages increased over time. The results indicate even though the percentage of children consuming sweetened beverages and snacks decreased over time those children who did consume sweetened beverages and snacks did so more often (Nicklas et al., 2004).

The location of where children are consuming the majority of their food has also changed over time. The Bogalusa Heart Study reports the total mean gram amount of food consumed at restaurants significantly increased overtime from 1973-1994. In 1973 the mean amount of food consumed at restaurants was six ± 50 grams per day and in 1993-1994 it was 76 ± 177 grams per day. The percentage of food consumed at restaurants increased from 0.4% to 4% of total food consumed by ten year old children

(Nicklas et al., 2004). Fast food restaurants account for more than half of food consumption away from home (American Dietetic Association, 2004). Children who consume the majority of meals at home are more likely to have a higher quality diet than those who consume a majority of their meals at fast food restaurants. (American Dietetic Association, 2004).

Portion sizes must be considered when evaluating the relationship between diet and childhood overweight. The portion size of many American foods has increased (Nestle, 2003). Young and Nestle (2002) compared portion sizes of foods from the most popular take-out, fast-food and family style restaurants to the federal and USDA standards for portion sizes. Young and Nestle (2002) concluded except for sliced white bread all other foods measured were portioned larger than federal and USDA standards. Increased portion sizes are of concern because larger portions can lead to increased food consumption (Nestle, 2003).

McConahy et al. (2002) examined food choices and portion sizes of commonly eaten foods of two year old children. Three surveys were compared, the NCFS 1977-78, the CSFII 1994-96, 1998 and a longitudinal sample of children 12-18 months old. The average portion size for most of the foods was consistent from the NCFS 1977-78 to the CSFII 1994-96, 1998. Of the one to two year olds who participated in the CSFII 1994-96, 1998 a positive association was seen between percent body weight and energy intake (McConahy et al., 2002).

Although there have been changes in American children's diets such as an increase in sweetened beverage consumption, an increase in children eating away from home, and an increase in the portion sizes of many commonly eaten foods there is still

controversy concerning if the calorie level of children's diets has increased over time. The American Dietetic Association (2004) reports energy intake of children has increased over time while Enns et al. (2002) and Nicklas et al. (2001) reported a significant change in energy intake was not observed among study participants. Nicklas et al. (2001) examined total energy intake of the Bogalusa Heart Study participants and reported energy intake ranged from 2,054 to 2,224 kcals/day over time. A significant increase was seen in the amount of protein and carbohydrates consumed by ten year old participants although total fat and saturated fat consumption decreased (Nicklas et al., 2001). Wright et al. (2003) reported from the NHANES 1999-2000 that average calorie intake for children ages 6-11 was 2,025.

An increase in calories consumed or decrease in energy expended overtime will lead to weight gain. Hill et al. (2003) proposes the idea of "closing the energy gap." Hill et al. (2003) suggest that if American adults and children reduce energy intake by 100 kcal a day through a combination of decreased energy intake and increasing physical activity, 90% of the population would counteract weight gain.

Barriers and Motivators of consuming a healthy diet

A common theme was found among four different studies examining barriers and motivators for children and adolescents of consuming a healthy diet (O'Dea, 2003; Nuemark-Sztainer et al., 1999; Croll et al., 2001; Monge-Rojas et al., 2005). Participants in these studies ranged from second graders to seniors in high school. One of the most common barriers to eating healthy among children and adolescents was availability of healthy foods at school and or home. Even if healthy foods were available at home or

school, participants often complained of time as a barrier of eating healthy foods. Children and adolescents felt it takes too long or they are to lazy (Monge-Rojas et al., 2005) to prepare healthy foods at home. At school, students complained of not enough time to stand in line during lunch. Taste, appearance and cost were considered barriers to eating healthy foods at school because participants complained the fruits and vegetables served at school did not look or taste good and were more expensive than the non-healthy choices (O'Dea, 2003; Nuemark-Sztainer et al., 1999; Croll et al., 2001; Monge-Rojas et al., 2005). Children and adolescents share a common lack of concern about their health as a barrier to eating healthy. Many of the participants didn't feel they needed to be concerned about what they eat because they are young and don't need to worry about health issues at this time. Peers and media influence were also recognized as barriers to eating healthy. Participants complained of eating healthy as "uncool" among peers and they were influenced by what was advertised on television. Family influence was also noted as a barrier because children and adolescents felt they eat what their parents have to offer them, so if parents did not prepare healthy foods or make them easily accessible participants were less likely to eat them (Monge-Rojas et al., 2005).

The majority of children and adolescents who participated in the various studies reported if parental and peer support was available they would be more motivated to eat healthy. A common suggestion among the students was to make healthy eating "cool" among peers. Children and adolescents reported if fruits and vegetables looked better at school and were served with a dip they would be more motivated to eat them. Obtaining knowledge about healthy eating so students could share with friends and family was also seen as a motivator (Monge-Rojas et al., 2005). Students among all four studies felt

eating healthy was good for them and made them feel better but only a few students reported this as a motivating factor (Croll et al., 2001).

PHYSICAL ACTIVITY

Physical Activity Recommendations for Children and Adolescents

The Dietary Guidelines for Americans recommends children and adolescents participate in moderate to vigorous physical activity for at least 60 minutes a day most days of the week (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2005). The American Heart Association (2005) recommends everyone over the age of two spend 30 minutes a day involved in moderate activity and 30 minutes at least three days a week involved in vigorous activity. Moderate physical activity is considered to be physical activity that does not make one sweat or breathe hard for at least 30 minutes; such as walking a 15 minute mile, cycling, or playing tennis. Vigorous physical activity is considered activity that makes one sweat and breath hard for at least 20 minutes for example, activities such as walking/running a 10 minute mile, playing basketball, climbing, playing tag, jumping rope, or swimming (National Heart, Lung and Blood Institute, 2005; Centers for Disease Control and Prevention, 2004c)

Healthy People 2010 places physical activity as one of America's leading health indicators (U.S. Department of Health and Human Services, 2000). The Leading Health Indicators were created to reveal major health concerns in the United States. The goals of Healthy People 2010 pertaining to physical activity are, "to increase the proportion of adolescents who engage in moderate physical activity for at least 30 minutes on five or

more of the previous seven days to 35%" and "to increase the proportion of adolescents who engage in vigorous physical activity that promotes cardiorespiratroy fitness three or more days a week for 20 or more minutes per occasion to 85%" (U.S. Department of Health and Human Services, 2000). Healthy People 2010 also set goals to increase the proportion of children and adolescents who participate in physical education class, increase the proportion of children who are physically active in physical education and to increase the proportion of public and private middle, junior high and high schools that offer physical education classes. A goal was set to increase the proportion of children and adolescents who watch no more than two hours of television on school days to 75% (U.S. Department of Health and Human Services, 2000).

The Children's Activity Pyramid (Figure 4) is another guideline created for physical activity recommendations of children (Willenberg, 2004). The pyramid is similar to the Food Guide Pyramid developed by the U.S. Department of Agriculture with everyday activities making the base of the pyramid. Everyday activities should be done as often as possible and consist of activities such as playing outside and taking the stairs instead of the elevator. The next section of the pyramid includes activities children should partake in at least three to five times a week for at least twenty minutes. This section is divided up into two parts; aerobic exercises and recreational activities. Leisure and playtime; and strength and flexibility are less intense activities and recommended two to three times a week. The top of the pyramid are sedentary activities such as watching television and playing video games. These are activities to cut down on. The Children's Activity Pyramid can be a fun interactive way to educate youth on the importance of physical activity (Willenberg, 2004).

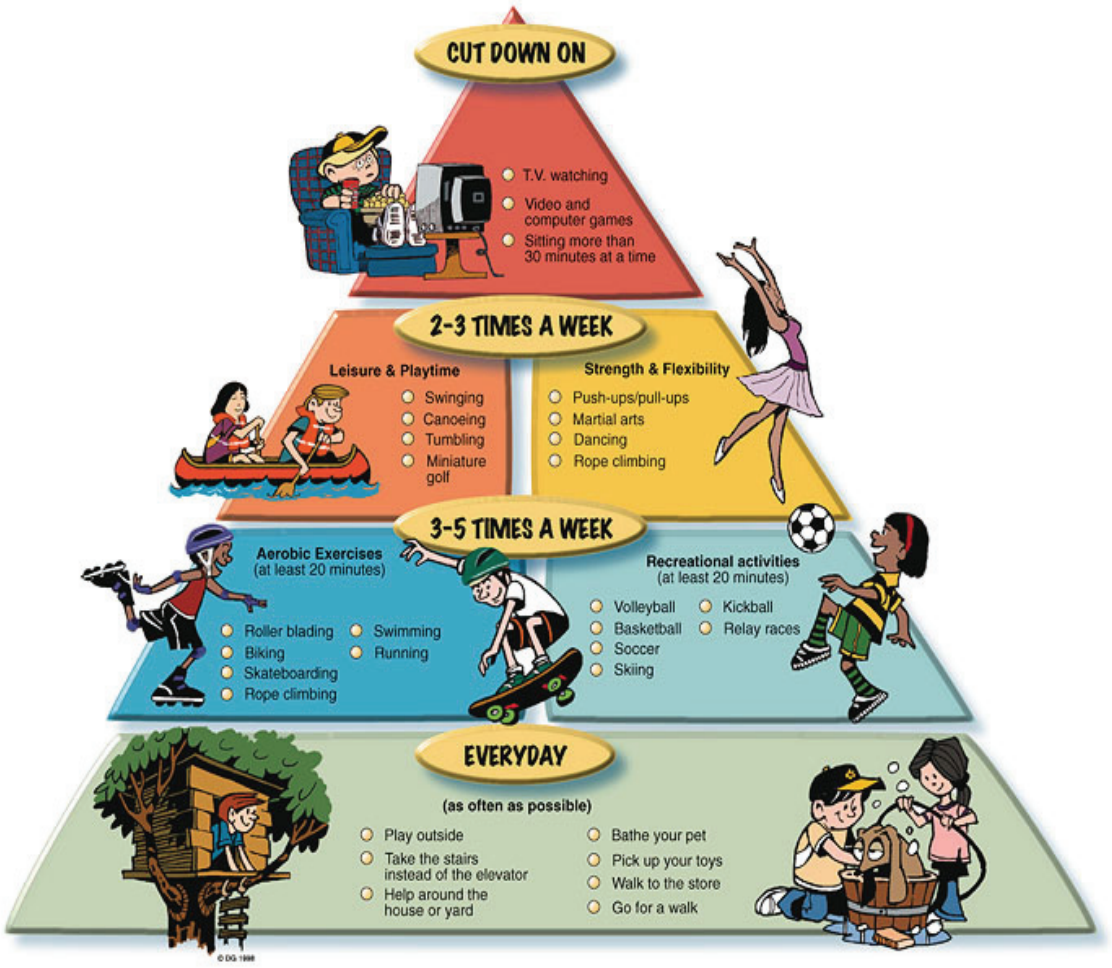

Figure 4. Children's Activity Pyramid (Willenberg, 2004).

Current Physical Activity Status of Children and Adolescents

The Youth Risk Behavior Surveillance System (YRBSS) is a compilation of results from a national school based survey conducted by the CDC, 32 state and 18 local school based survey's conducted by education and health agencies. The YRBSS is used to measure progress towards reaching many of the physical activity and fitness goals of Healthy People 2010. The YRBSS provides national and state data for many of the physical activity and fitness goals (Centers for Disease Control and Prevention, 2004c).

In 2003, 62.6% of the nation's high school students participated in vigorous physical activity at least three days a week (Centers for Disease Control and Prevention, 2004c). In Oklahoma 64.3% of high school students participated in vigorous physical activity at least three days a week (Centers for Disease Control and Prevention, 2004c). Approximately one-fourth (24.1%) of the nations high school students participated in moderate physical activity at least five days a week. In Oklahoma, which was similar to the national average, 25.1% of high school students participated in moderate physical activity at least five days a week. Vigorous and moderate physical activity was higher among males than females nationally and state wide. Physical activity also declined as students got older. Oklahoma had a fewer percentage (8.3%) of high school students compared to the nation (11.5%) who did not participate in vigorous or moderate physical activity during the previous week of when the survey was conducted (Centers for Disease Control and Prevention, 2004c).

Currently, children spend more time in leisure activities such as watching television, playing video games or on the computer than time spent in physical activity (Hill et al., 2003). The increase in lack of physical activity can also be related to a child's safety (Kibbe & Offner, 2003). For low income Native Americans watching television may provide a safe environment for children (Grey & Smith, 2003). Combine these factors with a decrease of physical activity in schools (Hill et al., 2003) and this may be one reason for the increase in childhood overweight. Many studies have examined the influence of lack of physical activity on overweight in children.

Gray and Smith (2003) examined 155 Native Americans 5-18 years old. Height, weight, skin folds, activity level, balance times and dietary intakes were measured. All

age groups had high levels of inactivity and prevalence of overweight. Fifty-nine percent of the youth were sedentary. In 9 to 18 year olds, more time spent watching television was positively associated with an increase in BMI. Gray and Smith (2003) reported energy intake was not associated with BMI, physical activity or fitness level. Salbe et al. (2002b) found that at ages five and ten the amount of time spent watching television was positively associated with body fat and body weight but negatively associated with time spent in sporting activities.

Berkey et al. (2003) examined the relationship between physical activity and BMI in boys and girls ages ten to 15. In this study, Berkey et al. (2003) combined the 85th and 95th percentiles of the CDC gender specific BMI- for- age growth charts defining overweight as greater than the 85th percentile. As boys increased time strength training BMI was increased, this is most likely due to gains in muscle mass not fat mass. An association was also seen in girls BMI increasing as physical inactivity increased. Girls and overweight boys who had an increase in physical activity over one year had a decrease in BMI. Increasing aerobic activity was associated with BMI decreasing in boys and girls. The effects of physical activity decreasing BMI were greater in overweight children compared to non-overweight children (Berkey et al., 2003).

Vandewater et al. (2003) examined the relationship between time spent in media usage to time spent in physical activity of children ages one to 12. Vandewater et al. (2003) compared 24 hour time use diaries to the children's BMI. Each child completed two diaries covering one random weekday and one random weekend day. The children's activities were divided into categories. The media categories were television use, electronic game use, computer use and print use. The activity categories were highly

active, moderately active, and sedentary activities. For all ages video game use was related to an increase in weight status but time spent watching television was not (Vandewater et al., 2003). A positive relationship was seen between time spent in sedentary activity and weight status. The results suggest children who are heavier spend less time in physical activity and more time in sedentary activities, especially playing electronic games. The relationship between higher weight and sedentary activities was seen for boys and girls of all ages. Electronic game use increased with age in both sexes with boys spending significantly more time playing electronic games than girls. No relationship was seen between weight status and those children who participated in highly active or moderately active activities. Time spent in highly active activities and sedentary activities increased with age for boys and girls. However, girls spent less time in highly active activities and more time in sedentary activities than boys (Vandewater et al., 2003).

Barriers and Motivators of physical activity

Children and adolescents of different ages and cultures were found to share similar barriers and motivators of participating in physical activity. American children and adolescents grades 2-11, English students 11-15 year old and American Indian children in 3-5 grade who were partaking in the Pathways study participated in the following studies. Lack of time due to school, homework, and after school jobs as well as a lack of energy were seen as barriers of physical activity among participants of all three studies (O'Dea, 2003; Mulvihill et al., 2000; Thompson et al., 2001). Spending time in non-physical indoor activities such as watching television, playing video and computer games, peer pressure, embarrassment, being self-conscious, and lack of support and or

criticism from teachers and parents were also seen as barriers of physical activity among children and adolescents (O'Dea, 2003; Mulvihill et al., 2000). Mulvihill et al. (2000) reported age as a barrier to physical activity among 11-15 year olds. Adolescents felt as they aged physical activities became more structured and they had to decide to be physically active. Cost of participating in sports and other physical activities was also seen as a barrier. Thompson et al. (2001) reported weather and a fear of getting hurt as barriers of Native American children participating in physical activities.

Support from peers, parents, and teachers were reported most commonly among the various studies as a motivator for children and adolescents to participate in physical activities (O'Dea, 2003; Mulvihill et al., 2000; Thompson et al., 2001). Adolescent females reported a greater motivation for physical activity if more private locations and female oriented sports and activities taught by female teachers were available (O'Dea, 2003; Mulvihill et al., 2000). Adolescents were motivated by physical activity because it made them feel better, prevented boredom, and assisted with weight control. The younger children reported enjoyment of physical activity as a motivator. Children and adolescents mentioned offering a wide variety of activities at school such as aerobics, martial arts, and water sports; providing locations away from school for physical activity and making activities more cost affordable as other motivating factors to participate in physical activities (O'Dea, 2003; Mulvihill et al., 2000).

BENEFITS OF A HEALTHY DIET AND EXERCISE

The benefits received from eating a healthy diet and participating in physical activity are best seen when the two behaviors are combined. A healthy diet and physical

activity can have such benefits as reducing the chances of death from heart disease, reducing cholesterol and blood pressure, as well as reducing the chances of having a stroke or developing type 2 diabetes. A healthy diet and exercise can help one lose or maintain a healthy weight and may also help reduce the risk of developing some types of cancers (American Cancer Society, 2002; Centers for Disease Control and Prevention, 2005).

Research suggests children develop habits early that continue throughout life (Kelder et al., 1994). Therefore, it is important for children and adolescents to understand the benefits of diet and physical activity at a young age. If children and adolescents become physically active while young they can build stronger bones, lean muscle, and decrease body fat which may help them during adulthood and old age from bone fractures and other health problems (Centers for Disease Control and Prevention, 2005). As mentioned above children and adolescents feel a lack of motivation to eat healthy and be physically active for health benefits. This is concerning because current research reports more children and adolescents are suffering from adverse health problems such as increased cholesterol levels, high blood pressure and type 2 diabetes.

HEALTH AFFECTS

Cholesterol

Fatty build- up in the arteries also known as atherosclerosis has been shown to begin in childhood. Children with high levels of fatty build- up are more likely to have high serum cholesterol as an adult (American Heart Association, 2004a). High serum

cholesterol may be related to overweight, diet, and a family history of high serum cholesterol (American Heart Association, 2004a; Hopper et al., 2001). The American Heart Association (2004b) lists tobacco, high blood cholesterol and other lipids, physical inactivity, overweight, and diabetes mellitus as being associated with an increased risk of cardiovascular disease. Cardiovascular disease (CVD) is any disease related to the heart or blood vessels (Mosby's, 2002).

Recommended serum lipids for children ages 2-19 are; total cholesterol (TC) levels < 170 mg/dL and LDL cholesterol (LDLC) levels < 110 mg/dL. Borderline is considered to be 170-199 mg/dL and 110-129 mg dL and high levels are ≥ 200 mg/dL and ≥ 130 mg/dL for TC and LDLC, respectively. HDL cholesterol (HDLC) levels are recommended to be ≥ 35 mg/dL and triglyceride (TG) levels are recommended to be ≤ 150 mg/dL (American Heart Association, 2004a).

Freedman et al. (1999) examined the relationship of overweight in children and adolescents to cardiovascular risk factors such as lipid levels, insulin, and blood pressure. Freedman et al. (1999) concluded that overweight in children is related to increased cardiovascular disease risk factors in childhood. Overweight children had more CVD risk factors than non-overweight children. For example, 100% of children ages 5-10 and 77% of youth ages 11-17 who had four or more CVD risk factors were overweight. Children who were considered overweight were 7.1 times more likely than non-overweight children to have TG levels > 130 mg/dL. Freedman et al. (1999) noted a stronger association between overweight and cardiovascular risk factors among Caucasian children than African American children.

Coronary heart disease (CHD), a type of CVD, is the greatest cause of death for adults in the United States (American Heart Association, 2004a). Contrary to what Freedman reported in 1999, in a 2001 study Freedman et al. reported childhood overweight alone was not a positive risk factor for CHD in adulthood. Freedman et al. (2001) proposed CHD risk was greatest among those who were consistently overweight throughout life. Freedman et al. (2001) tracked BMI of children who participated in the Bogalusa Heart Study over a 17 year period to examine if BMI in childhood was related to BMI and CHD risk factors in adulthood. Total cholesterol, TG, and LDLC levels increased over time while HDLC levels decreased over time (Freedman et al., 2001). The largest increase among all participants from childhood to adulthood was TG levels which were 63 ± 34 mg/dL in childhood and 92 ± 94 mg/dL in adulthood. HDLC levels decreased from 65 mg/dL to 50 mg/dL and LDLC levels increased from 90 mg/dL to117 mg/dL from childhood to adulthood, respectively (Freedman et al., 2001). Slight differences in CHD risk factors were seen among normal and overweight children who became either normal weight or obese adults. For example, children who had a BMI $< 50^{th}$ % for age and became normal weight adults had a LDLC level of 107mg/dL whereas, children whose BMI was $\geq$ 95% for age and became normal weight adults had a LDLC level of 103mg/dL. Children whose BMI was $< 50^{th}$% and became obese adults had a LDLC level of 130mg/dL whereas, children whose BMI was $\geq$ 95% and became obese adults had a LDLC level of 126mg/dL. Therefore, Freedman et al. (2001) concluded childhood overweight could not be considered an independent CHD risk factor in adulthood. The age of childhood overweight did not determine adult risk factors in this

study but the adults were young therefore, it is not certain about tracking CHD risk factors into middle age (Freedman et al., 2001).

A study conducted by Hopper et al. (2001) measured serum cholesterol levels in third grade children and their parents to examine the relationship between serum cholesterol, body composition, physical activity, and dietary intake. Hopper et al. (2001) reported children's weight, BMI, and sum of triceps and calf skinfolds were positively associated with serum cholesterol levels in children. Parents blood cholesterol levels, weight, BMI, skinfold sum, percent body fat estimation, and self reported high systolic and diastolic blood pressure were also positively associated with children's serum cholesterol levels. Children's blood cholesterol was the only measurement that was predictive of parent's blood cholesterol (Hopper et al., 2001).

High serum cholesterol levels in children may be related to increased body fat. Terchakovec et al. (2002) examined boys and girls who had hypercholesterolemia and non-hypercholesterolemia at ages 5, 8 and 12. Terchakovec et al. (2002) reported hypercholesterolemia was positively associated with BMI in girls. Girls who had hypercholesterolemia were more likely to have a greater increase in BMI over the six year study than non-hypercholesterolemia girls. This relationship was not seen in boys (Terchakovec et al., 2002).

Hypertension

Hypertension in children is defined as having blood pressure $\geq$ 95th percentile for age on three different occasions. The National High Blood Pressure Education Program (NHBPEP) recommends all children over the age of three have their blood pressure

measured. Secondary hypertension is more common in children than adults although, primary hypertension is becoming more common among children (National High Blood Pressure Education Program, 2004).

There is a strong association between high blood pressure and overweight among people of all ages. As the number of overweight children increases high blood pressure is becoming a significant problem in children and adolescents (National High Blood Pressure Education Program, 2004). Freedman et al. (1999) reported as children's BMI increased from the 85% to greater than the 97% systolic blood pressure (SBP) and diastolic blood pressure (DBP) increased. Overweight children were seven times more likely than non-overweight children to have high SBP or DBP. Younger children ages 5-10 showed a stronger association compared to older children ages 11-17 between overweight and high blood pressure (Freeman et al., 1999).

A study conducted by Sorof et al. (2004) examined the prevalence of hypertension among adolescents ages 10-19. Sorof et al. (2004) followed the NHBPEP recommendations to measure a child with elevated blood pressure three times before diagnosing them with hypertension. Sorof et al. (2004) reported BMI percentile as the strongest predictor of blood pressure. The percentage of children with elevated blood pressure increased as BMI percentage increased. Eleven percent of adolescents who had a BMI $\geq$ 95% had elevated blood pressure on the third measurement. Sorof et al. (2004) also reported gender as a predictor of elevated blood pressure. Males had significantly higher blood pressure than females on the first and third measurement. During the first measure elevated blood pressure was significantly higher among Hispanics but by the third measure no significant difference was seen between ethnicities. After adjusting for

gender, ethnicity, overweight and age on the third measurement, only overweight and male gender were found to be significantly associated with hypertension. Overall, the prevalence of hypertension in children after three measurements was found to be 4.5%. This is four times higher than the estimated 1% of children who have hypertension (Sorof et al., 2004).

It is necessary to diagnose hypertension in children and adolescents because uncontrolled hypertension can have detrimental affects. High blood pressure during childhood is thought to increase one's risk for developing hypertension as an adult. An overweight child who has primary hypertension has an increased risk for developing cardiovascular disease (National High Blood Pressure Education Program, 2004).

Type 2 Diabetes

Type 2 diabetes, previously referred to as "adult-onset diabetes" is becoming more common among adolescents (Amschler, 2002). Type 2 diabetes occurs from body cells becoming resistant to insulin or the pancreatic beta cells not producing adequate insulin (Amschler, 2002). It is estimated 90% of diagnosed diabetes cases among all ages are type 2 and about 1/3 of diabetes cases in adults are misdiagnosed or undiagnosed The American Diabetes Association states that as of 2004 there were no true-population based statistics on the prevalence of type 2 diabetes in children, but approximately 30% to 50% of newly diagnosed diabetes cases in children and adolescents are type 2. It is estimated that 85% of children and adolescents diagnosed with type 2 diabetes have a BMI $\geq$ 85% (American Diabetes Association, 2000).

A study conducted by Upchurch et al. (2003) described characteristics of 98 children and adolescents who were diagnosed with type 2 diabetes. Upchurch et al. (2003) reported 95 of the 98 participants had a BMI ≥ 85%. Approximately 60% of the children with reported data had mothers or fathers with type 2 diabetes. Ninety-four percent had acanthosis nigricans, which is common among children and adolescents with type 2 diabetes (American Diabetes Association, 2000). Sixty percent had SBP or DBP ≥ 95% for age, sex, and height. These are common characteristics among overweight children who have type 2 diabetes (American Diabetes Association, 2000).

Macaluso et al. (2002) examined characteristics and occurrence of Floridian children and adolescents ages 5-19 who had type 1 and type 2 diabetes over five years. Macaluso et al. (2002) reported similar results as Upchurch et al. (2003). The percentage of children and adolescents with type 2 diabetes significantly increased from 9.4% in 1994 to 20.0% in 1998. The average BMI of children with type 1 diabetes was 19.9 kg/m^2 compared to an average BMI of 32.6 kg/m^2 of children with type 2 diabetes. Approximately 84% of children and adolescents diagnosed with type 2 diabetes had a BMI- for- age ≥ 95%. Macaluso et al. (2002) reported children and adolescents with type 2 diabetes were more likely to be African American or Hispanic, female and have a BMI- for- age ≥ 85% at the time of diagnosis. Females were twice as likely as males to be diagnosed with type 2 diabetes than type 1 diabetes. Females who's BMI- for- age was between the 85% and 95% were 22 times more likely to be diagnosed with diabetes than females whose BMI for age was < 85%. Males were 23 times more likely to be diagnosed with type 2 diabetes when their BMI- for- age was ≥ 95% compared to males whose BMI- for- age was < 85% (Macaluso et al., 2002).

An increased risk of diabetes among certain ethnic groups was reported by the National Diabetes Education Program (American Diabetes Association, 2004). The National Diabetes Education Program listed American Indians, African Americans, Hispanics and Pacific Islander youth as being disproportionately affected by type 2 diabetes (American Diabetes Association, 2004). Macaluso et al. (2002) reported Hispanics were about six times more likely and African Americans were about three times more likely than non-Hispanic Caucasian children and adolescents to be diagnosed with type 2 diabetes.

Therefore, The National Diabetes Education Program has recommended children who have a BMI- for- age > 85% and two of the following characteristics; family history of type 2 diabetes in a first or second degree relative, American Indian, African American, Hispanic/Latino, Asian American, or Pacific Islander, and/or have signs of insulin resistance or conditions associated with insulin resistance such as acanthosis nigricans, hypertension, dyslipidemia, or polycystic ovarian syndrome be screened for type 2 diabetes by the age of ten (American Diabetes Association, 2004).

Adult Obesity

It is highly likely overweight children will continue to be overweight as adults (Kibbe, 2003). Children and adolescents who are overweight are significantly more likely to be overweight as adults compared to normal weight children and adolescents (Robinson, 2000). Robinson (2000) reported age at onset of overweight as an important predictor of overweight or obesity in adulthood. Other research agrees with Robinson (2000) that early onset of overweight is an important predicator but there is disagreement

about what age children and adolescents are most vulnerable for overweight continuing into adulthood.

Freedman et al. (2001) reported a strong correlation between those being overweight during childhood with becoming overweight adults. Of the 72% normal weight children (BMI- for- age < 50%) only 7% became obese adults (BMI $\geq$ 30) and of the 186 overweight children (BMI- for- age $\geq$ 95%) 77% became obese adults. Freedman et al. (2001) reported children who became overweight at $\leq$ 8 years of age had a significantly higher BMI as an adult than those children and adolescents who became overweight after eight years of age.

Ferraro et al. (2003) used self reported childhood weights from participants of the NHANES I: Epidemiologic Follow-up Study to examine the relationship between childhood overweight and severe adult obesity. The strongest predictor of severe adult obesity was reported to be childhood overweight. Adolescents who reported being overweight at age 12 or 13 were about five times more likely to be severely obese between the ages of 45 and 64 compared to those who reported being normal weight children. Ferraro et al. (2003) reported more than 14% of severely obese adults reported being overweight as children compared to only 4% of severely obese adults who reported being normal weight children.

Guo & Chumlea (1999) tracked BMI in children through adulthood. Men who had a BMI $\geq$ 28 kg/m^2 and women who had a BMI $\geq$ 26 kg/m^2 tended to have a higher BMI as children than those men and women who had a BMI $\leq$ 28 kg/m^2 and $\leq$ 26 kg/m^2, respectively. Boys and girls who had a BMI- for- age $\geq$ the 75% between 8-18 were twice as likely to become overweight as adults compared to those 8-18 years who had a

BMI- for- age ≤ 50%. Guo & Chumlea (1999) reported of the 27 adult men who had a BMI ≥ 28, 22 had a BMI- for- age ≥ % at age 18. Similar results were found in women, of the 22 adult women who had a BMI ≥ 26, 19 had a BMI- for- age ≥ 60% at age 18.

Law (2001) suggests that overweight children and adolescents may have a greater chance of becoming overweight adults due to rapid linear growth. Children who have rapid linear growth often have accelerated weight gain. It is necessary to intervene during childhood to help prevent the adverse health conditions associated with overweight such as high cholesterol, hypertension, and type 2 diabetes from occurring in children.

NUTRITION AND PHYSICAL ACTIVITY PROGRAMS

A review of nutrition intervention programs for adolescents found programs were more successful when they focused on behavioral change, targeted environmental as well as individual behaviors and included physical activity in combination with nutrition education (Hoelscher et al., 2002). Hoelscher et al. (2002) reported schools were appropriate locations for nutrition interventions because schools are structured environments capable of reaching a large number of children. Coordinated programs involving all disciplines of the school have the advantage of reinforcing behaviors in children (Hoelscher et al., 2002). A brief description of a few school based nutrition education programs involving nutrition education, physical activity, and multi-level programs combing nutrition education with physical activity are presented.

Team Nutrition, a multi-level school based nutrition education program was created by the USDA. The focus of Team Nutrition is to change dietary behaviors through nutrition education while reinforcing positive dietary messages throughout

various setting. The goals of the program are to decrease fat consumption while increasing consumption of fruits, vegetables, and whole grains. Team Nutrition also focuses on exposing children to different foods to encourage a varied diet (Levine et al., 2002). The University of Massachusetts Cooperative Extension Service and the New Bedford Public School Foodservice implemented eight Team Nutrition units into their third grade curriculum. Along with the Cooperative Extension Service; foodservice staff, principals and teachers were all involved in implementing the lessons. The eight unit classroom lessons were each accompanied by an interactive activity, food tasting and reacting activity and a family newsletter. After implementation of the program 41% of third graders reported an increased consumption of fruits, 34% increased vegetable consumption and 46% increased consumption of grain foods. Freeman (2002) reported after program implementation more students reported trying to choose healthy snacks and 29% of students reported enjoying the vegetables offered in the school cafeteria more after participating in Team Nutrition (Freeman, 2002).

Take 10!, a classroom based physical activity program was developed in 2001 by the International Life Sciences Institute. Take 10! focuses on increasing physical activity in kindergarten through fifth grade students (Peregrin, 2001). Each lesson consists of a brief ten minute exercise that replaces seated activity to incorporate grade-specific learning objectives such as mathematics, reading and science (Stewart et al., 2004). Teachers are encouraged to incorporate as many Take 10! lessons during the school day as possible. Stewart et al. (2004) measured energy expenditure of a first grade class, a third grade class and a fifth grade class who were participating in the Take 10! physical activity program. The majority of the students who participated wore electronic

pedometers while five students wore CSA accelerometers to measure level of physical activity, energy expended and steps per day of program implementation. The first and fifth grade classes participated in eight sessions during the week while the third grade class participated in nine sessions during the week. All sessions were considered moderate to vigorous physical activity and an average of 25-37 calories were expended per day of Take 10! activity. Pedometer counts averaged 743-1,022 steps per day of program implementation (Stewart et al., 2004). Rowe (2005) and Stewart et al. (2004) reported teachers enjoyed the Take 10! program. Teachers reported the program was easy to administer, did not require a lot of preparation time and students really enjoyed the program. Rowe (2005) reported Take 10! did not influence overall physical activity among elementary school children compared to elementary school children who were not participating in Take 10! and Take 10! participants did not take significantly more steps than control subjects. However, it was reported teachers of the students who were participating in Take 10! often used the program to replace recess and only implemented the program 2.5 days a week. If teachers could implement the Take 10! program five to ten times a week, participants could expend approximately 150 to 300 calories (Stewart et al., 2004).

Planet Health is a school based interdisciplinary intervention program targeted towards sixth through eighth graders. Planet Health combines nutrition education with physical activity and focuses on four areas of behavior change; decreasing the amount of time spent watching television to two hours a day, increasing the amount of time spent in moderate to vigorous activity, decreasing consumption of foods high in fat and increasing the consumption of fruits and vegetables. Planet Health is implemented into the four main

areas of middle school curriculum (social studies, math, science, and language arts) as well as physical education class. Gortmaker et al. (1999) reported in the two years Planet Health was implemented in five Massachusetts schools the prevalence of overweight in middle school females significantly decreased while an increase in overweight was seen among middle school females who attended the five Massachusetts control schools. Gortmaker et al. (1999) reported the most significant reduction in overweight was seen among African American girls. Although, a significant difference in weight was not seen among male students, overweight did decrease among both male intervention and control students. Males and females who were participating in Planet Health spent significantly less time watching television after two years compared to control students. Among sixth through eighth grade females a significant decrease in total energy intake as well as a significant increase in the amount of fruits and vegetables consumed was seen among Planet Health participants compared to non-participants. Significant differences were not seen among boys in either group for behavior changes other than television watching (Gortmaker et al., 1999).

Pathways, a school based program, focuses on increasing physical activity and healthy dietary behaviors of American Indian third through fifth grade children. The curriculum for the program is culturally based on six different American Indian nations' customs and practices. The curriculum is introduced to the children through the classroom, physical education, family education, and school foodservice. Participation in the curriculum occurs through culturally appropriate story-telling, hands-on activities, native learning modes and games. Pathways focuses on positively influencing personal,

behavioral, and environmental factors in order to make life long changes in the students and families of participants in the program (Davis et al., 1999).

A Coordinated Approach to Child Health: (CATCH) was originally developed under the name Child and Adolescent Trial for Cardiovascular Health and is a multi-level nutrition education program for third through fifth graders (Kibbe et al., 2004). The focus of CATCH is to reduce dietary fat, saturated fat and sodium intake as well as increase physical activity and prevent tobacco use among elementary school students. Between 1991 and 1994 Luepker et al. (1996) observed 5,106 multi-ethnic third grade students from four states who participated in the CATCH program. Three groups were compared; a control group, a school-based intervention group and a school-based intervention group plus family component. Luepker et al. (1996) reported the percentage of fat in school lunches decreased significantly among the intervention groups compared to the control group at the end of the study. The intensity of activity in physical education class increased among the intervention groups and students in the intervention groups reported spending significantly more time in vigorous activity compared to the control group. Self-reported intakes of fat were also significantly less among the intervention groups compared to the control group. No significant differences were seen between the two intervention groups concerning blood pressure, body size or cholesterol (Luepker et al., 1996). Another study of the CATCH program reported a significant decrease in cholesterol among CATCH participants but no significant changes in blood pressure, obesity and serum lipids between groups (Webber et al., 1996).

The schools health education, food service, and physical activity programs may be the most influential for promoting healthy eating behaviors in children because they

are less costly and are able to reach a large audience (Wechsler et al., 2000). A school garden is one example of incorporating food service, nutrition, physical activity, as well as science, and environmental studies (Briggs et al, 2003). A school garden allows a place for children to play and learn. Children are introduced to working with other students and are provided with interactive learning activities (Cason, 1999). Two examples of school garden programs are discussed.

KinderGarden, was developed to promote nutrition education and physical activity among kindergarteners (Cason, 1999). This school-based garden program is a collaboration of parents, teachers, school administrators, business volunteers, and the Cooperative Extension Service. Qualitative and quantitative methods were used to evaluate the outcomes of the program. Cason (1999) reported, 52% of kindergartners were able to properly identify fruits and 43% of kindergartners were able to properly identify vegetables from colorful pictures before the program was implemented. After program implementation the amount of students able to properly identify fruits from colorful pictures increased to 94% and the amount of students able to properly identify vegetables from colorful pictures increased to 86%. A 69% increase occurred in willingness to taste fruits and vegetables after participation in KinderGarden. Before the program, 89% of children choose cookies, cakes, and popsicles as the best snacks. After the program, 36% of children chose cookies, cakes, and popsicles as the best snacks (Cason, 1999).

Morris & Zidenberg-Cherr (2002) conducted a study based on the social cognitive theory comparing preferences for vegetables between fourth graders receiving no nutrition education (CO), only nutrition education (NL), or nutrition education and

hands-on-gardening (NG).The nutrition education included lessons on plant parts, nutrients, the Food Guide Pyramid, serving sizes, food labels, physical activity, goal setting, consumerism, and snack preparation. Gardening education was combined to complement each nutrition lesson. Pre/post and six month follow up tests were used to assess outcomes of nutrition knowledge and vegetable preparation. Morris & Zidenberg-Cherr (2002) reported the NL and NG groups had significantly higher preferences for broccoli and carrots compared to the CO group at post. Snow peas and zucchini were preferred significantly more by the NG group compared to the NL and CO groups at post. The six month follow-up survey revealed the NG retained a significantly higher preference for snow peas and zucchini compared to the NL and CO groups. The NG group had a significantly higher preference for broccoli than the CO group and the NL group had a significantly higher preference for carrots than the CO group at six months. These results suggest the two groups receiving nutrition education had higher preferences for vegetables and those who participated in gardening continued their preference for vegetables over time (Morris & Zidenberg-Cherr, 2002). A high preference was also seen in the NG group for vegetables that were not grown in the garden. For example, zucchini was not grown in the garden but was still liked among those in the NG group. The preference for most vegetables among the NG and NL group was significantly higher than the CO group at six months suggesting, the program may have long term beneficial effects (Morris & Zidenberg-Cherr, 2002).

Policies concerning a healthy environment are vital for schools to successfully plan, develop and implement comprehensive nutrition and physical activity programs into the school system (Briggs, 2003). Schools are a wonderful venue for nutrition and physical activity policy to take place. More than 97% of American children and adolescents attend school (Food and Nutrition Service, U.S. Department of Agriculture, 2005). Implementing policies into the school system can provide children with early education and behavior change that is more likely to continue throughout life. Policies involving the health of children can take place at the federal, state, district or individual school level.

The USDA reported in 2002 that 53% of private and public school students participated in the National School Lunch Program (NSLP) and 19% of private and public school students participated in the School Breakfast Program (SBP) (Food and Nutrition Service, U.S. Department of Agriculture, 2005). These federally funded programs have regulations regarding the foods and beverages to be served at meal time. However, the Federal regulations of the foods served outside of the NSLP and SBP are not as stringent. Schools are not to serve foods of minimal nutrition value foods (MNVF) in foodservice areas during meals times. Foods of minimal nutrition value are defined as foods that provide less than 5 percent of the RDA per serving for each of the eight essential nutrients and include gum, candies that are made from a large amount of sugar and carbonated beverages (Food and Nutrition Service, U.S. Department of Agriculture, 2005). All other foods such as a la carte or vending machines foods can be served all

times of the day anywhere on campus (U.S. Department of Agriculture, 2001). Schools can implement their own policies regarding the sale of other foods.

The Centers for Disease Control and Prevention has created a School Health Index as a tool to help schools identify areas where they need change. The CDC and the USDA have provided guidelines for successful comprehensive school health programs. Other organizations such as The National Association of State Boards of Education developed Fit, Healthy, and Ready to Learn which is a guideline for writing school nutrition policies (Food and Nutrition Service, U.S. Department of Agriculture, 2005).

As the concern about our children's health continues to increase more schools are taking action to help their kids live a healthier life. In 2004, Oklahoma established the Healthy and Fids Kids Act (Oklahoma Fit Kids Coalition, 2004). This act creates Healthy and Fit School Advisory Committees which must include parents, local health care professionals as well as community leaders. The Committees are to make recommendations to their local school regarding health education, physical education and physical activity and nutrition and health services. In 2005 three new bills were approved concerning nutrition and physical activity in the Oklahoma school system (Oklahoma Legislature, 2005a; Oklahoma Legislature, 2005b).

House Bill No. 1647 became effective on July 1, 2005. This bill is also known as the Oklahoma Kids Fitness Challenge Act. Under this bill the Oklahoma State Board of Education is to create physical activity programs for fifth grade students. Challenges from the Presidents Council of Physical Fitness and Sports and a "Walk Across Oklahoma" are examples of programs that will be incorporated into the school system. Information about public and private resources would also be made available to teachers as well information

regarding the use of pedometers. House Bill No. 1647 was considered an emergency measure by the House of Representatives (Oklahoma Legislature, 2005a).

Senate Bill No. 312 requires elementary schools to provide physical education instruction or physical activity programs for elementary school students in full day kindergarten through fifth grades. Physical instruction is to be provided for a minimum average of 60 minutes per week for elementary students. The State Board of Education is to provide school districts with information regarding the benefits of physical education and strongly encourage schools to provide physical instruction for students in grades 6-12. The physical education instruction will be associated with the Priority Academic Student Skills. Senate Bill No. 312 is to take place at the beginning of the 2006-2007 school year (Oklahoma Legislature, 2005b).

The third act to pass legislation in Oklahoma during the spring of 2005 is Senate Bill No. 265. This Bill is related to the sell of minimal nutrition value foods (MNVF) in schools. Under Senate Bill No. 265 elementary school students are not to have access to MNVF except on special occasions. Middle and junior high school students are to only have access to MNVF on special occasions and at events that take place during evening hours. The exception to this is diet soda that contains less than ten calories per bottle or can. High schools will be required to provide students with healthy options along with the MNVF. Incentives are to be given to student regarding the healthy options such as lower prices to encourage them to make healthy choices. Senate Bill No. 265 is to become effective July 1, 2007 (Oklahoma Legislature, 2005b).

The 109th U.S. Congress has pending legislation concerning childhood overweight (Office of Legislative Policy and Analysis, 2006). Senate Bill No. 799 was introduced in

April 2005 by Senator Edward M. Kennedy and is termed the Prevention of Childhood Obesity Act. This act would assist State programs with preventing childhood overweight and provide grant programs at the community level. The Prevention of Childhood Obesity Act would also intensify research conducted by the National Institute of Health pertaining to childhood overweight (Office of Legislative Policy and Analysis, 2006).

The policy implementations Oklahoma has made along with efforts of the Federal Government reflect the concern this nation has regarding the health of its children. These policies will help provide early interventions to children and may be the beginning of behavior and lifestyle modification. As the previous literature provides much information about the continuous increase of overweight among children and the detrimental health affects it can have at an early age it becomes obvious that interventions regarding behavior and lifestyle modification need to available to children. Implementing nutrition and physical education policies into the school system may be a beginning step to changing the status of overweight among children.

CHAPTER III

METHODOLOGY

PROGRAM DESCRIPTION

The purpose of this study was to evaluate the impact of an after school education and gardening program on food, nutrition and physical activity behaviors among youth in 3rd through 8th grade who participated in the Delaware County Oklahoma New Communities Project. This study was approved by the Institutional Review Board (IRB) for human subjects research at Oklahoma State University (Appendix B).

The Delaware County New Communities Project was an education and gardening program conducted in collaboration with the Oklahoma Cooperative Extension Service, a rural dependent school and the school's after school program. The school participating in this program was 72% Native American, 25% white, non-Hispanic and 3% Hispanic. The goal of this project was to provide youth with the knowledge, skills and behavior to lead healthier lives.

Participatory action research with youth and community members was used to determine the direction of the educational content and delivery methods. This process creates changes that stem from the community and empowers the community to be actively involved in solutions. Initial focus groups indicated concerns related to youth's

poor dietary intake, lack of food preparation skills and physical inactivity. The school provided the Delaware County New Communities Project an education facility with a complete kitchen and a small piece of land for a garden in response to the focus group concerns.

The duration of the school's after school program was approximately ninety minutes and operated five days a week. The Delaware County New Communities Project operated three days a week during the after school program and was open to all youth in Kindergarten through eighth grade who were participating in the school's after school program. However, due to the wide range of ages participating in the after school program, youth were divided into groups depending on grade level. The education and gardening program was provided one day a week for children in kindergarten, 1st and 2nd grade; one day a week for children in 3rd, 4th and 5th grade; and one day a week for children in 6th, 7th and 8th grade.

The Delaware County New Communities Project Coordinator provided interactive education to youth participating in the after school program in a group setting using a using a variety of curriculums, such as, Junior Master Gardeners (Junior Master Gardener Teacher/Leader Guide, 1999) Ag in the Classroom (Oklahoma Ag in the Classroom, 2006), and USDA Team Nutrition (Team Nutrition. 2004). Educational topics included information regarding; pyramid food groups, portions, breakfast, snacks, labels, eating-out, making healthy food choices, hand washing, food safety, choosing beverages, and importance of physical activity. Youth also participated in healthy food preparation techniques, emphasizing, but not limited to, garden produce. Youth prepared foods such

as soups, cornbread, roasted potatoes, roasted peanuts, boiled and baked apples, salads, vegetable casseroles, zucchini bread, carrot salad and salsa.

The garden was incorporated in the Delaware County New Communities Project as a method to actively involve youth in hands-on education related to nutrition, food preparation, food safety and physical activity. The garden was an ideal way to incorporate Native American culture by growing and preparing traditional foods and gardening concepts such as the "three sisters." The three sisters is a garden combination of corns, beans, and squash which facilitates growth of each crop. In the three sister garden the beans grow up the corn stalk while the squash serves as a mulch for the corn and beans. The garden also served as an ideal way to engage the community and attract partners including school personnel, parents, the Cherokee Nation and Master Gardeners.

Gardening activities included planting, watering, weeding, fertilizing, mulching and harvesting. Some of the produce grown in the garden included zucchini, pumpkin, corn, squash, beans, peppers, onions, tomatoes, carrots, lettuce, cucumbers, okra, potatoes, spinach, peanuts, and strawberries. In addition, students grew sunflowers, herbs and flowers.

PROGRAM EVALUATION

The impact of the Delaware County Oklahoma New Communities Prpject education and gardening program was evaluated using a pre/post questionnaire. This questionnaire was an Oklahoma Cooperative Extension youth pre/post questionnaire previously tested for reliability with children in 3rd through 5th grade (Brown & Hermann, 2004). Youth in 3rd through 8th grade who participated in the Delaware County Oklahoma

New Communities Project completed the pre questionnaire in the fall at the beginning of the school year and post questionnaire in the spring near the end of the school year. The pre/post questionnaire consisted of 12 questions with a three category "yes," "sometimes," and "no" response scale (Table 1). Youth were asked to circle the response which best represented their behavior. Responses were scored as "yes" = 2, "sometimes" = 1, and "no" = 0.

Table 1. Food, Nutrition and Physical Activity Questionnaire Questions.

1. I eat something before school starts.
2. I wash my hands before I eat.
3. I eat bread or grain foods every day.
4. I drink milk or eat dairy foods every day.
5. I eat fruit every day.
6. I eat vegetables every day.
7. I eat snacks from the Pyramid food groups.
8. I drink pop every day.
9. I eat candy, desserts or chips every day.
10. When I am thirsty, I drink water.
11. I use food nutrition labels.
12. I am physically active every day.

STATISTICAL ANALYSIS

Data were analyzed using the PC Statistical Analysis System (SAS) for Windows, (Version 9.1 SAS, Inst. Inc., Cary N.C.). The McNemar non-parametric test was used to analyze the data. In order to conduct the data analysis the responses “sometimes” and “no” were collapsed into one group and labeled “no.” Significance was set at $p < 0.05$.

CHAPTER IV

RESULTS AND DISCUSSION

EFFECT OF AN AFTER-SCHOOL EDUCATION AND GARDENING PROGRAM ON NUTRITION AND PHYSICAL ACTIVITY BEHAVIOR IN SCHOOL-AGE YOUTH, GRADES 3 - 8

INTRODUCTION

The Dietary Guidelines for Americans recommend children over the age of two consume five or more servings of fruits and vegetables daily (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2000). However, few children meet the recommended intake for fruits and vegetables. Only 25% of high school students who participated in The 2003 Youth Risk Behavior Surveillance Survey (YRBSS) consumed the recommended five or more servings of fruits and vegetables (Centers for Disease Control and Prevention, 2004c). In Oklahoma, this percent is lower than the national average, with only 14.3% of high school students consuming five or more servings of fruits and vegetables. Overall, fruit and vegetable consumption declined from 9th graders to 12th graders (Centers for Disease Control and Prevention, 2004c) and in Oklahoma this decline appears to continue with only 18 % of adults meeting the five a day recommendation (Centers for Disease Control and Prevention, 2001)

Research suggests a child's eating habits develop early and continue throughout life (Kelder et al., 1994). Exposing a child to different foods and nutrition education at a young age may help promote healthy eating behaviors (Morris & Zidenberg-Cherr, 2002). Kelder et al. (1994) recommends children receive nutrition education before sixth grade because habits developed during sixth grade may be more resistant to change. The schools health education, food service, and physical activity programs may be the most influential for promoting healthy eating behaviors in children because they are less costly and are able to reach a large audience (Wechsler et al., 2000). A school garden is one example of comprehensively teaching nutrition, physical activity, science, and environmental studies (Briggs et al., 2003). A school garden allows a place for children to play and learn. Children are introduced to working with other students and are provided with interactive learning activities (Cason, 1999). In a survey of fourth grade teachers at schools reported to have gardens, 47% reported they taught nutrition along with the use of gardening and 43% reported they perceived the garden to be "somewhat to very effective" at enhancing children's eating habits (Graham L & Zidenberg-Cherr S, 2005). Another study reported fourth grade children's preference for some vegetables improved when in-school gardening was combined with nutrition education (Morris & Zidenberg-Cherr, 2002).

The purpose of this study was to evaluate the impact of an after school education and gardening program on food, nutrition and physical activity behaviors among youth in 3rd through 8th grade who participated in the Delaware County Oklahoma New Communities Project.

PROGRAM DESCRIPTION

The Delaware County New Communities Project was an education and gardening program conducted in collaboration with the Oklahoma Cooperative Extension Service, a rural dependent school and the school's after school program. The school participating in this program was 72% Native American, 25% white, non-Hispanic and 3% Hispanic. The goal of this project was to provide youth with the knowledge, skills and behavior to lead healthier lives.

Participatory action research with youth and community members was used to determine the direction of the educational content and delivery methods. This process creates changes that stem from the community and empowers the community to be actively involved in solutions. Initial focus groups indicated concerns related to youth's poor dietary intake, lack of food preparation skills and physical inactivity. The school provided the Delaware County New Communities Project an education facility with a complete kitchen and a small piece of land for a garden in response to the focus group concerns.

The duration of the school's after school program was approximately ninety minutes and operated five days a week. The Delaware County New Communities Project operated three days a week during the after school program and was open to all youth in Kindergarten through eighth grade who were participating in the school's after school program. However, due to the wide range of ages participating in the after school program, youth were divided into groups depending on grade level. The education and gardening program was provided one day a week for children in kindergarten, 1st and 2nd

grade; one day a week for children in 3rd, 4th and 5th grade; and one day a week for children in 6th, 7th and 8th grade.

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RESULTS

Thirty-nine children completed the pre and post evaluation questions, forty-seven percent were male and fifty-three percent were female. There was a significant increase in the proportion of children reporting "I drink milk or eat dairy foods every day," "I eat vegetables every day," and "I am physically active every day" (Table 2). There was a significant decrease in the proportion of children reporting "I drink pop every day" and "I eat candy, desserts or chips everyday" (Table 2).

Table 2. Effect of an After School Education and Gardening Program on Youths' Reported Nutrition and Physical Activity Behaviors.

Question	Pre				Post					
	No		Yes		No		Yes		McNemar Test	
	n	%	n	%	n	%	n	%	$\chi 2$	p value
I eat something before school starts	25	64	14	36	23	59	16	41	0.29	=0.7905
I wash my hands before I eat	15	38	24	62	13	33	26	67	0.29	=0.7905
I eat bread or grain foods every day	31	79	8	21	28	72	11	28	1.0	=0.5078
I drink milk or eat dairy foods every day	23	59	16	41	13	33	26	67	6.3	=0.0213
I eat fruit every day	22	56	17	44	19	49	20	51	0.7	=0.5811
I eat vegetables every day	30	77	9	23	22	56	17	44	5.3	=0.0386
I eat snacks from the Pyramid food groups	22	56	17	44	16	41	23	59	3.0	=0.1460
I drink pop	16	41	23	59	23	59	16	41	5.4	=0.0391

every day										
I eat candy, desserts or chips every day	14	36	25	64	23	59	16	41	9.0	=0.0039
When I am thirsty, I drink water	18	46	21	54	19	49	20	51	0.2	=1.0000
I use food nutrition labels	30	77	9	23	29	74	10	26	0.2	=1.0000
I am physically active every day	16	44	20	56	8	22	28	78	5.3	=0.0386

IMPLICATIONS

The results of this study suggest incorporating an after school garden along with nutrition education and food preparation can significantly increase youths reported milk and dairy intake, vegetable intake and physical activity; and significantly decrease youths reported pop, candy, desserts or chip intake. Reported vegetable intake may have increased due to youth growing vegetables in the garden and eating foods prepared with garden produce during the education lessons. Youth may have reported more time spent in physical activity because they viewed themselves to be physically active during the education and gardening program.

Significant differences for the questions “I drink milk or eat dairy foods every day” and “I drink pop every day” may be due to youth receiving multiple lessons concerning beverages. No significant difference in youth reporting “When I am thirsty, I drink water” may be due to youth replacing pop with milk or dairy foods. Youth reporting “I eat candy, desserts or chips every day” may have significantly decreased due to youth replacing candy, desserts or chips with foods prepared during the Delaware County Oklahoma New Communities Project education and gardening program.

Although hand washing did not change significantly, more than 60% of youth reported washing their hands before and after the program. Incorporating food preparation into the curriculum encourages children to continue practicing food safety such as washing your hands before you eat.

A non- significant difference in fruit and bread or grain consumption may be related to only vegetables being grown in the garden. Youth received nutrition education and some food preparation with other foods groups although, emphasis may have been placed on vegetables grown in the garden. Nutrition education lessons are an important component to educate youth on the importance of all food groups although significant changes may not occur. A non-significant difference in snacks chosen from the Pyramid food groups and eating breakfast everyday may reflect less emphasis of these topics related to the garden.

An after school education and gardening project is an effective method for providing youth with interactive nutrition education and physical activity. Improving vegetable consumption through a school garden is one way to assist youth in meeting the five a day recommendation for fruit and vegetable consumption. Along with physical activity, increased consumption of fruits and vegetables may help youth maintain a healthy weight. Consuming five or more servings of fruits and vegetables may help maintain a healthy weight because fruits and vegetables are generally low in fat and calories and provide many essential nutrients (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2000).

In addition to the impact on the youth the garden provided additional community benefits. The gardening project proved to be an effective way of developing partnerships between the school and community. Parent's volunteered time watering and helping with the gardening activities. The Delaware County Master Gardeners adopted the after school garden and volunteered their time, expertise and some supplies. Local stores also donated both plants and supplies for the garden. The Cherokee Nation Food Distribution Center provided commodities for the healthy food preparation classes. Another observation was the incorporation of the gardening activities by the school. The school food service providers incorporated the garden produce into the school lunch salad bar, and asked for information on healthy recipes and portion sizes. The school food service providers also reported use of the school salad bar doubled. The school science and special education teachers incorporated the garden with their students. The school felt the garden was such a success the school principal and Delaware County New Communities Project Coordinator were successful in receiving additional funding to buy a greenhouse for the school. One of the school teachers volunteered to work with students in the green house growing plants and flowers as an alternative way to generate school funds instead of candy sales.

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CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY OF FINDINGS

The purpose of this study was to determine the impact of an after school education and gardening program on nutrition and physical activity behaviors among youth in 3rd through 8th grade participating in the Delaware County Oklahoma New Communities Project. This study evaluated whether or not the program improved children's nutrition and physical activity behaviors.

The objectives of the study included:

1. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on eating something before school starts.
2. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on washing hands before eating.
3. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on eating bread or grain servings every day.
4. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on eating or drinking servings of milk or dairy foods every day.

5. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on eating fruits every day.
6. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on eating vegetables every day.
7. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on choosing snacks from the Pyramid food groups.
8. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on drinking pop every day.
9. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on eating candy, desserts, or chips every day.
10. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on drinking water when thirsty.
11. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on using food nutrition labels.
12. To determine the effect of an after school education and gardening program among youth in 3rd -8th grade on being physically active every day.

NULL HYPOTHESIS

Null Hypothesis One Stated: There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I eat something before schools starts," after an education and gardening program. After completion of the after school gardening program, a significant difference in eating something before school starts was not

observed in 3rd – 8th grade youth. Therefore, the researcher fails to reject Null Hypothesis One.

Null Hypothesis Two Stated: There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I wash my hands before I eat," after an education and gardening program. After completion of the after school gardening program, a significant difference in washing hands before eating was not observed in 3rd – 8th grade youth. Therefore, the researcher fails to reject Null Hypothesis Two.

Null Hypothesis Three Stated: There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I eat bread or grain foods everyday," after an education and gardening program. After completion of the after school gardening program, a significant difference in eating bread of grain servings every day was not observed in 3rd – 8th grade youth. Therefore, the researcher fails to reject Null Hypothesis Three.

Null Hypothesis Four Stated: There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I drink milk or eat dairy foods every day," after an education and gardening program. After completion of the after school gardening program, a significant difference in drinking milk or eating dairy foods every day was observed in 3rd – 8th grade youth. Therefore, the researcher rejects Null Hypothesis Four.

Null Hypothesis Five Stated: There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I eat fruits every day," after an education and gardening program. After completion of the after school gardening program, a significant difference in eating fruits everyday was not observed in 3rd – 8th grade youth. Therefore, the researcher fails to reject Null Hypothesis Five.

Null Hypothesis Six Stated: There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I eat vegetables every day," after an education and gardening program. After completion of the after school gardening program, a significant difference in eating vegetables everyday was observed in 3rd – 8th grade youth. Therefore, the researcher rejects Null Hypothesis Six.

Null Hypothesis Seven Stated: There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I eat snacks from the Pyramid food groups," after an education and gardening program. After completion of the after school gardening program, a significant difference in choosing snacks from the Pyramid food groups was not observed in 3rd – 8th grade youth as reported in Table 2. Therefore, the researcher fails to reject Null Hypothesis Seven.

Null Hypothesis Eight Stated: There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I drink pop every day," after an education and gardening program. After completion of the after school gardening program, a significant difference in drinking pop everyday was observed in 3rd- 8th grade youth. Therefore, the researcher rejects Null Hypothesis Eight.

Null Hypothesis Nine Stated: There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I eat candy, desserts or chips every day," after an education and gardening program. After completion of the after school gardening program, a significant difference in eating candy, desserts, or chips everyday was observed in 3rd – 8th grade youth. Therefore, the researcher rejects Null Hypothesis Nine.

Null Hypothesis Ten Stated: There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "When I am thirsty, I drink water," after an

education and gardening program. After completion of the after school gardening program, a significant difference in drinking water when thirsty was not observed in 3rd – 8th grade youth. Therefore, the researcher fails to reject Null Hypothesis Ten.

Null Hypothesis Eleven Stated: There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I use food nutrition labels," after an education and gardening program. After completion of the after school gardening program, a significant difference in using food nutrition labels was not observed in 3rd – 8th grade youth. Therefore, the researcher fails to reject Null Hypothesis Eleven.

Null Hypothesis Twelve Stated: There will be no significant difference in the proportion of 3rd – 8th grade youth reporting "I am physically active every day," after an education and gardening program. After completion of the after school gardening program, a significant difference in being physically active everyday was observed in 3rd - 8th grade youth. Therefore, the researcher rejects Null Hypothesis Twelve.

The results of this study suggest that an after school education and gardening program among youth, in 3rd – 8th grade was effective in increasing reported milk, diary and vegetable intake, and daily physical activity; and decreasing pop, candy, dessert or chip intake.

CONCLUSIONS

The prevalence of childhood overweight is continuing to increase in the United States. Approximately 30% of youth ages 6-19 have a BMI for age $\geq$ 85th percentile. There is controversy over the reason for the increase in prevalence of overweight among

youth. Multiple etiologic factors such as genetics, socioeconomic status and ethnicity have been considered when examining contributions to childhood overweight.

Over time diet and physical activity behaviors have also changed among youth. Portion sizes along with an increase in dining out have also increased in the United States. According to the Healthy Eating Index the majority of youth and older Americans have diets that need improvement. Youth are drinking less milk and consuming fewer vegetables while increasing consumption of soft drink and fruit juices than reported twenty years ago. The question of whether an increase of calories is causing an increase in childhood overweight is still debated. It is known that an increase in calories, a decrease in physical activity and an increase in physical inactivity will lead to weight gain. In 2003, it was reported that only approximately one-fourth of youth participated in vigorous activity at least five days a week. Physical activity levels are reported to decline as youth get older. Sedentary behaviors such as video games and television are also replacing physical activity behaviors in youth.

Youth need to be educated at an early age about the benefits of a healthy diet and physical activity. Although, some youth report the benefits of healthy diet and physical activity are not a motivator to change behavior, a lack of healthy behaviors may have negative health effects at a young age (Croll et al., 2001). Overweight children have been found to have higher serum cholesterol levels, blood pressure and an increased risk for developing type 2 diabetes compared to non-overweight children. Childhood overweight is also of long term concern because overweight children are more likely to continue to be overweight throughout adulthood compared to non overweight children. It is important to educate youth on the negative effects an unhealthy lifestyle can have on them.

Educating youth at an early age may help to decrease the prevalence of childhood overweight. Youth education programs that focus on behavior change, target environmental and individual behaviors and included physical activity and nutrition education are reported to be most effective. Schools are an appropriate venue for nutrition education because they are structured environments that reach a large number of children.

An after school garden is one example of providing youth with hands on nutrition education and physical activity. The results of this study indicate an after school garden can positively improve various nutrition behaviors along with physical activity behaviors among 3rd - 8th grade youth attending a rural school. A school garden is an example of targeting environmental and individual behaviors which is thought to be most effective in making long term changes in behavior.

RECCOMENDATIONS

An after school gardening program can provide beneficial changes in youth's diet and physical activity behaviors. All of the youth in this study received nutrition education therefore, further research is needed to compare the effects of an after school gardening program among youth with and without nutrition education. Future gardening programs need to be evaluated using a larger sample size. This study consisted of a very small sample size which may have impacted the results.

Longitudinal research of an after school gardening program should be conducted in order to determine if gardening has long term effects on dietary and physical activity behaviors of youth. Research could also be conducted to examine the effects of an after school gardening program on dietary and physical activity behaviors of youth of various

grade levels. This research could help determine an appropriate time to educate youth and sustain long term changes in behavior.

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APPENDICES

APPENDIX A

OKLAHOMA NEW COMMUNITIES PROJECT

FOOD, NUTRITION AND PHYSICAL ACTIVITY QUESTIONNAIRE

Oklahoma New Communities Project
Food, Nutrition and Physical Activity Questionnaire

Check One: _____ Beginning _____ Ending

What grade are you in: _____

Circle the answer that best fits what you do.

1. I eat something before school starts.	Yes	Sometimes	No
2. I wash my hands before I eat.	Yes	Sometimes	No
3. I eat bread or grain foods every day.	Yes	Sometimes	No
4. I drink milk or eat dairy foods every day.	Yes	Sometimes	No
5. I eat fruit every day.	Yes	Sometimes	No
6. I eat vegetables every day.	Yes	Sometimes	No
7. I eat snacks from the Food Guide Pyramid food groups.	Yes	Sometimes	No
8. I drink pop every day.	Yes	Sometimes	No
9. I eat candy, desserts, or chips every day.	Yes	Sometimes	No
10. When I am thirsty, I drink water.	Yes	Sometimes	No
11. I use food Nutrition labels.	Yes	Sometimes	No
12. I am physically active every day.	Yes	Sometimes	No

APPENDIX B

OKLAHOMA STATE UNIVERSITY'S

INSTITUTIONAL REVIEW BOARD APPROVAL

FORM FOR HUMAN SUBJECTS

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

VITA

Sarah Jayne Walker

Candidate for the Degree of

Master of Science

Thesis: EFFECT OF AN AFTER SCHOOL EDUCATION AND GARDENING PROGAM ON NUTRITION AND PHYSICAL ACTIVITY BEHAVIORS IN SCHOOL AGE YOUTH, GRADES 3-8.

Major Field: Nutritional Sciences

Biographical:

Personal Data: Born in Wichita, Kansas, October 15, 1980, the daughter of Steve Vann and Jayne Culley Hood.

Education: Graduated from Memorial High School, Tulsa Oklahoma in May 1999; received an Associate of Arts degree from Eastern Oklahoma State College, Wilburton, Oklahoma in May 2001; received a Bachelors of Science degree from Oklahoma State University, Stillwater, Oklahoma in May 2004; completed Dietetic Internship at Oklahoma State University, June 2005; completed requirements for Master of Science from Oklahoma State University, Stillwater, Oklahoma in May 2006.

Professional Memberships: American Dietetic Association; Oklahoma Dietetic Association; North Central District Dietetic Association

Name: Sarah Walker Date of Degree: May, 2006

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: EFFECT OF AN AFTER SCHOOL EDUCATION AND GARDENING PROGAM ON NUTRITION AND PHYSICAL ACTIVITY BEHAVIORS IN SCHOOL AGE YOUTH, GRADES 3 - 8.

Pages in Study: 92 Candidate for the Degree of Master of Science

Major Field: Nutritional Sciences

Scope and Method of Study: The purpose of this study was to determine the impact of an after school education and gardening program on nutrition and physical activity behaviors among youth in 3rd through 8th grade who were participating in the Delaware County Oklahoma New Communities Project. Participants completed the pre questionnaire in the fall at the beginning of the school year and post questionnaire in the spring near the end of the school year. The pre/post questionnaire consisted of 12 questions using a three category response scale format; "yes," "sometimes," and "no." The McNemar non-parametric test was used to analyze the data and significance was set at $p < 0.05$.

Findings and Conclusions: Thirty-nine children completed the pre and post evaluation questions, forty-seven percent were male and fifty-three percent were female. There was a significant increase in the proportion of children reporting "I drink milk or eat dairy foods every day," "I eat vegetables every day," and "I am physically active every day" (Table 2). There was a significant decrease in the proportion of children reporting "I drink pop every day" and "I eat candy desserts or chips everyday" The results of this study suggest that incorporating an after school garden along with nutrition education and food preparation can significantly improve youths reported vegetable intake and physical activity behaviors.

ADVISER'S APPROVAL: Dr. Janice Hermann