1995

Childhood obesity

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CHILDHOOD OBESITY

An Abstract of a Thesis

Submitted

In Partial Fulfillment

of the Requirements for the Degree

Specialist in Education

Denise Kay Volker

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July 1995

ABSTRACT

The contributing factors in childhood obesity include psychological, physical fitness, and social elements. Much previous literature has studied such variables in isolation or in limited combinations. There is a need for multi-variate approaches to the research in childhood obesity.

The research question in this study was to determine was there any relationship between the subjects self-esteem, psychological and health locus-of-control, nutritional knowledge, food choices, and physical fitness, that will significantly distinguish overweight and normal weight youth, as determined through the measures of the Piers-Harris Children's Self Concept Scale (PHCSCS), the Nowicki-Strickland Locus-of-Control scale (CNS-IE), the Multidimensional Health Locus-of-Control scale (MHLC), the Wisconsin NET Nutrition Knowledge test for students, and the Food Choice Inventory?

The data for 19 variables in this study were obtained from 110 high school students from the 10th, 11th, and 12th grades of one high school. There were 27 students in the overweight group and 83 students in the regular and underweight group. Using a discriminant function analysis, the two groups could be reliably and significantly distinguished by a linear combination of five variables, (i.e. three measures of skinfold thickness, time on mile run, and high nutritious food choice). The other 14 variables did not distinguish the groups. Gender based analysis revealed that males did discriminate on skinfold thickness, but the females did not.

Inferences were drawn for future research and for applications for School Psychologists.

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This study by: Denise Kay Volker

Entitled: Childhood Obesity

has been approved as meeting the thesis requirement for the Degree of Specialist in Education

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ACKNOWLEDGEMENTS

First of all I would like to thank the members of my committee, Dr. Barry Wilson and Dr. Susan Kock, for their time, guidance, and helpful suggestions. And a very special thank you is extended to my thesis chairperson and advisor, Dr. Donald Schmits, for all of his time, assistance, and continued encouragement and support throughout this study.

I would also like to express my appreciation to Price Laboratory School and their staff for their co-operation and assistance in the collection of the data for my thesis. Including a special thank you to Robert E. Lee, Department Head of the Physical Education Program, and the physical education staff, for their co-operation, assistance, and support in the collection of the data for my study. And I also wish to thank the students who volunteered in my study.

And most importantly, I would like to thank my family. My parents, Fred and Bonnie Volker, who have provided continued encouragement and support. And a special thank you to my daughter Deborah for her patience, flexibility, and self-sufficiency, throughout my graduate studies.

And finally, I would also like to thank my relatives, my classmates, and the university staff for their continued guidance, encouragement, and support.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

In recent years the problem of child and adolescent obesity in the United States has received much attention. This growing concern is attributed not only to an increased prevalence and persistence of obesity, but also to the side effects often attributed to the condition, including physical health problems and psycho-social difficulties.

Obesity has been defined simply as an excess of body fat. However, when assessing obesity two steps need to be followed, these include measuring the amount of body fat, and then making a judgement regarding the extent to which body fat is excessive. Several methods are frequently used in the assessment of obesity, and each of these methods defines obesity as stated below. First, in using the measure of absolute weight, the degree of excess weight for height that is usually assumed to correspond to obesity is 20% (Foreyt & Cousins, 1989). Secondly, skinfold measures in excess of the 85th percentile, or one standard deviation above the mean, have also corresponded to overweightness or obesity (Wishon, 1990). Third, the Body Mass Index (BMI), which relates most closely to measuring of body fat, has defined overweight by the BMI at the 85th percentile, and severe overweight by the BMI as greater than or equal to the 95th percentile (Scott, Jeor, & Feldman, 1995). A fourth measure in the assessment of obesity includes body fat percentages. In children, obesity is defined as a body fat percentage greater than 25% for pubertal boys, greater than 30% for prepubertal children, and greater than 35% for pubertal girls (Weststrate & Deurenberg, 1989). Finally, growth data, in the form of height/weight tables are also frequently used with children in the assessment of overweightness and obesity. Any disproportion of height and weight, where weight is 25 percentiles greater than height for age places a child at nutritional risk for being overweight (Goldberg, 1995).

Diverse criteria have complicated estimates of the prevalence of obesity, but according to a Harris Poll conducted for Prevention Magazine (1988), nearly two-thirds of Americans age 25 and over were too fat and more than a third were at least 10% over the recommended weights for their height, body build, and sex (Wishon, 1990). In addition, other statistics have indicated that obesity is present in 5-10% of preschool age children, 10% of school age children, 15% of adolescents, and in 30% of American adults (Maloney & Klykylo, 1983). In a review of obesity data by William Dietz (1987), of the New England Medical Center Hospitals in Boston, it was determined that the prevalence of obesity has increased by 54% among 6 to 11 year old children and by 39% among 12 to 17 year olds over the past 15 to 20 years. In some population subgroups such as females, blacks, children from low-income families, or children with obese parents and siblings, the rates of obesity are considerably higher (Wishon, 1990).

It has been estimated that 20% of Americans are enough overweight to be at risk for certain diet-related diseases (Wishon, 1990). Obesity is one of the most important risk factors associated with cardiovascular disease, diabetes, gall bladder problems, osteoarthritis, respiratory problems, and varicose veins. Obesity is also often present in association with certain kinds of cancer, elevated cholesterol, and glucose intolerance. In addition, people who are obese are greater surgical risks and have a notably shorter life expectancy. The President's Council on Physical Fitness (Wishon, 1990), has concluded that 40% of children, ages five to eight years, show at least one heart disease risk factor, such as obesity, elevated cholesterol, or high blood pressure. It has been established that sustained hypertension (which contributes to the development of coronary artery disease), congestive heart failure, cerebral vascular disease, and renal insufficiency, are nearly three times higher among the overweight. It has been indicated that about two-thirds of mildly hypertensive adolescents will become hypertensive adults (Wishon, 1990).

Psychological consequences often associated with obesity include social stigmatization, rejection, withdrawal, isolation, and a diminished self-esteem (Wishon, 1990). In addition, obesity may also be related to underachievement.

Statement of the Problem

The purpose of this study was to determine whether selected psychological, physical fitness, and social variables can reliably and significantly distinguish between groups of regular weight or overweight adolescents.

Significance of the Study

Due to the increased prevalence and persistence of obesity, as well as the numerous physical health and psycho-social side effects often attributed to obesity, strategies for prevention and treatment need to be developed. However, in order to develop effective strategies, it is not only important to have a knowledge and understanding of the various etiologies of obesity, but also to determine any relationship between obesity and the variables of self-esteem, psychological and health locus-of-control, nutritional knowledge, food choices, and level of physical fitness of weight groups.

Research Question

Will there be a relationship between the subjects self-esteem, psychological and health locus-of-control, nutritional knowledge, food choices, and physical fitness, that will significantly distinguish overweight and normal weight youth, as determined through the measures of the Piers-Harris Children's Self Concept Scale (PHCSCS) (Piers &

Harris, 1984), the Nowicki-Strickland Locus-of-Control scale (CNS-IE) (Nowicki & Strickland, 1973), the Multidimensional Health Locus-of-Control scale (MHLC) (Wallston, Wallston, & DeVellis, 1978), the Wisconsin NET Nutrition Knowledge Test for students (Evans, 1981a), and the Food Choice Inventory (National Dairy Council, 1985)?

Limitations of the Study

1. The subjects represent predominantly Caucasian, middle class, midwestern students. This is not a sample representative of the U.S. population as a whole.

2. The subjects were only 10th, 11th, and 12th grade students. Consequently, the conclusions of this study may not be representative of high school students at all grade levels.

Definition of Terms

Adipose and Adipose Tissue

Adipose is a term used to refer to body fat or the amount of body fat found in adipose tissue. And adipose tissue is the connective tissue in the body which contains stored cellular fat.

Food Choice

Is defined as a person's general nutrition behavior. Person's may choose high nutrient-value foods which supply a greater proportion of nutrients in relation to calories, or they may choose low nutrient-value foods which supply a lesser proportion of nutrients in relation to calories. In this study, the quality of food choices which are made will be measured through interpretation of the raw scores on the Food Choice Inventory (National Dairy Council, 1985).

Health Locus-of-Control

Health locus-of-control is defined as the belief that one's health is or is not determined by one's behavior. Health externals are presumed to have generalized expectancies that the factors which determine their health are such things as luck, fate, chance, or powerful others, factors over which they have little control. Health internals believe that the locus of control for their health is internal, and that one stays or becomes healthy or sick as a result of his or her own behavior. In this study, health locus-of-control will be measured from the interpretation of the raw scores for internality, powerful others, and chance or fate, on the Multidimensional Health Locus-of-Control scale (MHLC) (Wallston et al., 1978).

Nutritional Knowledge

Nutritional knowledge is a person's awareness or understanding of the process of nutrition, which demonstrates that he/she can make informed food choices. In this study, nutritional knowledge will be measured from the interpretation of the raw score on the Wisconsin NET Nutrition Knowledge Test for students (Evans, 1981a).

Obesity

Obesity is defined as any disproportion between height percentile and weight percentile where weight is 25 percentiles greater than height for age (Goldberg, 1995), when compared with growth charts developed by the National Center for Health Statistics (NCHS) for children in the 2 to 18 year of age interval (Hamill et al., 1979).

Physical Fitness

Physical fitness is defined by performance in the areas of aerobic endurance, flexibility, muscular strength, and muscular endurance. In addition, physical fitness can also be assessed with the additional measure of body composition. In this study, physical fitness will be measured by the raw scores on the physical fitness test, for the tests of mile run, sit and reach flexibility test, sit-ups, pull-ups, and a measure of skinfolds as defined by the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD, 1980).

Psychological Locus-of-Control

Locus-of-control is defined as the source or cause to which one attributes control over the consequences of one's behavior, which is either "internal" or "external". For this study, psychological locus-of-control will be measured from the interpretation of the raw score on the Nowicki-Strickland Locus-of-Control Scale (CNS-IE) (Nowicki & Strickland, 1973).

Self-Esteem and Self-Concept

The terms self-esteem and self-concept, often used interchangeably in the literature, are defined as an individual's personal judgement or evaluation of his or her own self-concept in relation to a perceived or ideal self. A high self-esteem indicates satisfaction with the self, while a low self-esteem reflects dissatisfaction. In this study, self-concept will be measured through the interpretation of the total raw score on the Piers-Harris Children's Self Concept Scale (PHCSCS) (Piers & Harris, 1984).

CHAPTER II

REVIEW OF LITERATURE

Due to the increased prevalence and persistence of obesity, as well as the numerous physical health difficulties and psycho-social side effects often attributed to obesity, child and adolescent obesity has increasingly received attention. However, in order to develop effective strategies for the prevention and treatment of obesity in children and adolescents, it is important to have a knowledge and understanding of the various etiologies of obesity, as well as any relationship between self-esteem, psychological locus-of-control, health locus-of-control, nutritional knowledge, food choices, and level of physical fitness.

The chapter starts with a review of the definitions and measurements involved in obesity, turns to a discussion of the persistence of obesity, and reviews the etiological factors involved in obesity; the genetic environmental factors, developmental factors, factors of energy intake and energy expenditure, emotional factors, socio-economic status, and brain related influences on weight change. Studies on locus-of-control, self-esteem, nutritional knowledge, food choices, and physical fitness are included within each of these etiological factors.

Issues In Measuring Obesity

Although body weight has been the most commonly used measurement for the assessment of obesity, using weight measurement has four difficulties. The first relates particularly to children, for whom weight is partly a function of age and must be evaluated on an age-specific basis. The second difficulty is that weight is highly correlated with stature, independent of age. Thus, weight needs to be related to both age and height. The third difficulty is that sex differences are well substantiated and must also be included in the standards. And finally, there is the less well-defined problem of body build or body type. At any age or height, an individual can have a different lean body mass and, therefore, a different weight independent of the amount of body fat. Therefore, for weight to be a reliable measure of body fat, the variables of age, height, sex, and body build all need to be considered. Two additional problems inherent in the use of weight include what to use as a standard and what level of weight to consider excessive (Weil, 1977).

The measures of absolute weight and percentage of overweight are frequently used in the assessment of obesity as both are easy to measure and easy to understand. However, the validity of these measures has been questioned. Garn, Clark, and Guire (1975), cited in Foreyt and Cousins (1989), investigated whether individuals who are defined as obese through the measure of skinfolds are also defined as obese through the measure of the percentage of overweight. In a large sample of children and adults, it was found that the measures of skinfold thickness and percentage of overweight were generally in agreement for adults, but were discrepant for children and adolescents. Many nonobese adolescents were found to be at a percentage of overweight greater than 20%, and many obese children were found to be at a percentage of overweight less than 20%. The noted discrepancy between measures proposes caution for future research which assesses child and adolescent obesity with the single measure of absolute weight or percentage of overweight.

Another frequently used measure in the assessment of obesity is the body mass index (BMI). There are different methods which can be used to calculate the BMI. The most widely accepted BMI, especially for adults, is the Quetelet index (Garrow, 1978; Scott et al., 1995). The Quetelet index is most frequently used because it can be easily calculated and is not easily biased by height. However, a disadvantage of using the BMI in the assessment of body weight, is that it does not distinguish weight from fat or lean tissue. Therefore, it is recommended that the BMI be combined with measures of body composition, such as skinfolds or circumference for a more reliable measure (Garrow, 1978).

Relating skin fold thicknesses to body fat percentage offers a more accurate, objective, and consistent method for diagnosing obesity in comparison to the traditional method of body fat percentage; where obesity may be defined as body density greater than 25% (for pubertal boys), greater than 30% (for prepubertal children), or greater than 35% (for pubertal girls). However, caution is recommended when assessing extremely obese children and adults, where skin fold thicknesses cannot be accurately measured (Weststrate & Deurenberg, 1989).

Another measure which can be used with skinfold thickness equations for more precise adiposity measures includes using a waist-hip circumference ratio. However, changes of waist-hip circumference ratio with age and excessive weight have not yet been established (Gibson, 1993).

No single measure is capable of assessing obesity without error, therefore it is recommended that several measures of weight and body fat be collected, including absolute weight, percentage of overweight, the body mass index, and triceps and subscapular skinfolds (Foreyt & Cousins, 1989).

Weststrate and Deurenberg (1989) presented a method for assessing childhood obesity in a more objective way than most other routine methods used for diagnosing childhood obesity. They used the sum of bicipital, tricipital, subscapular, and suprailiacal skinfold thicknesses as related to total body density by use of theoretically defined prediction equations. Total body density was used to estimate the total body fat percentage by use of age-and sex-dependent equations on the relationship between body fat percentage and body density. These equations were constructed on the basis of published data on changes in the density of fat-free mass with age in children. With this method, childhood obesity could be assessed more consistently than with most other routine methods used to diagnose obesity in children.

Marshall, Hazlett, Spady, and Quinney (1990) undertook a comparative study of obesity measurements with 533 male and female subjects, aged 11.8-15.9. Six adiposity measures were used, which included three skinfold indices, and three height-weight indices derived from measures of height, weight, and eight skinfold thickness measurements. Their analysis supported the interpretation that the underlying construct of these factors was adiposity, and that a factor score of greater than 1.5 SD above the mean was a suitable standard for labeling obesity. Utilizing this dichotomy of factor scores as a standard, the study of differential diagnostic capabilities of four adiposity scales commonly used in identifying obesity was undertaken. However, to ensure a valid measure of obesity, the pursuit of additional measures and larger sample sizes would be recommended in this methodology.

Persistence of Obesity

A common observation made about obesity is its persistence. Although a majority of obese infants do not become obese children, Maloney and Klykylo (1983) argue that most obese children were obese infants, and at least 60%-80% of obese teenagers become and remain obese adults. Maloney and Klykylo, also cite Merritt (1979), who notes that "It is unusual for an obese child who becomes an obese teenager ever to attain normal weight status" (p. 436).

Several studies have shown a relationship between obese parents and the prevalence of childhood obesity. In one study, Deutscher et al. (1966), cited in Epstein and Cluss (1986), showed that 52% of the offspring of two obese parents were obese, 23% of the children were obese if one parent was obese, and only 10% were obese if both parents were lean. Also, the percentage of children who were obese in families with one obese parent did not vary with the sex of the obese parent.

In another study, data from the U.S. Health Examination Surveys were analyzed to determine changes in body fatness between childhood and adolescence (Zack, Harlan, Leaverton, & Cornoni-Huntley, 1979). A national probability sample of 2,177 children was examined. Cycle II of the survey examined a national probability sample of children 6 to 11 years of age, and focused on growth and development. Cycle III of the survey examined youths 12 to 17 years of age, and studied measurements of sexual maturation and biochemical determinations. The interval between examinations was three to four years. Adiposity (body fatness) was measured as skinfold thickness by pediatricians and specially trained nurses. The correlations between childhood and adolescent adiposity were explored, and separate rankings were made for each age-sex-race group. Results of the study indicated that about three-fourths of obese children (i.e. those above the 80th percentile for skinfold thickness) were classified as obese when re-examined three or four years later. They also found in their study that children of high socioeconomic class were reported to have higher levels of relative fatness than their less economically advantaged peers, and obese children of both sexes mature earlier than nonobese individuals. Further, in a multiple regression analysis of all potential factors, childhood fatness was the most important predictor of adolescent fatness. The prediction was relatively independent of physiological growth, sexual maturation, and economic status and was valid for both sexes, and for both caucasian and African subjects (Zack et al., 1979).

A significant relationship was found between weight at age 9-13 years among 717 American children and their adult weight. Of the 19 children who were over 120% of their ideal weight, 61% were similarly overweight as adults, whereas only 4% of 223 children who were under 95% of ideal weight became very overweight as adults. However, he noted that 39% of very fat children did not become very fat adults, and there were far more fat adults who were normal weight children than who were very fat children (Garrow, 1978).

Charney, Chamblee Goodman, McBride, Lyon, and Pratt (1976), found a similar pattern to Garrow when weight in infancy was compared with adult weight. In his survey, equal groups of children were chosen who were light, average or heavy during infancy and measured adult weight at age 20-30 years. Of these infants who exceeded the 90th percentile in the first six months of life, 36% were overweight adults, but only 14% of average or lightweight infants became overweight adults. Although these differences were considered significant, Garrow also recommended caution in applying these results for purposes of prediction.

Etiological Factors In Obesity

Obesity is considered a heterogeneous disorder with various etiologies. Stunkard (1980), cited in Maloney and Klykylo (1983), identified six major determinant areas of obesity. These areas include genetic versus environmental factors, development, energy intake and energy expenditure, emotional, socioeconomic status, and brain related influences on weight change.

Genetic Versus Environmental Factors

Obesity may be affected by genetic factors, environmental influences, or the interaction between both. The relationship between the two variates can be expressed in a variety of ways. For example, hereditary factors may influence aspects of calorie intake, such as a preference for high calorie foods or differences in satiety, and may also influence various aspects of energy expenditure, such as activity levels, resting metabolic rate, or the thermic effect of food. Environments also vary in the extent to which they contribute to obesity. For example, environments may promote caloric intake by increasing food availability and by providing various prompts or reinforcement to eat, and may also influence the amount of activity level available (Epstein & Cluss, 1986).

By studying related pairs of individuals in a family, adopted siblings or twins, the variance of the genetic and environmental components of obesity can be partitioned (Meyer & Stunkard, 1993). In nuclear family studies, data from parents and offspring, and from siblings have helped to identify the extent to which obesity is familial in nature. However, in these studies it is difficult to determine whether the familial aggregation for obesity is due to shared genes or shared environments (Meyer & Stunkard, 1993). Adoption studies provide information about the genetic components between the adoptee and the biological parent, as well as environmental components of the adoptee with the adopted family (Meyer & Stunkard, 1993). Twin studies have compared the similarity of identical, or monozygotic (MZ), twins who share all of their genes as well as their early rearing environment, with fraternal, or dizygotic (DZ), twins who in contrast share, on the average, only half of their genes and all of their early rearing environment. By comparing the similarities of MZ twins to the DZ twins, assessment can be made of the relative contribution of genetics and environment (Meyer & Stunkard, 1993).

Most family studies of obesity have used the body mass index (BMI; weight (kg)/ height (m2) as a proxy for body fat (Meyer & Stunkard, 1993). The advantage of using this measure is that it is easier to collect data on a large sample. However, the disadvantage of using solely a BMI measure, is that it is somewhat inaccurate as it is not really measuring body fat.

Ramirez (1993), conducted a study addressing the aggregation of total and relative fatness, as well as subcutaneous fat thickness in healthy nuclear families. The sample for this analysis included 529 Caucasian individuals, with 122 spouse pairs, 135 girls and 150 boys (from 212 sibling pairs). Both parents were less than 50 years old, with two or more children between 11 and 20 years old. Parents were also well educated, with middle to high incomes. Few of the adult participants smoked or drank alcoholic beverages. Few of them did engage in some form of physical activity on a regular basis. Family members were living in the same household, and families with adopted or step children were not included in the study. Ramirez obtained family and medical history from questionnaires completed by the participants. Subcutaneous fat thickness was measured using ultrasound images. Ramirez, also considered the variables of anthropometric measurements, body composition, and indices of relative fat distribution. The measurements were adjusted for age and body mass index, and the residuals were transformed to normalized z-scores by sex and age group. These z-scores were then used to calculate intraclass correlations between all family members.

The results of the Ramirez (1993) study showed significant familial correlations for the fat deposits on the upper abdomen, triceps, calf, and subscapula, as well as strong familial aggregation for the level of fatness and ponderosity. However, Ramirez, found that the subcutaneous fat on the lower abdomen and the corresponding indices were closely related to the level of fatness, and were significantly correlated between sisters, and between mothers and daughters. It was also found that the lower abdominal fat deposits were more likely to be influenced by environmental components such as diet, level of physical activity, current lifestyle, and childhood experiences.

Bouchard, Perusse, LeBlanc, Tremblay, and Theriault (1988) estimated the transmission of genetic and environmental influences on the amount and distribution of body fat in obesity. This study was conducted in an attempt to overcome former deficiencies in methodology from earlier familial studies. To overcome these deficiencies, the study included more refined measures of body composition, several kinds of relatives, and the use of a multivariate analysis technique to determine the amount of body fat and its distribution in biological inheritance.

Bouchard et al. (1988) assessed the genetic and environmental transmission between generations by measuring body mass index, the sum of six skinfold measurements, the percentage of body fat, fatmass, fat-freemass, and two indicators of fat distribution. Their sample included 1,698 individuals of 409 families, which included the following nine pairs of family members: spouses (348), foster parent-adopted child (322), siblings by adoption (120), first-degree cousins (95), uncle/aunt-nephew/niece (88), parent-natural child (1,239), full siblings (370), dizygotic twins (69), and monozygotic twins (87). Statistical procedures included multiple regression procedures to control for gender and age, and BETA path analysis to take into account both polygenic and cultural inheritance. The total transmissible variance in the study ranged from about 40% for the amount of subcutaneous fat to 60% for the pattern of subcutaneous fat distribution. It was also found that genetics accounted for only 5% of the variance for subcutaneous fat and the body mass index, but 20 to 30% for the percentage of body fat, fat mass, fat-free mass, and fat distribution. Bouchard et al. (1988) therefore concluded that the amount of internal fat is influenced more by heredity than the amount of subcutaneous fat and that environmental influences are also important in determining the amount and distribution of body fat.

The results of adoption studies are mixed, due in part to the fact that all have limited their studies to children, have failed to explore the full range of body weight, and were handicapped by lack of information on the biological parents. The first adoption study to include information about the biological parents of the adoptees, was conducted by Stunkard et al. (1986), who were therefore able to provide a clearer picture of the role of genetic factors in obesity. This study examined the contribution of genetic factors and family environment to human obesity in a sample of 540 adult Danish adoptees who were selected from a population of 3,580 adoptees. The sample was divided into four weight classes which included: thin, median weight, overweight, and obese weight. The data from self-reports on weight and height were used in this study, and compared with measured weights and heights from previous studies to assess the accuracy of the data. The comparisons of these reports were found to correspond closely, and were therefore considered sufficient for the study. To determine the significance of the differences between mean parental body-mass index in relationship to the adoptee weight class, a separate one-way analyses of variance, including a test for linear trends in means, was conducted for the body-mass indexes of the biological mothers, the biological fathers, the adoptive mothers, and the adoptive fathers. In each case, the independent variable was the adoptee weight class. The results of this study found a strong relationship between the weight class of the adoptees and the body-mass index of their biological parents. However, no relationship was found between the weight class of the adoptees and the body-mass index of their adoptive parents. Cumulative distributions of the body-mass index of the parents showed similar results, where there was a strong relationship between the body-mass index of the biological parents and adoptee weight class and no relationship between the index of adoptive parents and adoptee weight class. Furthermore, the relationship between biological parents and adoptees was not confined to the obesity weight class, but was present across the whole range of body fatness; from very thin to very fat. These results were found to be consistent in all analytic tests. Therefore, Stunkard et al. (1986), concluded that genetic influences have an important role in determining human fatness in adults, whereas, the family environment alone showed no apparent effect.

Sorensen (1992), analyzed the data from the Stunkard et al. (1986) Danish adoption study, and quantified the findings. The biological correlation between parents and offspring was found to range from 11 to 15%, while the correlation for full siblings was 23%. The full correlation of body mass index for heritability was found to range from 20 to 40%. However, the correlation between adoptive parents and adult adoptees was close to zero. This quantifiable analysis confirmed the results of the Stunkard et al. (1986) study, showing no apparent affect of the family environment on the body mass index of adoptees when they were adults.

From Sorensen's (1992) analysis, two questions were raised. Are genetic effects expressed in childhood, and, if so, at what age? And does the childhood rearing environments have an effect while the children are still living in the environment? To answer these questions, Sorensen, Holst, and Stunkard (1992), conducted an adoption study assessing the genetic and environmental influences of body mass index in children.

In the Sorensen et al. (1992) adoption study, a sample of 269 Danish adult adoptees was selected for whom annual school measurements from the ages of 7 to 13 were available. Correlation coefficients, minimizing age and sex bias, were used to assess both current and maximum body mass indexes between the adoptees in childhood and both their biological and adoptive parents, and also between their age matched biological and adoptive siblings. The sample was divided into four groups, based on the measure of their current weight. These four groups included thin (below the fourth percentile), medium weight (estimated close to the median), overweight (between the 92nd and 96th percentile), and obese (above the 96th percentile). Sorensen et al. (1992), found correlations to be stable across the years of 7 to 13 years. Also, an average correlation of 0.17 was found between adoptees and biological mothers, a correlation of 0.16 with biological fathers, and a correlation of 0.59 with biological siblings of the same age. The correlations with members of the adoptive families were found to be lower, with a correlation of 0.10 with adoptive mothers, 0.03 with adoptive fathers, and 0.14 with adoptive siblings. Sorensen et al. (1992), concluded that these findings were consistent with previous studies, and that the genetic influence on body mass index as strong as that expressed in adult life is already expressed by the age of seven years. It was also concluded that the rearing environment shared by the family has a weak influence during childhood.

Another complete adoption study by Price, Cadoret, Stunkard, and Troughton (1987), confirmed the major findings of the Danish study. This study examined the data from an adoptive registry in Iowa, where 357 adult adoptees (age 18 to 38 years) were identified through two Iowa adoption agencies: the Iowa Children's and Family Services agency and the Lutheran Social Services agency. The selected adoptees had been separated at birth from their biological parents, and data was collected through the use of adoption agency records, self-reports, reports by spouse, and interviews. The measure of fatness used in this study was the body mass index, which was examined both by correlation and regression analysis in which age was regressed out. The environmental variables considered in the study included rural versus urban upbringing, as well as disturbed rearing environments. Price et al. (1987), found that the body mass index of the adoptees was correlated with that of their biological parents, but not of their adoptive parents. It was also found that the body mass index of the female adoptees was highly correlated with that of their biological mothers, but was less correlated with that of their biological fathers. And the correlations between the body mass index of sons and their biological parents were positive, however, were not statistically significant. In contrast to the significant biological parent/offspring correlations, adoptive parent/offspring correlations were found to be negligible and nonsignificant.

Twin studies have been used for nearly a century in an attempt to separate genetic and environmental influences on human obesity (Meyer & Stunkard, 1993). These studies are based on the fact that MZ twins share a genetic correlation of 1.0, and DZ twins share a genetic correlation of 0.5. Therefore, if the rearing environments of both twins are similar, any differences may be attributed to genetic factors.

The largest twin study of human obesity yet undertaken, was conducted by Stunkard, Foch, and Hrubec (1986), who assessed the height, weight, and body mass index in a sample of 1,974 monozygotic and 2,097 dizygotic male twin pairs. Their sample was drawn from a Twin Registry maintained by the National Academy of Sciences-National Research Council (NAS-NRC). Zygosity of the sample was determined through blood typing, fingerprinting, and questionnaires. And height and weight measures were taken of the sample at the approximate age of 20 years, and again 25 years later through self-reports. The measures of fatness used in the study included the body mass index and the percentage overweight, according to 'Fogerty' tables of recommended weights. However, corrections for age in the study were not necessary, due to the narrow range in age differences of the sample.

In their study, Stunkard et al. (1986), found that the concordance rates of MZ twins were far higher than that of DZ twins at each of six levels of overweight studied. They also found large differences in the intraclass correlations of height, weight, and body mass index, between the pairs of MZ and DZ twins, which suggested a strong genetic link to obesity. The heritability for body mass index was estimated at 0.77 at the induction of the study, and at 0.84 at the 25 year follow-up. Through these statistics, it was concluded that approximately 80% of the variance in body mass index is accounted for by genetic factors. However, in estimating environmental influences, the large intrapair correlations between MZ twins suggested that environmental influences during early adulthood were small at 9%, 15%, and 19% for height, weight, and BMI, respectively. And 25 years later, these differences increased to 12%, 26%, and 33% for height, weight, and BMI, respectively. Stunkard et al. (1986), concluded that height, weight, and body mass index are correlated across time, and that human fatness is under substantial genetic control.

Meyer (1992), cited in Meyer and Stunkard (1993), conducted a large twin study to investigate the role of genetics in human obesity. Meyer studied the body mass index in 5,588 pairs of twins from the Virginia and American Association of Retired Persons adult twin registries. In her study, Meyer found a high genetic variance of 69% for men and 75% for women. Her study not only indicated a strong genetic link to obesity, but also indicated a significant gender difference in the genetic contribution of body mass index.

Another twin study by Stunkard, Harris, Pedersen, and McClearn (1990), assessed the effects of genetic and environmental influences on the body mass index of identical and fraternal twins reared together and apart. Their analysis allowed for a more accurate assessment of the genetic contribution on obesity. Their sample consisted of 93 pairs of identical twins reared apart, 154 pairs of identical twins reared together, 218 pairs of fraternal twins reared apart, and 208 pairs of fraternal twins reared together. Their sample was taken from the Swedish Adoption/Twin Study of Aging (SATSA). The mean age of the twins studied was 58.6 (+,-) 13.6 years. And 60% of the participants selected were women, conforming to the sex ratio for the last half of the life span. Measurements of height and weight were obtained through self-reports, questionnaires, and direct measurement. Analysis of intrapair correlations and maximum-likelihood model-fitting analysis were performed to evaluate the roles of genetic and environmental determinants of total phenotypic variance.

There were three principal findings in the Stunkard et al. (1990) study on the determinants of body mass index. First, they found a strong correlation between heredity and body mass index. The intrapair correlations of the 93 pairs of monozygotic twins reared apart provided estimates of genetic influences that were independent of environmental contributions, with a 0.70 correlation for men, and a 0.66 correlation for women. And similar estimates were derived from the maximum-likelihood model-fitting analyses, with 0.74 for men and 0.69 for women. Second, the intrapair correlations of the monozygotic twins were more than twice those of the dizygotic twins. And third, they found that neither the shared rearing environment nor the correlated environments, had any contribution to the variation in body-mass index. They therefore concluded that genetics have a strong influence on body mass index, whereas the childhood environment has little or no influence on body-mass index.

Development

Questions have been raised in the study of the development of adipose tissue in humans in which the answers to these questions would not only provide additional information about the development of obesity but also be advantageous in providing interventions, such as dietary control, during critical periods of development. For example, the following questions may be asked. At what age is cell number and cell size achieved? At what age do obese subjects begin to deviate from normal cellular development? At what age do obese subjects exceed normal adult values for cell size and number? And at what age if any can cell number be altered by dietary means?

Two types of adipose tissue cellular development have been recognized in the study of obesity (Maloney & Klykylo, 1983). The first type is hyperplastic, wherein the body has an abnormally high number of adipose cells, and the second type is hypertrophic, where the adipose cells are of normal number, but of increased fat volume. Thus, a subject who is obese, may have an increase in adipose cell number alone, or may be obese due to a combination of both increased cell number and cell size.

Knittle (1972) studied subcutaneous samples of adipose tissue from obese and nonobese subjects in which adipose cell number and size was determined. His subjects ranged in age from 2 to 26 years of age, and all obese subjects were above the 97th percentile for weight and height, exceeding their ideal weights by 130% or more. In studying cellular size, it was found that obese children had, on the average, larger cells than nonobese children at all age levels studied, although some degree of overlap was observed. It was found that nonobese children had cell sizes below adult values. It was also found that three obese children studied, had attained adult size fat cells by the age of six. However, by the age of 11 years, the fat cells of all obese children had attained, but had not exceeded adult values. In studying cellular number, it was found that obese children had a greater number of adipose cells at all ages. It was even found that the adult range of cellular number was exceeded in one 6-year-old girl. Also, all teen-age obese subjects had either attained or surpassed normal adult values, whereas, none of the non-obese children had attained adult values prior to the age of 12. Knittle observed that in some obese children a rapid increase in cellularity begins between the ages of five and seven years, or earlier, whereas in nonobese children a similar occurrence is observed between the ages of 9 and 12, with little change in number between the ages of 2 and 10.

Knittle (1972) therefore concluded that cellular development proceeds at a more rapid weight in obese subjects, with deviations in "normal" development being observed as early as two years of age. He also suggested that by the age of six, different groups can be distinguished within the obese population relative to cell number and size. These groups include subjects with cell numbers exceeding normal adult values, those with modest increases in cell number, those with increased cell size, and those with normal cell size. Knittle hypothesized that subjects who have exceeded normal adult values of cellularity will most likely retain their obesity, whereas those within the normal range or below may outgrow their "baby fat."

More recently, Sjostrom (1993), has reported that an increase in body fat from one month to one year of age is due only to an increasing fat cell weight (hypothrophic obesity), whereas the expansion of body fat from 1 to 22 years of age is due to an increase in fat cell number (hyperplastic obesity). Also, in adults, obesity up to 30 kg of body fat is usually associated with increased fat cell weight, whereas, in more severe cases of obesity, a combination of increased fat cell number and fat cell weight are usually observed. He also reports that in adulthood, short-term weight changes, of less than two years, are associated with changes in fat cell weight, while long-term changes are due to changes in fat cell number. And that increased fat cell weight is usually associated with a number of metabolic disturbances, while a high fat cell number is related to early onset of obesity and a poor maintenance of a reduced body weight.

Energy Intake and Energy Expenditure

Obesity can result from an imbalance in energy intake and energy expenditure. Variables in energy intake may include the availability of energy-rich foods, ingestive behaviors, palatability (foods pleasing to the palate or taste), changes in nutrient composition, and metabolic processes (Sclafani, 1993). Variables in energy expenditure may include the resting metabolic rate, the thermic effect of food, and the energy cost of physical activity (Ravussin

& Swinburn, 1993). However, the relative contribution of energy intake versus energy expenditure in the development of obesity is still controversial.

Differences in eating behavior between obese and lean subjects was studied by Bellisle (1988), who studied the food intake of 339 French children, aged 7-12 years, who lived in the Paris area. Daily energy consumption and distribution of intake over the waking hours was estimated from dietary histories. These dietary histories were compared in children of five corpulence categories, (lean, slim, average, fat, and obese), which were defined on the basis of weight/height index. Sex and age, in the study, were converted into standardized units. Bellisle found no difference in the estimated daily energy intake observed between the corpulence groups; however, the reported distribution of intake over the waking hours varied. Obese and fat children ate less at breakfast and more at dinner than their leaner peers. And the traditionally larger meals of the day, lunch and dinner, represented higher proportions of daily intake in fat and obese children. He also found that the energy value of the breakfast and afternoon snack was inversely related to corpulence. Bellisle (1988), therefore concluded that the results suggested a possible contribution of disturbed metabolic and/or behavioral daily cycles in the development of the overweight.

Drabman, Cordua, Hammer, Jarvie, and Horton (1979) assessed whether there was a difference in eating rates between normal and obese preschool children and whether noted patterns vary with increasing age. Their sample included 30 normal and 30 overweight children enrolled in 10 nursery schools and preschools, serving primarily white middle-class families in a metropolitan area in the South. Frequency data was obtained for four variables. These variables for eating rates included, number of bites, chews, sips of liquid, and talks with a neighbor, per 30 second observation intervals. An interobserver agreement method, and the Pearson product-moment correlation coefficient was used to assess the reliability of the data. A three-factor analysis of variance design (weight x age x sex), revealed that overweight, preschool children demonstrated a somewhat higher rate of the measure they titled fewer chews per bite. And boys showed increasing chew rates with increasing age. Talk rates also increased with age but were unrelated to sex or weight status. Sip rates were not significantly associated with age, sex, or weight status. The results of the study supported the hypothesis that overweight persons are characterized by an increased eating rate, even at an early age.

In another study, Hammar et al. (1972), of the University of Washington Adolescent Clinic, undertook an interdisciplinary study of adolescent obesity, focusing on the interrelation-ships of various aspects of obesity, rather than just isolated aspects of the problem. In their study, they evaluated the physical and physiologic changes, behavioral responses, and the psychological and social characteristics of obese teenagers, and compared these to a group of nonobese subjects. Their sample included 20 adolescent subjects, 10 obese and 10 nonobese, whose parents were recruited randomly from referrals for treatment to the Adolescent Clinic. Each subject in the sample was given a complete medical examination which included anthropometric measurements and sexual maturity ratings. They also received complete laboratory studies, were interviewed by a nutritionist, and were given a complete battery of questionnaires and psychological tests. Nutritional findings of the study included increased difficulties with infant feedings, food intolerances, formula changes, and an earlier introduction of solid foods among the obese group. Also, parents of obese adolescents commonly used food, particularly sweets, as reinforcement for good behavior. However, there were no differences found in the total daily caloric intake and eating patterns between the obese and nonobese adolescents. However, the obese subjects were less physically active and more interested in sedentary activity.

The role of physical activity and energy expenditure in the etiology of childhood obesity has remained controversial. Even though a number of studies have shown that physical activity is inversely correlated with adiposity, establishing that a relationship does exist between the two characteristics, they have not been able to establish a cause-and-effect relationship between the two variables (Pate, 1993). The variability of the outcomes in the studies have been attributed in part to differences in the definition of energy output, as well as differences in observational methodologies. While both physical activity and energy expenditure are related, they differ in that physical activity is a behavior, and energy expenditure is a physiological consequence of that behavior. The distinction is important as it is not clear whether the lower physical activity level of obese youngsters is associated with a lower level of energy expenditure. Since obese youth carry more weight, one may conclude that they are less active and expend more energy. However, conclusions regarding the daily energy expenditure of obese versus non-obese youth differ according to the method of energy expenditure which was applied. Studies have found that obese have a higher gross daily energy expenditure than non-obese youth, yet when energy expenditure is expressed relative to total body weight, considerably greater values are seen in the non-obese group. And when energy expenditure is expressed relative to fat-free mass, no differences were found between the two groups (Pate, 1993).

Two large-scale surveys of physical activity behavior in American children and youth have been conducted within the past decade. These surveys include the National Children and Youth Fitness Study (Phase I) (NCYFS I) which was conducted in the mid-1980s, and the Youth Risk Behavior Survey (YRBS) which was initiated in 1990 by the U.S. Centers for Disease Control and Prevention. Both of these national surveys provided information about physical activity behavior in American youth, however, they differed in their measure of physical activity. The NCYFS I provided information on the overall physical activity patterns of youth, by determining the physical activity and physical fitness levels of youth between the ages of 10 and 17 years of age. The YRBS assessed a variety of health behaviors in American high-school students, obtaining data on the frequency of participation in structured exercise sessions. The results of the NCYFS I indicated that the typical American youth received, on the average, between one and two hours of moderate to vigorous physical activity per day. However, the inter-subject variability in this study was very large, with a significant number of youth, as many as 20%-30%, averaging less than one-half hour of physical activity per day. The conclusion of this study was further supported by the results of the YRBS survey which found that approximately 50% of male youth and 75% of female youth failed to engage in moderate to vigorous activity on a frequent basis (three or more times per week). In addition, both studies found that girls were less active than boys, and that in both genders the activity level declined with age. Therefore, both surveys concluded that while the majority of American youth appear to be reasonably active, sizeable percentages of youth have already shown signs of becoming less active and sedentary (Pate, 1993).

One hypotheses for the noted increase in obesity, due to inactivity, among children within the last 20 years, is that this increase is caused in part by watching television. Dietz, cited in Kolata (1986), reported that the strongest predictor of subsequent obesity, next to prior obesity, is television viewing. He found a relationship between obesity and television viewing consistently in three studies. Dietz's explanation of how television contributes to obesity includes the increased amount of food that children eat while watching television. He reports that they eat more of the foods advertised on television, and receive the message while watching television that they will be thin no matter what they eat, as nearly everyone on television is thin. He also reports that children who watch television are inactive. Dietz has started studies of the metabolic rates of children who watch television. For example, the first child Dietz observed was a 12 year old boy, who while watching cartoons had dropped his metabolic rate by 200 calories an hour.

Other research was conducted by Locard et al. (1992), who studied the correlation of certain environmental factors and obesity in childhood, after taking the parental history of obesity into consideration. Their sample included 327 cases and 704 controls in a population of five year old children, from two French districts (Isere and Rhone). The anthropometric assessments were completed at school, which included medical examinations, including measures for height and weight, data from personal health records, and interviews with the parents. Obesity was defined as a weight for height greater than or equal to 2 standard deviations. The data collected included parental overweight and child birth overweight as "constitutional" factors and family structure, socio-economic level, and daily lifestyle (sleep, TV viewing, after school care, etc.) as "environmental" factors. The correlations between obesity at age five, constitutional factors, and environmental factors were statistically analyzed. The results of the study confirmed that parental overweight and birth overweight were closely related to the child's obesity at five years of age. The environmental factors which were found to correlate to childhood obesity included, southern European origin of the mother, snacks, excessive television viewing, and short sleep duration. They found that children who slept less than 10 hours a day were 4.9 times more likely to be obese by the age of five than children who slept more than 12 hours a day. Therefore, they concluded that the less a child sleeps, the higher the risk for obesity by the age of five. In respect to television viewing, they found that children who viewed television more than four times a day were 2.1 times more at risk of being obese. They also found that the more children watched television, the higher the risk for obesity by age five. They concluded from their study that modifications should be made in child care practices, in the prevention of obesity in children.

Emotional

For years obesity has been viewed as a disorder with strong behavioral determinants--"psychopathology manifested as overeating" (Wadden & Stunkard, 1987, p. 163). The obese were believed to overeat in a response to negative feelings, or in response to the lack of satisfactory interpersonal relationships. Food was seen as a source of comfort in the absence of other sources of solace. However, today these views have changed. Today when psychopathology is observed in obese individuals, it is seen as a consequence rather than a cause--a consequence of prejudice and discrimination to which the overweight are subjected to daily. This has also been supported by Rodin (1981), cited in Beck and Terry (1985), who has argued that "psychopathology", that may be associated with obesity, stems from society's reaction to fatness and the consequent rejection experienced by obese individuals, and not necessarily from psychological disturbances found within the individual" (p. 55).

The shift for a thinner ideal body shape in developed societies has led to negative attitudes and a pervasive stigmatization of obesity. These societal attitudes have led to an increased perception of body image, and have also raised question regarding the correlation between body image and self-esteem. Numerous studies have been conducted assessing probable correlations, but findings have shown mixed results. Stager and Burke (1982) conducted a study to determine the existence of body build stereotypes, the extent of identification with these stereotypes, and the effect of any identification upon a child's self-evaluation. Their sample included 406 Caucasian children, in grades four to eight, from a middle-class midwestern community. The children completed the Piers-Harris Children's Self Concept Scale, semantic differential ratings of the Global self-concept, and body build concepts of "skinny girl", "fat girl", "skinny boy", and "fat boy", and situationally specific self-concepts of "myself in the classroom", "myself at lunch/recess", and "myself when looking in a mirror". Measures of weight and height were obtained using a standard weighing scale and wall chart. And statistical techniques included differential and discriminant analysis. Their study verified the existence of a "fat child", "skinny child" stereotype, which was apparent across the sex groups and age groups studied. Fat children were described as stronger, braver, less good looking, more often teased, and having fewer friends than skinny children. They also found that actual fatness was generally related to identification, but not strongly so. This identification was even noted in children of a young age, suggesting an internalization of societal attitudes of body build even at a very young age. Also, low self-esteem was found to be concurrent with identification, regardless of the child's actual weight-to-height ratio.

In a study conducted by Wadden, Foster, Brownell, and Finley (1984), self-concept was compared between obese and normal-weight children. Their study replicated a previous study by Sallade (1973) who found that obese children had significantly lower self-esteem, as measured by the Piers-Harris Children's Self-Concept Scale, than did their normal weight peers. Wadden et. al. (1984) measured the heights and weights of 716 caucasian children in grades three to eight. Each child's percentage of ideal weight was calculated accounting for age, sex, and height. Children who were 20% or more over their ideal weight were classified as obese, while control subjects were within 5% of their ideal weight. In the study, the obese children averaged 35.1% over their ideal weight, and the control group averaged 0.4% over their ideal weight. Subjects from each group were matched for grade, sex, and height, and the grades were combined in the analysis, reducing the number of grades from six to three. Data were analyzed using a 2 X 2 X 3 ANOVA, factoring weight, sex, and grade. The self-concept scores in the study were 55.0 for the obese children and 58.1 for the normal weight children, a difference which was not considered statistically significant. However, the results of the Wadden et. al. (1984) study were similar to the Sallade (1973) study in which the self-concept scores were 52.2 for the obese children and 55.6 for the normal-weight children. However, further study was recommended by Wadden et al. (1984).

In another study conducted by O'Brien, Smith, Bush, and Peleg (1990), the relationship between obesity, health locus of control, and self-esteem was explored. They conducted a three-year longitudinal study of 1,003 urban black children, ages 9 through 12, from the District of Columbia public schools. The schools were selected randomly, and represented students in the middle to lower socioeconomic status range. Data were collected two times during the study, beginning when the children were in grades four to six, and then again when the children were in grades eight to ten. During each of these two times, subjects were classified as being either obese or non-obese. And from Time 1 to Time 2 subjects were categorized as remaining the same, or either changing from obese to non-obese or from non-obese to obese. Measures used for the study included the Children's Health Locus of Control scale (CHLC) and the Rosenberg Self-Esteem scale (SE). Height and weight measurements were collected with the use of a medical scale in which both height and weight were measured to the nearest 0.25 inch/pound. These measures were then duplicated and averaged to calculate excessive overweightness. Subjects with weight equal to or greater than 120%, based on age, gender, and height were classified as obese. This included 19.4% of the sample at Time 1, and 22.6% of the sample at Time 2. Analysis for the study included Pearson correlations, analyses of variance (ANOVA's), and multiple regression models. They found that self-esteem and locus-of-control improved across the entire sample. And multiple regression analyses indicated that baseline self-esteem was associated with decreased ponderosity only for subjects who changed from obese to non-obese. O'Brien et al. (1990), therefore concluded that feeling good about oneself contributed to the subject's ability to improve their obesity status, and that improving self-esteem may be a precursor to reducing obesity among some adolescents. However, continued research was recommended.

In a study by Cohen, Klesges, Summerville, and Meyers (1989), the influence of body weight on sociometric nominations and sociometric ratings by first, third, and fifth graders were assessed. Their sample included 43 first graders, 47 third graders, and 46 fifth graders, from a middle class public elementary school, with a racial balance of approximately 50% white and 50% nonwhite children. The children completed sociometric nominations and ratings. For the nominations task, the children were given a class roster and asked to nominate three children for each of six categories, which included: most liked and most disliked in the classroom, on the playground, and to sit with. For the ratings task, the children rated their liking of each classmate using a five-point Likert scale. Through assessment of the nominations and ratings, they found less liking (but not disliking) of overweight peers among first and third grade males, while weight did not appear to influence the decisions of fifth graders. Cohen et al. (1989) concluded that their results call into question the validity of a social stigma often assumed to be associated with overweight children. Even though they did not find sociometric choices to be related to weight status with increasing age, weight status may be found to influence the quantity and/or quality of social interactions among peers. However, further study would be needed.

Families where obesity is prevalent have also been associated with psychological dysfunction. Beck (1985) conducted a study to assess the psychological characteristics of obese and normal-weight families. Beck recruited eight obese families (parents and children) and eight nonobese families (parents and children), with children aged from 8 to 12 years. In his study, Beck utilized home observations, the Family Environment Scale (FES), psychiatric evaluations, and interviews. In addition, a previously collected sample of 285 families' psychological characteristics (over 1,100 individuals), were included in the study to serve as a normative barometer from which to compare the obese and nonobese families. Beck found that the obese families generally perceived their families differently in comparison to the normal-weight families, and the representative families. The obese families appeared to be less supportive, more conflictual, less self-sufficient and active, and less organized, and more controlling than the nonobese families. These differences between the obese and nonobese families did not appear to be related to the parents marital status. Also, the identified overweight and lean children did not differ in their perceptions of their families when compared to their siblings. Beck therefore concluded from his study that obese families have problematic characteristics. However, these findings do not address the question of whether obesity creates problematic family characteristics or certain characteristics found in families promote obesity. These results are considered preliminary, and replicative studies are needed.

In the interdisciplinary study of adolescent obesity by Hammar et al. (1972), different parental and family characteristics were found between the obese and nonobese adolescents. The obese adolescents appeared to occupy a unique position in their families. They were often a focus of parental conflicts, a source of embarrassment, and a scapegoat for their siblings. The parents did not feel that there was a warm, open, comfortable relationship between the obese adolescent and the family. The parents tended to view the prognosis for successful weight reduction as hopeless and offered minimal support to the adolescent in coping with his weight. Also, a low body image, low self-esteem, depression, and social isolation were noted among the obese group of adolescents.

Socioeconomic Status

Another variable of obesity which has recently received attention is socioeconomic status (SES). Sobal and Stunkard (1989) reviewed 144 published studies of socioeconomic status and obesity in developed and undeveloped societies. They found that the relationship between SES and obesity differs between developed and developing societies, differs within developed societies, and differs between men and women. In developing societies, they found that obesity was positively related to SES among men, women, and children. Obesity is rare in these countries due to an insufficient food supply and high levels of energy expenditure, however, the prevalence of obesity increases with rising wealth and increased food availability. In developed societies, by contrast, a strong inverse relationship was found between weight and SES for women, but not for men or children.

Sobal and Stunkard (1989) also reviewed the social attitudes toward obesity and thinness in different societies, and found them to be congruent with the distribution of obesity by SES. They found four variables which may mediate the influence of attitudes toward obesity and thinness among women in developed societies, resulting in the inverse relationship between SES and obesity. These variables include dietary restraint, physical activity, social mobility, and inheritance.

Brain Related Influences on Weight Change

The neuroendocrinological foundations of appetite and satiety have been investigated, and multiple theories of appetite have been proposed based on the use of metabolic signals to the hypothalamus. Work with lesions to the hypothalamus has indicated that the nucleaus is associated with satiety, while hunger is related to the lateral area of the hypothalamus. It is speculated that continued work in this area will reveal different subtypes of obesity which are related to various biochemical lesions of the hypothalamus (Maloney & Klykylo, 1983).

Applications

There are a number of areas of promise for investigation in the six major determinant areas of obesity, i.e. genetics versus environment, development, energy intake and energy expenditure, emotional, socio-economic status, and related brain influences on weight change. Such a multidimensional determinant structure logically requires a multi-factored research approach. Therefore, this study will focus on selected psychological, physical fitness, and social variables, including self-concept, psychological and health locus-of-control, nutritional knowledge, food choices, and physical fitness measures to determine whether these variables can reliably and significantly distinguish between groups of overweight and regular to underweight adolescents. The literature has suggested that these variables offer some contribution to obesity, but not without controversy. Therefore, by conducting a multi-variate study of the above listed variables, additional knowledge may be gained which may prove advantageous in the assessment and program treatment of obesity.

Most weight treatment programs have focused on diets, appetite suppressants, exercise programs, therapy, and behavior modification. Unfortunately, the majority of these programs have proven unsuccessful in weight loss maintenance. Current program strategies which prove most effective include those which integrate several program strategies. To date behavioral intervention has proven to be the most effective non-medical treatment to weight change. Although a multitude of strategies to educate parents and children about the value of a proper diet to ameliorate obesity have been attempted, most have proven unrewarding.

The school has increasingly been recognized as an ideal environment for the prevention and treatment of obesity. Unlike other generally accepted societal institutions, the school has daily contact with children over long periods of time, is cost-effective, facilitates early identification and treatment, has the potential for reaching large numbers of people, and includes important social aspects of the childs environment (Wolf, Cohen, & Rosenfeld, 1985). To date, school-based intervention strategies have primarily focused on three main areas, including behavioral modification, physical activity, and dietary management/nutrition education (Wolf et al. 1985).

Behavioral approaches to childhood and adolescent obesity emphasize modification of eating and exercise behaviors in relation to the child's immediate environment. These approaches may include modeling, or instructing methods for modifying specific aspects of the child's personal, social, and physical environment as a means of modifying energy intake and expenditure, teaching self-monitoring skills, establishing contracts, providing reinforcement or incentives, and providing motivation and social support from peers, school personnel, and parents. These approaches are most beneficial when implemented early and consistently across environments. And it has been found that school-based programs which incorporate behavioral approaches emphasizing modification of eating and exercise behaviors have been notably successfully in promoting weight loss (Wolf et al., 1985).

Physical activity and dietary management/nutrition education are both crucial factors in determining whether students lose weight, and more importantly, whether they maintain their weight loss. However, it has been determined that implementing either of these approaches alone may be ineffective, promote minimal weight reduction, or provide short term results (Wolf et al. 1985). Therefore, it is recommended to include both components in a more comprehensive approach, and to include both maintenance or relapse-prevention procedures as well as long-term follow-up, in the treatment and prevention of obesity.

School psychologists, along with school health personnel, are in an excellent position to promote effective weight change. They have frequent, systematic, and continual contact with children over an extended period of time. And they can enlist the assistance of important social support systems such as school personnel, the children's teachers, family, and friends in a collaborative effort. The school psychologist's role in this collaborative effort may include that of a facilitator, behavioral consultant, problem solver, counselor, and research analyst. These roles may be utilized at an administrative level, a staff level, or at a student level, and may also be utilized with parents and families. Although a multi-faceted approach has proven most effective in the prevention and treatment of weight loss, it is rarely considered or addressed within the school environment. A challenge for today's schools would be to first identify obesity as a serious problem with attributable health and psychological difficulties, educating school personnel and families, and teaching multiple strategies for effective weight management.

CHAPTER III

METHODOLOGY

The purpose of this study was to determine whether selected psychological, physical fitness, and social variables can reliably and significantly distinguish between groups of regular weight or overweight adolescents. This chapter starts with a description of the subjects who participated in the study, and then turns to a discussion of each of the measures which were used in the study; height and weight measures, skinfold measures, the Piers-Harris Children's Self Concept Scale (PHCSCS) (Piers & Harris, 1984), the Nowicki-Strickland Locus-of-Control Scale (CNS-IE) (Nowicki & Strickland, 1973), the Multidimensional Health Locus-of-Control scale (MHLC) (Wallston et al., 1978), the Food Choice Inventory (National Dairy Council, 1985), the Wisconsin NET Nutrition Knowledge Test for students (Evans, 1981a), and the physical fitness measures on the AAHPERD physical fitness test (AAHPERD, 1980). The chapter concludes with a description of the procedures which were used in the study.

Subjects

The subjects were 10th, 11th, and 12th grade students ($\underline{N}$ = 128) who attended a university laboratory school in a predominately white middle class metropolitan area in Iowa. The subjects ranged in age from 15 to 18 years of age; 70 were males and 58 were females. In addition, 27 of the participants in the study were classified as overweight and 83 of the participants were classified as normal to underweight. Participation in the study was voluntary and informed consent was obtained from all subjects (see Appendix B).

Attrition occurred from the available subject pool to the final group of subjects upon whose data the analysis was performed. The school had a population of 150 in the combined 10th, 11th, and 12th grades. Twenty-two students chose not to participate and there was no way to determine the reasons for their non-participation given the procedure approved by the University's Human Subjects Review Committee. Of the 128 subjects who chose to participate, 18 were deleted by the computer because of missing data.

Of the 18 deleted from the analysis, nine were from the overweight group and nine were from the regular/underweight group. Of the 18, eight subjects (four in each weight group) were absent from school on a data gathering day and the school year ended before additional data gathering days could be organized. There was no pattern to the data missing from the other 10 subjects.

After reviewing the 18 profiles for students with missing data, the researcher concluded that there was no systematic bias created by the deletion of the 18 subjects. The subjects in the analysis should be a representative sample of the available school census.

Instruments

Measures of Height/Weight

Measures of height and weight were taken of all subjects. These height/weight measures were then converted to centimeters and kilograms, and were plotted on physical growth charts developed by the National Center for Health Statistics (NCHS) for children in the 2 to 18 year of age interval (Hamill et al., 1979).

Growth charts are based on the distribution of height and weight values for children in a reference population. The National Center for Health Statistics' (NCHS) reference population is based on well-controlled body measurements data on children in the United States, and is the most widely one used (Robbins & Trowbridge, 1995). Therefore; plotting anthropometric values for an individual child on the charts indicates where the child ranks relative to all contemporary United States children of the same age and sex.

Growth curves based on these data have been developed by NCHS in the form of seven smooth percentile curves (5, 10, 25, 50, 75, 90, and 95). These smoothed percentile curves are sex-specific, and are produced for body weight-for-age and body stature-for-age. The relationship of percentile curves of body weights for associated stature is expressed by simultaneously plotting of the two measurements to create a percentile distribution of weight-for-stature. A disproportion between height percentile and weight percentile, where weight is 25 percentiles greater than height-for-age, places a child at nutritional risk for being overweight (Goldberg, 1995). This criteria was used in the study to categorize each subject into a weight group of overweight or normal weight to underweight. These curves are based on accurate measurements made on large nationally representative samples of children, and have proved to be highly useful for both clinical and public health use. They are commonly used to improve the assessment, evaluation, and identification of potential health and nutritional problems due to unusually low or high values for weight or stature, and to facilitate the comparison of growth and development of one group of children with others (Hamill et al., 1979).

The United States NCHS percentile curves for assessing physical growth of children were based on a large nationally representative probability sample, designed jointly by the NCHS and the United States Bureau of Census. The data consists of accurate measurements made on children from birth to 18 years of age and are mainly cross-sectional. Data includes measurements on all ethnic, geographic, and income groups, using standardized techniques, and provides reliable population estimates of the attained growth of children in the United States for these ages (Hamill et al., 1979).

All the data used for this older age interval were compiled by NCHS from three sources: Values collected during the Health Examination Survey (HES) Cycle I (1963-1965) for ages 6 to 11: HES Cycle II (1966-1970) for ages 12 to 17; and the first National Health and Nutrition Examination Survey NHANES I (1971-1974) for ages 2 to 17 (Gibson, 1990). This procedure made it possible to obtain the desired information efficiently and in such a manner that the statistical reliability of results was determinable. These factors, together with the fact that the examination and measurement processes were highly standardized and closely controlled, enabled the results of the surveys to describe the entire population of the United States on the basis of relatively small samples. In these three cycles, over 90% of the children in the initial probability sample were actually examined which resulted in a raw n of over 20,000 subjects--but the careful application to these data of the statistical sampling weights has resulted in an effective representation of almost 70 million children in the United States, ages 1 to 18 years (Hamill et al., 1979).

The World Health Organization has recommended the National Center for Health Statistics (NCHS) reference growth data as an international standard for comparisons of health and nutritional status of children among countries. The NCHS data are also highly recommended because they met most of the criteria suggested by the International Union of Nutritional Sciences for ideal reference data (Gibson, 1990).

Measure of Skinfolds

Skinfold measures were taken on all subjects following standard testing procedures outlined in the test manual of the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD, 1980). The AAHPERD Health Related Physical Fitness Test recommends the use of two skinfold fat sites (triceps and subscapular) for this test as both are easily measured and are highly correlated with total body fat.

> The triceps skinfold is measured over the triceps muscle of the right arm halfway between the elbow and the acromion process of the scapula with the skinfold parallel to the longitudinal axis of the upper arm. The subscapular site (right side of body) is 1 cm (1/2 inch) below the inferior angle of the scapula in line with the natural cleavage lines of the skin. (AAHPERD, 1980, p. 11)

The recommended testing procedures for measuring these skinfolds includes firmly grasping the skinfold between the thumb and forefinger to lift the subcutaneous adipose tissue to form a skinfold. The skinfold fat measure consists of a double layer of subcutaneous fat and skin. This thickness is then measured with a skinfold fat caliper. The caliper is placed at a point on the fold where true double thickness of skinfold fat exists, which is approximately mid-way between the crest and base of the skinfold. The contact surfaces of the caliper should be placed 1 cm (1/2 inch) above or below the finger from the point where the skinfold is held. The grip on the calipers is then slowly released, which enables the caliper to exert full tension on the skinfold. The skinfold measures are then read to the nearest 0.5 millimeter once the needle on the caliper stops. This should be one to two seconds after releasing the grip on the caliper. The skinfold measurement is then registered on the dial of the caliper. Each measurement is taken three consecutive times with the recorded score being the median of the three scores. A sum of the two skinfold median measures is then tabulated and compared with percentile norm tables for interpretation to evaluate the level of fatness in school age boys and girls. However, the exact relation of skinfold fat to body fatness in children has not yet been fully documented. While skinfolds are known to be related to body fatness in children, the absolute amount of body fat cannot be determined with certainty, as the relation of skinfold fat to body fatness changes in children with sex and age as they advance in maturity (AAHPERD, 1980). Thus, a given skinfold thickness does not correspond to the same body fat content for 7-years-olds as for 17-year-olds. However, at the present time the national percentile norms provide the best frame of reference for interpretation of skinfold fat results.

The validity of skinfolds was determined by correlating skinfolds with hydrostatic weighting, an accepted and valid method used by scientists to measure the degree of body fatness. The correlations (i.e., validity coefficients) between these two measures consistently ranged from 0.70 to

0.90 in both children and adults. Also, test-retest reliability of skinfold fat measures have been found to exceed 0.95 in experienced testers (AAHPERD, 1980).

Percentile norms for these measures were developed from a national sample of over 12,000 children and youth who ranged in age from 6 to 17 years of age. The percentile value reflects the percentage of boys and girls in the national sample who had or exceeded that skinfold thickness. The criterion for a desired degree of fatness for children is above the 50th percentile. When children are below the 50th percentile but above the 25th percentile they are considered to be at a desirable level for body fatness. However, for those below the 25th percentile, a high degree of fatness is reflected and a reduction in body fatness is encouraged to reach a more desirable level (AAHPERD, 1980).

Self-Concept

All subjects completed the Piers-Harris Children's Self Concept Scale (PHCSCS), subtitled The Way I Feel About Myself, (Piers & Harris, 1984). The PHCSCS is an 80-item self-report questionnaire designed to assess how children and adolescents in grades 4 through 12, (ages 8 to 18), feel about themselves. It is a paper-and-pencil test designed to be administered individually or in small groups, and in most instances takes 15 to 20 minutes to administer. Children taking the test mark either a "yes" or "no" in response to each of the 80 statements given, reflecting whether or not the statement is true most of the time. A score is then determined by the number of items checked in the direction of positive self-concept.

Self-concept, as assessed by this instrument, is defined as "a relatively stable set of self-attitudes reflecting both a description and an evaluation of one's own behavior and attributes" (Piers & Harris, 1984, p. 1). The Piers-Harris focuses on children's conscious self-perceptions, rather than attempting to infer how they feel about themselves from their behaviors or the attributions of others.

The total raw score is the total number of responses marked in the positive direction. The total raw score can also be converted to percentiles or stanines to aid in interpreting the scale. However, the most reliable measure with the best research support is the total score. The total score has a possible range of 0 to 80, and reflects the number of individual items which were responded to in the direction of positive self-concept. Thus, a high total score on the scale indicates a favorable self-concept (i.e., a high degree of self-esteem or self-regard), whereas lower scores are associated with lower self-concept.

The Piers-Harris appears to be a highly reliable instrument. Researchers studying reliability reported test-retest reliability at 0.77 and internal consistency from 0.88 to 0.93 (Piers & Harris, 1984). In addition, the validity coefficients of the Piers-Harris when compared to other scales designed to measure similar constructs have ranged from 0.32 to 0.85 (Piers & Harris, 1984).

Psychological Locus-of-Control

All subjects completed the Nowicki-Strickland Locus-of-Control Scale for Children (CNS-IE) (Nowicki & Strickland, 1973) (see Appendix C). This scale was developed to be a generalized measure of internal-external beliefs, or generalized expectancy of control in children. The scale is a paper and pencil measure containing 40 yes-no questions. The items describe reinforcement situations across interpersonal and motivational areas such as affiliation, achievement, and dependency. A score is determined by totaling the number of items marked in the external direction. The higher the score the more external the orientation. In addition, research with this measure has suggested that locus-of-control becomes more internal with age (Nowicki & Strickland, 1973).

Split-half correlations for the scale ranged from 0.63 to 0.81, and test-retest reliabilities over six week periods were from 0.63 for third graders, 0.66 for seventh graders, and .71 for tenth graders (Halpin & Ottinger, 1983; Phares, 1976). Also, correlations between the Nowicki-Strickland Scale for Children (CNS-IE) and other locus-of-control measures have shown to be significant: 0.31 and 0.51 with I+

scale of the IAR, 0.41 with the Bialer scale, and 0.61 and 0.38 with the I-E Scale (Phares, 1976).

Health Locus-of-Control

All subjects completed the Multidimensional Health Locus-of-Control (MHLC) Scale (see Appendix D). This scale was developed from the original Health Locus of Control (HLC) scale, developed by Wallston, Wallston, Kaplan and Maides (1976), cited in Wallston et al. (1978), as a unidimensional measure of people's beliefs that their health is or is not determined by their behavior. The original 11-item HLC scale distinguished persons with high scores as "health-externals" who were presumed to have generalized expectancies that the factors which determined their health were such things as luck, fate, chance, or powerful others, factors over which they had little control. And the other end of the dimension identified "health-internals" who believed that the locus of control for their health was internal, and that one stays or becomes healthy or sick as a result of his or her own behavior.

However, in review of the HLC scale, the conceptualization of locus of control as a unidimensional construct was questioned, as it was argued that by assessing more than one equivocal dimension of health locus of control, the probability of increasing understanding and prediction of health behaviors could be increased (Wallston et al., 1978). Therefore, the MHLC was developed, which included three eight-item Likert-type scales to measure generalized locus of control beliefs. These three dimensions of health locus of control beliefs include: internality (IHLC), a belief that one has personal control of ones own health; powerful others (PHLC), a belief that one's health is controlled for the most part by others, particularly doctors, nurses, and other medical experts; and chance or fate (CHLC) externally, a belief that health or illness is mostly a matter of luck or chance. The items in this scale utilize a six-point Likert-type format, ranging from "Strongly Disagree" (scored as one) to "Strongly Agree" (scored as six). The higher the score the more external the belief in locus of control.

The Cronbach Alpha reliability for the MHLC Scales six-item form ranges from 0.673 to 0.767. In addition, correlations in the predicted direction of the MHLC scales with health status has provided some evidence of predictive validity. However, the extent of the validity and reliability of this instrument is still not fully known (Wallston et al., 1978).

Knowledge of Nutrition

All subjects completed the Wisconsin NET Nutrition Knowledge Test, revised for the intermediate level, which was developed by the Wisconsin Nutrition Education and Training Program (NET) (see Appendix E) to provide an adequate measure of student nutritional knowledge (Evans, 1981a). The intermediate level test is a revision of the teacher knowledge test which was initially developed in 1980 to assess public and private elementary school teacher's and public school food managers nutrition knowledge, and to ascertain their opinions on various topics related to nutrition knowledge (Evans, 1981b). This initial test was also used as baseline data collection for the student knowledge test. The student knowledge test was developed from the same general objectives as the teachers' test, but was modified to a level suitable for sixth grade students. The test was also used with a sample of tenth grade students to provide an estimate of knowledge gain and attitude changes which occur from the sixth to tenth grade period. The tenth grade sample identified high schools from twenty-four districts using a probability-proportional-to-size selection procedure, in which a representative cross-sectional sample was randomly selected. The knowledge test consists of 40 multiple-choice items based on general behavioral objectives reflecting what a sixth grader should be able to do or say in order to demonstrate that he or she can make informed food choices. These same items were used at both the sixth and tenth grade levels to determine any changes in the overall scores and individual test items between grade levels. It was found that the typical gain from the sixth to tenth grade of students answering a test question correctly was 14% (Evans, 1981a).

Test validity of the initial Wisconsin NET Nutrition Knowledge Test was shown to have a good relationship between predictors of nutrition knowledge and nutrition knowledge test scores. Also, reliability coefficients were calculated using the Kuder-Richardson Formula 20 calculation method, in which the reliability coefficients ranged from 0.67 to 0.79. An item analysis was also performed for each test (Evans, 1981a; Evans, 1981b).

Food Choice Inventory

All subjects completed the Food Choice Inventory: A Test of Food Choice Behaviors For Students in Junior and Senior High School and Adults, by the National Dairy Council and University of Illinois at Chicago (1985) (see Appendix F). The Food Choice Inventory is a 40-item paper and pencil instrument that can be easily administered in 4 to 10 minutes, and also can be easily hand scored. The 40 food items of the inventory are classified into two categories of high and low nutrient value, in which high nutrient-value foods supply a greater proportion of nutrients in relation to calories, while low nutrient-value foods supply a lesser proportion of nutrients in relation to calories. The Food Choice Inventory was designed for students to select from one of three response options for each of the 40 foods listed. These options include foods they will eat, foods they would like but try not to eat, or foods they will not eat. However, due to an unfamiliarity of some of the foods listed for this region, a fourth response option was added, in which student's could mark "I don't know" for unfamiliar foods or for any indecisiveness in selection. These food selections in each of these response options can then be analyzed in two ways, by either analyzing all 40 food items, and by analyzing the foods by their nutrient value. This information, with the additional response option, yields a total of 12 scores or sets of information for each of the scales in the Food Choice Inventory.

The Food Choice Inventory also holds strong psychometric properties. The instrument was pilot tested several times, and was field tested in its present form as part of a national curriculum study. Through analysis, the Food Choice Inventory was found to be a valid measure of food choice behavior which was evidenced by strong relationships between the inventory's data and that of four other indicators. These include an intermethod agreement between the Food Choice Inventory and food model sort which was 97.5% out of a possible 100%, a Pearson correlation between the inventory and the printed menu selection which was a perfect 1.0, a Pearson correlation of 0.5 between the Food Choice Inventory and actual food selection, and a mean proportion of agreement of 85.1% out of a possible 100% between the inventory and actual food consumption. Cronbach's alpha, a measure of internal consistency, was used to assess reliability of the inventory. A reliability coefficient above 0.68 was considered desirable for an instrument that measured behavior. The Food Choice Inventory exceeded the desired level in eight out of nine reliability coefficients for each of the nine scales in this instrument. Since the psychometric properties of the Food Choice Inventory are so strong, as many as five items can be added to the instrument without altering the properties below acceptable levels (National Dairy Council, 1985).

In scoring the instrument, raw scores are converted to percentages which are then computed into individual or group averages. The scores can then be used to interpret current food choice behaviors as well as desirable and undesirable food choice behaviors. And if the inventory is used in both a pre and posttesting situation, the direction of food choice changes can also be interpreted.

Physical Fitness

All subjects completed a health related physical fitness test, by the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD, 1980), which included a measure of skinfolds to determine body composition, a one mile walk/run to measure aerobic endurance, a test of sit and reach to measure flexibility, and sit-ups and pull-ups to measure muscular strength and endurance. The results from each of these tests are then compared with standardized percentile norms for gender and age, which are used for evaluating a student's level of physical fitness. The percentile rank represents the percentage of students who scored at or below the provided test scores, with the larger percentiles representing higher levels of physical fitness.

The administration of the mile run test, which measures maximal functional capacity and endurance of the cardiorespiratory system, includes each of the following standardized procedures (AAHPERD, 1980). Students are instructed to run one mile in the fastest possible time. Walking is permitted in this measure; however, the objective is to cover the distance in the shortest possible time. The mile run can be administered on a 440-yard or 400 meter track or on any other flat, measurable area. Students begin on the signal, "ready, start." As they cross the finish line, the elapsed time is called to the participants. The mile run is then scored to the nearest second.

The one-mile run is a valid field test of cardiorespiratory function and performance because it is related to maximum oxygen intake and other physiological parameters of cardiorespiratory function, and provides an index of the participant's ability to run distances. Norms for this test were established from data collected on over 12,000 students in 13 states. In interpreting the results of this measure, it is recommended that students who score below the 25th percentile receive special attention and be encouraged to improve their distance runs. And it is recommended that those who score below the 50th percentile be encouraged to perform up to the median. However, caution should be used in interpreting the results, as the running test is not entirely determined by cardiorespiratory function. Other contributing factors include genetic potential (heredity), body composition, efficiency, effort, and maturity. Thus, the results not only reflect cardiorespiratory fitness, but also reflect inherited characteristics, running skill, relative leanness, and motivation to do well (AAHPERD, 1980).

The administration of the sit and reach test, which evaluates the flexibility (extensibility) of the low-back and posterior thighs, includes each of the following standardized procedures (AAHPERD, 1980). To assume the starting position, students remove their shoes and sit down with their knees fully extended and their feet placed flat and shoulder-width apart. To perform the test, the arms are extended forward with the hands being placed on top of each other. The student reaches directly forward, palms down, along a measuring scale four times, and holds the position of maximum reach on the fourth trial which must be held for one second. The raw score is the most distant point reached on the fourth trail measured to the nearest centimeter.

In assessing the reliability and validity of this test, the sit and reach test has been validated against several other types of flexibility tests. The coefficients obtained have generally ranged between 0.80 and 0.90. Also, the measure has a logical validity in that one must have good extensibility in the low-back, hip, and posterior thigh in order to achieve a good score on the test item. Reliability coefficients for the sit and reach test have been high, ranging above 0.70. Norms for the sit and reach test were established from data secured from 12,000 school age children in 13 states. In interpreting the scores of this measure, scores above the 50th percentile are considered a normal level of flexibility. And those students who score below the 25th percentile are shown to have a critical lack of flexibility (AAHPERD, 1980).

The administration of the sit-up test, which evaluates abdominal muscular strength and endurance, includes each of the following standardized procedures (AAHPERD, 1980). To assume the starting position, the student lies on his/her back with knees flexed, feet on the floor, and heels placed between 12 and 18 inches from the buttocks. The arms are then crossed on the chest with the hands on the opposite shoulders. The feet are held by partners to keep them on the testing surface. The student, by tightening his/her abdominal muscles, curls to the sitting position while maintaining arm contact with the chest. And the chin is to remain tucked on the chest. The sit-up is completed when the elbows touch the thighs. To complete the sit-up the student returns to the down position until the midback makes contact with the testing surface. A timer gives the signal "ready-go," and the sit-up performance is started on the word "go." Performance is stopped on the word "stop." The objective is to perform as many correctly executed sit-ups as possible in the 60-second time period. The number of correctly executed sit-ups performed in 60 seconds is the raw score.

The validity of the sit-up test has been determined from evidence from studies of muscle activity during the execution of a sit-up. These studies have shown that abdominal muscles are being utilized during the execution of the test. The reliability of sit-up tests have shown to be generally satisfactory; the test-retest reliability coefficients have ranged from 0.68 to 0.94. Norms were based for this test on data secured from 12,000 school age children in 13 states. Scores are interpreted by comparing the raw score with the standardized norm tables. Students who score below the 50th percentile are encouraged to improve their abdominal strength and endurance in addition to low back, hip, and posterior thigh flexibility. And this is most critical for those students who score below the 25th percentile (AAHPERD, 1980).

The administration of the pull-up test, which also measures strength and endurance in the shoulder area, included each of the following steps. Students are instructed to pull themselves up on a bar with palms faced away from the body. Students are to pull themselves up, with their chin extending above the bar. Their arms are then to be fully extended before the next pull-up is executed. The raw score is the total number of pull-ups executed within the established criteria. The raw score is then compared to a standard score. The standard score for females from age 15 to 18 is one, and the standard score for males from age 15 to 18 is five. In interpreting the score, any score which falls below the standard score for age and gender indicates an area of concern.

Procedures

During the spring semester of the 1994-1995 academic school year, measures were taken of the participants self-esteem, psychological and health locus-of-control, knowledge of nutrition, food preferences, physical fitness, skinfolds, and height and weight, to determine any relationship that would distinguish overweight and normal weight children. These measures were collected during two separate phases of data collection during a series of physical education classes for 10th, 11th, and 12th grade students at the laboratory school. The first phase was completed in eight classes over the course of two days, and the second phase was completed in 16 classes over the course of four days. Assistance in obtaining data was received from the Department Head of the Physical Education Program and additional physical education staff at the laboratory school.

In preparation of the data collection for the study, permission was granted from the secondary principal at the laboratory school, and parent letters (see Appendix A) were sent home with all 10th, 11th, and 12th grade students the week prior to the initial data collection. These letters explained the study to parents and students, and outlined the procedures to be administered in collecting the data in the study. The researchers phone number was also provided to answer any questions. In addition, student names were pre-assigned computer generated identification numbers to ensure confidentiality in the study. These numbers were only identifiable by the physical education staff, as the physical fitness data was also part of the regular physical education curriculum. This researcher is unable to match student names with the identification numbers assigned.

The first day of data collection in the first phase of the study, began with the researcher introducing herself to the subjects and providing a brief explanation of the study. Also, subject confidentiality was stressed, and the process of informed consent was explained and obtained. In addition, it was emphasized that participation in the study was voluntary and would not affect physical education grades. Following this, instructions were given explaining how to fill out each of the questionnaires. Questions were also addressed at this time. Testing took place in the school auditorium, and the subjects were instructed to spread out leaving at least one seat between each participant. In addition, subjects provided their own pencils and writing surface for testing. Test packets were passed out by the computer generated identification numbers to ensure confidentiality. The test packets on the first day contained a written consent as the cover letter of the packet, which subjects signed if they chose to participate in the study. This letter also gave consent to release any physical fitness data relevant to the study. The packet also contained the Piers-Harris Children's Self Concept Scale (PHCSCS) (Piers & Harris, 1984), the Nowicki-Strickland Locus-of-Control Scale (CNS-IE) (Nowicki & Strickland, 1973), and the Multidimensional Health Locus-of-Control (MHLC) Scale (Wallston et al., 1978). The subjects returned the test packets to the researcher following completion of the test items, and returned to their physical education activities.

The second day of data collection in the first phase of the study began by giving instructions on how to fill out each of the questionnaires for the second day. Any questions were also addressed at this time. Testing again took place in the school auditorium, and students were again instructed to spread out leaving at least one seat between each participant. Students provided their own pencils and writing surface for testing, and test packets were again passed out by the computer generated identification numbers to ensure confidentiality. The test packet on the second day included the Wisconsin NET Nutrition Knowledge Test for students (Evans, 1981a), and the Food Choice Inventory (National Dairy Council, 1985). Packets were again returned to the researcher following completion of the test items, and the subjects returned to their physical education activities. Students who chose not to participate in the study were instructed to bring home work on these days, and sat in a separate part of the auditorium to study.

The second phase of data collection in the study included the administration of each of the components of a health related physical fitness test, by the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD, 1980). These components included a measure of skinfolds to determine body composition, a one mile walk/run to measure aerobic endurance, a test of sit and reach to measure flexibility, and sit-ups and pull-ups to measure muscular strength and endurance. In addition, measures of height and weight were also included in this second phase of data collection. Each of these components of the physical fitness test were administered by the Department Head of the Physical Education Program and additional physical education staff at the laboratory school, during a series of physical education classes for

10th, 11th, and 12th grade students over a period of four days. Day one of the second phase of testing included the administration of the sit-ups test and the sit and reach test, day two included the administration of the skinfolds test, day three included the administration of the pull-ups test, and day four included the administration of the mile run test. All standardized test procedures were administered as outlined in the AAHPERD (1980) manual of the physical fitness test. The height and weight measures were also taken as time permitted at the end of each of the 4 days of data collection.

The sit-up test, which was administered on the first day of the second phase of data collection, took place on the stage of the school auditorium. Following standardized procedures, students were instructed to lie on their back with knees flexed, feet on the floor, and heels placed between 12 and 18 inches from the buttocks. Students were then instructed to cross their arms across their chest with their hands placed on opposite shoulders. The feet were held by partners to keep them firm on the testing surface. The subjects then performed sit-ups by tightening their abdominal muscles and curling to the sitting position, while maintaining arm contact with the chest. The chin remained tucked on the chest during the completion of the sit-up. A sit-up was considered complete when the subjects elbows touched the thighs and the subject returned to the down position, until the midback made contact with the testing surface. The subjects were given 60 seconds. A timer gave the signal "ready-go" and the sit-up performance was started on the word "go," and later stopped on the word "stop." The objective for this test was to perform as many correctly executed sit-ups as possible in the 60-second time period. This number was then recorded by the physical education staff as the raw score.

The sit and reach test, which was also administered on the first day of the second phase of data collection, was also completed on the stage of the school auditorium. Following standardized procedures, subjects were first instructed to remove their shoes and sit down with their knees fully extended and their feet placed flat and shoulder-width apart. Subjects were then instructed to extend their arms with their hands placed on top of each other. To perform the sit and reach test, the subject reached directly forward with palms down along a measuring scale four times, holding the position of maximum reach on the fourth trial. This position was then held for one second. The most distant point reached on the fourth trail, measured to the nearest centimeter, was then recorded by the physical education staff as the raw score.

Skinfold measures were taken of all subjects on the second day of the second phase of testing. These measures were taken in the weight room of the laboratory school, by the Department Head of the Physical Education Program. Standard testing procedures were followed as outlined in the test manual of the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD, 1980). These measures included two skinfold fat sites, including the tricep and subscapular regions. The triceps skinfold was measured over the triceps muscle of the right arm halfway between the elbow and the acromion process of the scapula, with the skinfold parallel to the longitudinal axis of the upper arm. The subscapular skinfold was measured on the right side of the body, 1 cm (1/2 inch) below the inferior angle of the scapula, in line with the natural cleavage lines of the skin. The skinfolds were measured by firmly grasping the skinfold between the thumb and forefinger, and lifting the subcutaneous adipose tissue to form a skinfold consisting of a double layer of subcutaneous fat and skin. This thickness was measured with a skinfold fat caliper. The caliper was placed at a point on the fold where a double thickness of skinfold fat was found, mid-way between the crest and the base of the skinfold. The contact surface of the caliper was then placed 1 cm (1/2 inch) above or below the finger from the point where the skinfold was held. The grip on the caliper was then slowly released enabling the caliper to exert full tension on the skinfold. The skinfold measures were then read to the nearest 0.5 millimeter once the needle on the caliper had stopped and was registered on the dial of the caliper. Each measurement was taken three consecutive times with the median of the three scores being recorded as the raw score.

The pull-up test, which was administered on the third day of the second phase of testing, was done in the weight room of the laboratory school. Following standardized procedures, students were instructed to place their hands on the pull-up bar with palms facing away from the body. They were then instructed to pull themselves up until their chin extending above the bar, and then fully extend their arms down before executing the next pull-up. The total number of pull-ups performed by subjects following this criteria was then recorded by the physical education staff as the raw score.

The final day of data collection in the second phase of testing included the administration of the mile run test. This test was administered on a 1/4 mile track at the laboratory school, and students were instructed to run one mile in their fastest time possible. Students began on the signal, "ready, start." The elapsed time was then called to the participants each time they made a lap around the track. The completed time was then rounded to the nearest second and recorded by the physical education staff as the raw score.

Height and weight measures were also collected during these four days of the second phase of data collection.

These measures were taken by physical education staff in the weight room of the laboratory school. Subjects were instructed to remove their shoes and step on the scale. Measured heights were recorded to the nearest half-inch, and measured weight was recorded to the nearest pound.

Following the collection of all data, the researcher scored the measures taken during the first phase of data collection. This included tabulating raw scores for the Piers-Harris Children's Self Concept Scale (PHCSCS) (Piers & Harris, 1984), the Nowicki-Strickland Locus-of-Control Scale (CNS-IE) (Nowicki & Strickland, 1973), the Multidimensional Health Locus-of-Control (MHLC) scale (Wallston et al., 1978), the Wisconsin NET Nutrition Knowledge Test for students (Evans, 1981a), and the Food Choice Inventory (National Dairy Council, 1985). In addition, raw scores which were recorded during the second phase of data collection were submitted to the researcher. All of the raw scores were then entered into the computer for analysis, using a Discriminant Function Analysis (SPSS) to determine whether the variables of self-esteem, psychological and health locus-of-control, knowledge of nutrition, food choices, and physical fitness measures could distinguish between weight groups. In determining the weight groups for analysis, the recorded height and weight measures were converted to centimeters and kilograms, and were then compared with percentile curves on physical growth charts developed by the National Center for Health Statistics (NCHS) (Hamill et al., 1979), for children in the 2 to 18 year of age interval. These percentile curves are sex specific, and are produced for body weight-for-age and body stature-for-age. By simultaneously plotting the height and weight measurements, a percentile distribution is created of weight-for-stature. Any disproportion between height percentile and weight percentile, where weight is 25 percentiles greater than height-for-age, placed the subject at nutritional risk for being overweight (Goldberg, 1995). This procedure categorized each subject into a weight group of overweight or normal weight to underweight for the analysis.

CHAPTER IV

RESULTS

The purpose of this study was to determine whether selected psychological, physical fitness, and social variables can reliably and significantly distinguish between groups of regular weight or overweight adolescents. A direct method discriminant analysis was undertaken of the variable scores of both overweight and normal to underweight children, with weight group membership as the dependent variable and selected psychological, physical fitness, and social variables as the discriminating variables of the analysis.

The discriminating variables of the analysis included the raw scores on the Piers-Harris Children's Self Concept Scale (PHCSCS) (Piers & Harris, 1984), the Nowicki-Strickland Locus-of-Control Scale (CNS-IE) (Nowicki & Strickland, 1973), the three dimensions of the Multidimensional Health Locus-of-Control scale (MHLC) (Wallston et al., 1978), the six scales of the Food Choice Inventory (National Dairy Council, 1985), the Wisconsin NET Nutrition Knowledge Test for students (Evans, 1981a), and the physical fitness measures on the AAHPERD physical fitness test (AAHPERD, 1980). The discriminating variables of the physical fitness test included sit-ups, sit and reach, triceps skinfold measures, subscapular skinfold measures, total skinfold measures, the mile run, and pull-ups.

The analysis resulted in centroids of 1.15270 for the overweight group and -0.37497 for the normal to underweight group. The canonical discriminant functions are provided in Tables 1, 3, and 5. The resulting discriminant analysis predicted group membership for five of the discriminating variables, including the three skinfold measures, one of the six scales on the Food Choice Inventory, and the mile run of the physical fitness test.

Table 1

Canonical Discriminant Functions for All Variables

Fcn	% of Variance	Canonical Corr	Wilks' Lambda	Chi Square	Sig
1*	100.00	0.5529	0.6943	35.934	0.0108

Note. * Marks the 1 canonical discriminant functions remaining in the analysis.

The discriminating variables which most strongly predicted group membership in the discriminant function was the total measure of triceps and subscapular skinfolds, the measure of subscapular skinfolds, and the measure of tricep skinfolds with coefficients of -2.68, 1.84, and 1.82

respectively. Overweight children obtained a much higher mean score on this factor. However, when the discriminant variable of gender was included in the analysis, the mean scores for males in both weight groups, was significantly higher than either of the mean scores for females. This analysis indicates that overweight males in the study measured a high degree of fatness, with the mean falling at the 10th percentile for the measure of tricep skinfold, and at the 25th percentile for the total measure of skinfolds. However, the normal to underweight group fell at the 50th percentile for the tricep skinfold measure, and at the 35th percentile for the total measure of skinfolds, which placed them at a desirable level for body fatness, scoring between the 25th and 50th percentile. However, the mean scores for females indicated that both overweight and normal to underweight groups fell well above the percentile range for a desirable level of body fatness.

The next strongest predictor to group membership was the choice of high nutritious foods which children will eat with a coefficient of -0.43. The normal to underweight groups mean score was higher than the overweight group on this factor, indicating that normal to underweight children will eat more high nutritious foods in comparison to the overweight group. However, the mean difference between groups is not significant.

And the fifth highest predictor to group membership in the discriminant function was the mile run with a coefficient of 0.35. The overweight group mean score was significantly higher on this factor, indicating that the overweight group took longer to complete the mile run with a mean of eight minutes and 58 seconds in comparison to a mean of 7 minutes and 46 seconds for the normal to underweight group.

A second discriminant analysis was done using only those five discriminant variables which were found to be predictive in the first analysis. However, the resulting discriminant analysis added very little additional information to the initial analysis. Again, the discriminating variables which most strongly predicted group membership in the second analysis was the total measure of triceps and subscapular skinfolds, the measure of subscapular skinfolds, and the measure of tricep skinfolds with coefficients of -2.00, 1.48, and 1.44 respectively. In addition, the canonical correlation in the first analysis of nineteen variables was 0.55 which compared to a canonical correlation of 0.48 in the second analysis of five variables resulting in only a slight loss of predictability (see Tables 2, 4, and 6). Therefore, the fourteen variables which were excluded in the second analysis were shown to have added very little predictability to the over-all groups discrimination.

Table 2

Canonical Discriminant Functions for Five Variables

Fcn	% of Variance	Canonical Corr	Wilks' Lambda	Chi Square	Sig
1*	100.00	0.4832	0.7666	31.503	0.0000

Note. * Marks the 1 canonical discriminant functions remaining in the analysis.

Table 3

Standardized Canonical Discriminant Function Coefficients in Analysis of All Variables

Variables	Function 1
Piers-Harris	-0.18758
Nowicki-Strickland	-0.21233
Health L-O-C - Internal	-0.42688
Health L-O-C - Chance	0.14002
Health L-O-C - Others	-0.08839
High Nutritious Foods/ Subjects Will Eat	0.30614
High Nutritious Foods/ Like But Try Not To Eat	-0.17940
High Nutritious Foods/ Subjects Will Not Eat	0.20364

table continues

Variables	Function 1
Low Nutritious Foods/ Subjects Will Eat	-0.20745
Low Nutritious Foods/ Like But Try Not To Eat	0.19105
Low Nutritious Foods/ Subjects Will Not Eat	-0.29278
Nutritional Knowledge	-0.10553
Sit-Ups	0.33101
Sit and Reach	0.15444
Tricep Skinfolds	1.81550
Subscapular Skinfolds	1.83929
Total Skinfolds	-2.68107
Mile Run	0.34611
Pull-Ups	0.33378

Note. All variables are listed in the order they were entered in the computer.

Table 4

Standardized Canonical Discriminant Function Coefficients in Analysis of Five Variables

Variables	Function 1
Total Skinfolds	-2.00241
Subscapular Skinfolds	1.43918
Tricep Skinfolds	1.48225
Mile Run	0.24192
High Nutritious Foods/ Subjects Will Eat	-0.38352

Table 5

Pooled Within-Groups Correlations Between Discriminating Variables and Canonical Discriminant Functions of All Variables

Variables	Function 1
Total Skinfolds	0.61660
Subscapular Skinfolds	0.59986
Tricep Skinfolds	0.58371
Mile Run	0.45108
High Nutritious Foods/ Subjects Will Eat	-0.33687

table continues

Variables	Function 1
High Nutritious Foods/ Like But Try Not To Eat	-0.21970
Health L-O-C - Chance	0.20051
Piers-Harris	-0.18611
Low Nutritious Foods/ Like But Try Not To Eat	0.17111
Health L-O-C - Others	-0.14117
Pull-Ups	-0.12972
High Nutritious Foods/ Subjects Will Not Eat	0.11752
Low Nutritious Foods/ Subjects Will Eat	-0.11158
Sit-Ups	0.08043
Nowicki-Strickland	0.07668
Sit and Reach	0.04375
Health L-O-C - Internal	0.04355
Low Nutritious Foods/ Subjects Will Not Eat	-0.03062
Nutritional Knowledge	0.00527

Table 6

Pooled Within-Groups Correlations Between Discriminating Variables and Canonical Discriminant Functions of Five Variables

Variables	Function 1
Total Skinfolds	0.85975
Subscapular Skinfolds	0.84207
Tricep Skinfolds	0.81425
Mile Run	0.60209
High Nutritious Foods/ Subjects Will Eat	-0.40653

CHAPTER V

DISCUSSION

This study was conducted to determine if selected psychological, physical fitness, and social variables could reliably and significantly distinguish between groups of overweight and normal to underweight adolescents, as determined through the measures of the Piers-Harris Children's Self Concept Scale (PHCSCS) (Piers & Harris, 1984), the Nowicki-Strickland Locus-of-Control Scale (CNS-IE) (Nowicki & Strickland, 1973), the Multidimensional Health Locus-of-Control scale (MHLC) (Wallston et al., 1978), the Food Choice Inventory (National Dairy Council, 1985), the Wisconsin NET Nutrition Knowledge Test for students (Evans, 1981a), and the physical fitness measures of the AAHPERD physical fitness test (AAHPERD, 1980).

Findings of Study

The results of the study were that the strongest predictors in distinguishing between weight groups were the physical measures of skinfold thickness, which included the total measure of triceps and subscapular skinfolds, the measure of subscapular skinfolds, and the measure of tricep skinfolds. However, the predictability of these measures varied with gender. Males in the overweight group obtained a much higher mean score on this factor which indicated a high degree of body fatness, in comparison to males in the normal to underweight group whose mean score indicated a desirable level of body fatness. However, no difference was found with females between groups, as the mean of both female groups fell at a desirable level of body fatness. The next strongest predictor to group membership was the choice of high nutritious foods which children will eat, as measured by the Food Choice Inventory (National Dairy Counsel, 1985). The normal to underweight groups mean score was higher than the overweight group on this factor, indicating that normal to underweight children will eat more high nutritious foods in comparison to the overweight group. However, the difference in choices which were made between groups was not significant. And finally, the fifth highest predictor to group membership in the study was the physical fitness variable of the mile run. Data from the analysis indicated that the overweight group took longer to complete the mile run than did the normal to underweight group.

Therefore, the highest predicting variables distinguishing overweight from other weight groups are variables from the physical fitness measures. This finding corresponds with the findings of Hammar et al. (1972) who found that obese subjects are less physically active than nonobese subjects; and Pate (1993) who found physical activity to be inversely correlated with adiposity. However, the remaining fourteen variables, including the psychological and social variables, added very little predictability in distinguishing between weight groups.

This finding contradicts the findings of Bellisle (1988) who studied the food intake from dietary histories of children from five corpulence groups, and found the energy value of food choices to be inversely correlated to obesity. It also contradicts the findings of Stager and Burke (1982), Wadden et al. (1984), and O'Brien et al. (1990) who found a relationship between obesity and low self-esteem. The results are also different from O'Brien et al. (1990) who concluded that feeling good about oneself contributes to a subjects ability to improve his/her obesity status. The statistical techniques which were applied in each of these studies varied as Stager and Burke (1982) included differential and discriminant analysis, Wadden et al. (1984) analyzed data using a 2 X 2 X 3 ANOVA, and the study by O'Brien, et al. (1990) included the analyses of Pearson correlations, analysis of variance (ANOVA's), and multiple regression models. In addition, each of these studies used a significantly greater sample size, as well as fewer discriminating variables. None of these studies undertook as many discriminating variables, using a discriminant function analysis, with as small a sample size, which may be a contributing factor to the discrepancy between the findings.

Implications for Practice

Considering the greater predictability of physical fitness variables in distinguishing between weight groups, as well as the very little predictability of the psychological and social variables, as found in this study, it would be advantageous to consider these differences in the development of weight management programs for children.

The school has increasingly been recognized as an appropriate environment for the prevention and treatment of childhood obesity, as the school has daily contact with children over long periods of time. Some schools even provide two meals per day to the children. To date, school-based intervention programs have primarily focused on integrating behavioral modification, physical activity, and dietary management/nutrition education to offer a more comprehensive approach to treatment. The strategies which are most often used in these approaches have included modeling, instructing methods for modifying specific aspects of the child's personal, social, and physical environment as a means of modifying energy intake and expenditure, teaching self-monitoring skills, establishing contracts, providing reinforcement or incentives, and providing motivation and social support from peers, school personnel, and parents (Wolf et al., 1985).

However, in considering the higher predictability of the physical measures in distinguishing between weight groups, it may be advantageous for health and wellness educators to place a greater emphasis on physical fitness measures in the prevention and treatment of overweight children. Physical fitness measures can be used by fitness educators by first identifying children who fall below the standardized criterion as needing special attention or individualized programming. Any weaknesses identified by the fitness measures can then be targeted in an individualized program for the student. In addition, students can monitor their own progress by either noting individual progress or by comparing their progress with that of the standardized group. By self-monitoring their progress, students may become more motivated to improve individualized scores and strengthen their identified weaknesses. In addition, health and wellness educators can educate students regarding the benefits of physical fitness for the prevention and treatment of overweightness.

While offering instruction in dietary management/nutritional knowledge may be beneficial to students, the findings in this study did not indicate any added benefits to separating by weight groups of children when educating for weight management, as both groups reponded with similar knowledge of good food choices, with no significant differences being found. In addition, the psychological and social variables identified in this study also did not distinguish between groups. This finding contradicts the prevalent view in our society of an obese personality type, in which the obese are believed to overeat in response to negative feelings, or in response to the lack of statisfactory interpersonal relationships. Instead, any psychopathology which may be associated with obesity may stem from society's reaction to obesity and the consequent rejection experienced by obese individuals, and not necessarily from psychololgical disturbances found within the inidividual. Therefore, schools can address any prejudices and discrimination of obese individuals by offering programs to educate staff, students, and parents on this issue.

In addition, school psychologists are also in an excellent position to promote effective weight change. They have frequent, systematic, and continual contact with children over an extended period of time. And they can enlist the assistance of important social support systems such as school personnel, health personnel, the children's teachers, family, and friends in a collaborative effort. The school psychologist's role in this collaborative effort may include that of a facilitator, behavioral consultant, problem solver, counselor, and research analyst. These roles may be utilized at an administrative level, a staff level, or at a student level, and may also be utilized with parents and families. Although a multi-faceted approach has proven most effective in the prevention and treatment of weight loss, it is rarely considered or addressed within the school environment. A challenge for today's schools would be to first identify obesity as a serious problem with attributable health and psychological difficulties, educating school personnel and families, and teaching multiple strategies for effective weight management.

Suggestions for Future Research

In considering future research in the determination of selected variables which can reliably and significantly distinguish overweight groups from normal and underweight groups, the following limitations of the current study should be considered. First, it is recommended that the sample size be increased both to offer more generalizability to the population as a whole and to increase the reliability and validity of the study. Stevens (1986) has recommended that the ratio of the total sample size to the total number of variables should be as large as 20 to 1 in a discriminant analysis in order to reliably interpret the results. Only the second analysis, wherein only the five highest correlations in the line were used did this study, meet Steven's suggestion.

Secondly, it is recommended that fewer discriminating variables be used, especially if the number of subjects is not large, to decrease the probability of chance in the analysis. For example, this study could have used the one total measure of skinfolds rather than the three measures. And a single measure of food choices, such as a daily food diary or journal could have been used, which might have offered a more accurate measure of food choices, rather than using multiple scales on a reflective measure of food choice behavior.

And finally, it is recommended that the problem of obesity be considered more seriously in the research and practice of school psychologists, as very little literature has been found with implications for school psychologists. For example, school psychologists can continue to research the area of obesity, not only to increase their own understanding and knowledge of obesity, and also to further educate school personnel, students, and families with current and accurate information, to aid in displaying the myths which are often associated with obesity. In addition, school psychologist can facilitate a collaborative effort in the education and intervention of obesity in the schools, by conducting inservices, assisting with the curriculum of physical health programs, and assisting in the development, implementation, and monitoring of the physical health plans of students in the prevention and treatment of obesity. And finally, school psychologists can assist by offering counseling and support to overweight students, the families of overweight students, and school personnel, as well as deterring the prejudices and discrimination which are often associated with obesity. Therefore, through the utilization of the unique role of the school psychologist, in a school environment, significant gains can be made in the education and intervention of childhood obesity.

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APPENDIX A

Parent Letter

Dear Parents, 04-20-95

As a graduate student at the University of Northern Iowa, I will be conducting a research project investigating the relationship between self-esteem, psychological locus-of-control, health locus-of-control, nutritional knowledge, food choices, and physical fitness in distinguishing between weight groups of youth. I will be giving all 10th, 11th, and 12th graders at the Laboratory School the opportunity to participate in the study. However, participation is voluntary.

Participants in the study will first be asked to complete a series of questionnaires, which will include the Piers-Harris Children's Self Concept Scale, the Nowicki-Strickland Locus-of-Control Scale, the Multidimensional Health Locus-of-Control (MHLC) Scale, the Wisconsin NET Nutrition Knowledge Test for students, and the Food Choice Inventory. These questionnaires will be administered during the student's physical fitness class, and data will be coded to ensure confidentiality.

Secondly, students will complete the (AAHPERD) physical fitness test which is already a part of the Physical Education curriculum at the laboratory school. Data which will be collected from the physical fitness test will include the one mile walk/run, the sit and reach test, sit-ups, pull-ups, and skinfold measures. Height and weight measures will also be included in the study. The procedures of the physical fitness test will be administered by the Department Head of the Physical Education program, physical education staff, and this researcher, following standard test procedures. The physical fitness test will require no more physical exertion than is regularly required in physical education class. The results of the physical fitness test will also be coded to ensure confidentiality.

Again, participation in this project is voluntary, and participation will in no way affect a student's grade in physical education. In addition, students may withdraw from participation in the project at any time.

We will initiate the research project on Monday, April 24th, 1995. It is anticipated that the questionnaires will take two partial class periods. The physical fitness test will take two to three class periods to complete.

If you have any questions about the project, please call Denise K. Volker (Department of Educational Psychology and Foundations) at 273-2321 (office) or 273-2695 (department). If you have any questions about the rights of research subjects, call the Graduate College Office at UNI (273-2748).

I will look forward to working with your student on this project.

Sincerely,

Denise Volker (Graduate student, U.N.I.)

APPENDIX B

Informed Consent

You are being asked to participate in a research project investigating the relationship between self-esteem, psychological locus-of-control, health locus-of-control, nutritional knowledge, food choices, and physical fitness in distinguishing between overweight and normal weight youth. Participants in the study will first be asked to complete a series of questionnaires, which will include the Piers-Harris Children's Self Concept Scale, the Nowicki-Strickland Locus-of-Control Scale, the Multidimensional Health Locus-of-Control (MHLC) Scale, the Wisconsin NET Nutrition Knowledge Test for students, and the Food Choice Inventory. These questionnaires will be administered during a common class of the participants, and data will be coded to ensure confidentiality. Secondly, students will complete the (AAHPERD) physical fitness test which is already a part of the Physical Education curriculum at the laboratory school. Data which will be collected from the physical fitness test will include the one mile walk/run, the sit and reach test, sit-ups, pull-ups, and skinfold measures. Height and weight measures will also be taken at this time. The procedures of the physical fitness test will be administered by the Department Head of the Physical Education program, the school nurse, and this researcher, following standard test procedures. The physical fitness test will require no more physical exertion than is regularly required in physical education class. Some shortness of breath and mild muscle fatigue may occur as a result of the aerobic fitness testing. However, participants are responsible for monitoring their own condition during fitness testing, and should any unusual symptoms occur (nausea, dizziness, extreme shortness of breath), participation should cease, and the researcher should be informed of the symptoms.

The questionnaire responses and aerobic fitness testing results will be coded for confidentiality. No one but the regular physical education instructor and the school nurse will know your test responses and results. They may be contacted following the study if you wish to obtain your results.

Participation in this project will in no way affect your grade in physical education. You may withdraw from participation in the project at any time.

If you have any questions about the project, please call Denise K. Volker (Department of Educational Psychology and Foundations) at 273-2321 (office) or 273-2695 (department). If you have any questions about the rights of research subjects, call the Graduate College Office at UNI (273-2748). If you consent to participate in this project, please sign the consent form given below and return it to me when you complete the questionnaires.

I am fully aware of the nature and extent of my participation in this project as stated above. I understand that I may withdraw from participation at any time. I hereby consent to my participation in this project. I acknowledge that I have received a copy of this consent statement.

(signature of subject) (date)

(printed name of subject)

(signature of investigator)

APPENDIX C

Locus of Control Scale: Nowicki-Strickland, 1973

1. Do you believe that most problems will solve themselves if you just don't fool with them? YES NO

2. Do you believe that you can stop yourself from catching a cold? YES NO

3. Are some kids just born lucky? YES NO

4. Most of the time do you feel that getting good grades means a great deal to you? YES NO

5. Are you often blamed for things that just aren't your fault? YES NO

6. Do you believe that if somebody studies hard enough he or she can pass any subject? YES NO

7. Do you feel that most of the time it doesn't pay to try hard because things never turn out right anyway? YES NO

8. Do you feel that if things start out well in the morning that it's going to be a good day no matter what you do? YES NO

9. Do you feel that most of the time parents listen to what their children have to say? YES NO

10. Do you believe that wishing can make good things happen? YES NO

11. When you get punished does it usually seem it's for no good reason at all? YES NO

12. Most of the time do you find it hard to change a friend's (mind) opinion? YES NO

13. Do you think that cheering more than luck helps a team to win? YES NO

14. Do you feel that it's nearly impossible to change your parent's mind about anything? YES NO

15. Do you believe that your parents should allow you to make most of your own decisions. YES NO

16. Do you feel that when you do something wrong there's very little you can do to make it right? YES NO

17. Do you believe that most kids are just born good at sports? YES NO

18. Are most of the other kids your age stronger than you are? YES NO

19. Do you feel that one of the best ways to handle most problems is just not to think about them? YES NO

20. Do you feel that you have a lot of choice in deciding who your friends are? YES NO

21. If you find a four-leaf clover do you believe that it might bring you good luck? YES NO

22. Do you often feel that whether you do your homework has much to do with what kind of grades you get? YES NO

23. Do you feel that when a kid your age decides to hit you, there's little you can do to stop him or her? YES NO

24. Have you ever had a good luck charm? YES NO

25. Do you believe that whether or not people like you depends on how you act? YES NO

26. Will your parents usually help if you ask them to? YES NO

27. Have you felt that when people were mean to you it was usually for no reason at all? YES NO

28. Most of the time, do you feel that you can change what might happen tomorrow by what you do today? YES NO

29. Do you believe that when bad things are going to happen they just are going to happen no matter what you try to do to stop them? YES NO

30. Do you think that kids can get their own way if they just keep trying? YES NO

31. Most of the time do you find it useless to try to get your own way at home? YES NO

32. Do you feel that when good things happen they happen because of hard work? YES NO

33. Do you feel that when somebody your age wants to be your enemy there's little you can do to change matters? YES NO

34. Do you feel that it's easy to get friends to do what you want them to? YES NO

35. Do you usually feel that you have little to say about what you get to eat at home? YES NO

36. Do you feel that when someone doesn't like you there's little you can do about it? YES NO

37. Do you usually feel that it's almost useless to try in school because most other children are just plain smarter than you are? YES NO

38. Are you the kind of person who believes that planning ahead makes things turn out better? YES NO

39. Most of the time, do you feel that you have little to say about what your family decides to do? YES NO

40. Do you think it's better to be smart than to be lucky? YES NO

APPENDIX D

Multidimensional Health Locus of Control

1. Strongly Disagree
2. Moderately Disagree
3. Slightly Disagree
4. Slightly Agree
5. Moderately Agree
6. Strongly Agree

1.	If I get sick, it is my own behavior which determines how soon I get well again.	1	2	3	4	5	6
2.	No matter what I do, if I am going to get sick, I will get sick.	1	2	3	4	5	6
3.	Having regular contact with my physician is the best way for me to avoid sickness.	1	2	3	4	5	6
4.	Most things that affect my health happen to me by accident.	1	2	3	4	5	6
5.	Whenever I don't feel well, I should consult a medically trained professional.	1	2	3	4	5	6
6.	I am in control of my health.	1	2	3	4	5	6
7.	My family has a lot to do with my becoming sick or staying healthy.	1	2	3	4	5	6
8.	When I get sick I am to blame.	1	2	3	4	5	6
9.	Luck plays a big part in determining how soon I will recover from an illness.	1	2	3	4	5	6
10.	Health professionals control my health.	1	2	3	4	5	6
11.	My good health is largely a matter of good fortune.	1	2	3	4	5	6
12.	The main thing which affects my health is what I myself do.	1	2	3	4	5	6

13. If I take care of myself, I can avoid illness.	1	2	3	4	5	6
14. When I recover from an illness, it's usually because other people (for example, doctors, nurses, family, friends) have been taking good care of me.	1	2	3	4	5	6
15. No matter what I do, I'm likely to get sick.	1	2	3	4	5	6
16. If it's meant to be, I will stay healthy.	1	2	3	4	5	6
17. If I take the right actions I can stay healthy.	1	2	3	4	5	6
18. Regarding my health, I can only do what my doctor tells me to do.	1	2	3	4	5	6

APPENDIX E

Intermediate Level Nutrition Survey

Instructions: For each question choose the one best answer and circle the corresponding answer. If you don't know the answer, guess.

1. Which of these is not a nutrient?
   a. carbohydrate
   b. protein
   c. saccharine
   d. water

2. If a person doesn't get enough iron in his diet, she or he might develop:
   a. anemia
   b. diabetes
   c. pimples
   d. night blindness

3. A nutrient is:
   a. anything that can be absorbed by the body
   b. a substance needed for normal functioning of the body
   c. anything you eat or drink
   d. a substance found only in living cells

4. Most of the calcium in our bodies is in the:
   a. blood vessels
   b. bones
   c. fingernails and hair
   d. skin

5. In general, which are the best sources of vitamin C?
   a. fruits and vegetables
   b. whole grain breads and cereals
   c. milk and dairy products
   d. meat and meat substitutes

6. Which contains the most iron?
   a. bananas
   b. milk
   c. apples
   d. beef

7. To get the best protein combination, what should you eat with bread?
   a. peanut butter
   b. grape jelly
   c. butter
   d. oatmeal

8. The amount of vitamin C you need each day can be provided by:
   a. one orange
   b. five oranges
   c. ten oranges
   d. you can never get enough of this nutrient

9. To get enough vitamin A you should:
   a. eat dark green or deep yellow vegetables 3 to 4 times weekly
   b. eat a potato every day
   c. eat some whole grain bread every day
   d. use honey instead of sugar

10. The best way to be sure you get all the nutrients you need is to:
   a. take a vitamin supplement every day
   b. drink lots of milk
   c. eat a wide variety of foods
   d. eat wheat germ every day

11. A Calorie is:
   a. a measure of food energy
   b. a kind of fat
   c. a measure of weight
   d. a chemical stimulant

12. Which has the most Calories?
   a. an ounce of sugar
   b. an ounce of margarine
   c. an ounce of meat
   d. an ounce of starch

13. Which of the following does <u>not</u> contain Calories?
   a. protein
   b. alcohol
   c. minerals
   d. carbohydrate

14. We get fatter when we:
   a. eat more Calories than we need
   b. eat too often
   c. eat potatoes and bread
   d. don't drink enough water

15. We use the most food energy per hour when we:
   a. play baseball
   b. run
   c. sleep
   d. study

16. When you are growing rapidly, your need for nutrients:
    a. is greater
    b. is less
    c. is the same as when you're not growing
    d. is determined by biorhythms

17. If there were no more oranges in the stores, what could we buy to give us just as much vitamin C without more Calories?
    a. tomatoes
    b. apples
    c. peaches
    d. carrots

18. When ingredients are shown on the label of a food, the one that's first on the list is:
    a. the most nutritious
    b. the most expensive
    c. the one that is in the food in the greatest amount
    d. the one that has the most protein

19. If you want to know about nutrition, the best person to ask is:
    a. a waitress
    b. a dietitian
    c. Dear Abby
    d. a clerk in a health foods store

20. Which of these snacks has the most nutrients for the least Calories?
    a. strawberries
    b. banana cake with cream cheese frosting
    c. apple pie
    d. blueberry ice cream

21. If you don't eat meat, you need to choose foods carefully because:
    a. vegetables are more expensive
    b. you must get the nutrients found in meat from other foods
    c. you can't live without meat in your diet
    d. you can't get enough dietary fiber without eating meat

22. If you have a hamburger on a bun and a glass of milk for lunch and the same thing for dinner, which foods should you eat more of for breakfast and snacks?
    a. fruits and vegetables
    b. breads and cereals
    c. milk and dairy products
    d. butter and margarine

23. If you never drink milk or eat dairy products, what is most likely to happen?
    a. you won't get enough nutrients to keep your bones healthy
    b. you'll get canker sores
    c. you'll lose your hair
    d. you'll get iron-deficiency anemia

24. When eating at a fast food restaurant you should:
    a. try to include fruits or vegetables in other meals
    b. drink coffee instead of Coke
    c. never eat potatoes and bread at the same meal
    d. make sure they serve butter instead of margarine

25. A person who frequently eats food with lots of sugar will probably get:
    a. tooth decay
    b. arthritis
    c. pimples
    d. cancer

26. People who are very fat often have problems with:
    a. double vision
    b. feeling unpopular or awkward
    c. stomach ulcer
    d. swollen glands

27. The cheapest food source of the mineral calcium is:
    a. ice cream
    b. milk
    c. Cheddar cheese
    d. cream cheese

28. Some people like to eat peanuts but don't like peanut butter. This is probably because:
    a. peanut butter is more expensive
    b. they don't like the way peanut butter feels in their mouth
    c. peanut butter doesn't have as much vitamin A as peanuts
    d. peanuts have less cholesterol than peanut butter

29. After an argument with her mother, Mary eats a dozen cookies. This indicates:
    a. fighting burns up a lot of calories
    b. Mary sometimes relieves her anger with food
    c. sugar makes people forget their problems
    d. Mary doesn't have enough carbohydrate in her diet

30. A commercial that says, "Wouldn't you like to be a 'Pepper' too?"
    a. shows how nutritious the product is
    b. appeals to your desire to be part of a group
    c. tells you how the product tastes
    d. points out the low cost of the product

31. Agnes won't eat grapes when grape-pickers are on strike. This shows:
    a. Agnes doesn't like grapes
    b. Agnes is allergic to grapes
    c. politics can affect food choices
    d. grapes can cause cancer

32. The way to get the most protein from fertile land is to raise:
    a. soybeans
    b. beef cattle
    c. pigs
    d. spinach

33. People with malnutrition:
    a. are always skinny
    b. all live in slums
    c. may be overweight or underweight
    d. usually have malaria

34. Which is the highest quality (most complete) protein?
    a. egg
    b. corn
    c. wheat
    d. lima beans

35. Fresh lettuce is available in Wisconsin all year because:
    a. refrigeration and modern transportation allow it to be brought in from areas with warmer winters
    b. it keeps for months in the refrigerator
    c. it has lots of vitamin D
    d. stores use chemicals to keep it from wilting

36. Preservatives are used in food to:
    a. keep food fresh longer
    b. disguise food that is spoiled
    c. kill insects that attack food as they grow
    d. make the food cook faster

37. Which nutrient is most easily destroyed by cooking?
    a. protein
    b. carbohydrate
    c. vitamin C
    d. calcium

38. Which of the following is most likely to make food unsafe to eat?
    a. leaving egg salad in a warm room overnight
    b. picking cucumbers before they're ripe
    c. adding artificial colors to soda pop
    d. keeping bananas in the refrigerator

39. The process of breaking food down into chemicals that can be absorbed into the body is:
    a. digestion
    b. dialysis
    c. insulin
    d. peristalsis

40. You should throw away a bulging can of food because:
    a. it might be too acidic
    b. it might be spoiled and contain dangerous toxins
    c. it might explode
    d. it will smell funny

APPENDIX F

Food Choice Inventory

Food Choice Inventory

We all like some foods and dislike other foods. There is nothing "good" or "bad" about this. Using the list of 40 foods on this page, you are asked to identify your food choices. You have probably eaten many of the foods. Some of the foods in the list you may never have tasted.

Directions

First look at the two examples below. There are four ways to respond. SELECT:

A = if you **WILL EAT** the food
B = if you **LIKE BUT TRY NOT TO EAT** the food too often
C = if you **WILL NOT EAT** the food
D = if you **DO NOT KNOW** if you like the food

Circle the letter that best indicates your food choice. For example, if you like granola, then you would circle A as shown below. Now circle the letter that best describes your choice for the second example, beets.

Example

	WILL EAT A	LIKE BUT TRY NOT TO EAT B	WILL NOT EAT C	DON'T KNOW D
GRANOLA	A	B	C	D
BEETS	A	B	C	D

When you are clear about how to respond, you are ready to begin marking your choices on the 40 item food list. The instructor will tell you when to begin.

	WILL EAT A	LIKE BUT TRY NOT TO EAT B	WILL NOT EAT C	DON'T KNOW D
1. APPLE PIE	A	B	C	D
2. BEAN SPROUTS	A	B	C	D
3. BLACKEYED PEAS	A	B	C	D
4. BROCCOLI	A	B	C	D
5. BUTTER	A	B	C	D
6. CANDY	A	B	C	D
7. CANNOLI	A	B	C	D
8. CAULIFLOWER	A	B	C	D
9. CHICKEN	A	B	C	D
10. COOKED GREENS	A	B	C	D

	WILL EAT A	LIKE BUT TRY NOT TO EAT B	WILL NOT EAT C	DON'T KNOW D
11. COOKIES	A	B	C	D
12. CORN CHIPS	A	B	C	D
13. COTTAGE CHEESE	A	B	C	D
14. DONUTS	A	B	C	D
15. EGG ROLL	A	B	C	D
16. EGGS	A	B	C	D
17. FISH	A	B	C	D
18. FRENCH DRESSING	A	B	C	D
19. GELATIN CUBES	A	B	C	D
20. GRITS	A	B	C	D
21. GYROS	A	B	C	D
22. HAMBURGER PATTY	A	B	C	D
23. HAM HOCKS	A	B	C	D
24. JAM	A	B	C	D
25. KALE	A	B	C	D
26. LIVER PATE	A	B	C	D
27. LOW FAT MILK	A	B	C	D
28. MARGARINE	A	B	C	D
29. OATMEAL	A	B	C	D
30. OYSTERS	A	B	C	D
31. POTATO CHIPS	A	B	C	D
32. QUICHE	A	B	C	D
33. SOFT DRINK	A	B	C	D
34. SKIM MILK	A	B	C	D
35. SPICE CAKE	A	B	C	D
36. SWEET ROLL	A	B	C	D
37. WHITE BREAD	A	B	C	D
38. WHOLE MILK	A	B	C	D
39. WHOLE WHEAT BREAD	A	B	C	D
40. YOGURT	A	B	C	D

For office use only T ______
H ______
L ______