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An Evaluation of Influences on Preadolescent Boys' Body Mass Index and Body Composition

Lynn Samson Brann
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To the Graduate Council:

I am submitting herewith a dissertation written by Lynn Samson Brann entitled "An Evaluation of Influences on Preadolescent Boys' Body Mass Index and Body Composition." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Human Ecology.

Jean Skinner, Major Professor

We have read this dissertation and recommend its acceptance:

Naima Moustaid-Moussa, Michael Zemel, Dixie Lee Thompson, Priscilla Blanton

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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An Evaluation of Influences on Preadolescent Boys' Body Mass Index and Body Composition

A Dissertation

Presented for the

Doctor of Philosophy

Degree

University of Tennessee, Knoxville

Lynn Samson Brann

May 2003

Dedication

This dissertation is dedicated to Scott, my husband and best friend, who gave me the support and encouragement that I needed to complete this process.

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I would like to acknowledge the many individuals who have helped to make this dissertation possible. I would like to thank Dr. Jean Skinner, my major professor, for her guidance and patience throughout this process. Her insights were invaluable. I would also like to thank my committee members, Dr. Michael Zemel, Dr. Naima Moustaid-Moussa, Dr. Priscilla Blanton, and Dr. Dixie Lee Thompson, for their support and willingness to provide advice along the way. I am truly grateful to have had such a diverse and competent group of professionals as mentors. Additionally, I would like to thank Ann Reed for her statistical guidance and patience.

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Abstract

This study was designed to investigate the differences in the diets, activity levels, body concerns, body esteem, and body perceptions of fifty preadolescent boys in relation to their body mass index (BMI; kg/m^2) and their percent body fat (PBF), measured using air-displacement plethysmography. Additionally, it was designed to examine general parenting and child feeding practices of parents in relation to their sons' BMI and PBF. Boys were recruited based on their BMI and were placed into either an average BMI group or a high BMI group. Additionally, boys were placed into either a lower PBF group or an upper PBF group. The results of this study were divided into three parts.

The first part examined the relationship between the BMI and PBF of the boys and evaluated whether boys grouped by their BMI status would be grouped similarly based on their PBF. PBF was significantly correlated with BMI ($r=0.74$, $p<.0001$) and the two ways of grouping boys were not independent ($\chi^2=13.52$, $p<.0001$). Twelve of the 50 boys were classified differently into the BMI and PBF groups. Boys were recruited for the study based on their BMI, and boys whose BMI fell between the 68^{th} and the 85^{th} percentile were intentionally excluded from the study to allow for greater separation between groups of boys. It was anticipated that this separation in BMI would also provide a separation in PBF between groups. However, no clear separation in PBF between groups was evident. Therefore, results were mainly presented based on boys' BMI groups.

The second part examined whether differences existed in the diets, activity levels, body concerns, body esteem, and body perceptions of the boys by their BMI groups and examined if parents perceived their sons differently depending on their sons' BMI. No

differences were found in the energy intakes or activity levels by boys' BMI groups. Boys in the high BMI group were more concerned about their weight and appearance as compared to boys in the average BMI group. Boys in the high BMI group perceived themselves as bigger than the boys in the average BMI group, and the same was true for their parents. Boys in the high BMI group rated their current figure as heavier than their ideal boy figure.

The third part examined differences in mothers' and fathers' child feeding practices and parenting practices by their sons' BMI groups. Mothers and fathers of boys with a high BMI saw their sons as more overweight, were more concerned about their weight, and used pressure to eat less often with their sons compared to mothers and fathers of boys with an average BMI. In addition, fathers of boys with a high BMI monitored their sons' eating less often than fathers of boys with an average BMI. When compared to fathers, mothers were more responsible for providing food to their sons. No differences were found in general parenting practices by boys' BMI. However, mothers were more likely to use the authoritative style of parenting compared to fathers.

Some overall conclusions may be drawn from this study. Classification of boys based on their BMI and PBF produced different groups of boys, indicating that BMI may be a useful screening tool, but it can be problematic when evaluating individual boys. Boys in the high BMI group perceived themselves to be heavier than boys in the average BMI group, and they were more concerned about their bodies compared to boys in the average BMI group. Finally, parents of boys with an average BMI tended to use more controlling child feeding practices with their sons compared to parents of boys with a high BMI.

Preface

This preface is designed to provide an explanation of the format of this dissertation. Part I contains an introduction to the study, a review of the literature relevant to the study, and an outline of the study purpose. Part II includes a description of the methodology and explains some methodological issues encountered. Parts III, IV, and V contain the study results written in journal style for three publications. Appendices A, B, and C include copies of questionnaires used in the study. Appendices D and E contain additional results based on boys' body composition.

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List of Abbreviations

ADP	air displacement plethysmography
ANOVA	analysis of variance
BES	Body Esteem Scale
BMI	body mass index
CFQ	Child Feeding Questionnaire
kg	kilograms
m	meters
MANOVA	multivariate analysis of variance
PBF	percent body fat
PPQ	Parenting Practices Questionnaire

Part I:

Introduction, Review of the Literature, and Study Purpose

Introduction

Overweight in children has emerged as a major public health issue (1). The causes of overweight are multifactorial and weight status is dependent upon energy balance (2). In order to achieve energy balance in children, there needs to be a balance between food intake and energy output. It seems relevant to address the two main factors that influence energy balance: diet and activity. In addition to this, assessing body concerns in a less-studied group of children (preadolescent boys) may help to better address these issues for boys (3,4). Therefore, this study aimed to evaluate diet and activity levels in relation to body mass index (BMI) and body composition in preadolescent boys and to assess the body concerns of this group. This study also examined family environmental influences on children's weight and body composition, specifically parental child feeding practices. In order to assess non-food related parent-child interactions, general parenting practices were also evaluated.

Review of the Literature

This review of the literature summarizes current research relevant to this study. Although this study focuses on preadolescent boys, studies on adolescents were also included in this review of the literature, where appropriate, as problems of adolescents may have their origins in the earlier years. The review of the literature begins with an overall evaluation of childhood weight status and body composition, which includes the prevalence of childhood overweight, ways of assessing body weight and body composition, and the persistence of overweight from childhood into adulthood. The complications of overweight are discussed, with an emphasis on psychosocial

consequences of childhood overweight. Next, the causes of overweight, both genetic and environmental, are addressed. The final three sections of the literature review focus on three factors influencing childhood weight status: childhood activity, childhood diet, and child feeding and parenting practices. Following the literature review, the study purpose and research questions are discussed.

Childhood Weight Status and Body Composition

Prevalence of Childhood Overweight

Researchers often use different criteria to define overweight in children, which can be problematic when evaluating prevalence and trends (5,6). The revised Centers for Disease Control (CDC) growth charts using gender- and age-specific body mass index (BMI) curves are currently being used as a tool to evaluate trends and to monitor growth in children (7). These growth charts include BMI percentiles for children ages 2 to 19 years old and are based on several US health examination surveys, including the National Health Examination Survey II and III (NHES II, 1963-1965; NHES III 1966-1970) and the National Health and Nutrition Examination Survey I, II, and III (NHANES I, 1971-1974; NHANES II, 1976-1980; NHANES III, 1988-1994) (6). Data for children 6 years and older from the NHANES III were not included in the reference population to create the latest BMI percentiles because of increasing trends in overweight in children (8). According to these revised BMI curves, children with a BMI between the 85th and 95th percentile are considered at risk for overweight, while children with a BMI at the 95th percentile or greater are considered overweight (9).

In recognition of the growing health problem of childhood overweight, one of the goals of Healthy People 2010 is to *reduce the proportion of children who are overweight*

or obese (1). According to data from the National Health and Nutrition Examination Survey (NHANES) 1999-2000, 30.3 % of children ages 6 through 11 were classified as at risk for overweight ($85^{th} \geq$ percentile $< 95^{th}$), and 15% of children were classified as overweight ($\geq 95^{th}$ percentile BMI) (9). Comparison of these results with earlier surveys indicates an increase in prevalence of overweight in children at each survey point from the 1960s to the present (9). The Healthy People 2010 objective to reduce the prevalence of overweight among children and adolescents has a target set at no more than five percent prevalence of overweight (1).

Assessing Weight Status and Body Composition

Obesity and overweight are often used interchangeably in the literature, but this can be confusing. Obesity can be defined as an excess adipose tissue (10), whereas overweight is excess weight for height (5). In adults, BMI is an accepted measure for defining overweight and obesity because it is based on and related to the comorbidities associated with obesity (11). In children, BMI measures are population-based and are not related to health-related conditions (7). BMI, which is a measure of weight-for-height, is commonly used as a screening tool for weight status and is an indirect measure of adiposity (12). The use of BMI as a measure of adiposity in children has some limitations due to the variations in growth and maturation among children (13). Therefore, when dealing with children, it may be appropriate to use a more direct measure of body composition along with BMI whenever possible.

In the most simplified form, body composition can be divided into fat mass and fat-free mass (14,15). An excess amount of fat mass has been linked to increased health risks in children (16,17). Several techniques exist for determining body composition of

individuals (18). When dealing with children, some of these methods are more appropriate than others.

Anthropometric measurements, which can include height, weight, and skinfold (SF) thickness, have many practical advantages because they are non-invasive and inexpensive (19). However, these measurements assess body fat of the subcutaneous fat layer and are highly operator-dependent (18). A few body volume measurements exist to analyze body composition: underwater weighing (UWW) and air-displacement plethysmography (ADP). UWW is problematic in a pediatric population because it requires individuals to be completely submerged under water after exhaling air from the lungs (18). ADP is a quick, comfortable, and non-invasive technique (20). A relatively new device called the BOD POD® (Life Measurements, Inc., Concord, CA) uses air displacement plethysmography to determine body volume (21). From body volume, body density is calculated and estimations of fat and fat-free mass are derived. A major advantage of ADP over UWW is that individuals are not submerged under water, making ADP a more attractive device for measuring body composition in children. Dual energy x-ray absorptiometry (DXA), an imaging method, has gained increasing popularity as a measure to assess body composition in children (16). In relation to the other methods discussed, this technique is expensive and is less available (18).

Most currently used measures of assessing body composition have disadvantages because some components of body composition are assumed constant. A four-compartment model of body composition should produce the most accurate measure because it also accounts for body water and bone rather than assuming a constant density for these two components (22). This technique is costly for general use and requires a

great deal of equipment, but it has been employed as a "gold standard" for which to compare other methods.

Fields and Goran (22) evaluated the following four body composition assessment techniques: DXA, UWW, ADP, and total body water (TBW), against the 4-compartment model in 9- to 14- year-old children. Using regression analysis to determine the accuracy of the individual body composition techniques compared to the 4-compartment model, the researchers found that the regression for fat mass by DXA and by TBW as compared to the 4-compartment model significantly deviated from the line of identity. However, the regression for fat mass by UWW and ADP did not significantly deviate from the line of identity. Precision of the individual measurements was assessed from the regression analysis using the R^2 and the standard error of the estimate (SEE). Fat mass from TBW explained 98% of the variance in fat mass (SEE = 1.5 kg) by the 4-compartment model. Fat mass by ADP, UWW, and DXA explained 97% (SEE=1.7 kg), 95% (SEE=2.1), and 95% (SEE=2.0 kg) of the variance in fat mass by the 4-compartment model, respectively. Bias between the individual techniques and the 4-compartment model, as assessed by residual plots, was found for DXA, UWW, and TBW in the estimate of fat mass. ADP was the only technique that did not exhibit bias for fat mass. Therefore, the researchers concluded that ADP was the only body composition technique that could estimate fat mass in 9- to 14- year-old children accurately, precisely, and without bias.

Over the past few years, DXA has been viewed as the primary research tool for the evaluation of body composition in children. Another technique, ADP in the form of the BOD POD, has recently shown great promise as a tool for determining the body composition in children (22-24). As current techniques are refined and new techniques

are developed, the assessment of body composition in children will improve and become a more commonly used measure for health assessment.

Persistence of Overweight into Adulthood

Significant determinants of childhood overweight persisting into adulthood include the severity of overweight, age of onset, and parental obesity (25). The more severe the obesity, the more likely that it will persist into adulthood. Likewise, the older the overweight child, the more likely the obesity will persist into adulthood (26). Guo et al (27) used data from the Fels Longitudinal Study to predict overweight and obesity in adulthood from BMI values in childhood and adolescence. These researchers found that children or adolescents with a high BMI percentile were at high risk of being overweight or obese as adults (at age 35). The probability of a 9-year-old male whose BMI was at the 85th percentile was 17%, whereas the probability was 30% if the child's BMI was at the 95th percentile. The probabilities increased with age of the children.

The presence of one or more obese parents increases the risk of obesity in children. Whitaker et al (26) examined the risk of obesity in young adulthood with childhood obesity and parental obesity. These researchers found that among children one to three years of age the strongest predictor of obesity in adulthood was the parents' obesity status. As the children aged, the more important predictor of obesity in adulthood was child's obesity status.

According to Dietz (25), three critical developmental stages in childhood exist which have implications for the future prevalence of overweight and obesity. These periods include the prenatal period, the period of adiposity rebound and adolescence.

Overweight that begins at any one of these critical periods appears to increase the risk for chronic obesity and related complications.

Complications of Childhood Overweight

Many adverse health consequences are linked to pediatric overweight and as overweight increases, so does the prevalence of health risks (26). Some complications that can occur during childhood involve orthopedic, neurological, pulmonary, gastroenterological, and endocrine conditions. These conditions are likely to exist in the more severely overweight children. Other medical complications may include hyperlipidemia, glucose intolerance, hypertension, and sleep apnea (29). Also, the incidence and prevalence of type 2 diabetes in children is increasing (30). Shina et al (31) found the presence of impaired glucose intolerance in 25 percent of obese children and 21 percent of obese adolescents. In addition to health consequences in childhood and adolescence, overweight status during these periods has been shown to affect adult morbidity and mortality (32,33).

Of equal concern are the social consequences of childhood overweight (29,33,34). Overweight children have been seen by others as unhealthy, academically unsuccessful, socially inept, unhygienic, and lazy (35). When children evaluated figure drawings of thin, normal weight, and chubby children, the thin children were rated most favorably and the chubby children least favorably (36). This study addresses children's body concerns in relation to weight status and body composition; therefore, this issues will be discussed further.

Body Concerns in Children in Relation to Weight Status and Body Composition

In our society, thinness is valued, especially among females. In an effort to understand the impact of this ideal, researchers have begun focusing on body concerns among children (4,37-46). Much of the research has been directed toward females, because females tend to report greater body image concerns than boys (46,47). However, recently researchers have started reevaluating the issue of body image in boys.

Cohane and Pope (3) reviewed the literature on body image in boys and found that boys did demonstrate less overall body concern than females; however, body image concerns among boys of all ages were common. Boys often reported wanting to be bigger rather than thinner, but many of the studies did not decipher whether the desire to be bigger was associated with increased muscle or just increased body size. Researchers are currently working to determine the role of the desire for muscularity in boys as it relates to body concerns, body dissatisfaction, and weight status (3).

Vander Wal and Thelan (41) examined eating and body image concerns of overweight and average weight children. The overweight children were more likely to exhibit dieting behaviors, to express weight concern, and to be more dissatisfied with their bodies than the average weight children. These behaviors were more prevalent in girls than in boys. Other researchers have found similar results in overweight and non-overweight adolescents (39,40,43). In these studies, overweight adolescents were more likely to express weight concerns and engage in dieting behaviors.

Body esteem, which evaluates children's feelings about their appearance and weight, has been used by researchers to assess body image concerns (47-49). Researchers have found a significant negative association between body esteem and BMI

in girls (48,49). Mendelson et al (47) found that measures of body esteem were inversely related to the relative weight of both boys and girls. In a group of healthy boys representing a wide range of BMI percentiles, body esteem (negatively) and body dissatisfaction (positively) predicted BMI (45).

Another frequently used measure of assessing body image concerns among children is figure preference (50). Children are often asked to identify their perceived and ideal body size using between five to seven drawings, which range in size from very thin to very overweight figures. Based on figure preference studies involving boys of varying weights (46,50,51), a notable number of boys desired a thinner body size, with estimates ranging from 20% to 33%. The estimates for those desiring a larger body size range from 15% to 23%. Thompson et al (52) found that BMI was significantly associated with body dissatisfaction in boys, where the boys who had a higher BMI desired to have a thinner body size.

With the steady increase in the prevalence of overweight among children and adolescents in the United States (9), it is also important to examine how parents perceive their children's body size. Baughcum and coworkers (53) found that many low-income mothers did not view their overweight children as overweight. In a sample of adolescents and their mothers from South Carolina, Thompson et al (52) found that selections of children's current body size were strongly associated between mothers and sons, but their selections of an ideal child size were not associated. No studies were identified that examined parents' perceptions of their preadolescent sons' body size based on their weight status (normal weight versus overweight) using figure drawings.

Overall, researchers have found that boys exhibit fewer body image concerns and dieting behaviors than girls (46,47). If boys are raised to believe that having a muscular physique is the ideal body type, then they may be less inclined than girls to strive for thinness. Boys, in general, often express a desire to be bigger (3). When dealing with overweight boys, body size perceptions and body image concerns are important to evaluate. If overweight children do not see themselves as overweight, and if their parents do not recognize their weight status, this could undermine motivation to develop realistic and achievable weight loss or weight maintenance goals.

Causes of Childhood Overweight

Overweight and obesity occur when there is an imbalance between energy intake and energy expenditure, with intake exceeding expenditure (2). Energy intake can be defined as energy input from carbohydrates, protein and fat. Energy expenditure is made up of activity energy expenditure (AEE), resting energy expenditure (REE), and thermic effect of feeding (TEF). The average child eats approximately a half of a million kilocalories per year and is able to regulate body weight by balancing energy intake with output (54). Energy balance is regulated over the long-term, and overweight or obesity occurs when there is a mismatch between energy intake and energy expenditure.

Body weight and body composition are maintained when there is this delicate balance between input and output, and this is determined by many genetic and environmental factors that are not completely understood. This section will briefly focus on the genetic and environmental factors contributing to childhood overweight and will introduce the environmental factors that will be discussed in more detail throughout this literature review.

Genetic Versus Environmental Factors

Within all populations, there is a variation of body weight and body fatness among individuals who are in energy balance (2). As of the year 2000, more than 200 genetic factors related to risk of overweight in humans have been identified (55). A great deal of support exists for the idea that body weight and adiposity are explained in part by a genetic or heritable component (56-58); however, the contribution of genetic factors cannot be stated with certainty. Researchers have found that the contribution of genetic variability in body fatness lies somewhere between 25 to 70% (56,57,59-60), with studies from monozygotic twins suggesting the variability to be 50-70% and family studies suggesting 25-50%. It is also important to emphasize that there are always problems separating genetic and environmental influences, particularly in children because they live in families.

Rapid increases in the prevalence of childhood overweight over the last few decades, in a stable genetic population, emphasize the importance of environmental factors on this issue. Hill and Melanson (2) provided a model of the effect of environmental factors on energy balance. When energy intake and energy output are in equilibrium, body fat mass is constant. The factors that are driving up energy intake include high fat, energy dense foods; palatable, low cost, easily available foods; and large portion sizes. Factors that are driving down energy expenditure include decreased work related physical activity, decreased activity of daily living, and increased sedentary activity. The factors causing an imbalance in energy balance lead to an increase in body fatness. Children's food intake and activity patterns (a component of energy expenditure) are two of the major modifiable environmental factors affecting weight status and body

composition. Along with these two factors, family patterns and family influences on diet and activity are also important environmental influences. Accordingly, the next three sections of this literature review will address childhood activity, childhood diet, and child feeding and parenting in relation to children's weight status.

Childhood Activity

In this section, current trends in children's activity will be explored, along with ways to measure activity and determinants and influences of activity. Children's physical activity and/or inactivity in relation to weight status also will be examined.

Current Trends in Children's Activity and Inactivity

The most recent version of the *Nutrition and Your Health: Dietary Guidelines for Americans* (62) emphasizes the need for regular physical activity for individuals of all ages with their "Aim for fitness" guideline, which emphasizes being physically active on a daily basis. Physical activity is a critical component to energy balance and to overall health (63). Luepker (64) reviewed recent physical activity patterns of American children and found that overall physical activity has declined over the past several decades. Children are spending less time in physical education classes and more time in sedentary activities, such as watching television or playing video or computer games.

The National Children and Youth Fitness study I and II, which took place between 1984 and 1986, assessed activity of children and adolescents (65). However, this survey has not been repeated. Currently, the physical activity of youth is measured with the Youth Risk Behavior Survey (YRBS), which is a school-based survey of high school students initiated in 1990 by the Centers for Disease Control and Prevention. In 1992, a supplement of the YRBS was added to the National Health Interview Survey to

assess activity of a national sample of 12- to 21-year-old individuals. Data from the YRBS indicated that boys' participation in vigorous activity was higher than girls (72.3% versus 53.5%, respectively). Whites were more active than other racial groups, and activity decreased with age (65). A major problem in estimating the current trends in activity in children and adolescents is limited national data on physical activity in youth younger than high school age (65,66).

Researchers have become increasingly interested in children's inactivity. Some areas of interest include time spent watching television, using the computer, and playing video games. (67-73). NHANES III and subsequent NHANES have included children's sedentary activity such as time spent watching television and computer or video game time (66). According to data from NHANES III, 61% of children aged 8 to 16 years old reported watching 2 or more hours of television per day. Children's inactivity in relation to their weight status will be discussed further in a later section.

Measuring Children's Activity

Physical activity can be defined as "any bodily movement produced by skeletal muscles that result in energy expenditure" (74). Since a small imbalance between energy expenditure and energy intake can result in weight changes, it is important to have accurate measures of activity (75). In a review of physical activity assessment in children and adolescents, Sirard and Pate (76), discuss primary measures, secondary measures, and subjective measures for assessing activity in youth. Direct observation, doubly labeled water, and indirect calorimetry are considered primary measures or criterion standards for which to compare other methods. Secondary measures, or objective techniques, include heart rate monitors, pedometers, and accelerometers. Finally,

subjective techniques include self-report questionnaires, interviewer-administered questionnaires, proxy-reports, and activity diaries. Subjective techniques are often the easiest data to obtain, but rely on the accuracy of responses from children and sometime parents. Both secondary and subjective measures should be validated against primary measures (76). According to Sirard and Pate (76), the criterion method of assessing physical activity in children should be direct observation. However, because of the time investment, other methods may be more appropriate.

Determinants of and Influences on Children's Activity

Much of the data related to determinants of activity in youth is cross-sectional, making true identification of determinants difficult. Kohl and Hobbs (63) reviewed the determinants of physical activity behaviors in children and adolescents and outlined three fundamental factors which determine physical activity: 1) physiologic and developmental factors, 2) environmental factors, and 3) psychological, social, and demographic factors.

Sallis and coworkers (77) reviewed correlates of physical activity of children and adolescents. Variables that were positively related to children's physical activity included sex (male), parental overweight status, physical activity preferences, intention to be active, previous physical activity, healthy diet, program/facility access, and time spent outdoors. Perceived barriers were inversely related to children's physical activity. No association was found for the following frequently studied variables: socioeconomic status, body image, self-esteem, perceived benefits, attitudes toward sweating, after-school activity, smoking, alcohol use, energy intake, neighborhood safety, and parents providing transportation to a physical activity place. For adolescents, sex (male), ethnicity (white), perceived ability, competence, intentions, previous physical activity,

community sports, sensation seeking, support from others, sibling physical activity, direct involvement from parents, and opportunities to exercise were all positively related to physical activity. Age, depression, and sedentary time after school and on weekends were inversely related to physical activity. Variables unrelated to physical activity in adolescents included: socioeconomic status, self-esteem, enjoyment of exercise, perceived stress, alcohol use, healthy diet, and peer modeling.

Many researchers have found parental influences to be important determinants of children's physical activity (78-81). However, Kimiecik and Horn (89) found that parents' exercise behavior was unrelated to their children's moderate-to-vigorous physical activity participation. Parent's inactivity has been found to be a strong predictor of children's inactivity levels (81).

Children's Activity and Inactivity in Relation to Weight Status and Body Composition

A lack of physical activity and an excessive amount of sedentary activity may be significant causes of overweight in children. Results from a cross-sectional study of children in South Carolina showed that participation in moderate to vigorous physical activity was lower for overweight children than for non-overweight children (82). Much of the classic and current research evaluating children's weight status and body composition has been related to children's inactivity (67,69,72,73,83-87).

Dietz and Gortmaker (67) pioneered the research linking childhood overweight to television viewing, when they found significant associations between the time spent watching television and the prevalence of overweight in children and adolescents. According to data from NHANES III, hours of television watching were related to both BMI and skinfold thickness (87). As compared to children who watched less than 2

hours of television per day, children who watched television more than 4 hours per day had higher percent body fat ($p<.001$) and higher BMI ($p<.001$). Similar results were seen with data from the 1999 YRBS with high school students (73). Youth who watched more than 4 hours of television per day were 40% more likely to be classified as overweight compared to those who watched less than one hour, and 20 to 25% more likely than those who watched 2 to 3 hours per day. In a large group of 9 to 16 year old children, the odds of obesity increased by 12% for each additional hour of television viewing (OR=1.12, 95% CI=1.02-1.22), whereas the odds of obesity for this group decreased by 10% for each additional hour of moderate and/or vigorous activity (OR=0.90, 95% CI=0.83-0.98) (69). Similar results were found in a study of preschool children, where the odds of the children being at risk of overweight (having a BMI greater than the 85th percentile) were increased by 11% for each additional hour of television and videos watched per day (72). In a cross-sectional study of 9-year-old boys, time spent on sedentary activity was directly proportional to fat mass as measured by skinfold thickness ($r=0.46$, $p< .05$) (84). Sedentary activity has been directly related to increases in BMI in both boys and girls (86). In children participating in the Cardiovascular Health in Children Study, increased hours of playing video games increased the risk of being overweight for males and females after adjusting for ethnicity and SES ($p<.019$) (85). Overall, research in the area of sedentary activity and weight status in children indicates that the greater time spent in activities, such as watching television and playing video games, the greater the chance of the child being overweight and/or overfat.

Childhood Diet

The second critical component to energy balance is dietary intake. Accordingly, this section will focus on current trends in dietary intake of children, ways to measure food intake, and influences on food intake in children. Children's dietary intake in relation to weight status and body composition will be addressed.

Current Trends in Dietary Intake

Troiano and coworkers (88) used data from NHANES III and earlier surveys to assess energy and fat intakes of children and adolescents. Energy intake among children and adolescents changed very little from the 1970s to the 1988-1994 NHANES survey. Mean total fat and saturated fat decreased during these time periods, with total fat decreasing from 36-37% to 33-34% and saturated fat decreasing from 14% to 12%. The researchers noted that the fat intakes of the children studied were higher than the recommendation of less than 30% of energy from fat. However, according to the new recommendations based on the Acceptable Macronutrient Distribution Ranges (AMDR) of the Dietary Reference Intakes (DRI) for fat intake for children, it is now recommended that children consume between 25% and 35% of their total energy from fat (89). According to these new recommendations, children's mean fat intakes do fall within this range.

Skinner and coworkers (90) evaluated the longitudinal nutrient intakes of preschool children. Mean intakes of folate, vitamins D, and E were found to be below recommended levels at most interviews, while the children were 24 to 60 months old. The most frequently eaten main dishes of the children included pizza, fried chicken, and hot dogs. Children's diets were lacking in food variety over time, indicating that overall,

children did not consume the minimum recommended number of servings for each food group (bread, vegetable, fruit, meat, dairy).

Munoz and coworkers (91) compared the food intakes of U.S. children and adolescents with national recommendations, based on the Food Guide Pyramid (92), using data from the U.S. Department of Agriculture's 1989-1991 Continuing Survey of Food Intake by Individuals (CSFII). These researchers found that children and adolescents had mean intakes below the minimum recommendations for all food groups, expect the dairy group. Only 1% of the children and adolescents studied met all of the national recommendations for food group intake and 16% did not meet any of the recommendations. Overall, the children's diets did not meet the recommendations for most food groups. These results were supported by the research of Brady and colleagues (93), who also compared children's dietary intake patterns with the Food Guide Pyramid. Few children in this study met the Food Guide Pyramid recommendations and a significant portion of the children's kcalories came from the tip of the Pyramid, which includes discretionary fat and added sugar (46% of total energy).

Using the U.S. Department of Agriculture's 1989-1991 CSFII, Subar and coworkers (94) evaluated dietary sources of nutrients among children. They found ready-to-eat fortified cereals to be a major source of energy, vitamins, and minerals in children. Low nutrient-dense foods, such as soft drinks, cakes, cookies, quick breads, and doughnuts were major contributors to energy, fat, and carbohydrates. Researchers have noted a negative trend in beverage consumption with age of children. Skinner and Carruth (95) found that children's juice intake decreased significantly between the ages of 2 and 6 years ($p<.0001$), while at the same time, intakes of carbonated beverages

increased ($p<.0001$). In another study of children and adolescents, children 12 years old and younger, milk contributed 50% or more of total energy from beverages; whereas, among adolescents, soft drinks provided approximately 8% of total energy (88). Overall, it appears that children are not meeting recommendations for dietary quality, and many are making poor food choices.

Measuring Dietary Intakes of Children

When measuring the dietary intakes of children, individuals other than the children, typically parents, are often responsible for recording the intakes. Dietary intake methods have existed for well over half of a century and improvements in measuring intakes have occurred over time (96). Several methods exist for measuring dietary intakes of individuals and these methods can be divided into the three following categories: 1) diet histories or retrospective questionnaires, such as food frequencies, 2) recall of foods recently eaten, and 3) diet records (96-98).

Diet histories and food frequency questionnaires provide information about usual or habitual dietary patterns, but these can be limited by the recall of individuals and seasonality of food intake (97). Diet recalls usually involve the recollection of all food and beverages consumed within the last 24-hour period (99). This method is not representative of habitual intake and is not useful for measuring the nutrient content of an individual's overall diet. However, in large-scale studies, diet recalls can provide an overview of average nutrient intakes of populations (100). Multiple diet recalls can be used for estimating intakes of individuals and diet recalls can be combined with other methods, such as diet records, to assess intakes of individuals (100). The multiple-pass 24-hour recall method, which differs from the traditional 24-hour diet recall, was

developed by the U.S. Department of Agriculture to improve the accuracy of the traditional method (101). A trained interviewer uses five distinct passes to acquire information about the subject's food intake over the previous 24 hours (98). These five passes allow the interviewer to probe for forgotten foods and for details about portion sizes. Also, the interviewer is able to collect information about the time and place of each eating occasion and to review for additional details. When using this method, it is recommended that at least three days of intake be collected because of day-to-day variability in food intake (98).

Diet records are considered one of the most accurate methods for assessing dietary intake, because they do not rely on recollection of food eaten. Typically, individuals record all food and beverages consumed for a period of 3 to 7 days. However, these data are completely self-reported and rely on the accuracy and honesty of the person recording the intake. Poor compliance in keeping the records and alterations of the diet during the recording period are two issues that affect the accuracy of diet records (97).

In the 1980s it became possible to validate dietary assessment methods with the development of the doubly-labeled water (DLW) technique (102). Using this method, it has been shown that energy intake, determined with self-reported dietary recording methods, is often underreported in a variety of populations ranging from adolescents to the elderly (103). Researchers have related underreporting of food intake in adults to weight status (with a higher weight status being associated with greater underreporting) (104,105), gender (with females underreporting more often than males) (104), and to individuals who were trying to control their weight (105).

In a review, Hill and Davies (103) evaluated the literature on self-reported energy intake as determined by the DLW technique in a variety of groups, including children and adolescents. Overall, diet records of younger children, when reported by a parent or guardian, showed good agreement with the DLW technique, and in some cases energy intake was even overreported. However, in studies with older children and adolescents who reported their own intakes underreporting was present.

A group of 118 children, with a mean age of 10 years old, were divided into categories according to their ethnicity, sex, age, and body fat (106). Their energy intake was assessed using an 8-day diet record with some parental assistance and intake was compared to the DLW technique. Underreporting of energy intakes increased with age of the children and was apparent in all groups studied. Caucasian children underreported their intakes by 20%, whereas African American children underreported by 27%. Underreporting by Caucasian girls and boys was 24% and 17% below energy expenditure, respectively. For African American children, girls underreporting was 26% compared to energy expenditure, and African American boys had the highest rates of underreporting at 28%. Children categorized as obese (using skinfold measurements) underreported intake by 25% compared to 21% for children categorized as lean.

The multiple-pass 24-hour recall method was shown to be accurate when compared to the DLW method in children ages 4 to 7 (107). Fisher et al (108) compared the multiple-pass 24-hour recall method with the DLW method in a group of 4- to 11-year-old children. Their reporting was evaluated in relation to their body weight and body composition (measured with DXA). Approximately 34% of the children accurately reported their dietary intakes, whereas 20% under reported and 46% over reported

intakes. In comparison to over reporters, under reporters had higher relative weights ($p < .0001$) and higher body fat ($p < .0001$), indicating that under reporting was more prevalent among the heavier children. Other research supports the idea that underreporting is more common as the age of the child increases (109) and as body weight and body fatness increases (110,111). The accuracy of reporting increased when parents reported their children's intake (103).

Influences on the Dietary Intakes of Children

Several influences on dietary intakes of children have been identified. With respect to specific influences on children's diets, early experience, learning, and children's food preferences are all factors that shape children's dietary intakes (112-117). Many of these influences are related to parental child feeding and will be discussed in a later section.

The impact of television viewing on children's activity was discussed in a previous section. It is appropriate to evaluate the influence of television viewing on food consumption patterns of children as well. Television viewing is proposed to promote weight gain by decreasing the amount of time spent in physical activity and by increasing energy intake (70). A nationally representative cross-sectional study revealed that energy intake has a tendency to increase with increasing amount of television watched, especially among females (118). Coon and coworkers (119) evaluated the relationships between television viewing during meals and children's food consumption patterns. Children from families who watched television during 2 or more meals were compared to children from families who either did not watch television during meals or watched television during only one meal. Children from the high television viewing during meals

group ate fewer vegetables and fruits and consumed more pizza, snack foods, and soda than children who watched television during meals less frequently. Overall, television viewing seems to be contributing to increased energy intake and a poorer quality diets in children.

Children's Dietary Intake in Relation to Weight Status and Body Composition

Researchers have speculated as to how the composition of children's diets relate to their weight status and body composition. Much of the data in this area have yielded inconsistent results. In a sample of preschool children, Atkins and Davies (120) found no significant relationships between dietary intakes of total energy, fat, carbohydrate, or protein to percentage of body fat. In this study, physical activity was related to body fat, while composition of the diet was not related. Findings from a different study indicated that children's percentage of body fat was positively related to fat intake, percent of energy from dinner, mother's and father's BMI and negatively related to carbohydrate intake, and percent of energy from breakfast, dinner, and night time snack (121). After taking parents' BMI into account, diet composition no longer contributed to explaining children's body fat. Tucker and coworkers (122) found a positive relationship between the percent of energy as fat and a negative relationship between the percent of energy as carbohydrates and measures of body fat. Nguyen and colleagues (123) reported this positive relationship between fat intake and body fat in boys only. Rolland-Cachera and coworkers (124) found that the only dietary macronutrient associated with children's adiposity was protein. The relationship between children's diet composition and body composition is not certain. It appears that this relationship is quite complex. For example, the type of dietary fat may be more important in explaining body composition

than total fat intake (125). Also the type of carbohydrate, such as those higher in fiber and less refined, may play a role (94).

Recently, researchers have begun to examine the role of calcium in modifying body fat and body weight (126-130). Zemel and colleagues (129,130) have proposed the mechanism for which dietary calcium, produces an "anti-obesity" effect. Diets rich in calcium inhibit the influx of intracellular [Ca^{2+}], thereby stimulating lipolysis and inhibiting lipogenesis. This mechanism has been demonstrated in animal studies (127) and in a clinical trial with obese patients (131). Using NHANES III data, these researchers also observed this inverse relationship between calcium and BMI for both men and women (126).

Other researchers have supported this mechanism in adults (132,133). Davies et al (133) examined data from 5 clinical studies and found that higher calcium intakes were associated with lower body weight. In a group of women participating in a 2-year exercise intervention, Lin et al (132) found that calcium intake predicted changes in body weight and body fat in those women with low energy intakes.

A few researchers have examined the role of calcium in moderating body fat in children (134-136). Carruth and Skinner (134) evaluated this relationship in preschool children using their longitudinal calcium intakes from ages 2 to 5 in relation to their body composition as measured by DXA. These researchers found that children with higher longitudinal intakes of calcium and those who consumed more servings of dairy products per day had lower body fat. This relationship was reexamined in the same group of children at 8 years of age, when body fat was assessed a second time (135). Longitudinal dietary calcium was found to be negatively related to percent body fat. Other researchers

found that lower dairy product intake was associated with obesity in a group of low-income Puerto Rican children (136). The results of these studies support the intake of calcium rich foods and beverages to moderate body fat in children.

Child Feeding and Parenting Practices

Many events and traditions are centered on certain types of foods. Even in our every day life, families have routines and food is a necessity. For these reasons, and many more, our families impact what, when, and how we eat. Parents play an important role in the development of the eating habits of children. Parents influence the eating behaviors of children in a variety of ways, such as through the foods they purchase, through child feeding strategies, and through role modeling of acceptable eating behaviors (137,138). This section of the literature review will address general parenting practices and the relationship of these practices to child feeding. Also, the relationships between parents' and children's eating behaviors, child feeding practices, and children's weight status and body composition will be explored.

The Relationship Between Child Feeding and Parenting Practices

Levels of control in the feeding relationship between parents and children varies among individuals (114). Birch and Fisher (114) describe three types of child feeding patterns with varying levels of control between parents and children and these include: highly-controlling, laissez-faire, and responsive parenting. Mothers who are highly controlling do not give their children a chance to regulate their own meal time, meal size, or food selection. Rather, these mothers tend to force-feed their children. Mothers with a laissez-faire strategy do not force or urge their children to eat (or not eat), even if their children may be at nutritional risk. They assume their children are able to regulate when,

what, and how much to eat. In the third pattern, responsive parenting, mothers acknowledge their children's needs and demands for food and respond to these needs and demands accordingly.

Birch and Fisher (114) relate these child feeding styles to Baumarind's (139) authoritative, permissive, and authoritarian parenting styles. From the results of Baumarind's (140) longitudinal studies on parenting, she has concluded that authoritative parents were demanding, responsive, and assertive; while they avoided being restrictive and intrusive. Their discipline was supportive and not punitive. From this parenting style, children were more likely to be assertive, socially responsive, self-regulated, and responsible. Permissive parents were responsive, but not very demanding. They were usually lenient and avoided confrontation with their children. Finally, authoritarian parents were both demanding and directive, but not responsive. They expected their children to be obedient and provided little if any explanation for their orders.

In relation to child feeding practices Birch and Fisher (114) speculated that a responsive, or authoritative, parent assists in their child's development of self-control over eating, whereas other styles may lead to problems with self-regulation (114,137). The degree and type of control parents' use over their children's food intake may influence the eating behaviors and even the weight outcomes of their children (114,141).

Costanzo and Woody (142) introduced the theory of domain-specific parenting styles, using the example of obesity proneness, to illustrate that parenting styles are tailored to parents' concerns and perceptions of children's risk for developing a problem in a specific domain. According to this theory, parents will impose greater control over their children's eating if they are invested in their own weight and appearance (possibly

because of their own struggles with weight), if the parents perceive their child is at risk for overweight, or if the child appears to lack self-regulatory behavior.

In a recent review of family environmental factors influencing the control of food intake and childhood overweight, Birch and Davison (141) provided a model of behavioral mediators of eating and weight status of parents and children. According to these researchers, the model demonstrates "… how parents' weight status is linked to parents' own eating patterns and their child-feeding practices, which, in turn, influence children's eating behaviors and, in due process, children's weight status" (p. 895). The three child feeding practices in the center of this model include restriction, pressure to eat, and monitoring. It is apparent from this model that parental eating styles and child feeding practices have an effect on children's eating behaviors, which influence children's weight status. Accordingly, the next portion of this literature review will address the relationship between parents' and children's eating behaviors and child feeding practices and how these factors may be influenced by or may be influencing child weight status.

Relationships Between Parents' and Children's Eating Behaviors, Child Feeding Practices, and Children's Weight Status and Body Composition

Food preferences, for all ages, evolve from a combination of stimuli that include taste, smell, appearance, and touch. For children, these characteristics are influences by familiarity with food and repeated exposure to a variety of foods (115-117,143,144). In two separate studies, children's food preferences increased with repeated exposure, where ten or more exposures were necessary to increase preferences in 2-year-old children

(144), and up to fifteen exposures where needed to increase preferences in 4 and 5 year old children (145).

Skinner and colleagues (115) evaluated toddlers' food preferences in concordance with family members' preferences in a sample of 118 children aged 28 to 36 months and their families. Agreement between foods liked and disliked was calculated as the percent concordance for each family pair (mother/child, father/child, and sibling/child). Concordance for liked foods was high (75.5% to 79.3%), which suggests similarities among food preferences of children and their family members. Along with this, the total concordance, or the percentage that both liked a food plus the percentage that both individuals in the pair disliked the food, was also high (82.1% to 83.3%). Most foods (124 of 196) were liked and eaten by the children studied. The children in the study liked greater than 80% of the foods that were offered to them. The researchers concluded that the category of "food never offered" was the most limiting category in relation to food preferences of the children.

Using a subset of the sample just discussed, Skinner and coworkers (116) evaluated children's longitudinal food preferences (children at 2 to 3 years, at 4 years, and at 8 years) and factors that are related to food preferences. The number of foods liked by the children did not significantly change over the 5-year time period; however, the children liked most foods. Factors predicting children's food preferences at 8 years of age (R^2=0.79) included the number of foods liked at 4 years of age (positive predictor) and children's food neophobia scores (negative predictor). As in the earlier study, foods disliked by the mothers were often not offered to the children, indicating that mothers own food preferences impact children's food preferences.

As the previous study demonstrates, food neophobia or "picky eating" may limit a child's willingness to try new foods. A group of young children who were perceived as "picky" by their mothers consumed a more limited variety of foods as compared to their "non-picky" peers (146). Mothers of the "picky eaters" used tactics like persuasion to get their children to eat ($p<.0001$) and fixed special foods for their children ($p<.0001$) more often than mothers of "non-picky eaters". Some of the neophobic behaviors of these children did not improve with maturity (147). Food neophobia can be a problem for many children, but there are ways to lessen this problem (143).

When young children are given food, they will usually eat until they are satisfied and leave the rest. This occurs when parents give them the chance to regulate their energy intake (143). If children are forced to eat when they are no longer hungry, then they may lose their sense of energy regulation, which could result in long-term problems (137). The best predictor of children's ability to regulate their energy intake in a group of 3-to-5-year-old children was parental control in child feeding (137). Mothers of children who were more controlling had children who demonstrated higher rates of eating, less ability to regulate their energy intake, and increased adiposity. In a study of young girls eating over a 2-year period, researchers found that young girls' eating in the absence of hunger was associated with overweight status of the girls and restrictive child feeding practices of parents (148).

The influence of the presence or absence of parents during the eating occasions of children has also been explored in relation to child weight status. Klesges and coworkers (149) investigated the role of parental influences on the food selection of 53 five-year-old children and the role of overweight on food selection. Mothers' monitoring of food

intake and the threat of monitoring resulted in children choosing fewer non-nutritious foods and meals that were lower in calories. The weight status of the mothers and the children had no significant effect on the food selection of the children. Laessle and coworkers (150) evaluated the parental influences on eating behaviors in overweight and normal weight preadolescent children and found a significant difference in the eating behavior between the two groups of children only when mothers were present during eating. The overweight children ate significantly faster and took significantly larger bites than the normal weight children when being monitored by their mothers. Koivosto and colleagues (151) observed the meals of 50 families to evaluate parent-child interactions during mealtime. Forty-three percent of the parental behaviors observed consisted of non-food statements and 22% consisted of statements related to food and eating. Negative statements about food and the child's eating made up 11% of the parental behaviors. Children who were of normal weight received more neutral statements about food from parents than did children who were overweight ($p < .05$). When children were prompted to eat and acted on parental recommendation, they ate more and regulated their own energy intake less.

Parental eating attitudes and eating styles have been evaluated in relation to the weight status and body composition of children. Hood and colleagues (152) found that parents who exhibit high dietary restraint (restricting food intake to control body weight) and high levels of disinhibited eating (inability to resist emotional and social cues when not hungry) may promote the development of excess body fat (as measured by skinfold thickness) in young children. However, in a similar study, no relationship was found

between children's percent body fat and parental eating styles when body fat of the children was measured using DXA (153).

In a study of 75 preschool children and their parents, mothers' dietary disinhibition and mothers' BMI positively predicted daughters' overweight (154). Birch and Fisher (155) found that mothers' dietary restraint and mothers' perceptions of their daughters' risk of overweight predicted maternal control in feeding (restriction and monitoring) and these then predicted daughters' eating and relative weight. Using the same sample of children, Carper and coworkers (156) examined dietary restraint and disinhibition of 5-year-old girls in relation to their parents' control in child feeding. These researchers found that parental control in feeding (in the form of pressure in child feeding) was associated with young girls' emergence of dietary restraint and dietary disinhibition.

Researchers have evaluated parental eating behaviors and child feeding practices in relation to children's dietary intake and dietary quality (157,158). Mothers' pressure on their daughters to eat was negatively related to the quality of their daughters' diets. Mothers who consumed diets higher in fat used more restriction and pressure to eat in child feeding than mothers who consumed diets lower in fat (157). The researchers concluded that mothers' controlling child feeding practices did not promote healthier diets in children and that mothers' dietary intakes were important influencers on the intakes of their daughters. In another study with the same population of mothers and daughters, these researchers found that mothers' pressure on their daughters' to eat was associated with lower intakes of fruits and vegetables (158). Mothers' who consumed

more fruits and vegetables had daughters who consumed a higher number of fruits and vegetables.

Much of the research examining parental control over children's eating in relation to weight and body composition has been done in small samples of mainly Caucasian children, especially female children. However, Robinson and coworkers (159) examined this issue in a population-based sample of 792 third graders from a variety of ethnic and socioeconomic backgrounds. These researchers found that parents who reported greater control over their daughters' food intake had daughters who were *less* overweight. This is contrary to other findings in the literature (137,155). Parental control over sons' diets was not associated with degree of overweight among boys. Overweight parents reported using less controlling child feeding practices. The children in this study were slightly (8 to 9 years old) older than most of the other populations studied and they were from more diverse backgrounds, indicating that earlier findings may not generalize to all populations.

One study was found in the literature that addressed the relation between mothers' child feeding practices and children's adiposity which included both boys and girls and used a reliable and accurate measure of body fat, DXA (160). This study was also unique because it evaluated both African American and Caucasian boys and girls. Monitoring, responsibility for feeding, restriction, pressure to eat, and concern for child's weight were the child feeding practices evaluated in relation to children's total fat mass, as assessed by DXA. Socioeconomic status and energy intake gathered from three dietary recalls were used as control variables. Concern for child's weight (positively related) and pressure to eat (negatively related) explained 15% of the variance in total fat mass in the

children after adjusting for total lean mass, sex, ethnicity, socioeconomic status, and energy intake. Energy intakes from fat did not contribute significantly to the variance; however, energy intakes from sources other than fat (negatively related) predicted 5% of the variance in total fat mass. The only difference found for mothers' child feeding practices according to the sex of their child was for monitoring, where mothers scored higher for monitoring of boys food intake than for girls.

Previously, researchers have found relationships between children's BMI and restrictive child feeding practices (155,157) and monitoring of children's food intake (155). Children's BMI has also been related to parents' concern for children's weight (155) and pressure on children to eat (113,156,157). In the previous study examined, Spruijt-Metz and coworkers (160) found that concern for children's weight and pressure on children to eat were related to total fat mass.

Much of the research in the area of child feeding practices has come out of the laboratory of Birch and colleagues (137, 148,154-158,161,162). These researchers have focused specifically on the influences of mothers' child feeding practices on their daughters' eating and weight because it has been hypothesized that influences of parental child feeding practices differ by child gender. A stronger effect of child feeding practices on child BMI has been found in girls compared to boys (163,164). Mothers' dieting behaviors and child feeding practices have been related to daughters' weight status, but not to sons' weight status (137,154,156). Researchers have hypothesized that this is due to the differences in socialization of males and females with regards to food and eating. Mothers may be less controlling with their sons than with their daughters because their daughters have to face the societal ideal of thinness. On the contrary, if mothers have the

societal expectations that their sons should be strong and muscular as opposed to thin and weak, they may exert more pressure to eat and may be less restrictive with the foods they offer.

Study Purpose

The purpose of this study was two-fold. This study was designed to evaluate the diet, activity, and body concerns of preadolescent boys grouped by their BMI and percent body fat (PBF). Additionally, it was designed to examine general parenting and child feeding practices of parents in relation to their sons' BMI and PBF groups. This study sought to answer the following research questions:

1) Are there differences in the dietary intakes and activity levels of boys grouped by their BMI and PBF?
2) Are there differences in the body concerns, body esteem, and body size perceptions of boys grouped by their BMI and PBF?
3) Do parents' perceptions of their sons' current and ideal body size differ by their sons' BMI and PBF groups?
4) Do parents' general parenting styles differ depending on their sons' BMI or PBF groups?
5) Do child feeding practices of parents differ depending on their sons' BMI and PBF groups?
6) Do mothers and fathers differ in parenting style and child feeding practices?

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Part II:

Methodology

Research Design

The design of this research can be described as a cross-sectional, non-intervention study that is descriptive in nature and involves preadolescent boys and their parents. The specific aims of the study were: 1) to compare diet, activity, and body concerns of preadolescent boys grouped by their body mass index (BMI) and percent body fat (PBF); and 2) to compare parents' child feeding practices and parenting practices in relation to their sons' BMI and PBF.

Human Subjects Review

The University of Tennessee Institutional Review Board for research involving human subjects reviewed and approved this study prior to subject recruitment.

Participants

Fifty preadolescent boys and their parents were recruited from the Knoxville area to participate in the study. Recruitment was via advertisements in the local press, flyers, and referrals from other mothers in the study. Boys were grouped by their BMI (kg/m^2) percentile into an average BMI group or a high BMI group. The BMI percentiles were provided by the Centers for Disease Control and were based on weight, height, gender, and age, because as children grow and mature their body composition changes (1). An attempt was made to achieve equal numbers of boys in each of the two BMI groups. Child participants met the following inclusion and exclusion criteria:

Inclusion Criteria:

- Group 1 (average BMI): BMI between the 33rd and 68th percentile

- Group 2 (high BMI): BMI $\geq 85^{th}$ percentile
- Race/ethnicity: Caucasian (to control for differences in growth and body image concerns among racial groups)
- Socioeconomic status: all

Exclusion Criteria:

- History of chronic or metabolic disease (because of confounding effects on weight regulation)

This study involved participation from both parents, when possible. Mothers were defined as the primary adult female living with the child, which could have included the child's biological mother, adoptive mother, or stepmother. Fathers were defined as the primary adult male in the child's life, which could have included the child's biological father, adoptive father, or stepfather. Fathers did not necessarily have to be living with the child at the time of the study. If the child's father was not a present figure in his life, then no father's data were collected. Table 1 shows the family characteristics of the participants. Preliminary screening was done by telephone with potential participants. At this time, the details of the study were described and the participation criteria were outlined. Mothers and their sons were interviewed twice. At the time of the first interview, mothers were given the father's questionnaire and father's consent form. Fathers were asked to fill this form out at a convenient time, and mothers returned these forms to the interviewer (the PI) at the time of the second interview.

Table 1. Family characteristics of the whole group of participants and of the participating fathers

Family Characteristics	**Whole Group**[a] (n=50)	**Participating Fathers**[b] (n=31)
Married parents	43/50	26/31
Divorced parents	7/50	5/31
Child living with mother and stepfather	4/50	4/31
Child living with father and stepmother	1/50	0/31
Child living with mother	2/50	1/31

[a]Includes mothers and boys with complete data
[b]Includes fathers who completed the Father's Questionnaire

Interview I

Mothers and boys were interviewed first in their home or in a convenient private location. Mothers read the consent form and were allowed to ask any questions they had regarding the study. In the presence of the mother, the interviewer (the PI) explained the study to the child, answered any questions the child had regarding the study, and obtained assent from the child to participate. While the mother was completing her questionnaires, the child completed the appropriate questionnaires with the help of the interviewer. After mothers and children completed their questionnaires, they were trained by the interviewer on how to complete food records. This training included instructions on serving sizes using food models. One 24-hour food recall was taken to determine all food and beverage intake consumed by the child on the previous day. The interviewer left the appropriate questionnaires for the fathers to fill out at a convenient time or for the mother to mail to the child's father. A second interview was scheduled to complete the study. Mothers were asked to return the child's food records at the second interview and, if applicable, the mothers were asked to return the fathers' questionnaires to the interviewer at the second interview. Mothers were paid $15 for completing this interview and children were given a UT water bottle as compensation.

Interview II

The second interview took place in the Applied Physiology Laboratory located in the Health, Physical Education, and Recreation Building on the University of Tennessee campus. The Bod Pod® whole body plethysmography (Life Measurement, Inc., Concord, CA) was used to estimate body fatness in the children. Upon completion of this session, mothers and children were paid a total of $15 for their participation.

Children's Data

A copy of the Children's Questionnaire can be found in Appendix A.

Diet

Three days of children's dietary data (two weekdays and one week-end day) were collected from the boys and their mothers. This included one 24-hour recall and two days of food records. Mothers and boys were trained on how to properly record food intake using food models. Dietary data were entered into Nutritionist Pro (Version 1.2.207, First Data Bank Inc., CA). Nutrient data were then exported into Microsoft Excel 2000 (Version 9.0) for further analyses by SPSS for Windows (Version 11.5, SPSS, Inc., Chicago, IL).

Activity

Mothers were asked about their sons' time spent in physical activity, such as team sports, classes/lessons, and other play time. A total of number of sports teams and classes was computed for each child. Mothers were also asked to report the number of hours per week their sons spend playing outside. In addition to this, mothers were asked to report hours per week their sons spend in sedentary activities, such as watching television and videos and playing computer and video games. A measure of total sedentary activity was created by adding together the hours spent watching television/videos and playing video/computer games per week. Activity was also assessed using a question from a study of weight control behaviors of Native American adolescents (2). Mothers were asked "How many times per week does your child work, play, or exercise hard enough to make him sweat and breathe heavily?" The responses for this question were as follows: never, 1 to 2 times per week, or 3 or more times per week.

Body Concerns and Body Size Perceptions

Due to a lack of validated measures of body concerns for boys, a variety of individual questions related to weight and health concerns and desire for muscularity, were taken from the literature and many of these questions were adapted to apply to boys. Boys were asked two questions to assess their perception of their current health (2). Questions related to weight concerns were adapted from The McKnight Risk Factor Survey (MRFS), which evaluated risk for disordered eating in girls (3,4). In order to assess boys' concerns about being too thin and to assess the desire for muscularity, three questions were developed by the principal investigator. Two questions, developed by Truby & Paxton (5) when they evaluated body image in children with cystic fibrosis, were adapted to evaluate body size satisfaction and body weight satisfaction. Four questions were included to address sociocultural factors on boys' body image. Two of these questions were taken from the Sociocultural Attitudes Toward Appearance Questionnaire (6). The third question, which assessed how much boys would like to look like male figures in the media, was taken from the MRFS (3) and adapted for boys. A fourth question was developed to assess boys' desires to look like a football player.

Boys completed the Body Esteem Scale (7), which assessed different aspects of body esteem in children with emphasis on feelings about appearance and feelings about body weight. This 24-item scale used a yes/no format, with a higher score indicating higher body esteem. Mendelson and White (7) reported that the scale had good split-half reliability (r = .85) and good construct validity with the Physical Appearance and Attributes subscale of the Piers-Harris Children's Self-Concept Scale (r = .67).

Figure drawings (8) were used to examine boys' ideas of their current body size and the size that they would like to be. There were seven drawings, which ranged from very thin to very heavy boy silhouettes. Test-retest reliability for the figure rating tasks for children as young as 8 years of age have been found to be high (9). Also, boys were shown figure drawings of adult males (8) and were asked to choose the figure that looked most like their father and the figure that represented the way they wanted to look when they were grown up.

Height, Weight, and Body Composition

Body weight was measured, at the first interview, using a quality portable bathroom type scale with children in lightweight clothing with no shoes. Height was also measured at the first interview using a steel measuring tape and a square, while the children stood upright against a wall or doorway. Both height and weight were measured twice and an average of the two measures was computed. BMI was calculated from the averaged height and weight measurements via a standard equation (kg/m^2).

Body composition was assessed, at the second interview, using an air-displacement plethysmography system, known as the BOD POD® Body Composition System (Life Measurement, Inc., Concord, CA). This device derives body volume of the participant in order to calculate body density and estimate fat and fat-free mass (10). The BOD POD is comprised of two chambers: a test chamber for the subject and a reference chamber. The subject's body volume was measured when the subject sat inside the test chamber and displaced a volume of air equal to the volume of his body. Therefore, body volume is calculated by subtracting the volume of air in the chamber when the subject is being measured from the volume of air when the chamber is empty (11). The three steps

for measuring body volume include: calibration, subject volume, and measurement of thoracic gas volume. A standard 2-point calibration was performed before each participant was measured. In order to minimize isothermal air from clothing and hair, subjects wore tight-fitting swimsuits and swim caps during the testing procedure. Subjects were weighed on an electronic scale that was connected to the computer. Subject's body volume in the test chamber was measured once and then repeated to assess agreement between the two measures. If the measurements did not agree, a third measurement was performed. In a few instances (n=4), none of the three measurements were in close agreement and the machine was recalibrated and the process was repeated. The final step is measurement of thoracic gas volume (Vtg). This procedure is done to correct for the amount of air remaining in the lungs during breathing. An option exists in the BOD POD software to use a prediction equation for Vtg, and for the ease of operation the predicted Vtg was used for all subjects in this study. In order to transform the body density calculated from the BOD POD into a child-specific equation, percent body fat was calculated with the Lohman equation (13). No standards for percentage of fat in children have been established. Therefore, we used a median split to divide the boys into two groups based on their PBF.

Parents' Data

A copy of the Mother's Questionnaire can be found in Appendix B and the Father's Questionnaire can be found in Appendix C.

Demographic, Family Health History, and Child Health History

Demographic, Family Health History and Child Health History were included in the Mother's Questionnaire. As part of the Demographic Information section, mothers reported the level of education and occupation for themselves and for their sons' father. Socioeconomic status (SES) scores were determined with the Hollingshead Four Factor Index, which uses education and occupation of the family's primary wage earner(s) (13). In the Family Health History section, mothers reported the ages, heights, and weights of the children's immediate family members and the weight status (overweight, average weight, underweight) of the mothers' and fathers' immediate family members. Mothers also reported whether biological relatives of the child had been treated for certain diseases or conditions (i.e. diabetes, heart disease, food allergies, etc.). Finally, mothers reported any health problems or illnesses of the child within the past year. Mothers also reported whether the child had any known food allergies and the length of the food allergy.

Parents' Perceptions of their Sons' Health and Body Size

Mothers and fathers were asked to assess their sons' general health and health status in relation to other children. These questions were adapted from the children's health perceptions questions (2). They also rated their sons' current body size and ideal size of a boy using the same figure rating scale given to the boys (8).

The Child Feeding Questionnaire

Mothers and fathers completed the 30-item Child Feeding Questionnaire (CFQ) (14) to assess their beliefs, attitudes, and practices in relation to child feeding, particularly in relation to parental control over feeding and weight status. Seven factors have been

identified in the CFQ, with four of the factors measuring parental beliefs regarding obesity proneness in children and three of the factors measuring parental control of children's eating and parental attitudes in relation to child feeding practices. The four factors measuring parental beliefs regarding obesity proneness in children include: 1) *parent's perceived responsibility in child feeding* (3 items; 1=never to 5=always), assessing the extent to which parents perceive they are responsible for the food provided to their children; 2) *perceived parent weight* (4 items; 1=markedly underweight to 5=markedly overweight), evaluating how parents see their own weight over their lifetime; 3) *perceived child weight* (5 items; 1=markedly underweight to 5=markedly overweight) evaluating parents' perceptions of their children's weight from their first year of life to the present; and 4) *concern about child weight* (3 items; 1=unconcerned to 5=very concerned) assessing parents' concern about children having to diet or becoming over weight. The internal consistency (Cronhbach's α) was 0.88 for parental responsibility, 0.71 for parents' perception of their own weight, 0.83 for parents' perception of their children's weight, and 0.75 for concern about child's weight (14). The three remaining factors related to parental control of children's eating and parental attitudes related to child feeding practices are: 1) *restriction of child's food intake* (8 items; 1=disagree to 5=agree), evaluating the extent to which parents' restrict their children's access to foods; 2) *pressure to eat* (4 items; 1=disagree to 5=agree), assesses the extent to which parents pressure their children to eat more food; and 3) *monitoring* (3 items; 1=never to 5=always), evaluating how much parents keep track of certain types of foods. The Cronhbach's α was 0.73 for restriction, 0.70 for pressure to eat, and 0.92 for monitoring (14). Each parent was given a score for each subscale of the CFQ by taking the average

score that makes up each respective subscale. Therefore, parents have seven scores corresponding to each of the seven subscales, and these scores can range from a 1 to a 5.

Parenting Practices

In order to assess non-food related parent-child interactions, mothers and fathers completed the Parenting Practices Questionnaire (PPQ) (15). This questionnaire assesses mothers' and fathers' general parenting style using Baumarind's (16) styles of authoritative, authoritarian, and permissive parenting styles. The PPQ consists of 62 items (15), with 27 of these items corresponding to the authoritative parenting style, 20 items corresponding to the authoritarian parenting style, and 15 items corresponding to the permissive parenting style. The internal constancies (Crohnbach's α) for the authoritative, authoritarian, and permissive styles were 0.91, 0.86, and 0.75, respectively (15). The parents' responses were divided into the three predetermined parenting styles and an average score for each of the parenting styles was calculated for each parent. Therefore, each parent had a score for the authoritative, authoritarian, and permissive parenting styles. These scores could range from 1 to 5, with a higher score indicating a greater use of that parenting style.

Height and Weight

As part of the Mother's questionnaire, each mother reported her current height and weight and the heights and weights of her immediate family members. BMI for mothers was calculated from the self-reported heights and weights via a standard equation (kg/m^2). BMI for fathers was calculated using the same equation from mothers' reports of the fathers' heights and weights.

Statistical Analyses

The statistical analyses for comparison of variables of interest by boys' BMI and body composition groups for this study are presented in order of the specific aims of the study provided in the research design section at the beginning of this methodology. Statistical analyses were performed using SPSS for Windows (Version 11.5, SPSS, Inc., Chicago, IL). Descriptive statistics, including means, standard deviations, ranges, and frequencies were computed for variables of interest. Simple correlations between variables of interest were computed. A probability level of 0.05 was used as the significance level for all tests.

To compare diet, activity, and body concerns of preadolescent boys by their BMI and body composition

In order to compare diet and activity of boys independent samples t-tests were used to evaluate energy and nutrient intakes, number of teams or classes, and sedentary activity of the boys by their BMI and PBF groups. When evaluating differences in body concerns of the groups of boys, either independent samples t-tests or chi-square analyses were used depending on whether the variables of interest were continuous or categorical.

To compare parents' child feeding and parenting practices in relation to their sons' BMI and body composition

Multivariate analyses of variance (MANOVAs) were used to test for differences in the various dependent variables, including child feeding practices using the CFQ and parenting practices using the PPQ, by boys' BMI groups, by boys' PBF groups, and between parents. MANOVAs were used to provide protection against the possibility of a

Type I error. Follow-up tests, in the form of univariate analyses of variance (ANOVAs), were used to evaluate significant multivariate tests.

Methodological Issues

This study was designed to evaluate the variables of interest by both boys' BMI groups and by boys' PBF groups. Boys were recruited for the study based on their BMI and boys whose BMI fell between the 68^{th} and the 85^{th} percentile were intentionally excluded from the study to allow for greater separation between groups of boys. It was anticipated that this separation in BMI would also provide a separation in PBF between groups. However, no clear separation in PBF between groups was evident. Therefore, the results of this study in Part III describe the relationship between the BMI and PBF between the preadolescent boys. The results in Parts IV and V correspond to the first and second specific aims outlined in this methodology, but are presented only by boys' BMI groups. The results by boys' PBF groups are provided in Appendix D and E. One boy was dropped from further analyses after Part III because he had a high BMI, but an exceptionally low PBF.

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Part III:

Classification of Preadolescent Boys Based on their Body Mass Index and Percent Body Fat Produces Different Groups

Abstract

- **Objective:** To examine the relationship between body mass index (BMI) and percentage body fat (PBF) in preadolescent boys and to determine whether boys grouped by their BMI status would be grouped similarly based on their PBF.
- **Design:** A cross-sectional study related to the BMI and body composition of preadolescent boys.
- **Subjects/settings:** Participants included 50 Caucasian boys 8 to10 years old who were recruited based on their BMI, initially calculated from mothers' estimates of their current height and weight. Height and weight were measured to verify BMI for each boy. PBF was determined using air-displacement plethysmography. Boys were grouped based on their BMI status into an average BMI group (BMI percentile between the 33rd and the 68th) and a high BMI group (BMI percentile ≥85th) and based on their PBF into a lower PBF group (PBF < 21.8) and an upper PBF group (PBF > 21.8). Boys 'participation on sports teams and in classes, the number of hours spent playing outside, and boys' sedentary activities were reported by their mothers.
- **Statistical analyses performed:** Independent samples t-test were used to examine differences in age, weight, height, activity, BMI, BMI percentile and PBF for boys by their group status. Correlation analysis was used to examine the relationship between BMI and PBF of the boys. A chi-square test was used to examine similarities in proportions for the possible outcomes for grouping by BMI and PBF.

- **Results:** Differences were found in weight, BMI, BMI percentile and PBF between the groups of boys when they were divided by their BMI and by their PBF. A significant difference was found in the number of hours per week in sedentary activity by boys' PBF groups ($p < .05$), with boys in the upper PBF group participating in a greater number of hours of sedentary activity than boys in the lower PBF group. PBF was significantly correlated with BMI ($r=0.74$, $p<.0001$), and the two ways of grouping boys were not independent ($\chi^2= 13.52$, $p<.0001$). Six of the 25 boys in the high BMI group were also classified as being in the lower PBF group, and 6 of the 25 boys in the average BMI group were also classified as being in the upper PBF group, indicating that 6 boys from each group were classified differently.
- **Applications/conclusions:** BMI may be a useful screening tool to determine adiposity in groups, but it can be problematic when evaluating individual boys. Before intervening with boys who have a high BMI, it may be prudent to examine body fat to verify their risk of overweight. Additionally, it is important for practitioners to recognize that some boys who have a high body fat may be missed when only BMI is used for screening.

Introduction

According to national survey data, the prevalence of overweight in children has increased from the 1960s to the present (1). The Centers for Disease Control (CDC) growth charts using gender- and age-specific BMI curves are currently being used as a tool to evaluate these trends in children in the United States (2). BMI is commonly used

as a screening tool for weight status and is an indirect measure of adiposity (3). However, the use of BMI as a measure of adiposity in children has some limitations due to the variations in growth and maturation among children (4).

Researchers have examined the use of BMI to assess obesity in children (4-10). Using a large representative sample of seven-year-old children from the United Kingdom, Reilly and coworkers (10), determined that 12% of the children who had a PBF in the top 5% were not correctly identified as being obese (having a BMI >95th centile). Six percent of the children who were not obese (those who were not in the top 5% for body fat percentage) were identified as being obese using BMI. Ellis and coworkers (6) found 10% of the males whose PBF was above the 85th percentile for the sample were not classified as at risk of overweight or overweight according to their BMI values. Also, 17% of the males whose body fat fell below the 85th percentile, were identified as at risk of overweight or overweight using BMI. Ellis and coworkers (6) concluded that BMI may be appropriate for describing the adiposity within populations, but it has drawbacks when it is used to assess the degree of adiposity in the individual child.

The objectives of this study were: 1) to assess to the relationship between BMI and a measure of adiposity in preadolescent boys and; 2) to evaluate if boys grouped by their BMI status would group similarly based on their percentage of body fat.

Methods

Participants

Fifty Caucasian preadolescent boys were recruited from the Knoxville, TN area to participate via advertisements in the local press, flyers, and referrals from other mothers.

All boys were between the ages of 8 and 10 years old and had no history of chronic or metabolic disease. Boys were recruited based on their BMI, initially calculated from mothers' estimates of their current height and weight. The protocol was approved by The University of Tennessee's Institutional Review Board for research involving human subjects. Informed consent was obtained from the mothers, and boys gave their assent to participate.

BMI and Body Composition

To verify BMI estimates, boys' body weight was measured using a quality portable bathroom type scale with the children in lightweight clothing with no shoes. Height was measured with a steel measuring tape and a square, while the children stood upright against a wall or doorway. Both measures were taken twice, averaged, and BMI was calculated. Boys were placed into two groups based on their BMI percentile using the CDC growth charts for the United States (11). For this study, boys whose BMI fell between the 33rd and the 68th percentile were placed into an average BMI group and those whose BMI fell at or above the 85th percentile were placed into a high BMI group. Boys in the high BMI group would be considered either at risk of overweight (BMI percentile between the 85th and the 95th) or overweight (BMI percentile $\geq$ 95th) according to the CDC growth charts (2). Boys whose BMI fell between the 68th and the 85th percentile were intentionally excluded from the study to allow for greater separation between groups of boys.

Body composition of the boys was assessed using an air-displacement plethysmography (ADP) system, known as the BOD POD® Body Composition System (Life Measurements, Inc., Concord, CA). This device derives body volume of the

participant in order to calculate body density and estimate fat and fat-free mass (12). In order to minimize isothermal air from clothing and hair, children wore tight-fitting swim suits and swim caps during the testing procedure. Subject's body volume was measured once and then repeated to assess agreement between the two measurements. If the measurements did not agree, a third measurement was performed. In a few instances (n=4), none of the three measurements were in close agreement and the machine was recalibrated and the process was repeated. In order to transform the body density data calculated from the BOD POD into a child-specific equation, PBF was calculated with the Lohman equation (13). ADP has recently shown great promise as a tool for determining the body composition in children (14-16). No standards for PBF in children have been established. Therefore, we used a median split to divide the children into two groups based on their PBF.

Boys' Activity

Mothers reported their sons' involvement in the past year on sports teams and classes/lessons that involved physical activity and the number of teams and classes were totaled for each boy. Mothers also reported the number of hours per week that their sons spend playing outside. Finally, mothers reported hours per week that their sons spend in sedentary activities, such as watching television/videos and playing computer/video games. The total number of hours per week spent in these activities was calculated for each boy.

Data Analyses

Statistical analyses were performed using SPSS for Windows (Version 11.5, SPSS, Inc., Chicago, IL). Independent samples t-tests were used to test for differences in

age, weight, height, activity, BMI, BMI percentile, and PBF for the boys grouped by their BMI and by their PBF. A correlation was computed between BMI and PBF of the boys. The data were analyzed to evaluate if the boys falling into the two distinct BMI groups (average versus high) were the same boys who fell into the PBF groups (lower versus upper). A chi-square test was used to test for similarities in proportions between the two possible outcomes for BMI groups and PBF groups.

Results

As shown in Table 1, no differences were found in age and height when the boys were grouped either by BMI or PBF. Although they were similar in these characteristics, they differed in weight, BMI, BMI percentile and PBF. Boys in the upper PBF group spent more hours per week in sedentary activity compared to boys in the lower PBF group, but this differences was not found for boys grouped by their BMI.

The relation between PBF and BMI groupings is shown in Figure 1. PBF was significantly correlated with BMI ($r=0.74$, $p<.0001$). Figure 1 also shows the classifications of boys as having either an average or high BMI and as having either a lower or upper PBF. The chi-square test revealed that the two ways of grouping boys were not independent of one another ($\chi^2= 13.52$, $p<.0001$). Nineteen of the 25 boys were classified as having both an average BMI and lower PBF, while the remaining 6 boys of average BMI were considered to have an upper PBF. Nineteen of the boys from the high BMI group were classified as having an upper PBF, and 6 boys of high BMI were classified as having a lower PBF. These data indicate that 12 out of the 50 (24%) boys in the sample were classified differently into the BMI and PBF groups.

Table 1. Means, standard deviations, and ranges of selected characteristics of the sample

	BMI Groups[a]				PBF Groups[b]			
	Average (n=25)		*High* (n=25)		*Lower* (n=25)		*Upper (n=25)*	
	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD	Range
Age (years)	9.4 ± 0.8	8.0 - 10.8	9.2 ± 0.8	8.0 – 10.9	9.3 ± 0.8	8.0 - 10.7	9.3 ± 0.8	8.0 – 10.9
Weight (kg)	30.8 ± 4.2[c]	23.9 – 40.7	41.6 ± 7.5	30.7 – 64.6	32.5 ± 5.9[c]	23.9 – 43.4	39.8 ± 8.5	28.4 – 64.6
Height (m)	1.4 ± 0.1	1.3 – 1.5	1.4 ± 0.1	1.3 - 1.6	1.4 ± 0.1	1.3 – 1.5	1.4 ± 0.1	1.3 - 1.6
BMI (kg/m^2)	16.4 ± 0.9[c]	14.8 – 18.0	21.3 ± 2.9	18.5 – 32.4	17.1 ± 1.8[c]	14.8 – 20.9	20.7 ± 3.4	16.6 - 32.4
Body Fat (%)	15.8 ± 7.9[c]	1.7 – 33.7	28.5 ± 8.8	7.7 – 46.4	13.7 ± 5.4[c]	1.7 – 21.6	30.6 ± 6.6	22.1 - 46.4
BMI Percentile	51.2 ± 13.4[c]	34.7 – 67.3	92.5 ± 4.8	85.7 – 99.6	57.4 ± 21.6[c]	34.7 – 94.5	86.4 ± 13.6	55.7 – 99.6
Sedentary Activity (h/wk)	19.0 ± 8.0	4.5 – 39.0	19.0 ± 12.2	2.3 – 64.0	15.8 ± 7.1[c]	2.3 – 36.0	22.2 ± 11.8	7.5 – 64.0
Teams (# per year)	2.2 ± 1.3	0.0 – 5.0	2.5 ± 1.4	0.0 – 5.0	2.3 ± 1.2	0.0-5.0	2.4 ± 1.5	0.0 – 5.0
Play Outside (h/wk)	17.0 ± 9.3	6.8 – 39.5	15.5 ± 7.7	3.0 – 31.0	15.7 ± 8.5	6.8 – 39.5	16.8 ± 8.6	3.0 – 39.0

[a]BMI= body mass index groups with average BMI group having a BMI percentile between the 33rd and the 68th percentile and the high BMI group having a BMI percentile ≥ 85th percentile.
[b]PBF= percentage body fat groups include a lower PBF group with a % body fat less than the median of 21.8 and an upper PBF group greater than the median.
[c] Significant difference between groups at $p<.05$

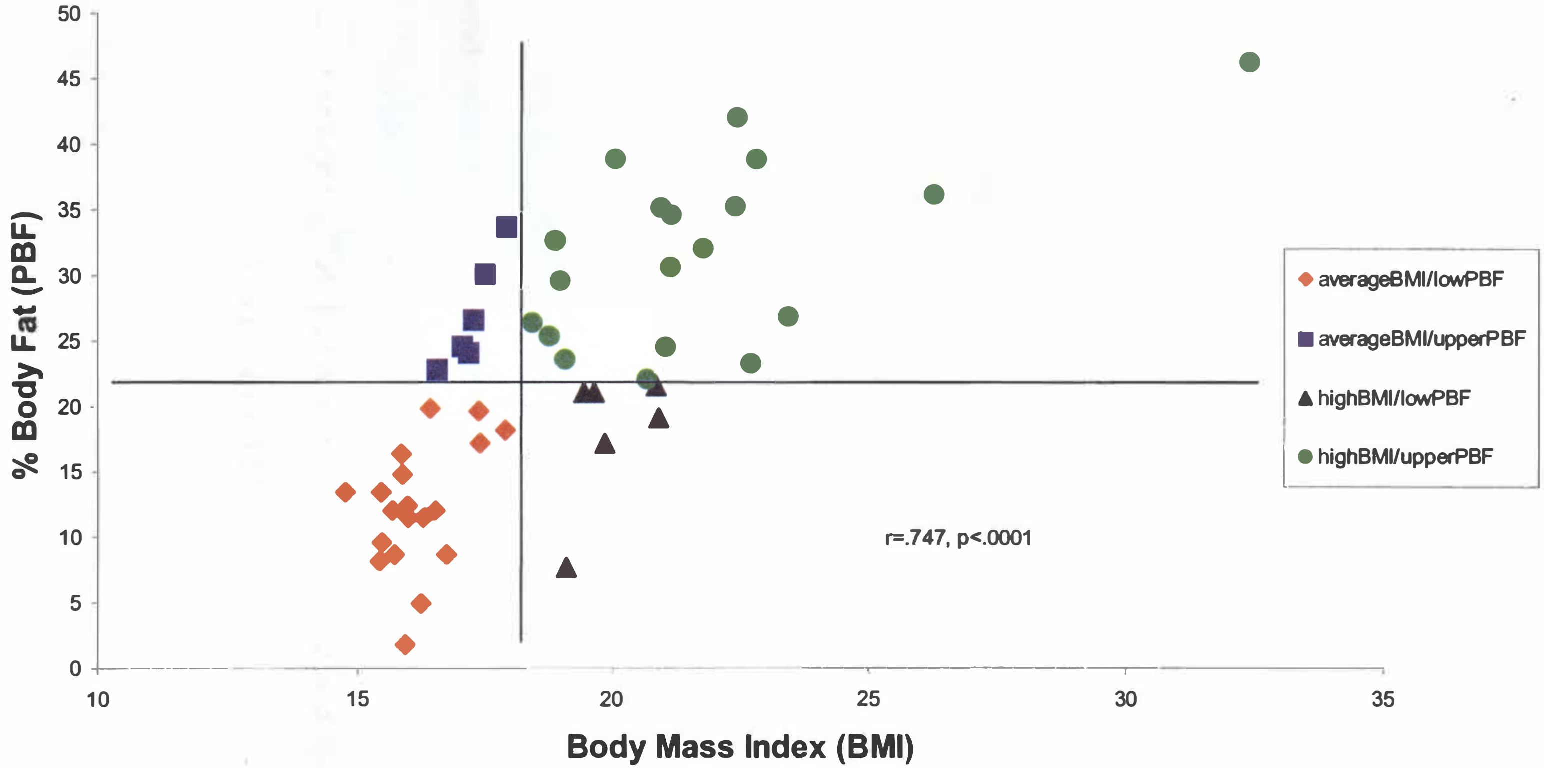

Figure 1. Relationship between percent body fat and body mass index

It is possible that different proportions of lean and adipose tissue contributed to the misclassifications in this group of boys. One boy who was classified as being in the high BMI group (BMI= 19.1) and the lower PBF group (PBF=7.7), participated in gymnastics approximately 9 hours per week. It is probable that this boy had a higher BMI due to his higher amount of lean body mass. Two of the boys who fell into the average BMI group (BMI=18 and 17.3) and upper PBF group (PBF=33.7 and 26.6) did not participate on any sports teams or recreation classes, whereas all of the boys in the high BMI/lower PBF group participated on at least one team/class. The 6 boys in the high BMI/lower PBF group spent approximately 11.5 hours per week involved in sedentary activity (television viewing, computer time, and video game time) compared to the 25.1 hours spent in sedentary activity by the average BMI/upper PBF boys. The sedentary activity time was 17.1 and 21.3 hours per week for boys in the average BMI/lower PBF group and high BMI/upper PBF group, respectively.

Discussion

We found a significant difference in sedentary activity between groups of boys based on their PBF, but not based on their BMI. BMI does not differentiate between whether excess weight is fat or muscle, but in this study we evaluated adiposity along with BMI. Other researchers have found a significant relationship between sedentary activity and adiposity in children (17-19). Maynard and coworkers (5) found that annual increases in BMI in children are often associated with the lean rather than the fat component of BMI, especially in males. Fat-free mass contains both muscle mass and

bone mass (20). Levels of physical activity have been positively related to bone mass in young boys (21,22), which could also be a contributing factor to body composition.

The classification of children using BMI as a measure of adiposity is similar to results of other studies (6,10). The results from the current study and from previous studies indicate that although BMI provides a good overall description of the adiposity of children, it still mislabels some children.

One limitation in assessing the ability of BMI to estimate adiposity is that researchers have used a variety of methods for estimating body composition in children. In this study, we used ADP to assess adiposity in children. To our knowledge, this is the first study that evaluates the relationship between BMI and ADP in children. ADP has been evaluated against other methods, including a 4-compartment model, and has been shown to be a valid method for measuring adiposity in children (14-16). We found a significant correlation between PBF and BMI, and this correlation was similar to correlations found by other researchers using dual energy x-ray absorptiometry (23,24) and hydrodensitometry (25) in boys of similar age.

This study is limited by a small sample size of boys that were all Caucasian; therefore, the results do not necessarily generalize to other ethnic or racial groups or to females. However, the results do support previous findings of Ellis and coworkers for white boys (6). We intentionally excluded boys whose BMI fell between the 68^{th} and the 85^{th} BMI percentiles, and we expected to see a similar gap in boys' PBF. However, this was not the case as PBF for the boys was more of a continuous measure.

As the prevalence of overweight in children increases (1), it is important to have a valid measure of adiposity that will not miss the children who have excess body fat.

Additionally, it is just as important to have a measure that does not falsely mislabel children as overweight or overfat, when this is not the case. In the clinical setting, BMI values are recommended to evaluate individual children (2). Practitioners need to be careful to prevent missing children with a high body fat, since adiposity in childhood has been associated with adverse health consequences in adulthood (26,27). Also, the results of this study support the need to examine body fat in children with a high BMI before intervention, such as dietary restriction, is implemented.

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Part IV:

Diet, Activity, Body Concerns, Body Esteem, and Body Perceptions of Preadolescent Boys

Abstract

- **Objective:** To determine if differences existed in the diets, activity levels, body concerns, body esteem, and body perceptions of preadolescent boys grouped by their body mass index (BMI) and to determine how accurately parents perceive their sons' body size.
- **Design:** The study design was descriptive and cross-sectional in nature.
- **Subjects/setting:** Subjects included 49 preadolescent boys and their parents. Boys were grouped by their BMI into an average BMI group (BMI percentile between the 33rd and the 68th) and a high BMI group (BMI percentile greater than or equal to the 85th). Mothers described their sons' activity levels and provided three days of dietary information for the boys. Boys completed a questionnaire related to their body concerns, body esteem, and body perceptions. Mothers and fathers completed questionnaires related to their perceptions of their sons' current and ideal body size.
- **Statistical Analyses:** T-tests were used to evaluate differences in energy and nutrient intakes, activity, body esteem, and body perceptions by boys' BMI groups.
- **Results:** No differences were found in the energy intakes or activity levels of boys by their BMI groups. Boys in the average BMI group had higher levels of body esteem compared to boys in the high BMI group. Boys in the high BMI group perceived themselves as bigger than the boys in the average BMI group, and parents of boys with a high BMI perceived their sons as bigger than parents

of boys with an average BMI. Boys in the high BMI group rated their current figure as heavier than their ideal boy figure.

- **Applications/conclusions:** Preadolescent boys with a high BMI were more concerned with their appearance or weight compared to boys with an average BMI. Preadolescent boys and their parents were aware of the boys' body sizes. If weight loss or weight maintenance intervention is warranted, practitioners need to discuss with parents and boys their body perceptions in order to develop realistic and achievable goals.

Introduction

Overweight in children has emerged as a major public health issue (1). The causes of overweight are multifactorial and weight status is dependent upon energy balance (2). In order to achieve energy balance in children, there needs to be a balance between food intake and energy output. According to national survey data, children's energy intakes have changed very little over the past few decades (3). Researchers have speculated as to how the composition of children's diets relate to their weight status. Much of the data in this area have yielded inconsistent results, where some researchers have found no relationships between diet composition and weight status (4), while other researchers have found positive relationships between fat intake and weight status (5-7) and negative relationships between carbohydrate intake and weight status (5,6).

Luepker (8) reviewed recent physical activity patterns of American children and found that overall physical activity has declined over the past several decades. Children are spending less time in physical education classes and more time in sedentary activities,

such as watching television or playing video or computer games. Sedentary activity, mainly in the form of hours of television viewing, has been related to higher weight status in children (9-14).

In addition to exploring the causes of childhood overweight, it is equally as important to evaluate the social consequences of childhood overweight (15-17). Overweight children have been seen by others as unhealthy, academically unsuccessful, socially inept, unhygienic, and lazy (18). In an effort to understand the impact of the ideal of thinness, researchers have begun focusing on body concerns and eating disturbances among children (19-28). In a study examining eating and body concerns of children ages 9 to 11 years old, the overweight children were more likely to exhibit dieting behaviors, to express weight concern, and to be more dissatisfied with their bodies than the average weight children (24). Researchers have found that body concerns among boys of all ages are common (29). Thompson et al (30) found that body mass index (BMI) was significantly associated with body dissatisfaction in boys, where the boys who had a higher BMI desired to have a thinner body size. Based on figure preference studies (28,31,32), a notable number of boys desired a thinner body size, where estimates ranged from 20% to 33%. The estimates for those who desired a larger body size ranged from 15% to 23%.

It also is important to examine how accurately parents perceive their children's body size. Baughcum and coworkers (33) found that many low-income mothers did not view their overweight children as overweight. However, in a sample of children of varying weights, Thompson et al (30) found strong associations between mothers' and children's ratings of children's current body size. No studies were identified that

examined parents' perceptions of their preadolescent sons' body size based on their sons' BMI.

This study was designed to evaluate the diets and activity levels of preadolescent boys in relation to their BMI and to assess the body concerns and body esteem of this group. Additionally, it was designed to evaluate boys' and parents' perceptions of the boys' body size. Accordingly, the specific research questions are listed below.

1) Are their differences in the diets and activity levels of preadolescent boys grouped by their BMI?
2) Are there differences in the body concerns, body esteem, and body size perceptions of boys grouped by their BMI?
3) Do parents' perceptions of their sons' body size differ by their sons' BMI groups?

Methods

Participants

Participants were forty-nine preadolescent boys between the ages of 8 and 10 years old and their parents, recruited from the Knoxville, TN area by the use of advertisements in the local press, flyers, and referrals from other mothers. During a telephone screening, mothers were asked to report their sons' current heights and weights, and from these estimates, body mass index (BMI; kg/m^2) was calculated for each boy. Boys were placed into an average BMI group or a high BMI group, based on their BMI percentile using the Centers for Disease Control growth charts for the United States (34). The average BMI group consisted of boys whose BMI percentile fell between the 33rd and the 68th percentile, whereas the high BMI group was made up of

boys whose BMI percentile was greater than or equal to the 85^{th} percentile. Boys whose BMI percentile fell between the 68^{th} and the 85^{th} percentile were excluded from the study to ensure a potentially greater separation in the study variables between groups. All boys were Caucasian and had no history of chronic or metabolic disease.

Mothers were defined as the primary adult female living with the child and fathers as the primary adult male in the child's life. Mothers/son pairs were interviewed by the first author in their homes, and mothers were given the father's questionnaire and the father's consent form. Fathers were asked to fill out these forms at a convenient time and return the forms to the researchers. This study was approved by the University of Tennessee's Institutional Review Board (IRB) for research involving human subjects. Mothers' consent and boys' assent were obtained prior to beginning the interview.

Demographic and Weight Status Information

Mothers provided information about occupation and education level for both parents. Using the Hollingshead Index, socioeconomic status (SES) scores were calculated from the occupation and education of the family's primary wage earner(s) (35). Mothers also reported heights and weights for both parents, and BMI for each parent was calculated.

In order to verify mothers' estimate of their sons' heights and weights, all boys were weighed on a quality portable scale and height was measured with a steel tape measure and a square during the personal in-home interview. Measurements were taken twice for each child and the averaged measurements were used to calculate BMI. If the boy's measured BMI did not fit within the specified average BMI or high BMI groups, his data were excluded from the analyses.

Boys' Dietary Intakes

Three days of children's dietary data (two weekdays and one week-end day) were collected from the boys and their mothers. This included one 24-hour recall and two days of food records. Mothers and boys were trained on how to properly record food intake using food models. In order to evaluate the boys' diets, dietary data were entered into Nutritionist Pro (Version 1.2.207, First Data Bank Inc., CA).

Boys' Activity

Mothers reported their sons' involvement in the past year on sports teams and classes/lessons that involved physical activity and the number of teams and classes were tallied for each boy. Mothers also reported hours per week that their sons spent in sedentary activities (watching television and videos and playing computer and video games) and a total for all of these activities was calculated for each boy.

Boys' Body Concerns and Body Esteem

Boys responded to a variety of questions related to their body concerns. Due to the lack of validated measures of body concerns for children, a variety of individual questions related to boys' weight and health concerns and desire for muscularity, were taken from the literature (20,23,27). Boys also completed the Body Esteem Scale (BES) (36), which assessed different aspects of body esteem in children with emphasis on feelings about appearance and feelings about body weight. This 24-item scale used a yes/no format, where a higher score indicated higher body esteem. Mendelson and White (36) reported that the scale had good split-half reliability ($r = .85$) and good construct validity with the Physical Appearance and Attributes subscale of the Piers-Harris Children's Self-Concept Scale ($r = .67$).

Figure Drawings

Figure drawings (31) were used to examine boys' ideas of their current body size and the size that they would like to be. There were seven drawings of boys' silhouettes, which ranged from very thin to very heavy. Test-retest reliability for the figure rating tasks for children as young as 8 years of age have been found to be high (28). Also, children were shown figure drawings of adult males (31) and were asked to choose the figure that looked most like their father and the figure that represented the way they wanted to look when they were grown up. Mothers and fathers rated their sons' current body size and ideal size of a boy using the same figure rating scale given to the boys (31).

Statistical Analyses

Means and standard deviations were computed for variables relating to characteristics of participants by their BMI groups. Independent samples t-tests were performed to examine if differences in these variables existed between groups and to examine whether differences in energy and nutrient intakes, activity levels, and body esteem existed between groups. Chi-square tests were used to compare body concerns measures of the boys by the BMI groups. Independent samples t-tests were used to assess differences in the participants' perceptions of the figure drawings by the boys' BMI groups. Analyses were run using SPSS for Windows (Version 11.5, SPSS, Inc., Chicago, IL).

Results

Participants

No significant difference was found for age of the boys by their BMI groups, with the mean ages of the 25 boys in the average BMI group and the 24 boys in the high BMI group being 9.4 and 9.2 years, respectively. The two groups did differ in their mean BMI (high BMI mean = 21.4; average BMI mean = 16.4; $p<.0001$). On average, both groups of boys came from families of middle to upper socioeconomic status. The mean age and BMI of parents did not differ by their sons' BMI group. Mothers (n=49) and fathers (n=31) were on average 39 and 42 years old, respectively, and had mean BMIs of 25.8 and 27.0, indicating that both mothers and fathers were on average slightly overweight.

Boys' Dietary Intakes

No differences were found in boys' mean energy or macronutrient distributions by their BMI groups (Table 1). Energy intakes for the boys in both groups were adequate in relation to the Estimated Energy Requirements for active boys (37). Also, distributions of protein, fat, and carbohydrates fell within the Acceptable Macronutrient Distribution Ranges for children (37). Nutrient intakes were similar between groups of boys, with the exception of vitamin D. Boys in the high BMI group consumed more vitamin D compared to boys in the average BMI group. Boys met or exceeded their requirements for most nutrients, with the exception of calcium and vitamin D. Boys' mean calcium intakes did not meet the adequate intake (AI), and the boys in the average BMI group did not meet the AI for vitamin D (38).

Table 1. Boys' mean (± standard deviation) energy and nutrient intakes by their body mass index (BMI) groups

Food Component	**EER/RDA/AI/AMDR**[a]	**Average BMI Group**[b]	**High BMI Group**[c]
Energy (kcal)	1,911/2,096*	2111 ± 369	2024 ± 359
Protein (g)	**19/34**	71 ± 12	74 ± 17
% of kcal	10-30	13%	15%
Fat (g)	No Data	79 ± 19	76 ± 27
% of kcal	25-35	33%	32%
Carbohydrate (g)	**130/130**	287 ± 58	270 ± 46
% of kcal	45-65	54%	53%
Calcium (mg)	*800/1,300*	890 ± 258	1091 ± 544
Vitamin D (µg)	*5/5*	3.3 ± 1.9[d]	5.3 ± 4.0
Vitamin A (µg)	**400/600**	1062 ± 767	861 ± 648
Vitamin C (mg)	**25/45**	137 ± 124	94 ± 62
Iron (mg)	**10/8**	12.8 ± 3.0	13.0 ± 3.3
Zinc (mg)	**5/8**	8.8 ± 2.8	9.5 ± 3.0
Folate (µg)	**200/300**	236 ± 100	238 ± 79

[a]Estimated Energy Requirement (EER) in ordinary type with an asterisk (*), Recommended Dietary Allowances (RDA) in **bold type**, Adequate Intakes (AI) in *italic type*, and Acceptable Macronutrient Distribution Ranges (AMDR) in ordinary type. All come from the Dietary Reference Intakes available at www.nap.edu. and are shown for boys 8 years old/and boys 9 and 10 years old.
[b]Boys whose BMI fell between the 33rd and the 68th percentile; of the 25 boys in this group, 12 were 8 years old.
[c]Boys whose BMI was ≥ 85th percentile; of the 24 boys in this group, 8 were 8 years old.
[d]Significant difference between groups at $p<.05$

Boys' Activity

No differences were found in either the mean number of sports teams/classes or the mean number of hours per week of sedentary activity between boys' BMI groups. On average, boys played on 2.3 sports teams/classes per year and spent 19.2 hours a week in sedentary activity.

Boys' Body Concerns and Body Esteem

Differences between groups for questions related to body concerns were tested with χ^2; however, the number of responses was less than 5% in some cells making the tests underpowered for statistical significance. Twenty-four of the 25 boys with an average BMI and all 24 boys with a high BMI thought their health was either good or fair. A majority of boys (23/25 average BMI and 22/24 high BMI) thought that their body size was just right. When boys were asked how often in the past year they wanted to be thinner, 4 boys with an average BMI answered sometimes or a lot, whereas 13 boys with a high BMI responded sometimes or a lot. Accordingly, 15 of the boys from the average BMI group reported wanting to be bigger compared to 8 of the boys from the high BMI group. A majority of boys (22/25 average BMI and 18/24 high BMI) wanted to have more muscles. While more than half of the boys from each group were not trying to change, 2 of the boys in the average BMI group and 10 of the boys in the high BMI group reported trying to lose weight. Six of the boys with an average BMI wanted to gain weight, whereas none of the boys with a high BMI wanted to gain weight.

Scores on the BES differed between boys in the two groups ($p=.03$), with the boys in the average BMI group reporting higher body esteem (20.8 ± 2.0) as compared to boys

in the high BMI group (18.2 ± 5.4). Based on the 24-item scale of the BES, boys in both groups reported moderately high levels of body esteem.

Figure Drawings

Table 2 shows the means and standard deviations of the participants' perceptions of the child figure drawings by boys' BMI groups. A lower score would represent a thinner boy and a higher score would represent a heavier boy. Boys in the high BMI group perceived themselves as bigger than the boys in the average BMI group, yet their perceptions of the ideal boy figure did not differ. Mothers and fathers of boys with a high BMI rated their sons as being heavier and chose a heavier ideal boy body size compared to mothers and fathers of boys with an average BMI. No differences were found by boys' BMI groups for either the boys' ratings of their fathers' body size or for their ratings of the ideal male body size.

No differences were found in the ratings of the current versus the ideal boy figure for boys in the average BMI group, but boys in the high BMI group rated their current figure as heavier than their ideal boy figure. Boys in both groups rated their fathers' figure as significantly heavier than their ideal male figure. Mothers of boys with an average BMI chose an ideal figure that was heavier than their sons' current figure. Mothers and fathers of boys with a high BMI chose an ideal figure that was thinner than their sons' current figure.

Discussion

In this study, no differences were found in the energy intakes or macronutrient distributions of boys by their BMI groups. These results are consistent with other

Table 2. Means and standard deviations of boys', mothers', and fathers' perceptions of current and ideal boy figures by boys' body mass index (BMI) groups and boys' perceptions of their fathers' figure and the ideal male figure by boys' BMI groups

	Means ± SD		**P Values**		
	Average BMI Group	*High BMI Group*	*Average vs. High*[a]	*Current vs. Ideal*	
Figure Drawing Ratings[b]				Average BMI Group[c]	High BMI Group[d]
Boys'	(n=25)	(n=24)			
Current Boy Figure	3.6 ± .5	4.3 ± .5	<.0001	NS[e]	<.0001
Ideal Boy Figure	3.7 ± .7	3.7 ±.6	NS		
Current Father Figure	4.5 ± .9	4.3 ± .8	NS	.001	<.0001
Ideal Male Figure	3.7 ± .7	3.8 ± .7	NS		
Mothers'	(n=25)	(n=24)			
Current Boy Figure	3.4 ± .7	4.8 ± .8	<.0001	.020	.030
Ideal Boy Figure	3.7 ± .4	4.1 ± .5	.006		
Fathers'	(n=14)	(n=17)			
Current Boy Figure	3.4 ± .5	4.9 ± .7	<.0001	NS	<.0001
Ideal Boy Figure	3.6 ± .5	4.2 ± .6	.008		

[a]P values correspond to tests between the average and high BMI groups of boys, their mothers, or their fathers
[b]Collins, 1991(Reference 31); Figure drawing range from 1 (very thin) to 7 (very heavy)
[c]P values correspond to tests between ratings of the current and ideal figures of boys, mothers, or fathers from the average BMI group
[d]P values correspond to tests between ratings of the current and ideal figures of boys, mothers, or fathers from the high BMI group
[e]NS=not significant

researchers who have evaluated energy intake and overweight in children and have been unable to decipher a clear relationship between the two (39-41). Also, dietary surveys have shown that mean energy intakes for children have changed very little in the last few decades (3). One possible explanation for the lack of a relationship between energy intake and overweight may be that dietary methods lack the sensitivity to detect small differences in energy intakes, which can over time result in weight gain (42). Results from studies examining macronutrient distributions and weight status in children have been inconsistent (4-7), indicating that the relationship between children's diet composition and weight status is not certain.

No differences were found between BMI groups for participation in either the number of sports teams/classes or in the number of hours per week boys spent in sedentary activity. Researchers have found negative relationships between participation in physical activity and weight status in children (14,43-45) and positive relationships between television viewing (as a measure of sedentary activity) and weight status in children (10,11,44,45). Among children ages 8 to 16 years old examined in the National Health and Nutrition Examination Survey III, 26% watched 4 or more hours of television a day and 67% watched at least 2 or more hours per day (10). Similar to the national survey data, boys in this study spent on average almost 3 hours per day in sedentary activity.

Regardless of weight status, a majority of boys from both groups thought that their body was just right, as opposed to too thin or too fat. In a group of fourth grade American Indian children who typically have a high rate of overweight, Stevens et al (25) also found that most boys thought that they were just right. However, a greater number

of boys in the high BMI group were trying to lose weight compared to the boys in the average BMI group. Other researchers have found attempts at weight loss were higher among overweight children as compared to normal weight children (24,26).

Body esteem, which evaluates children's feelings about their appearance and weight, did differ between boys with an average BMI and a high BMI in this study. Researchers have found a significant negative association between body esteem and BMI in girls (46,47). Mendelson et al (48) found that measures of body esteem were inversely related to the relative weight of both boys and girls. Scores on the BES for the boys in this study were moderately high and were similar to scores reported in the literature (27,49).

Boys in this study had similar ideas of how they would like to look regardless of weight status. Boys from the high BMI group chose a heavier current body size and a similar ideal body size, which suggests that they were more dissatisfied with their body size and their desire to be thinner was greater than the boys with an average BMI. Other researchers also have found that body dissatisfaction was greater among overweight children as compared to normal weight children (24,50). No differences were found in the boys' perception of their fathers' body size, which was supported by the fact that fathers' mean BMIs did not differ by boys' BMI groups. Boys rating of an ideal male figure did not differ by BMI group. This figure was smaller than the figure chosen to represent their fathers, indicating that boys may wish to have a different (smaller) body than their fathers' body and that boys recognized their fathers' slightly overweight status.

No studies were identified that examined parents perceptions of their sons by their BMI using figure drawings. When low income mothers were asked how they perceived

their children's weight, many mothers did not view their overweight preschool children as overweight (33). Results from the current study indicated that parents of boys with a high BMI did recognize that their sons were heavier than did parents of boys with an average BMI, but parents of boys with a high BMI also selected a heavier boy drawing as ideal.

The small sample size limited the ability to truly test differences in body concerns by the groups of boys. Also the cross-sectional nature of the study does not allow for causality of boys' body concerns to be determined. The sample was made up Caucasian participants who were of middle to upper SES making generalization of the results to other races/ethnicities and economic classes difficult.

In conclusion, when evaluating the diets and activity levels in the two groups of boys by their BMI, no differences were found. The body esteem of the preadolescent boys differed by boys' BMI groups, indicating that boys with a high BMI were more concerned with their appearance and weight compared to boys with an average BMI. However, the body esteem of boys in the high BMI group was moderately high, implying that these boys were not overly concerned about their weight or appearance. Results from this study support the idea that boys and parents are aware of the boys' current body size. If weight loss or weight maintenance intervention is warranted, practitioners need to discuss with parents and boys their perceptions of body size in order to develop realistic and achievable goals.

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Part V:

More Controlling Child Feeding Practices Found Among Parents of Boys with an Average BMI

Abstract

- **Objective:** To determine if differences existed in mothers' and fathers' child feeding practices and parenting practices by their sons' body mass index (BMI).
- **Design:** The study design was cross-sectional in nature.
- **Subjects/setting:** Subjects were 49 Caucasian preadolescent boys and their parents. Boys were grouped by their BMI status into two groups: an average BMI group (n=25) and a high BMI group (n=24). Parents of the boys completed questionnaires related to their child feeding practices and general parenting practices.
- **Statistical analyses performed:** Multivariate analyses of variance (MANOVAs) were used to compare child feeding and parenting practices between parents of boys' in the average BMI group and the high BMI group, and between mothers and fathers. Analyses of variance (ANOVAs) were used as follow-up tests where appropriate.
- **Results:** Mothers of boys with a high BMI saw their sons as more overweight ($p=.03$), were more concerned about their sons' weight ($p<.0001$), and used pressure to eat less often with their sons compared to mothers of boys with an average BMI. These findings were also true of fathers. In addition, fathers of boys with a high BMI monitored their sons' eating less often than fathers of boys with an average BMI ($p=.006$). When compared to fathers, mothers were more responsible for providing food to their sons ($p<.0001$). No differences were found in general parenting practices by boys' BMI. However, mothers of boys with an average BMI and mothers of boys with a high BMI were more likely to

use the authoritative style of parenting compared to fathers of boys with an average BMI (p=.009) and fathers of boys with a high BMI (p=.014), respectively.

- **Applications/conclusions:** Parents of boys with an average BMI tended to use more controlling child feeding practices with their sons compared to parents of boys with a high BMI. Understanding the relationships between parental child feeding practices and boys' weight status will help professionals educate parents about the most effective feeding practices to use with their sons.

Introduction

The recent increase in the prevalence of childhood overweight has been well established (1-3). Many adverse health consequences are linked to childhood overweight and as weight increases, so does the prevalence of health risks (4). Rapid increases in the prevalence of childhood overweight over the last few decades, in a stable genetic population, emphasize the importance of environmental factors on this issue (5,6).

Family environmental influences, particularly parental influences, make up one component of the environment that has been evaluated in relation to the weight status of children. Parents influence the eating behaviors of children in a variety of ways, and one important way is through their child feeding practices (7). Levels of control in the feeding relationship between parents and children vary among individuals (8). Birch and Fisher (8) describe three types of child feeding patterns with varying levels of control between parents and children, and these include: highly-controlling, laissez-faire, and responsive parenting. Mothers who are highly controlling do not give their children a

chance to regulate their own meal time, meal size, or food selection. Rather, these mothers tend to force-feed their children. Mothers with a laissez-faire strategy do not force or urge their children to eat, even if the child may be at nutritional risk. They assume their children are able to regulate when, what, and how much to eat. In the third pattern, responsive parenting, mothers acknowledge their child's needs and demands for food and respond to these needs and demands accordingly.

Birch and Fisher (8) related these child feeding styles to Baumarind's (9) authoritative, permissive, and authoritarian parenting styles. From the results of longitudinal studies on parenting, Baumarind (10) has concluded that authoritative parents were demanding, responsive, and assertive; while they avoided being restrictive and intrusive. Their discipline was supportive and not punitive. From this parenting style, children were more likely to be assertive, socially responsive, self-regulated, and responsible. Permissive parents were responsive, but not very demanding. They were usually lenient and avoided confrontation with their children. Finally, authoritarian parents were both demanding and directive, but not responsive. They expected their children to be obedient and provided little if any explanation for their orders.

Birch and Fisher (8) speculated that a responsive (authoritative) parent assists in their child's development of self-control over eating, whereas other styles may lead to problems with self-regulation (8,11). In subsequent studies they found relationships between children's weight (8,11-16) and parents' child feeding practices; however, in a large population based study, Robinson et al (17) did not find a relationship.

Because most research in the area of child feeding practices has focused on girls' weight status (12,18), this study was planned to evaluate parenting and child feeding

practices in relation to preadolescent boys' BMI and to compare differences between mothers and fathers in their child feeding practices. Additionally, general parenting styles in relation to children's BMI were examined. This study sought to answer the following research questions:

1) Do child feeding practices of parents differ depending on the child's BMI?
2) Do general parenting styles differ depending on the child's BMI?
3) Do mothers and fathers differ in child feeding practices and in parenting styles?

Methods

Sample

Forty-nine Caucasian preadolescent boys and their parents were recruited from the Knoxville, TN area to participate via advertisements in the local press, flyers, and referrals from other mothers. Boys were recruited based on their BMI, initially calculated from mothers' estimates of boys' weight and height. Boys were placed into two groups based on their BMI percentile using the revised Centers for Disease Control growth charts for the United States (19). For this study, boys whose BMI fell between the 33rd and the 68th percentile were placed in the average BMI group, and those whose BMI fell at or above the 85th percentile were placed in the high BMI group. All boys were between the ages of 8 and 10 years old and had no history of chronic or metabolic disease.

This study involved participation from both parents when possible. Mothers were defined as the primary adult female living with the child, and fathers were defined as the

primary adult male in the child's life. If the child's father was not present in the child's life, then no father's data were collected. Mothers and sons were interviewed twice, and mothers were given the father's questionnaire at the first interview. Fathers were asked to fill out these forms at a convenient time, and mothers returned these forms to the interviewer at the time of the second interview. The University of Tennessee's Institutional Review Board approved the study protocol: mothers signed informed consent forms, and boys signed assent forms prior to participating in the study.

Boys' Measures

Weight Status

To verify BMI estimates, boys' body weight was measured at the first interview using a quality portable bathroom type scale with the children in lightweight clothing with no shoes. Height was measured with a steel measuring tape and a square, while the children stood upright against a wall or doorway. Both measures were taken twice, averaged, and BMI was calculated.

Parents' Measures

Demographic and Parent Weight Information

Mothers reported occupation, level of education, age, height, and weight for themselves and for the children's fathers. Socioeconomic status (SES) scores were determined with the Hollingshead Four Factor Index, which uses education and occupation of the family's primary wage earner(s) (20). Scores can range from 8 (low) to 66 (high). BMI was calculated for both parents.

Child Feeding Questionnaire

Mothers and fathers completed the 30-item Child Feeding Questionnaire (CFQ) (21) to assess their beliefs, attitudes, and practices in relation to child feeding, particularly in relation to parental control over feeding and weight status. Seven factors have been identified in the CFQ; internal consistencies (Crohnbach's α) of these factors ranged from ranged from 0.70 to 0.93 (21). Four of the factors measure parental beliefs regarding obesity proneness in children and three of the factors relate to parental control of children's eating and parental attitudes in relation to child feeding practices (Table 1). Means were computed for each factor of the CFQ for each parent.

Parenting Practices Questionnaire

In order to assess non-food related parent-child interactions, mothers and fathers completed the Parenting Practices Questionnaire (PPQ) (22). This questionnaire, which consists of 62 items, assesses parents' use of three general parenting styles based on Baumarind's typologies of authoritative, authoritarian, and permissive parenting styles (9). The internal constancies (Crohnbach's α) for the authoritative, authoritarian, and permissive styles were 0.91, 0.86, and 0.75, respectively (22). A subset of the items from the PPQ is shown in Table 2. Mean scores for each parenting style were calculated for each parent.

Data Analyses

All analyses were performed using SPSS for Windows (Version 11.5, SPSS Inc., Chicago, IL). Group means and standard deviations were computed for variables of interest. Independent samples t-tests were used to assess differences in SES, age, and BMI between groups of boys.

Table 1. Child Feeding Questionnaire[a] factors, description of items, number of items, and response options

Factor[b]	Description of Items	# of Items	Response Options
Parents' Perceived Responsibility in Child Feeding	Assess the extent to which parents perceive they are responsible for the food provided to their children	3	1= never 5= always
Perceived Parent Weight	Evaluate how parents see their own weight over their lifetime	5	1= markedly underweight 5= markedly overweight
Perceived Child Weight	Evaluate parents' perceptions of their children's weight from the first year of life to present	5	1=markedly underweight 5=markedly overweight
Concern About Child Weight	Assess parents' concerns about children having to diet or becoming over weight	3	1= unconcerned 5= very concerned
Restriction	Evaluate how much parents keep track of certain types of foods	8	1= disagree 5= agree
Pressure to Eat	Assess the extent to which parents pressure their children to eat more food	4	1= disagree 5= agree
Monitoring	Evaluate how much parents keep track of certain types of foods	3	1= never 5= always

[a]Reference number 21.
[b]The first four factors measure parental beliefs regarding obesity proneness in children and the last three factors are related to parental control of children's eating and parental attitudes related to child feeding practices.

Table 2. Parenting styles from the Parenting Practices Questionnaire[a], number of items related to each style, and examples of items

Parenting Style	# of Items	Example of Items[b]
Authoritative	27	I give comfort and understanding when my child is upset. I emphasize reasons for rules. I encourage my child to express himself freely even when disagreeing with parents. I show patience with my child.
Authoritarian	20	I argue with my child. I guide my child by punishment more than by reason. I disagree with my child. I punish my child by taking privileges away from my child with little if any explanation.
Permissive	15	I state punishments to my child and do not actually do them. I give in to my child when he causes a commotion about something I allow my child to interrupt others. I find it difficult to discipline my child.

[a]Reference number 22
[b]Response options for items of the PPQ range from 1=never to 5=always

Multivariate analyses of variance (MANOVAs) were performed for the 7 factors of the CFQ for mothers and for fathers as the dependent variables by boys' BMI. MANOVAs were used to test the factors of the CFQ between mothers and fathers of the average BMI boys and between mothers and fathers of the high BMI boys. Also, MANOVAs were performed to test for differences in the three styles of parenting practices for mothers and for fathers by boys' BMI. Finally, MANOVAs were performed to test for differences in mothers' and fathers' parenting practices. MANOVA was used to provide protection against the possibility of a Type I error. Only multivariate tests that were significant were pursued with univariate analyses of variance (ANOVAs). A probability level of 0.05 was used as the criterion for significance for all tests.

Results

Descriptive data on the subjects are presented in Table 3. Data are presented by boys' BMI groups. Demographic and weight status information was available for 49 boys, 49 mothers, and 48 fathers. One mother was not able to provide any information about her child's father because he was estranged from the family. No differences were found between groups for SES, age of participants (mothers, fathers, or boys), and BMI of mothers and fathers. The sample was on average of middle to upper SES. Based on a desirable BMI of < 25, mothers and fathers were slightly overweight. As planned, the boys in the high BMI group had a significantly higher BMI than the boys in the average BMI group ($p<.0001$).

Table 3. Means and standard deviations of selected characteristics of the sample

		BMI Groups[a]	
		Average[b]	*High*[c]
SES[d]		51.9 ± 9.4	
Age (years)			53.2 ± 9.4
	Mothers	39.3 ± 4.9	
	Fathers	42.9 ± 6.4	38.2 ± 4.9
	Boys	9.4 ± 0.9	40.7 ± 4.8
BMI (m/kg^2)			9.2 ± 0.8
	Mothers	25.3 ± 6.0	
	Fathers	26.6 ± 3.7	26.3 ± 4.4
	Boys	16.4 ± .85[e]	27.4 ± 3.7

[a]BMI= body mass index groups with average BMI group having BMI percentile between the 33rd and the 68th percentile and the high BMI group having a BMI percentile ≥ 85th percentile.
[b]Average BMI group classification includes mothers (n=25), fathers (n=24), and boys (n=25).
[c]High BMI group classification includes mothers (n=24), fathers (n=24), and boys (n=24).
[d]SES=socioeconomic status determined from occupation and education of parents; scores range from 8(low) to 66 (high).
[e]Significant difference between groups at $p<.0001$

Child Feeding

Means and standard deviations for each factor of the CFQ for mothers and for fathers by boys' BMI group are shown in Table 4. All mothers completed the CFQ; whereas, fathers of 14 boys in the average BMI group and 17 fathers of boys in the high BMI group completed the CFQ.

The results of the multivariate test showed a significant main effect for boys' BMI group for mothers (F=3.805, p=.003). The MANOVA for the same effect was also significant for fathers (F=9.200, p<.0001) for the 7 factors on the CFQ. These results indicate that at least one of the factors of the CFQ differs by boys' BMI group for both mothers and for fathers. Univariate ANOVAs were then conducted to determine which factors on the CFQ were significant by boys' BMI group for mothers and for fathers.

Table 4 presents the ANOVAs for each of the 7 factors of the CFQ of mothers by their sons' BMI group. The effect of boys' BMI group was significant for perceived child weight, concern about child weight, and pressure to eat. These results indicate that mothers of boys with a high BMI saw their sons as more overweight and were more concerned about their sons' weight than were mothers of boys with an average BMI. Mothers of the boys with a high BMI used pressure to eat *less* often than mothers of boys with an average BMI.

Results from the ANOVAs for the effects of boys' BMI group on each of the 7 factors of the CFQ for fathers are presented in Table 4. Boys' BMI group was significant for the factors perceived child weight, concern about child weight, pressure to eat, and monitoring of child's food intake. Fathers of boys with a high BMI perceived their

Table 4. Univariate analyses of variance (ANOVAs) for the factors of the Child Feeding Questionnaire (CFQ)[a] and the parenting styles of the Parenting Practices Questionnaire (PPQ)[b] by parents of boys with average BMI and by parents of boys with high BMI

CFQ Factors		Means ± SD		P Values		
		Average BMI Group	High BMI Group	Average vs. High[c]	Mothers vs. Fathers	
					Average BMI Group[d]	High BMI Group[e]
Responsibility	Mothers	3.9 ± 0.6	3.9 ± 0.5	NS[f]	<.0001	<.0001
	Fathers	2.4 ± 0.5	2.2 ± 0.4	NS		
Perceived Weight	Mothers	3.1 ± 0.4	3.2 ± 0.4	NS	NS	NS
	Fathers	3.2 ± 0.3	3.2 ± 0.4	NS		
Perceived Child Weight	Mothers	2.9 ± 0.2	3.1 ± 0.3	0.030	NS	NS
	Fathers	3.0 ± 0.1	3.2 ± 0.2	0.015		
Concern about Child Weight	Mothers	1.4 ± 0.6	2.4 ± 1.2	<.0001	NS	NS
	Fathers	1.3 ± 0.6	2.5 ± 1.2	0.004		
Restriction	Mothers	2.9 ± 1.0	3.2 ± 0.8	NS	NS	NS
	Fathers	2.7 ± 0.7	3.1 ± 1.0	NS		
Pressure to Eat	Mothers	2.3 ± 0.9	1.4 ± 0.6	<.0001	0.001	NS
	Fathers	3.3 ± 0.8	1.7 ± 0.7	<.0001		

Table 4. Continued

		Means ± SD		P Values		
		Average BMI Group	High BMI Group	Average vs. High	Mothers vs. Fathers	
					Average BMI Group	High BMI Group
Monitoring	Mothers	3.2 ± 0.7	3.0 ± 0.6	NS	NS	0.005
	Fathers	3.3 ± 2.4	2.4 ± 0.8	0.006		
PPQ Styles						
Authoritative	Mothers	4.1 ± 0.3	4.1 ± 0.4	NT[g]	0.009	0.014
	Fathers	3.8 ± 0.3	3.7 ± 0.6	NT		
Authoritarian	Mothers	1.9 ± 0.4	1.9 ± 0.3	NT	NS	NS
	Fathers	2.1 ± 0.4	1.9 ± 0.3	NT		
Permissive	Mothers	2.0 ± 0.3	1.9 ± 0.3	NT	NS	NS
	Fathers	2.0 ± 0.3	1.9 ± 0.4	NT		

[a] Reference number 21; Scales range from 1 to 5, with a five indicating a greater use of a particular child feeding practice
[b] Reference number 22; Scales range from 1 to 5, with five indicating a greater use of a particular parenting style
[c] P values correspond to tests between mothers of boys with average BMI and mother of boys with high BMI or fathers of boys with average BMI and fathers of boys with high BMI
[d] P values correspond to tests between mother and fathers of boys with average BMI
[e] P values correspond to tests between mothers and fathers of boys with high BMI
[f] NS = not significant [g] NT= not tested; follow-up tests were not performed because the MANOVAs were not significant

children to be more overweight, were more concerned about their weight status, used pressure to eat *less* often and monitored their sons eating *less* than fathers of boys with an average BMI.

The results of the multivariate test showed a significant main effect for parent gender (mothers versus fathers) for the boys with an average BMI ($F=31.00$, $p<.0001$). The MANOVA for the effect of parent gender was also significant for the boys with a high BMI ($F=33.00$, $P<.0001$). These results indicate that at least one of the factors of the CFQ differed by mothers and fathers for both boys with an average BMI and with a high BMI. Univariate ANOVAs were conducted to determine which factors were significant.

The ANOVAs for the factors of the CFQ for mothers and fathers of boys with an average BMI and of boys with a high BMI are shown in Table 4. Mothers of boys with an average BMI reported being more responsible for providing food to their sons and used pressure to eat less often on their sons than fathers of boys with an average BMI. Mothers of boys with a high BMI reported being more responsible for providing food to their sons and monitoring their sons' food intake more often than fathers of boys with a high BMI.

Parenting Practices

Means and standard deviations for each parenting typology (authoritative, authoritarian, and permissive) from the PPQ are shown in Table 4. Complete data on the PPQ was available for all mothers of the average BMI group and for 14 of the fathers of these children. Among the high BMI percentile group, all mothers provided complete data, whereas 16 fathers completed the PPQ for this group. According to the results from

the MANOVAs for the effects of boys' BMI on parenting typologies, no differences between BMI groups were found on any of the parenting typologies for mothers (F=0.263, p=0.852) or for fathers (F=1.103, p=0.366).

The results of the MANOVAs showed a significant main effect for parental status (mothers versus fathers) for boys with an average BMI (F=35.00, p=.039) and for boys with a high BMI (F=36.00, p=.039). Therefore, follow-up tests (ANOVAs) were conducted to determine which parenting styles were significant between parents of boys with an average BMI and between parents of boys with a high BMI (Table 4). Mothers of boys with an average BMI were more likely to use the authoritative style of parenting compared to fathers of boys with an average BMI. Likewise, mothers of boys with a high BMI were more likely to use the authoritative style of parenting compared to fathers of boys with a high BMI. Mothers and fathers were equally as likely to use the authoritarian and permissive styles of parenting; however, the most used style for all parents was the authoritative.

Discussion

When examining parental child feeding practices in relation to the weight status of children, it is important to understand how parents perceive their children's weight status. Of the four factors on the CFQ that related to parental beliefs regarding obesity proneness in children, mothers' perceptions of their children's weight and mother's concern about their children's weight differed depending on their sons' BMI classification. Birch and Fisher (12) found a similar relationship in daughter's BMI and mothers' perception of their daughters' weight and concern for their weight. Baughcum and coworkers (23) evaluated maternal perceptions of their children's weight status by

asking mothers if they considered their preschool children overweight and found that many of the mothers interviewed did not view their overweight children as overweight.

Mothers of children who were classified in the high BMI group used less pressure on their sons to eat. These results are consistent with other studies (15,16). It appears from these results that mothers are using more pressure to eat on their sons with an average BMI, but mothers with sons who have a high BMI use this tactic less often.

No other studies were found that evaluated child feeding practices of fathers in relation to their sons' weight status. In this study, fathers of boys with a high BMI rated their sons as heavier and were more concerned about their sons' weight compared to fathers of boys with an average BMI. Fathers of sons with a high BMI used pressure to eat less often and monitored their sons' food intake less than fathers of sons with an average BMI. These results indicate that fathers are using more controlling child feeding practices with their average BMI sons.

When evaluating child feeding practices between mothers and fathers, mothers of boys from both BMI groups were more responsible for their children's food intake compared to fathers. These results are consistent with other studies, where women were found to be responsible for most of the family food roles (24). Mothers of boys in the high BMI group monitored their sons' food intake more often than fathers of these boys. Mothers may be more aware of their sons' food intake, especially if they are more responsible for their food intake. Fathers' perceptions of children's weight status and concern about their weight were similar to mothers' perceptions and concerns. It appears that parents in this study were in agreement about their children's weight status.

Results of this study indicate that general parenting styles do not seem to be related to the weight status of preadolescent boys. No other studies were located that evaluated general parenting styles in relation to children's weight. Costanzo and Woody (26) introduced the theory of domain-specific parenting styles, using the example of obesity proneness, to illustrate that parenting styles are tailored to parents concerns and perceptions of children's risk for developing a problem in a specific domain. None of the questions on the PPQ addressed parenting in relation to child weight status. This may indicate that parenting styles are context specific (27).

None of the parenting styles were correlated with the child feeding practices of restriction, pressure to eat, or monitoring. These findings support the idea that parenting practices in relation to child feeding do not generalize into other parenting domains. Parents in this study tended to favor a more authoritative parenting style, as opposed to authoritarian or permissive styles, with their sons. These results are consistent with other research on parenting styles with similar samples of primarily middle to upper SES Caucasian participants (28). Consistent with other research on differential parenting styles for fathers and mothers (29), mothers used authoritative parenting more than fathers.

This study evaluated the child feeding practices and parenting practices of both mothers and fathers. Unfortunately, even after a few attempts to collect data from fathers, fathers were less willing participants than mothers, primarily due to lack of time. The sample for this study consisted of Caucasian participants from middle to upper SES, which makes generalization to other groups difficult. However, child feeding results were similar to those found by Spruijt-Metz et al, (16) and their sample included both

Caucasian and African American mothers and children. The design of this study was descriptive and cross-sectional in nature, which does not allow for conclusions regarding cause and effect. It may be that the child feeding practices of parents are a reaction to their children's BMI rather than a cause of this factor.

In conclusion, mothers and fathers of sons with a high BMI perceived their sons as more overweight and were more concerned about their weight than mothers and fathers of sons with an average BMI. Yet it was the parents of boys with an average BMI who used more controlling child feeding practices with their sons compared to parents of boys with a high BMI. Future research should focus on further examining the parental child feeding practices on boys' weight status among boys of various ethnic and social class backgrounds. Understanding the relationships between parental child feeding practices and boys' weight status will help professionals educate parents about effective feeding practices to use with their sons.

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Appendices

Appendix A:

Children's Questionnaire

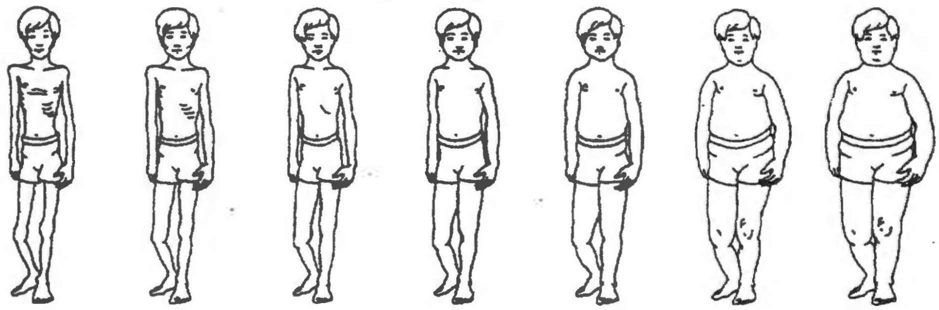
CHILDREN'S QUESTIONNAIRE

1. In general, would you say your health is
   a. good
   b. fair
   c. poor
2. Do you think you are
   a. healthier than most people your age
   b. not as healthy as most of them
   c. just about the same as people your age
3. In the past year, how often have you felt fat?
   a. never
   b. sometimes
   c. a lot
4. In the past year, how often have you thought about wanting to be thinner?
   a. never
   b. sometimes
   c. a lot
5. In the past year, how often have you worried about having fat on your body?
   a. never
   b. sometimes
   c. a lot
6. In the past year, how often have you felt too thin?
   a. never
   b. sometimes
   c. a lot
7. In the past year, how often have you wanted to be bigger?
   a. never
   b. sometimes
   c. a lot

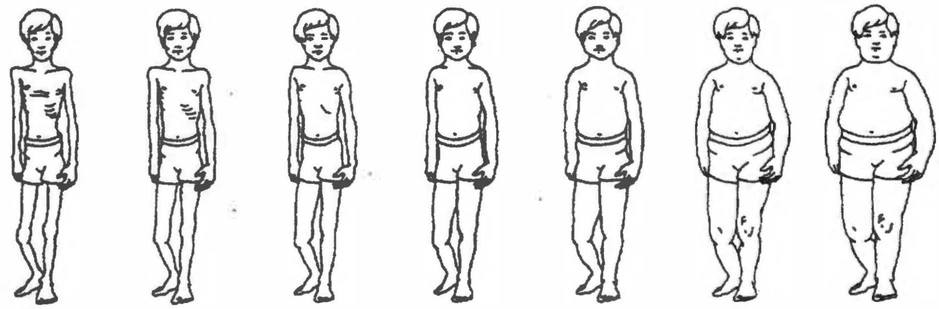
8. In the past year, how often have you wanted to have more muscles?
    a. never
    b. sometimes
    c. a lot
9. Which of the following are you trying to do about your weight?
    a. lose weight
    b. stay the same weight
    c. gain weight
    d. not trying to do anything about weight
10. In the past year, have you tried to lose weight?
    a. Yes
    b. No
11. If yes, did you do any of these things to lose weight?
    a. Eat less food
    b. Eat different foods
    c. Exercised to burn calories or fat
    d. Made yourself throw up
12. In the past year, have you tried to gain weight or gain muscle?
    a. Yes
    b. No
13. If yes, did you do any of these things to gain weight/muscle?
    a. Eat more food
    b. Take food supplements
    c. Lifted weights to build muscle
    d. Exercised to build muscle

14. Do you think your body is
    a. too thin
    b. just right
    c. too fat
15. Would you like your body to be
    a. thinner
    b. stay the same
    c. fatter
    d. more muscular
16. In the past year, how much have you tried to look like the boys or men you see on television, in movies, or in magazines?
    a. never
    b. sometimes
    c. a lot
17. I think that the more muscular you are, the better you look in clothes.
    a. agree
    b. disagree
    c. don't know
18. I wish I looked like a body builder.
    a. agree
    b. disagree
    c. don't know
19. I wish I looked like a football player.
    a. agree
    b. disagree
    c. don't know

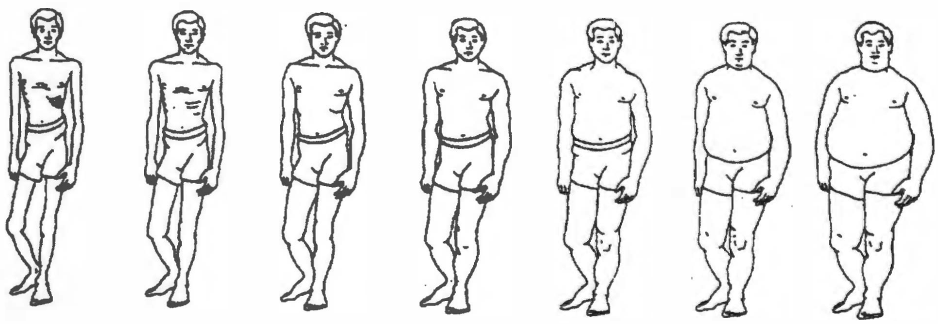
1. Which picture looks most like you?



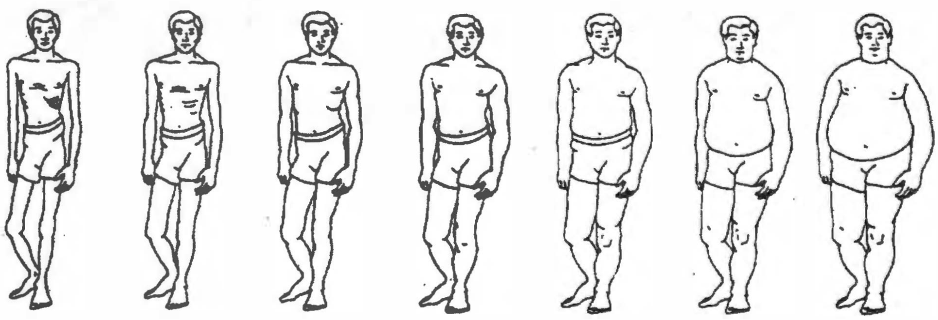
2. Which picture shows the way you want to look?



3. Which picture looks like your dad?



4. Which picture looks like you want to look when you grow up?



1. I like what I look like in pictures.	Yes	No
2. Kids my own age like my looks.	Yes	No
3. I'm pretty happy about the way I look.	Yes	No
4. Most people have a nicer body than I do.	Yes	No
5. My weight makes me unhappy.	Yes	No
6. I like what I see when I look in the mirror.	Yes	No
7. I wish I were thinner.	Yes	No
8. There are lots of things I'd change about my looks if I could.	Yes	No
9. I'm proud of my body.	Yes	No
10. I really like what I weigh.	Yes	No
11. I wish I looked better.	Yes	No
12. I often feel ashamed of how I look.	Yes	No
13. Other people make fun of the way I look.	Yes	No
14. I think I have a good body.	Yes	No
15. I'm looking as nice as I'd like to be.	Yes	No
16. It's pretty tough to look like me.	Yes	No
17. I wish I were fatter.	Yes	No
18. I often wish I looked like someone else.	Yes	No
19. My classmates would like to look like me.	Yes	No
20. I have a high opinion of the way I look.	Yes	No
21. My looks upset me.	Yes	No
22. I'm as nice looking as most people.	Yes	No
23. My parents like my looks.	Yes	No
24. I worry about the way I look.	Yes	No

Appendix B:

Mothers' Questionnaire

MOTHERS' QUESTIONNAIRE

1. Demographic Information

1. Mother's date of birth: ______________
2. Father's date of birth: _______________
3. Child's date of birth: _______________
4. Mother's Education level (check the highest level)
   _____ < 7th grade
   _____ junior high school
   _____ some high school
   _____ high school graduate
   _____ some college or specialized training
   _____ college graduate
   _____ graduate school or professional training
5. Father's Education (check the highest level)
   _____ <7th grade
   _____ junior high school
   _____ some high school
   _____ high school graduate
   _____ some college or specialized training
   _____ college graduate
   _____ graduate school or professional training
6. Please list:
   Mother's Occupation ____________________________________
   Father's Occupation _____________________________________
7. In which of these categories does you household income fit best? Circle the letter corresponding to your answer.
   a. Below $20,000
   b. Between $20,000 and $40,000
   c. Between $40,001 and $60,000
   d. Between $60,001 and $80,000
   e. Between $80,001 and $100,000
   f. Over $100,000

II. Family Health History

1. Please indicate whether your child's mother (M), father (F), grandmother (GM), grandfather (GF), brothers (B), sisters (S), uncles (U), or aunts (A), if biological relatives, have ever been treated for:

adult-onset diabetes	__________	stroke	__________
juvenile diabetes	__________	high blood pressure	__________
heart disease	__________	hyperlipidemia	__________
thyroid conditions	__________	polycystic ovary disease	_________
sleep apnea	__________	asthma	__________
intestinal problems	__________	liver disease	__________
kidney disease	__________	food allergies	__________
overweight/obesity	__________	osteoporosis	__________

2. List any health problems of your child's relatives not covered above.

____

____

3. Please report your age, height, and weight, your spouse's age, height, and weight, and the age, sex, height and weight for each of your children.

PERSON	AGE	SEX	HEIGHT	WEIGHT
Self	_____	F	_______	_______
Spouse	_____	M	_______	_______
Child 1	_____	______	_______	_______
Child 2	_____	______	_______	_______
Child 3	_____	______	_______	_______
Child 4	_____	______	_______	_______
Child 5	_____	______	_______	_______

4. Circle whether each person in your family is currently overweight, average, or underweight, if applicable?

PERSON	Overweight		Average weight		Underweight
Your mother	very	slightly	average	slightly	very
Your father	very	slightly	average	slightly	very
Your sibling	very	slightly	average	slightly	very
Your sibling	very	slightly	average	slightly	very
Your sibling	very	slightly	average	slightly	very
Your sibling	very	slightly	average	slightly	very

5. Circle whether each person in your husband's family is currently overweight, average, or underweight, if applicable?

PERSON	Overweight		Average weight		Underweight
His mother	very	slightly	average	slightly	very
His father	very	slightly	average	slightly	very
His sibling	very	slightly	average	slightly	very
His sibling	very	slightly	average	slightly	very
His sibling	very	slightly	average	slightly	very
His sibling	very	slightly	average	slightly	very

III. Child's Health History

1. Does your child have any ongoing or chronic health problems? ___ yes / ___ no

2. If yes, what are the problems? How long has the child had the problems? What medications were given?

Problem	Length of Problem	Medication

3. How many times have you taken your child to the doctor in the last 12 months? _____

4. Has your child been ill in the last 12 months? ____ yes/ ____ no

5. If yes, what were the illnesses and length of the illnesses? What medications were given?

Illness	Length of Illness	Medication

6. Has your child been hospitalized for any reason during the last 12 months?
___ yes/___no

7. If yes, describe the hospitalization(s). ____

____

8. Does your child have any allergies to food or food products? ____ yes/ _____no

9. If yes, what food or food products is your child allergic to and how long have you been aware of this/these allergies?

Food/food product	Length of Allergy

IV. Please circle the letter that corresponds to your answer.

1. In general, would you say your child's health is
   a. good
   b. fair
   c. poor
2. Do you think your child is
   a. healthier than most children his age
   b. not as healthy as most children his age
   c. just about the same as children his age

V. Please circle the number that corresponds to your answer. Note that while most questions refer to your child, a few questions (numbers 4 to 7) relate to you.

1. When your child is at home, how often are you responsible for feeding him?

1	2	3	4	5
never	seldom	half of the time	most of the time	always

2. How often are you responsible for deciding what your child's portion sizes are?

1	2	3	4	5
never	seldom	half of the time	most of the time	always

3. How often are you responsible for deciding if your child has eaten the rights kind of foods?

1	2	3	4	5
never	seldom	half of the time	most of the time	always

4. How would you classify **your weight** during **your** childhood (5 to 10 years old)?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

5. How would you classify **your weight** during **your** adolescence?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

6. How would you classify **your weight** during **your** 20s?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

7. How would you classify **your weight** at present?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

8. How would you classify your child's weight during the first year of his life?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

9. How would you classify your child's weight as a toddler?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

10. How would you classify your child's weight as a pre-schooler?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

11. How would you classify your child's weight from kindergarten through 2nd grade?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

12. How would you classify your child's weight at the present time?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

13. How concerned are you about your child eating too much when you are not around him?

1	2	3	4	5
unconcerned	a little concerned	concerned	fairly concerned	very concerned

14. How concerned are you about your child having to diet to maintain a desirable weight?

1	2	3	4	5
unconcerned	a little concerned	concerned	fairly concerned	very concerned

15. How concerned are you about your child becoming overweight?

1	2	3	4	5
unconcerned	a little concerned	concerned	fairly concerned	very concerned

16. I have to be sure that my child does not eat too many sweets (candy, ice cream, cake, or pastries).

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

17. I have to be sure that my child does not eat too many high-fat foods.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

18. I have to be sure that my child does not eat too much of his favorite foods.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

19. I intentionally keep some foods out of my child's reach.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

20. I offer sweets (candy, ice cream, cakes, pastries) to my child as a reward for good behavior.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

21. I offer my child his favorite foods in exchange for good behavior.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

22. If I did not guide or regulate my child's eating, he would eat too many junk foods.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

23. If I did not guide or regulate my child's eating, he would eat too much of his favorite foods.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

24. My child should always eat all of the food on his plate.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

25. I have to be especially careful to make sure my child eats enough.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

26. If my child says "I'm not hungry", I try to get him to eat anyway.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

27. If I did not guide or regulate my child's eating, he would eat much less than he should.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

28. How much do you keep track of sweets (candy, ice cream, cake, pies, pastries) that your child eats?

1	2	3	4	5
never	rarely	sometimes	mostly	always

29. How much do you keep track of the snack food (potato chips, Doritos, cheese puffs) that your child eats?

1	2	3	4	5
never	rarely	sometimes	mostly	always

30. How much do you keep track of high-fat foods that your child eats?

1	2	3	4	5
never	rarely	sometimes	mostly	always

VI. Please provide answers to the following questions regarding your child.

1. Estimate the number of hours per day that your child watches television.

   _____________ Average Weekday ____________ Average Weekend Day

2. How many hours per week does your child watch videotapes? __________
3. How many hours per week does your child play video/computer games? ______
4. During the past 12 months, on how many organized recreational sports teams such as basketball or soccer teams did your child play?

   Number of sports teams _________

   If your child played on any teams, please provide the type of team, number of months out of the year , times per week, and average minutes per time that he played.

Type of Team	**Number of Months**	**Times per Week**	**Minutes per time**
1.			
2.			
3.			
4.			
5.			

5. During the past 12 months, how many types of recreational classes or lessons such as gymnastics or karate did he participate in?

   Number of types of classes/lessons ________

   If your child participated in recreational classes or lessons, provide the classes/lessons, the number of months out of the year, times per week, and average minutes per time that he played.

Type of Class/Lesson	Number of Months	Times per Week	Minutes per time
1.			
2.			
3.			
4.			
5.			

6. When it is suitable weather, how many hours per day does your child spend playing outside?

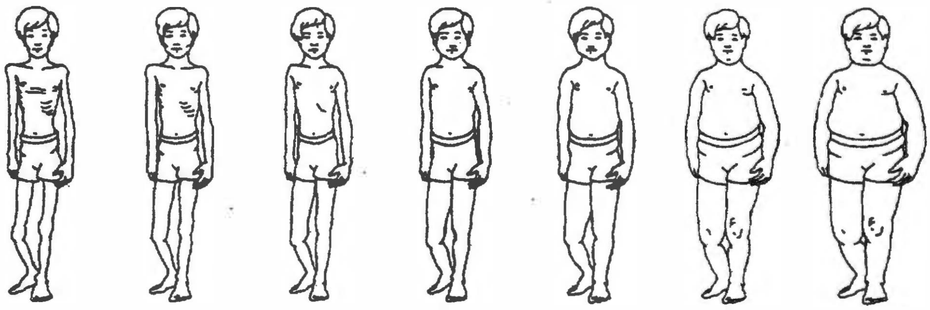
   On a normal week day _________ hours per day

   On a normal weekend day ________ hours per day

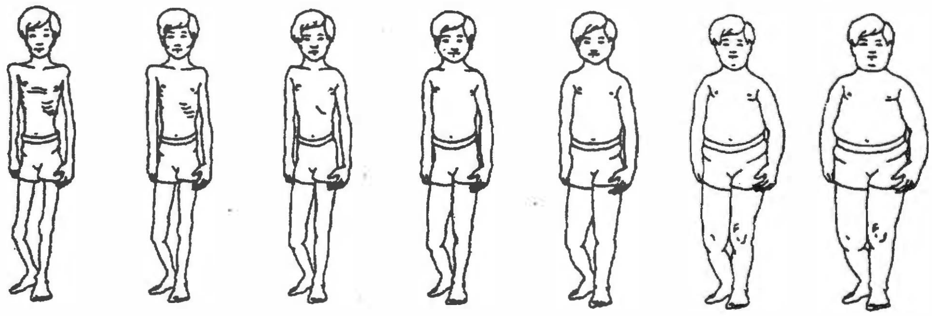
7. How many times per week does your child work, play, or exercise hard enough to make him sweat and breathe heavily?
   a. Never
   b. 1 to 2 times per week
   c. 3 or more times per week

VII. Please circle the picture that corresponds to your answer.

1. Which picture looks most like your child?



2. Which picture shows the way you would like your child to look?



VII. Please circle the number that corresponds to your answer.

RATE HOW OFTEN YOU EXHIBIT THIS BEHAVIOR WITH YOUR CHILD.	**Never**	**Once in Awhile**	**About Half of the Time**	**Very Often**	**Always**
1. I encourage my child to talk about his troubles.	1	2	3	4	5
2. I guide my child by punishment more than by reason.	1	2	3	4	5
3. I know the names of my child's friends.	1	2	3	4	5
4. I find it difficult to discipline my child.	1	2	3	4	5
5. I give praise when my child is good.	1	2	3	4	5
6. I spank when my child is disobedient.	1	2	3	4	5
7. I joke and play with my child.	1	2	3	4	5
8. I withhold scolding and/or criticism even when my child acts contrary to my wishes.	1	2	3	4	5
9. I show sympathy when my child is hurt or frustrated.	1	2	3	4	5
10. I punish by taking privileges away from my child with little if any explanation.	1	2	3	4	5
11. I spoil my child.	1	2	3	4	5
12. I give comfort and understanding when my child is upset.	1	2	3	4	5
13. I yell or shout when my child misbehaves.	1	2	3	4	5
14. I am easy going and relaxed with my child.	1	2	3	4	5
15. I allow my child to annoy someone else.	1	2	3	4	5

	Never	Once in Awhile	About Half of the Time	Very Often	Always
16. I tell my child my expectations regarding behavior before he engages in an activity.	1	2	3	4	5
17. I scold and criticize to make my child improve.	1	2	3	4	5
18. I show patience with my child.	1	2	3	4	5
19. I grab my child when being disobedient.	1	2	3	4	5
20. I state punishments to my child and do not actually do them.	1	2	3	4	5
21. I am responsive to my child's feelings or needs.	1	2	3	4	5
22. I allow my child to give input into family rules.	1	2	3	4	5
23. I argue with my child.	1	2	3	4	5
24. I appear confident about parenting abilities.	1	2	3	4	5
25. I give my child reasons why rules should be obeyed.	1	2	3	4	5
26. I appear to be more concerned with my feelings than with my child's feelings.	1	2	3	4	5
27. I tell my child that I appreciate what he tries or accomplishes.	1	2	3	4	5
28. I punish by putting my child off somewhere alone with little if any explanation.	1	2	3	4	5

	Never	Once in Awhile	About Half of the Time	Very Often	Always
29. I help my child to understand the impact of behavior by encouraging him to talk about the consequences of his actions.	1	2	3	4	5
30. I am afraid that disciplining my child for misbehavior will cause the child to not like his parents.	1	2	3	4	5
31. I take my child's desires into account before asking him to do something.	1	2	3	4	5
32. I explode in anger towards my child.	1	2	3	4	5
33. I am aware of problems or concerns about my child in school.	1	2	3	4	5
34. I threaten my child with punishment more often than actually giving it.	1	2	3	4	5
35. I express affection by hugging, kissing, and holding my child.	1	2	3	4	5
36. I ignore my child's misbehavior.	1	2	3	4	5
37. I use physical punishment as a way of disciplining my child.	1	2	3	4	5
38. I carry out discipline after my child misbehaves.	1	2	3	4	5
39. I apologize to my child when making a mistake in parenting.	1	2	3	4	5
40. I tell my child what to do.	1	2	3	4	5

	Never	Once in Awhile	About Half of the Time	Very Often	Always
41. I give in to my child when he causes a commotion about something.	1	2	3	4	5
42. I talk it over and reason with my child when he misbehaves.	1	2	3	4	5
43. I slap my child when he misbehaves.	1	2	3	4	5
44. I disagree with my child.	1	2	3	4	5
45. I allow my child to interrupt others.	1	2	3	4	5
46. I have warm and intimate times together with my child.	1	2	3	4	5
47. When two children are fighting, I discipline the children first and ask questions later.	1	2	3	4	5
48. I encourage my child to freely express himself even when disagreeing with me.	1	2	3	4	5
49. I bribe my child with rewards to bring about compliance.	1	2	3	4	5
50. I scold or criticize when my child's behavior doesn't meet my expectations.	1	2	3	4	5
51. I show respect for my child's opinions by encouraging my child to express them.	1	2	3	4	5
52. I set strict well-established rules for my child.	1	2	3	4	5

	Never	Once in Awhile	About Half of the Time	Very Often	Always
53. I explain to my child how I feel about his good and bad behavior.	1	2	3	4	5
54. I use threats as punishment with little or no justification.	1	2	3	4	5
55. I take into account my child's preferences in making plans for the family.	1	2	3	4	5
56. When my child asks why he has to conform, I state: because I said so, or I am your parent and I want you to.	1	2	3	4	5
57. I appear unsure on how to solve my child's misbehavior.	1	2	3	4	5
58. I explain the consequences of the child's behavior.	1	2	3	4	5
59. I demand that my child does things.	1	2	3	4	5
60. I channel my child's misbehavior into more acceptable activity.	1	2	3	4	5
61. I shove my child when he is disobedient.	1	2	3	4	5
62. I emphasize the reasons for rules.	1	2	3	4	5

Appendix C:

Fathers' Questionnaire

FATHERS' QUESTIONNAIRE

Please answer all the following questions regarding your child that is participating in this study.

I. Please circle the letter that corresponds to your answer.

1. In general, would you say your child's health is
   a. good
   b. fair
   c. poor
2. Do you think your child is
   a. healthier than most children his age
   b. not as healthy as most children his age
   c. just about the same as children his age

II. Please circle the number that corresponds to your answer. Note that while most questions refer to your child, a few questions (numbers 4 through 7) relate to you.

1. When your child is at home, how often are you responsible for feeding him?

1	2	3	4	5
never	seldom	half of the time	most of the time	always

2. How often are you responsible for deciding what your child's portion sizes are?

1	2	3	4	5
never	seldom	half of the time	most of the time	always

3. How often are you responsible for deciding if your child has eaten the rights kind of foods?

1	2	3	4	5
never	seldom	half of the time	most of the time	always

4. How would you classify **your weight** during **your** childhood (5 to 10 years old)?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

5. How would you classify **your weight** during **your** adolescence?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

6. How would you classify **your weight** during **your** 20s?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

7. How would you classify **your weight** at present?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

8. How would you classify your child's weight during the first year of his life?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

9. How would you classify your child's weight as a toddler?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

10. How would you classify your child's weight as a pre-schooler?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

11. How would you classify your child's weight from kindergarten through 2nd grade?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

12. How would you classify your child's weight at the present time?

1	2	3	4	5
markedly underweight	underweight	normal	overweight	markedly overweight

13. How concerned are you about your child eating too much when you are not around him?

1	2	3	4	5
unconcerned	a little concerned	concerned	fairly concerned	very concerned

14. How concerned are you about your child having to diet to maintain a desirable weight?

1	2	3	4	5
unconcerned	a little concerned	concerned	fairly concerned	very concerned

15. How concerned are you about your child becoming overweight?

1	2	3	4	5
unconcerned	a little concerned	concerned	fairly concerned	very concerned

16. I have to be sure that my child does not eat too many sweets (candy, ice cream, cake, or pastries).

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

17. I have to be sure that my child does not eat too many high-fat foods.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

18. I have to be sure that my child does not eat too much of his favorite foods.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

19. I intentionally keep some foods out of my child's reach.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

20. I offer sweets (candy, ice cream, cakes, pastries) to my child as a reward for good behavior.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

21. I offer my child his favorite foods in exchange for good behavior.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

22. If I did not guide or regulate my child's eating, he would eat too many junk foods.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

23. If I did not guide or regulate my child's eating, he would eat too much of his favorite foods.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

24. My child should always eat all of the food on his plate.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

25. I have to be especially careful to make sure my child eats enough.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

26. If my child says "I'm not hungry", I try to get him to eat anyway.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

27. If I did not guide or regulate my child's eating, he would eat much less than he should.

1	2	3	4	5
disagree	slightly disagree	neutral	slightly agree	agree

28. How much do you keep track of sweets (candy, ice cream, cake, pies, pastries) that your child eats?

1	2	3	4	5
never	rarely	sometimes	mostly	always

29. How much do you keep track of the snack food (potato chips, Doritos, cheese puffs) that you child eats?

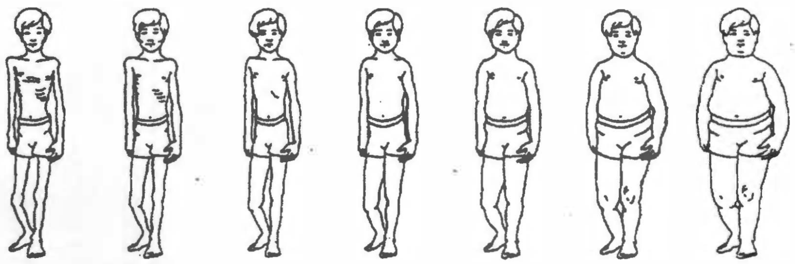
1	2	3	4	5
never	rarely	sometimes	mostly	always

30. How much do you keep track of high-fat foods that your child eats?

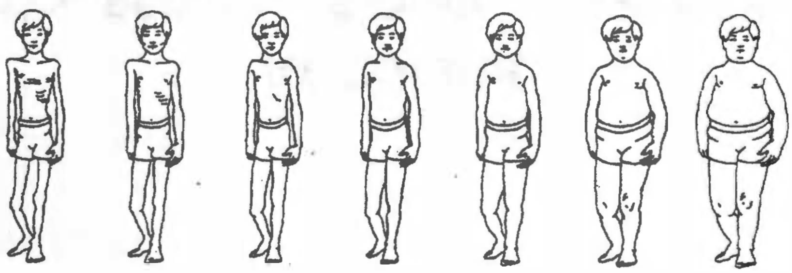
1	2	3	4	5
never	rarely	sometimes	mostly	always

III. Please circle the picture that corresponds to your answer.

1. Which picture looks most like your child?



2. Which picture shows the way you would like your child to look?



VII. Please circle the number that corresponds to your answer.

RATE HOW OFTEN YOU EXHIBIT THIS BEHAVIOR WITH YOUR CHILD.	**Never**	**Once in Awhile**	**About Half of the Time**	**Very Often**	**Always**
1. I encourage my child to talk about his troubles.	1	2	3	4	5
2. I guide my child by punishment more than by reason.	1	2	3	4	5
3. I know the names of my child's friends.	1	2	3	4	5
4. I find it difficult to discipline my child.	1	2	3	4	5
5. I give praise when my child is good.	1	2	3	4	5
6. I spank when my child is disobedient.	1	2	3	4	5
7. I joke and play with my child.	1	2	3	4	5
8. I withhold scolding and/or criticism even when my child acts contrary to my wishes.	1	2	3	4	5
9. I show sympathy when my child is hurt or frustrated.	1	2	3	4	5
10. I punish by taking privileges away from my child with little if any explanation.	1	2	3	4	5
11. I spoil my child.	1	2	3	4	5
12. I give comfort and understanding when my child is upset.	1	2	3	4	5
13. I yell or shout when my child misbehaves.	1	2	3	4	5
14. I am easy going and relaxed with my child.	1	2	3	4	5
15. I allow my child to annoy someone else.	1	2	3	4	5

	Never	Once in Awhile	About Half of the Time	Very Often	Always
16. I tell my child my expectations regarding behavior before he engages in an activity.	1	2	3	4	5
17. I scold and criticize to make my child improve.	1	2	3	4	5
18. I show patience with my child.	1	2	3	4	5
19. I grab my child when being disobedient.	1	2	3	4	5
20. I state punishments to my child and do not actually do them.	1	2	3	4	5
21. I am responsive to my child's feelings or needs.	1	2	3	4	5
22. I allow my child to give input into family rules.	1	2	3	4	5
23. I argue with my child.	1	2	3	4	5
24. I appear confident about parenting abilities.	1	2	3	4	5
25. I give my child reasons why rules should be obeyed.	1	2	3	4	5
26. I appear to be more concerned with my feelings than with my child's feelings.	1	2	3	4	5
27. I tell my child that I appreciate what he tries or accomplishes.	1	2	3	4	5
28. I punish by putting my child off somewhere alone with little if any explanation.	1	2	3	4	5

	Never	Once in Awhile	About Half of the Time	Very Often	Always
29. I help my child to understand the impact of behavior by encouraging him to talk about the consequences of his actions.	1	2	3	4	5
30. I am afraid that disciplining my child for misbehavior will cause the child to not like his parents.	1	2	3	4	5
31. I take my child's desires into account before asking him to do something.	1	2	3	4	5
32. I explode in anger towards my child.	1	2	3	4	5
33. I am aware of problems or concerns about my child in school.	1	2	3	4	5
34. I threaten my child with punishment more often than actually giving it.	1	2	3	4	5
35. I express affection by hugging, kissing, and holding my child.	1	2	3	4	5
36. I ignore my child's misbehavior.	1	2	3	4	5
37. I use physical punishment as a way of disciplining my child.	1	2	3	4	5
38. I carry out discipline after my child misbehaves.	1	2	3	4	5
39. I apologize to my child when making a mistake in parenting.	1	2	3	4	5
40. I tell my child what to do.	1	2	3	4	5

	Never	Once in Awhile	About Half of the Time	Very Often	Always
41. I give in to my child when he causes a commotion about something.	1	2	3	4	5
42. I talk it over and reason with my child when he misbehaves.	1	2	3	4	5
43. I slap my child when he misbehaves.	1	2	3	4	5
44. I disagree with my child.	1	2	3	4	5
45. I allow my child to interrupt others.	1	2	3	4	5
46. I have warm and intimate times together with my child.	1	2	3	4	5
47. When two children are fighting, I discipline the children first and ask questions later.	1	2	3	4	5
48. I encourage my child to freely express himself even when disagreeing with me.	1	2	3	4	5
49. I bribe my child with rewards to bring about compliance.	1	2	3	4	5
50. I scold or criticize when my child's behavior doesn't meet my expectations.	1	2	3	4	5
51. I show respect for my child's opinions by encouraging my child to express them.	1	2	3	4	5
52. I set strict well-established rules for my child.	1	2	3	4	5

	Never	Once in Awhile	About Half of the Time	Very Often	Always
53. I explain to my child how I feel about his good and bad behavior.	1	2	3	4	5
54. I use threats as punishment with little or no justification.	1	2	3	4	5
55. I take into account my child's preferences in making plans for the family.	1	2	3	4	5
56. When my child asks why he has to conform, I state: because I said so, or I am your parent and I want you to.	1	2	3	4	5
57. I appear unsure on how to solve my child's misbehavior.	1	2	3	4	5
58. I explain the consequences of the child's behavior.	1	2	3	4	5
59. I demand that my child does things.	1	2	3	4	5
60. I channel my child's misbehavior into more acceptable activity.	1	2	3	4	5
61. I shove my child when he is disobedient.	1	2	3	4	5
62. I emphasize the reasons for rules.	1	2	3	4	5

VIII. Please report your age, height and weight.

1. Age ______________ 2. Height ________________ 3. Weight ____________

Appendix D:

Body Fat Data Related to Part IV

Table A.D1. Boys' mean (± standard deviation) energy and nutrient intakes by their percent body fat (PBF) groups

Food Component	EER/RDA/AI/AMDR[a]	Lower PBF Group[b]	Upper PBF Group[c]
Energy (kcal)	1,911/2,096*	2114 ± 330	2025 ± 393
Protein (g)	**19/34**	74 ± 14	71 ± 16
% of kcal	10-30	14%	14%
Fat (g)	No Data	79 ± 19	76 ± 26
% of kcal	25-35	33%	33%
Carbohydrate (g)	**130/130**	287 ± 49	272 ± 55
% of kcal	45-65	53%	53%
Calcium (mg)	*800/1,300*	970 ± 287	1007 ± 540
Vitamin D (µg)	*5/5*	4.0 ± 2.0	4.5 ± 4.1
Vitamin A (µg)	**400/600**	1002 ± 538	943 ± 896
Vitamin C (mg)	**25/45**	118 ± 83	114 ± 116
Iron (mg)	**10/8**	12.9 ± 3.3	12.9 ± 2.9
Zinc (mg)	**5/8**	9.3 ± 2.9	9.0 ± 2.9
Folate (µg)	**200/300**	234 ± 90	240 ± 90

[a]Estimate Energy Requirement (EER) in ordinary type with an asterick (*), Recommended Dietary Allowances (RDA) in **bold type**, Adequate Intakes (AI) in *italic type*, and Acceptable Macronutrient Distribution Ranges (AMDR) in ordinary type. All come from the Dietary Reference Intakes available at www.nap.edu. and are shown for boys 8 years old/and boys 9 and 10 years old.

[b]Boys whose PBF fell below the median of 21.8%; of the 24 boys in this group, 11 were 8 years old.

[c]Boys whose PBF was above the median of 21.8%; of the 25 boys in this group, 9 were 8 years old.

Table A.D2. Descriptive information for the body concerns questions and the Body Esteem Scale of the boys by their percent body fat (PBF) groups[a]

Questions[b]	**Responses**[c] **by PBF Group**	
	Lower (n=24)	*Upper* (n=25)
In general, would you say your health is?		
Good	11	14
Fair	12	11
Poor	1	0
Do you think your body is?		
Too thin	2	0
Just right	22	23
Too fat	0	2
In the past year, how often have you wanted to be thinner?		
Never	19	13
Sometimes	3	11
A Lot	2	1
In the past year, how often have you wanted to be bigger?		
Never	9	17
Sometimes	12	5
A lot	3	3
In the past year, how often have you wanted more muscles?		
Never	2	7
Sometimes	11	11
A Lot	11	7
Which of the following are you trying to do about your weight?		
Lose weight	3	9
Stay the same	17	14
Gain weight	4	2
Body Esteem Scale[d]	20.8 ± 2.0	18.2 ± 5.5

[a]The lower PBF group consists of boys whose PBF was below the median of 21.8% body fat and the upper PBF group consists boys whose PBF was above the median.
[b]Chi-square used to test differences by group for body concerns questions; however, the number of responses in some cells was less than 5% making the test underpowered for statistical significance.
[c]Shown as number of responses, except for the Body Esteem Scale which is shown as a group mean ± standard deviation; potential scores range from 0 to 24
[d]Independent samples t-test used to compare means on the Body Esteem Scale. A significant difference was found in the BES between groups (p<.05).

Table A.D3. Means and standard deviations of boys', mothers', and fathers' perceptions of current and ideal boy figures by boys' percent body fat (PBF) groups and boys' perceptions of their fathers' figure and the ideal male figure by boys' PBF groups

	Means ± SD		**P Values**		
	Lower PBF Group	*Upper PBF Group*	*Lower vs. Upper*[a]	*Current vs. Ideal*	
Figure Drawing Ratings[b]				Lower PBF Group[c]	Upper PBF Group[d]
Boys'	(n=24)	(n=25)			
Current Boy Figure	3.8 ± .6	4.1 ± .7	NS[e]	NS	.001
Ideal Boy Figure	3.8 ± .7	3.6 ±.6	NS		
Current Father Figure	4.3 ± .8	4.4 ± .8	NS	.016	.002
Ideal Male Figure	3.7 ± .7	3.8 ± .6	NS		
Mothers'	(n=24)	(n=25)			
Current Boy Figure	3.5 ± .8	4.6 ± .9	<.0001	NS	<.0001
Ideal Boy Figure	3.8 ± .5	4.0 ± .5	NS		
Fathers'	(n=13)	(n=18)			
Current Boy Figure	3.5 ± .7	4.7 ± .8	<.0001	NS	<.0001
Ideal Boy Figure	3.7 ± .6	4.1 ± .6	NS		

[a]P values correspond to tests between the lower and upper PBF groups of boys', mothers, or fathers
[b]Collins, 1991(Reference 31 from Part IV); Figure drawing range from 1 (very thin) to 7 (very heavy).
[c]P values correspond to tests between ratings of the current and ideal figures of boys, mothers, or fathers from the lower PBF group
[d]P values correspond to tests between ratings of the current and ideal figures of boys, mothers, or fathers from the upper PBF group
[e]NS=not significant

Appendix E:

Body Fat Data Related to Part V

Table A.E1. Means and standard deviations of selected characteristics of the sample

		Percent Body Fat Groups[a]	
		Lower[b]	*Upper*[c]
SES[d]		51.3 ± 9.2	53.8 ± 9.4
Age (years)			
	Mothers	39.3 ± 4.6	38.2 ± 5.1
	Fathers	42.2 ± 5.5	41.4 ± 6.0
	Boys	9.3 ± 0.8	9.3 ± 0.8
BMI (wt/ht^2)			
	Mothers	25.6 ± 5.3	25.9 ± 5.3
	Fathers	26.3 ± 3.5	27.6 ± 3.7
	Boys	17.0 ± 1.8[e]	20.6 ± 3.4
Body Fat (%)			
	Boys	13.9 ±5.4[e]	30.6 ± 6.6

[a]Percentage body fat (PBF) groups include a lower PBF group with a % body fat less than the median of 21.8 and an upper PBF group greater than the median.
[b]Lower PBF group classification includes mothers (n=24), fathers (n=23), and boys (n=24)
[c]Upper PBF group classification includes mothers (n=25), fathers (n=25), and boys (n=25)
[d]SES=socioeconomic status determined from occupation and education of parents; scores can range from 8 (low) to 66 (high)
[e]Significant difference between groups at $p<.0001$

Table A.E2. Multivariate analyses of variance (MANOVAs) for the 7 Child Feeding Questionnaire[a] factors and for the 3 Parenting Practices Questionnaire[b] parenting styles of mothers and fathers by boys' percent body fat (PBF) groups[c] and of parents of lower and upper PBF groups by parent gender

	Child Feeding Practices				**Parenting Styles**			
	Mothers[d]		Fathers[e]		*Mothers*[f]		*Fathers*[g]	
Effect	*F Value*[h]	*P Value*	*F Value*	*P Value*	*F Value*	*P Value*	*F Value*	*P Value*
PBF groups (Lower vs. Upper)	2.96	.013	1.71	.157	.196	.90	.93	.44
	Lower PBF group		*Upper PBF group*		*Lower PBF group*		*Upper PBF Group*	
Effect	*F Value*	*P Value*	*F Value*	*P Value*	*F Value*	*P Value*	*F Value*	*P Value*
Parent gender (Mothers vs. Fathers)	10.34	<.0001	16.56	<.0001	3.277	.033	2.18	.107

[a]Birch et al, 2001(reference 21 from Part V)
[b]Robinson et al, 1995 (reference 22 from Part V)
[c]Percentage body fat (PBF) groups include a lower PBF group (n=24) with a % body fat less than the median of 21.8 and an upper PBF group (n=25) greater than the median.
[d]24 mothers of boys in the lower PBF group and 25 mothers of boys in the upper PBF group completed the Child Feeding Questionnaire
[e]13 fathers of boys in the lower PBF group and 18 fathers of boys in the upper PBF group completed the Child Feeding Questionnaire
[f]24 mothers of boys in the lower PBF group and 25 mothers of boys in the upper PBF group completed the Parenting Practices Questionnaire
[g]13 fathers of boys in the lower PBF group and 17 fathers in the upper PBF group completed the Parenting Practices Questionnaire
[h]Wilks' Lambda criterion was used.

Table A.E3. Univariate analyses of variance (ANOVAs) for the factors of the Child Feeding Questionnaire (CFQ)[a] and the parenting styles of the Parenting Practices Questionnaire (PPQ)[b] by parents of boys with lower percent body fat (PBF) and by parents of boys with upper PBF and between mothers and fathers

		Means ± SD		P Values		
		Lower PBF Group	Upper PBF Group	Lower vs. Upper[c]	Mothers vs. Fathers	
CFQ Factors					Lower PBF Group[d]	Upper PBF Group[e]
Responsibility	Mothers	4.0 ± 0.6	3.8 ± 0.5	NS[f]	<.0001	<.0001
	Fathers	2.4 ± 0.5	2.2 ± 0.5	NT[g]		
Perceived Weight	Mothers	3.1 ± 0.4	3.1 ± 0.4	NS	NS	NS
	Fathers	3.2 ± 0.3	3.2 ± 0.4	NT		
Perceived Child Weight	Mothers	3.0 ± 0.2	3.1 ± 0.4	NS	NS	NS
	Fathers	3.0 ± 0.1	3.2 ± 0.2	NT		
Concern about Child Weight	Mothers	1.3 ± 0.5	2.4 ± 1.2	<.0001	NS	NS
	Fathers	1.4 ± 0.7	2.4 ± 1.2	NT		
Restriction	Mothers	2.8 ± 1.0	3.2 ± 0.8	NS	NS	NS
	Fathers	2.8 ± 0.7	3.1 ± 1.0	NT		
Pressure to Eat	Mothers	2.2 ± 1.0	1.5 ± 0.7	.014	0.047	.021
	Fathers	2.9 ± 1.1	2.2 ± 1.0	NT		

Table A.E3. Continued

		Means ± SD		P Values		
		Lower PBF Group	Upper PBF Group	Lower vs. Upper	Mothers vs. Fathers	
					Lower PBF Group	Upper PBF Group
Monitoring	Mothers	3.3 ± 0.7	3.0 ± 0.6	NS	NS	NS
	Fathers	2.9 ± 1.0	2.7 ± 0.9	NT		
PPQ Styles						
Authoritative	Mothers	4.1 ± 0.3	4.1 ± 0.4	NT	0.003	NT
	Fathers	3.8 ± 0.3	3.8 ± 0.5	NT		
Authoritarian	Mothers	1.9 ± 0.4	1.9 ± 0.3	NT	NS	NT
	Fathers	2.1 ± 0.3	1.9 ± 0.3	NT		
Permissive	Mothers	2.0 ± 0.3	1.9 ± 0.3	NT	NS	NT
	Fathers	2.1 ± 0.3	1.9 ± 0.3	NT		

[a]Birch et al, 2001 (Reference 21 from Part V); Scales range from 1 to 5, with a five indicating a greater use of a factor
[b]Robinson et al, 1995 (Reference 22 from Part V); Scales range from 1 to 5, with five indicating a greater use of a parenting style
[c]P values correspond to tests between mothers of boys with lower PBF and mothers of boys with upper PBF or fathers of boys with lower PBF and fathers of boys with upper PBF
[d]P values correspond to tests between mother and fathers of boys with lower PBF
[e]P values correspond to tests between mothers and fathers of boys with upper PBF
[f]NS=not significant [g] NT= not tested; follow-up tests were not performed because the MANOVAs were not significant

Vita

Lynn Samson Brann attended grade school and junior high school at St. Mary's School in Augusta, Maine. She graduated from Cony High School in 1993. She received a Bachelor of Science degree in Human Nutrition from the University of Maine in 1997. Following this, Lynn received a Master of Science degree in Nutrition from the University of Tennessee, Knoxville in 1999. Along with her Master's degree, Lynn also completed the dietetic internship at the University of Tennessee and received her Registered Dietitian credential in 1999. She received her Doctor of Philosophy degree from the University of Tennessee in 2003.