

Fall 11-24-2015

Prospective Predictors of Adolescent BMI: Parenting Style, Gender, and Weight Perception

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Prospective Predictors of Adolescent BMI: Parenting Style, Gender, and Weight
Perception

A Thesis
Presented in
Partial Fulfillment of the
Requirements for the
Degree of Masters of Science of
Psychology

By
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December 2015

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Acknowledgments

I have the deepest gratitude for having had the opportunity to work closely with my thesis chair, Dr. Jocelyn Smith Carter, over the past two years. Dr. Carter has not only provided me invaluable mentorship on this project, but has also taken an interest in my professional trajectory for which I will always be grateful.

I am also grateful for the continued support from my reader, Dr. Kathryn Grant, who has provided me with various opportunities to gain new skills in both community engagement and clinical research. Additionally, Dr. Grant has gone above and beyond her call of duty to develop me professionally for which I will always be thankful.

I owe many thanks to my program director Dr. Kimberly Quinn who has not only lent me her ear during times of success but also during failure. #KimQuinn has helped me grow in ways that I never saw possible and for that I am grateful.

Additionally, I am thankful for the constant and unwavering support of my parents, Tina Armand and Darrin Dellucci; my brother, Adam Dellucci; and my godmother, Darlene Dellucci. I am also eternally grateful for the support of my grandmother, Audrey Dellucci, whose strength and dedication has inspired me each day.

I also wish to acknowledge the support of my colleagues in DePaul University's psychology department. Without the daily support from Crystal

Steltenpohl, Danielle Vaclavik, Saritha Terelandur, and Dr. Theresa Luhrs none of this would have been possible.

I want to give a special thanks to my two best friends, Kinetta N. Crisp and Savanah Gray, for always being there. I also want to thank Caitlyn Simmons for helping me celebrate my successes and talking to me during my failures.

Lastly, I owe thanks to both the members of the Healthy Families Lab and The Cities Mentor Project for always providing me with support on my graduate school ventures.

Biography

Trey Dellucci was born in Plaquemine, Louisiana on November 8, 1990. He graduated from Dutchtown High School in 2008 and obtained a Bachelor of Arts in psychology from Southeastern Louisiana University in 2012 before pursuing his master candidacy at DePaul University. His primary research interests include the psychosocial factors that influence adolescent's health and health related behaviors in underserved populations.

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Abstract

Obesity affects both adolescents and adults worldwide (Popkin & Doak, 1998). Determining which factors contribute to risk factors to the high prevalence of obesity in America is important because excess weight can negatively affect both physical health and psychosocial functioning (Kolotkin, Meter, & Williams, 2001). Few longitudinal studies have assessed the association between parenting styles and adolescent's body mass index (BMI; Rhee et al, 2006). Past research has shown that parents greatly influence adolescent's body image (Al Sabbah et al., 2009). Using data from the National Longitudinal Study of Adolescent Health, the current study examined the influence of parenting styles on adolescent's weight over time (Harris et al., 2009). Additionally, we tested a mediation model on the relationship between parenting style and adolescent's BMI through weight perception. The final aim of this study was to determine whether weight perception differed by gender. The current study failed to find an association between parenting styles and adolescent's weight gain over time and between weight perception and weight gain over time. The current study did find a difference in weight perception by gender. Girls were more likely to perceive themselves as heavier and boys were more likely to perceive themselves as lighter. Future studies should be developed to gain a better understanding of the developmental trajectory of adolescent obesity and the effects of parenting styles. Additionally, more research is needed to better understand the differences in body image by gender.

Introduction

Obesity affects both adolescents and adults worldwide (Popkin & Doak, 1998). About 15% of adolescents between the ages of two and nineteen are classified as overweight and an additional 17% are obese (Ogden, Carroll, Kit, & Flegal, 2014). More than 35% of adults in America are obese (Ogden et al., 2014) and a child suffering from excess weight during adolescence is at greater risk of being obese as an adult (Serdula, Ivery, Coates, Freedman, Williamson, & Gyers, 1993).

Determining which factors contribute to the high prevalence of obesity in America is important because excess weight can negatively affect both physical health and psychosocial functioning (Kolotkin, Meter, & Williams, 2001). In the United States alone approximately 300,000 deaths are attributed to obesity each year (Allison, Fontaine, Manson, Stevens, & VanItallie, 1999). Obesity is an independent risk factor for cardiovascular disease and may affect the heart through its influence on risk factors such as hypertension and inflammatory markers (Poirier et al., 2006). In addition to heart disease, obesity also places individuals at higher risk of developing a number of other diseases and health concerns including Type II diabetes mellitus, stroke, sleep apnea, knee osteoarthritis, and certain cancers (Poirier et al., 2006). Beyond health concerns, obesity also places strains on a person's quality of life, happiness, self-esteem, and emotional wellbeing (Fontaine & Barofsky, 2001).

Many studies have examined associations with weight gain and obesity, and have found a complex web of risk factors. A number of cross-sectional

(Andersen, Crespo, Bartlett, Cheskin, & Pratt, 1998; Rolls, 2003) and longitudinal studies (Gangwisch, Malaspina, Boden-Albala, & Heymsfield, 2005; Kimm et al., 2002; Neumark-Sztainer, Story, Falkner, Beuhring, & Resnick, 1999; Neumark-Sztainer, Wall, et al., 2006) have found that behavioral, socio-environmental and psychological factors contribute to weight gain and obesity. Multiple behavior risk factors such as, excess dietary intake (relative to energy expenditure) (Rolls, 2003), decreased physical activity (Kimm et al., 2002) and increased time spent engaging in sedentary behaviors (Andersen et al., 1998), sleep debt (Gangwisch et al., 2005), and engagement in weight-control behaviors (Neumark-Sztainer, Wall, et al., 2006; Stice, Cameron, Killen, Hayward, & Taylor, 1999) contribute to weight gain. Socio-environmental factors such as being raised in poverty (Anand, Basiotis, & Klein, 1999), and having overweight peers (Fiore, Travis, Whalen, Auinger, & Ryan, 2006) and parents (Whitaker, Deeks, Baughcum, & Specker, 2000) can also contribute to obesity. In addition, psychological factors such as negative body image have been linked to both childhood and adult obesity (Johnson & Wardle, 2005; Neumark-Sztainer, Paxton, hannan, Haines, & Story, 2006). Given all of the risk factors associated with obesity, there is need to develop theories and models that explain how they influence each other.

Studies testing mediation and moderation models using socio-environmental, personal, and behavioral factors have been limited and have particularly focused on factors such as social economic status, race, and education (Sanchez-Vaznaugh, Kawachi, Subramanian, Sanchex, & Acevedo-Garcia, 2009). Sanchez-Vaznaugh et. al. (2009) found that women with higher education and

higher SES had lower BMI when controlling for race. Psychosocial factors may account for the differences by gender. Women are more likely to be sensitive to weight than men (Paeratakul, White, Williamson, Ryan, & Bray, 2002).

Additionally, they may be more likely to internalize the ideal body weight portrayed by the media (Grogan, 2007).

Fewer studies have explored psychological mediators and moderators. Psychological factors are important to study because they impact health behaviors and are potentially modifiable through interventions. One study found that self-efficacy moderated the relation between physical activity and obesity, such that those who had high self-efficacy and high physical activity had the lowest BMIs (Gamble, Parra, & Beech, 2009). Another study found that maternal perceptions and concern about child's weight mediated the association between child's weight and maternal feeding practices (Webber, Hill, Cooke, Carnell, & Wardle, 2010). To date, no study has examined the indirect effects of weight satisfaction between parenting styles and adolescent's BMI.

The current longitudinal study will integrate multiple risk factors in aim of better understanding how they influence each other. To do this, the study will examine a mediation model in which weight perception will mediate the impact of parenting styles on adolescent's weight gain five years later. In addition, this study will examine differences in weight perception by gender.

Parental Influences on Adolescent Health

Parents potentially promote healthy behaviors in their children through social support (Ackard & Neumark-Sztainer, 2001), positive influences, and

filtering out negative influences on their children (Neumark-Sztainer, 2005). Children with parents who are nurturing are more likely to believe that they are valued and have higher self-esteem (Bayer, Sanson, & Hemphill, 2006; Cicchetti & Toth, 1998). In addition, parents have a significant influence on behaviors (Ackard, Neumark-Sztainer, Story, & Perry, 2006; Moreno & Thelen, 1993) and perceptions surrounding eating (Fulkerson, Neumark-Sztainer, & Story, 2006; Neumark-Sztainer, Eisenberg, Fulkerson, Story, & Larson, 2008). This occurs through modeling dietary habits and by having direct control of available foods in the home (Rhee, 2008). Children also gain the most information on dieting from their parents (Schur, Sanders, & Steiner, 2000). Parents teach children that eating healthier and restricting foods will lead to weight loss and a thinner body shape (Abramovitz & Birch, 2000).

Parental influence is often studied in the context of the parenting style (Van der Horst et al., 2007). Maccoby and Martin (1983) identified two important elements captured by parenting style: responsiveness and demandingness. Responsiveness refers to “the extent to which parents intentionally foster individuality, self-regulation, and self-assertion by being attuned, supportive, and acquiescent to children’s special needs and demands”; demandingness refers to “the claims parents make on children to become integrated into the family whole, by parent’s maturity demands, supervision, disciplinary efforts and willingness to confront the child who disobeys” (Baumrind, 1991).

Based on the interactions between responsiveness and demandingness four widely accepted patterns of parenting have been proposed: *authoritative* (high

responsiveness – high demandingness), *authoritarian* (low responsiveness – high demandingness), *permissive-indulgent* (high responsiveness – low demandingness), and *neglectful* styles (low responsiveness – low demandingness) (Baumrind, 1991; Kremers, Brug, de Vries, & Engels, 2003; Maccoby, 1992; Van der Horst et al., 2007). Authoritative parents are firm, supportive, and warm, and incorporate shared-decision making, set appropriate boundaries, provide moderate levels of monitoring, and exhibit effective conflict resolution (Kremers et al., 2003). In contrast, authoritarian parents are strict, less warm rigid, inflexible and exhibit high control (Kitzman-Ulrich et al., 2010; Kremers et al., 2003). Permissive-indulgent parents allow their children to make decisions and regulate their own activities, but have minimal punishment when things go wrong and have a relationship with their child that is most similar to that of a friend, while neglectful parenting is low in responsiveness and demandingness; neglectful parents lack control and affective expression (Golan & Crow, 2004).

According to family system theory, adolescents are able to better manage daily life in the context of warm and supportive family interactions (Kerr & Bowen, 2005; Kitman-Ulrich et al., 2010; Murdock & Gore Jr, 2004). The adolescent from a supportive family is better able to separate his or her own intellectual and emotional functioning from that of the family and is less likely to depend on others' approval and acceptance. In contrast, adolescents with low differentiation are at higher risks of group think and are more vulnerable to stress. Family system theory predicts that adolescents with authoritative parents would have the best health outcomes and have positive health behaviors (Radziszewska,

Richardson, Dent, & Flay, 1996) such as healthy dieting and lower rates of childhood obesity (Kremers et al., 2003; Rhee, 2008; Van der Horst et al., 2007). However, findings of past studies investigating the association between parenting styles and adolescent's weight has not always been consistent.

Parenting practices influence adolescent's weight. Cross sectional studies examining the association between parenting and adolescent's weight have had mixed findings. While some studies have found that mealtime parenting practices are associated with children BMIs (Gable & Lutz, 2001; Webber et al., 2010), others have found no significant associations (Blissett & Haycraft, 2008; Brown et al., 2008). Gable and Lutz (2001) found that pressuring children to eat faster and to clean their plates were associated with children who had higher body mass index, but Webber et al. (2010) found that adiposity was associated with lower pressures to eat. In contrast, Brown et al. (2008) found no association between pressure to eat and adolescent's BMI. Differences in the findings may be attributed to the methodology of each study. Each study used a separate validated measure to assess parent's feeding practices and pressure to eat. Only Brown et al. (2008) further separated feeding control into two variables, assessing the differences between overt and covert control. Sample ages from the study also differed from ages 3 to 8 which may mask developmental variations in the relations among these variables.

Although some studies found no associations between parenting styles and adolescent BMI, they did report significant findings for adolescent's diet. For example, one study in the United Kingdom failed to find associations between

parenting styles and adolescent's BMI, but found that authoritative parenting was associated with adolescents eating more fruits and vegetables (Blissett & Haycraft, 2008). Similarly, a study examining parental control found no significant weight differences between adolescents with covert controlling and overt controlling parents, but found that children with parents who engaged in covert control ate healthier foods (Brown, Ogden, Vögele, & Gibson, 2008). Although the cross-sectional literature has often found that parenting styles influence adolescent diet, it has not found consistent associations between parenting-style and adolescent's weight, suggesting the need for further research.

In contrast to the cross sectional studies, the longitudinal literature has produced more consistent results. To date, only three longitudinal studies have investigated the association between parenting styles and adolescent's weight. These studies have consistently shown that children from authoritative homes have lower BMIs than the children from authoritarian, neglectful, and permissive households (Berge, Wall, Loth, & Neumark-Sztainer, 2010; Fuemmeler et al., 2012; Rhee, Lumeng, Appugliese, Kaciroti, & Bradley, 2006). Two of these longitudinal studies have included large ethnically and economically diverse samples, representative of adolescents in the United States (Berge et al., 2010; Fuemmeler et al., 2012). Two of these studies also examined dietary habits as an independent outcome finding that authoritative families had children who consume more fruits and vegetables (Berge et al., 2010; Rhee et al., 2006). These studies provide evidence that parenting does influence weight over time, but these studies did not test mediators of these effects. It is important to improve

longitudinal findings by using object measurements of height and weight and represent parenting style using a multidimensional measure. In addition, researchers should begin integrating other risk factors such as body image into their models in aim of better understanding the relation between parenting style and weight gain.

Does Body Image Mediates the Association Between Parenting Styles and Adolescent's BMI?

Body image captures how individuals feel about and perceive their bodies. It is affected by physiology, psychological and societal factors such as gender, self-esteem, and pressure from family and friends (Ata, Ludden, & Lally, 2007; Rierdan & Koff, 1997). Body image has been measured by examining cognitive components such as unrealistic expectations for appearance (Barker & Galambos, 2003); behavioral components such as avoiding perceived body scrutiny (e.g. shopping at the mall); and perceptual components such as body size (Ata et al., 2007; Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999).

Body image influences weight and weight related behaviors (Neumark-Sztainer, Paxton, Hannan, Haines, & Story, 2006; Neumark-Sztainer, Wall, et al., 2006). Body image has generally been measured in terms of overall satisfaction, but weight concordance (or perception) might be a component of body image that has the closest relation to weight gain. Weight perception is the accuracy of one's weight category and his or her perceived weight category (Desmond, Price, Gray, & O'Connell, 1986).

Body image and BMI. Both cross-sectional (Field et al., 2003) and longitudinal studies (Davison, Markey, & Birch, 2003; Field et al., 2003; Stice & Whitenton, 2002) have found associations between body image and obesity, however the direction is unclear. Some studies have suggested that body image influences weight (Davison et al., 2003), while others have suggested that weight influences body image (Stice, Presnell, & Spangler, 2002). For example, a three-year longitudinal study examining the development of girl's body image found that the girls with highest rates of weight concern at age 5 also had the highest body dissatisfaction at age 7 and the highest BMI at age 9 (Davison et al., 2003). Another longitudinal study found that individuals who were dissatisfied with their weight had the highest BMI increases during the three-year follow-up after controlling for BMI (Field et al., 2003). In contrast, a longitudinal study investigating factors that influence body image found that individuals with higher BMIs develop more weight dissatisfaction over time (Stice & Whitenton, 2002). Conceptually, a reciprocal relationship likely exists and it is important to test longitudinal effects in nationally represented samples.

Weight perception is a specific type of body image that has not yet been fully studied in relation to BMI. Adolescents who are underweight or normal weight but perceive themselves as overweight are at risk for eating disorders such as anorexia nervosa (Desmond et al., 1986), while those who are overweight but perceive themselves to be a healthy or underweight are less likely to engage in weight control practices such as diet or exercise (Strauss, 1999). Desmond et al. (1986) found that perception of weight was a better predictor of dieting in high

school students than actual weight. This is important to consider because nutrition and physical behaviors adopted in childhood are likely to persist into adulthood (Kelder, Perry, Klepp, & Lytle, 1994; Law, 2000), contributing to the rising rates of obesity. Although the direction of the association between body image in general and BMI is unclear, weight perception in particular might be more likely to increase unhealthy behaviors, which in turn increases future BMI.

Parent-child interactions. Parents not only have a large influence on adolescent's weight, but they are also a vital contributor to child's body image. Parents influence body image in both genders (Bearman, Presnell, Martinez, & Stice, 2006; Berndt & Hestenes, 1996) through modeling behaviors (Lowes & Tiggemann, 2003), parent-child communication (Al Sabbah et al., 2009), and the importance they place on being thin (Field et al., 2001). A cross-sectional study found that male and female adolescents who perceived communication difficulties with their parents had higher rates of weight concern (Al Sabbah et al., 2009). These results were particularly strong when examining same-gender parent and child relations. In addition, a study found that parent support deficits predicted adolescent's body dissatisfaction over two years (Bearman et al., 2006).

Adolescent's Gender Effects on Body Image and Parenting Practices

Gender differences in body image. Body image varies across genders. Most research on body satisfaction has included only female populations with limited research investigating the role of body satisfaction in males (McCabe & Ricciardelli, 2004). These studies show that women have body image concerns (Cash & Henry, 1995; Grabe, Ward, & Hyde, 2008). The existing literature

examining body satisfaction in males and females has been mixed depending on how body satisfaction is defined. Males suffer less body dissatisfaction (Pingitore, Spring, & Garfieldt, 1997; Tiggemann & Williamson, 2000) than female adolescents, but males equally desire to change their weight (McCabe & Ricciardelli, 2001; Neumark-Sztainer et al., 1999). These mixed results can possibly be explained by understanding the ideal body image for each gender.

Females and males typically have different weight change desires. While females desire to lose weight (Furnham, Badmin, & Sneade, 2002), men desire to lose body fat and gain weight through muscle building (McCabe, Ricciardelli, & Banfield, 2001; Neumark-Sztainer et al., 1999). The difference in the body ideal between genders can be explained by the gender intensification hypothesis (Hill & Lynch, 1983). As adolescents mature physically and emotionally they begin to identify more strongly with their same-gender stereotype. These stereotypes differ for each gender, that female physical attractiveness is linked with extreme thinness (Carper, Negy, & Tantleff-Dunn, 2010; Furnham et al., 2002; Mulgrew, Volcevski-Kostas, & Rendell, 2014; Stice, Hayward, Cameron, Killen, & Taylor, 2000). In contrast, males subscribe to an ideal that emphasizes a mesomorphic build, placing focus on obtaining a V-shaped masculine physique (Furnham et al., 2002; Furnham & Calnan, 1998; M. McCabe & Ricciardelli, 2001).

Rationale

Obesity is a worldwide health concern. Determining which factors contribute to weight gain is important because of the negative outcomes associated with obesity. Past research has found associations between parenting

styles and adolescent obesity (Berge et al., 2010; Fuemmeler et al., 2012; K. E. Rhee et al., 2006); parent-child interactions and body image (Al Sabbah et al., 2009; M. P. McCabe & Ricciardelli, 2005); and body image and BMI (Field et al., 2003). These individual associations are consistent with mediation; however no study has tested a model in which adolescent's weight perception mediates the association between parenting style and BMI. The majority of the existing literature has been cross sectional in nature and few studies were able to investigate causal directions. This current study will have the strength of being longitudinal and having a large representative sample of adolescents in four regions of the country.

Statement of Research Questions and Hypotheses

The current study is designed to investigate the association between parenting style and BMI, while exploring weight perception as a possible mediator. In addition, we will examine possible differences in weight perception by adolescent's gender. Based on the existing literature, this paper will complete its aims by investigating two primary hypotheses:

Hypotheses:

Hypothesis I: Weight perception will mediate the relation between parenting styles and adolescent weight gain five years later.

Hypothesis I_a: Adolescents with authoritative parents will be more likely to have an accurate weight perception.

Hypothesis I_b: Adolescents with authoritative parents will gain the least amount of weight at Wave II compared to adolescent's with authoritarian, indulgent, and neglectful parents.

Hypothesis I_c: Adolescent's weight perception will be a predictor of weight gain at Wave II.

Hypothesis II: Girls will be more likely to perceive themselves as being heavier than they are. Boys will be more likely to see themselves as being lighter than they are.

Methods

Procedure

Data were extracted from Wave I and Wave II of the National Longitudinal Study of Adolescent Health (Add Health) (Harris et al., 2009). Add Health is a nationally representative school-based, longitudinal study of health-related behaviors of adolescents and their outcomes in early adulthood. Initially, an in-school questionnaire was administered to a nationally representative sample of students in grades 7 through 12 attending either one of 80 high schools or 52 middle schools during the 1994-95 school year (Harris et al., 2009). These schools were chosen with respect to region of country, urbanicity, size, type and ethnicity. In addition to the school-based assessments, four additional waves of in-home interviews (Wave I, 1994-95; Wave II, 1996; Wave III, 2001-02; Wave IV, 2007-08) were conducted. Approximately 20,745 adolescents between the ages of 12 and 18 completed the first wave of follow-up in-home interviews between 1994-95 (Wave I). A year later, in 1996, a second follow-up was

conducted (Wave II). The in-home Wave III sample consists of Wave I respondents six years later. The last set of in-home interviews was taken at Wave IV in 2008.

At each wave, a computer-assisted questionnaire was administered to the participants by a researcher. Each interview took approximately 90 to 120 minutes. Following the interview the researchers took physical measurements (e.g. height and weight). This current study used the data examining parent-child relationship quality, parent's expressive support, weight change behaviors, and physical measurements such as height and weight.

The institutional review board of the University of North Carolina, Chapel Hill, approved the National Longitudinal Study for Adolescent Health.

Participants

The sample in the current study was composed of 6504 adolescents at Wave I, 48.40% were male. The majority of the participants in the study identified their race as White (57.40%), 24.40% identified as Black, 11.5% Hispanic 3.8% Asian, 2.0% Native American and another 0.80% as other. The mean age of the participants at Wave I was 15.53 years ($SD = 1.79$) and at Wave II was 16.02 years ($SD = 1.62$).

Measures

Gender. Participant biological gender was coded as 1 = male and 2 = female.

Race. Race was assessed during the initial interview at Wave I. Participants self-reported on their race and were allowed to choose more than one

identifier. Respondents marked White, Black/African American, American Indian/Native American, Asian/Pacific Islander, or other and responses were coded so that Hispanic = 1, Black/African American = 2, Asian/Pacific Islander = 3, American Indian/Native American = 4, Other = 5, and White = 6.

Body mass index. Body mass index is the most common measure of obesity, and is calculated by weight in kilograms divided by height in meters, squared. During the in-home interview, height was measured to the nearest one-eighth inch by trained research staff through use of a measuring tape, and then converted into meters. Weight was recorded to the nearest half pound by trained Add Health field staff using a provided digital scale. During measurement, participants were clothed but not wearing shoes. BMI based on national norm values of age and gender are a statistically valid measure of overweight and obesity in children (Must & Anderson, 2006).

Body Image. Adolescent's weight perception was assessed by comparing the reported answer to an item that asked "How do you think of yourself in terms of weight?" and their actual BMI. Possible responses to the item included "very underweight", "slightly underweight", "about the right weight", "slightly overweight", and "very overweight". Responses for very underweight and slightly underweight were grouped together as perceiving their weight as underweight. Slightly overweight and very overweight were grouped together as perceiving their weight as being overweight. This grouping has been used in other studies (Kaufman & Augustson, 2008; Vaughan & Halpern, 2010).

A weight perception variable was then created based on the concordance of an adolescent's perceived weight and their BMI. Participants were categorized as having a perception that is "heavier than their actual weight", "an accurate perception of their weight", or perceived themselves to be "lighter than they truly are". Weight concordance was contrast coded so that an accurate perception was given the score of "0", perceived to be lighter was given the score of "-0.50", and perceived to be heavier was given the score of "0.50".

Maternal/paternal care and support. Wave I included five questions related to perceived maternal care and support with responses ranging from 1 to 5. Higher scores represent more care and support. Questions measuring support and care included the following: (a) "How close do you feel to your mom?" (b) "How much do you think she cares about you?" (c) "Most of the time your mom is warm and loving" (d) "You are satisfied with the way mom and you communicate with each other" (e) "Overall you are satisfied with your relationship with mom".

Adolescents reported on similar questions to assess paternal care and support. Internal consistency was found for maternal care and support ($\alpha = 0.84$) and paternal care and support ($\alpha = 0.88$).

Low/High Parental Support. The mean was used to create low and high parental support variables. Participants who reported less than 4.43 on the maternal support variable were coded as having a low supportive mother. Those who reported more than 4.43 were coded as having a high supportive mother. Participants who reported less than 4.24 on the paternal support variable were

coded as having a low supportive father. Those who reported more than 4.24 were coded as having a high supportive father.

Parental control. Wave II included seven questions used by past researchers to measure parental control and monitoring (Fuemmeler et al., 2012). Questions measuring control and monitoring were as follows: Do your parents let you make your own decisions about (a) the people you hang around with; (b) the time you must go home on the weekend; (c) what you wear; (d) how much TV you watch; (e) which TV program you watch; (f) time you go to bed on the weeknights; and (g) what you eat? Responses were either “yes” or “no” and higher amounts of yeses represented less parental control and monitoring. A low internal consistency was found for the parental control measure ($\alpha = 0.65$).

Low/High Parental Control. The mean was used to create low and high parental control variable. Participants who reported less than 1.85 on the parental control variable were coded as having high controlling parents. Those who reported greater than 1.85 were coded as having low controlling parents.

Parenting style. Dummy coded, categorical variables describing maternal and paternal parenting styles were created using variations of the high and low scores of parental care and support and parental control. Authoritative mothers/fathers were high in both parental support and control. Authoritarian mothers/fathers were low in support and high in control; indulgent mothers/fathers were high in support and low in control; and neglectful mothers/fathers were low in support and low in control.

Results

Attrition Analyses

Multiple chi-square test of independence were run prior to the primary hypothesis analyses to determine if group differences existed between participants who completed the measures of parenting styles at Wave I, and BMI at Wave I and Wave II and those who did not. A total of 3,043 (46.79%) participants completed the parenting style measures at Wave I and BMI at Wave II and Wave II. Group differences were found for both gender $\chi^2(1) = 6.53, p < 0.05$, and race, $\chi^2(1) = 185.71, p < 0.05$.

Descriptive Statistics

Body Mass Index. At Wave I, the majority of adolescents had a BMI ($N = 6,091, M = 22.46, SD = 4.39$) in the normal range (64.5%), followed by overweight (15.4%), underweight (13.7%), and obese (6.4%). At Wave II, the majority of adolescents had a BMI ($N = 4,749, M = 23.02, SD = 5.01$) in the normal range (61.5%), followed by overweight (15.9%), underweight (13.2%), and obese (9.4%).

A oneway ANOVA found significant gender differences on adolescent's BMI at Wave I, $f(1, 6,288) = 8.49, p < 0.01$, such that males had higher weights ($M = 22.63, SD = 4.33$) than females ($M = 22.31, SD = 4.44$). A separate oneway ANOVA also found significant racial differences on Wave I BMI, $f(5, 6,266) = 18.29, p < 0.001$. A Bonferroni post-hoc test revealed that Native American ($M = 24.21, SD = 6.17$) youth had the highest weight compared to White ($M = 22.18, SD = 4.24$) followed by Black ($M = 23.12, SD = 4.64$), and then Hispanic ($M = 22.75, SD = 4.13$). Asian youth ($M = 21.28, SD = 3.42$) had lower weights

compared to White adolescents, and those who identified as Other did not differ from Whites in terms of BMI Other ($M = 21.52$, $SD = 4.40$).

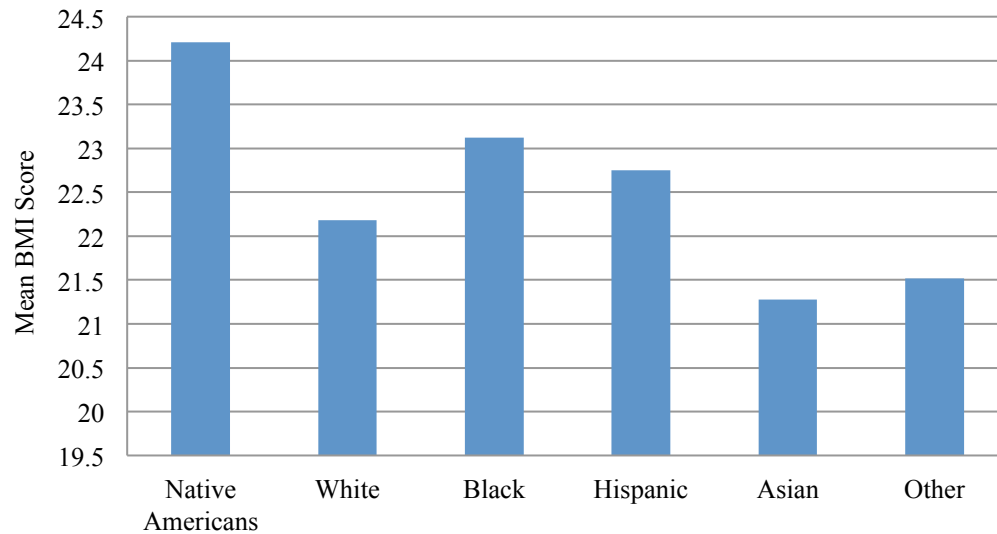


Figure 1. BMI at Wave I by race.

Parenting Styles. Authoritative (27%) parenting styles were most common for mothers, followed by indulgent (23%), neglectful (22.9%), and authoritarian (20.7%). Similarly, fathers were most likely to exhibit authoritative (22%) parenting styles, followed by indulgent (17.8%), neglectful (15.9%), and authoritarian (13.7%). Separate chi-square tests of independence were run in order to determine if there were gender differences in parenting styles. There were significant differences between maternal parenting styles, $\chi^2(3) = 20.49$, $p < 0.001$, and paternal parenting styles, $\chi^2(3) = 30.34$, $p < 0.001$, by adolescent gender. Mothers and fathers were more likely to exhibit authoritative and neglectful parenting styles for sons compared to daughters, and parents were more likely to exhibit authoritarian and indulgent parenting styles for daughters

compared to sons. See Figure 2 for detailed results for the maternal model and Figure 3 for the paternal model.

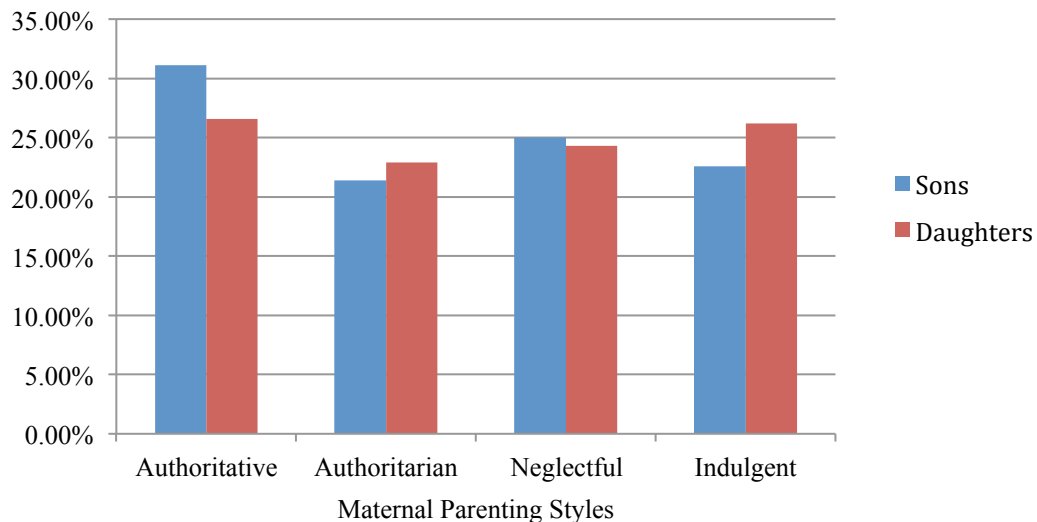


Figure 2. Chi-square results for maternal parenting styles by gender

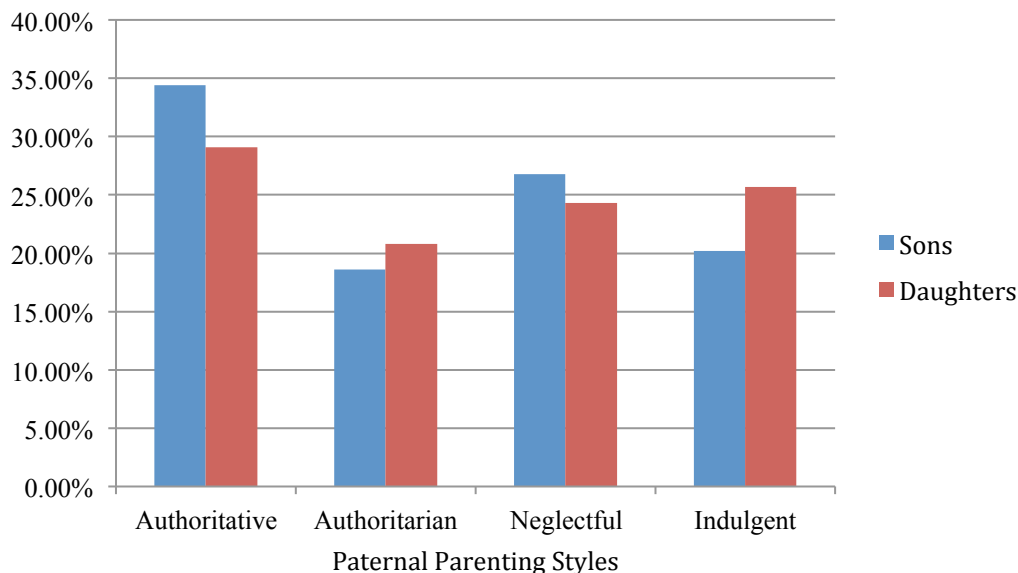


Figure 3. Chi-square results for paternal parenting styles by gender.

Primary Analyses: Hypothesis testing

Separate structural equation models (SEM) for maternal and paternal parenting styles were originally conducted to test the current study’s mediation hypothesis. Variables measuring parental care, support, and control were used to

create a latent variable for parenting styles. The models tested both the direct effects (parenting styles) and indirect effects (through weight perception and weight control behaviors) on Wave II BMI. Neither the maternal parenting style nor the paternal parenting style model were able to be identified in the measurement models and therefore were not appropriate for the study's hypothesis testing. Following SEM, various regression analyses were implemented to examine the study's aims. For a full diagram of the SEM models see Appendix A and B.

Hypothesis I: Weight concordance will mediate the relation between parenting styles and adolescent weight gain at Wave II.

The Baron and Kenny (1986) approach was used to test the current study's main hypothesis. A series of regression models were utilized to test for mediation between parenting styles and adolescent's weight gain through weight perception. Each model controlled for Wave I BMI, adolescent's gender, and adolescent's race. Model 1 examined both parenting styles and weight perception as predictors of BMI at Wave II. Step 1 included all control variables. Step 2 included dummy coded variables representing either maternal or paternal authoritarian, indulgent, and neglectful parenting styles. The reference group for parenting styles was authoritative parenting. The final step included dummy coded variables for adolescent's weight concordance including "perceived to be lighter" and "perceived to be heavier". The reference group for weight perception was "perceived accurate weight". Neither the overall maternal model, $f(8, 4007) = 1.02, p > 0.05$, nor the paternal model, $f(8, 2996) = 0.81, p > 0.05$, were found to

be predictive of BMI at Wave II, suggesting that there is no direct effect between either parenting styles and BMI or weight perception and BMI. Results for these models can be found in Table 1.

Table 1.
Summary of hypothesis II: Parenting styles and weight perception predicting BMI

Predictor	Maternal Models (N = 4016)				Paternal Models (N = 3005)			
	B	S.E.	R ²	R ²	B	S.E.	R ²	R ²
Step 1			.00	.00			.00	.00
Intercept	23.33	0.60			23.52	0.71		
W1BMI	0.00	0.03			-0.02	0.03		
Gender	0.10	0.16			0.24	0.19		
Race	- 0.06	0.04			-0.06	0.05		
Step 2			.00	.00			.00	.00
Intercept	23.37	0.60			23.50	0.71		
W1BMI	0.00	0.03			-0.02	0.03		
Gender	0.01	0.16			0.24	0.19		
Race	- 0.06	0.04			-0.06	0.05		
Neglectful	-0.03	0.22			-0.21	0.25		
Indulgent	-0.16	0.22			-0.10	0.25		
Authoritarian	-0.09	0.22			0.12	0.26		
Step 3			.00	.00			.00	.00
Intercept	23.27	0.61			23.42	0.72		
W1BMI	0.01	0.03			-0.01	0.03		
Gender	0.00	0.17			0.20	0.20		
Race	- 0.07	0.04			-0.06	0.05		
Neglectful	0.00	0.22			-0.20	0.25		
Indulgent	- 0.14	0.22			-0.09	0.25		
Authoritarian	- 0.09	0.22			0.11	0.26		
Perceived Thinner	0.78	0.47			0.26	0.54		
Perceived Heavier	0.38	0.39			0.37	0.46		

Notes. Authoritative parenting styles was the reference group for PS in all models. Accurate weight perception was the reference group for WP in all models.

Hypothesis I_a: Adolescents with authoritative parents will be more likely to have an accurate weight perception.

In concordance with the Baron and Kenny approach, a logistic regression was performed to test the effects of parenting styles on adolescent's weight perception at Wave I. Step 1 accounted for the control variables and Step 2 introduced dummy coded parenting style variables. There was no significant finding for either the maternal model, $\chi^2(6) = 2.12, p > 0.05$, nor the paternal model, $\chi^2(3) = 5.26, p > 0.05$. See Table 2. for model details.

Table 2.
Summary of hypothesis I_a: Parenting styles predict weight perception.

Predictor	Maternal Model (N = 3893)				Paternal Model (N = 2899)			
	B	S.E.	Wald	Exp (B)	B	S.E.	Wald	Exp (B)
Step 1								
W1 BMI	.00	.01	.04	1.00	.00	.01	.00	1.00
Gender	-.05	.07	.52	.95	-.09	.078	1.32	.92
Race	.01	.02	.08	1.01	-.02	.02	.99	.98
Constant	-.51	.20	6.61	.60	-.40	.23	2.93	.67
Step 2								
W1 BMI	.00	.01	.02	1.00	.00	.01	.02	1.00
Gender	-.05	.07	.52	.95	-.09	.08	1.47	.91
Race	.01	.02	.12	1.01	-.02	.02	.78	.98
Authoritative			1.49				2.92	
Authoritarian	.05	.09	.32	1.06	.13	.11	1.47	1.14
Neglectful	-.06	.09	.51	.94	-.05	.10	.24	.95
Indulgent	.03	.09	.08	1.03	.06	.11	.37	1.07
Constant	-.52	.20	6.78	.59	-.45	.24	3.57	.64

Notes. Authoritative parenting styles was the reference group for PS in all models.

Hypothesis II_b: Adolescents with authoritative parents will have the least weight gain at Wave II compared to adolescent's with authoritarian, indulgent, and neglectful parents.

To test for hypothesis I_b multiple linear regression models were performed separately for paternal and maternal parenting styles predicting Wave II BMI. Model 1 controlled for Wave I BMI, adolescent's gender, and adolescent's race. Model 2 included dummy coded variables representing either maternal or paternal authoritarian, indulgent, and neglectful parenting styles. The reference group for parenting styles was authoritative parenting. There was no main effect found for the maternal model, $f(6, 4289) = 0.77, p > 0.05$, nor the paternal model, $f(6, 3,19) = 0.91, p > 0.05$, between parenting styles and Wave II BMI. Results for this model are in Table 3.

Table 3.
Summary of hypothesis I_b: Parenting styles predict Wave II BMI.

Predictor	Maternal Model (N = 4296)				Paternal Model (N = 3197)			
	B	S.E.	R ²	R ²	B	S.E.	R ²	R ²
Step 1			.00	.00			.00	.00
Intercept	23.31	0.46			23.17	0.54		
W1BMI	0.00	0.02			0.00	0.02		
Gender	0.11	0.15			0.26	0.18		
Race	-0.06	0.04			-0.06	0.05		
Step 2			.00	.00			.00	.00
Intercept	23.40	0.46			23.16	0.54		
W1BMI	0.00	0.02			0.00	0.02		
Gender	0.12	0.15			0.37	0.18		
Race	-0.06	0.04			-0.06	0.05		
Neglectful	-0.13	0.21			-0.20	0.25		
Indulgent	-0.23	0.21			-0.05	0.24		

Authoritarian	- 0.17	0.22	0.16	0.26
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Notes. Authoritative parenting styles was the reference group for PS in all models. Accurate weight perception was the

Hypothesis I_c: Adolescent's weight concordance will be a predictor of weight gain at Wave II.¹

To test Hypothesis I_c, a hierarchical regression model was performed with weight perception predicting Wave II BMI. Step 1 controlled for Wave I BMI, adolescent's gender, and adolescent's race. Step 2 included dummy coded variables representing adolescent's weight perception as "perceiving to be thinner or heavier". The reference group was accurate weight perception. There was no main effect found between adolescent's weight perception and Wave II BMI, $f(5, 4273) = 1.37, p > .05$. Results for the models are detailed in Table 4.

Table 4.
Summary of hypothesis I_c: Adolescent's weight concordance predicts Wave II BMI.

Predictor	<i>B</i>	<i>S.E.</i>	<i>R</i> ²	<i>R</i> ²
Step 1			.00	.00
Intercept	23.21	0.58		
W1BMI	0.00	0.02		
Gender	0.11	0.15		
Race	- 0.04	0.04		
Step 2			.00	.00
Constant	23.09	0.59		
W1BMI	0.01	0.03		
Gender	0.02	0.16		
Race	- 0.05	0.04		
Perceives to be thinner	0.70	0.45		
Perceives to be heavier	0.49	0.38		

Notes. $N = 4279$

¹ Tested for gender differences but found no significant results

Additional Pearson's correlations were run between all study variables and found significant correlations in cross sectional analyses. Higher levels of parental control was associated with lower weights at Wave I, $r = -.06, p < .001$. Additionally, adolescents with either indulgent mothers ($r = .05, p < .001$) or fathers ($r = .06, p < .001$) had higher BMIs at Wave I. Those with either authoritative mothers ($r = -.06, p < .001$) or fathers ($r = -.06, p < .001$) had lower BMIs at Wave I. See Appendix C for a complete correlation table. Thus, the cross-sectional analyses provided partial support for mediation.

Hypothesis II: Girls will be more likely to perceive themselves as being heavier than they are. Boys will be more likely to see themselves as being lighter than they are.

Chi-square analyses comparing gender to weight perception supported our second hypothesis. Twenty-four percent of males were more likely to view themselves as being underweight compared to 8% of female adolescents, $\chi^2(1) = 333.16, p < 0.001$ (Figure 4), and 29% of females were more likely to view themselves as being overweight compared to 13% of male adolescents, $\chi^2(1) = 299.47, p < 0.001$ (Figure 4). There was no differences between males and females in having an accurate perception of their weight, $\chi^2(1) = 0.16, p > 0.05$ (Figure 4).

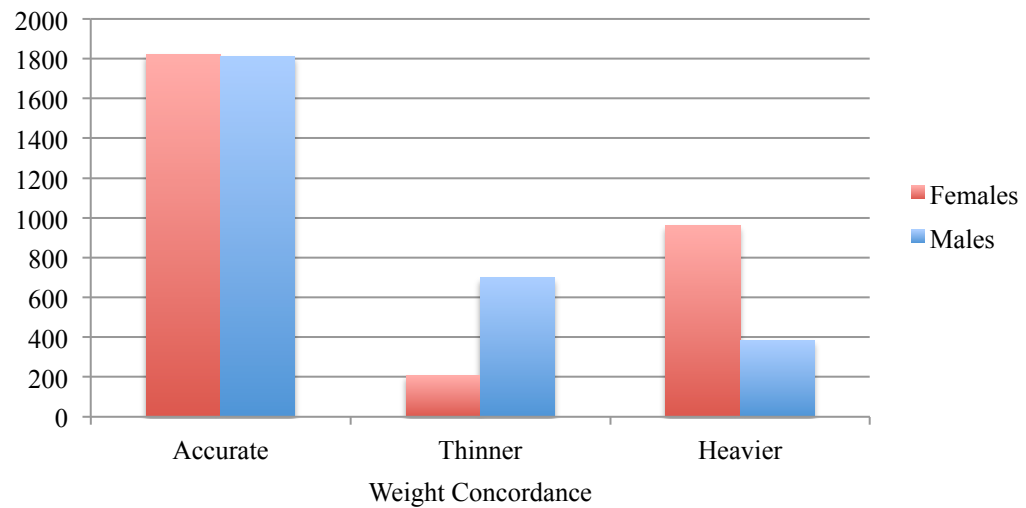


Figure 4. Chi-square results for gender differences in weight concordance.

Discussion

The current study examined the role of gender, parenting style, and weight perception in the prediction of weight gain over time in adolescents. This study examined adolescent's perception of weight as a mediator between parenting styles and weight gain one year later. In addition, it tested for differences in weight perception by adolescent's gender. We hypothesized that those with authoritative parents would have more accuracy in their perceived weight, leading to less weight gain overtime. We also hypothesized that adolescent girls would view themselves as being heavier than they truly are, and adolescent boys would perceived themselves as being lighter. We used data from Wave I and Wave II of the National Longitudinal Study of Adolescent Health (Harris et al., 2009) to analyze our hypotheses using a series of hierarchical regression models. Despite findings in previous studies (Berge et al., 2010; Fuemmeler et al., 2012; Rhee et al., 2006), we found no association between parenting styles and weight gain, or between perceived weight and weight gain over time. However, the second

hypothesis was supported, revealing that girls were more likely to perceive themselves as heavier and boys as lighter than they actually are according to objective measures of BMI status.

Parenting Styles and BMI

The primary goal of the current study was to examine the effects of parenting styles on adolescent's weight gain over time. The current study failed to find a direct relationship between both maternal parenting styles and paternal parenting styles and adolescent's weight gain. Prior to this study, there had only been three longitudinal studies which examined the role of parenting styles on a child's BMI, revealing that children from authoritative homes typically have lower BMI compared to those from authoritarian, neglectful, and indulgent homes (Berge et al., 2010; Fuemmeler et al., 2012; Rhee et al., 2006). The current study did not support previous findings and revealed no association between parenting styles and adolescents weight for mother or father models. These differences may be attributed to differences in methodology such as the age of the sample and the measurement of parent-child relationships. For example, Rhee et al (2006) examined the influence of parenting styles on weight in a sample of infants and was less ethnically diverse. The current study examined the relationship between parenting styles and weight gain in a sample of older adolescents ($M = 15.53$, $SD = 1.79$). The current study also differs from Berge et al (2010) who examined parenting styles by categorizing parenting styles by dimensions of communication and demandingness, as compared to the current study that varied by levels of supportiveness and control. Future longitudinal studies following children from

youth to early adulthood are needed to better understand the developmental influences of parenting styles on weight gain over time.

In addition to methodological differences, the current study's focus on the roles that parents play in adolescent's BMI might be less developmentally-salient than other relationships such as those with peers. As children get older they turn to peers for social support and guidance that influences self-identity (Hoffman, Ushpiz, & Levy-Shiff, 1988; Parker & Gottman, 1989). Adolescents model behaviors from friends that are related to weight, such as eating (Story, Neumark-Sztainer, & French, 2002) and physical activity (Anderssen & Wold, 1992). Peers also have an effect on their mood (Galambos, Leadbeater, & Barker, 2004), which has been linked to adolescent obesity (Goodman & Whitaker, 2002). Future studies should consider the relative influence of peer and parental relationships on weight gain to further examine this possibility.

Authoritative and indulgent parenting styles were associated with BMI in cross-sectional models.. Adolescents with either an authoritative mother or father had lower weights at Wave I, where as those with either an indulgent mother or father weighed more. In addition, an association was found between parental control and BMI, such that adolescents with higher controlling parents weighed less at Wave I. No association was found between support and BMI. It is possible that parental control has a greater influence on adolescent weight, than does parental support, which may also explain the failure to find significance in our main hypothesis testing. Past literature examining the roles of parental control and weight gain in childhood have largely focused on meal time practices in children

and have been widely mixed (Gable & Lutz, 2001; Blissett & Haycraft, 2008). Future studies should be developed to explore the roles of parental control independently on adolescent's weight.

Adolescent's Weight Perception

The hypothesis that parenting styles would influence adolescent's weight perception was not supported in the current study. Although past studies have found that the parent-child relationship has an effect on adolescent's body image (e.g. Al Sabbah et al., 2009), the same may not be true for parenting styles. Other socio-environmental factors in the home may have greater influences on adolescent's weight perception than levels of parental support and control. For example, studies exploring mother's influence on adolescent's body image have found that eating behaviors (J. Fulkerson et al., 2002) and attitude (Cooley, Toray, Wang, & Valdez, 2008) are associated with the daughter's own disproportionate view of weight. Similarly, Levine et al, (1994) found that weight/shape-related teasing and criticism by family is strongly correlated with weight concerns in middle school girls. Future studies should consider communication and support in relation to weight instead of general levels of parental support and control.

The current study also examined the association between weight perception and body mass index and found no main effect. This is surprising given that a vast amount of literature links body image with BMI. In particular, those who are the most dissatisfied with their bodies are typically at the greatest risk for obesity or extreme thinness (Field et al., 2003; Stice & Whitenton, 2002). Similarly, those who perceive themselves as being thinner are less likely to

engage in behavior changes associated with weight loss (Strauss, 1999), placing them at greater risk for becoming or staying obese.

The methodology of the current study may have contributed to the lack of significant findings. Traditionally, body image has been measured using a scale that measures body satisfaction (e.g. Brand, Rothblum, & Solomon, 1992; Gettelman & Thompson, 1993); however, the current study used a measure of weight perception that compared an individual's perception of their weight statuses to their objective body mass index. Examining weight perception is important because of its association with weight status (Strauss, 1999) and eating pathology over time (Desmond et al., 1986). However, neither the individuals that viewed themselves as being heavier nor those who viewed themselves as being thinner were at greater risk of gaining weight the following year. It is possible that despite the discordance between their perceptions and their actual weight, they were not dissatisfied with their bodies, reducing the likelihood of behavioral or emotional changes that are often associated with weight gain. Future studies should test an interaction between body satisfaction and weight concordance. It may be that those who have a disproportionate view of their body weight and are dissatisfied with their bodies are at risk of weight change over time.

The current study was also limited by using a categorical variable defining weight perception. We may have failed to capture differences among those who have a greater distortion of their body weight. Instead, future studies should use a continuous measure of weight perception to calculate whether the amount of discordance between actual and perceived weight is important to consider.

The Role of Gender

The second hypothesis that there would be gender differences in weight perceptions was supported. In the current study, girls were more likely to perceive themselves as being heavier, and boys were more likely to perceive themselves as being lighter. These findings are an extension of the existing literature and are consistent with past studies investigating adult samples, in that females often desire to lose weight, while men desire to gain weight through muscle building (McCabe et al., 2001; Neumark-Sztainer et al., 1999). Girls may believe that they are heavier because they may feel that they do not fit the stereotype of being extremely thin, and boys may feel that they are in need of obtaining a mesomorphic build (Furnham et al., 2002; Furnham & Calnan, 1998; McCabe & Ricciardelli, 2001).

This finding is important because of the growing rates of eating pathology in both young females and males (e.g. anorexia nervosa). Girls who have a disproportionate view of their bodies are at a greater risk for developing excessive dieting and may begin a restriction-binge cycle leading to weight gain over time (Herman & Mack, 1975). Similarly, males who view their bodies as being too light are at a greater risk of excessively using steroids, supplements, and excessive exercise, which is associated with muscle dysmorphia (McCreary, Hildebrandt, Heinberg, Boroughs, & Thompson, 2007).

Understanding differences in adolescent's weight perception by gender will help tailor new treatment and prevention strategies targeting body image. New treatments are particularly needed for males. In the past, boys were thought

to suffer less body dissatisfaction than girls (Pingitore, Spring, & Garfieldt, 1997; Tiggemann & Williamson, 2000), but it is more likely that they have different body image concerns. Given that body image is correlated with traditional gender roles (Mishkind, Rodin, Silberstein, & Striegel-Moore, 1986), it is likely that young boys desire to have more muscle build. There is little research on the factors that influence the unique body concerns in young males and fewer prevention programs targeting body image in adolescent boys. The current study supports the need for continued research on the factors that influence unique body image concerns in boys so that future treatments can target the unhealthy side effects of body dissatisfaction, such as steroid usage to increase muscle size (Neumark-Sztainer et al., 1999).

Implications

The current study only found one significant finding: weight perceptions differ by gender in adolescents. Similar to past studies, the current study found that females often see themselves as being heavier and males see themselves as being smaller. It is likely that these perceptions play a role in the increasing prevalence of steroid and supplement use in adolescent boys and the amount of unhealthy dieting among young girls (Neumark-Sztainer et al., 1999). This finding can be implemented into current or future treatments for body image and eating pathology, allowing for unique treatments by gender. Specifically, treatment for females should continue to focus on coping skills targeting the drive for thinness and educating girls on healthy diet and exercise, while those targeting males should focus on education around healthy muscle weight and body fat.

Future studies should be conducted to examine possible correlations between weight perception in adolescent boys and steroid and supplement use. Finally, the current finding also supports the need to conduct research using body image measures that are multi-dimensional accounting for both thinness and muscle size for boys (e.g. Body Parts Satisfaction Scale for Men; McFarland & Petrie, 2012).

Strengths and Limitations

The current study had several strengths. First, it includes a nationally representative sample that is largely diverse both ethnically and economically. Additionally, it has a unique benefit of being longitudinal, allowing us the ability to examine change in weight over time. This is important because it allows for better interpretation when considering directionality. The current study also had the strength of examining both mothers and fathers, compared to past studies that have been limited to mothers only. Gaining a fuller understanding of each parent's role on adolescent's weight is important for future research, and prevention and intervention strategies.

The study also included limitations, particularly in the measurement of body image. Traditional measures examined body image as a construct of satisfaction with one's body; in contrast, our measure includes only concordance with weight and perception of weight. It is possible that we lost effects by not parsing out those who have a distorted view of their weight and are satisfied with their bodies versus those with low body satisfaction. These limitations suggest directions for further research.

Future studies should continue to investigate the effect of parenting styles on adolescent's weight longitudinally, but should also include measures of other weight related behaviors such as physical activity and diet.

Conclusion

The current study found no effect between parenting styles and adolescent's weight gain in either maternal or paternal models. It also failed to find a relationship between weight perception and BMI one year later. We did find a difference in weight perception by gender that is consistent with past research (McCabe et al., 2001; Neumark-Sztainer et al., 1999). Female youth are more likely to view themselves as heavier than they actually are and male youth are more likely to view themselves as lighter. This finding suggests the need for tailored prevention/intervention strategies for body image for young boys and girls.

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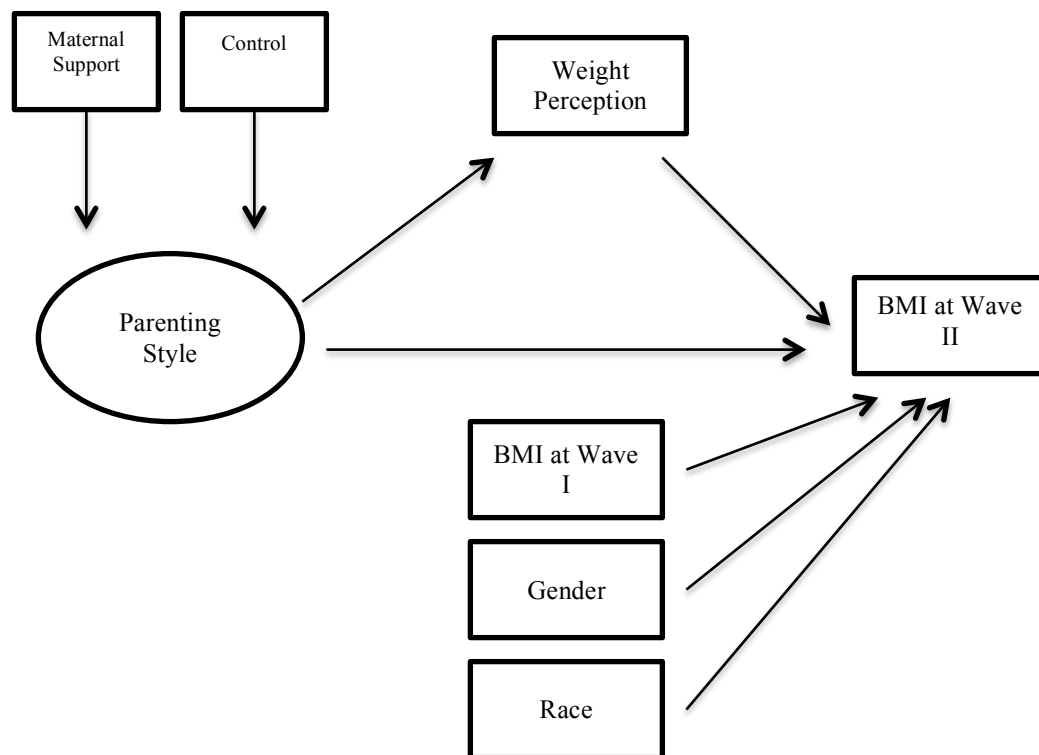
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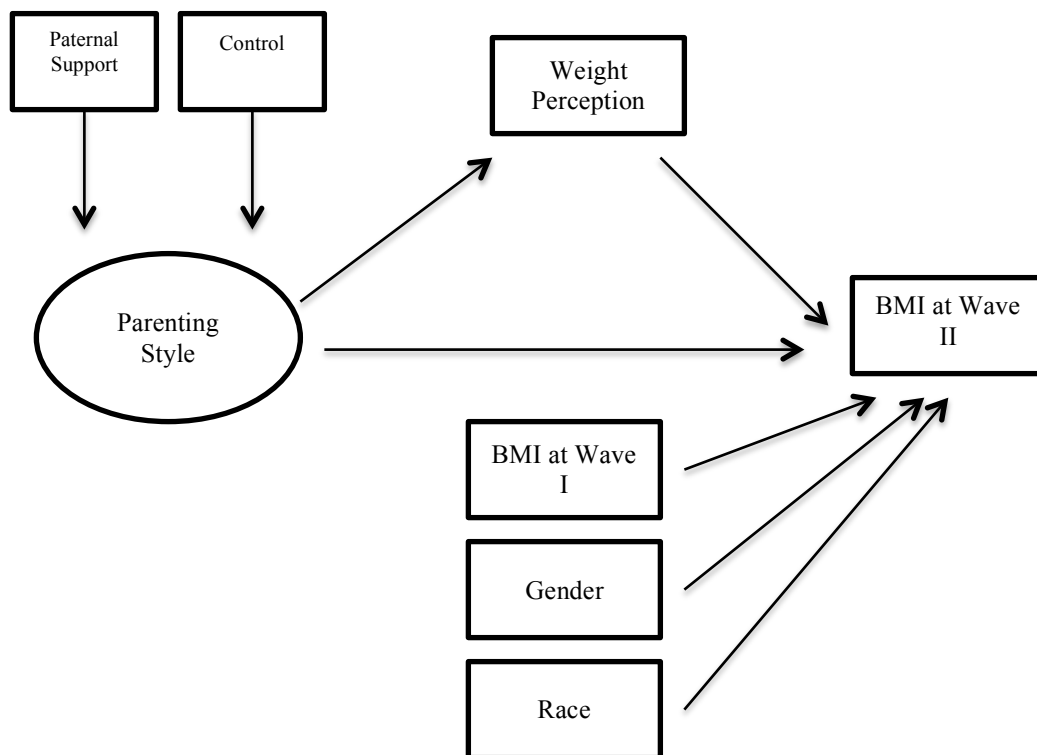
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Appendix A. SEM model: Maternal parenting style predicting BMI at Wave II



Appendix B. SEM model: Paternal parenting style predicting BMI at Wave II



Appendix C. Correlation Table

Table 5.
Correlations

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Parental Control	-															
2. Maternal Care and Support	.01**	-														
3. Paternal Care and Support	.06**	.49**	-													
4. Maternal PS - Neglectful	-.46**	-.43**	-.26**	-												
5. Maternal PS - Indulgent	-.47**	.39**	.16**	-.33**	-											
6. Maternal PS - Authoritarian	.42**	-.45**	-.22**	-.30**	-.31**	-										
7. Maternal PS - Authoritative	.50**	.44**	.29**	-.36**	-.36**	-.34**	-									
8. Paternal PS - Neglectful	-.46**	-.22**	-.49**	.56**	.10**	-.29**	-.35**	-								
9. Paternal PS - Indulgent	-.48**	.19**	.39**	.12**	.59**	-.31**	-.38**	-.32**	-							
10. Paternal PS - Authoritarian	.38**	-.28**	-.44**	-.27**	-.28**	.56**	.01	-.27**	-.29**	-						
11. Paternal PS - Authoritative	.54**	.27**	.46**	-.38**	-.39**	.08**	.65**	-.37**	-.40**	-.34**	-					
12. Underweight WP	.02	.00	.04*	-.03*	.00	.01	.02	-.05*	-.01	.01	.04*	-				
13. Overweight WP	.05**	-.05**	.00	-.02	-.03*	.04*	-.01	-.03	-.02	.04	.02	.23**	-			
14. Wave I BMI	-.06**	-.01	-.02	.02	.05**	-.01	-.05**	.01	.06**	-.01	-.06**	-.13**	.15**	-		
15. Wave II BMI	.02	-.01	-.01	.00	-.01	.00	.01	-.02	.00	.02	.00	.03	.03	.00	-	
16. Child's Gender	-.01	-.11**	-.08**	.04**	-.01	.02	-.05**	.07**	-.03	.03	-.06**	.24**	.23**	.04*	.01	-
17. Race	-.09**	.01	.05**	.04*	.03*	-.05**	-.02	.02	.07**	-.06**	-.03*	.09**	.05**	-.08*	-.01	.00

Notes. Parenting Styles = PS; Weight Perception = WP; * p < .05, ** p < .001; N_{range} = 6337- 4128