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Associations Between Parent-Child Relationship Quality, Parent Feeding Practices, and Child Weight Status in Preadolescent Children

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Doctor of Philosophy

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ABSTRACT

Associations Between Parent-Child Relationship Quality, Parent Feeding Practices, and Child Weight Status in Preadolescent Children

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The present study evaluated associations between parent-child connectedness and communication, parent perceptions of child weight, parent feeding behaviors (restriction, pressure to eat, and monitoring), and child body mass index percentile among a sample of children aged 8-12 years. To evaluate these associations, this study used a cross-sectional design and maximum likelihood (ML) structural equation modeling to examine a mediation model with parental feeding behaviors mediating the associations between parent-child relationship quality and child body mass index. Furthermore, because of the known associations between parental perceptions of child weight and parent feeding practices, models examining the mediating effects of parent feeding practices between parent perceptions of child weight and child body mass index were also examined. Finally, we used mixture modeling to conduct latent profile analyses, specifying high, moderate, and low levels of each feeding behavior, in order to examine the mediation effects of specific levels of feeding behaviors. Study findings supported restriction as a mediator between parent reported communication (PRC) and child weight, as well as between parent perceptions of child weight (PCW) and child weight. The results also indicated that parent perceptions of child weight predicted feeding practices and child weight. Both restriction and monitoring predicted child weight. Overall, these findings provide evidence for the role of parent-child relationship quality in predicting parent feeding behavior. However, study findings suggest that these associations may differ depending on the rater (i.e., child, parent).

Keywords: parent-child, communication, connectedness, perceived child weight, feeding practices

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Associations Between Parent-Child Relationship Quality, Parent Feeding Practices, and Child Weight Status in Preadolescent Children

Research examining factors that contribute to the development of weight status among children has proliferated over the past decade. This represents an important area of research because of the positive benefits that being at a healthy weight can provide for children. Research suggests that healthy weight children (BMI <5th - <85th percentile; nccd.cdc.gov) are at lower risk for obesity in adulthood (Venn et al., 2007; Wang, Chyen, Lee, & Lowry, 2007). This lowers their risk for other obesity-related diseases including hypertension, heart disease, diabetes, and sleep apnea. Furthermore, research shows that healthy weight children are less likely to experience early mortality and other impairments such as medical and psychological co-morbidities (de Sausmarex, & Dunsmuir, 2011). Taken together, research suggests that being in a healthy weight may be a protective factor against many physical and mental health conditions in children.

Healthy Weight as a Protective Factor Against Obesity-Related Diseases

In a recent review of the literature, Daniels (2009) found that healthy weight children have fewer health difficulties related to hypertension, type II diabetes, and fatty liver disease compared to their obese counterparts. In addition to these findings, research has shown an association between childhood obesity and decreased insulin sensitivity and increased circulating insulin levels; the first of which is an important risk factor for the development of type II diabetes (Steinberger, Moran, Hong, Jacobs, & Sinalko, 2001). Thus, these findings suggest being in a healthy weight may decrease children's risk of developing hypertension, fatty liver disease, and type II diabetes.

Furthermore, Ingelsson et al. (2007) found a connection between obesity and the development of cardiovascular disease (CVD) in adults. They found that overweight and obese individuals were 0.53 - 0.59 times more at risk of developing CVD than their normal weight counterparts when subclinical disease was controlled ($p = 0.001$; $p = 0.003$). While, other researchers found that obesity was associated with an increased risk for myocardial infarctions (Horvei et al., 2014; Manson et al., 1990). Although these associations were documented in adults, research supports the notion that atherosclerosis begins developing during childhood (Berenson et al., 1998; Cote, Harris, Panagiotopoulos, Sandor, & Devlin, 2013; McGill et al., 2001). For example, Mahoney et al. (1996) found the strongest predictor of coronary calcium later in life was increased body mass during childhood. They found that obese or overweight children were 3.0 times more likely to develop coronary calcium as young adults than healthy weight children ($p = 0.01$; Mahoney et al.,1996). Thus, Mahoney et al. (1996) concluded that healthy weight children were at reduced risk for developing coronary calcium and associated cardiovascular risk compared to their overweight and obese peers. This is an important area of research because coronary calcium is associated with increased risk of myocardial infarctions (heart attacks). Therefore, these results indicate that healthy weight children are at lower risk for cardiac health complications during both childhood and adulthood.

Healthy Weight Decreases Risk of Early Mortality

Moreover, Olshanksy et al. (2005) found that healthy weight children have fewer health concerns (e.g. type II diabetes, coronary heart disease, etc) and less risk of early mortality compared to those experiencing childhood obesity. Contrary to the general trend of increased life expectancy in recent generations, Olshanksy et al. (2005) hypothesized the current generation will have a shorter life span than their parent's generation because of the adverse health consequences of childhood obesity and associated comorbidities. Fontaine, Redden, Wang, Westfall, and Allison (2003) conducted a study in which they examined the expected number of years of life lost due to obesity. They estimated the life expectancy of severely obese individuals to be 5 to 20 years lower than their normal weight peers (Fontaine et al., 2003). Because childhood obesity appears to contribute to early mortality, finding factors that assist children in achieving and maintaining a healthy weight during childhood could help reduce early mortality and lengthen the current generation's life expectancy.

Healthy Weight Reduces Risk for Breathing Difficulties

Healthy weight children are also less likely to experience obstructive sleep apnea (Kang, Lee, Weng, Hsu, 2012; Mallory Jr., Fiser, & Jackson, 1989; Mofid, 2014), which is associated with numerous health and psychosocial concerns including school difficulties, behavior dysregulation, low quality of life, and executive functioning deficits (Daniels, 2009; Mofid, 2014; Rhodes et al., 1995). In one study, Kang, Lee, Weng, and Hsu (2012) found that the risk of having obstructive sleep apnea was 6.27 higher in obese children than their normal weight counterparts ($p = 0.001$), indicating that being in a healthy weight can substantially reduce the risk of sleep related breathing problems. Furthermore, research has shown that healthy weight children are less likely to develop habitual snoring (OR = 5.8, $p = 0.001$; Anuntaseree, Sangsupawanich, Mo-suwan, Ruangnapa, & Pruphetkaew, 2014). Anuntaseree et al. (2014) also found that the development of habitual snoring was significantly associated with changes in weight category from *not obese* to *obese,* indicating that children who became obese were more likely to develop habitual snoring than those who stayed in a healthy weight (OR for children who became obese = 6.7, $p = <0.001$; OR for children in healthy weight = 3.9, $p = <0.001$). Moreover, children below the 85^{th} percentile for BMI have also been shown to have a decreased risk for the development of asthma (Rodriguez, Ahn, Winkleby, Sundquist, & Kraemer, 2002). Rodriguez et al. (2002) found that children with BMI's over the 85^{th} percentile were twice as likely to have increased frequency of wheezing and 16 times more likely to be hospitalized for asthma in the last year than those who had lower BMI percentile. Consequently, being in a healthy weight appears to be a protective factor against disorders associated with disruptions in breathing and sleeping.

Psychosocial Benefits of Healthy Weight

Daniels (2009) conducted a study examining psychosocial functioning in children of various weights. He found a relationship between childhood obesity and psychosocial complications later on in life, including increased symptoms of depression and poorer quality of life. Conversely, healthy weight children demonstrate lower rates of depression and higher rates of health-related quality of life (Britz et al., 2000; Schwimmer, Burwinkle, & Varni, 2003). Schwimmer et al. (2003) found that children at a healthy weight endorsed significantly higher quality of life in both physical and psychosocial functioning compared to their obese counterparts. The associations demonstrated medium to large effect sizes, respectively (d = 0.78, d = 1.13 respectively). Additionally, Schwimmer et al. (2003) found that health-related quality of life in obese children was 5.5 times poorer than healthy weight children and comparable to children being treated for cancer. This represents a significant detriment to psychosocial functioning for obese children when one considers that children currently undergoing chemotherapy for cancer report the poorest quality of life of any pediatric chronic illness (i.e., type 1 diabetes, congenital heart disease, juvenile rheumatoid arthritis).

Furthermore, Lu et al. (2012) reported that healthy weight children and adolescents aged 10-17 years reported fewer negative emotions, like irritability and depression, than their overweight or obese counterparts. In particular, when rating emotions over the last month, they found that on average overweight and obese girls endorsed an average of 2.3 more negative emotions, while overweight and obese boys were likely to have 1.6 more negative emotions when compared to normal weight peers ($p = <0.05$; Lu et al., 2012). Taken together, these findings suggest that being at a healthy weight during childhood may benefit children and families with increased psychosocial functioning, increased quality of life, and a decrease in negative emotions.

Healthy Weight Influences Executive Control Abilities and School Functioning

Research examining weight status differences in school settings suggests that being at a healthy weight may be a correlate with negative consequences related to executive abilities and social functioning. For example, Reinert, Po'e, and Barkin (2013) conducted a systematic literature review of the relationship between executive functioning and obesity in children and adolescents. They found that healthy weight children and adolescents exhibited higher levels of inhibitory control than their obese counterparts. Moreover, there is some evidence suggesting an association between obesity during childhood and structural deficits in regions of the brain associated with inhibitory control, poor working memory, and decreased ability to focus attention in females (Reinert et al., 2013). Furthermore, healthy weight girls scored higher on reading and math assessments than girls who became overweight or obese during elementary school (Reading r = -2.54, $p = <0.01$, Math r = -1.62, $p = <0.05$; Datar, & Sturm, 2006). Additionally, Crosnoe and Muller (2004) found that adolescent students with BMIs lower than the 85th percentile had higher grade point averages than their obese peers.

Research also suggests that healthy weight children achieve superior school functioning on parent- and self-report measures compared to overweight and obese children (Schwimmer et al., 2003). T-tests comparing parent-reports of obese children and adolescents with their healthy weight counterparts on school performance yielded a large effect size (t = -12.10, p = <0.001, d = 1.42), while self-report comparisons yielded a medium effect size (t = -6.45, p = <0.001, d = 0.71, Schwimmer et al., 2003). These results suggest that being at a healthy weight may promote more academic achievement in school from both child and parent perspectives. There are also benefits of being at a healthy weight in social domains of school functioning. For instance, Mahoney, Lord, and Carryl (2005) found that in first, second, and third grade, teachers rated healthy weight children as more popular, less frequently rejected and isolated, and as having better interpersonal skills than overweight or obese children.

Taken together, research supports numerous associations between healthy weight children and academic, social, physical, and neuropsychological benefits, including lower risk for obesogenic diseases and other psychological, behavioral, and medical difficulties compared to their overweight or obese counterparts. Because research supports many associations between negative health-related, psychosocial, and cognitive consequences and childhood obesity, it is important to understand factors that contribute to healthy weight status in children.

Contributors to Child Weight Status

One important factor that appears to contribute to weight status in children is parent involvement with dietary consumption. In a study done by Miller et al. (2012) examining how often children's eating was supervised by adults in a sample of middle school students (6-8th grade), they found that adults supervised 86% of children's eating at this age. They found an inverse relationship between time spent eating unhealthy foods and time spent under adult supervision, indicating that children are more likely to engage in healthier eating when supervised by parents (r = -0.78, p = <0.05; Miller et al., 2012). Moreover, this line of research suggests that parents supervise a majority of children's eating at this age, and that a parent's supervision can improve a child's dietary intake. This demonstrates the need for research examining parent's involvement in the process of children's development of healthy eating habits and weight status because there appears to be a relationship between parental involvement and child food consumption.

The importance of parental monitoring in fostering healthy behaviors with children and adolescents has been demonstrated across numerous research areas. For example, Criss et al. (2015) found that parental monitoring was associated with less substance abuse among adolescents and that grades were incrementally predicted by both child disclosure and parental involvement. Because of the strong influence that parental practices have over children's environments, specifically eating habits during childhood, it is important to assess factors that contribute to healthier parent feeding patterns to better understand child weight outcomes.

Associations Between Parental Feeding Practices and Child Weight

Previous research suggests an important association between parental feeding practices and child weight status. During childhood, parent's influence over food availability, the structure of meals, and the modeling of eating habits are influential in a child's development of lifelong dietary habits and may contribute to either a healthy weight status or obesity (Koplan, Liverman, & Kraak, 2004). Thus, parent feeding practices seem to be an important area of research because of the strong relationship between parental influence and child food intake.

Moreover, studies examining the associations between parent feeding practices and children's eating behavior and weight status have yielded mixed results. In a study of 156 mothers of children (aged 2-4 years) the investigators did not find a significant association between mother's pressure to eat, restriction, monitoring, and modeling of healthy eating and a child's BMI one-year later. They concluded that maternal feeding practices did not appear to influence a child's weight status over a period of a year (Gregory, Paxton, & Brozovic, 2010). Conversely, in a study examining the associations between parent feeding restriction on child BMI at baseline and a 3-year follow-up, Campbell et al. (2010) found that restrictive feeding practices negatively predicted child BMI ($r = -0.013$, $p = 0.04$), indicating that higher parental restriction led to decreases in child BMI. This association demonstrated a medium effect size ($r^2 = 0.76$) when baseline maternal BMI, maternal education level, and child sex were controlled. Specifically, Campbell et al. (2010) found that parental restriction of energy-dense foods and drinks may be a protective factor in maintaining healthy weight status in younger children (5-6 year-olds), but no effect was found in older children (10-12 years-old).

Zhang and McIntosh (2011) also explored the association between parental feeding practices and children's weight status. They examined a sample of 312 children (aged 9-11 and 13-15) and found that both maternal and paternal feeding patterns predicted child weight outcomes (Zhang & McIntosh, 2011). Moreover, they found parental feeding practices such as encouraging children to eat healthy foods and monitoring child food intake to be associated with lower weight status in children and higher levels of parental control to be linked with higher weight status. Furthermore, according to a study done by Rodgers et al. (2013) several aspects of parent feeding behaviors were associated with maladaptive child weight, such as high levels of restriction, pressure to eat, and monitoring. Rodgers et al. (2013) used the Child Feeding Questionnaire (CFQ), Preschooler Feeding Questionnaire (PFQ), Parent Feeding Style Questionnaire (PFSQ), and BMI to assess the relationship between parent feeding practices and child weight. Participants were assessed at two time points, approximately 52-weeks apart. They reported that higher levels of parental restriction and pressure to eat predicted overeating in children at time 1 and 2 (e.g. baseline assessment and 52 weeks later). Parental restriction and pressure to eat accounted for 27% of the variance in a child's overeating. Overall, they found that these feeding practices led to more obesogenic eating behaviors in children, which contributed to higher weight status (Rodgers et al., 2013).

Moreover, in a comprehensive literature review, Faith et al. (2004) summarized the research on the association between parental feeding styles and child eating habits and weight status conducted over the preceding seven years. Out of the twenty-two studies reviewed, 19 reported at least one significant association between parental feeding patterns and child weight. Eight studies reported a significant relationship between parental restriction and child weight outcomes, while only one study reported no relationship (Faith et al., 2004). Thus, the majority of recent research suggests a significant association between parental feeding practices and child weight.

Furthermore, research has shown that maternal and child factors can influence parental feeding patterns (Francis, Hofer, & Birch, 2001). The specific parent-child factors that contribute to feeding practices are not yet well known; however, Francis et al. (2001) found that mothers reported using more restrictive feeding practices when they were more involved with weight and eating issues, and when their daughters were heavier. This shows that in addition to feeding patterns influencing child weight, certain characteristics of parents, children, and their relationships with each other may have important implications for parental feeding patterns.

Though some research suggests that parental feeding practices such as pressure to eat, restriction, and monitoring do not have significant associations with child weight, the majority of the research on this topic suggests that parental feeding can have direct effects on child weight. Taken together, results of the literature examining parental feeding as a predictor of child weight status indicates that the majority of studies show at least one significant relationship between parental feeding patterns and child weight. These results suggest a need for further investigation of parental factors that influence parental feeding behavior as a way to intervene in child weight.

Associations Between Parent-Child Connectedness and Parental Feeding Behaviors

Research suggests that parent-child connectedness may affect aspects of children's dietary behavior at each stage of their development. Research on parent-child connectedness, which is defined as the extent to which a child feels loved, cared for, and close to their parents, is grounded in attachment theory (Boutelle et al., 2009). Goossens, Braet, Van Durme, Decaluwe, and Bosmans (2012) studied the role of connectedness to mothers and fathers as a predictor of eating pathology and weight gain in children ages 8-11. This study assessed associations between parent-child connectedness and eating behavior and BMI among 601 preadolescents (48% female) at two time points (baseline and one year later). At baseline they found significant associations between connectedness and several features of eating pathology; however no significant associations between connectedness and BMI were observed. However, when they controlled for gender and baseline levels of eating pathology and weight, they found significant associations and differences between connectedness to father versus mother. They found an association between children's connectedness towards their mother and dietary restraint, eating concerns, weight concerns, shape concerns, and BMI in children one year later. Whereas, decreased connectedness in children toward their fathers were found to be predictive of persistence in children's subjective binge eating episodes (Goossens et al., 2012). This study shows preliminary evidence of the longitudinal association between connectedness and eating pathology and weight gain in children.

In addition to these results, Boutelle et al. (2009) found that higher parent–child connectedness was associated with increased body satisfaction for females, increased self-esteem for males, and decreased depressive symptoms for both males and females in a longitudinal study over a five-year period. Proportion of variance predictable from parent-child connectedness for these associations ranged from 13% to 24% when controlling for grade, marital status, ethnicity/race, socioeconomic status, and income, suggesting parent-child connectedness as an important factor in a child's emotional development. Overall, Boutelle et al. (2009) found that interventions aimed at strengthening the parent-child relationship throughout adolescence may protect against negative emotional outcomes in children and adolescents. Since this relationship is seen as a protective factor against negative emotional consequences, it is reasonable to assess the feasibility of parent-child connectedness as a protective factor for negative physical consequences as well.

Moreover, a population-based study consisting of 4,746 students in public schools completed the Project EAT (Eating Among Teens) survey, which includes the Parent-Adolescent Connectedness Scale (Ackard, Neumark-Sztainer, Story, & Perry, 2006), which focuses on adolescents' perceptions of both parental caring and communication. Ackard et al. (2006) examined parent-child connectedness and its associations with a number of variables, including unhealthy weight control strategies. They found that compared to other members of their cohort who reported high levels of maternal connectedness, youth who reported low levels of maternal connectedness reported a high prevalence of unhealthy weight control behaviors (Ackard et al., 2006). Results of this cross-sectional study indicated that one fourth of children in the sample felt unable to talk to their mother about problems, and one half of girls and one third of boys felt unable to talk to their father. These results indicate that perceiving low parental communication and caring was associated with unhealthy weight control strategies in children and adolescents.

Therefore, because parent-child connectedness has been shown to have an inverse relationship with child weight control strategies and parent's tend to be more involved in a child's eating habits during pre-adolescence (Ackard et al., 2006), it is reasonable to suggest that the parent-child relationship may have an important impact on a parent's feeding style. Future research aimed at improving our understanding of the association between the parent-child relationship and parent feeding practices and child weight will likely be helpful in better understanding how to reduce prevalence of overweight and obesity in children.

Associations Between Parent-Child Communication and Parental Feeding Behaviors

Furthermore, Lanigan (2012) suggests that parent-child communication regarding healthy eating and feeding practices among caregivers and their children may be an essential part of obesity prevention initiatives. Specifically, parent-child communication was defined as the extent to which parents perceive that they listen to their child and the extent to which the child perceives that their parent listens to them. Lanigan (2012) found that family communication accounted for 29% of the variance in efficacy and feeding knowledge among families when controlling for misconceptions about eating behaviors and priority placed on obesity prevention by caregivers. This study suggests that family communication and parent feeding practices are an important aspect to target when looking at healthy weight in children because of their role in changing efficacy and feeding knowledge, which in turn improve feeding practices. Moreover, Parletta et al. (2012) found that in a sample of 382 children aged 2-12, more "attack like" parent-child communication predicted higher child BMI. Another study of parent-child communication found that lower levels of parent-child communication were associated with higher levels of parental control (Keijsers, & Poulin, 2013). Because of these results, it is reasonable to explore the association between parent-child communication and parent-feeding practices due to the evidence suggesting that they may be related through differential use of parental control.

Associations Between Perceived Child Weight and Parent Feeding Practices

Research has shown that weight outcomes tend to be similar across family members, in that the prevalence of overweight and obesity tends to increase at the same rate across parents and children (Lazzeri, Pammolli, Pilato, & Giacchi, 2011). This presents a problem because overweight parents are less likely to accurately classify their child's weight status, and therefore, they are less likely to implement appropriate behavioral strategies to mitigate risk of further weight gain (Aljunaibi, Abdulle, & Nagelkerke, 2013). Furthermore, some researchers suggest that parental concern is an important predictor of a parent's motivation to engage in behaviors to manage weight (Moore, Harris, & Bradlyn, 2011). However, before a parent can be concerned about their child's weight, they must first be able to accurately identify their child as at risk for weight difficulties. Research on parental perceptions of their child's weight suggests that parents may alter their feeding strategies based off of their perceptions of their child's weight. For example, Doolen, Alpert, and Miller (2008) found that parents often underestimate their child's weight status making them "unable to intervene" in strategies to reduce obesity. They suggest that parents are unable to engage in feeding practices that would reduce the risk of increasing weight-related problems if they are unable to first classify their child as either overweight or at risk for being overweight. Moreover, this study suggests that unknowing parents are more likely to engage in maladaptive feeding practices because of their misperceptions of their child's weight. For example, parents may perceive their overweight child as healthy weight and therefore fail to implement feeding practices that could improve their child's weight. These findings study suggest that parents' perceptions of child weight as an important area of research because of the weight consequences that can arise from inaccurately identifying a child's weight status combined with the tendency to not engage in appropriate feeding patterns to mitigate risk. Additional research done by Payne, Galloway, and Webb (2011) suggests that parents may alter their feeding practices depending on their perceptions of their child's weight rather than parent feeding practices driving child weight. Taken together, these studies provide the basis for using perceived child weight as a covariate because the research suggests that parent motivations for engaging in specific feeding patterns (restriction, pressure to eat, and monitoring) vary depending on their perception of their child's weight status, and literature in this area suggests that parents may be prone to misinterpret their child's weight. Therefore, this study aims to further explore the association between perceived child weight (PCW) and child weight as mediated by parent feeding practices.

Hypotheses

Based on the aforementioned literature, this study aimed to assess associations between parent-child connectedness and communication, parent perceptions of child weight, parent feeding practices, and weight status in children. Specifically, we hypothesized that: 1) parent-child connectedness and parent-child communication would be inversely associated with BMI percentile; 2) Parent feeding patterns (i.e., restriction, pressure, monitoring) would mediate the association between parent-child connectedness and child BMI (See Figure 1); and 3) Parent feeding patterns would mediate the association between parent-child communication and child BMI (See Figure 2). Furthermore, we hypothesized that 4) Perceived Child Weight (PCW) would be inversely related to child BMI percentile, 5) that PCW would be associated with higher levels of restriction, pressure to eat, and monitoring, and 6) that the association between PCW and child BMI would be mediated by parent feeding practices (See Figure 3).

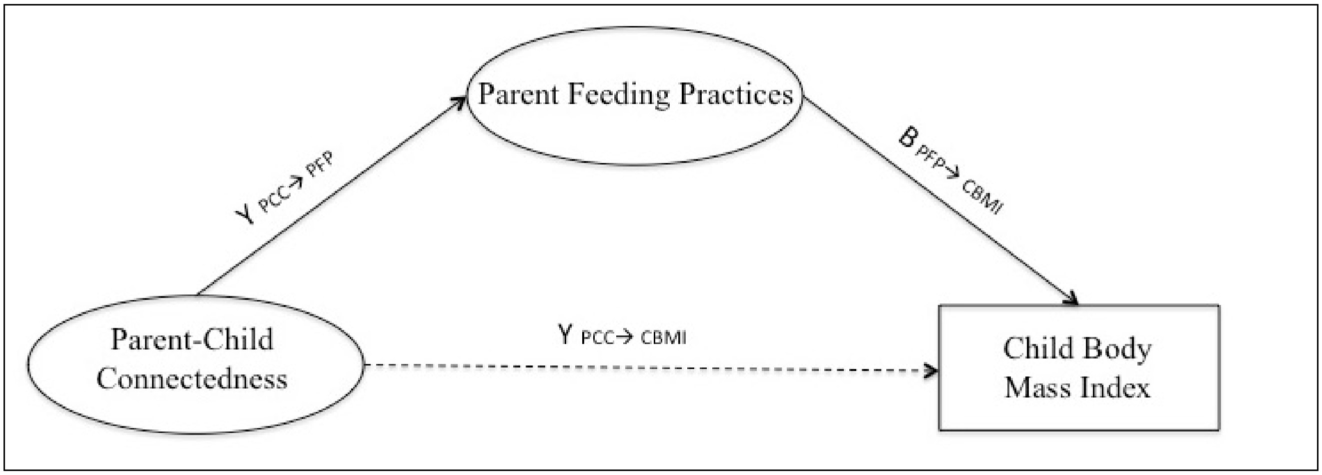

Figure 1. Proposed Model for Parent-Child Connectedness

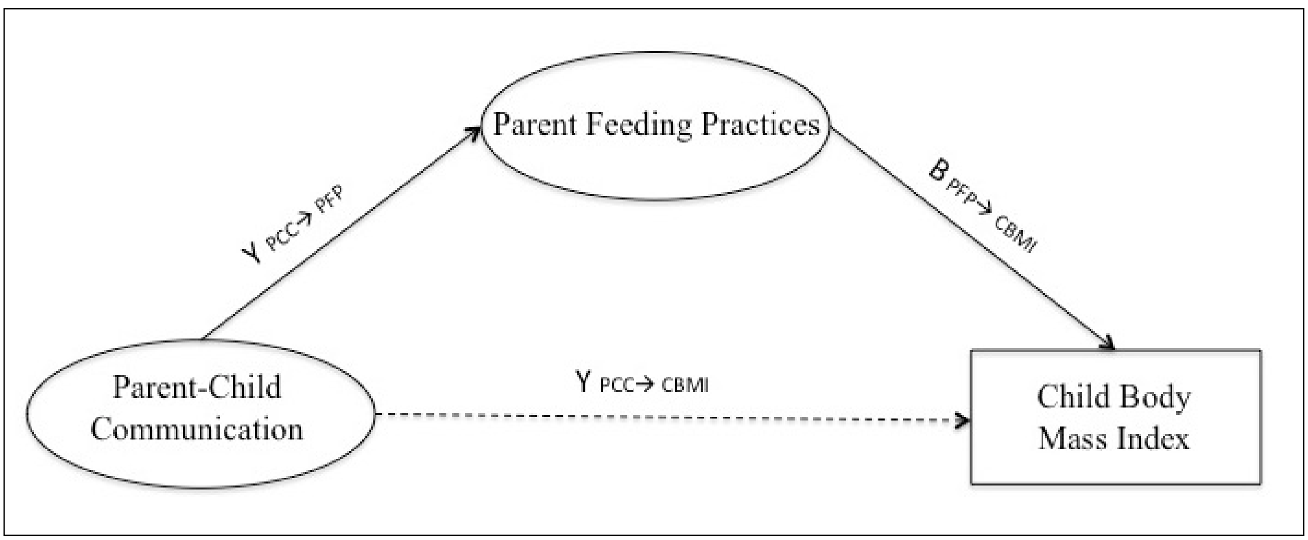

Figure 2. Proposed Model for Parent-Child Communication

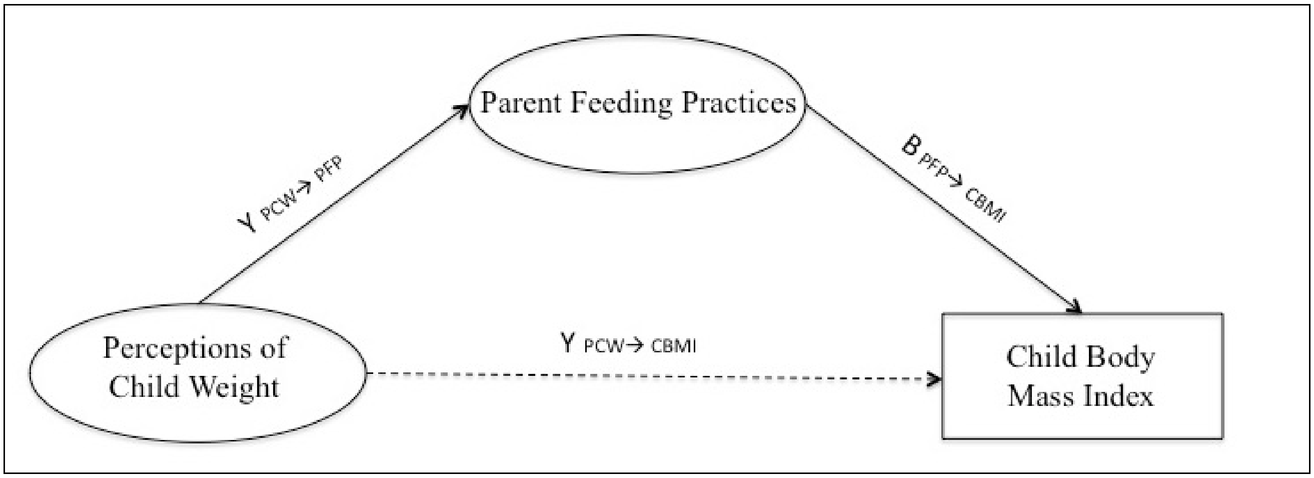

Figure 3. Proposed Model for Perceptions of Child Weight

Methods

Participants

Three-hundred eight child-parent dyads were recruited from physical education classes at five elementary schools within the Provo Utah School District. Children were aged 8 to 12 years-old (males n = 144; mean age = 9.73, SD = .92; Caucasian = 82.50%; Hispanic = 7.80%; Other = 9.70%). Participants were relatively equally distributed across the three grade levels (3-5) (3rd grade =35.40%; 4th grade = 29.90%; 5th grade = 34.10%); however, there were two participants who were in 6th grade (See Table 1). Income for participants was lower than national estimates, with a sample mean of $6,230; whereas, the population mean for families across the United States ranges from $7,670 to $9,910 depending on parent age (United States Census, 2015). Participant inclusion criteria were: a) the child was between the ages of 8-12 years-old, b) the child had no serious health related concerns that would preclude them from participating in physically rigorous activity, c) one parent/guardian participated in the study and provided consent, d) the child provided written assent, and e) the parent/guardian and child spoke English. These children were recruited as part of a larger cross-sectional health behavior study.

Table 1

Summary of Demographic and Anthropometric Data

Characteristic	All Participants
N	308 (144 Males)
Mean Age (SD)	9.73 (0.91)
Mean BMI Percentile (SD)	53.18 (28.64)
BMI Category (%)*	
Underweight	7 (2.3%)
Normal Weight	247 (80.2%)
Overweight	32 (10.4%)
Obese	20 (6.5%)
Race/Ethnicity (%)	
Caucasian	254 (82.50%)
Hispanic	24 (7.80%)
Pacific Islander	5 (1.62%)
Black	1 (0.32%)
Asian	1 (0.32%)
Multiracial & Other	23 (7.47%)
Grade (% in each)	
3rd Grade	109 (35.40%)
4th Grade	92 (29.90%)
5th Grade	105 (34.10%)
6th Grade	2 (0.60%)
Monthly Gross Income (SD)	6.23 (3.15)

Note. Monthly Gross Income was measured in approximately $1,000 increments: 1 = $0 - 999, 2 = $1,000– 1,999, 3 = $2,000 – 2,999, 4 = $3,000 - $3,999, 5 = $4,000 – 4,999, 6 = $5,000 – 5,999, 7 = $6,000 – 6,999, 8 = $7,000 – 7,999, 9 = $8,000 – 8,999, 10 = 9,000 – 9,999, 11 = 10,000 +. * = BMI data was not collected for two participants.

Measures

Weight status. Research has shown BMI to be a moderately reliable indicator of body fat percentage (Mei et al., 2002) and risk for numerous health-impairing conditions (Daniels, 2009; Ingelsson et al., 2007; Steinberger et al., 2001). Therefore, consistent with Centers for Disease Control and Prevention definitions, child Body Mass Index percentile (CBMIP) for age and sex was used as the outcome variable in this study. CBMIP was calculated using the child's height (measured to the eighth of the inch) and weight (measured to the tenth of a pound), which were measured and recorded by trained researchers. Children were measured without shoes in light clothing. All BMI percentiles were calculated using the standardized formula (BMI = [weight (kg)]/[height (m)]^2; Keys et al., 1972).

Parent child communication. Forehand et al. (1997) adapted Barnes and Olson's Communication Scale (1985), so it could be used and applied to children and adolescents and their parents. This revised scale (CS-R) consists of 10 questions, which are scored on a 4-point Likert-type scale with responses ranging from 1 (strongly disagree) to 4 (strongly agree). The totals from both parent and child reports are summed to form one composite scale, with possible scores range from 20 to 80. Higher scores represent better parent-child communication. Ten child-response questions assess the degree to which they perceive their parent listens to them (e.g., "My parents and I can talk about almost anything" and "My parents sometimes don't listen to me"). Similarly, ten parent-response questions assess the degree to which parents listen to their child (e.g., "I sometimes don't listen to my child"). In the original validation of this communication scale, responses from parent and child reports correlated significantly ($r = .39$, $p < .01$) with an alpha coefficient of .85. In addition to demonstrating high face validity, the parent-adolescent communication scale has also demonstrated construct validity in studies in various adolescent populations (McDermott Sales et al., 2007; Xia, Xie, Zhou, Defrain, & Meredith, 2004).

Parent child connectedness. The Parent-Child Connectedness Measure (PCCM; Boutelle et al., 2009) was created to examine the reciprocal relationship between parent–child connectedness and depressive symptoms, self-esteem, and body satisfaction. The measure consists of four statements rated on 5-point likert-type scales which assess the degree to which children feel connected to their father and mother (e.g., "How much do you feel that your mother cares about you?"; "How much do you feel you can talk to your father about your problems?").

Two questions assess the relationship with the child's mother and two inquire about the relationship with the child's father. A total score comprising the mean of the four items represents aggregate parent-child connectedness, with higher scores indicating greater connection to parents (Cronbach's α=.69). Test–retest reliability for the PCCM is reported to be high (Spearman coefficient = .69–.82). Although this measure has been used in similar studies assessing the effects between parent-child connectedness and child food intake and weight outcomes, evidence for validity has not been reported (Ackard et al., 2006; Boutelle, et al., 2009). Since this measure is high in face validity and used in similar populations, it is reasonable to assess the role of parent-child connectedness on child weight using this measure.

Perceived child weight. The Child Feeding Questionnaire (CFQ) assesses aspects of parent feeding perceptions, attitudes, and practices for parents of children aged 2-11 years-old (Birch et al., 2001). There are 31 items that load onto seven factors, four of which measure parental beliefs related to their child's obesity proneness (e.g., Perceived responsibility, Parent perceived weight, Perceived child weight, and Parents' concerns about child weight). Several studies have shown the factor validity of the seven subscales originally proposed by Birch et al. (2001; Camci, Bas, & Buyukkaragoz, 2014; Corsini, Danthiir, Kettler, & Wilson, 2008; Geng et al., 2009). This study will use the perceived child weight scale as a measure of parental perception of child weight. This subtest consists of six items that assess parents' perceptions of their child's weight history over six time periods starting from infancy and going into adolescence (i.e., "Your child from 3rd through 5th grade"). Each item is rated on a 5-point Likert-type scale with anchors ranging from "markedly underweight" to "markedly overweight." The perception of child weight scale demonstrated acceptable internal consistency (Cronbach's α = .83) and demonstrated a positive correlation with independent measures of child weight status (r = 0.43, p = <0.001). Birch et al. (2001) indicated that the CFQ is a valid measure in assessing parent perceptions, attitudes, and practices of child-feeding. Additional support for the validity of the perception of child weight subscale has been demonstrated across several cultures (Canals-Sans et al., 2016; Corsini et al., 2008; Geng et al., 2009; Nowicka, Sorjonen, Pietrobelli, Flodmark, & Faith, 2014). Because the perceptions of child weight scale collects information about the child's weight history from infancy to current age, and we collected objective data for child weight only at one time point, only one item that reflects parents' current perceptions of their child's weight ("Your child from 3rd through 5th grade") was used in analyses.

Parent feeding practices. As mentioned previously, the Child Feeding Questionnaire (CFQ) assesses aspects of parent's feeding perceptions, attitudes, and practices for parents of children aged 2-11 years-old. The CFQ consists of 31 items which load onto seven factors, three of which that measure parental control practices and attitudes about parent feeding (e.g., Monitoring, Restriction, and Pressure to Eat). Items within each factor were rated on a 5-point Likert-type scale, with a word anchor specific to the factor representing each point. A confirmatory factor analysis tested a 7-factor model in two populations (group 1 n = 148 mothers and fathers; group 2 n = 126 Hispanic mothers and fathers). They found the internal consistency for the 7 factors to be > .70. This study will use three scales from the CFQ to assess parent's feeding practices regarding their use of restriction, monitoring, and pressure to eat. Each scale is measured using a 5-point Likert-type scale that has a word anchor at each point on the scale. The restriction scale consists of eight items, which measure the extent to which parents restrict their child's access to foods (i.e. "I intentionally keep some foods out of my child's reach"). The restriction scale demonstrated acceptable internal consistency (Cronbach's α = .73). The monitoring scale consists of three items that measure the extent to which parents oversee their child's eating (i.e. "How much do you keep track of the high fat foods that your child eats?"). This scale demonstrated excellent internal consistency (Cronbach's $\alpha = .92$). Lastly, the pressure to eat scale is made up of four items that assess the parent's tendency to pressure their child to eat more food, typically at mealtimes (i.e. "My child should always eat all the food on her plate." The pressure to eat scale demonstrated acceptable internal consistency (Cronbach's $\alpha = .70$). In addition to factor validity, convergent validity was found between the Restriction, Pressure to Eat, and Monitoring subscales and the Caregiver's Feeding Styles Questionnaire (CFSQ), which is another measure of parental feeding behavior (F (9, 518) = 3.17, p = <0.001; Hughes, Power, Fisher, Mueller, & Nicklas, 2005). Furthermore, in a longitudinal study examining parent feeding practices in a cohort of toddlers, CFQ subscales (i.e., restriction, pressure to eat, monitoring) were correlated with independent mealtime observations of parent's feeding styles (restriction $r = 0.37$, p = <0.01, pressure to eat $r = 0.35$, p = <0.01; Farrow, & Blissett, 2005), demonstrating concurrent validity with parent's observed feeding behavior in the home.

Procedures

The Brigham Young University Institutional Review Board, the Provo City School District, and each of the five participating elementary school principals approved the study procedures. A legal guardian provided consent through an online survey using Qualtrics Survey Software prior to a child's participation in the study. Parents or guardians completed several questionnaires on one occasion, including a basic demographic assessment, the parent-child communication measure, and the CFQ. After parents had completed the online survey, a testing session was scheduled at each participating elementary school for the child participant.

Children were first given explanations of assent in groups. After they had each assented, each child was given measures in a standardized order by trained researchers. First, each child was administered the parent-child connectedness and communication measures. Then the same trained experimenter measured each child's height and weight. Each child was assessed at a single time point.

Statistical Analysis

Data cleaning. Data were examined for outliers and randomness. No outliers were identified. Primary study variables were normally distributed and therefore did not require transformations. Data missingness was assessed using Little's Missing Completely at Random (MCAR) Test, results of which concluded that data was found to be missing at random. Missing data were dealt with in the maximum likelihood estimation process. Thus, missing data were dealt with in the default maximum likelihood estimation of the sample variance and covariance matrix using the expectation-maximization algorithm.

Structural equation modeling. Structural equation modeling (SEM) using SPSS and M-Plus was used to test the structural and measurement models (see figure 4; Muthén, & Muthén, 2012). The analysis for the mixture model followed a general SEM outline, which included: model identification, parameter estimation, model fit, and interpretation of the models (Hoyle, 2012). SEM is optimal for assessing mediation analysis because it allows the evaluation of both measurement and structural models, as it combines multiple regression (MR) and confirmatory factor analysis (CFA; Hoyle, 2012). As such, SEM allows both the relationship between observed indicators and latent variables (measurement model) and the relationship between latent variables within the same model (structural model) to be evaluated simultaneously. It also allows for the evaluation of direct and indirect effects, which allows us to assess mediation effects, as well as direct effects between specific predictors and the outcome variables. Lastly, SEM controls for and systematically partitions error and disturbances across observed and latent variables. Furthermore, we used maximum likelihood estimation (MLE) mixture modeling to examine mediation effects of parent feeding behaviors on the association between parent-child relationship quality (e.g., connectedness and communication) and child BMI percentile, while using parent's perceived child weight as a covariate because of the previous findings that suggest parents may respond differentially depending on their perceptions of their child's weight (Doolen et al., 2008).

Furthermore, because raw sores, typically taken from Likert scales, can bias results (Thurstone, 1928), standardized factor scores were used as manifest indicators for the latent constructs. Raw score bias tends to favor central scores and ignore extreme scores because they are non-linear. Whereas, standardized factor scores transform the raw scores into more linear measures of the data so as to reduce bias and increase the likelihood that the inferences being made from the results are more accurate and reproducible (Thurstone, 1928). Furthermore, standard scores are optimal for comparisons across measures. Therefore, standardized factor scores were calculated using Thurstone's (1935) approach, which uses least squares regression. This approach is optimal because regression factor scores predict the location of individual scores on a specific factor, rather than predicting the score by the less refined weighted sum method (DiStefano, Zhu, & Mindrillia, 2009). Regarding the number of indicators needed for each latent construct Kenny (1979) suggests, "Two might be fine, three is better, four is best, and anything more is gravy" (p. 143). As such, each latent variable was specified with at least three indicators (individual items) consistent with Kenny's approach (1979).

Model specification. To specify the measurement models, confirmatory factor analysis was used to evaluate how well the manifest measures loaded onto latent variables. Means and standard deviations of primary study variables are displayed in Table 2.

Table 2

Means and Standard Deviations of Primary Study Variables

Variables	Means (SD)	Range
Child Reported Parent-Child Connectedness	17.77 (2.22)	7-20
Child Reported Communication	24.79 (3.20)	13-28
Parent Reported Communication	22.05 (3.12)	14-28
Perceived Child Weight	2.97 (0.47)	1-4
Restriction	2.96 (1.00)	1-5
Pressure to Eat	2.96 (1.00)	1-5
Monitoring	3.50 (1.01)	1-5
Child Body Mass Index Percentile	53.18 (28.64)	0.01-0.99

Initial results from the CFA revealed that the child rating of the parent-child communication factor and the parent child connectedness factor (only consists of child rating) were highly correlated (r = 0.81). To reduce limitations related to shared variance between these two factors, child rated items were combined into one latent factor: Child-Reported Relationship Quality (e.g., connectedness and communication). Conversely, parent-reported communication (PRC; parents only completed the communication measure) loaded onto an independent factor. Consistent with previous validation studies, the subscales on the CFQ (e.g., restriction, pressure to eat, and monitoring) loaded onto their respective latent constructs (Birch et al., 2001). Items with factor loadings below 0.4 were eliminated because factor loadings below 0.4 demonstrate poor indicators of the latent constructs. Therefore, factor loadings higher than 0.4 derived from the CFA were included in the final structural models. Items dropped because of low factor loadings include six items on the Parent-Child Communication Scale (e.g., items 2, 5, & 7 for both parent and child report). Factor loadings for specific items and subscales used in the final model can be found in Table 3. After dropping items with low factor loadings, each latent variable still had at least three indicators consistent with Kenny's (1979) rule of thumb.

Table 3

Estimated factor item loadings for the final 5-factor model

Item	Parent Reported Communication	Child Reported Relationship Quality	Monitoring	Restriction	Pressure to Eat
PACP 1	0.74				
PACP 3	0.61				
PACP 4	0.82				
PACP 6	0.67				
PACP 8	0.85				
PACP 9	0.85				
PACP 10	0.82				
PACC 1		0.64			
PACC 3		0.74			
PACC 4		0.57			
PACC 6		0.46			
PACC 8		0.63			
PACC 9		0.75			
PACC 10		0.69			
PCCM 1		0.71			
PCCM 2		0.66			
PCCM 3		0.78			
PCCM 4		0.69			
CFQ 29			0.97		
CFQ 30			0.99		
CFQ 31			0.89		
CFQ 17				0.81	
CFQ 18				0.84	
CFQ 19				0.77	
CFQ 20				0.74	
CFQ 21				0.77	
CFQ 22				0.71	
CFQ 23				0.87	
CFQ 24				0.91	
CFQ 26					0.92
CFQ 27					0.65
CFQ 28					0.89

Note. PACP = Parent Adolescent Communication Measure parent report items; PACC = Parent Adolescent Communication Measure child report items; PCCM = Parent Child Connectedness Measure items; CFQ = Child Feeding Questionnaire items. For item content, refer to Appendices A-D.

Tests of mediation. MacKinnon, Lockwood, Hoffman, West, and Sheets' (2002) approach was used to test for mediation effects. In order to establish mediation using this method, a mediator variable has to be established as the cause of the association between two other variables by using one of these three major approaches: 1) causal steps, 2) difference in coefficients, and 3) product of coefficients (MacKinnon et al., 2002). Our analysis examined the direct and indirect effects using the product of coefficients method, which is optimal compared to Baron and Kenny's causal step method (Baron, & Kenny, 1986). Specifically, the product of coefficients method yields a more accurate Type 1 error rate and improved power to detect indirect effects. The product of coefficients method divides the estimate of the proposed mediator variable effect by its standard error, and then the value is compared to a normal distribution to determine significance.

Initial structural tests of mediation were conducted to evaluate mediation effects of individual feeding practices (e.g., monitoring, pressure to eat, and restriction) without separating them into profiles (e.g., high, moderate, low). Next, mixture modeling was used to statistically identify latent profiles for the mediation constructs (e.g., restriction, pressure to eat, and monitoring) using the Vuong-Lo-Mendell-Rubin Likelihood ratio test. Mixture modeling was used to construct statistical models and assess associations between factors. Alpha was set at 0.05 for all significance tests.

CFQ latent profile analysis. Variability in levels of use on the CFQ subscales differentially predicts weight outcomes in children (Rodgers et al., 2013; Zhang, & McIntosh, 2011). For example, Jensen et al. (2014) reported that moderate levels of restriction, pressure, and monitoring predicted the best outcomes in a pediatric weight control intervention, while high levels of restriction, pressure, and monitoring predicted maladaptive weight outcomes (Rodgers et al., 2013). Therefore, because the literature suggests that differing levels of parental feeding practices predict different weight outcomes for children (Rodgers et al., 2013; Zhang, & McIntosh, 2011), the Vuong-Lo-Mendell-Rubin Likelihood ratio test was used to identify latent profiles corresponding to specific levels of feeding practices for each CFQ subscale (e.g., high, moderate, low). Results of the Vuong-Lo-Mendell-Rubin Likelihood ratio test were significant for three profiles in each group (Restriction, p =0.006; Monitoring, $p = 0.000$; Pressure to Eat, $p = 0.009$). Specifically regarding responses to restrictive feeding practices, **profile one** ($n = 72$) demonstrated high levels of restriction, **profile two** ($n = 75$) demonstrated moderate levels of restriction, and **profile three** ($n = 161$) demonstrated low levels of restriction. Responses for monitoring were as follows: **profile one** ($n = 45$) demonstrated high levels of monitoring, **profile two** ($n = 137$) demonstrated moderate levels of monitoring, and **profile three** ($n = 126$) demonstrated low levels of monitoring. Pressure to eat also demonstrated high (**profile one**, $n = 65$), moderate (**profile two**, $n = 107$), and low (**profile three**, $n = 136$) levels of use. Classification was based on latent factor scores, meaning a standardized score with a mean of 0 was calculated for each classification (e.g., high, moderate, low). Means for classifications of each parent feeding practice (e.g., restriction, pressure to eat, and monitoring) can be seen in detail in Table 4.

Table 4

Means and Standard Errors for Mixture Model-derived feeding behavior profiles

Feeding Practice	Mean (SE)	*N*	Classification
Restriction			
Profile One	2.39 (0.30)	72	High
Profile Two	-0.15 (<0.001)	75	Moderate
Profile Three	-2.79 (0.35)	161	Low
Pressure to Eat			
Profile One	3.02 (1.10)	65	High
Profile Two	-0.85 (0.60)	107	Moderate
Profile Three	-4.50 (<0.001)	136	Low
Monitoring			
Profile One	8.74 (0.77)	45	High
Profile Two	3.70 (0.34)	137	Moderate
Profile Three	-1.23 (<0.001)	126	Low

Note. Means for CFQ sub-scale scores are based on latent factor scores and do not correspond to manifest variable ranges; means for latent factor scores are 0.

Model estimation. Maximum likelihood (MLE) estimation was used to evaluate model parameters and standard errors. Specifically, MLE was used to provide a test robust to potential latent profile-specific variance because each feeding practice (e.g., restriction, pressure to eat, and monitoring) was divided into sub-groups (e.g., high, moderate, and low) in order to assess latent profile-specific mediation effects. In addition, MLE is robust to missing data when it is missing at random.

Evaluation of model fit. Model fit was evaluated using Brown and Moore's (2012) three criteria of acceptable models for CFA and SEM analysis: 1) global goodness of fit measures, 2) localized strain indices, and 3) the size, direction, and statistical significance of the model's parameter estimates. Specifically, global model fit was evaluated using the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the non-normed fit index (TLI). These indices provide a relatively accurate estimate of global model fit compared to χ^2 fit index because χ^2 is overly sensitive to sample size, which tends to result in a higher rejection rate of true models in small samples and a higher acceptance rate of false models in large samples (West, Taylor, & Wu, 2012). Furthermore, guidelines for an acceptable model fit were consistent with Hu and Bentler's suggested approach (1999). Thus, criteria for good model fit estimates were as follows: an RMSEA ≤ .06, an NNFI ≥ .95, and CFI ≥ .95 (Hu, & Bentler, 1999). Lastly, the size, direction, and statistical significance of factor loadings and standardized factor coefficients were evaluated.

Confirmatory factor analysis. Consistent with Hoyle's (2012) approach, goodness of fit of the CFA model was assessed using Hu and Bentler's (1999) guidelines for acceptable model fit for appropriate cutoffs (RMSEA ≤ .06, an NNFI ≥ .95, and CFI ≥ .95). Using these cutoffs, the root mean square error of approximation (RMSEA) was acceptable (.042), and the CFI (0.971) and TLI (0.968) indices suggested the model was a good fit for the data. Because of the goodness of fit indices and how the proposed model fit theoretically with the data this model was identified and used in the final mediation analysis (see figure 4).

Power analysis. Because *a priori* power analyses methods for SEM assume only one parameter estimate and the proposed SEM mediation models test multiple parameters, recent research indicates that *a priori* power analyses are not optimal (Muthén, & Muthén, 2009). Moreover, Muthén and Muthén's (2009) suggest that these *a priori* power analyses are not sufficient for SEM models because of the amount of error introduced to the model in order to account for multiple parameter estimates. Rather than introduce excessive error or estimate power for only one parameter estimate, Muthén and Muthén (2009) suggest conducting a post hoc power analysis during the statistical analyses when the parameters of the model are estimated. However, a general rule in SEM is that sample sizes of n> 100 usually yield sufficient power, and similar studies in this field conducting SEM analysis have around 200-300 participants (Gray et al., 2010; Koplan et al., 2004; Rodgers et al., 2013; Zhang, & McIntosh, 2011). Therefore our sample (N = 308) was adequately powered enough to detect our hypothesized effects when using the whole sample as indicators of individual parental feeding practices. Post hoc power analyses for the full-group model revealed that our study was adequately powered to detect effects for each of our significant associations: PCW on CBMIP (1.00), restriction on CBMIP (0.91), PCW on restriction (0.72), PCW on pressure to eat (0.82), and PRC on restriction (0.64).

Results

Full Sample Direct Effects

In the full sample structural equation model, perceptions of child weight (PCW) significantly predicted child BMI percentile (CBMIP; ß = 0.427, $p = 0.000$), while parent reported communication (PRC) did not. However, both PCW and PRC were associated with restriction, respectively (ß = 0.196, $p = 0.000$; ß = -0.185, $p = 0.000$). PCW was also significantly associated with pressure to eat (ß = -0.287, $p = 0.000$), but neither PRC nor PCW predicted parental monitoring. Regarding feeding practices, restriction was positively predictive of CBMIP (ß = 0.242, $p = 0.000$); however, pressure to eat and monitoring were not significantly associated with CBMIP. CRRQ was not significantly associated with feeding practices or CBMIP.

Full Sample Indirect Effects

When examining the mediation effects of restriction, there was a significant total effect between PRC and CBMIP (ϒ = -0.052, $p = 0.006$). Consistent with my hypothesis, there was a negative indirect effect for restriction mediating the association between PRC and CBMIP, suggesting restriction was a significant mediator between the two variables ($\alpha\beta$ = = -0.045, p = 0.004). While restriction did not mediate the association between CRRQ and CBMIP (ß = -0.015, $p = 0.253$), results of our mediation analysis revealed that restriction mediated the association between PCW and CBMI. Specifically, there was a significant total effect (ϒ =

0.066, $p = 0.024$) and small indirect effect ($\alpha\beta = 0.047$, $p = 0.001$) between PCW and CBMIP. Monitoring and pressure to eat were not significant mediators between any of the hypothesized associations.

Latent Profile Analysis Direct Effects

In the mixture model analyses, neither PRC nor CRRQ were significantly associated with CBMIP. However, PCW was positively associated with CBMIP in profiles where parents endorsed high, moderate, and low levels of restriction, respectively (ß = 0.380, $p = 0.004$, $n = 72$, ß = 0.445, $p = 0.000$, $n = 75$, ß = 0.532, $p = 0.000$, $n = 161$). Likewise, PCW was positively predictive of CBMIP in parents endorsing high (ß = 0.383, $p = 0.003$, $n = 45$), moderate (ß = 0.440, $p = 0.000$, $n = 137$), and low levels of monitoring (ß = 0.527, $p = 0.000$, $n = 126$). PCW was also positively predictive of CBMIP in parents endorsing high (ß = 0.400, $p = 0.003$, $n = 65$), moderate (ß = 0.440, $p = 0.000$, $n = 107$), and low levels of pressure to eat (ß = 0.527, $p = 0.000$, $n = 136$). There was also a trend towards significance for the association between PCW and pressure to eat in parents who endorsed high levels of use (ß = -0.251, $p = 0.050$, $n = 65$). Furthermore, monitoring was negatively associated with BMIP in parents endorsing low levels of use (ß = -0.148, $p = 0.049$, $n = 126$). Restriction and pressure to eat were not associated with CBMIP when classified into profiles (i.e., high, moderate, and low).

However, there were several associations between the predictors and levels of specific feeding practices. PRC was negatively associated with restriction in parents endorsing moderate and low levels of restriction (ß = -0.164, $p = 0.048$, $n = 75$, ß = -0.238, $p = 0.005$, $n = 161$). Moreover, CRRQ was negatively associated with pressure to eat in the profile where parents endorsed high levels of pressure to eat (ß = -0.459, $p = 0.000$, $n = 65$).

Latent Profile Analysis Indirect Effects

When feeding practices were considered individually and classified into high, moderate, and low profiles, no significant mediation effects were observed for any of the parent feeding practices (i.e., restriction, monitoring, and pressure to eat) between PRQ and CBMIP, CRRQ and CBMIP, or PCW and CBMIP.

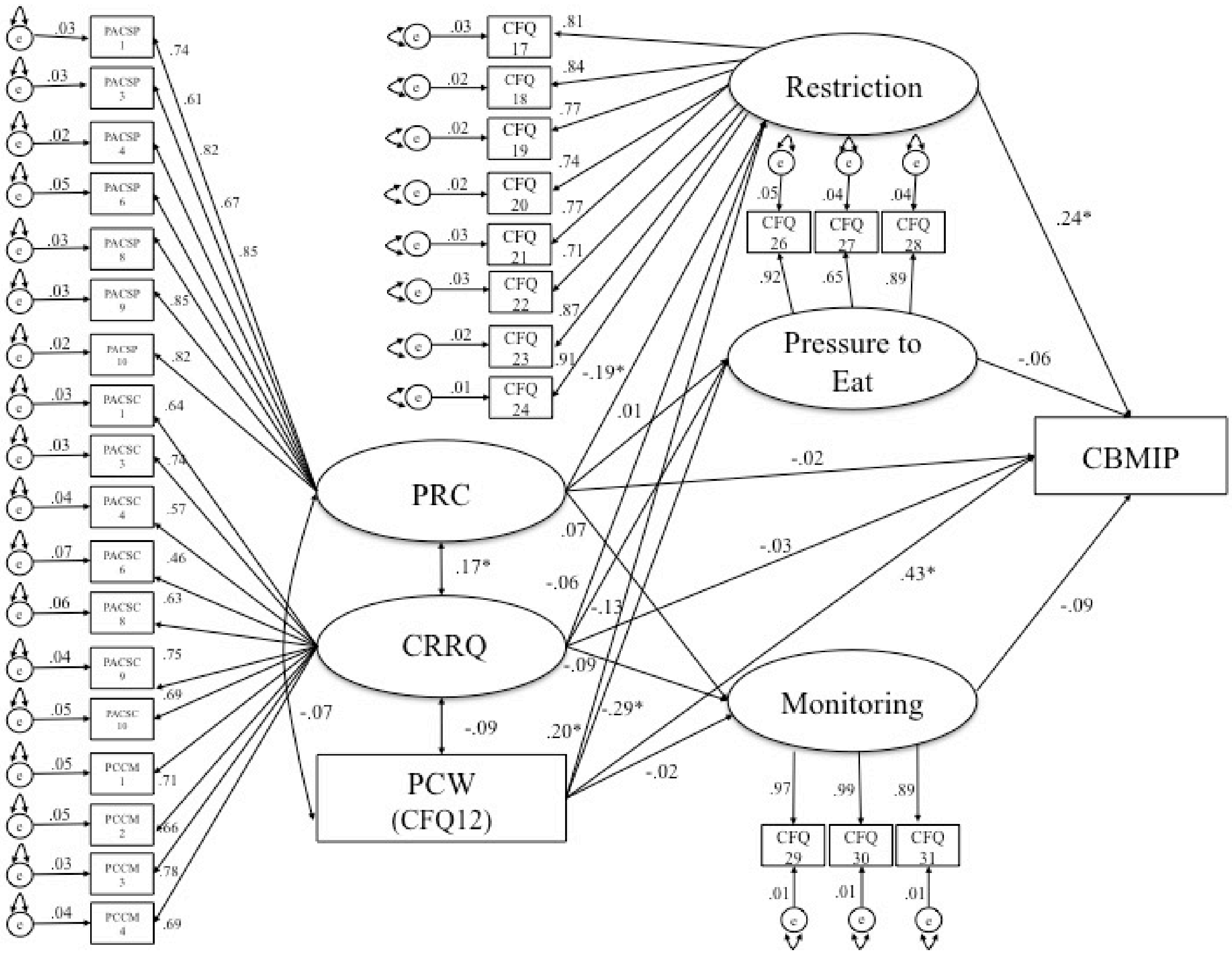

Figure 4. Structural and Measurement Model

CBMIP = *Child Body Mass Index Percentile;* PRQ= *Parent Reported Communication;* CRRQ: *Child Reported Relationship Quality;* PCW = *Perceptions of Child Weight;* PACSP = *Parent Report on Communication Questionnaire*; PACSC = *Child Report on Communication Questionnaire ;* PCCM= *Parent-Child Connectedness Measure;* CFQ 12 = *Child Feeding Questionnaire Item for Perceived Child Weight* (Birch et al., 2001)*;* CFQ 17, 18, 19, 20, 21, 22, 23, 24 = *Child Feeding Questionnaire Items for Restriction* (Birch et al., 2001); CFQ 26, 27, 28 = *Child Feeding Questionnaire Items for Pressure to Eat* (Birch et al., 2001); CFQ 29, 30, 31 = *Child Feeding Questionnaire Items for Monitoring* (Birch et al., 2001). * = $p \leq .05$

Discussion

Child weight status is an important area of research in pediatric psychology due to the multitude of risks associated with being overweight and obese during childhood (de Sausmarex, & Dunsmuir, 2011; Horvei et al., 2014; Steinberger et al., 2001; Venn et al., 2007; Wang et al., 2007). For example, being at a healthy weight has been shown to lower risk associated with myocardial infarctions, adult obesity, early mortality, type II diabetes, coronary heart disease, sleep apnea, and asthma (Cote et al., 2013; Daniels, 2009; Ingelsson et al., 2007; Kang et al., 2012; McGill et al., 2001; Mofid, 2014; Olshanksy et al., 2005; Schwimmer et al., 2003). Being overweight or obese during childhood has also been associated with emotional, academic, social, and executive control difficulties (Datar, & Sturm, 2004; Mahoney et al., 2005; Reinert et al., 2013). Therefore, understanding contributors to child weight status is an important area of research in order to better understand associations that lead to healthier child weight outcomes.

Consequently, this study aimed to examine associations between parent-child relationship quality (communication and connectedness), parent feeding practices (restriction, monitoring, and pressure to eat), and child BMI percentile (CBMIP) in preadolescent children. Given the previous research suggesting that parent perceptions of child weight may be a confounding variable when examining parent feeding practices (Doolen et al., 2008; Ek et al., 2016), this study also set out to examine the associations between parent perceptions of child weight (PCW) and CBMIP, and determine whether they were mediated by parent feeding practices (i.e., restriction, monitoring, and pressure to eat).

This study first examined direct and indirect associations between parent-child relationship quality (PRC and CRRQ), parent feeding practices, and CBMIP. Findings from this analysis revealed that PRC was negatively associated with restriction, which suggests that as parents indicated higher levels of parent-child communication, parents engaged in less restrictive feeding practices. This is important because lower levels of parental restriction is an outcome that has been shown to be better for the attainment of a healthy child weight. Parents who engage in less restrictive feeding are more likely to have children with healthier BMI across the lifespan (Birch et al., 2003; Farrow et al., 2015; Lee, & Keller, 2012; Ogden et al., 2013; Rollins et al., 2014). Previous research suggests that reducing parental restriction may help children learn better self-regulation skills, which then leads to healthier food selections and more appropriate portion sizes (Birch et al., 2003; Farrow et al., 2015; Lee, & Keller, 2012; Ogden et al., 2013; Rollins et al., 2014). Analyses of our mixture model revealed similar results in that PRC was negatively associated with restriction in parents who endorsed using moderate and low levels of restriction. These findings are important given the literature suggesting moderate use of restriction as optimal for the attainment of a healthy weight (Jensen et al., 2014). Moreover, while low levels of restriction are not as optimal as moderate levels, they appear more adaptive than high levels of restriction, which have been linked to decreased child self-regulation and increased child weight (Farrow et al., 2015; Lee, & Keller, 2012). Thus, these findings suggest that as a parent's perception of parent-child communication increases, their use of restrictive feeding practices decreases to more adaptive levels. Consequently, our study provides preliminary evidence that having higher parent-child communication can have positive consequences for parent feeding behavior.

These results are important because higher restrictive feeding practices were predictive of higher CBMIP in our whole sample analysis. This finding is commensurate with previous literature suggesting that higher restriction is suboptimal for weight outcomes, as it often leads to children overindulging on food when they do have access (Birch et al., 2003; Ogden et al., 2013). Regarding the other feeding practices, neither monitoring nor pressure to eat were associated with CBMIP in the whole sample. However, monitoring was negatively associated with CBMIP in the profile where parents endorsed monitoring their children's food intake in low levels. These findings suggest that as parental monitoring decreases, children are more likely to have increased weight. This finding supports the current literature suggesting extreme levels of feeding as suboptimal (Jensen et al., 2014). We did not find support for any associations between pressure to eat and CBMIP. The fact that we observed associations for restriction and monitoring but not pressure to eat are unsurprising given the literature suggesting mixed findings when examining the effects of parent feeding practices on child weight (Campbell et al., 2010; Faith et al., 2004; Gregory et al., 2010; Rodgers et al., 2013; Zhang, & McIntosh, 2011). One reason for equivocal findings in the literature is that feeding practices may be responses to parental perceptions of child weight and concern for child weight, rather than predictors of child weight (Ek et al., 2016; Gregory et al., 2010). However, the majority of the literature examining this relationship suggests significant associations between parent feeding practices and child weight (Faith et al., 2004), and the majority of our findings are in line with the findings that feeding practices are associated with child weight. Future research should be aimed at examining the potential factors contributing to these disparate outcomes.

While, PRC was not directly associated with CBMIP, there was a significant indirect effect between PRC, restriction, and CBMIP. This suggests that restriction was a significant mediator between PRC and CBMIP, though the effect size was small ($\beta = -0.045$). This mediation is atypical because while PRC was associated with restriction and restriction with CBMIP, PRC was not directly associated with CBMIP. Recent research suggests that mediation effects can exist without this direct association (MacKinnon, & Fairchild, 2009). Our results suggest an indirect effect that has important implications. This finding suggests that as parent-child communication increases, restrictive feedings practices decrease, which in turn predicts lower child weight. These findings imply that positive parent perceptions of parent-child communication may be a protective factor against obesogenic feeding habits, which in turn may lead to more optimal weight outcomes for children.

Because parent-child communication may be a protective factor against obesogenic feeding practices, these findings provide preliminary evidence that there may be merit in including intervention content aimed at improving parent-child communication into weight management interventions. These findings are in line with the research suggesting that a multi-factorial approach is required when considering effective child weight management treatments (National Health and Medical Research Council; NHMRC). Researchers suggest that factors beyond a child's diet and physical activity must be considered in order to develop more well-rounded treatments to effectively manage child weight (NHMRC). Many evidence-based weight management programs have already tried to go beyond diet and exercise by including modules aimed at improving parent behaviors like feeding practices (Birch, & Fisher, 1995). In fact, many child weight management programs employ the parent as an agent of change through teaching parents how to implement more adaptive feeding practices (Golan, & Crow, 2004). This is in line with our findings that parent perceptions played a more important role in parent feeding practices and child weight outcomes than child perceptions. Furthermore, research has started looking into the effectiveness of interventions aimed at improving child-feeding practices. For example, Burrows, Warren, and Collins (2010) reported that an intervention effectively decreased maladaptive parent feeding practices (e.g., restriction, pressure to eat), and that these changes were sustained at follow up two years later. While research examining interventions aimed at modifying parent feeding practices is promising, relatively few interventions have examined methods other than increasing education about diet and physical activity. Our findings suggest that incorporating ways to improve parent-child communication may indirectly improve child weight through improved parent feeding practices. These results provide some evidence for the inclusion of interventions aimed at improving parent-child communication quality, as it may lead to more optimal outcomes for child weight because of less restrictive parental feeding behavior.

Moreover, our findings that PRC and CRRQ were not associated with CBMIP were somewhat surprising, as previous research has shown associations between parent-child relationship quality (i.e., communication) and CBMIP (Parletta et al., 2012). In fact, previous research has shown that lower parent-child communication predicts higher BMI when examined in populations where the majority of participants are overweight or obese (Parletta et al., 2012). Because our study was conducted with a community sample with a wide range of BMI percentiles, it is possible that our null finding for an association between PRC and CRRQ and weight status is attributable to study sample differences compared to previous research conducted with overweight/obese samples. It is possible that these associations are more salient in overweight and obese children, and that traditional mediation may have been supported in a higher weight sample.

Our findings from initial analyses of the whole sample are interesting because parent-child communication was only a significant predictor of restriction when it was rated by the parent. Our study failed to demonstrate direct and indirect effects between child reported relationship quality, feeding practices, and CBMIP in statistical models using the whole sample. The findings that child ratings of parent-child communication and connectedness were not associated with parent feeding or weight outcomes in our whole model present preliminary evidence that parent perceptions of the parent-child relationship quality may be more important than child perceptions within the context of weight outcome research. These findings differ from previous research suggesting that child ratings have been associated with eating habits and weight outcomes (Ackard et al., 2006; Parletta et al., 2012). Our results for child reported parent-child relationship quality may have differed from previous findings for a few reasons. First, while we initially aimed to assess child reports of communication and connectedness as separate constructs, they were highly correlated which necessitated combining them into a single latent factor. This precluded analysis of each construct independently, which could have reduced our ability to detect effects for the associations between individual factors. This assumption seems likely as child connectedness and communication have been associated with child eating and weight outcomes when measured separately (Ackard et al., 2006; Parletta et al., 2012). On the other hand, it is also possible that child ratings of the parent-child relationship quality are less predictive of parent feeding practices because parents are less attuned to their children's perceptions of relationship quality, leading them to adopt feeding strategies based on their own perceptions. Parents may alter feeding practices based on their own perceptions rather than their child's because they may be unaware of their child's perceptions regarding the parent-child relationship, or they may simply value their own perceptions more.

While initial examination of CRRQ as a predictor failed to yield significant associations, analysis of the mixture model yielded a negative association between CRRQ and pressure to eat in parents who endorsed high levels of pressured feeding. This finding suggests that as a child perceived higher levels of warmth, caring, and communication, their parent endorsed using lower levels of pressure to get their child to eat. This is important because research has shown a positive correlation between pressure to eat certain foods at mealtimes and a child's tendency to avoid that food later on in life (Galloway, Fiorito, Francis, & Birch, 2006; Lee, & Keller, 2012). This is particularly salient in child weight outcome research because many parents may engage in pressuring their child to eat healthier foods, like vegetables, in the hopes of improving their child's weight through healthier eating habits; however, the opposite was found to be true. Thus, extreme levels of pressure to eat can also lead to mismanagement of food intake from the child, which has negative health implications for their future; while, moderate levels of pressure to eat are associated with more adaptive weight outcomes in children (Jensen et al., 2014). The finding that CRRQ negatively predicted pressure to eat in our mixture model is important because these findings were only present in the profile where parents endorsed using high levels of pressure, suggesting that a child's perception of higher warmth and communication may be important for decreasing maladaptive parent feeding practices (Galloway et al., 2006; Lee, & Keller, 2012).

Furthermore, our study examined the direct and indirect associations between PCW, parent feeding practices, and CBMIP. The results of our study indicated that PCW was positively associated with CBMIP in all models examined (whole sample, mixture models). These results suggest that among our sample, parents were able to accurately identify their child's weight status. This finding differs from the current literature suggesting that parent's often tend to inaccurately estimate their child's weight (Doolen et al., 2008; Tremblay, Rinaldi, Lovsin, & Zecevic, 2012). However, our findings may under-represent the phenomena that parents misinterpret their children's weight because most of the children in our sample were in the normal weight range. It is possible that it is more difficult to categorize weight when children are at the extremes of weight (e.g., underweight, overweight, obese). This may have explained our findings, as Aljunaibi et al. (2013) found that 63.5% of parents who misclassified their child's weight were parents of children that were overweight or obese and our sample was mostly normal weight children.

Results of the full sample analysis suggested that PCW was positively associated with restriction and negatively associated with pressure to eat. These results indicate that parents engaged in different feeding practices based on their perceptions of their child's weight.

Moreover, congruent with our hypothesis, results showed that as parents perceived their child to be more overweight, they exhibited higher levels of food restriction. These findings are in line with previous research indicating that parents tended to exhibit higher levels of control over access to foods when perceiving their child as being overweight (Tremblay et al., 2012). This is important because high restriction has been well documented as a maladaptive feeding practice due to the phenomena that occurs when children are restricted; namely, they tend to demonstrate dysregulation towards foods when they do have access and eat more (Birch et al., 2003; Farrow et al., 2015; Ogden et al., 2013; Rollins et al., 2014), which in turn then lead to higher child weight outcomes. These findings suggest that if a parent perceives their child to be overweight, and therefore employs more restrictive feeding practices, then their child is more likely to have negative weight outcomes due to the tendency of children to overeat when they have the opportunity to do so. This is important in light of our earlier findings suggesting that parents are able to identify their child's weight and that higher restriction leads to higher weight outcomes. In sum, these results seem to indicate that even when parents can accurately identify their child's risk for being overweight or obese, they are unable to engage in helpful feeding practices to mitigate risk.

This study also showed that parents who perceived their children as overweight tended to exert less pressure to eat on their child. This is an important finding due to the previous research suggesting that moderate levels of pressure to eat were associated with more adaptive weight outcomes in children (Jensen et al., 2014). Therefore, these results suggest that parents' perceiving a higher weight status in their child tend to engage in too little pressure to eat at mealtimes when compared to optimal feeding strategies. Taken together these results indicate that parents who perceive their children as overweight exert too much restriction and too little pressure to eat. These findings provide additional support to Payne et al.'s (2011) findings that parents may alter their feeding behavior in response to their child's weight. These findings suggest that parents may engage in unhelpful feeding strategies when they perceive their child as at a higher weight, like restrict access to high calorie foods or not pressure their child to eat enough, and that even if their perceptions are accurate the strategies that they use to reduce weight end up being counterproductive (Birch et al., 2003; Galloway et al., 2006; Lee, & Keller, 2012; Ogden et al., 2013).

These findings are incongruent with the previous literature (Doolen et al., 2008) indicating that parent's perceptions of their children's weight often interfere with their ability to effectively engage in appropriate interventions to promote positive weight outcomes.
Instead, these results suggest that helping parents understand the outcomes of specific feeding strategies and how to implement more effective feeding strategies may be helpful in reducing their engagement in obesogenic feeding practices, as simply understanding that their child is at a higher weight seems insufficient to enact the appropriate strategies. These same associations were not found in the mixture model. Although, there was a trend towards significance in the association between PCW and pressure to eat in parents who endorsed high levels of use. It is possible that there were no direct effects between PCW and feeding practices in the mixture models due to reduced sample size.

Furthermore, restriction partially mediated the association between PCW and CBMIP, suggesting that restrictive feeding practices are part of the mechanism of action between the association between PCW and CBMIP. These findings suggest that restriction appears to be part of the link between PCW and CBMIP. Although, it is important to note that this finding was not a full mediation, which is indicative that there may be other mechanisms of action between PCW and CBMIP. Specifically, the literature has identified parent weight and parental concern about their child's weight as some of the important indicators for how adapt a parent is at accurately identifying their child's weight. It is possible that these factors may play a role in mediation as well, but our study did not examine these associations.

Taken together, these findings present incongruent results from the previous research suggesting that parents misperceive their child's weight and in turn engage in maladaptive feeding practices (Doolen et al., 2008). Rather, our findings suggest that even when parent's perceptions of their child's weight are accurate, they still engage in maladaptive feeding practices. These findings have important implications for weight management interventions, especially due to the fact that some researchers have already begun looking at outcomes associated with addressing parent misperceptions of child weight as part of weight management interventions. Parkinson et al., (2015) conducted a study to develop a protocol aimed at improving parent's perceptions of their child's weight in order to improve a parent's ability to engage in appropriate action. The results of the proposed randomized controlled trial examining the impact of this protocol over one year are not yet available (Parkinson et al., 2015). However, our findings suggest that correcting parent's perceptions of their child's weight may not be enough to impact child weight. Rather, our findings suggest that interventions aimed at correcting extreme feeding practices may be the most helpful in promoting a healthy weight for children.

Limitations

When considering specific study limitations, we must first discuss our sample, which included a fairly homogenous ethnic sample (predominantly Caucasian = 81.65%). Therefore, the homogeneity of our sample decreases the generalizability of the results to other more heterogeneous populations because they are not well represented in the current sample. Furthermore, our study findings cannot be generalized to children outside our sample age range (8-12 years-old), which limits the exploration of developmental effects on our variables. Another limitation to the generalizability of our results is that study participants were required to be physically fit enough to engage in vigorous exercise to participate in the larger study from which these data were drawn. Although, we do not have specific information regarding how many dyads would have participated had there not been an exercise component, excluding a subset of potential participants may have played a role in the observed results and predominantly healthy weight sample. For example, our study sample does not reflect current estimates for overweight and obesity nationally. While national prevalence for overweight and obesity in preadolescents is 16.5% and 17.5% respectively (Ogden et al., 2015), our sample was 10.4% overweight and 6.5% obese. Therefore, because our sample does not mirror national obesity prevalence estimates, our study findings may not be generalizeable to overweight and obese children, as previous research suggests differential associations between parent-child relationship quality, parent perception of child weight, and parent feeding practices depending on weight status (Parletta et al., 2012; Tremblay et al., 2012). Studying these associations in both more focused and heterogeneous samples of ethnicities, age, and weight categories (e.g., overweight, obese) is important for future research in order to assess these associations in order to optimize prevention and intervention services for children in diverse populations.

Furthermore, some limitations in our methodology of note. First, while we set out to examine parent-child communication and connectedness separately, child responses on these measures were highly correlated rendering this initial proposal as a sub-optimal way to measure our predictors. Therefore, child responses on the communication and connectedness measures were aggregated into one latent construct: Child Reported Relationship Quality; while parent report loaded onto its own factor of Parent Reported Communication. This method did not allow us to examine the specific aspects of the parent-child relationship (connectedness or communication) independently, rather they were examined by rater. Furthermore, the parent-child connectedness measure only demonstrated moderate reliability, and validity is not established for this measure. Lastly, power for mixture modeling approaches was variable. Sample size was significantly reduced when compared to the initial sample in order to account for specific profiles (e.g., high, moderate, and low), which reduced power to detect an effect. It is possible that effects could have been more accurately assessed if each group had a larger sample size. Lastly, cross-sectional studies are not an optimal study design for assessing mediation. Studying these measures across different time points may have been more conducive to detecting effects (Gunzler, Chen, & Zhang, 2013).

Future Directions

Results from this study provide preliminary evidence supporting further research into parent-child relationship factors that influence parent feeding practices, and examining how these associations extend to child weight outcomes. Future research should be aimed at exploring how the parent-child relationship may serve as a protective factor for obesogenic feeding behaviors, as well as whether the associations differ depending on rater (i.e., parent, child). Future research should also explore the utility of integrating the current findings into research developing intervention and prevention programs so as to include specific factors that may promote adaptive feeding practices (i.e., improving parent child communication or warmth in order to enhance optimal feeding practices, improving parent’s understanding of optimal feeding practices once they have identified their child as overweight, etc). By enhancing the literature in these areas, more comprehensive treatment approaches can be implemented. Improving evidence based prevention and interventions aimed at weight management for children would in turn help reduce the prevalence of obesity and health difficulties among adults (e.g. type II diabetes, heart disease, hypertension, sleep apnea, etc), as well as promote healthier social, emotional, psychological, and physical development in children and adolescents.

Conclusion

Examining parental factors that influence child weight is an important research aim. This study provides evidence that superior parent/child communication and relationship quality may predict more adaptive parent feeding behaviors. Study findings suggest that future research examining the differences between parent and child perceptions of the parent-child relationship quality and how they relate to feeding practices and child weight is important. Study findings also provide preliminary evidence for restrictive feeding as a mediator between parent reported communication and child BMI, as well as between perceptions of child weight and child BMI. Results of this study concur with the previous literature suggesting that feeding practices (i.e., restriction, monitoring) are associated with weight outcomes, which provides more evidence for future prevention and intervention research to continue looking into predictors of differential feeding practices. Furthermore, this study also provides evidence that parent perceptions of weight are important predictors of parental feeding behaviors, and that parents are able to accurately categorize their child's weight. However, these findings suggest being able to accurately perceive their child's weight is insufficient for the promotion of healthy feeding habits, as parents tend to engage in maladaptive feeding practices whether they are able to accurately categorize their child's weight or not. Thus, these results support the exploration of predictors that may change a parent's engagement in feeding practices to more adaptive ones.

Overall, this study aimed to add to the body of research on child weight outcomes by examining the association between parent-child relationship quality (communication and connectedness) and parent perceptions of child weight on feeding practices and child weight. Taken together, these findings suggest that parent reported communication, child reported relationship quality, parent perceptions of child weight, and parent feedings practices are important areas for future research in order to more thoroughly understand parent-child factors that influence child weight.

References

Ackard, D., Neumark-Sztainer, D., Story, M., & Perry, C. (2006). Parent-child connectedness and behavioral and emotional health among adolescents. *American Journal of Preventative Medicine, 30*(1), 59-66.

Aljunaibi, A., Abdulle, A., & Nagelkerke, N. (2013). Parental weight perceptions: A cause for concern in the prevention and management of childhood obesity in the United Arab Emirates. *PLoS ONE*, *8*(3), 1-5.

Anuntaseree, W., Sangsupawanich, P., Mo-suwan, L., Ruangnapa, K., & Pruphetkaew, N. (2014). Prospective cohort study on change in weight status and occurrence of habitual snoring in children. *Clinical Otolaryngology, 39,* 164-168.

Barnes, H., & Olson, D. (1985). Parent-adolescent communication and the circumplex model. *Child Development, 56*(2), 438-447.

Baron, R., & Kenny, D. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.

Berenson, G., Srinivasan, S., Bao, W., Newman III, W., Tracy, R., & Wattigney, W. (1998). Association between multiple cardiovascular risk factors and atherosclerosis in children and young adults. The Bogalusa Heart Study. *New England Journal of Medicine, 338,* 1650–1656.

Birch, L., & Fisher, J. (1995). Appetite and eating behavior in children. *Pediatric Clinical North American Journal, 42*(4), 931-953.

Birch, L. Fisher, J., Grimm-Thomas, K., Markey, C., Sawyer, R., & Johnson, S. (2001). Confirmatory factor analysis of the child feeding questionnaire: A measure of parental attitudes, beliefs and practices about child feeding and obesity proneness. *Appetite, 36,* 201-210.

Birch, L., Fisher, J., & Davison, K. (2003). Learning to overeat: Maternal use of restrictive feeding practices promotes girls' eating in the absence of hunger. *The American Journal of Clinical Nutrition*, *78*(2), 215-220.

Boutelle, K., Eisenberg, M., Gregory, M., & Neumark-Sztainer, D. (2009). The reciprocal relationship between parent-child connectedness and adolescent emotional functioning over 5 years. *Journal of Psychosomatic Research, 66,* 309-316.

Britz, B., Siegfried, W., Ziegler, A., Lamertz, C., Herpertz-Dahlmann, B., Remschmidt, H.,… Hebebrand, J. (2000). Rates of psychiatric disorders in a clinical study group of adolescents with extreme obesity and in obese adolescents ascertained via a population based study. *International Journal of Obesity and Related Metabolic Disorders, 24*, 1707-1714.

Brown, K., Ogden, J., Vogele, C., & Gibson, E. (2008). The role of parental control practices in explaining children's diet and BMI. *Appetite, 50*(2), 252-259.

Burrows, T., Warren, J., & Collins, C. (2010). The impact of a child obesity treatment intervention on parent child-feeding practices. *International Journal of Pediatric Obesity, 5*(1), p. 43-50.

Canals-Sans, J., Blanco-Gomez, A., Luque, V., Ferre, N., Ferrando, P., Gispert-Llaurado, M.,…Closa-Monaterolo, R. (2016). Validation of the child feeding questionnaire in Spanish parents of school children. *Journal of Nutrition Education and Behavior, 48*, 383-391.

Camci, N., Bas, M., & Buyukkaragoz, A. (2014). The psychometric properties of the child feeding questionnaire (CFQ) in Turkey. *Appetite, 78*, 49-54.

Campbell, K., Andrianopoulos, N., Hesketh, K., Ball, K., Crawford, D., Brennan, L.,…Timperio, A. (2010). Parental use of restrictive feeding practices and child BMI z-score. A 3-year prospective cohort study. *Appetite, 55*(1), 84-88.

Corsini, N., Danthiir, V., Kettler, L., & Wilson, C. (2008). Factor structure and psychometric properties of the child feeding questionnaire in Australian preschool children. *Appetite, 51,* 474-481.

Cote, A., Harris, K., Panagiotopoulos, C., Sandor, G., & Devlin, A. (2013). Childhood obesity and cardiovascular dysfunction. *Journal of the American College of Cardiology, 62*(15), 1310-1319.

Criss, M., Lee, T., Morris, A., Cui, L., Bosler, C., Shreffler, K., & Silk, J. (2015). Link between monitoring behavior and adolescent adjustment: An analysis of direct and indirect effects. *Journal of Child and Family Studies, 24,* 668-678.

Crosnoe, R., & Muller, C. (2004). Body mass index, academic achievement, and school context: Examining the educational experiences of adolescents at risk of obesity. *Journal of Health and Social Behavior, 45*, 393–407.

Daniels, S. (2009). Complications of obesity in children and adolescents. *International Journal of Obesity, 33,* 60-65.

Datar, A., & Sturm, R. (2006). Childhood overweight and elementary school outcomes. *International Journal of Obesity, 30*, 1449-1460.

de Sausmarez, E., & Dunsmuir, S. (2011). Overweight and obese children's weight-related behaviors and cognitions: Assessment and intervention. *Educational and Child Psychology, 28*(4), 14-22.

DiStefano, C., Zhu, M., & Mindrilia, D. (2009). Understanding and using factor scores: Considerations for the applied research. *Practical Assessment, Research & Evaluation, 14*, 20.

Doolen, J., Alpert, P., & Miller, S. (2008). Parental disconnect between perceived and actual weight status of children: A metasynthesis of the current research. *Journal of the American Academy of Nurse Practitioners, 21,* 160-166.

Ek, A., Sorjonen, K., Eli, K., Lindberg, L., Nyman, J., Marcus, C., & Nowicka, P. (2016). Associations between parental concerns about preschoolers' weight and eating and parental feeding practices: Results from analyses of the child eating behavior questionnaire, the child feeding questionnaire, and the lifestyle behaviors checklist. *PloS One, 11*(1), 1-20.

Faith, M., Scanlon, K., Birch, L., Francis, L., & Sherry, B. (2004). Parent-child feeding strategies and their relationships to child eating and weight status. *Obesity Research, 12*(11), 1711-1722.

Farrow, C., Haycraft, E., & Blissett, J. (2015). Teaching our children when to eat: How parental feeding practices inform the development of emotional eating: A longitudinal experimental design. *The American Journal of Clinical Nutrition, 101*(5), 908-913.

Farrow C., & Blissett J. (2005). Is maternal psychopathology related to obesogenic feeding practices at 1 year? *Obesity Research, 13*, 11.

Francis, L. A., Hofer, S. M., & Birch, L. L. (2001). Predictors of maternal child-feeling style: Maternal and child characteristics. *Appetite, 37*(3), 231-243.

Fontaine, K., Redden, D., Wang, C., Westfall A., & Allison, D. (2003). Years of life lost due to obesity. *Journal of the American Medical Association, 289,* 187-193.

Forehand, R., Miller, K. S., Dutra, R., & Chance, M. W. (1997). Role of parenting in adolescent deviant behavior: Replication across and within two ethnic groups. *Journal of Consulting and Clinical Psychology*, *65*(6), 1036.

Galloway, A., Fiorito, L., Francis, L., & Birch, L. (2006). Finish your soup': Counterproductive effects of pressuring children to eat on intake and affect. *Appetite, 46*(3), 318-323.

Geng, G., Zhu, Z., Zuzuki, K., Tanaka, T., Ando, D., Sato, D., & Yamagata, Z. (2009). Confirmatory factor analysis of the child feeding questionnaire (CFQ) in Japanese elementary school children. *Appetite, 52,* 8-14.

Golan, M., & Crow, S. (2004). Targeting parents exclusively in the treatment of childhood obesity: Long term results. *Obesity Research, 12,* 357-361.

Goossens, L., Braet, C., Van Durme, K., Decaluwe, V., & Bosmans, G. (2012). The parent-child relationship as predictor of eating pathology and weight gain in preadolescents. *Journal of Clinical Child and Adolescent Psychology, 41*(4), 445-457.

Gunzler, D., Chen, T., Wu, P., & Zhang, H. (2013). Introduction to mediation analysis with structural equation modeling. *Shanghai Archives of Psychiatry, 25*(6), 390-394.

Gray, W. N., Janicke, D. M., Wistedt, K. M., & Dumont-Driscoll, M. C. (2010). Factors associated with parental use of restrictive feeding practices to control their children's food intake. *Appetite, 55*(2), 332-337.

Gregory, J. E., Paxton, S. J. & Brozovic, A. M. (2010). Maternal feeding practices, child eating behaviors and body mass index in preschool-aged children: A prospective analysis. *The International Journal of Behavioral Nutrition and Physical Activity,* 7.

Hendy, H., & Williams, K. (2012). Mother's feeding practices for children 3-10 years of age and their associations with child demographics. *Appetite 58*(2), 710-716.

Horvei, L., Braekkan, S., Mathiesen, E., Njolostad, I., Wilsgaard, T., & Hansen, J. (2014). Obesity measures and risk of venous thromboembolism and myocardial infarction. *European Journal of Epidemiology, 29*(11), 821-830.

Hoyle, R. (2012). Introduction and overview. In R. H. Hoyle (Ed.), *Handbook of structural equation modeling*. New York: Guilford Press.

Hu, L., & Bentler, P. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1-55.

Hughes, S., Power, T., Fisher, J., Mueller, S., & Nicklas, T. (2005). Revisiting a neglected construct: Parenting styles in a child-feeding context. *Appetite, 44,* 83-92.

Ingelsson, E., Sullivan, L., Fox, F., Murabito, J., Benjamin, E., Polak, J.,…Vasan, R. (2007). Burden and prognostic importance of subclinical cardiovascular disease in overweight and obese individuals. *Circulation, 116*(4), 375-384.

Kang, K., Lee. P., Weng, W., & Hsu, W. (2012). Body weight status and obstructive sleep apnea in children. *International Journal of Obesity, 36,* 920-924.

Keijsers, L., & Poulin, F. (2013). Developmental changes in parent-child communication throughout adolescence. *Developmental Psychology, 49*(12) 1-8.

Kenny, D. (1979). *Correlation and causality.* New York: Wiley.

Kenny, D. (2008). Reflections on mediation. *Organizational Research Methods, 11,* 353-358.

Keys, A., Fidanza, F., Karvonen, M., Kimura, N., & Taylor, H. (1972). Indices of relative weight and obesity. *Journal of Chronic Diseases, 25,* 29-343.

Koplan, J., Liverman, C., & Kraak, V. (2004). *Preventing childhood obesity: Health in the balance.* Washington: National Academies Press.

Lanigan, J. (2012). The relationship between practices and child-care providers' beliefs related to child feeding and obesity prevention. *Journal of Nutrition Education and Behavior, 44*(6), 521-529.

Lazzeri, G., Pammolli, A., Pilato, V., & Giacchi, M. (2011). Relationship between 8/9-yr-old school children BMI, parents' BMI and educational level: A cross sectional survey. *Nutrition Journal, 10*(1)*,* 76-83.

Lee, H., & Keller, K. (2012). Children who are pressured to eat at home consume fewer high-fat foods in laboratory test meals. *Journal of the Academy of Nutrition and Dietetics, 112*(2), 271-275.

Lu, E., Dayalu, R., Diop, H., Harvey, E., Manning, S., & Uzogara, S. (2012). Weight and mental health status in Massachusetts, national survey of children's health, 2007. *Maternal and Child Health Journal, 16,* 278-286.

Mahoney, L., Burns, T., Standford, W., Thompson, B., Witt, J., Rost, C., & Lauer, R. (1996). Coronary risk factors measured in childhood and young adult life are associated with coronary artery calcification in young adults: The Muscatine Study. *Journal of the American College of Cardiology, 27,* 277-284.

Mahoney, J., Lord, H., & Carryl, E. (2005). Afterschool program participation and the development of child obesity and peer acceptance. *Applied Developmental Science, 9,* 202–215.

MacKinnon, D., Lockwood, C., Hoffman, J., West, S., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods, 7*(1), 1-35.

MacKinnon, D., & Fairchild, A. (2009). Current directions in mediation analysis. *Current Directions in Psychological Science, 18*(1), 16-20.

Mallory, G. Fiser, D., & Jackson, R. (1989). Sleep-associated breathing disorders in morbidly obese children and adolescents. *The Journal of Pediatrics, 115*, 892-897.

Manson, J., Colditz, G., Stampfer, M., Willett, W., Rosner, B., Monson, R.,…Hennekens, C. (1990). A prospective study of obesity and risk of coronary heart disease in women. *The New England Journal of Medicine, 322*(13), 882-889.

McDermott Sales, J., Milhausen, R., Wingood, G., DiClemente, R., & Salazar, L. (2007). Validation of a parent-adolescent communication scale for use in STD/HIV prevention interventions. *Health and Education Behavior, 35*(3).

McGill Jr., H., McMahan, C., Zieske, A., Malcom, G., Tracy, R., & Strong, J. (2001). Effects of nonlipid risk factors on atherosclerosis in youth with a favorable lipoprotein profile. *Circulation, 103,* 1546-1550.

Mei, Z., Grummer-Strawn, L., Pietrobelli, A., Goulding, A., Goran, M., & Dietz, W. (2002). Validity of body mass index compared with other body-composition screening indexes for the assessment of body fatness in children and adolescents. *The American Journal of Clinical Nutrition, 75,* 978-985.

Miller, W., Hering, M., Cothran, C., Croteau, K., & Dunlap, R. (2012). After-school physical activity and eating behaviors of middle school students in relation to adult supervision. *Society of Nutrition Education and Behavior 44*(4), 326-334.

Mitchell, S., Brennan, L., Hayes, L., & Miles, C. (2009). Maternal psychosocial predictors of controlling parental feeding styles and practices. *Appetite, 53*(3), 384-389.

Mofid, M. (2014). Obstructive sleep apnea: The sleeping giant of the childhood obesity epidemic. *Journal of the American Academy of Physician Assistants, 27*, 27-30.

Moore, L., Harris, C., & Bradlyn, A. (2011). Exploring the relationship between parental concern and the management of childhood obesity. *Maternal and Child Health Journal*, *16*, 902-908.

Murashima, M., Hoerr, S., Hughes, S., & Kaplowitz, S. (2012). Feeding behaviors of low-income mothers: Directive control relates to a lower BMI in children, and a nondirective control relates to a healthier diet in preschoolers. *The American Journal of Clinical Nutrition, 95*(5), 1031-1037.

Muthen, L., & Muthen, B. (2009). *Structure equation modeling: A multidisciplinary journal*. Mortimer Street, London: Lawrence Erlbaum Associates, Inc.

National Health and Medical Research Council. (2003). *Clinical practice guidelines for the management of overweight and obesity in children and adolescents.* Melbourne: National Health and Medical Research Council.

Nowicka, P., Sorjonen, K., Pietrobelli, A., Flodmark, E., & Faith, M. (2014). Parental feeding practices and associations with child weight status. Swedish validation of the child feeding questionnaire finds parents of 4-year-olds less restrictive. *Appetite, 81,* 232-241.

Ogden, J., Cordey, P., Cutler, L., & Thomas, H. (2013). Parental restriction and children's diets. The chocolate coin and Easter egg experiments. *Appetite, 61,* 36-44.

Ogden, C., Carroll, M., Fryar, C., & Flegal, K. (2015). Prevalence of obesity among adults and youth: United States, 2011-2014. *NCHS Data Brief, 219*.

Olshansky, S., Passaro, D., Hershow, R., Layden, J., Carnes, B., Brody, J.…Ludwig, D. (2005). A potential decline in life expectancy in the United States in the 21st century. *New England Journal of Medicine, 352*, 1138-1145.

Paikoff, R. & Brooks-Gunn, J. (1991). Do parent-child relationships change during puberty? *Psychological Bulletin, 110*(1), 47-66.

Parletta, N., Peters, J., Owen, A., Tsiros, M., & Brennan, L. (2012). Parenting styles, communication and child/adolescent diets and weight status: Let's talk about it. *Early Child Development and Care, 182*(8), 1089-1103.

Parkinson, K., Jones, A., Tovee, M., Ells, L., Pearce, M., Araujo-Soares, V., & Adamson, A. (2015). A cluster randomized trial testing an intervention to improve parents' recognition of their child's weight status: A study protocol. *BMC Public Health, 15*(1), 1-8.

Payne, L., Galloway, A., Webb, R. (2011). Parental use of differential restrictive feeding practices with siblings. *Pediatric Obesity, 6*(2), 540-546.

Reinert, K., Po'e, E., & Barkin, S. (2013). The relationship between executive function and obesity in children and adolescents: A systematic literature review. *Journal of Obesity, 2013,* 1-10.

Rhodes, S., Shimoda, K., Waid, L., O'Neil, P., Oexmann, M., Collop, N., & Willi, S. (1995). Neurocognitive deficits in morbidly obese children with obstructive sleep apnea. *The Journal of Pediatrics, 127,* 741-744.

Rodenburg, G., Kremers, S., Oenema, A., & van de Mheen, D. (2014). Associations of parental feeding styles with child snacking behavior and weight in the context of general parenting. *Public Health Nutrition, 17*(5), 960-969.

Rodgers, R., Paxton, S., Massey, R., Campbell, K., Wertheim, E., Skouteris, H., & Gibbons, K. (2013). Maternal feeding practices predict weight gain and obesogenic eating behaviors in young children: A prospective study. *The International Journal of Behavioral Nutrition and Physical Activity, 10*(24), 1-10.

Rodriguez, M., Ahn, D., Winkleby, M., Sundquist, J., & Kraemer, H. (2002). Identification of population subgroups of children and adolescents with high asthma prevalence: Findings from the third national health and nutrition examination survey. *Archives Pediatric Adolescent Medicine, 156*, 269-275.

Rollins, B., Loken, E., Savage, J., & Birch, L. (2014). Effects of restriction on children's intake differ by child temperament, food reinforcement, and parent's chronic use of restriction. *Appetite, 73*, 31-39.

Schwimmer, J., Burwinkle, T., & Varni, J. (2003). Health-related quality of life of severely obese children and adolescents. *Journal of the American Medical Association, 289,* 1813–1819.

Silberstein, D., Feldman, R., Gardner, J., Karmel, B., Kuint, J., & Geva, R. (2009). The mother-infant feeding relationship across the first year and the development of feeding difficulties in low-risk premature infants. *Infancy, 14*(5), 501-525.

Steele, R., Jensen, C., Gayes, L., & Leibold, H. (2014). Medium is the message: Moderate parental control of feeding correlates with improved weight outcome in a pediatric obesity intervention. *Journal of Pediatric Psychology*, *39*(7), 708-717.

Steinberger, J., Moran, A., Hong, C., Jacobs, Jr. D., & Sinalko, A. (2001). Adiposity in childhood predicts obesity and insulin resistance in young adulthood. *The Journal of Pediatrics, 138*, 469-473.

Thurstone, L. (1928). The absolute zero in intelligence measurement. *Psychological Review, 35*(3), 175-197.

Thurstone, L. (1935). *The vectors of mind: Multiple-factor analysis for the isolation of primary traits.* Chicago: University of Chicago Press.

Tremblay, L., Rinaldi, C., Lovsin, T., & Zecevic, C. (2012). Parents' perceptions of children's weight: The accuracy of parent ratings and associations to strategies for feeding. *Early Child Development and Care, 182*(8), 1027-1040.

Wang, L., Chyen, D., Lee, S., & Lowry, R. (2007). Association between body mass index in adolescence and obesity in adulthood. *Journal of Adolescent Health, 42,* 512-518.

Webber, L., Cooke, L., Hill, C., & Wardle, J. (2010). Child adiposity and maternal feeding practices: A longitudinal analysis. *American Journal of Clinical Nutrition, 92*, 1423-1442.

West, S., Taylor, A., & Wu, W. (2012). Model fit and model selection in structural equation modeling, Hoyle, R (Ed.), *Handbook of Structural Equation Modeling* (pp. 209-231). New York: Guilford.

Venn, A., Thomson, R., Schmidt, M., Cleland, V., Curry, B., Gennat, H., & Dwyer, T. (2007). Overweight and obesity from childhood to adulthood: A follow up of participants in the 1985 Australian schools health and fitness survey. *Medical Journal of Australia, 186*(8), 458-460.

Xia, Y., Xie, X., Zhou, Z., Defrain, J., & Meredith, W. (2004). Chinese adolescents' decision-making, parent-adolescent communication and relationships. *Faculty Publications, Department of Child, Youth, and Family Studies, 52.*

Zhang, L. & McIntosh, W. (2011). Children's weight status and maternal and paternal feeding practices. *Journal of Child Health Care, 15*(4), 389-400.

Appendix A

Parent-Adolescent Communication Scale-Child Report

Items
The 10 questions asked of the adolescent were as follows:
(1) My parents and I can talk about almost anything.
(2) My parents sometimes don't listen to me.*
(3) I can tell my parents how I feel about everything.
(4) I am satisfied with how my parents and I talk together.
(5) I am careful about what I say to my parents.*
(6) When I ask a question, I get honest answers from my parents.
(7) There are topics I avoid discussing with my parents.*
(8) My parents know how to talk to me.
(9) I find it easy to discuss problems with my parents.
(10) It is easy for me to discuss all my true feelings with my parents.

Note. Each question was scored on a 4-point Likert-type scale with responses ranging from (strongly disagree) to 4 (strongly agree).
*Items dropped for low factor loadings.

Forehand, R. Miller, K., Dutra, R., & Chance, M. (1997). Role of parenting in adolescent deviant behavior: Replication across and within two ethnic groups. *Journal of Consulting and Clinical Psychology, 65,* 6, 1036-1041. doi: 10.1037/0022-006X.65.6.1036

Appendix B

Parent-Adolescent Communication Scale-Parent Report

Items

The 10 questions asked of the parent were as follows:

(1) My child and I can talk about almost anything.

(2) My child sometimes doesn't listen to me.*

(3) I can tell my child how I feel about everything.

(4) I am satisfied with how my child and I talk together.

(5) I am careful about what I say to my child.*

(6) When I ask a question, I get honest answers from my child.

(7) There are topics I avoid discussing with my child.*

(8) My child knows how to talk to me.

(9) I find it easy to discuss problems with my child.

(10) It is easy for me to discuss all my true feelings with my child.

Note. Each question was scored on a 4-point Likert-type scale with responses ranging from (strongly disagree) to 4 (strongly agree).
*Items dropped for low factor loadings.

Forehand, R. Miller, K., Dutra, R., & Chance, M. (1997). Role of parenting in adolescent deviant behavior: Replication across and within two ethnic groups. *Journal of Consulting and Clinical Psychology, 65,* 6, 1036-1041. doi: 10.1037/0022-006X.65.6.1036

Appendix C

Parent-Child Connectedness Measure

Items
(1) How much do you feel that your mother cares about you?
(2) How much do you feel that your father cares about you?
(3) How much do you feel you can talk to your mother about your problems?
(4) How much do you feel you can talk to your father about your problems?

Note. Statements were rated on 5-point scales from “not at all” to “very much”.

Boutelle, K., Eisenberg, M., Gregory, M., & Neumark-Sztainer, D. (2009). The reciprocal relationship between parent—child connectedness and adolescent emotional functioning over 5 years. *Journal of Psychosomatic Research,66,* 4, 309-316. doi: 10.1016/j.jpsychores.2008.10.019

Appendix D

Child Feeding Questionnaire

Factor	Variable Name	Item #	Question	Response Options
Perceived Child Weight	PCW5	12	Your child from 3rd through 5th grade	1 = markedly underweight; 2 = underweight; 3 = normal; 4 = overweight; 5 = markedly overweight
Restriction	RST1	17	I have to be sure that my child does not eat too many sweets (candy, ice cream, cake or pastries)	1 = disagree; 2 = slightly disagree; 3 = neutral; 4 = slightly agree; 5 = agree
	RST2	18	I have to be sure that my child does not eat too many high-fat foods	
	RST3	19	I have to be sure that my child does not eat too much of his/her favorite foods	
	RST4	20	I intentionally keep some foods out of my child's reach	
	RST5	21	I offer sweets (candy, ice cream, cake, pastries) to my child as a reward for good behavior	
	RST6	22	I offer my child her favorite foods in exchange for good behavior	
	RST7	23	If I did not guide or regulate my child's eating, he/she would eat too many junk foods	
	RST8	24	If I did not guide or regulate my child's eating, he/she would eat too much of his/her favorite foods	
Pressure to Eat	PE1	25	My child should always eat all of the food on his/her plate	1 = disagree; 2 = slightly disagree; 3 = neutral; 4 = slightly agree; 5 = agree
	PE2	26	I have to be especially careful to make sure my child eats enough	
	PE3	27	If my child says "I'm not hungry," I try to get him/her to eat anyway	
	PE4	28	If I did not guide or regulate my child's eating, he/she would eat much less than he/she should	
Monitoring	MN1	29	How much do you keep track of the sweets (candy, ice cream cake, pies, pastries) that your child eats?	1 = never; 2 = rarely; 3 = sometimes; 4 = mostly; 5 = always
	MN2	30	How much do you keep track of the snack food (potato chips, Doritos, cheese puffs) that your child eats?	
	MN3	31	How much do you keep track of the high-fat foods that your child eats?	

Birch, L., Fisher, J., Grimm-Thomas, K., Markey, C., Sawyer, R., & Johnson, S. (2001). Confirmatory factor analysis of the child feeding questionnaire: A measure of parental attitudes, beliefs and practices about child feeding and obesity proneness. *Appetite, 36,* 201-210.