Published in final edited form as:

Clin Pediatr (Phila). 2013 December ; 52(12): . doi:10.1177/0009922813497091.

Persistently Obese Youth: Interactions Between Parenting Styles and Feeding Practices With Child Temperament

Richard E. Boles, PhD¹, Jennifer Reiter-Purtill, PhD², and Meg H. Zeller, PhD²

¹School of Medicine, University of Colorado Denver, Aurora, CO, USA

²College of Medicine, University of Cincinnati, OH, USA

Abstract

Objective—To assess the interaction of parent and child characteristics with feeding practices and mealtime functioning.

Design—Longitudinal, predictive study comparing baseline characteristics with follow-up assessments.

Participants—The caregivers of 52 persistently obese youth and 32 nonoverweight comparison youth completed measurements of child temperament, parental feeding practices, parenting styles, and interactions during mealtimes.

Results—Adolescents with persistent obesity were significantly more likely to be parented using problematic feeding practices when parents also reported difficult child temperaments. Additionally, adolescents with persistent obesity and difficult temperaments were significantly more likely to have lower levels of positive mealtime interactions.

Conclusion—Persistently obese youth are at increased risk for problematic parental feeding practices and mealtime functioning, particularly when youth are described as having difficult temperaments. These results indicate that further investigations are needed to better understand the mechanisms linking parent and child characteristics with health-related behaviors for adolescents with obesity.

Keywords

parenting; temperament; obesity; adolescent; feeding

The overall prevalence of child and adolescent obesity has been largely stable over the past decade, though estimates remain significantly high compared with prior decades.¹ In 2009–2010, the prevalence of obesity for adolescents aged 12 to 19 years was 18.4%, with a significant increase in BMI among male adolescents, highlighting an important exception to the stabilization trend in obesity prevalence.¹ Interventions for adolescent obesity have had limited success, suggesting that researchers expand on basic eating- and/or activity-based models to include contextual factors that may affect weight-related health outcomes.² Specifically, the complex interaction of maternal parenting and child characteristics related

© The Author(s) 2013

Corresponding Author: Richard E. Boles, University of Colorado Denver, 12631 East 17th Ave, Aurora, CO 80045, USA., richard.boles@ucdenver.edu.

Reprints and permissions: sagepub.com/journalsPermissions.nav

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

to obesity development may advance our contextual understanding of adolescent obesity development and trajectories.^{3–5}

Broadly speaking, parenting has been empirically linked with the social, behavioral, and emotional development of children.^{3,6,7} Based on a transactional theoretical model, the process of child development is considered dialectical, shaped by both parent and child factors.⁸ In addition, child characteristics, such as temperament, may influence the degree of the parenting effects, based on interaction theoretical models.³ Baumrind⁹ described 2 dimensions of parenting style, “demandingness” (eg, supervision and discipline) and responsiveness (eg, developing child individuality and self-regulation), which Maccoby and Martin¹⁰ used to classify parenting styles as authoritative (high responsiveness/high demandingness), authoritarian (low responsiveness/high demandingness), permissive (high responsiveness/low demandingness), and neglectful (low demandingness/low responsiveness). Studies linking parenting styles to obesity have shown inconsistent findings. Rhee et al¹¹ longitudinally examined a large cohort of young children and found that authoritarian parents showed an almost 5-fold increase in odds of having an overweight child in the first grade. However, Agras et al¹² found no longitudinal association between parenting style and child weight status. More recently, Berge et al¹³ conducted a longitudinal study with adolescents (N = 2516) and found that an authoritative maternal parenting style predicted lower BMI in adolescents 5 years later. Discrepancies in linking parenting with obesity may be clarified by examining the influence of other parent and child characteristics, such as temperament.¹⁴

Child temperament is generally considered a biologically based combination of individual differences in reactivity and self-regulation.¹⁵ Reactivity refers to levels of responsiveness to external and internal environments, whereas self-regulation is an executive-based process of orienting and controlling attention and managing physiological, affective, and behavioral responses.¹⁶ A “difficult” child temperament is characterized as being a combination of biological arrhythmicity, high intensity and withdrawal, and negative mood, with a significantly increased risk for poor adult interactions and psychosocial problems.^{17,18}

To date, 2 studies have examined parenting styles and child temperament with regard to adolescent obesity. Our laboratory conducted the first study, a cross-sectional design, with obese and nonobese comparison youth. Our findings indicated that obese adolescents had more difficult temperaments relative to nonoverweight comparisons and that female parents of obese youth reported using less behavioral control (ie, less structure) than comparison parents.¹⁹ In addition, the interaction between low maternal Warmth and high Difficult Temperament was associated with higher risk for obesity among adolescents. Wu et al²⁰ advanced this work by conducting a longitudinal study of child temperament and parental sensitivity, defined as the level of maternal awareness for child needs and wants.²¹ Supporting earlier cross-sectional findings, children with more difficult temperaments combined with insensitive mothers were at greater risk for obesity during grade school but not during early childhood.²⁰ Specific mechanisms between parenting styles and child temperament remain unclear, however.

Parental feeding practices may be an important focus within the context of parenting styles and child temperament. To date, nearly all studies of parental feeding practices have involved parents of infants and young children. Although controlling feeding practices (including restriction, pressure to eat, and excessive monitoring) may be initially effective at modifying child eating behavior, consistent findings are that controlling feeding practices become problematic by interfering with a child’s innate ability to self-regulate eating-related behaviors.^{22,23} Aided by instrument validation for older samples of children, researchers have begun to explore parent feeding with older children and adolescents.^{24,25} Results

showed that parental perceptions and concern about child weight, restriction, and monitoring were positively associated with BMI percentile, whereas pressure to eat was inversely related to BMI percentile.²⁴

Mealtime functioning has emerged as an additional factor for determining risk of obesity. The prioritization of mealtimes and self-reported positive mealtimes have been associated with lower unhealthy weight control behaviors and depression among adolescents.²⁶ Moreover, mothers of treatment-seeking adolescents with obesity have reported significantly more mealtime challenges (eg, worrying about child eating and arguments about meals) and less positive family mealtime interactions compared with parents of nonoverweight youth.²⁷ To date, little is known about the longitudinal relationship between reported mealtime functioning in the context of feeding practices with treatment-seeking youth with obesity.

The current study focused on 2 primary aims: (1) to determine the longitudinal relationship between parent-reported difficult temperament in youth and parental feeding practices and (2) to examine the longitudinal relationship between parent-reported difficult temperament in youth and mealtime functioning. With regard to aim 1, we hypothesized that higher levels of youth difficult temperament at time 1 (T1) would longitudinally predict greater restriction, greater pressure to eat, and lower monitoring approximately 4 years later at time 2 (T2), and these associations would be stronger for persistently obese youth (ie, youth who remained in the obese category at both time points) compared with nonoverweight youth. Additionally, among families of persistently obese youth, lower Warmth, higher Psychological Control, and Lower Behavioral Control at T1 would moderate (ie, strengthen) the association between T1 youth difficult temperament and the use of problematic feeding practices at T2.

Our hypotheses for aim 2 were that higher levels of youth difficult temperament at T1 would longitudinally predict greater mealtime challenges and less Positive Mealtime Interactions at T2, and this association would be stronger for persistently obese youth compared with nonoverweight youth. Among families of persistently obese youth, lower Warmth, higher Psychological Control, and lower Behavioral Control at T1 would moderate (ie, strengthen) the association between T1 youth difficult temperament and T2 family functioning at mealtimes.

Method

Study Design and Procedures

This longitudinal study is a follow-up to part of a larger study about psychosocial functioning of obese youth presenting for treatment compared with nonoverweight peers with similar demographic characteristics. A description of study details has been published elsewhere.¹⁹ Briefly, the initial T1 study included classroom data collection of peer relationships for obese children and nonoverweight comparison peers, who were selected based on similar gender, age, and race,¹⁹ as well as a home-based assessment of psychosocial functioning data from obese youth, comparison peers, and parents.²⁷ A T2 follow-up assessment occurred approximately 50 months later for both groups after the initial study for participants, in which selected T1 measures were repeated in addition to measures not related to the present study.

Baseline data (T1) were collected for both groups by research assistants in locations convenient for the family (ie, research offices or homes). Once informed consent forms were signed, youth and parents independently completed questionnaires, followed by measurement of height and weight. Families were monetarily compensated for their participation. Follow-up data were collected in the same manner as baseline data described

above. Because the majority of parents were the biological mother, we refer to all adults as mother, although 7% of adults included grandmothers or adult female siblings. This study was approved by an institutional review board.

Measures

Demographics: This measure provided family characteristics, including maternal marital status and education level, family income, and size. Information from this measure was used to calculate socioeconomic status (SES) based on the Revised Duncan,^{28,29} in which higher scores indicate higher occupational attainment.

Anthropometrics: All participating youth and mothers were measured in triplicate for height and weight. Height was measured using a calibrated portable stadiometer (Creative Health Products, Plymouth, MI). Weight was measured using a portable digital scale (SECA, Hamburg, Germany). BMI (kg/m^2) was calculated for adults, and BMI z-scores (zBMI) were calculated using Centers for Disease Control growth charts containing age-specific median, standard deviation, and distribution skewness correction information using the LMS method.³⁰

Predictor Variable (T1)

Revised Dimensions of Temperament Survey: The Revised Dimensions of Temperament Survey is a parent report assessment of child temperament using a 4-point scale (*usually false, more false than true, more true than false, and usually true*). In all, 54 items are used to create 10 aspects of temperament: general activity level, sleep activity level, approach-withdrawal, flexibility-rigidity, mood quality, attentional focus-distractibility, persistence, and 3 types of rhythmicity (eating, sleep, and daily habits). Rhythmicity is the consistency of a child's biological functions, such as waking, becoming tired or hungry, and bowel movements. Three broadband scales of temperament are created, which include Adaptability/Positive Affect, Attention Focus, and General Rhythmicity. Higher scores reflect higher temperamental characteristics. This measure has reported adequate reliability and validity estimates.¹⁸ A difficult temperament index (DTI) was also created from dichotomization of the narrow-band temperament scales. Specifically, a child received a "1" if their parent reported a score each time above the 70th percentile for general activity and below the 30th percentile for flexibility-rigidity, approach-withdrawal, mood, attention, and rhythmicity. DTI scores ranged from 0 to 6, in which higher scores reflected greater difficult temperament.

Outcome Variables (T2)

Child Feeding Questionnaire (CFQ)²²: The original CFQ is a 31-item questionnaire measuring parental beliefs, attitudes, and practices within the context of child feeding. This measure has been modified and psychometrically validated for use in an adolescent population with minimal modifications compared with the original CFQ.²⁴ We selected the most commonly reported scales found to be correlated with weight outcomes and parenting behaviors, including Restriction, Pressure to Eat, and Monitoring. Cronbach's scores for the present sample showed excellent internal reliability for Monitoring and Restriction ($\alpha = .95$ and $.92$, respectively), whereas Pressure to Eat was questionable ($\alpha = .63$).

About Your Child's Eating-Revised (AYCE-R)³¹: The AYCE-R assesses parent concerns and beliefs about interactions during mealtimes and child eating. Parents complete 25 items across 3 subscales: (1) Resistance to Eating, (2) Positive Mealtime Interactions, and (3) Child Aversion to Mealtime. For the present study, the subscales Positive Mealtime Interactions and a revised Resistance to Eating were used. Specifically, revisions to the

Resistance to Eating subscale included the elimination of 6 items measuring concerns about undernutrition, and the scale was renamed Mealtime Challenges. Sample items include the following: “I worry that my child will not eat right unless closely supervised” and “There are arguments between me and my child over eating.” The AYCE-R has been used to measure family functioning during mealtimes for comparisons between children with chronic health problems and healthy comparison children.^{31,32}

Moderating Variables (T1)

Parents–Revised Parental Behavior Inventory (PRPBI)³³: The PRPBI consists of 3 factors with 10 items in each factor. Items are rated by parents as “like,” “somewhat like,” and “not like” themselves. The 3 factors are (1) Warmth (acceptance vs rejection), in which higher scores indicate a greater level of parent’s appreciation of the child’s needs; (2) Psychological Control (control vs autonomy), where higher scores reflect a parent’s use of negative control practices; and (3) Behavioral Control (firm vs lax control), in which higher scores indicate parental use of structure and order). This measure has demonstrated internal reliability and validity.³⁴

Participants

Obese youth were recruited from a family-based weight management clinic for young people 5 to 19 years old. Children were required to have a BMI at or above the 95th percentile based on age and gender for participation.³⁵ Initial T1 study eligibility criteria included that children be between 8 and 16 years old, not receiving homeschooling or full-time special education services, and having no genetic syndromes for which obesity is a comorbidity.

Of 107 eligible families of obese youth, 90 participated in the T1 classroom study, with 86 families also participating in the T1 home-based assessment (95.5%). Youth were considered eligible for the T2 follow-up if they were less than 19 years of age and had a participating parent. Of the 86 T1 participants, 19 were older than 19 years, 1 youth had no participating parent because of parental illness, and 1 child had died, leaving 65 eligible youth. At T2, 6 families declined participation (59/65 = 90.7%). For the purposes of this study, youth who were not persistently obese at both T1 and T2 data collection ($n = 5$) or whose participating parent was male ($n = 2$) were also excluded. A total of 52 obese youth were retained for the longitudinal phase (54% female).

In all, 90 nonoverweight peers participated in the T1 classroom assessment of the initial study, with 74 families also participating in the T1 home-based assessment. Of these 74 participants, 18 were older than 19 years and ineligible for the T2 follow-up; 14 comparison families declined participation, leaving 42 of 56 (75%) to participate at T2. For the purposes of this study, youth who were not persistently nonoverweight ($n = 8$) or who did not have a participating female parent ($n = 2$) were also excluded. Therefore, 32 nonoverweight youth were retained for the longitudinal phase (47% female).

Statistical Analyses

Descriptive analyses for participant characteristics were calculated and are presented in Table 1. Pearson product-moment correlations were conducted of T1 temperament with T2 parent feeding practices and mealtime functioning within each group (obese and comparison groups). To examine if the magnitude of the correlations differed between groups, Fisher’s r to Z transformations were performed and z -tests conducted.

Among families of persistently obese youth, hierarchical linear regression analyses were used to test whether parenting behaviors at T1 would moderate the association between T1

youth difficult temperament and T2 parent feeding practices and family functioning at mealtimes. DTI and the Parenting Behavior subscales (Warmth, Psychological Control, or Behavioral Control) were entered simultaneously in the first step of the model, followed by the interaction of DTI with each Parenting Behavior subscale in the second step. Separate models were tested for 2 criterion variables: CFQ and AYCE-R subscales. Independent variables were centered before model entry, and interaction terms were created by multiplying centered variables.³⁶

Results

Descriptive statistics for participant demographic variables indicated, as expected, significant differences for *z*BMI and BMI between groups for both youth and parents (see Table 1). Youth for both groups were an average age of 16 years old, whereas parents reported an average age of 43 to 44 years at the T2 assessment. Comparison group parents reported about 1.2 years of additional education and greater SES compared with parents of obese youth, both of which were statistically significant. Because SES was not significantly associated with our primary outcome variables, it was not included as a covariate for subsequent analyses.

Correlations Among Child Temperament and Parenting and Feeding Behaviors

Pearson product moment correlations were calculated between T1 DTI and T2 Feeding Practices and Family Functioning at Mealtimes. Within the obese youth group, higher DTI scores were significantly and inversely related to Positive Mealtime Interactions. Specifically, higher levels of difficult temperament in youth were associated with lower levels of Positive Mealtime interactions ($r = -0.35$; $P < .05$). Within the comparison youth group, DTI was positively associated with Pressure to Eat ($r = 0.37$; $P < .05$). No group differences in these associations were identified.

In addition to DTI, each of the broadband scales of temperament were tested for correlation relationships with the subscales for the CFQ and AYCE. Within the obese youth group, a significant inverse relationship was found between Adaptability/Positive Affect and Child Aversion to Mealtime ($r = -0.33$; $P < .05$). Within the comparison group, Adaptability/Positive Affect was inversely related to Pressure to Eat ($r = -0.43$; $P < .05$) and positively related to Positive Mealtime Interactions ($r = 0.49$; $p < .05$).

Correlations between difficult temperament and the hypothesized moderating variable, parenting behaviors, were evaluated at both T1 and T2 assessment periods. Results showed a significant negative relationship between parent-reported Warmth and DTI for the obese group at T1 ($r = -0.50$; $P < .001$) but not for the comparison group ($r = -0.02$; $P < .05$). An r to z transformation for comparison showed that these 2 correlations were significantly different ($P < .05$).

Predicting Child Feeding Practices and Mealtime Interactions for Persistently Obese Youth

Hierarchical linear regressions were used to determine the proportion of variance in parent-reported T2 child feeding practices and mealtime functioning explained by T1 difficult temperament (DTI), parenting behaviors, and their interaction for persistently obese youth only (Table 2). Separate regressions were completed for each outcome variable. When examining the main effects in step 1, Behavioral Control parenting behavior positively predicted Pressure to Eat ($\beta = 0.38$; $P < .01$). DTI predicted Positive Mealtime Interactions ($\beta = -0.37$; $P < .01$). Maternal Warmth inversely predicted Aversion to Mealtimes ($\beta = -0.39$; $P < .05$). These main effects continued to be significant in step 2. There were no other main effect predictor variables.

Moderation was assessed by examining the interactions of DTI with each parenting behavior variable in Step 2 of these regressions. Post hoc probing of all significant interaction effects was also completed using simple slopes analyses.³⁷ Two significant interactions were found in the prediction of T2 child feeding practices. Specifically, the interaction between DTI and Psychological Control inversely predicted Pressure to Eat ($\beta = -0.51$; $P < .01$), whereas the interaction between DTI and parental Warmth positively predicted Monitoring ($\beta = .39$; $P < .05$; Table 2). No significant interactions were found for T2 Positive Mealtime Interactions or Aversion to Mealtimes. Significant interactions were examined and plotted (Figures 1 and 2). Post hoc analyses indicated that the slope of the association between DTI and Pressure to Eat was significant at both high levels of Psychological Control ($t = -0.27$; $P = .011$) and low levels of Psychological Control ($t = 2.87$; $P = .006$; Figure 1). This finding indicates that parents who report using low psychological control (ie, more autonomous parenting) are more likely to report using pressure to eat when the child has higher levels of difficult temperament (Figure 1). In contrast, parents who report using higher psychological control are less likely to report using pressure to eat when the child has higher levels of difficult temperament.

Post hoc analyses of the interaction between Difficult Temperament and parental Warmth in the prediction of Monitoring indicated that the slope of the association between DTI and Monitoring was not significant at either high ($t = 1.44$; $P = .16$) or low levels of Warmth ($t = -1.97$; $P = .06$). Thus, the interaction was significant because of the opposing direction of slopes, but tests of the simple slopes indicated no significant moderation (Figure 2).

Discussion

The present investigation builds on emerging literature linking child temperament and parenting with feeding practices and mealtime functioning. To our knowledge, these are the first longitudinal results that showed that adolescents with persistent obesity are more likely to be parented using problematic feeding practices when difficult child temperaments were reported by parents. Moreover, parents who reported using more autonomous parenting were more likely to use negative feeding practices (pressuring to eat) when adolescents were reported to have difficult temperaments. This is particularly key toward understanding why some children may have remained persistently obese despite having favorable parenting styles.

Cross-sectional studies on parental pressure to eat and child outcomes consistently show an inverse relationship to weight.^{14,38,39} Although this finding may seem positive, observation studies show that parental pressure to eat is also positively associated with increased child energy intake but with poorer dietary quality.⁴⁰ Longitudinal studies linking pressure to eat and child eating and weight are limited and sometimes inconsistent, though an inverse relationship with weight has been reported, similar to cross-sectional studies.²³ Further studies on pressure to eat have shown that pressuring to eat certain foods actually reduces the child's preferences for these foods,⁴¹ resulting in greater intake of the targeted food when rewarded with dessert⁴² and lower intake of the pressured food when not rewarded with other food.⁴³

Collectively, these studies show that pressure to eat may be in response to parental concerns with low child weight or low food intake but results in counterintuitive outcomes (ie, less intake and preference for healthy foods). The present study suggests that even when parents are dealing with much older children who have been persistently obese, they report using problematic feeding practices even when parenting styles included positive structure (ie, behavioral control) or less guilt and manipulation (ie, psychological control), particularly when adolescents were reported to have difficult temperaments.

This study also provides longitudinal support of our hypotheses suggesting that among adolescents with persistent obesity, difficult child temperaments were significantly associated with less parent-reported warmth at T1 as well as lower levels of Positive Mealtime Interactions at T2. In contrast, positive temperament characteristics (eg, positive affect) of persistently obese youth at T1 were predictive of lower levels of Aversion to Mealtimes by parents at T2. As a result, distress and emotional problems during mealtimes may contribute to fewer family meals and less opportunity to shape and model healthy eating habits.²⁷

The present study results need to be considered in light of the limitations. The sample of children with persistent obesity were treatment seeking and may not generalize to youth who have been persistently obese but not actively seeking treatment for obesity. Moreover, our small preliminary sample of families did not include other race/ethnicities known to be at increased risk for obesity, including Latino and Native American families, and the results may not generalize to these and other groups. Although parenting style and child temperament are considered stable characteristics, repeated measurement would have provided greater evidence of stability over time. Given the adolescent population, additional child report of parenting will further validate findings. Finally, although our study utilized a longitudinal design, causal inferences are not possible without sequentially testing predictor and criterion variables.

The present study showed that child temperament, parenting styles, and feeding practices interact among youth with persistent obesity, which may help explain adolescent weight development over time. Additional research will need to consider the role of additional key behaviors related to obesity, including dietary intake and physical activity, in order to expand the present model. This study also demonstrates the continued interaction of parenting with adolescent weight, underscoring possible challenges in designing interventions to modify eating and activity habits with adolescents who are often considered to be much more independent in their eating and activity decisions. Additional investigations are needed to develop and test treatments for adolescents with obesity, in which child temperament may be “matched” with more effective parenting styles and feeding practices.

Acknowledgments

Funding

This study was funded in part by training grants from the National Institutes of Health (NIH: K23 DK60031; NIH: K23 DK087826) awarded to the senior author (MHZ) and first author (REB)

References

1. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999–2010. *JAMA*. 2012; 307:483–490. [PubMed: 22253364]
2. Gilles A, Cassano M, Shepherd EJ, Higgins D, Hecker JE, Nangle DW. Comparing active pediatric obesity treatments using meta-analysis. *J Clin Child Adolesc Psychol*. 2008; 37:886–892. [PubMed: 18991137]
3. Kiff CJ, Lengua LJ, Zalewski M. Nature and nurturing: parenting in the context of child temperament. *Clin Child Fam Psychol Rev*. 2011; 14:251–301. [PubMed: 21461681]
4. Topham GL, Page MC, Hubbs-Tait L, et al. Maternal depression and socio-economic status moderate the parenting style/child obesity association. *Public Health Nutr*. 2010; 13:1237–1244. [PubMed: 19968899]
5. Murphy SP, Barr SI. Challenges in using the dietary reference intakes to plan diets for groups. *Nutr Rev*. 2005; 63:267–271. [PubMed: 16190313]

6. Frick, PJ. Family dysfunction and the disruptive behavior disorders: a review of recent empirical findings. In: Ollendick, TH.; Prinz, RJ., editors. *Advances in Clinical Child Psychology*. Vol. 17. New York, NY: Plenum; 1994. p. 203-226.
7. Maccoby EE. Parenting and its effects on children: on reading and misreading behavior genetics. *Annu Rev Psychol*. 2000; 51:1–27. [PubMed: 10751963]
8. Sameroff AJ. Developmental systems and psychopathology. *Dev Psychopathol*. 2000; 12:297–312. [PubMed: 11014740]
9. Baumrind D. Current patterns of parental authority. *J Dev Psychol*. 1971; 4:1–103.
10. Maccoby, EE.; Martin, JA. Socialization in the context of the family: parent-child interaction. In: Mussen, P., editor. *Handbook of Child Psychology: Socialization, Personality, and Social Development*. Vol. 4. New York, NY: Wiley; 1983. p. 1-101.
11. Rhee KE, Lumeng JC, Appugliese DP, Kaciroti N, Bradley RH. Parenting styles and overweight status in first grade. *Pediatrics*. 2006; 117:2047–2054. [PubMed: 16740847]
12. Agras WS, Hammer LD, McNicholas F, Kraemer HC. Risk factors for childhood overweight: a prospective study from birth to 9.5 years. *J Pediatr*. 2004; 145:20–25. [PubMed: 15238901]
13. Berge JM, Wall M, Loth K, Neumark-Sztainer D. Parenting style as a predictor of adolescent weight and weight-related behaviors. *J Adolesc Health*. 2010; 46:331–338. [PubMed: 20307821]
14. Ventura AK, Birch LL. Does parenting affect children's eating and weight status? *Int J Behav Nutr Phys Act*. 2008; 5:15. [PubMed: 18346282]
15. Rothbart, MK.; Bates, JE. Temperament. In: Eisenberg, N., editor. *Handbook of Child Psychology*. Vol. 3. New York, NY: Wiley; 1998. p. 105-176.
16. Rothbart MK, Sheese BE, Rueda MR, Posner MI. Developing mechanisms of self-regulation in early life. *Emot Rev*. 2011; 3:207–213. [PubMed: 21892360]
17. Thomas, A.; Chess, S. *Temperament and Development*. Oxford, UK: Brunner/Mazel; 1977.
18. Windle M. Revised dimensions of Temperament Survey (DOTS-R): Simultaneous group confirmatory factor analysis for adolescent gender groups. *Psychol Assess*. 1992; 4:228–234.
19. Zeller MH, Boles RE, Reiter-Purtill J. The additive and interactive effects of parenting style and temperament in obese youth seeking treatment. *Int J Obes*. 2008; 32:1474–1480.
20. Wu TJ, Dixon WE, Dalton WT, Tudiver F, Liu XF. Joint effects of child temperament and maternal sensitivity on the development of childhood obesity. *Matern Child Health J*. 2011; 15:469–477. [PubMed: 20358395]
21. Ainsworth, MDS. *Maternal Sensitivity Scales*. Baltimore, MD: Johns Hopkins University; 1969.
22. Birch LL, Fisher JO, Grimm-Thomas K, Markey CN, Sawyer R, Johnson SL. Confirmatory factor analysis of the Child Feeding Questionnaire: a measure of parental attitudes, beliefs and practices about child feeding and obesity proneness. *Appetite*. 2001; 36:201–210. [PubMed: 11358344]
23. Faith MS, Scanlon KS, Birch LL, Francis LA, Sherry B. Parent-child feeding strategies and their relationships to child eating and weight status. *Obes Res*. 2004; 12:1711–1722. [PubMed: 15601964]
24. Kaur H, Li C, Nazir N, et al. Confirmatory factor analysis of the child-feeding questionnaire among parents of adolescents. *Appetite*. 2006; 47:36–45. [PubMed: 16624444]
25. Sato A, Jelalian E, Hart CN, et al. Associations between parent behavior and adolescent weight control. *J Pediatr Psychol*. 2011; 4:451–460. [PubMed: 21112925]
26. Fulkerson JA, Strauss J, Neumark-Sztainer D, Story M, Boutelle K. Correlates of psychosocial well-being among overweight adolescents: the role of the family. *J Consult Clin Psychol*. 2007; 75:181–186. [PubMed: 17295578]
27. Zeller MH, Reiter-Purtill J, Modi AC, Gutzwiller J, Vannatta K, Davies WH. Controlled study of critical parent and family factors in the obesigenic environment. *Obesity (Silver Spring)*. 2007; 15:126–136. [PubMed: 17228040]
28. Stevens G, Featherman DL. A revised socioeconomic index of occupational status. *Soc Sci Res*. 1981; 10:364–395.
29. Nakao, K.; Treas, J. *The Socioeconomic Index of Occupations: Construction From the 1989 Occupational Prestige Scores*. Chicago, IL: National Opinion Research Center, University of Chicago; 1992.

30. Kuczmarski R, Ogden CL, Grummer-Strawn LM, et al. CDC growth charts. *Adv Data*. 2000; (314):1–27. [PubMed: 11183293]
31. Davies CM, Noll RB, Davies WH, Bukowski WM. Mealtime interactions and family relationships of families with children who have cancer in long-term remission and controls. *J Am Diet Assoc*. 1993; 93:773–776. [PubMed: 8320403]
32. Davies, W.; Nuzzo, LK.; Zeller, MH. *Mealtime Behaviors in Families With Chronically Ill Youth and Controls*. Washington, DC: American Psychological Association; 2000.
33. Schludermann E, Schludermann S. Replicability of factors in children's report of parent behavior (CRPBI). *J Psychol*. 1970; 76:239–249.
34. Schwarz JC, Barton-Henry ML, Pruzinsky T. Assessing child-rearing behaviors: a comparison of ratings made by mother, father, child, and sibling on the CRPBI. *Child Dev*. 1985; 56:462–479. [PubMed: 3987419]
35. Kirk S, Zeller M, Claytor R, Santangelo M, Khoury PR, Daniels SR. The relationship of health outcomes to improvement in BMI in children and adolescents. *Obes Res*. 2005; 13:876–882. [PubMed: 15919841]
36. Tabachnick, B.; Fidell, LS. *Using Multivariate Statistics*. 4. New York, NY: Harper Collins; 2001.
37. Aiken, L.; West, SG. *Multiple Regression: Testing and Interpreting Interactions*. Newbury Park, CA: Sage; 1991.
38. Keller KL, Pietrobelli A, Johnson SL, Faith MS. Maternal restriction of children's eating and encouragements to eat as the "non-shared environment": a pilot study using the child feeding questionnaire. *Int J Obes*. 2006; 30:1670–1675.
39. Spruijt-Metz D, Lindquist CH, Birch LL, Fisher JO, Goran MI. Relation between mothers' child-feeding practices and children's adiposity. *Am J Clin Nutr*. 2002; 75:581–586. [PubMed: 11864866]
40. Campbell KJ, Crawford DA, Ball K. Family food environment and dietary behaviors likely to promote fatness in 5–6 year-old children. *Int J Obes*. 2006; 30:1272–1280.
41. Newman J, Taylor A. Effect of a means-end contingency on young children's food preferences. *J Exp Child Psychol*. 1992; 53:200–216. [PubMed: 1578198]
42. Birch L, McPhee L, Shoba BC, Steinberg L, Krehbiel R. "Clean up your plate": Effects of child feeding practices on the conditioning of meal size. *Learn Motiv*. 1987; 18:301–317.
43. Galloway AT, Fiorito LM, Francis LA, Birch LL. "Finish your soup": counterproductive effects of pressuring children to eat on intake and affect. *Appetite*. 2006; 46:318–323. [PubMed: 16626838]

Figure 1.
Association between T1 DTI with T2 Pressure to Eat moderated by T1 maternal psychological control
Abbreviations: CFQ, Child Feeding Questionnaire; SD, standard deviation.

Figure 2.
Association between T1 DTI with T2 Monitoring is moderated by T1 maternal warmth
Abbreviations: CFQ, Child Feeding Questionnaire; SD, standard deviation.

Table 1
Descriptive Statistics of Participant Characteristics at Time 1 (T1) and Time 2 (T2).

	Obese (n = 52)		Comparison (n = 32)		<i>t</i> ^a
	M	SD	M	SD	
Time 1 child zBMI	2.44	0.28	-0.20	0.72	-19.73***
Time2 child zBMI	2.46	.36	-0.05	0.82	-16.27***
T2 female caregiver BMI	36.06	10.47	26.79	6.70	-4.95***
T2 child age (years)	16.04	1.41	16.19	1.21	0.48
T2 female caregiver age (years)	44.88	7.87	43.56	8.15	-0.74
T2 female caregiver education (years)	13.45	2.35	14.69	1.96	2.48*
T2 family SES ^b	42.16	22.56	53.52	23.00	2.22*
T2 single-caregiver families	n = 25 (48%)		n = 8 (25%)		4.42 ^c
Child race					
African American	n = 25		n = 12		
White	n = 23		n = 19		
Other	n = 4		n = 1		

Abbreviations: M, mean; SD, standard deviation; zBMI, BMI z-score; SES, socioeconomic status.

^aBased on 2-tailed independent *t* tests.

^bFamily socioeconomic status, based on Duncan TSEI2. Higher scores indicate greater occupational attainment.

^c 2 value.

Table 2

Coefficients of Independent Variables in Linear Regression Analyses Predicting Feeding Practices and Mealtime Interactions.^a

T2 Dependent Variable	T1 Predictors and Steps	Change R^2	, Step 1	, Step 2
CFQ Monitoring	1. DTI	0.05	−0.10	−0.14
	Warmth		0.05	−0.17
	Behavioral Control		0.22	0.19
	Psychological Control		−0.03	−0.10
	2. DTI X Warmth	0.13		0.35*
	DTI X Behavioral Control			−0.14
	DTI X Psychological Control			−0.09
CFQ Pressure to Eat	1. DTI	0.20*	0.08	−0.11
	Warmth		0.22	0.09
	Behavioral Control		0.38**	0.37**
	Psychological Control		0.21	0.02
	2. DTI X Warmth	0.18**		0.02
	DTI X Behavioral Control			0.13
	DTI X Psychological Control			−0.48**
AYCE Positive Mealtime Interactions	1. DTI	0.18*	−0.37*	−0.38*
	Warmth		0.08	0.10
	Behavioral Control		0.18	0.18
	Psychological Control		−0.14	−0.15
	2. DTI X Warmth	0.003		−0.06
	DTI X Behavioral Control			−0.01
	DTI X Psychological Control			−0.03
AYCE Aversion to Mealtimes	1. DTI	0.17	0.02	−0.05
	Warmth		−0.39*	−0.49**
	Behavioral Control		−0.08	−0.11
	Psychological Control		−0.14	−0.26
	2. DTI X Warmth	0.09		0.07
	DTI X Behavioral Control			−0.15
	DTI X Psychological Control			−0.25

Abbreviations: CFQ, Child Feeding Questionnaire; DTI, difficult temperament index; AYCE, About Your Child's Eating–Revised.

^a* $P < .05$; ** $P < .01$.