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Family Context and Weight Status among 18-Month-Old Infants in Southern Appalachia: The
Role of Temperament, Parenting Style, and Maternal Feeding Practices

Thesis submitted in partial requirement of Honors

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Abstract

Pediatric obesity is a major public health crisis in the United States, and is particularly prevalent in the Southeast. Recent research has shifted the focus toward identifying obesity risk factors earlier in the lifespan, as 9.7% of infants and toddlers are at high weight-for-length (>95th percentile). Family context variables have been found to be related to infant and child weight status. A better understanding of these early contributors may facilitate the continued development of interventions for infants and toddlers at risk for obesity.

The purpose of the current study was to examine infant weight as it relates to parent-report of temperament, parenting style, and maternal feeding practices, in a sample of 18-month old children ($n = 58$) residing in Southern Appalachia. Mothers completed three surveys at infant age 18 months: the Early Childhood Behavior Questionnaire (ECBQ), the Parental Authority Questionnaire (PAQ), and the Infant Feeding Questionnaire (IFQ). Anthropometric data was obtained for parents and infants and contributed to body mass index (BMI) and standardized weight-for-length scores, respectively. Maternal BMI and percentile scores were obtained from the Centers for Disease Control and Prevention (CDC). Weight-for-length scores and percentiles were derived from infant weight and recumbent length measures using the 2006 World Health Organization (WHO) Growth Standards.

Results of bivariate correlations showed authoritarian parenting style was negatively associated with infant weight status, $r(51) = -.34, p < .05$. In contrast to previous findings related to early childhood, infants of authoritarian parents were found to be of lower weight status. This novel finding suggests that the role of parenting style in infancy may differ from early childhood.

Further longitudinal research beginning in infancy is warranted to examine the role of these concurrent factors on later development.

Introduction

Pediatric overweight and obesity continues to be a significant public health crisis in the United States, with 32% of children and adolescents aged 2 through 19 considered overweight or obese (Ogden, Carroll, Curtin, Lamb & Flegal, 2010). A particularly affected area is the southeastern United States, as research has shown a higher prevalence of childhood overweight and obesity in this region (Singh, Kogan, & Van Dyck, 2010). Based on current trends, the prevalence of child overweight will nearly double by 2030, and all American adults will be overweight or obese in 2048 (Wang, Beydoun, Liang, Caballero, & Kumanyika, 2008). A troubling trend has materialized in American infants, with 9.7% of infants and toddlers at high (> 95th percentile) weight-for-length status (Ogden, Carroll, Kit, & Flegal, 2012).

The consequences of pediatric obesity affect physical and psychosocial aspects of life. Obese children are at high risk for numerous medical conditions, including precursors to cardiovascular disease, sleep apnea, and diabetes (Freedman, Mei, Srinivasan, Berenson, & Dietz, 2007; Li, Ford, Zhao, & Mokdad, 2009). From a psychosocial perspective, obese children struggle with low self-esteem, self-image, and self-concept (Cornette, 2008). Using parent reports, Ingerski and colleagues (2010) found that obese youth had lower levels of health-related quality of life compared to youth with other chronic conditions, including sickle cell disease and cystic fibrosis. The multifaceted problems associated with obesity in the physical and psychosocial realms make it an especially difficult condition for young people to manage.

A significant step in combating obesity relies on the identification of its causes. Genetic predispositions, environmental factors, and socioeconomic influences are major contributors to one's weight status (U.S. Department of Health and Human Services, 2001). Farooqi and O'Rahilly (2007) outline deficiencies in brain areas related to appetite, revealing the involuntary,

biological predisposition to increased caloric intake among obese individuals. Home and school environments contribute to levels of food intake, screen time, and physical activity levels in children, demonstrating the integral role of parents and teachers in weight management (USDHHS, 2001).

Elevated weight status in infancy has proved to form lasting patterns of overweight and obesity in later childhood and adolescence. Dubois and Girard (2006) found that high weight gain in the first five months of life was positively correlated with overweight at 4.5 years. A multi-ethnic sample from the Special Supplemental Nutrition Program for Women, Infants, and Children in New York State revealed rapid weight gain in the first six months of life correlated with increased risk for overweight at 4 years, independent of confounders such as maternal BMI and breastfeeding history (Dennison, Edmunds, Stratton, & Pruzek, 2006). Using retrospective data, Johannsson and colleagues found that children who were overweight at 2.5 years were more likely to be overweight at 6 and 9 years, and 51% of overweight 6 year olds remained overweight at 15 years (2006). Rapid postnatal weight gain in infancy (0-6 months) and early childhood (3-6 years) in a sample of 248 children predicted larger body mass index and fat mass at 17 years (Ekelund et al., 2006). These studies suggest a consistency of weight status over periods of childhood and adolescent development.

Recent studies have used an ecological-systems framework to better understand factors surrounding pediatric obesity (Davison & Birch, 2001). In their review, Kitzmann, Dalton, and Buscemi (2008) focused on the role of the family, finding that overweight and obese children are at greater likelihood to experience nonauthoritative parenting, higher familial conflict, and lower family support compared to their normal-weight peers. In fact, in order for children to eat healthier foods, increase physical activity, and decrease screen time, a collaborative and communicative

effort by parents and teachers in the home and school domains has been recognized as extremely important (Waters et al., 2011). Prevention and intervention strategies to combat pediatric obesity – including those targeting management of weight status in children below two years of age – have been moderately successful (Ciampa et al., 2010; Waters et al., 2011). Further examination of factors and interactions specific to family context may contribute to more successful prevention and intervention strategies, especially with younger children. As evident in the literature, significant contributors to weight status in infancy are child temperament, parenting style, and maternal feeding practices. A more thorough explanation of their associations with weight status will be explored in the following sections.

Temperament & Child Weight

Child weight, by nature, is affected to some degree by the behavioral interplay between parents and children. Specifically, mothers as primary caregivers of infants are part of a crucial developmental period involving the recognition of their child's actions. A proper understanding of child temperament types allows parents to focus their energy on their child's specific needs. Temperament is defined as “the set of inborn characteristics that distinguish one person from another in the behavioral style they manifest” (Schaffer, 2006). Strong patterns of behavior develop quickly in infancy, and the enduring aspects of infant temperament can influence the reciprocal feeding relationship.

The effects of child temperament on familial feeding practices, contexts, and interactions have gained attention with the development of the obesity epidemic. Studies have shown that infants subject to rapid weight gain are perceived by their mothers to be “more difficult than average” or high in fussiness (Carey, 1985; Wasser et al., 2011). Elevated fussiness has been associated with early exposure to complementary solid foods and fruit juice as early as 3 months of

age (Wasser et al.). Adherence to breastfeeding recommendations remains a significant cornerstone of maternal education due to the risk factors inherent to early complementary feeding. Low attention span levels in male infants were found to be related to higher standardized weight levels and a higher overall risk for overweight and obesity at age six, while the same outcome occurred in female infants with negative food reactions (Faith & Hittner, 2010). Longitudinal data from the Infant Care and Risk of Obesity Project revealed that high amounts of limb movements and “squirring” decreased the risk for later fatness, while elevated levels of distress in response to limitations led to fatness in adulthood (Slining et al., 2009). Temperament may negatively impact the dynamic between an overweight mother and overweight infant. Agras and colleagues (2004) found child temperament to be a mediating factor between parent overweight and child overweight, suggesting that difficult temperament may negatively influence the frequency of feeding due to reciprocal frustration between parent and child.

Similar patterns have arisen from temperament data in later childhood. High emotionality in children aged 6 to 12 predicted overweight between the ages of 24 and 30 (Pulkki-Råback et al., 2005). The correlation between high emotionality and overweight was independent of related risk factors, strengthening the significance of child temperament as a predictor for later weight-related issues. Overall, this growing body of literature suggests that difficult temperament is associated with greater risk for development of overweight or obesity in childhood, making it an important variable for future study.

Parenting Style & Child Weight

The four most commonly researched parenting styles in the scientific literature are authoritarian, authoritative, permissive, and neglectful (Baumrind, 1989). Authoritative parents are highly demanding, but also highly responsive. Authoritarian parents are highly demanding, but

show low levels of responsiveness. Permissive parents exhibit low levels of demandingness matched with contrastingly high levels of responsiveness. Finally, neglectful parents exhibit low levels of demandingness and responsiveness (Baumrind).

A developing body of scientific evidence shows a correlation between general parenting styles and physical health in children. Maternal authoritarian style has been shown to be a weight status risk factor for sons, and maternal neglectful parenting places daughters at risk for high weight status (Berge, Wall, Loth, & Neumark-Sztainer, 2009). Another study examining parenting styles and weight status in a population of first-graders found that children of authoritarian parents were five times more likely to be overweight than those of authoritative parents, while children of permissive and neglectful parents were twice as likely to be overweight (Rhee, Lumeng, Appugliese, Kaciroti, & Bradley, 2009). A similar dynamic has been found in treatment-seeking youth populations. Parents of obese youth in a Cincinnati pediatric weight management clinic self-reported lower levels of parental warmth (i.e., caregiver appreciation, acceptance vs. rejection) than those of comparison groups (Zeller, Boles, & Reiter-Purtill, 2008).

Developmental implications of parenting styles necessitate the promotion of authoritative parenting. A review by Berge (2009) of thirteen studies found that authoritative parenting style was highly associated with lower child BMI, higher availability of fruits and vegetables in the home environment, and higher levels of physical activity. Contrastingly, authoritarian and neglectful parenting styles were positively associated with BMI, a prevalence of unhealthy foods in the home environment, and negatively associated with physical activity (Berge). Further, a study of 1,171 first-graders showed a negative relationship between children of authoritative mothers and eating in response to negative emotions (Topham et al., 2011). Clearly, negative aspects of certain parenting styles are associated with unhealthy behaviors, while placing children

at risk for high weight status. To date, no studies have examined the role of parenting style as related to weight status in children under the age of 2, despite research suggesting parenting style as early as age 6 months contributes to developmental outcomes in late childhood, including academic competence and social skills (Stright, Gallagher, & Kelley, 2008).

Maternal Feeding Practices & Weight Status

The mother-child feeding relationship is a crucial factor related to an infant's development. Various behaviors and beliefs surrounding infant feeding constitute this domain of parenthood, such as concerns about undereating or overeating, feeding on a schedule, and using food as a soothing mechanism. With persistent practice, these early interactions may form long-lasting eating patterns. Burdette, Whitaker, Hall and Daniels (2006) found that maternal concern about infant overeating, as well as maternal obesity, was related to high adiposity at 5 years of age. The aforementioned study builds on the link between maternal obesity and high child weight status, while also honing in on problematic feeding patterns in obese mothers. A primary goal of studies like Burdette et al. (2006) is to determine effective feeding protocols for obese mothers based on strategies of their non-obese counterparts.

Perceptions of infant hunger and satiability influence mothers' feeding styles, with parents' concern about future overweight being associated with a restrictive feeding style, while parents' concern about underweight is associated with a pressuring feeding style (Gross, Mendelsohn, Fierman, & Messito, 2011). Fundamental practices, such as the maintenance of breastfeeding versus formula feeding, form the basis of these weight-related perceptions. In a 2004 study, Taveras et al. examined the protective effects of breastfeeding against overweight and obesity. Their findings included a markedly decreased risk for restricting energy intake among breastfeeding mothers compared to formula-feeding mothers (Taveras et al., 2004).

Infant-centered feeding techniques seem to allow for satiety to be achieved naturally, as opposed to overfeeding or underfeeding based on inaccurate perceptions. Taken together, these findings suggest maternal feeding practices – specifically concern about infant underweight or overweight – may relate to later weight outcomes.

Joint Effects of Temperament, Parenting Style, and Maternal Feeding

Numerous studies have focused on the need to examine joint effects of child and parent characteristics related to infant weight. Three significant precursors to later weight status are infant temperament, parenting style, and maternal feeding practices. Recent research on these formative patterns has focused on dynamical interactions between children and family members (Wu, Dixon, Dalton, Tudiver, & Liu, 2010). A directionally opposite yet similar study found maternal perceptions of infant temperament and mealtime negativity at 6 months predicted controlling feeding style at 1 year (Blissett & Farrow, 2007). Indulgent feeding styles among parents have been correlated with high BMI in early childhood after controlling for various variables, including child temperament (Hughes, Shewchuck, Baskin, Nicklas, & Qu, 2008). The aforementioned study examined feeding styles associated with parental demandingness and responsiveness in low-income families with preschool children; however, these relationships have not been investigated in infants.

Misinterpretations of temperamental cues may negatively influence feeding patterns. Many mothers believe the primary cause of infant distress is hunger, which in turn affects their feeding behaviors (Redsell et al., 2010). Mothers' engagement in feeding to soothe their infant has been found to be negatively related to maternal self-efficacy, and positively related to difficult infant temperament (Stifter, Anzman-Frasca, Birch, & Voegtline, 2011). Children of mothers who were obese prior to pregnancy were found to be at high risk for obesity in early childhood

(Whitaker, 2004; Burdette et al., 2006), further demonstrating the closely linked nature of the mother-child nourishment relationship. Additional research is needed to better understand the complex interplay among family context variables including temperament, parenting style, and maternal feeding practices on the development of child overweight and obesity.

Current Study

The growing pediatric obesity problem in the southeastern region of the United States demands further research. Weight status in infancy may be a primary indicator of risk for obesity later in childhood. Therefore, a more thorough understanding of certain physical and behavioral interactions between mothers and infants may guide prevention and intervention efforts and thus be integral to curbing the pediatric obesity epidemic.

The purpose of the current study was to examine infant weight as it relates to parent-report of temperament, parenting style, and maternal feeding practices in 18-month olds residing in Southern Appalachia, specifically Northeast Tennessee. A review of the literature revealed several studies featuring directional and inclusionary differences among the variables at hand. This study is a unique contribution to the literature due to its inclusion of parenting style in mothers of 18-month-olds. Parental response patterns are of interest in relation to temperament, maternal feeding style, and weight status, as infant behavior begins to gain saliency at 18 months. This milestone of infancy may profile the earliest indication of parenting patterns.

Because of the varied conceptualizations in previous studies, an exploratory approach to the relation between family context variables –temperament, parenting style, and maternal feeding practices, and infant weight – is necessary to best interpret our cross-sectional data. The primary aim of this study was to examine how temperament, parenting style, and maternal feeding were related to infant weight status at 18 months. To date, one study found distinct combinations of low

maternal sensitivity (an aspect of parenting style) and difficult infant temperament at 6 months predicted obesity in early to middle childhood (Wu et al., 2010). Building on that study, the secondary aim of the current study was to further understand the joint effects of family context variables as related to infant weight status.

Methods

Participants

Fifty-eight mother-infant dyads from a community in the southeastern United States participated in the study (25 female infants, 33 male infants). In order to participate, infants were to be 18 months old at the time of their laboratory visit.

Procedure

Participants were part of a larger cross-sectional study by the Program for the Study of Infancy entitled Elicited Imitation for Inappropriate Object Substitution (EIOS), which examined executive function in infants. The East Tennessee State University Institutional Review Board approved the study. Mothers were recruited by mail and phone from birth announcements published in two regional newspapers. Upon agreeing to participate in the study, mothers completed three surveys, as well as informed consent documents, in advance of their laboratory visit. The three surveys administered were valid and reliable measures of infant temperament, parenting style, and maternal feeding practices. Mothers returned the surveys to research assistants upon arriving to the laboratory for the EIOS study. Anthropometric data was collected at the end of the laboratory visit.

Measures

Demographics. Demographic data of interest included ethnicity, number of siblings, maternal education level, and socioeconomic status (WIC participation). These items were

included in the Infant Feeding Questionnaire, as described below.

Infant temperament. The 201-item Early Childhood Behavior Questionnaire (ECBQ) was administered to examine various fine-grained, consistent aspects of behavior in infants (Putnam, Gartstein, & Rothbart, 2006). Mothers responded about the frequency of their infant's various behaviors during two weeks preceding completion of the survey. Items were ranked on an ordinal scale from 1 (never) to 7 (always). Eighteen dimensions of infant temperament are derived from the ECBQ. Factor analysis completed by Putnam et al. (2006) resulted in three superdimensions. The first superdimension, *surgency*, is defined as enhanced extraversion and anticipatory behavior in situations featuring high-intensity stimuli, along with low unease in new situations and increased sociability (Putnam et al., 2006). The second superdimension, *effortful control*, is defined as "the efficiency of executive attention, including the ability to inhibit a dominant response and/or to activate a subdominant response, to plan and to detect errors" (Rothbart & Bates, 2006 as cited in Casalin, Luyten, Vliegen, & Meurs, 2012). The third superdimension, *negative affectivity*, is described as frequent exhibition of fear, frustration, and sadness with slow recovery (Putnam et al., 2006). *Surgency* is composed of five dimensions (sociability, activity level, impulsivity, high intensity pleasure, positive anticipation); *effortful control* is composed of five dimensions (cuddliness, inhibitory control, low intensity pleasure, attention shifting, attention focusing); and *negative affectivity* is composed of eight dimensions (discomfort, fear, motor activation, sadness, perceptual sensitivity, shyness, reversed soothability, frustration). This measure is psychometrically sound and widely used. Putnam et al. (2006) reported Cronbach's α for the three ECBQ superdimensions: .76, .79, and .78, respectively. For the current study, Cronbach's α for the three ECBQ superdimensions were .68, .62, and .60, respectively.

Parenting style. The 30-item Parental Authority Questionnaire (PAQ) was collected to examine parenting styles and disciplinary habits (Buri, 1991). Ten randomized items corresponded to each parenting style – authoritarian (strict obedience, controlling behavior, punitive discipline, low responsiveness), authoritative (firm but clear, flexible, balanced demandingness, high responsiveness), and permissive (non-demanding, somewhat neglectful, uninvolved, low responsiveness). Mothers ranked items on a Likert-type scale from 1 (strongly disagree) to 5 (strongly agree) as to how each statement applied in terms of their parent-child relationship. Each set of ten items for each parenting style was added and fell within a range between 10 and 50; higher scores reflected that specific style. For example, a mother scoring 46 on the “permissive” scale would reflect a more permissive parent, whereas a score of 13 would reflect a less permissive parent. The PAQ has been found to be a valid and reliable measure. According to Buri (1991), reported Cronbach’s α for the three PAQ subscales were .82, .74, and .85. For the current study, Cronbach’s α for the three PAQ parenting styles were .78, .68, and .68, respectively.

Maternal feeding practices. The 28-item Infant Feeding Questionnaire (IFQ) is used to determine feeding attitudes and behaviors during the first year of an infant’s life (Baughcum et al., 2001). This survey established seven factors of retrospective maternal attitudes and behaviors toward feeding: (1) concern about infant undereating or becoming underweight (undereating), (2) concern about infant’s hunger (hunger), (3) awareness of infant’s hunger and satiety cues (infant cues), (4) concern about infant overeating or becoming overweight (overeating), (5) feeding infant on schedule (schedule), (6) using food to calm infant’s fussiness (food to calm), and (7) social interaction with the infant during feeding (social). Mothers responded with one of five answers ranging from 0 (never/disagree a lot) to 4 (always/agree a lot). One item of the scheduled feeding factor was reverse scored (“Did you let your child eat whenever he/she wanted to?”). Each of the

seven factor scores were computed by averaging factor-specific items together to establish a value ranging from 0 to 4. The IFQ is a psychometrically valid and reliable instrument. According to Baughcum et al. (2001), reported Cronbach's α for the seven IFQ scores were .71, .74, .65, .55, .48, .44, and .24, respectively. For the current study, Cronbach's α for the seven IFQ scores were .78, .53, .63, .54, .88, .63, and .04, respectively.

Anthropometrics. Maternal height and weight, along with infant length and weight, were collected at the infant age 18-month laboratory visit. Height data was collected using a SECA wall-mounted stadiometer. Infant recumbent length was determined using the paper-and-pencil method, which is the predominant measurement technique used by primary care providers (Lipman et al., 2004). This measure consisted of the infant lying down horizontally while a research assistant made a mark above the head and below the foot. Weight was measured using a Tanita digital scale. Height and weight measurements were collected twice to ensure accuracy. The first and second measurements were averaged to determine a mean height and weight. If a discrepancy (i.e., .5 cm for height/length, .3 kg for weight) arose between the first two measurements, a third measurement was taken. The average of these three measurements was then used as the final value. Maternal BMI was calculated as weight (kilograms) divided by height (meters) squared. Maternal BMI status was determined by consulting the Centers for Disease Control and Prevention standards (Flegal, Carroll, Kit, & Ogden, 2012). Infant standardized weight-for-length scores and percentiles were created utilizing the 2006 WHO Child Growth Standards (WHO Child Growth Standards). The CDC recommends the use of the WHO standards for children under 24 months due to their reflection of growth patterns among predominantly breastfed infants under "optimal environmental health conditions" (Grummer-Strawn, Reinold, & Krebs, 2010). Previously recommended CDC growth charts served as a reference of how children

had grown, rather than how they should optimally grow. In summary, the high-quality design of the 2006 Multicentre Growth Reference Study – the source of the WHO Standards – establishes it as the CDC’s recommended set of guidelines (Grummer-Strawn et al., 2010).

Results

Descriptives

Infants were predominantly white (93.1%). Subjects’ socioeconomic status was not collected; however, postnatal participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) (25.9%) was noted. Among mothers, 68.9% had completed a four-year degree or a graduate degree. Weight status of mothers (34% overweight, 32.1% obese) was similar to statewide data on adult overweight and obesity in Tennessee (36% overweight, 32% obese) (CDC, 2011). Further characteristics of study participants can be found in Table 1.

Bivariate Correlations between Family Context Variables and Infant Weight Status

Bivariate correlations were conducted to examine the relation between variables of interest. Intercorrelations of study variables for the entire sample can be found in Table 3. Significant correlations between family context variables and infant weight status are reported below. For the sample as a whole, authoritarian parenting style was negatively correlated with infant weight status, $r = -.34, p < .05$. There were no additional statistically significant correlations when conducted separately based on gender.

Bivariate Correlations among Family Context Variables

Bivariate correlations among family context variables can also be found in Table 3. Significant findings for the entire sample are reported below, as well as those specific to gender. In the overall sample, the effortful control superdimension of temperament was negatively associated with authoritarian parenting, $r = -.33, p < .05$, whereas the negative affectivity superdimension was

positively associated with authoritarian parenting, $r = .37, p < .01$. The surgency superdimension of temperament was positively associated with maternal recognition of infant cues during feeding, $r = .26, p < .05$. Authoritative parenting style was positively correlated with feeding on a schedule, $r = .29, p < .05$. Authoritarian parenting style was negatively correlated with awareness of infant cues, $r = -.34, p < .01$. This correlation was especially pronounced in girls, $r = -.61, p < .01$. Among girls, feeding to calm was negatively associated with effortful control, $r = -.53, p < .01$, as well as negative affectivity, $r = -.52, p < .05$. In boys, surgency was positively associated with authoritative parenting, $r = .37, p < .05$, while negative affectivity was positively correlated with authoritarian parenting, $r = .55, p < .001$.

Partial Correlations

Based on a review of the literature, theoretical explanations, and our hypotheses, we chose to run partial correlations examining the relation between specific family context variables and infant weight status. The relation between maternal feeding and infant weight status was examined controlling for temperament, maternal BMI, and parenting style. These partial correlations failed to yield significant results. Controlling for temperament variables, authoritarian parenting style remained negatively correlated with infant weight status, $r = -.35, p < .05$. This relationship was expected due to the statistically significant primary outcome of our study, along with a non-significant finding between temperament and infant weight status.

Exploratory Analysis

Finally, building on one previous study with preschoolers (Hughes et al., 2008), we decided to examine potential differences in temperament, parenting style, and infant weight status based on maternal feeding practices. Specifically, we focused on the IFQ subdimension “concern about infant overeating or becoming overweight” due to a prior study that found it to predict

weight outcomes in later childhood (Burdette et al., 2006). Responses to this item ($M = .53$, $SD = .64$) were used to create a dichotomized variable indicating high concern [i.e., scores that fell one standard deviation above the mean (>1.17)] versus low concern (i.e., <1.17) for infant overeating or overweight. An independent samples t -test found permissive parenting style to be significantly higher among mothers with high concern for overweight and overeating ($M = 22.86$, $SD = 6.44$) compared to those with low concern for overweight and overeating ($M = 19.00$, $SD = 3.41$), ($t(52) = -2.45$, $p = .018$). The t -test of temperament dimensions and infant weight status failed to yield significant results.

Discussion

Previous research has indicated a strong relation between family context variables and child weight status. Specifically, a number of factors within the familial framework of development in infancy have been found to influence weight status early in the lifespan (Kitzmann et al., 2008). An exploratory approach was taken in the current study to examine family context variables (temperament, parenting style, and maternal feeding practices) in relation to infant weight status, as well as the joint effects of these variables related to weight in 18-month-olds living in Southern Appalachia. One dimension of parenting style was found to be significantly related to infant weight; however, we found no statistically significant relations between temperament and maternal feeding practices as related to infant weight. Due to the lack of statistically significant findings related to our primary aim, joint effects of family context variables were not pursued further.

The primary finding of our study – the negative correlation between authoritarian parenting style and infant weight status – is noteworthy due to this study’s novel examination of parenting style in infancy. The finding is inconsistent with prior research on the relation between

these variables among children in early to middle childhood, which has found authoritarian parenting to be positively related with weight status (Berge et al., 2009; Rhee et al., 2009).

However, these studies do not explore the role of parenting style with infants less than 2 years of age.

Aspects of the mother-child relationship change over time. The characteristics of parenting style, including disciplinary responses and methods of control, vary greatly between infancy and early childhood (e.g., 5 years old). At age 18 months, the foundational interactions between mother and child relate to feeding, bathing, and a more comprehensive role in managing the infant's physical needs. Such dynamics of the relationship multiply significantly into early and middle childhood, when the child gains levels of independent cognition and physical range of environment than was previously possible. As the child progresses developmentally, the disciplinary mindset and techniques of the mother progress concurrently. Thus, the correlation between authoritarian parenting style and lower infant weight status may be explained by the increased stringency and management of these parents in terms of feeding intake and overt control of the infant's surroundings.

Consistent with a prior study (Hughes et al., 2008) linking indulgent feeding styles to higher BMI in children, our exploratory analysis revealed significantly higher levels of permissive parenting style among mothers with high concern about infant overeating and overweight than those with low concern about infant overeating and overweight. This finding suggests that mothers who are more uninvolved and *laissez-faire* in terms of parenting style have heightened concerns regarding their infant's weight status. Such heightened concerns about infant overeating and overweight have proven to be predictive of higher adiposity later in childhood (Burdette et al., 2006). A better understanding of the relation between permissive parenting style and concern

about high infant weight may improve prevention strategies for mothers.

There were several strengths of the current study. An exploratory approach was used due to prior the methodological and directional variability of prior studies in this subfield of infant development research. Three family context variables were examined simultaneously, whereas related studies have typically examined only two (e.g., Topham et al., 2011; Wasser et al., 2011). Previous research has examined parenting style as related to early and middle childhood (Berge, 2009; Rhee et al., 2009); however, this is the first study to date to examine parenting style in mothers of 18-month-old infants. As recommended by the CDC (Grummer-Strawn et al., 2010), this study incorporated standardized weight-for-length z-scores and percentiles established by the 2006 WHO Child Growth Standards rather than the formerly recommended CDC guidelines. As such, accurate assessment of infant anthropometric data compared to weight-for-length standards reflective of the international infant population was achieved. Conducting this study in Southern Appalachia, specifically Northeast Tennessee, was especially significant considering the unique health disparities and high overweight and obesity rates in the region. In fact, rates of maternal overweight and obesity in our sample accurately represented statewide percentages for adults in Tennessee (CDC, 2011).

There were some limitations of this study. The sample was small, affecting the statistical power of the findings. Other sample characteristics limiting the applicability of the results include relatively high socioeconomic status, as well as high levels of maternal education. The cross-sectional design of this study limits our ability to interpret results beyond the time of data collection. A longitudinal approach may reveal more about changes in interactions between family context variables, as well as the enduring precursors of childhood weight status issues.

Future research should address the limitations at hand. A larger, more diverse sample size

will provide a representative perspective of the interplay between family context variables related to infant weight status. Some researchers have explored ethnic and cultural differences in developmental practices among certain populations, and an expansion of these efforts may point to specific issues surrounding the mother-child relationship. A large-scale, longitudinal study in this subfield of infant development research would be impactful to the region of Southern Appalachia in an effort to improve interventions related to overweight and obesity. For instance, a better understanding of family context variables related to infant weight status will lead to beneficial directives and educational modules for mothers, which could be implemented in a variety of healthcare settings.

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Table 1

Demographics for Mother-Child Dyads

	Mean (SD) or %
Infants	
Weight-for-length	
Underweight (<5 th percentile), <i>n</i> (%)	2 (4.3)
Normal, <i>n</i> (%)	43(91.5)
Overweight (>95 th percentile), <i>n</i> (%)	2 (4.3)
Ethnicity	
White/Caucasian, <i>n</i> (%)	54 (93.1)
Hispanic White <i>n</i> (%)	2 (3.4)
Asian or Pacific Islander, <i>n</i> (%)	1 (1.7)
Other, <i>n</i> (%)	1 (1.7)
Number of siblings	
<i>M</i> (<i>SD</i>)	1.14 (.999)
Range	0—5
Mothers	
Parental BMI status	
Underweight (below 18.5 kg/m ²), <i>n</i> (%)	3 (5.7)
Normal (18.5—24.9 kg/m ²), <i>n</i> (%)	15 (25.9)
Overweight (25.0—29.9 kg/m ²), <i>n</i> (%)	18 (34.0)
Obese (30.0 kg/m ² and above), <i>n</i> (%)	17 (32.1)
Highest level of school completed	
College graduate (4-year degree), <i>n</i> (%)	22 (37.9)
Graduate school, <i>n</i> (%)	18 (31.0)
Some or junior college (2-year degree), <i>n</i> (%)	14 (24.1)
High school graduate or GED, <i>n</i> (%)	3 (5.2)
Trade, technical, or vocational, <i>n</i> (%)	1 (1.7)
WIC participation directly after giving birth	
Yes, <i>n</i> (%)	15 (25.9)
No, <i>n</i> (%)	43 (74.1)

Table 2

Descriptive Data of Temperament, Parenting, Feeding, and Anthropometric Measures

<i>Maternal Feeding</i>	<i>n</i>	M	SD	Range
Undereating/Underweight Concerns	58	1.11	0.91	.00-3.75
Infant Hunger Concerns	58	0.46	0.57	.00-2.00
Awareness of Infant Cues	58	3.42	0.49	2.25-4.00
Overeating/Overweight Concerns	58	0.53	0.64	.00-3.00
Infant Feeding Schedule	58	1.53	1.10	.00-4.00
Food to Calm	58	1.60	0.85	.00-3.50
Social Interaction During Feeding	58	3.22	0.59	1.50-4.00
<i>Infant Temperament</i>	<i>n</i>	M	SD	Range
Surgency	56	3.71	0.56	2.35-4.86
Effortful Control	56	3.72	0.32	2.98-4.48
Negative Affectivity	56	1.68	0.49	0.85-2.86
<i>Parenting Style</i>	<i>n</i>	M	SD	Range
Authoritarian	54	30.52	5.48	16.00-42.00
Authoritative	54	41.37	3.87	34.00-50.00
Permissive	54	19.50	4.06	11.00-30.00
<i>Anthropometrics</i>	<i>n</i>	M	SD	Range
Infant Weight-for-Length	48	-0.18	1.06	(-2.86)-2.69
Maternal z-BMI	53	27.25	4.88	16.11-36.57

Note. $N = 58$, therefore missing data is reflected in n for each factor.

Table 3

Bivariate Correlations among Variables of Interest

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Maternal Feeding</i>															
1. Undereating/Underweight Concerns	--	-.04	-.37**	-.10	.18	-.13	.21	-.06	-.23	.25	.15	.07	.08	-.19	.18
2. Infant Hunger Concerns		--	.04	-.19	-.19	-.12	-.20	-.23	-.22	.26	.04	.15	-.05	-.07	-.13
3. Awareness of Infant Cues			--	-.34**	-.14	.04	-.06	.26*	.25	.01	-.28*	.02	-.21	.28	-.08
4. Overeating/Overweight Concerns				--	.16	-.01	-.02	-.02	-.03	-.05	.08	.05	.17	-.01	.02
5. Infant Feeding Schedule					--	-.21	.13	-.01	-.03	.17	.20	.29*	-.13	.09	.09
6. Food to Calm						--	-.17	.04	-.25	-.24	.06	.03	.03	-.02	-.14
7. Social Interaction During Feeding							--	.05	.05	.06	.01	.03	-.14	-.04	.04
<i>Infant Temperament</i>															
8. Surgency								--	.12	.05	.12	.21	.04	-.03	-.10
9. Effortful Control									--	-.23	-.33*	.03	.18	.13	.24
10. Negative Affectivity										--	.37**	.00	-.23	.01	.23
<i>Parenting Style</i>															
11. Authoritarian											--	-.02	-.17	-.34*	-.10
12. Authoritative												--	-.08	.05	-.06
13. Permissive													--	.07	.11
<i>Anthropometrics</i>															
14. Infant Weight-for-Length														--	.18
15. Maternal z-BMI															--

* $p < .05$, 2-tailed Pearson's r

** $p < .01$, 2-tailed Pearson's r