Abstract

Background

Firstborn children are more likely to have obesity than secondborns, which may partially be explained by differential use of food to soothe infant distress, which has been inked to higher weight status.

Objectives

To test associations between birth order and maternal food to soothe and whether differences in sibling temperament and BMI *z*-scores were associated differences in maternal food to soothe.

Methods

Random effects models assessed associations between birth order and food to soothe. Linear regressions examined associations between differences in maternal food to soothe and sibling differences in temperament at 16 weeks and BMI *z*-scores at 1 year.

Results

Mothers (n=117) used contextual-based food to soothe more with firstborns than secondborns (2.69 vs. 2.39, p<0.0001). Sibling differences in negative affect were associated with differences in maternal contextual-based (R^2=0.09, p=0.002) and emotion-based (R^2=0.09, p=0.003) food to soothe. Sibling differences in effortful control were associated with differences in maternal emotion-based food to soothe (R^2=0.04, p=0.04). Finally, differences in maternal emotion-based food to soothe were associated with sibling differences in BMI *z*-scores at age 1 year (R^2=0.14, p=0.0001).

Conclusions

To promote healthy child weight, mothers should learn to respond to each child's temperament and use alternatives to food to soothe infant distress.

Introduction

Firstborn children are more likely to have obesity than their younger siblings,[1,2] despite secondborn siblings being more likely to experience an adverse prenatal environment (i.e., higher maternal pre-pregnancy BMI, risk for gestational diabetes, and higher birthweight).[3] The parenting literature shows that mothers spend more time interacting with firstborns compared to second and laterborns during infancy.[4] However, quantity does not necessarily equal quality, and between-family comparisons reveal that mothers of firstborns are also more likely to use coercive, controlling, interfering, extreme, or inconsistent parenting strategies than mothers of laterborn children.[5] Such non-responsive parenting practices are thought to promote overweight status during infancy.[6] Findings that firstborns are more likely to have obesity may be partially explained by inexperienced, first-time mothers using more controlling (e.g., pressure, food to soothe) than responsive (e.g., regular mealtime routines) feeding practices compared to experienced mothers.[7]

Food to soothe (FTS) is defined as a non-responsive, control-based feeding practice whereby a caregiver offers distressed but nonhungry infants food in order to calm them,[8] thereby potentially increasing the risk of overweight during infancy.[8,9] Additionally, FTS may be associated with children learning to eat in response to emotional states, overriding their ability to regulate their food intake (i.e., eat when hungry, stop eating when full). Indeed, maternal use of FTS has been associated with increased emotional eating,[10] less healthy dietary patterns (e.g., energy dense snack foods, less fruit and vegetable intake),[11] and eating in the absence of hunger during later childhood.[12] Negative affect (i.e., fussiness) and surgency (i.e., extraversion) also have been linked to FTS,[8,9,13,14] in that infants who are higher in negative affect and/or surgency may evoke this feeding practice, resulting in higher risk for overweight; in contrast, infant effortful control (such as manifested in emotion regulation) may be protective.[9,15-18]

Reflecting most obesity research to date, examinations of FTS have focused on one child per family, despite national data indicating that approximately 80% of US children < 18 years old have at least one sibling.[19] Studies that capture the characteristics and experiences of more than one child in a family by using a sibling design, however, can provide unique insights into family processes and child outcomes that between-family comparisons (of children from different families) cannot. Because siblings share stable family background and family member characteristics (e.g., socioeconomic status, parental education and work involvement, parental personality), within-family comparisons of siblings implicitly control for a range of third variables—whether measured or not-- that may otherwise explain child outcomes.[20] Although randomized controlled trials are the standard for identifying causal effects, they are not always possible for both practical and ethical reasons. Thus, in this analysis we used a sibling design to better illuminate whether maternal FTS practices are driven by child characteristics and whether those maternal practices lead to higher weight status in infancy.

Individual differences in characteristics such as gender, temperament, personality, or cognitive ability make siblings distinct from one another[21] and may influence how mothers feed their infants--ultimately resulting in sibling differences in weight status. Prior research on siblings shows that both mothers and fathers tailor their parenting behaviors to such child individual characteristics. A meta-analysis of twin studies found a heritability estimate of 23% for parenting negativity and positivity, suggesting that genetically grounded characteristics of children may partially explain individual differences in certain parenting behaviors, thus highlighting the role children can play in shaping parenting practices.[22] That is, because siblings interact differentially with their parents, their parents, in turn, may treat them differently.[23]

In this analysis, we focused on one domain of parental behavior that has not yet been investigated using a sibling design: Maternal feeding in early infancy. Prior literature suggests that mothers may approach feeding siblings differently due to child characteristics like temperament that have been shown to be highly heritable.[22,24] We built on this literature to advance understanding of child characteristics that may shape mothers' use of FTS, specifically birth order and temperament.[7,8,22,24] The first aim of this secondary data analysis was to assess birth order effects on maternal use of FTS at infant age 16 weeks by assessing the same mothers' behaviors toward their two infants at the same age, but at different points in time, and testing the hypothesis that use of FTS would be more frequent in firstborn infants. The second aim was to determine whether sibling differences in temperament traits at 16 weeks were associated with differences in maternal FTS at 16 weeks, testing the hypothesis that larger sibling differences in temperament (negativity, surgency, effortful control) would be positively associated with larger sibling differences in maternal use of FTS. An additional, exploratory aim was to test whether sibling differences in maternal FTS at infant age 16 weeks were associated with sibling differences in BMI *z*-scores at 1 year of age.

Methods

Participants

The Intervention Nurses Start Infants Growing on Healthy Trajectories (INSIGHT) study is a randomized clinical trial comparing a responsive parenting (RP) intervention designed to prevent childhood obesity in firstborn infants versus a safety control intervention aimed at mother-child dyads.[25] Maternal eligibility criteria included English speaking, at least 20 years old, and generally healthy. Newborns had to be full-term, healthy and singleton, with a birthweight of at least 2500g. Mothers provided written consent while still in the hospital; they were contacted 10–14 days following childbirth and randomized to a study group. Nurses delivered interventions to first-time mothers and their infants at 4 home visits in the first year after birth, followed by clinical research center visits at ages 1, 2, and 3 years.

Mothers participating in INSIGHT were invited to participate in an ancillary observation-only study involving secondborn siblings (*n*=117), SIBSIGHT, following the birth of their second child. Inclusion criteria for the secondborn included singleton infants ≥36 weeks of gestation, no medical conditions that would impact feeding, birthweight ≥2250g, and families planning to live in Central Pennsylvania for one year following the birth of their secondborn. While the inclusion criteria were slightly different for SIBSIGHT, no secondborns were delivered <2500g or <37 weeks gestation. SIBSIGHT data were collected in homes at 3–4, 16, and 28 weeks and at a clinical research center at child age 1 year. The INSIGHT and SIBSIGHT studies were approved by the Human Subjects Protection Office of the Penn State College of Medicine.

Responsive Parenting Intervention Feeding Components

The RP intervention included guidance on infant feeding, sleep, emotion regulation, and interactive play. RP feeding guidance included teaching mothers to recognize and respond appropriately to hunger and fullness cues, alternative soothing strategies, and use of structure-based, non-controlling feeding practices that allow the child to drive intake through shared control of the initiation and termination of feeding. More details on study design, recruitment/eligibility, measures and a CONSORT diagram, have been previously published.[25]

Measures

Background Characteristics

Demographic information was collected at enrollment into INSIGHT and updated at enrollment in SIBSIGHT. Race/ethnicity was collected using categories consistent with National Institutes of Health enrollment tables. Maternal age and pre-pregnancy weight and infant sex, birthweight and gestational age were extracted from medical records.

Food to Soothe

A modified version of the 12-item Baby's Basic Needs questionnaire (BBN)[26] assessed maternal use of FTS with each sibling at 16 weeks of age. This 10-item instrument was adapted to include contexts and situations where a mother could use FTS with a nonhungry infant. Mothers were asked to endorse the frequency of using FTS on a scale from 1= "Never" to 5= "Always," with an option for "Does not Apply." Two items from the original scale were removed at this 16-week time point since they were not developmentally appropriate. Subscales used in this analysis include contextual-based and emotion-based FTS. Higher scores in contextual-based FTS reflect greater use in particular situations (i.e., in a doctor's waiting room, in the car, before bed). Higher emotion-based FTS scores indicate greater use in response to either the infant's distress, or maternal stress, frustration, or anger. Cronbach's alphas ranged from 0.74-0.90 for first and secondborns.

Temperament

Infant temperament was assessed using the validated, 37-item Infant Behavior Questionnaire-Revised Very Short Form (IBQ-R VSF)[27] when each sibling was 16 weeks of age. Mothers were asked to rate the frequency of specific infant behaviors over the past week, using a scale from 1= "Never" to 7 = "Always," with an additional option for "Does not apply." Analyses focused on 3 factors: negative affect (e.g., How often did your baby seem angry (crying and fussing) when you left her/him in the crib?), surgency (e.g., How often during the last week did your baby move quickly toward new objects?) and effortful control (e.g., When singing or talking to your baby, how often did s/he soothe immediately?). Cronbach's alphas ranged from 0.74-0.83 for first and secondborns.

BMI *z*-score

At the 1-year study visit for each sibling, infant weight and recumbent length were measured by trained research nurses. Weight was measured in duplicate to the nearest 0.1 kg using an electronic scale (Seca 354). Recumbent length was measured in duplicate to the nearest 1 cm using a portable stadiometer (Shorr Productions). A third measurement was taken when weight and length differed by more than 0.05 kg and 1 cm, respectively. Multiple measures were averaged. Infant weight for age and length for age were converted to BMI *z*-scores using World Health Organization growth standards.[28]

Statistical Analysis

Birth Order Effects on FTS at 16 weeks

Separate random effects models using PROC MIXED in SAS version 9.4 (SAS Institute Inc., Cary, NC) examined FTS subscales as the dependent variables to determine if they differed as a function of birth order, with "family" (family ID) treated as a random effect. Mixed models using maximum likelihood estimation are robust in correcting for missing data.[29,30] Interactions with intervention study group were explored and when nonsignificant, interactions were removed; study group was retained in all models as a covariate.[31]

Sibling Differences in FTS at 16 weeks

Complete case analysis was conducted for all models (PROC GLM). Sibling differences in both temperament and in maternal use of FTS were calculated by subtracting scores for firstborns from scores for secondborns following Farrow and colleagues.[32] Pearson bivariate correlations revealed that sibling differences in temperament were correlated with differences in maternal FTS. Next, linear regression models were estimated to assess the links between sibling differences in dimensions of temperament (the predictors) and sibling differences in maternal contextual-based and emotion-based FTS (dependent variables), controlling for secondborn temperament so as to isolate the effects of temperament differences.[33] Finally, to further investigate directionality, logistic regression adjusting for study group was run to determine if higher secondborn temperament compared to firstborns was associated with higher use of FTS in secondborns compared to firstborns.

Sibling Differences in BMI z-scores at 1 Year

A second set of linear regression models explored whether differences in maternal FTS at 16 weeks were associated with sibling differences in BMI *z*-scores at 1 year. In a preliminary step, covariates were explored for all models included sibling differences in maternal pre-pregnancy BMI, gestational age, and birthweight as well as the sibling dyad's age spacing and sex constellation (same vs. different). These were tested independently and retained if significant. All models also were adjusted for intervention study group a priori. The alpha level was set at $p < 0.05$.

Results

Mothers were predominantly White, non-Latinx, married and had incomes >$50,000 (Table 1). At secondborn age 1 year, all 117 (100%) families remained in the trial. Secondborns (n=117) were delivered 30.2 ± 10.2 months after firstborns. Mothers had higher pre-pregnancy BMIs with their secondborns. Firstborns had higher mean gestational ages than secondborns. There were no significant differences in baseline characteristics by study group.

Birth Order Effects on Food to Soothe at 16 weeks

As shown in Figure 1, the random effects models adjusting for study group revealed that mothers used contextual-based FTS more frequently with firstborns than secondborns (2.69 vs. 2.39, $p < 0.0001$), but there were not birth order differences in emotion-based FTS. Study group did not moderate birth order effects on FTS.

Sibling Differences in FTS at 16 weeks

Sibling differences in negative affect were positively correlated with differences in maternal use of contextual-based (r=0.32, p=0.002) and emotion-based (r = 0.29, p=0.006) FTS: When siblings differed more in their negative affect, they also differed more in maternal use of contextual-based and emotion-based FTS. There were no correlations between sibling differences in either surgency or effortful control and differences in maternal FTS. In the next step, linear regression models confirmed these correlational results, showing that sibling differences in negative affect were positively associated with sibling differences in maternal contextual-based FTS (Model set 1; B=0.26; 95% CI :0.10, 0.43; p=0.002) and emotion-based FTS (Model set 2; B=0.29; 95% CI:0.10, 0.47; p=0.003) (Table 2). Specifically, a 1-unit sibling difference in negative affect was associated with a 0.26-unit difference in maternal contextual-based FTS as well as a 0.30-unit difference in maternal emotion-based FTS. Further, sibling differences in effortful control were positively associated with differences in maternal emotion-based FTS (Model set 2; B=0.27; 95% CI: 0.006, 0.53; p=0.04; Table 2). Here, a 1-unit sibling difference in effortful control was associated with a 0.27-unit difference in maternal emotion-based FTS. Sibling differences in surgency, however, were not associated with differences in maternal contextual-based or emotion-based FTS (all *p*s > 0.05).[34] Results of the logistic regression analyses revealed that when secondborns were higher in negative affect compared to the firstborn, mothers were 0.32 [CI: 0.13-0.83; p=0.02] times less likely to use more contextual-based FTS with the secondborn compared to the firstborn. Adjusting for study group did not change the outcome. For the other temperament subscales, there was no significant relationship between higher secondborn temperament compared to firstborn and higher secondborn FTS compared to firstborn.

Sibling Differences in BMI z-scores at 1 Year

As shown in Table 3, differences in maternal emotion-based FTS at 16 weeks were positively associated with sibling differences in BMI *z*-scores at 1 year (*B*=0.49; 95% CI: 0.24, 0.74; *p*=0.0001): A 1-unit difference in maternal emotion-based FTS was associated with a 0.49-unit sibling difference in BMI *z*-scores. However, differences in maternal contextual-based FTS were not associated with sibling differences in BMI *z*-scores at 1 year.

Discussion

This analysis contributes to the literature on maternal feeding in infancy, moving beyond prior between-family comparisons using longitudinal data to examine within-family differences in sibling temperaments, maternal FTS, and sibling BMI *z*-scores, all measured when siblings were approximately the same ages, at different points in time. Findings revealed that, on average, mothers used more contextual-based FTS but not emotion-based FTS with firstborns than with secondborns. By comparing children from the same families using a sibling design, we were able to rule out third variables that otherwise may have explained this birth order difference. Findings also suggested that infant temperament may have implications for maternal use of FTS. Again, because our sibling design implicitly controls for the effects of family characteristics, we were better able to isolate the effects of child temperament on maternal feeding. In particular, mothers who perceived differences negative in affect between their infants (when each was age 16 weeks) also used different amounts of contextual-based and emotion-based FTS. Further, mothers who perceived differences in effortful control between their infants used different amounts of emotion-based FTS. Lastly, differences in maternal emotion-based FTS at 16 weeks were associated with sibling differences in weight status at age 1 year.

The family systems process of mothers' learning from experience may partially explain birth order effects on feeding. Prior research consistent with such experiential learning that used a sibling design shows that parents exhibited more effective parenting, including lower conflict and higher levels of warmth and knowledge with secondborn as compared to firstborn siblings.[7,35,36] Evidence in the feeding domain is limited to between-family comparisons, but findings from the 1970s demonstrated that first-time mothers were less responsive to their newborn infants' hunger and fullness cues in the hospital than multiparous mothers. [37-40] Our findings that mothers used FTS more frequently with their firstborn infants than with their secondborns provides further support for the operation of an experiential learning process in that mothers may become more competent in responsive feeding through the learning process while feeding their firstborn and are better able to interpret hunger/fullness cues, thus using less FTS. In contrast to our findings, another explanation in the parenting literature is that, with the arrival of a secondborn, mothers must divide their time, resources, attention and affection between two children and thereby are less able to be responsive to laterborn as compared to firstborn children.[41] Indeed, one early study of parenting that used a sibling design documented that mothers spent significantly less time in social, affectionate, and caregiving interactions with their secondborns than they had with their firstborns,[4] suggesting they may have less time to soothe secondborns using any technique, thus leading secondborns to develop better self-soothing strategies. However, the findings from the current analysis, building upon classic feeding studies, suggest that mothers may be *less* responsive with their firstborns than their secondborns when it comes to feeding-- using more FTS with those children, possibly due to their inexperience. More work is needed to test this learning from experience explanation along with alternative hypotheses, by including additional siblings and focusing on other feeding practices and other time points across child development.

The birth order effects we observed were limited to contextual-based FTS, that is use of FTS in particular situations (i.e., in a doctor's waiting room, in the car, before bed) to prevent or stop infant fussing.[8] One reason for birth order differences in contextual-based but not emotion-based FTS may be that first-time mothers have lower maternal self-efficacy and higher postpartum anxiety than multiparous mothers.[42] Consistent with this interpretation, Stifter and colleagues reported that mothers who had less confidence in their parenting were more likely to use FTS.[8] With lower self-efficacy, first time mothers may be less confident and more reactive to infant crying in public setting, resulting in greater use food as a quick and effective strategy to calm their firstborn infants. However, self-efficacy alone may not be enough to decrease the use of FTS. Knowledge gained over time also may influence mothers' feeding of siblings, as parenting studies show that mothers who reported high self-efficacy but low knowledge of child development were the least sensitive with their infants.[43] This suggests that mothers may have been overly confident in parenting their infants, yet had knowledge gaps about parenting, highlighting the potential significance of knowledge that can be gained from experience with a firstborn. Findings from our analysis are consistent with this explanation, given that mothers used less contextual-based FTS with secondborns.

Prior research has linked infant temperament to maternal use of FTS[8,9,44] and other control-based feeding practices.[45] The current analysis expands upon previous work in its use of a longitudinal, sibling design. A sibling design engenders greater confidence that the observed linkages were not driven by stable third variables such as maternal and family characteristics—because these are shared by both siblings. In this way, our findings provide strong evidence that child temperament may elicit maternal use of FTS, although, over time, reciprocal directions of effect likely evolve as mothers influence their children's eating habits and in turn, children further influence mothers' feeding practices. Our results further show that sibling differences in effortful control were linked to sibling differences in emotion-based FTS, that is, maternal use of FTS in response to infant distress and/or maternal stress, frustration, or anger.[8] Effortful control is one element of child emotion regulation, which may help to explain this linkage.[46] In contrast to our hypothesis, however, we found no association between sibling differences in surgency and sibling differences in maternal use of FTS. Other studies have likewise reported null effects of surgency,[8] though some have linked surgency to infant weight status[15,16] and documented its role as moderator in the association between FTS and child weight outcomes.[9] Clearly, further research on how surgency operates in maternal feeding and child overweight is warranted.

Our results also revealed an association between sibling differences in maternal emotion-based, but not contextual-based FTS at 16 weeks and sibling differences in BMI *z*-scores at 1 year. Maternal use of emotion-based FTS is often reactive to their own or their children's emotions[8] and feeding interactions are often bidirectional in nature.[47] Therefore, more work is needed to explore how emotion-based and contextual-based FTS differentially impact child weight status. Our findings at 1 year of age are consistent with other studies that have examined FTS and BMI *z*-scores in infancy and toddlerhood. For example, in their study of families of infants and toddlers, Stifter and colleagues documented that mothers who reported using FTS had children with higher BMI *z*-scores.[8] Yet, other studies that used between-family designs yielded mixed results regarding these linkages at different points across development.[13,48-50] In such studies, third variable effects may have obscured the associations of interest. To our knowledge, this is the first analysis of maternal FTS and child BMI to use a longitudinal sibling design, and thus further work is needed to replicate the results observed here.

Our longitudinal sibling design with high participant retention was a key strength of this analysis, as were our multiple measures of infant temperament and maternal FTS. Although our reliance on maternal reports was subject to mono-reporter bias (which would inflate the similarity between mothers' reports of their FTS with their two children), mothers exhibited differential use of FTS. Although sibling differences in FTS were small, on average, they were nonetheless linked to both sibling differences in temperament and sibling BMI *z*-score differences.

Limitations of this analysis include its convenience sample that was almost all white, educated, two- parent families with infants. Future research should examine these processes in other sociocultural groups. Additionally, the measures used in this analysis did not include clinical cutoffs, and thus the clinical significance of the effects we observed is unknown. Future research should incorporate a range of measures of FTS such as observational data, and examine a broader swath of development to better understand whether FTS and BMI *z*-score linkages are maintained over time.

Despite these limitations, our analysis is the first to examine links between infant temperament, FTS and BMI *z*-scores using a sibling design. Taken together, findings suggest that mothers may develop specific feeding practices based on their parenting experience and also in response to each infant's temperament characteristics, practices that may ultimately lead to distinct weight outcomes for each sibling. Future studies drawing upon concepts from the parenting literature are needed to examine potential mechanisms behind birth order effects on maternal use of FTS, a control-based feeding practice in early childhood that can contribute to obesity risk. Understanding these family systems processes more fully and teaching mothers how to respond sensitively to each infant's temperament are important steps toward promoting children's healthy weight within families.

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Author Contributions

JSS and IMP designed the INSIGHT and SIBSIGHT studies; CFR, SMM, CHL conceptualized the research questions; CFR and MEM analyzed data; JSS, IMP, SMM, CHL provided feedback on analyses; CFR wrote the paper; CFR had primary responsibility for final content. All authors read and approved the final manuscript.

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Table 1. Demographic characteristics of mothers and consecutively born sibling dyads at the time of delivery

and variables of interest (n=117)		
	Firstborn	**Secondborn**
Randomization of Participants		
Responsive Parenting Intervention Group, *n* (%)[1]	57 (48.7)	57 (48.7)
Maternal Characteristics		
Pre-pregnancy BMI, kg/m^2	25.1 (5.1)	25.9 (5.5)*
Non-Latinx white, *n* (%)	109 (93.2)	109 (93.2)
Married, *n* (%)	107 (91.5)	111 (94.9)
Household income, *n* (%)	-	-
<$50,000	17 (14.5)	8 (6.8)
≥ $50,000	97 (82.9)	101 (86.3)
Don't know/refuse to answer/missing	3 (2.6)	8 (6.8)
Infant Characteristics		
Birthweight, kg, Mean (*SD*)	3.4 (0.4)	3.5 (0.4)
Sex= female, *n* (%)	62 (53.0)	67 (57.3)
Gestational age at delivery (in weeks)	39.6 (1.3)	39.4 (1.0)*
Birth spacing, Mean (*SD*) (in months)	-	30.2 (10.2)
Variables of Interest[2]		
Negative Affect, 16 weeks, Mean (*SD*)	3.35 (0.91)	3.36 (0.88)
Surgency 16 weeks, Mean (*SD*)	4.10 (0.91)	3.93 (0.91)
Effortful Control, 16 weeks, Mean *(SD*)	5.28 (0.70)	5.00 (0.73)*
Contextual-based food to soothe, 16 weeks, Mean (*SD*)	2.69 (0.73)	2.39 (0.87)*
Emotion-based food to soothe, 16 weeks, Mean (*SD*)	1.74 (0.87)	1.75 (0.97)
BMI *z*-score WHO adjusted, 1 year, Mean (*SD*)	0.41 (0.95)	0.54 (0.91)

Table 2. Sibling differences in infant negative affect and effortful control, but not surgency, were associated with differences in maternal use of food to soothe (FTS)[1]						
	Model Set 1 Differences in Maternal Contextual-based FTS			**Model Set 2 Differences in Maternal Emotion-based FTS**		
	***B* (95% CI)**	***p* value**	**R^2**	***B* (95% CI)**	***p* value**	**R^2**
Sibling Differences in Negative Affect						
Model	-	0.007	0.16	-	0.001	0.22
Intercept	0.08 (-0.59, 0.75)	0.81	-	0.65 (-0.11, 1.41)	0.09	-

Negative Affect	0.26 (0.10, 0.43)	0.002	0.09	0.29 (0.10, 0.47)	0.003	0.09
Sibling Differences in Surgency						
Model	-	0.18	0.08	-	0.01	0.16
Intercept	-0.41 (-1.21, 0.38)	0.31	-	-0.44 (-1.33, 0.44)	0.32	-
Surgency	0.04 (-0.14, 0.21)	0.67	0.002	-0.02 (-0.22, 0.17)	0.83	0.00
Sibling Differences in Effortful Control						
Model	-	0.22	0.07	-	0.009	0.17
Intercept	0.28 (-1.03, 1.58)	0.68	-	0.96 (-0.52, 2.44)	0.20	-
Effortful Control	0.14 (-0.09, 0.36)	0.23	0.02	0.27 (0.006, 0.53)	0.04	0.04

Table 3. Sibling differences in BMI *z*-scores were associated with differences in maternal use of emotion-based food to soothe (FTS) at 1 year[1]

	Sibling Differences in BMI z-score at 1 year		
	***B* (95% CI)**	***p* value**	R^2
Differences in Maternal Contextual-based FTS			
Model	-	0.02	0.12
Intercept	0.33 (-0.03, 0.68)	0.07	-
Contextual-based Food to Soothe	0.11 (-0.17, 0.39)	0.44	0.006
Differences in Maternal Emotion-based FTS			
Model	-	<0.0001	0.24
Intercept	0.12 (-0.23, 0.48)	0.49	-
Emotion-based Food to Soothe	0.49 (0.24, 0.74)	0.0001	0.14

Table and Figure Legends

Figure 1:
Birth order differences in food to soothe (FTS) from random effects models (Mean, *SD*). Mothers used significantly more contextual-based FTS with firstborns compared to secondborns. Model 1: AIC: 471.0, BIC: 476.5, Error Residual: 0.26; Model 2: AIC: 511.5, BIC: 517.0, Error Residual 0.33.
*$p<0.0001$
Birth order x Study Group interactions explored, but not significant

Table 1:
*Significant sibling difference $p<0.05$
[1]There were no significant differences in demographic characteristics by study group
[2]Key variables of interest for analysis: secondborn contextual-based FTS, first and secondborn emotion-based FTS varied by study group

Table 2:
[1]Models adjusted for sibling differences in gestational age, and birthweight, study group, and secondborn temperament

Table 3:
[1]Models adjusted for sibling differences in birthweight, dyad sex constellation and study group