Observed assertive and intrusive maternal feeding behaviors increase child adiposity1–3

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ABSTRACT

Background: Few studies have examined observed maternal feeding behaviors and their potential association with child adiposity. The association between maternal prompting to eat and child adiposity has been inconsistent.

Objectives: This study sought to identify factors associated with maternal feeding behaviors and to test the hypothesis that more maternal prompts to eat, more assertive prompts, and more intrusiveness are associated with greater child adiposity.

Design: Children (n = 1218) and their mothers were videotaped eating a standardized snack at ages 15, 24, and 36 mo. Maternal prompts to eat, the percentage of prompts that were assertive, and intrusiveness were coded. Adjusted regression analyses evaluated predictors of prompts, the percentage of assertive prompts, and intrusiveness and the relation of each of these factors with child adiposity (weight-for-length z score at 15 mo and BMI z score at 24 and 36 mo) after control for the child’s race-ethnicity, sex, and family income-to-needs ratio, and maternal education, weight status, and depressive symptoms.

Results: At 36 mo, mothers gave an average of 9.3 prompts; 61% of prompts were assertive, and 48% of mothers were intrusive. Lower maternal education and minority race-ethnicity were associated with a greater percentage of assertive prompts and intrusiveness. A greater percentage of assertive prompts and intrusiveness, but not total prompts, was associated with higher child adiposity.

Conclusions: Assertive prompting and an intrusive style had small but significant associations with greater child adiposity. Future work should focus on maternal motivations for assertive and intrusive feeding styles and mechanisms through which these feeding styles might increase child adiposity. Am J Clin Nutr doi: 10.3945/ajcn.111.024851.

INTRODUCTION

The Expert Committee Recommendations on the Assessment, Prevention, and Treatment of Child and Adolescent Overweight and Obesity (1) reported that there is consistent evidence that parents should, “allow the child to self-regulate his or her meals and avoid overly restrictive feeding behaviors.” The data associating maternal feeding behaviors with child weight status (2), however, have been inconsistent, particularly for feeding behaviors related to prompting or pressuring the child to eat, which have been positively (3, 4), negatively (5–15), and not (11, 16–21) associated with markers of child adiposity.

Testing the hypothesis that certain maternal feeding behaviors increase children’s adiposity is difficult because the suspect feeding behaviors tend to cluster within low-income and minority populations, which have a higher risk of childhood obesity (22, 23). Low-income mothers have been found to more frequently prompt their children to eat (16, 24), and low-income African American mothers, compared with other low-income groups, have been described as having a more authoritarian (25) and controlling (26) feeding style. Maternal feeding behaviors have typically been assessed by questionnaire, which has methodologic limitations (27). Since 1981, the few studies that have evaluated maternal feeding style by direct observation in association with child weight status have included a total of only ~200 child participants, and >80% of these participants have been white (3, 4, 10, 18, 28, 29). Larger samples that allow for control over potential confounders would allow for better understanding of the association between maternal feeding behaviors and child adiposity.

The current study used a cohort of >1200 children drawn from 10 US cities. Children were videotaped eating a standardized snack with their mothers at 3 time points across toddlerhood to address 2 objectives: 1) to identify maternal and child characteristics that are associated with observed maternal feeding behaviors, and 2) to test the hypothesis that more prompts, a greater percentage of prompts being assertive, and more intrusiveness are associated with greater child adiposity.

SUBJECTS AND METHODS

Subjects

In 1991, 1364 families were recruited to participate in the Eunice Kennedy Shriver NICHD5 SECCYD, which sought to...
examine child behavior and development over time in relation to childcare experiences. The study was conducted at 10 sites across the United States and used a conditional random sampling plan designed to prevent selection bias. Detailed information about the study design and procedures is available at http://www.nichd.nih.gov/research/supported/seccyd/overview.cfm. For the analyses reported here, the sample was restricted to subjects having at least one videotaped feeding interaction with contemporaneously measured child anthropometric measures, resulting in a sample of 1218 children and their mothers. The study was approved by the Institutional Review Boards of all relevant institutions.

Children were videotaped at ages 15, 24, and 36 mo while eating a snack with their mother in the laboratory. The snack procedure occurred in the context of a day-long research study visit during which the families were frequently being videotaped. The procedure was developed for the NICHD SECCYD based on the procedure used in the Clinical Nursing Models Study (30). A research assistant entered the room with a tray containing one slice of American cheese, a snack-sized box of raisins, several crackers, a small container of O-shaped toasted whole-grain oat cereal (Cheerios; General Mills), and a bottle of unsweetened apple juice. The mother was told, “Now it’s time to take a break and have a snack. I have a table and chairs here for you and [your child]. Here’s the snack on this tray. Go ahead and have some yourself. Let me know when you are finished.” The research assistant then left and the snack period was videotaped for 10 min. The video image included both mother and child.

Primary predictor: maternal feeding behaviors

Maternal feeding behaviors were coded from videotapes specifically used for this analysis and are not part of the coded data available as part of the NICHD SECCYD data set. On the basis of prior methods used by others (3, 4, 17, 18), 3 types of maternal prompts to eat were coded: 1) physical encouragements, defined as moving food in the child’s direction or handing the child food, giving the child a bite, or feeding the child; 2) verbal encouragements, defined as suggesting (eg, “You liked this when we had it at home”), commanding, or directing (eg, “Eat it.”) or making positive statements about the food (eg, “Wow, this is good!”). If the mother gave a string of verbal encouragements without ≥5 s between each statement, the episode was counted as a single verbal encouragement; and 3) verbal offers, defined as simply making a verbal food offer (eg, “Do you want more food?”). Directing the child to sit down or helping the child to open a container or pour juice after the child requested it were not considered prompts. If a mother delivered 2 prompt types simultaneously (eg, a verbal encouragement in conjunction with a physical encouragement), each was counted separately. From these 3 variables, 2 summary variables were created for this analysis: 1) total prompts, defined as the sum of all 3 prompt types, and 2) percentage of assertive prompts, defined as the percentage of total prompts that were either verbal or physical encouragements (as opposed to verbal offers).

Mothers were coded as intrusive if they displayed any evidence of intrusiveness during the interaction, even if it did not typify the majority of the interaction. With use of the Intrusiveness/Over Control Scale designed for the NICHD SECCYD Mother-Child Structured Interaction Task (31) as a guide, maternal intrusiveness during feeding was defined as maternal behavior that was adult-centered rather than child-centered, and imposed the mother’s agenda on the child. Examples of intrusive maternal behavior included the mother not allowing the child a “turn” or time to respond at his or her own pace, not allowing the child to make choices, overwhelming the child with a rapid succession of suggestions, insisting on the mother’s own agenda, overstructuring the interaction, frequently interrupting or redirecting, or excessively or abruptly disciplining the child. Maternal intrusiveness could have occurred even if the child was resigned to the intrusions and did not resist.

Each videotape was coded by ≥2 independent trained observers blinded to study hypotheses. Interrater reliability, as indexed by intraclass correlation coefficients or Cohen’s ρ as appropriate, exceeded 0.70 for all measures. Total prompts were not highly correlated across child age (r = 0.14 between ages 15 and 24 mo, r = 0.18 between ages 15 and 36 mo, and r = 0.30 between ages 24 and 36 mo). There was also little agreement in intrusiveness across age (Cohen’s ρ = 0.02 between ages 15 and 24 mo, 0.13 between ages 15 and 36 mo, and 0.07 between ages 24 and 36 mo). Only 2 prior studies have examined the stability of maternal feeding behaviors as children age. Although both found maternal behaviors to be stable, neither examined stability in the same age range as our study, and both of these prior studies used maternal self-report and not observed behaviors (11, 15). In addition, similar to our findings, others (3, 4, 13, 18) have also found that maternal feeding behaviors, particularly when they are observed (3, 4) and not self-reported, differ based on the child’s age. Therefore, in lieu of creating a summary score for maternal feeding behaviors across ages 15, 24, and 36 mo, behaviors measured at each age were included in the analysis.

To assess the validity of the maternal feeding behaviors coded specifically for this analysis, the resulting codes were compared with data available as part of the NICHD SECCYD data set that were hypothesized to be conceptually related. To evaluate convergent validity of the observed maternal feeding behaviors with maternal self-report, the total prompts observed at age 36 mo were compared with maternal response on a 4-point scale (“definitely no,” “mostly no,” “mostly yes,” or “definitely yes”) to the question “Do you let your child eat what he/she feels like eating?” from the Raising Children Questionnaire (32), which was administered at age 54 mo. Mothers who replied “definitely no” gave significantly more prompts (mean ± SD: 12.72 ± 7.32) in the observed videotaped feeding interaction at 36 mo than did mothers who replied “mostly no” (9.27 ± 5.32) or “mostly yes” (9.12 ± 5.43) (P < 0.05). To evaluate the convergent validity of maternal intrusiveness during feeding with maternal sensitivity and intrusiveness in the context of other mother-child interactions, the dichotomous ratings of maternal intrusiveness during the videotaped feeding interaction coded for this analysis were compared with the ratings of maternal sensitivity available as part of the NICHD SECCYD data set that were previously applied by a separate research team to the same mother-child dyads during a videotaped structured play interaction. This play interaction occurred at home within 2 wk of the feeding interaction at each age. At ages 15 and 24 mo, mothers were rated by NICHD SECCYD–trained observers in 3 domains, and a composite score representing maternal sensitivity was calculated by the NICHD SECCYD with a range of 3–12; higher scores represent greater sensitivity. At 36 mo, the composite score was created similarly, but with a range of 3–21. Mothers coded in this analysis as intrusive during feeding were rated by the NICHD SECCYD as...
less sensitive during the contemporaneous home play interaction at 15 mo \( (9.23 \pm 1.80 \text{ compared with } 9.58 \pm 1.50; P < 0.01) \), 24 mo \( (8.99 \pm 1.85 \text{ compared with } 9.60 \pm 1.65; P < 0.001) \), and 36 mo \( (16.69 \pm 2.99 \text{ compared with } 17.71 \pm 2.51; P < 0.001) \). The home play interaction was also rated by the NICHD SECCYD for intrusiveness at 24 mo on a scale of 1 to 4; higher scores indicate more intrusiveness. Mothers coded as intrusive during feeding in this analysis were coded by the NICHD SECCYD as significantly more intrusive during the home play interaction \( (1.60 \pm 0.82 \text{ compared with } 1.40 \pm 0.65; P < 0.001) \). Consistent with the observation of only modest stability in maternal feeding behaviors coded for this analysis between 15, 24, and 36 mo, maternal sensitivity coded by the NICHD SECCYD during home play interactions likewise had only modest stability \( (r = 0.40–0.49) \).

Finally, the validity of the observed maternal prompts coded for this analysis was further tested by evaluating the percentage of the prompts with which the child complied. Child compliance with maternal prompts was defined by using prior methods \( (33) \) as food passing prompts with which the child complied. Child compliance with this analysis was further tested by evaluating the percentage of the prompts that the child complied with maternal prompts with which the child complied. Child compliance with maternal prompts was defined by using prior methods \( (33) \) as food passing prompts with which the child complied. Child compliance with maternal prompts was defined by using prior methods \( (33) \) as food passing prompts with which the child complied. Child compliance with maternal prompts was defined by using prior methods \( (33) \) as food passing prompts with which the child complied.

**Primary outcome: Child anthropometric measures**

Child anthropometric measures were obtained with the use of a standardized protocol by trained research assistants during laboratory visits, and \( z \) scores were calculated on the basis of growth charts of the US CDC. Child weight and length were measured at age 15 mo, and weight-for-length \( z \) scores were calculated. Child weight and height were measured at 24 and 36 mo and BMI \( z \) score calculated. Weight-for-length and BMI \( z \) scores are referred to collectively as adiposity \( z \) scores. Child weight status was also examined as “overweight” compared with “not overweight” based on an adiposity \( z \) score \( \geq 85 \text{th percentile for age and sex.} \)

**Covariates**

Mothers reported the child’s sex, race and ethnicity, the family’s income \( (15, 24, \text{ and } 36 \text{ mo}) \), and their own years of education at the time of the child’s birth. Race-ethnicity was included as “non-Hispanic white” compared with “Hispanic or not white.” The ITNR \( (\text{total family income relative to the poverty level for a family of a particular size}) \) was calculated. Mothers reported depressive symptoms on the CES-D scale \( (34) \). CES-D scores range from 0 to 60; higher scores indicate more severe depressive symptoms, and a score of \( \geq 16 \) is considered clinically significant.

The NICHD SECCYD data set does not include measured maternal weight or height contemporaneous with the child’s anthropometric data. Figure ratings based on pictorial scales correlate with actual measured weight status \( (35–37) \), with \( r = 0.87 \) using the 9-point Stunkard Figure Rating Scale \( (35) \) with videotape images and BMI \( (38) \). Mothers’ images on videotape when the child was 15 mo \( (n = 1114) \), 24 mo \( (n = 1161) \), and 36 mo \( (n = 1175) \) were therefore assigned a figure rating from the Stunkard Figure Rating Scale from 1 to 9; higher ratings represent a higher BMI. Mothers’ entire bodies were viewable, standing as they entered the room with the child and then as they sat at the table. Each videotape was coded by 2 independent trained observers; intraclass correlation coefficients exceeded 0.80. Data points at which the mother was pregnant were excluded \( (n = 48 \text{ for } 15 \text{ mo}, n = 69 \text{ for } 24 \text{ mo}, \text{ and } n = 358 \text{ for } 36 \text{ mo}) \). Maternal figure ratings were correlated across ages \( (r = 0.72 \text{ for each correlation between } 15 \text{ and } 24 \text{ mo, } 15 \text{ and } 36 \text{ mo, and } 24 \text{ and } 36 \text{ mo}) \). The mean maternal figure rating when the child was 15, 24, and 36 mo of age \( (n = 1235) \) correlated with maternal BMI 12–14 y later when the child was 15 y of age based on maternal self-reported weight and height \( (n = 912; r = 0.74) \). This somewhat moderate degree of correlation over time is consistent with the high prevalence of significant weight fluctuation among women in this age range \( (39) \).

Of the 1364 participants recruited at birth, 1250 children participated in at least one videotaped feeding interaction at ages 15, 24, or 36 mo and had codable videos. Of these, 17 were excluded because of missing child anthropometric data, and 15 were excluded because there was no tape of the mother while not pregnant. Of these remaining 1218 children, 707 \( (58.1\%) \) had all 3 videos, 379 \( (31.1\%) \) had 2 videos, and 132 \( (10.8\%) \) had 1 video. The 1218 children included in this analysis did not differ by sex from the 146 children in the original cohort not included \( (P = 0.13) \); however, they were more likely to be non-Hispanic white \( (77.3\% \text{ compared with } 68.5\%; P = 0.02) \), and their mothers had more years of education \( (14.4 \text{ compared with } 13.2; P < 0.001) \). Of the 1218 subjects included in this analysis, subjects contributing more observations were more likely to be non-Hispanic white \( (P < 0.05) \) and to have mothers with more education \( (P < 0.01) \). Subjects contributing more observations had a lower adiposity \( z \) score at age 15 mo \( (P < 0.05) \), but there were no differences in adiposity \( z \) scores at other ages. Subjects contributing more observations also had mothers who gave more total prompts at age 15 mo \( (P < 0.05) \), but there were no differences in total prompts at other ages. The number of observations a subject contributed was not associated with the percentage of assertive prompts or maternal intrusiveness at any age.

**Statistical analysis**

All analyses were conducted by using SAS 9.2 \( (\text{SAS Institute}) \). Univariate descriptive statistics were used to describe the sample. Relative rates, parameter estimates and ORs, each with 95% CIs, were calculated as appropriate.

To address the second objective of this study, adjusted Poisson, linear, and logistic regression models were used to predict total prompts, percentage of assertive prompts, and intrusiveness. Covariates in the models were the child’s sex and race-ethnicity, family ITNR, and maternal education, depressive symptoms, and figure rating. Analyses were stratified by age based on preliminary models showing interactive effects with age.

To address the second objective of this study, generalized estimating equations, accounting for repeated measures within subjects, were used to create a series of models, all of which predicted child adiposity \( z \) scores across ages 15, 24, and 36 mo. In these models, estimates were adjusted for the child’s age, sex,
and race-ethnicity; family ITNR; and maternal education, depressive symptoms, and figure rating. All variables, with the exception of the child’s sex and race-ethnicity and maternal education were included as time-varying covariates. Model 1 evaluated the main effect of total prompts. Model 2 also included the percentage of assertive prompts. Model 3 included only the percentage of assertive prompts, and excluded total prompts. Model 4 added the main effect intrusiveness to model 3. Model 5 tested the main effect of intrusiveness without total prompts or the percentage of assertive prompts. Additional models tested whether there was a significant interaction between the main effects of percentage of assertive prompts and intrusiveness as well as each of these main effects with child sex. The final model was repeated predicting adiposity $z$ score and whether or not the child was overweight at 36 mo, with control for adiposity $z$ score at 15 mo.

**RESULTS**

At age 36 mo, the child sample was 50.0% male, 78.5% non-Hispanic white, and 18.7% overweight. The mean (±SD) family ITNR was 3.5 ± 3.1, maternal education was 14.4 ± 2.5 y, maternal CES-D score was 9.1 ± 8.4, and maternal figure rating was 4.8 ± 1.5. Frequencies of maternal feeding behaviors by child age are shown in Table 1. The adjusted models predicting total prompts, percentage of assertive prompts, and intrusiveness are shown in Table 2. Child sex was not a significant predictor of any maternal feeding behavior at any age. Minority race-ethnicity predicted a greater percentage of assertive prompts at ages 15 and 24 mo and more intrusiveness at ages 15 and 36 mo. Higher family ITNR was associated with more total prompts at 15 mo, but not at later ages, and was not associated with any other maternal feeding behaviors. Lower maternal education was associated with more total prompts at 24 and 36 mo, a greater percentage of assertive prompts at 24 mo, and more intrusiveness at all ages. More maternal depressive symptoms were not associated with any maternal feeding behavior at any age. A higher maternal figure rating was associated with more total prompts at 24 mo but was not associated with any other maternal feeding behaviors.

The adjusted models predicting child adiposity $z$ scores across ages 15, 24, and 36 mo are shown in Table 3. No main effect of total prompts (model 1) was observed. Percentage of assertive prompts was significant when added to the model, and total prompts remained nonsignificant (model 2). Exclusion of total prompts did not change the main effect of percentage of assertive prompts (model 3). Percentage of assertive prompts and intrusiveness each had significant and independent main effects (model 4). The main effect of intrusiveness was not affected by percentage of assertive prompts (model 5). Of the 5 models, model 4 had the lowest quasi-likelihood information criteria (40), indicating the best fit, and was therefore considered to be the most parsimonious model. Subsequent analyses were performed with model 4 only. No significant interactions were found between the percentage of assertive prompts and intrusiveness ($P = 0.23$), percentage of assertive prompts and sex ($P = 0.32$), or intrusiveness and sex ($P = 0.56$).

In the replication of model 4 predicting adiposity $z$ score at 36 mo, while controlling for adiposity $z$ score at 15 mo, there was no significant main effect of percentage of assertive prompts ($β = 0.03; 95\% CI: -0.30, 0.36$) or of maternal intrusiveness ($β = -0.09; 95\% CI: -0.21, 0.02$). In the same model predicting the child being overweight at age 36 mo, there was also no significant main effect of percentage of assertive prompts (OR: 1.62; 95\% CI: 0.48, 5.50) or intrusiveness (OR: 0.74; 95\% CI: 0.48, 1.14). The models in Tables 2 and 3 were repeated in the subsample of 707 subjects who contributed observations at all 3 ages, and the results did not change (data not shown).

**DISCUSSION**

Our findings for maternal and child characteristics that are associated with maternal feeding behaviors support and extend most of the prior literature. Our finding that lower maternal education was associated with more prompting, a greater percentage of assertive prompts, and intrusiveness is consistent with some prior studies (16, 41), but not others (13, 14). The studies that were not consistent with our findings tended to have more homogeneous samples, which may explain their null findings. Our finding that minority race-ethnicity was associated with more prompting, a greater percentage of assertive prompts, and intrusiveness was also consistent with prior studies with a similar degree of racial-ethnic diversity in their cohorts (6, 42); one prior study that was relatively homogeneous did not identify a significant association with race-ethnicity (13). Consistent with most (6, 13, 18), but not all (4), prior studies, we found no relation between child sex and maternal feeding behaviors. The single study finding that boys received more prompts to eat was focused on an older age range with a small, homogenous sample. It is difficult to compare our findings for family ITNR with prior literature, because we found only one prior study that examined this relation, and its sample was relatively small and homogeneous (14). We did not

<p>| TABLE 1 |</p>
<table>
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<th>Maternal feeding behaviors by children’s age</th>
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<tr>
<td><strong>Behavior</strong></td>
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<td><strong>Physical encouragements</strong></td>
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<td><strong>Verbal encouragements</strong></td>
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<td><strong>Verbal offers</strong></td>
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<td><strong>Total prompts</strong></td>
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<td><strong>Percentage of assertive prompts</strong></td>
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<td><strong>Intrusiveness (%)</strong></td>
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$^1$ Mean ± SD; range in parentheses (all such values).
| TABLE 2 | Adjusted models predicting total prompts, percentage of assertive prompts, and intrusiveness at different ages |
|----------------------------------|----------------------------------|----------------------------------|
|                                  | Total prompts | Percentage of assertive prompts | Intrusiveness |
|                                  | 15 mo | 24 mo | 36 mo | 15 mo | 24 mo | 36 mo | 15 mo | 24 mo | 36 mo | 15 mo | 24 mo | 36 mo |
| No. of subjects                  | 917   | 854   | 741   | 916   | 854   | 739   | 917   | 854   | 741   | 917   | 854   | 741   |
| Female child (vs male child)     | 0.98 (0.92, 1.04) | 0.95 (0.89, 1.02) | 0.96 (0.88, 1.04) | -0.32 (-2.55, 1.91) | 0.18 (-2.53, 2.88) | 1.12 (-1.89, 4.12) | 0.96 (0.74, 1.25) | 0.93 (0.69, 1.25) | 0.81 (0.60, 1.09) |
| Non-Hispanic white child (vs not) | 0.97 (0.90, 1.04) | 0.98 (0.90, 1.07) | 1.08 (0.97, 1.20) | -3.92 (-6.76, -1.08) | -3.46 (-6.61, -0.30) | 0.16 (-3.67, 4.00) | 0.68 (0.48, 0.95) | 0.84 (0.58, 1.22) | 0.64 (0.44, 0.93) |
| ITNR                             | 1.02 (1.01, 1.03) | 0.99 (0.98, 1.003) | 0.99 (0.98, 1.004) | -0.38 (-0.79, 0.03) | -0.46 (-0.94, 0.02) | -0.41 (-0.93, 0.11) | 1.03 (0.98, 1.08) | 0.96 (0.90, 1.04) | 0.97 (0.92, 1.03) |
| Maternal education (y)           | 0.99 (0.98, 1.01) | 0.97 (0.96, 0.99) | 0.98 (0.96, 0.997) | -0.48 (-1.00, 0.04) | -0.84 (-1.53, -0.16) | -0.14 (-0.83, 0.56) | 0.88 (0.83, 0.94) | 0.91 (0.84, 0.98) | 0.91 (0.85, 0.98) |
| Maternal CES-D score             | 0.998 (0.994, 1.002) | 1.00 (0.996, 1.004) | 1.01 (1.00, 1.01) | 0.02 (-0.13, 0.16) | -0.13 (-0.30, 0.04) | -0.01 (-0.17, 0.18) | 0.99 (0.97, 1.00) | 1.01 (1.00, 1.03) | 1.00 (0.98, 1.02) |
| Maternal figure rating           | 0.99 (0.97, 1.01) | 1.04 (1.01, 1.06) | 1.02 (0.997, 1.01) | 0.14 (-0.61, 0.89) | 0.73 (-0.17, 1.62) | 0.11 (-0.88, 1.10) | 0.95 (0.88, 1.04) | 1.07 (0.97, 1.19) | 1.04 (0.94, 1.15) |

1 95% CIs in parentheses. CES-D, Center for Epidemiologic Studies–Depression; ITNR, income-to-needs ratio. 
2 Values are relative rates from Poisson regression: a 1-unit change in the covariate predicts the relative change in the rate of total prompts (eg, a 1-y increase in maternal education at age 24 mo is associated with a change of 0.97 in the rate of prompts or a 3% decrease in the rate of prompts). 
3 Values are β coefficients from linear regression: a 1-unit change in the covariate predicts the change in percentage of assertive prompts [eg, at 15 mo, non-Hispanic white (vs not) was associated with 3.92% fewer assertive prompts]. 
4 Values are ORs from logistic regression: ORs represent the unit change in the covariates [eg, at age 15 mo, mothers of non-Hispanic white children have 0.68 times lower odds of intrusiveness than do mothers of children who are not non-Hispanic white]. 
5 Significant, P < 0.05.
find maternal depressive symptoms to be consistently associated with maternal feeding behaviors. This observation was consistent with that of one prior study that identified no significant association (14), but was not consistent with studies that found that maternal psychopathology was linked with more (42–44) or less (21) self-reported pressuring of the child to eat. The fact that this prior work used self-reported, as opposed to observed, feeding styles may explain the discrepancy with our own findings. Specifically, depressed mothers may self-report their own feeding practices as more intrusive than they actually are, because depressed individuals tend to perceive things negatively (45), and depressed mothers have a lower sense of parenting self-efficacy (46). In addition, Farrow and Blissert (47) recently concluded that the current evidence indicates that, whereas maternal psychopathology is linked with child eating problems, it is not consistently linked with maternal feeding behaviors. More work is needed in this area to better understand these associations. Finally, our observation that the maternal figure rating was not consistently associated with maternal feeding behaviors is consistent with the null findings in all prior studies that examined this question (3, 4, 10, 13, 14, 16, 17, 19, 24, 41).

Our finding that a greater percentage of assertive prompts and intrusiveness, not simply the total number of prompts to eat, were each associated with greater child adiposity is consistent with prior literature. Although prior literature initially appears conflicting, careful review of the varying ways in which prompting or pressure to eat was defined reveals relative consistency in the findings across studies. Self-report measures such as the Preschool Feeding Questionnaire (16) conceptualize pressure to eat as relatively assertive, including items addressing bribing and punishing. In contrast, self-report measures such as the Child Feeding Questionnaire (48) conceptualize pressure to eat as relatively less assertive, including items such as, “I have to be especially careful to make sure my child eats enough.” When the definition of prompting was not conceptualized as assertive (3–7, 9, 11, 15, 18, 20, 21) or was not clearly defined (10, 19), the studies had null findings. In contrast, when prompting was conceptualized as assertive (3, 4), studies usually found a positive association with child adiposity. Studies that examined assertive prompting but did not detect a relation with child adiposity differed from our study in that their participants were primarily white (17, 18), not living in the United States (18), or from relatively well-educated families (17, 18) or had small samples with few overweight children (17, 18). One study did not detect an association between assertive prompting and child adiposity in a relatively large, diverse sample, but assertive prompting was determined by self-report of assertive feeding practices, which may have led to some bias in reporting that underestimated the use of these feeding strategies (16). In summary, our findings are consistent with prior literature in that only assertive prompting, but not all types of prompting, was associated with child adiposity.

Although maternal feeding behaviors and child adiposity were concurrently associated at ages 15, 24, and 36 mo, maternal feeding behaviors at age 15 mo were not associated with child adiposity at age 36 mo. This suggests that maternal feeding behaviors affect child adiposity contemporaneously, but do not have long-lasting effects on children’s adiposity 2 y later—a finding consistent with some studies in the literature (11, 49–52) but not others (9, 15, 53–57). It is also possible that the relatively small effect of maternal feeding behaviors is overwhelmed by cofounders such as television viewing or consumption of calorically dense foods (eg, sweets or French fries), which are, like maternal feeding behaviors, associated with both markers of socioeconomic status (58, 59) and adiposity (58, 60) and an increase in frequency between ages 15 and 36 mo (61, 62).

This study had several strengths, including the longitudinal videotaped observed eating behavior, growth data, and ability to control for a large number of time-covarying potential confounders. In addition, the sample was drawn from 10 different regions around the nation and included participants from rural, suburban, and urban communities. Although the data set was primarily non-Hispanic white, there was still an unprecedented number of videotaped observed mother-child eating episodes in low-income and minority populations compared with the samples in prior published work. Specifically, our cohort included 276 children who were not non-Hispanic white. In contrast, prior cohorts that included both observed maternal feeding behaviors and child adiposity have included only 6 black children and 23 Hispanic children (3, 4, 10, 18, 28, 29). In addition, our cohort included 554 children (46% of the cohort) with a family income <185% of the federal poverty level. Our study also coded both specific maternal behaviors (prompts) and the mother’s general propensity to control the child’s behavior (intrusiveness)—a combination rarely observed in prior work.

### TABLE 3

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<tr>
<th>Parameter estimates and 95% CIs from adjusted models predicting BMI z scores across ages 15, 24, and 36 mo†</th>
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<tbody>
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<td>Model‡</td>
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<tr>
<td>Total prompts</td>
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<td>Percentage of assertive prompts‡</td>
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<td>Intrusiveness (yes vs no)</td>
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† n = 1218 participants contributing 2512 observations. n = 2509 observations for models 3 and 4 because 4 observations had no prompts; therefore, the percentage of assertive prompts could not be calculated. Generalized estimating equations, accounting for repeated measures within subjects, adjusted for the child’s age, sex, and race-ethnicity; family income-to-needs ratio; and maternal education, Center for Epidemiologic Studies–Depression score, and figure rating.

‡ Model 1 evaluated the main effect of total prompts. Model 2 evaluated the main effects of total prompts and percentage of assertive prompts. Model 3 evaluated the main effect of only percentage of assertive prompts, while excluding total prompts. Model 4 evaluated the main effects of percentage of assertive prompts and intrusiveness. Model 5 evaluated the main effect of intrusiveness without total prompts or percentage of assertive prompts.

§ A 1-unit change is equivalent to the change from 0% to 100%.

⁴ Significant, P < 0.05.
As with all laboratory-based studies, the standardization of the protocol reduced environmental variability and confounding, but also reduced ecologic validity. The findings must therefore be considered in the context of prior work in the more naturalistic setting of the family mealtime at home (3, 4, 10, 63). In addition, the choice to use the same foods for all children necessarily meant that children’s liking for and familiarity with the foods was not standardized across subjects, which also could have affected the mother-child interaction. Limitations of this study included the absence of a contemporaneous measure of maternal BMI and some degree of attrition. Although the snack session occurred more than 1 h into the day’s research laboratory visit, it is unknown exactly how long each child fasted before the snack session, which could have influenced the child’s eating behavior. Finally, maternal feeding behaviors during a snack may differ from those during a meal; maternal socialization of children’s behavior during mealtime may be more relevant to children’s outcomes.

In summary, the results of this study suggest that maternal feeding behaviors constitute a small but potentially important contributor to childhood obesity risk. The findings also indicate that the way in which prompting or “pressure to eat” is defined is an important determinant of the relation with child adiposity. Future research should consider more detailed definitions of maternal prompting and pressure to eat, because only assertive or intrusive styles appear to relate to child adiposity. The findings also suggest that, in young children, intrusive maternal feeding practices do not irrevocably interfere with the children’s ability to respond to internal satiety cues. This observation suggests that interventions focused on maternal feeding practices can have a beneficial effect on children’s adiposity. The findings also suggest that such interventions need to focus specifically on assertive or intrusive maternal behaviors and not simply on prompting in general. This approach is challenging, because it requires developing a more nuanced understanding of the complex motivations underlying these maternal behaviors (64). When the motivations for these behaviors are better understood, interventions to reduce intrusive maternal feeding behaviors could be made more effective.

The authors’ responsibilities were as follows—JCL and RHB: designed the research; JCL and TNO: conducted the research; DPA and NK: analyzed the data; RFC and RHB: provided essential databases necessary for the research; JCL and TNO: conducted the research; DPA and NK: analyzed the data. All authors read and approved the final manuscript. None of the authors had any conflicts of interest. The American Heart Association had no role in the design, implementation, analysis, or interpretation of the data.

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