Maternal-Child Feeding Patterns and Child Body Weight

Findings From a Population-Based Sample

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Background: Certain mother-child feeding patterns (MCFPs) may promote childhood obesity and/or disordered eating.

Objectives: To assess the demographic correlates of MCFPs and to test whether differences in MCFPs are associated with child body mass index (BMI; calculated as weight in kilograms divided by the square of height in meters) z scores in a population-based study.

Design: A secondary analysis of the National Longitudinal Survey of Youth main and child cohorts was conducted on more than 1000 Hispanic, African American, and non-Hispanic/non–African American children, aged 3 to 6 years. The MCFPs were measured by means of 3 interview questions probing mother-allotted child food choice, child compliance during meals, and child obedience during meals.

Results: Mothers of non-Hispanic/non–African American children allotted greater food choice than mothers of African American or Hispanic children. Maternal BMI and other demographic measures were unrelated to MCFPs. The lowest levels of mother-allotted child food choice and child eating compliance were associated with reduced child BMI, with mean BMI z scores of −0.36 and −0.41, respectively. Effect sizes were small, however, and MCFPs did not discriminate children who were overweight or at risk for being overweight from children who were not (P > .05).

Conclusions: Feeding strategies providing the least child food choice were associated with reduced child BMI. However, MCFPs did not relate to child overweight status.

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MTERNAL CONTROL during feeding may promote childhood obesity or disordered eating patterns, which are partially determined by environment. Mothers who report greater feeding control have children who are less adept at regulating energy intake and tend to consume more calories at laboratory meals. Children who focus on external cues while eating (eg, feeding prompts) tend to regulate calories less successfully than children who focus on internal satiety sensations. Experimental studies confirm that restricting children’s access to preferred foods increases the probability that children will eat those foods when given free access. Maternal prompts to eat have also been associated with increased child food intake and child body weight in some studies. However, recent studies have failed to detect an association between maternal feeding style and child obesity status. Collectively, these data have generated increasing interest in the study of mother-child feeding patterns (MCFPs) as they pertain to childhood obesity.

Few studies have examined the association between MCFPs and childhood obesity status across ethnic and socioeconomic groups. Because these studies traditionally sampled from white families, recent studies have explored these issues in more diverse samples. Baughcum et al found limited evidence of! the association between maternal feeding control and child body mass index (BMI, calculated as weight in kilograms divided by the square of height in meters) in a set of studies that included mothers who were below the federal poverty level, had no greater than a high school education or a General Educational Development certificate, and were nonwhite. Robinson et al found limited support for associations between feeding style and child body composition in an ethnically diverse community sample. In the first study to use dual energy x-ray absorptiometry, Spruijt-Metz et al found a positive association between maternal feeding restraint and...
child total body fat in a sample that included white and African American families.

The present study tested the association between 3 MCFPs (ie, mother-allotted child food choice, child eating compliance, and child eating obedience) and child BMI z score in a population-based sample. We conducted a secondary data analysis of a national database20 to describe the distribution of these MCFPs in the population, test their sociodemographic correlates, and evaluate their association with child BMI z score when controlling for sociodemographic variables and maternal BMI.

METHODS

PARTICIPANTS

We obtained data on mothers from the National Longitudinal Survey of Youth (NLSY) main sample from 1986. A summary of the NLSY is available elsewhere.20 The NLSY is one of several national labor surveys that have been administered by the Bureau of Labor Statistics, US Department of Labor, since 1966 to address a range of labor, social, and demographic issues in the country.20,21 Data collection for the NLSY began in 1979 and continues annually to provide follow-up sociodemographic, health, and employment data.20,21 The original NLSY sample consisted of a nationally representative cohort of 12,686 men and women, aged 14 to 22 years. In 1986, NLSY administrators began inviting women from the original sample who had become mothers to participate in a supplemental child interview to address the health and development of their children. Interviews were conducted by trained staff, took approximately 90 minutes, and occurred at the participants’ home or by telephone.20,21

Sample sizes varied by question. Question 1 had 1083 valid family responses (203 Hispanic, 322 African American, and 558 non-Hispanic/non–African American [NHNAA]). Question 2 had 1790 valid family responses (323 Hispanic, 353 African American, and 929 NHNAA). Question 3 had 1783 valid family responses (322 Hispanic, 538 African American, and 923 NHNAA). The NHNAA children, defined by the National Center for Health Statistics, were primarily white and included various nationalities (the most common of which was German [18.4%]).20 The cohort includes an overrepresentation of children born to mothers who were relatively young, less educated, disadvantaged, and members of minority groups. The sample of child participants was balanced approximately equally between male and female participants. In the present study, child participants were between ages 35 and 73 months, because this was the only age group in which parents were asked questions concerning MCFPs. Descriptive statistics for the sample are provided in Table 1.

MEASURES

The NLSY interview included 3 questions. Question 1 (MCFP-Q1) was “How much choice is your child allowed in deciding what foods he/she eats at breakfast and lunch?” Response options were recoded as (1) no choice, (2) little choice, (3) some choice, and (4) a great deal of choice. Question 2 (MCFP-Q2) was “When it is mealtime, how often does your child eat what you want him/her to eat?” Question 3 (MCFP-Q3) was “When your child doesn’t eat what you want him/her to eat and you tell him/her to do so, how often does he/she obey and eat?” Response options to questions 2 and 3 were coded as (1) almost never, (2) less than half the time, (3) half the time, (4) more than half the time, and (5) almost always.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child age, mo</td>
<td>52.4 ± 16.9</td>
</tr>
<tr>
<td>Maternal age, y</td>
<td>25.1 ± 2.1</td>
</tr>
<tr>
<td>Maternal BMI</td>
<td>24.3 ± 5.1</td>
</tr>
<tr>
<td>Household income, $</td>
<td>18,258 ± 13,565</td>
</tr>
<tr>
<td>BMI†</td>
<td>15.78 ± 1.36</td>
</tr>
<tr>
<td>BMI z score†</td>
<td>0.01 ± 0.97</td>
</tr>
<tr>
<td>BMI percentile†</td>
<td>50.41 ± 29.68</td>
</tr>
<tr>
<td>% Female†</td>
<td>48.5</td>
</tr>
<tr>
<td>Ethnicity, %†</td>
<td>18.0</td>
</tr>
<tr>
<td>Hispanic</td>
<td>30.1</td>
</tr>
<tr>
<td>African American</td>
<td>51.9</td>
</tr>
<tr>
<td>NHNAA</td>
<td>12.0</td>
</tr>
<tr>
<td>Maternal education level, %</td>
<td>6.2</td>
</tr>
<tr>
<td>&lt;High school</td>
<td>75.5</td>
</tr>
<tr>
<td>High school</td>
<td>18.3</td>
</tr>
</tbody>
</table>

Child and Mother Demographics

Child demographic measures were maternally reported ethnicity (ie, NHNAA, Hispanic, or African American) and sex. Maternal demographic measures for 1986 were age, household income, highest maternal education (categorized as less than high school, high school, or more than high school), and self-reported weight. Self-reported maternal height was recorded in 1985. The BMI was computed for mothers, and has been validated in adult and pediatric samples.22,23 Child height and weight were directly assessed by means of a tape measure and portable bathroom scale, or by means of maternal report. These data were collected at home assessments in 1986, the same year in which MCFPs were assessed. We converted these data to BMI values, which in turn were converted to age- and sex-specific z scores and percentiles per the revised growth charts from the Centers for Disease Control and Prevention.24 Because the raw data did not distinguish those children for whom BMI was derived from direct assessment vs those for whom it was derived from the maternal report, we could not control for this in our analyses.

Statistical Analysis

Measures of central tendency provided descriptive data for each MCFP question.

Association of MCFPs With Sociodemographic Variables

Univariate analyses of variance (ANOVAs) were conducted in which each MCFP question was treated as the dependent variable and the following variables were treated as independent variables: maternal education, maternal BMI, family income, child sex, and child race/ethnicity. None of the interaction effects among predictors was significant; hence, we only included main effects in our final models.

Association of Child BMI z Score With MCFPs

Univariate ANOVAs were conducted in which the BMI z score was treated as the dependent variable and the following variables were treated as independent variables: maternal education, maternal BMI, family income, child sex, child race/ethnicity, maternal age, maternal BMI, maternal education level, family income, and child age.
ethnicity, and the respective MCFP question. As a measure of effect size, we report the partial eta squared statistic ($\eta^2$), which represents the percentage of variance in BMI $z$ score that is uniquely due to the MCFP question controlling for other predictors. When the main effect for an MCFP question was observed, post hoc pair-wise comparisons explored potential non-linear associations between the feeding question and BMI $z$ score.

Interactions between each MCFP question and child sex, ethnicity, and maternal BMI were tested using interaction terms (MCFP $\times$ sex, MCFP $\times$ ethnicity, and MCFP $\times$ maternal BMI). None of these interactions were significant and, therefore, only main effects were included in the final ANOVA models. Analyses were conducted using statistical software (SPSS version 10; SPSS Inc, Chicago, Ill). We examined the potential confounding of clustering of sibling responses using sensitivity analyses (STATA version 6; Stata Corp, College Station, Tex), and found no significant effect. Therefore, we did not adjust for siblingship in our final analyses.

To rule out the potential influence of extreme BMI values, we restricted analyses to child BMI values ranging from the 2nd to the 98th percentile. Results did not change substantially when we tried other cutoffs (eg, the 3rd and 97th BMI percentiles).

Finally, we replicated the aforementioned ANOVA analyses using child overweight status as the outcome variable. Children whose BMI was greater than or equal to the 85th age- and sex-specific percentile were classified as overweight or at risk for being overweight. Using ANOVA models, we tested whether the 3 MCFPs would discriminate children who were overweight or at risk for being overweight from those children who were not.

**RESULTS**

**MCFP DESCRIPTIVE STATISTICS**

Figure 1 presents the response distributions to each MCFP question pooling all respondents. The mean±SD for MCFP-Q1 was 3.0±0.75. Most mothers reported giving their child some or a great deal of food choice during breakfast and lunch (81%), whereas less than 5% of the mothers report giving their children no choice during these meals. The mean±SD for MCFP-Q2 was 4.0±1.0. The most common response was “almost always” (44%), and almost 50% of the mothers reported child eating obedience “half the time” or “more than half the time.” The mean±SD for MCFP-Q3 was 3.6±1.1. Most mothers reported child compliance with eating directives. Only 16% of the mothers reported child compliance “almost never” or “less than half the time,” whereas approximately 84% reported child compliance at least or more than half the time. The most common response was “almost always” (30%).

**MCFPs AND SOCIODEMOGRAPHIC VARIABLES**

**MCFP-Q1**

Mother-allotted child food choice differed as a function of child ethnicity ($P<.001$); mothers of NHNAA children allotted their children greater food choice during breakfast and lunch (mean±SD, 3.2±0.03) than did mothers of Hispanic or African American children (mean±SE, 2.9±0.05 and 2.9±0.04, respectively). Figure 2 illustrates that a greater proportion of Hispanic and African American children had no mother-allotted child food choice (8.8% and 4.5%, respectively) than NHNAA children (1.9%). None of the other variables was related to mother-allotted child food choice, including maternal BMI ($P = .86$).

**MCFP-Q2**

Child eating compliance was not significantly associated with any of the family demographic variables, including maternal BMI ($P = .73$).

**MCFP-Q3**

Child obedience during eating was not significantly associated with any of the family demographic variables, including maternal BMI ($P = .31$).
Child BMI percentile was positively associated with maternal BMI (P < 0.001) and maternal education (P = 0.04) and marginally associated with mother-allotted child food choice (P = 0.06) (Table 2). The corresponding effect size for MCFP-Q1 was small (R^2 = 0.01). Child BMI z scores (mean ± SE) across response categories were −0.36 ± 0.15 (no choice), 0.08 ± 0.07 (little choice), 0.01 ± 0.04 (some choice), and 0.04 ± 0.06 (a great deal of choice) (Figure 3). Pair-wise comparisons confirmed that children receiving no food choice had a lower BMI z score than children receiving little, some, or a great deal of food choice (P < 0.05 for each comparison). The mean BMI z score did not differ among children in the other groups.

When replicating this analysis using child overweight status as the outcome variable, mother-allotted child food choice did not discriminate children who were overweight or at risk for being overweight from those who were not (P = 0.61).

MCFP-Q2

Child BMI z score was positively associated with maternal BMI (P < 0.001) and maternal education (P = 0.001) and marginally associated with child compliance during eating (P = 0.06) (Table 3). The corresponding effect size for MCFP-Q2 was small (R^2 = 0.01). Child BMI z scores (mean ± SE) across response categories were −0.41 ± 0.17 (almost never compliant), −0.07 ± 0.10 (compliant less than half the time), −0.01 ± 0.05 (compliant half the time), −0.01 ± 0.04 (compliant more than half the time), and 0.06 ± 0.03 (almost always compliant) (Figure 4). Pair-wise comparisons confirmed that children who were the least compliant during eating had a lower BMI z score.
MCFP-Q3

Child BMI $z$ score was positively associated with maternal BMI ($P < .001$) and maternal education ($P = .001$), but not child eating obedience ($P = .76$) (Table 4). When replicating this analysis using child overweight status as the outcome variable, child eating obedience did not discriminate children who were overweight or at risk for being overweight from those who were not ($P = .43$).

Table 4. ANOVA Source Table for Child Eating Obedience and Its Association With Child BMI $z$ Score*

<table>
<thead>
<tr>
<th>Source</th>
<th>$F$</th>
<th>$P$ Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected model</td>
<td>3.88</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Intercept</td>
<td>18.95</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Child eating obedience</td>
<td>0.46</td>
<td>.76</td>
</tr>
<tr>
<td>Child sex</td>
<td>0.63</td>
<td>.42</td>
</tr>
<tr>
<td>Child ethnicity</td>
<td>2.01</td>
<td>.13</td>
</tr>
<tr>
<td>Maternal education</td>
<td>6.74</td>
<td>.001</td>
</tr>
<tr>
<td>Maternal BMI</td>
<td>28.86</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Household income</td>
<td>1.41</td>
<td>.15</td>
</tr>
</tbody>
</table>

Abbreviations: ANOVA, analysis of variance; BMI, body mass index (calculated as weight in kilograms divided by the square of height in meters); NHNAA, non-Hispanic/non–African American.

*R = 0.178 (322 Hispanic, 538 African American, and 923 NHNAA; error, 1771; corrected total, 1782). $R^2 = 0.03$ (adjusted $R^2 = 0.02$).

When replicating this analysis using child overweight status as the outcome variable, child eating compliance did not discriminate children who were overweight or at risk for being overweight from those who were not ($P = .43$).

COMMENT

To our knowledge, this is the first population-based study sampling from across the United States to test whether maternal feeding strategies are associated with child BMI. The information provided by such a sample may help reconcile existing inconsistencies in the literature. Mother-allotted child food choices differed as a function of child ethnicity. Specifically, mothers of NHNAA children reported allotting their children greater food choice than mothers of African American or Hispanic children. These findings are consistent with recent data indicating that mothers of white children report less monitoring of child eating, responsibility for child eating, feeding restriction, pressure to eat, and child weight concern than mothers of African American children. Cultural factors associated with ethnicity therefore may play a role in the development of parental feeding styles that may relate to child eating practices. The association between ethnicity and mother-allotted child food choice was independent of income (ie, no race $\times$ income interaction). Future research is needed to explore potential links between ethnicity and maternal feeding style and to better understand specific within-group feeding styles.

The MCFPs were unrelated to other familial measures, including income and maternal education and BMI. The lack of association with maternal BMI is notable because of the strong association between maternal and child BMI reported in the literature. Maternal feeding practices have been proposed as a potential mediating pathway linking this association. Our findings suggest that maternal feeding practices do not link maternal and child BMI. To the extent that maternal BMI and mother-child feeding patterns have independent associations with child BMI percentile, distinctly different mechanisms may underlie these relations. Maternal feeding control may relate more strongly to dietary restraint and disinhibition per se than BMI.

A major finding from this study was that mother-allotted child food choice and child eating compliance were associated with child BMI percentile. The finding that maternal BMI was statistically controlled in these analyses is particularly noteworthy. Maternal BMI is a well-established predictor of child BMI, and so one might expect any association between maternal feeding style and child BMI to decay after controlling for maternal BMI. However, that was not the case. Although causes cannot be inferred, our findings suggest that understanding the ways in which mothers feed their children may be important for understanding variations in child weight.

The finding that reduced mother-allotted child food choice was associated with reduced child BMI percentile seems discrepant with some previous findings in the literature. This may be due partially to the psychometric properties of MCFP-Q1, which may represent a different dimension from existing child feeding questionnaires. Alternatively, certain parental controls on child eating may be important for child growth and obesity prevention. Satter proposes an “appropriate division of responsibility” during feeding whereby the mother controls which foods are offered to the child, who in turn decides whether and how much to eat. Studies by the US Department of Agriculture suggest that children who prepare their own lunches may be at greater risk for obesity than children whose lunches are prepared for them. Finally, parental training is an essential component of effective childhood obesity treatment. Hence, MCFP-Q1 may represent an adaptive domain of parental control vis-à-vis child eating and body weight. The strongest associations were observed among mothers providing the least food choice (Figure 2), whose children had a BMI approximately 0.35 SD below the mean. Therefore, the most restrictive food choices may have pronounced effects on child body weight.

Children who tended to be more compliant with maternal feeding directives (MCFP-Q2) tended to have a greater BMI. Although the previous studies have not explored child eating compliance per se, our findings may be consistent with data on maternal “encouragements to eat” measured from videotaped parent-child feeding interactions. The analysis by Drucker et al of 77 parent-child dyads found that parental encouragements to eat were positively associated with child total energy intake and meal time but not child BMI. Parental encouragements were also correlated with child relative body weight and child eating time at home meals. It is conceivable that MCFP-Q2 at least partially reflects this en-
encouragement domain, which might be an important domain for subsequent research.

These findings may also be consistent with studies reporting a negative correlation between child body fat and maternal feeding prompts. Birch et al. found that mothers whose children had reduced body fat were more likely to use various feeding prompts during structured laboratory meals. McKenzie et al. found similar negative correlations between maternal use of feeding prompts and child BMI during observational home meals. In the same spirit, it is possible that mothers of relatively underweight children perceive their children as being non-compliant with parental feeding directives and encouragement to eat aimed at increasing the child’s weight. From this perspective, the feeding relationship would be secondary to the child’s lower BMI.

Despite these statistically significant relationships, the associated effect sizes were notably small, as MCFPs accounted for less than 1% of the variance in child BMI. Moreover, none of these feeding strategies significantly discriminated overweight from nonoverweight children. It is therefore questionable whether the MCFPs captured by these particular questions play a major role in the cause of pediatric obesity. If these MCFPs have an impact on child weight, their effects seem to be modest. Larger effects, if they exist, may operate at the lower end of the BMI spectrum. These small effect sizes are consistent with results from a recent community-based multiethnic sample and, in general, are compatible with the behavioral genetics literature of pediatric obesity. Results from twin and adoption studies suggest that variations in child body composition are probably influenced by a multitude of environmental inputs that have small to moderate effects rather than few environmental inputs that have a large effect.

The present results should be interpreted in light of study limitations. First, our assessment of MCFPs relied on 3 questions for which psychometric data were unavailable. The strength of these questions rests in their practicality for large-scale investigation, although their association with existing child feeding questionnaires needs to be tested. Second, current conceptualizations of MCFP distinguish “pushing/encouraging child eating” from “restraining/prohibiting child eating.” However, MCFP-Q1 only addresses food choice in a general sense and therefore may be insufficient to address certain theoretical models. MCFP-Q2 and MCFP-Q3 do not obviously reflect these particular feeding domains but seem to reflect child responses to parental feeding tactics. Third, measures of maternal dietary restraint or inhibition, which may be important covariates, were not obtained. Fourth, the relatively young age of our sample (children and parents) is a caveat. Children older than 6 years of age might be less likely to follow maternal feeding directives. Fifth, although the overall sample size was large, the number of participants in the extreme categories of reduced MCFPs was small (Figure 1). Finally, MCFP-Q1 only addresses feeding choice during breakfast and lunch. Given that a number of children may eat one or both of these meals out of the home, these findings may not readily generalize to such families.

In conclusion, reduced mother-allotted child food choice and child eating compliance were associated with lower child BMI percentiles, even after controlling for maternal BMI. These notably nonlinear associations imply the lack of a simple dose-response between feeding relationship and child BMI, an issue that may deserve consideration in future research. Whether these feeding patterns influence child weight or respond to child characteristics such as weight needs to be tested in prospective studies. However, none of the maternal feeding strategies studied in this population-based study discriminated children who were overweight or at risk for being overweight from those children who were not.

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