MATERNAL PROMPTS TO EAT, CHILD COMPLIANCE, AND MOTHER AND CHILD WEIGHT STATUS

JULIE C. LUMENG, MD, AND LORI M. BURKE, BS

Objective To determine if there is a relationship between maternal prompting to eat, child compliance, and mother and child weight.

Study design Seventy-one 3- to 6-year-old children and their mothers were videotaped tasting four foods (two familiar, two novel). Maternal prompts to eat and the child's compliance with the prompts were coded. Multiple logistic regression evaluated demographic, anthropometric, and food characteristics that predicted prompting and compliance; and demographic, behavioral, and food characteristics that predicted child body mass index *Z* score (BMIz) in the children of obese and non-obese mothers.

Results Obese mothers did not prompt more than non-obese mothers, but children of obese mothers were more compliant (70.2% ± 19.4 v 59.6% ± 21.2, $P = .04$). Low maternal education, a novel food, and younger child age predicted prompting. Maternal obesity, a familiar food, and older child age predicted compliance. In children of obese mothers, low maternal education, more prompts to eat novel foods, fewer prompts to eat familiar foods, and fewer child bites of familiar foods predicted child BMIz ($R^2 = 64\%$). In children of non-obese mothers, none of the covariates predicted child BMIz.

Conclusions Children of obese mothers may be more responsive to environmental cues to eat. *(J Pediatr 2006;149:330-5)*

The prevalence of childhood obesity has increased significantly in the past 20 years,[1] with growing disparities based on race and socioeconomic status.[2] Although both genetics and environment contribute to obesity risk, the rapid secular increase in prevalence is driven by environmental factors that increase caloric consumption and reduce caloric expenditure. Parents are in a key position to shape the environments of children, and increasing interest has focused upon the role of parenting behaviors in contributing to obesity risk. Maternal feeding practices have received particular attention as a potential risk factor for childhood obesity.[3,4] Feeding practices may be broadly conceptualized as either restricting or promoting a child's intake. Restrictive maternal feeding practices, such as limiting consumption of or access to particular foods, have been associated with greater adiposity and more eating in the absence of hunger in girls.[5,6] Few studies have addressed the impact of maternal feeding practices that promote intake, such as prompting children to eat, on eating behavior or adiposity. The results of these studies have been contradictory[4,7-9] with the initial study in young children showing a robust positive association between maternal prompting and child adiposity,[7] but subsequent studies being unable to demonstrate an association.[8,9]

Although previous studies have evaluated the relationship of maternal feeding practices with children's eating behaviors and overweight risk,[10] none have evaluated the potential relationships between maternal prompting, the child's compliance with prompts, and mother and child weight status in a healthy, diverse, sample of 3- to 6-year-old children using direct observation of behavior. The present study therefore seeks to address three objectives: (1) to determine if maternal prompting to eat or the child's compliance with the prompts differs by maternal obesity status; (2) to identify demographic factors and food characteristics associated with maternal prompting and child compliance; and (3) to determine if prompting and compliance are associated with the child's weight status. We hypothesized that obese mothers and mothers with lower education would prompt their children more to eat, and that children whose mothers prompted them more to eat would have a higher mean body mass index (BMI).

AIC	Akaike Information Criteria	BMIz	Body mass index *Z* score
BMI	Body mass index	CDC	Centers for Disease Control

From the Center for Human Growth and Development; and the Department of Pediatrics, Division of Child Behavioral Health, University of Michigan, Ann Arbor.

The American Heart Association had no role in (1) the study design; (2) the collection, analysis, and interpretation of data; (3) the writing of the report; or (4) the decision to submit the paper for publication. The first draft of the manuscript was written by Dr Lumeng, and no form of payment was given to anyone to produce this manuscript.

Supported by the American Heart Association Fellow-to-Faculty Transition Award 0275040N to Dr Lumeng and in part by K24 HD 042489 to Dr Bauchner.

Submitted for publication Nov 17, 2005; last revision received Jan 19, 2006; accepted Apr 5, 2006.

Reprint requests: Dr Julie C. Lumeng, Center for Human Growth and Development, 300 North Ingalls Building, 10th Floor, University of Michigan, Ann Arbor, MI 48109-0406. E-mail: jlumeng@umich.edu.

0022-3476/$ - see front matter

10.1016/j.jpeds.2006.04.009

METHODS

Sample

Three- to six-year-old children and their mothers were recruited through postings in diverse communities. Exclusion criteria included food allergies, serious health conditions that could affect appetite or eating, or not being conversant in English. Mothers and children fasted for 2 hours before the study. Only one child per enrolled family was allowed to participate, and families were compensated $20. Written informed consent was obtained. This study was approved by the University of Michigan Medical School Institutional Review Board.

Mothers provided child age, sex, race/ethnicity (white or not white), and maternal education (<4-year college degree versus ≥4-year college degree). At the conclusion of the study protocol, mother and child heights were measured without shoes on a wall-mounted measuring tape and weights were measured without shoes or heavy clothing on a scale with accuracy to 0.1 kg (Taylor Precision). BMI was calculated and child BMIz was derived based on the Centers for Disease Control (CDC) growth charts.[11] This age range is the period of adiposity rebound, during which a child's BMI declines to a nadir and then begins to increase again.[12] The significant changes in BMI, which also differ by sex, necessitate standardizing raw BMI to a value reflecting standard deviations from the mean for a particular age and sex (a *Z* score). Mothers were categorized as obese by the CDC definition (BMI ≥30).

Food Presentation Protocol

Mother and child were seated at a table in a quiet room without distractions. Instructions were directed equally at both mother and child, who were told that they would be videotaped while sampling foods. They were told that they did not need to try the foods if they did not want to, but that we were interested in their opinions of the foods. Four foods were presented individually and sequentially, at which time each was placed on the table equidistant between mother and child and a brief verbal description, as outlined below, was provided. The order of the food presentations was randomized for all children. The researcher left the mother-child pair in the room with each food for 4 minutes, after which the food was removed and the next food presented. After each food, the researcher briefly interviewed the mother and child about their opinions of the foods, recording their comments with paper and pencil to emphasize to the mother and child the researcher's interest in their opinions of the foods. Our intent in recording these responses was to remove some of the family's focus from the videotape data, by suggesting that the primary study outcome of interest to the researchers was their response to the verbal inquiries about their opinions of the foods. Food was weighed on a scale (Salter) with accuracy ± 1 g before and after presentation.

The four foods differed in familiarity and taste (sweet or salty), which were chosen as the two factors on which to vary the foods because these characteristics are primary predictors of children's food preferences.[13,14] Sweetness and saltiness are empirically palatable to humans,[15] and were selected as the primary tastes on the premise that children would be most likely to eat these foods, even if unfamiliar. The novel foods were selected to closely match the familiar foods in terms of food category and sensory characteristics. Snack foods were chosen as the food stimuli for this study on the premise that these types of foods may be the focus of the greatest variability in maternal behavior during eating in obese versus non-obese mothers. The salty familiar food was a 30-g (150 kcal) bag of potato chips (Lay's Original®). The sweet familiar food was a 45-g (150 kcal) commonly commercially available sweet, cream-filled sponge cake (Hostess Twinkie®). The salty novel food was a 30-g (140 kcal) bag of vegetable chips commercially available as a snack akin to potato chips (Terra Chips Original Flavor®). The sweet novel food was a 55-g (230 kcal) traditional, sweet Chinese moon cake. Descriptive information for the two novel foods was given during their presentation. For the vegetable chips, mother-child pairs were told, "Instead of chips made from potato, these are made from a mix of exotic vegetables: taro, sweet potato, yuca, batata, parsnip, and ruby taro." For the moon cake, they were told "This is eaten during the Chinese Moon Festival. There are many different kinds. This one is a lotus paste moon cake. Lotus is a type of flower." Mothers reported familiarity with each food at the conclusion of the protocol, and responses confirmed correct categorization of foods as novel or familiar to this sample (data available upon request).

Behavior of each mother-child pair was coded by two independent trained observers blind to study hypotheses. Inter-rater reliability, as indexed by intra-class correlation coefficients or Cohen's κ as appropriate, exceeded 0.70 for all measures. Bites of each food by both mother and child were coded. Prompting was defined as the sum of physical encouragements, verbal encouragements and food offers, defined per methods in prior research.[7-9,16] Compliance with a prompt was defined per prior research methods as the child taking a bite (defined as food passing the lips) within 5 seconds of the prompt.[17] Child compliance is presented as the proportion of prompts with which the child complied. Thus, a child may have taken few bites, but if all bites occurred within 5 seconds after a maternal prompt to eat, the child's compliance would have been high. In contrast, a child may have taken many bites, but if the child rarely took a bite within 5 seconds after a maternal prompt to eat, the child's compliance with prompts would have been low. Number of bites the child took and compliance with prompts were thus two independent scores.

Statistical Analysis

All statistical analyses were conducted using Statistical Analysis Systems, version 9.1 (SAS Institute, Cary, NC).