An investigation of maternal food intake and maternal food talk as predictors of child food intake

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DeJesus, J. M., Gelman, S. A., Viechnicki, G. B., Appugliese, D., Miller, A. L., Rosenblum, K. L., & Lumeng, J. C. (2018). An investigation of maternal food intake and maternal food talk as predictors of child food intake. *Appetite, 127,* 356-363. doi: 10.1016/j.appet.2018.04.018

Abstract:

Though parental modeling is thought to play a critical role in promoting children's healthy eating, little research has examined maternal food intake and maternal food talk as independent predictors of children's food intake. The present study examines maternal food talk during a structured eating protocol, in which mothers and their children had the opportunity to eat a series of familiar and unfamiliar vegetables and desserts. Several aspects of maternal talk during the protocol were coded, including overall food talk, directives, pronoun use, and questions. This study analyzed the predictors of maternal food talk and whether maternal food talk and maternal food intake predicted children's food intake during the protocol. Higher maternal body mass index (BMI) predicted lower amounts of food talk, pronoun use, and questions. Higher child BMI z-scores predicted more first person pronouns and more wh-questions within maternal food talk. Mothers of older children used fewer directives, fewer second person pronouns, and fewer yes/no questions. However, maternal food talk (overall and specific types of food talk) did not predict children's food intake. Instead, the most robust predictor of children's food intake during this protocol was the amount of food that mothers ate while sitting with their children. These findings emphasize the importance of modeling healthy eating through action and have implications for designing interventions to provide parents with more effective tools to promote their children's healthy eating.

Keywords: Language | Mother-child relations | Feeding behavior | Pediatric obesity

Article:

Parenting is thought to play a critical role in the development of children's eating behaviors and the prevention of childhood obesity (Barlow, 2007; Branen & Fletcher, 1999; Epstein, Valoski, Wing, & McCurley, 1994; Golan & Crow, 2004; Golan, Fainaru, & Weizman, 1998; Kraak, Liverman, & Koplan, 2005). Specifically, parent modeling and food intake are hypothesized to relate to child food intake, and consequently parents are strongly encouraged to model healthy eating behavior for their children (Barlow, 2007; Ogata & Hayes, 2014; Oliveria et al., 1992; Pearson, Biddle, & Gorely, 2009; Scaglioni, Arrizza, Vecchi, & Tedeschi, 2011; Zuercher, Wagstaff, & Kranz, 2011). Parents can model healthy eating through their own eating behavior, specifically by eating healthy foods and avoiding unhealthy foods in front of their children. For instance, one study found that parental modeling (i.e., eating the food themselves) was more effective than physical prompts (e.g., moving the food towards the child, handing the food to the child) in encouraging children to eat an unfamiliar fruit (Blissett, Bennett, Fogel, Harris, & Higgs, 2016). Questionnaires asking parents to report their feeding practices include questions about these behaviors in subscales on parental modeling, such as, "I model healthy eating for my child by eating healthy foods myself" and "I eat food I want my child to eat" (Musher-Eizenman & Holub, 2007; Tibbs et al., 2001).

Though several studies have found associations between self-reported parental modeling behaviors and child food intake (Draxten, Fulkerson, Friend, Flattum, & Schow, 2014; Oliveria et al., 1992; Tibbs et al., 2001), it is unclear if these associations are the result of modeling directly (i.e., parents purposefully eating healthy foods and avoiding unhealthy foods in front of their children) or other aspects of parents' and children's shared food environment. For instance, if parents alter their home food environment to make healthy foods more available and unhealthy foods less available to their children, this behavior also changes the foods that are available for parents to eat at home. Additionally, self-reported feeding practices do not necessarily map on to independent observations of these behaviors, particularly among overweight children (Farrow, Blissett, & Haycraft, 2011). To fully understand associations between parents' food intake and children's food intake, directly observing parents and children eat both healthy and unhealthy foods is critical and currently absent from many investigations of parental modeling.

Research on what parents say to their children about food has largely relied on parental report. Only a few studies have observed parent-child conversations about food and examined the relation between parent talk and child food intake. For instance, several feeding questionnaires obtain parental self-reports of how parents talk to their children about food, including the taste or health properties of foods (Hendy, Williams, Camise, Eckman, & Hedemann, 2009; Musher-Eizenman & Holub, 2007). Just a few studies have directly analyzed the content of what parents say to their children about food in observational settings; these studies focus on broad styles of talk. For instance, one study found that the style of maternal talk about food (e.g., "practical no-nonsense," "easy-going," "disengaged," "indulgent worry") differs between sociodemographic groups (Pesch, Harrell, Kaciroti, Rosenblum, & Lumeng, 2011). Maternal feeding practices similarly cluster within socioeconomic groups (Baughcum et al., 2001). Other studies have differentiated between types of prompts, such as direct commands, indirect commands, and physical prompts, which mothers tend to use more often in the second half of a meal (Stark et al., 2000). Additionally, mothers of obese children are less likely to encourage children to eat a dessert than mothers of normal weight children and are more likely to discourage eating a variety of foods, including a familiar dessert, familiar vegetable, and unfamiliar vegetable (Pesch et al., 2016). These studies suggest that how mothers interact with children around food differs based on sociodemographic and anthropometric characteristics of the mother and child. Yet little is known about how parents' modeling behaviors and the content of their food talk may guide children's intake.

A few experimental studies have examined how different messages about foods influence children's food choices. For example, children are more likely to select foods that adults had previously endorsed, particularly when adults had endorsed the food in absolute terms ("I think this is yummy") rather than a comparison ("I like this one better," Lumeng, Cardinal, Jankowski, Kaciroti, & Gelman, 2008) when adult teachers enthusiastically model eating those foods (Hendy & Raudenbush, 2000), or when adults communicate that foods are enjoyed by children's peers (DeJesus, Shutts, & Kinzler, in press). Preschool-age children selectively seek out familiar adults, such as their mother or a teacher, when they are learning information about the health of a food (Nguyen, 2012) and discount verbal information provided about food by people who have previously provided inaccurate information in another domain, such as erroneously stating that a bag contained a crayon when it actually contained a ball (Nguyen, Gordon, Chevalier, & Girgis, 2016). Although children are more attentive to the food choices of their peers than to the food choices of their teachers (Hendy & Raudenbush, 2000), they view adults as reliable sources of complex information, such as information about nutrition (VanderBorght & Jaswal, 2009). Children's attention to other people's food choices emerges early in development, as one-year-old children expect people who share food preferences to affiliate or be part of the same cultural group, as measured by their patterns of looking to a video display (Liberman, Woodward, Sullivan, & Kinzler, 2016), and are more likely to select foods that have been modeled by cultural ingroup members (Shutts, Kinzler, McKee, & Spelke, 2009). However, these studies do not directly examine how the content of other people's food talk (specifically, parents) and their food intake compare directly as guides to children's food intake.

The present study directly examines maternal food talk and maternal food intake as unique sources of information that could be independently associated with children's food intake. We examined a large sample of maternal food talk and intake in a structured eating protocol, in which mothers and children ate several foods together in laboratory-like setting. This design provides the benefit of allowing naturalistic conversations (i.e., parents were not given any conversation prompts or instructed to talk about the foods with their child) in a highly structured and controlled environment. We analyzed maternal food talk overall, as well as specific aspects of maternal food talk such as directives, pronoun use, and questions. These food talk variables could provide insight into the extent to which mothers use language to model healthy eating behavior while they are eating with their children. For instance, mothers may use directives to set limits on children's intake (see Lucas-Thompson, Graham, Ullrich, & MacPhee, 2017, for evidence that observed limit setting is associated with more healthy food choices during grocery shopping), pronouns to tell children about their own likes and dislikes, and questions to start conversations about food with their children. First, we hypothesized that mothers would differ from one another in how frequently they talk about food and examined several predictors of maternal food talk, including maternal and family characteristics (maternal body mass index (BMI), maternal race/ethnicity, maternal education, household food insecurity) and child characteristics (child BMI z-scores, child age, child sex). Second, we examined maternal food talk and maternal food intake as independent predictors of measured child food intake during the protocol. Finally, we examined whether these effects were moderated by food type or the maternal and child characteristics described previously. We hypothesized that any possible association between maternal food talk and child intake could be more robust among unfamiliar foods, as parental impressions of those foods may be particularly informative, compared to foods that are familiar and about which children already have opinions. In addition, these associations could differ depending on children's contexts and experiences (e.g., whether or not they experience household food insecurity).

1. Method

1.1. Participants

Participants included 234 four-to eight-year-old children (118 male, 116 female; mean age = 71.03 months, SD = 8.49 months, range = 48.26–96.76 months) and their biological mothers, adoptive mothers, or grandmothers (mean age = 31.30 years, SD = 7.09 years, range = 20.63–62.74 years). The vast majority of caregivers in this sample were biological mothers ($N = 224$), so we refer to the entire group as mothers throughout; 7 were grandmothers and 3 were adoptive mothers. Participant age and demographics, including maternal race/ethnicity, maternal education, and household food insecurity, were collected by questionnaire.

Mother-child dyads were enrolled in a longitudinal study on psychosocial and behavioral contributors to children's obesity risk in low-income families. Participants in the original study ($N = 301$) were invited to participate through children's Head Start programs in Southcentral Michigan. To be eligible for the original study, mothers had to be fluent in English and have less than a four-year college degree. Children were excluded from the original study if they had a gestational age less than 35 weeks; significant perinatal or neonatal complications; serious medical problems; food allergies; or if they were living in foster care. Children were three-to four-years of age at the time of recruitment and four-to eight-years of age when they participated in the Structured Eating Protocol (SEP), the task examined in the present study.

From the original sample, 244 mother-child dyads completed the SEP; those that did not complete the SEP could not be contacted, had moved out of the study area, had developed an allergy since recruitment, or were not interested in or available to participate in this particular protocol. Of those that completed the SEP, 234 dyads were included in this analysis; for 10 dyads, transcripts of the SEP were not available (e.g., because of technical error or a child became ill during the study). See Table 1 for demographic information about the sample of participants included in this study. The 234 dyads in this analysis did not differ from the 67 dyads not included with regard to maternal BMI ($p = .86$), maternal education ($p = .77$), household food insecurity ($p = .33$), child BMIz ($p = .52$), child age ($p = .78$), or child sex ($p = .79$). However, the mothers included in this analysis were more likely to be White, non-Hispanic than those who were not included (73.1% vs. 47.8% of the full sample, $p < .0001$).

Table 1. Participant characteristics ($N = 234$).

	N (%) or Mean (SD)
Mother characteristics	

	N (%) or Mean (SD)
Maternal BMI; mean (SD)	33.15 (9.49)
Maternal race/ethnicity:	
White non-Hispanic; n (%)	171 (73.08)
Other; n (%)	63 (26.92)
Maternal level of education:	
High school diploma or less; n (%)	113 (48.29)
Some college courses; n (%)	94 (40.17)
2 year college degree; n (%)	27 (11.54)
Household food insecurity	75 (32.05)
Child characteristics	
Child BMI z-score; mean (SD)	0.82 (1.02)
Child age (months); mean (SD)	71.03 (8.49)
Child is male; n (%)	118 (50.43)

1.2. Overall study design

In the SEP (also described in Goulding et al., 2014; Lumeng & Burke, 2006; Mosli et al., 2015; Pesch et al., 2016; Radesky et al., 2015), mothers and children were given a series of foods to eat. Four foods were included in the SEP that varied in familiarity (familiar vs. unfamiliar) and taste (savory vs. sweet): Green beans (familiar/savory), artichokes (unfamiliar/savory), chocolate cupcakes (familiar/sweet), and halvah (unfamiliar/sweet). When asked to report whether the mothers themselves had eaten the food before, 99% of mothers reported yes for green beans, 42% for artichoke hearts, 98% for cupcakes, and 6% for halvah. When asked to report whether their child had eaten the food before, 98% of mothers reported (on behalf of her child) yes for green beans, 13% for artichoke hearts, 95% for cupcakes, and 0.4% for halvah.

All procedures were approved by the university's Institutional Review Board. Mothers provided informed written consent and were compensated $60 for their participation in this portion of the larger longitudinal study.

Mothers and children were invited to participate in the SEP in a quiet room in their home or a convenient community center (e.g., Head Start) and were asked to fast for 2 h prior to the study. Mothers and children were seated alone at a table and were given each food individually by a research assistant. Mothers and children were each given their own sample of food on different colored dishes (e.g., a red plate for the mother and a blue plate for the child, without any labels or packaging) and were told simply that they could try the foods if they wished to do so. The specific foods served were one cup of canned green beans (Del Monte, Cut Green Beans, No Salt Added; 123.7 ± 0.5 g, 45 kilocalories), one cup of canned artichoke hearts (Reese Quartered Artichoke hearts, 123.7 ± 0.5 g, 50 kilocalories), two chocolate cupcakes (Hostess Chocolate Cupcakes, 104.96 ± 0.5 g, 320 kilocalories), and a quarter of a container of halvah (Ziyad Halvah with Vanilla, 76 ± 0.5 g, 384 kilocalories). Each person received their own serving of each food (i.e., the mother received one cup of green beans and the child also received one cup of green beans, on separate plates). Utensils and napkins were provided. The research assistant left the room while dyads had the opportunity to eat each food and returned after 4 min to remove the remaining food. This procedure was repeated for each food, with food order counterbalanced across dyads. The entire protocol was videotaped for offline coding.

Each food was weighed on a scale before and after the test session (see Table 2 for maternal and child intake data). However, food intake was not available for all participants, as occasionally circumstances arose in which this weight did not accurately reflect each person's intake. For instance, if a child ate a few bites of food from their mother's plate, then the difference between the pre- and post-test weight of each food would not accurately reflect the child's or the mother's food intake, or if the child dropped a piece of food anywhere other than their plate (e.g., the floor, table, or trash), their pre-post-test difference would not accurately reflect the child's food intake. Research assistants took detailed notes about the measurements in the event that the pre-/post-test weights might not accurately reflect intake. Green bean intake was available for 203 mothers and 203 children; artichoke intake was available for 207 mothers and 201 children; cupcake intake was available for 195 mothers and 198 children; halvah intake was available for 187 mothers and 159 children.

Table 2. Maternal and child food intake and maternal food talk by food type ($N = 234$). For types of maternal talk, means represent the mean number of utterances that were coded as representing that type of talk.

Mean (SD)	Green beans	Artichokes	Cupcakes	Halvah
Types of maternal food talk				
Overall food talk	12.38 (7.53)	14.24 (7.93)	12.96 (6.52)	14.14 (8.90)
Directives	1.93 (3.12)	2.45 (3.06)	2.02 (2.25)	1.91 (2.76)
1st person pronouns	2.88 (2.87)	4.08 (3.99)	3.06 (2.57)	3.18 (3.25)
2nd person pronouns	5.94 (4.16)	6.58 (4.85)	6.46 (4.76)	5.59 (4.64)
Tag questions	0.60 (0.92)	0.41 (0.91)	0.61 (1.06)	0.57 (1.07)
Wh- questions	0.81 (1.28)	1.18 (1.55)	0.83 (1.31)	1.09 (1.27)
Yes/no questions	3.56 (3.35)	4.24 (3.52)	3.21 (3.10)	3.96 (3.59)
Other questions	0.33 (0.63)	0.41 (0.82)	0.36 (0.74)	0.32 (0.64)
Food intake				
Maternal food intake, g	26.81 (27.56)	9.64 (15.12)	34.39 (25.27)	8.29 (10.40)
Child food intake, g	26.50 (29.55)	4.89 (7.47)	44.15 (27.23)	8.94 (12.01)

1.3. Linguistic coding

Transcription. Transcribers were trained to transcribe the SEP videos using a modified Discourse Transcription style, with turn-at-talk as the primary unit of analysis (Du Bois, 1991; Du Bois, Schuetze-Coburn, Cumming, & Paolino, 1993). Line breaks between turns-at-talk were created if there was a change in speaker or a noticeable pause in speech (i.e., more than a second or two). Transcription was performed using Atlas.ti software (Version 7.5.11).

Coding. Coders were trained to code from SEP transcripts using Atlas.ti. Instances of maternal talk were autocoded from transcripts, in which maternal utterances were marked as MOT. Then, food talk was coded by marking any reference to food within maternal talk as each food was provided, including foods that were not present during the study. Maternal food talk was construed broadly – for instance, if the child said something about food and the mother replied “mm-hmm,” the mother's “mm-hmm” would be coded as food talk. Coders were instructed to err on the side of coding a turn-at-talk as food talk (rather than not) if the content of the mother's talk was ambiguous.

Next, a series of other features were coded within turns-at-talk marked as maternal food talk. Specifically, coders marked directives, pronouns (1st and 2nd person), and questions (tag questions, wh-questions, yes/no questions, and other questions). Directives were defined as turns-at-talk in which the mother told the child to do something, such as, “stop making a mess,” “don't,” “quit it,” “take another bite,” and, “one more bite.” First person pronouns included turns-at-talk that used I, me, my, our(s), we, and mothers referring to herself in the third person (e.g., a mother saying, “Mommy likes these”). Second person pronouns included turns-at-talk in which mothers used you, your, yours, and generic you (see Orvell, Kross, & Gelman, 2017). Tag questions were defined as truncated questions at the end of an instance of maternal food talk, such as a mother saying, “you like these, don't you?” or, “it's different, isn't it?” Wh-questions were defined as questions mothers asked using who, what, when, where, why, how, and which, such as, “what are you doing?” or, “which food was your favorite?” Yes/no questions were defined as questions mothers asked whose answers could take on the form of yes or no (regardless of the child's actual reply), such as, “you think it tastes like fruit?” or, “want to eat the rest of it?” Other questions were defined as questions that did not clearly fit into the question categories defined above, such as, “do you like this one or the first one better?”

To calculate reliability for each code, a set of 20 transcripts was double-coded and intraclass correlations were calculated. For all codes, ICCs were greater than 0.88, except for “other questions” (ICC = 0.60). The small number of disagreements observed were resolved by discussion. The number of times each code occurred for each food was generated by Atlas.ti (see Table 2 for descriptive data).

1.4. Anthropometrics

At the end of the protocol, child and mother anthropometrics were collected. Participant weights (kg) and heights (m) were measured based on standard procedures (Shorr, 1986) and BMI was calculated as kg/m^2. Twelve mothers were pregnant when they completed the SEP or had given birth within the previous 3 months. For these mothers, self-reported pre-pregnancy weight was used instead of measured weight to calculate maternal BMI. For children, BMIs were z-scored for age and sex based on the United States Centers for Disease Control Growth Charts (Kuczmarski et al., 2002). Child BMI z-scores (rather than unadjusted BMI) were used in statistical analyses.

2. Results

2.1. Predictors of maternal food talk

Descriptive statistics for maternal food talk and maternal and child food intake by food type are shown in Table 2. To examine the predictors of maternal food talk, we conducted a series of repeated-measures linear regressions (one model for each type of food talk) with all predictors included simultaneously: 4-category food type (the repeated measure), maternal BMI, maternal race/ethnicity (Hispanic or not White vs. non-Hispanic White), maternal education (having a high school diploma or generalized equivalency diploma (GED) or more vs. not), household food insecurity (not reporting food insecurity vs. reporting food insecurity), child BMIz, child age in months, and child sex (male vs. female). To examine total maternal talk, which was coded without respect to specific foods, we conducted the same analysis but omitted 4-category food type. We conducted separate analyses for each type of talk: Maternal food talk, directives, 1st person pronouns, 2nd person pronouns, tag questions, wh-questions, yes/no questions, and other questions, and total maternal talk (including food and non-food talk; see Table 3). Each type of food talk was a count of that talk type for each mother, broken down by food for all types of talk other than total maternal talk.

Table 3. Repeated measures linear regression models predicting types of maternal talk; estimate (SE); $N = 234$. Asterisks indicate significant *p*-values; 0.05 (*), 0.01 (**), 0.001 or smaller (***).

Predictors	Maternal food talk	Directives	1st person pronouns	2nd person pronouns	Tag questions	Wh-questions	Yes/no questions	Other questions	Maternal talk (total)
Food type									
Green Beans vs. Halvah	−1.75 (0.52)***	0.02 (0.21)	−0.29 (0.22)	0.37 (0.32)	0.03 (0.08)	−0.29 (0.10)**	−0.36 (0.23)	0 (0.06)	n/a
Artichoke vs. Halvah	0.09 (0.57)	0.52 (0.25)*	0.90 (0.26)***	0.96 (0.32)**	−0.17 (0.08)*	0.09 (0.12)	0.29 (0.24)	0.09 (0.06)	
Cupcakes vs. Halvah	−1.20 (0.52)*	0.10 (0.20)	−0.14 (0.21)	0.90 (0.31)**	0.03 (0.08)	−0.26 (0.10)**	−0.74 (0.24)**	0.04 (0.06)	
Maternal BMI	−0.11 (0.04)**	0.002 (0.01)	−0.05 (0.01)***	−0.06 (0.02)*	−0.01 (0.004)**	−0.01 (0.01)*	−0.04 (0.02)**	−0.005 (0.003)	−0.57 (0.22)**
Maternal race/ethnicity									
Hispanic or not White vs.	0.15 (0.95)	0.33 (0.25)	−0.33 (0.36)	−0.22 (0.48)	−0.14 (0.09)	0.04 (0.12)	−0.32 (0.33)	−0.04 (0.06)	4.93 (5.13)
Non-Hispanic White									
Maternal education									
(≤HS/GED vs. > HS grad)	0.26 (0.80)	0.14 (0.24)	0.30 (0.32)	0.27 (0.46)	−0.11 (0.08)	0.002 (0.11)	0.29 (0.32)	−0.03 (0.06)	2.10 (4.42)
Household food insecurity									

Predictors	Maternal food talk	Directives	1stperson pronouns	2ndperson pronouns	Tag questions	Wh-questions	Yes/no questions	Other questions	Maternal talk (total)
(Food secure vs. not)	1.24 (0.81)	−0.06 (0.28)	0.10 (0.34)	0.33 (0.52)	0.01 (0.09)	0.12 (0.12)	0.48 (0.31)	0.02 (0.06)	7.15 (4.78)
Child BMIz	0.36 (0.39)	0.10 (0.13)	0.37 (0.15)**	0.08 (0.20)	−0.02 (0.04)	0.15 (0.06)**	0.05 (0.15)	0.01 (0.03)	2.54 (1.97)
Child age (months)	−0.004 (0.04)	−0.04 (0.02)**	0.004 (0.02)	−0.06 (0.03)*	−0.001 (0.004)	−0.001 (0.01)	−0.05 (0.02)**	−0.0004 (0.004)	0.19 (0.26)
Child sex (male vs. female)	−1.32 (0.80)	0.37 (0.24)	−0.001 (0.32)	0.04 (0.46)	0.04 (0.08)	0.08 (0.12)	−0.65 (0.33)*	−0.09 (0.06)	0.35 (4.38)

These regression models demonstrate that, across different types of food talk, mothers with higher BMIs exhibited less talk, including maternal food talk ($b = -0.11$, $SE = 0.04$, $p = .004$) and total maternal talk ($b = -0.57$, $SE = 0.22$, $p = .01$). In addition, mothers with higher BMIs used fewer first person pronouns ($b = -0.05$, $SE = 0.01$, $p = .0003$), fewer second person pronouns ($b = -0.06$, $SE = 0.02$, $p = .02$), fewer tag questions ($b = -0.01$, $SE = 0.004$, $p = .002$), fewer wh-questions ($b = -0.01$, $SE = 0.01$, and fewer yes/no questions ($b = -0.04$, $SE = 0.02$, $p = .01$), $p = .03$).

In addition, a few types of maternal food talk were associated with their children's BMI z-scores: Child BMIz was positively associated with maternal use of first person pronouns (i.e., mothers referencing their own likes and dislikes; $b = 0.37$, $SE = 0.15$, $p = .01$) and wh-questions ($b = 0.15$, $SE = 0.06$, $p = .01$). Child age was negatively associated with maternal use of directives ($b = -0.04$, $SE = 0.02$, $p = .01$), second person pronouns ($b = -0.06$, $SE = 0.03$, $p = .03$), and yes/no questions ($b = -0.05$, $SE = 0.02$, $p = .01$).

2.2. Predictors of child food intake

To examine maternal food talk and maternal food intake as predictors of child intake, we conducted a repeated-measures linear regression with maternal food intake, maternal food talk, 4-category food type (the repeated measure), maternal characteristics (i.e., maternal BMI, maternal race/ethnicity, maternal education, household food insecurity), and child characteristics (i.e., child BMI z-score, child age, child sex) entered simultaneously as predictors of child food intake (see Table 4).

Table 4. Repeated measures linear regression predicting child food intake (in grams).

Predictors	Estimate	SE	P-value
Maternal food intake	0.27	0.06	<.0001
Maternal food talk	−0.15	0.09	.10
Food type			<.0001
Green Beans vs. Halvah	12.74	2.45	<.0001

Predictors	Estimate	SE	P-value
Artichoke vs. Halvah	−4.08	1.06	.0001
Cupcakes vs. Halvah	28.30	2.52	<.0001
Maternal characteristics			
Maternal BMI	0.007	0.08	.93
Maternal race/ethnicity (Hispanic or not White vs. Non-Hispanic White)	−2.57	1.95	.17
Maternal education (≤HS grad/GED vs. > HS grad)	−1.50	1.62	.35
Household food insecurity (Food secure vs. not)	1.50	1.78	.40
Child characteristics			
Child BMIz	2.56	0.88	.004
Child age (months)	0.15	0.10	.12
Child sex (male vs. female)	−2.15	1.60	.18

We observed a main effect of food type ($p < .0001$); compared to halvah (the reference category), children were more likely to eat green beans ($b = 12.74$, $SE = 2.45$, $p < .0001$), less likely to eat artichokes ($b = -4.08$, $SE = 1.06$, $p = .0001$), and more likely to eat cupcakes ($b = 28.30$, $SE = 2.52$, $p < .0001$). See Table 2 for descriptive statistics on maternal and child food intake. In addition, child BMIz was positively associated with child food intake ($b = 2.56$, $SE = 0.88$, $p = .004$).

In terms of our primary research question (i.e., is what mothers eat or what they say associated with children's food intake), these regression models revealed that maternal food intake was a significant predictor of children's food intake (i.e., the more mothers ate during the study, the more children ate; $b = 0.27$, $SE = 0.06$, $p < .0001$), but maternal food talk was not significantly associated with children's intake ($b = -0.15$, $SE = 0.09$, $p = .10$).

Two additional models tested for potential moderation by food type. The interaction between food type and maternal food intake was not significant ($p = .45$). The interaction between food type and maternal food talk also was not significant ($p = .47$). These interactions suggest that food type did not moderate the effect of either maternal food intake or maternal food talk on children's intake. Maternal food intake predicted child food intake, whereas maternal food talk did not, regardless of the type of food mothers and children were offered. An additional model found that the interaction between maternal food intake and maternal food talk was not significant ($p = .51$).

In addition, we tested for moderation by the covariates in the model (maternal BMI, maternal race/ethnicity, maternal education, household food insecurity, child BMIz, child age, and child sex). Specifically, we examined interactions of each covariate with maternal food talk and maternal food intake. We did not find moderation by maternal BMI (talk: $p = .28$, intake: $p = .80$), maternal race/ethnicity (talk: $p = .85$, intake: $p = .54$), maternal education (talk: $p = .23$, intake: $p = .10$), child BMIz (talk: $p = .8$, intake: $p = .11$), child age (talk: $p = .56$, intake: $p = .28$), or child sex (talk: $p = .21$, intake: $p = .59$). However, we did find a significant interaction between household food insecurity and maternal food intake (talk: $p = .88$, intake: $p = .02$). Among food-secure families, we observed the original pattern – maternal food intake predicted child intake ($p < .0001$), but maternal food talk did not ($p = .29$). Among foodinsecure families, neither maternal food intake ($p = .27$) nor maternal food talk ($p = .39$) predicted children's food intake. Instead, food type ($b = -3.77$, $SE = 1.57$, $p < .0001$) and child BMIz ($b = 4.14$, $SE = 1.33$, $p = .002$) predicted children's food intake for this subgroup.

Similar patterns of results were observed in separate regression models that included each specific type of maternal food talk (i.e., directives, pronouns, questions). Maternal food intake was significant in every model ($p = .0001$ or less), whereas only yes/no questions ($b = -0.56$, $SE = 0.22$, $p = .01$) and other questions ($b = -2.16$, $SE = 0.87$, $p = .01$) were independent significant predictors of child food intake, and the association between these specific types of maternal food talk and child intake was negative (for all other types of maternal food talk, $ps > .38$).

2.3. Correlations between maternal food talk and maternal food intake

One might argue that maternal food intake, but not maternal food talk, predicted child food intake because the more time mothers spent eating, the less time was available to talk. However, overall maternal food talk and maternal food intake were not significantly correlated for green beans ($r(203) = 0.04$, $p = .59$), artichokes ($r(207) = -0.09$, $p = .69$), or halvah ($r(187) = -0.01$, $p = .88$), although it was significantly negatively correlated for cupcakes ($r(195) = -0.15$, $p = .04$). Therefore, this pattern cannot be fully explained because mothers are simply talking less if they are eating more. However, this may play some role in the association between maternal food talk, maternal intake, and child intake for cupcakes specifically.

3. Discussion

This study reveals several important findings regarding the ways that mothers talk to their children about food, in a context in which the opportunities to eat and the foods available were controlled across participants. First, mothers used a variety of types of food talk, even during short, unstructured conversations about food, including different types of directives, pronouns, and questions. A few maternal and child characteristics were related to different types of maternal food talk, namely maternal BMI, child BMIz, and child age. Maternal BMI was negatively associated with several types of talk, suggesting that the higher the mother's BMI, the less she talked during the study (about food or overall). Child BMIz was positively associated with maternal use of first person pronouns and wh-questions, which may be especially reflective of mothers' attempts at modeling through language, specifically in sharing their own preferences as a means of indirectly encouraging intake of that food (e.g., "I like this" when eating green beans) and asking children questions that might encourage children to reflect on their own behavior (e.g., "Why are you not eating yours?"). Child age was negatively associated with maternal use of directives, second person pronouns, and yes/no questions, which may be indicative of mothers using more complex language with older children (e.g., Snow, 1972), rather than simple commands and questions. Ultimately, however, the most robust predictor of child food intake during the SEP was maternal food intake, rather than overall maternal food talk or the specific aspects of maternal food talk coded in this study.

With regard to the factors that predict maternal food talk, these findings highlight that many factors are associated with how mothers talk about food, including their own weight. The higher mothers' BMI in this study, the less frequently they talked about their own preferences (as indexed by pronouns), asked their children questions, and talked about food. Mothers who are overweight demonstrate more concern about their children's weight status (Carnell, Edwards, Croker, Boniface, & Wardle, 2005), yet are also more likely to underestimate their children's weight (Warschburger & Kröller, 2009). Mothers may find it especially difficult to know *what* to say to their children to promote healthy eating given that the same feeding practices have been shown to be both positively and negatively associated with healthy outcomes (Birch, Fisher, & Davison, 2003; Campbell et al., 2010; Faith, Berkowitz, et al., 2004; Farrow & Blissett, 2008; Rodgers et al., 2013; Spruijt-Metz, Li, Cohen, Birch, & Goran, 2006; Stang & Loth, 2011; Webber, Cooke, Hill, & Wardle, 2010). Some studies have shown counterproductive effects of verbal pressure and restriction on children's eating, such that children actually demonstrate the opposite behavior of what was intended by the prompt (Galloway, Fiorito, Francis, & Birch, 2006; Jansen, Mulkens, & Jansen, 2007). Other studies demonstrate that calling foods healthy can backfire and children are actually less likely to select those foods (Maimaran & Fishbach, 2014; Wardle & Huon, 2000). Heavier mothers might be especially conscious of not saying the wrong thing given the stigma surrounding obesity (Carr & Friedman, 2005; Puhl & Brownell, 2001; Puhl & Heuer, 2010; Schwartz, Chambliss, Brownell, Blair, & Billington, 2003; Strauss & Pollack, 2003) and internalized weight biases that lead to negative self-appraisals and stereotypes (Kahan & Puhl, 2017). Consequently, overweight or obese parents might talk less about food because they perceive or internalize stigma based on their own weight. These findings suggest opportunities to design interventions that provide parents with effective prompts.

With regard to the factors that predict children's food intake, maternal food intake was positively associated with children's food intake, whereas maternal food talk (the total amount and the specific types of food talk we coded, such as directives, pronouns, questions) was not significantly associated with children's food intake. This finding provides an important contrast to research in cognitive development that has examined children's learning about food and other topics from other people. In these studies, children demonstrate a robust tendency to learn from other people's verbal statements (e.g., Harris, 2007; Koenig & Harris, 2005), including in food contexts (DeJesus et al., in press; Lumeng et al., 2008; Nguyen, 2012; Nguyen et al., 2016; VanderBorght & Jaswal, 2009). In light of this body of research, we might have expected maternal food talk to positively predict children's food intake. However, aside from studies finding that children disregard an informant's inaccurate statements when their own observations contradict those statements (Ma & Ganea, 2010), we actually know remarkably little else about how children respond to actions compared to language as a source of information. To our knowledge, no experimental study has directly manipulated the type of information that children receive (i.e., verbal statements vs. action) and compared their effectiveness. The present study provides important initial evidence that children may be more likely to follow what people do, rather than what people say. Future studies along these lines would not only contribute to our knowledge of the factors that guide children's food selection, but also inform our understanding of children's social learning more broadly.

In addition, we observed moderation based on children's experience of household food insecurity. Specifically, it was only when parents did not report household food insecurity that maternal food intake, but not maternal food talk, predicted children's food intake. Among children who did experience household food insecurity, neither maternal talk nor maternal food intake predicted children's food intake. This finding highlights the importance of considering children's contexts when examining the predictors of children's food intake and the obesity more generally. Though previous studies have found mixed evidence for a direct association between food insecurity and weight gain in children (Burke, Frongillo, Jones, Bell, & Hartline-Grafton, 2016; Dubois, Farmer, Girard, & Porcherie, 2006; Gundersen, Garasky, & Lohman, 2009; Nettle, Andrews, & Bateson, 2017), a growing body of research demonstrates that childhood exposure to psychosocial stress is associated with a variety of risk factors for obesity, such as eating in the absence of hunger and emotional eating (Miller et al., in press), cortisol reactivity (Doom et al., in press), and poor sleep patterns (Miller, Lumeng, & LeBourgeois, 2015). Considering these contexts in future observational and experimental studies is critical to fully understand the factors that influence children's food intake and weight gain.

An important strength of this study is that it includes a relatively large sample of mothers and children, including a socioeconomically diverse group of participants. However, there are several limitations to consider in future studies. First, though this study is observational, the laboratory-like setting may not reflect the way that eating interactions naturally unfold between parents and children at home (Faith, Scanlon, Birch, Francis, & Sherry, 2004). Though the laboratory-like setting has important benefits (e.g., controlling the type and amount of food available), a more naturalistic setting (e.g., family meals) may be more reflective of the conversational styles or eating behavior that would occur at home (Alm, Olsen, & Honkanen, 2015; Pan, Perlmann, & Snow, 2000; Wiggins, 2014). It is possible that overweight mothers might not feel as self-conscious about talking about food at home and may engage in more conversation in that context, compared to the laboratory-like setting of this protocol. However, it is also possible that these mothers might avoid talking about food in front of other people, even in everyday non-experimental settings. Second, we analyzed maternal talk and food intake in the aggregate; therefore, it is unknown from this analysis if children were more or less likely to take a bite of food shortly after particular types of maternal talk. Examining the timing between maternal talk and child food intake, and even defining what constitutes a behavioral response to talk that is not a directive, is an important project for future research. Third, mothers were not given any specific instructions about how to interact with their children in this study. The unstructured nature of these conversations is a strength in terms of observing what mothers and children spontaneously say and do. However, mothers and children may not view these interactions as learning opportunities compared to a more structured interaction. Fourth, because this study specifically recruited mothers to participate (e.g., not fathers or teachers), it is an open question whether the obtained results would generalize to interactions involving other family members or any unrelated adult. Finally, we focused exclusively on maternal talk in this study; understanding children's contributions to these conversations is an important project for future study.

This study sets the stage for several important future directions, in addition to those described thus far. First, the current paper and a long history of research on parenting and eating behavior has examined maternal food talk or prompts provided by adults. However, this literature rarely examines children's food talk, which may provide important insights into the relation between parental feeding strategies and children's food intake, and has the opportunity to reveal what knowledge and beliefs children bring to these interactions. Second, it is critical to examine the role of fathers in guiding children's eating behavior (see Cabrera, Volling, & Barr, 2018). The vast majority of the literature on child feeding has focused on mothers and the present study builds on that work. In addition, women in the United States continue to perform the majority of household labor, including meal planning, cooking meals, and feeding children (Lachance-Grzela & Bouchard, 2010). However, we recognize the importance of studying the role of fathers in food contexts. Mothers and fathers may employ different feeding strategies and children may respond differently to them (see Dayton, Walsh, Oh, & Volling, 2015, for a related study in infants). Including examinations of child talk and fathers in future studies would represent an important expansion of our understanding of family eating dynamics.

To conclude, we found that how much food mothers ate, but not how much mothers spontaneously talked about food (including overall food talk and food-related directives, pronouns, and questions), significantly predicted children's food intake in a structured study of parent-child food interactions. This finding suggests that it may be especially important for parents to consider how and what they eat in front of their children. For instance, mothers on average ate less than half of the cupcakes provided in this study (34.39 g out of approximately 100 g), and they may have been especially motivated to avoid being observed eating an unhealthy food in front of their child. Nevertheless, children may be sensitive to subtle differences in the amount that mothers did eat – on average, mothers ate more of the cupcake than other foods. From a health perspective, these findings suggest that additional guidance on modeling healthy behaviors may be useful to add to pediatric feeding guidelines. Specifically, these guidelines suggest that parents should model healthy eating behavior (e.g., Barlow, 2007), yet it may be important to also remind parents that children are watching parents' unhealthy behaviors and they may be unwittingly modeling unhealthy behaviors.

Acknowledgements

This research was supported by NICHD grant R01HD061356 to J.C.L. and NIH T32 Postdoctoral Research Fellowship (T32HD079350) and AHA Postdoctoral Research Fellowship (17POST33400006) to J.M.D. We thank Elizabeth Roach for assistance in transcription and coding.

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