

## ORIGINAL ARTICLE

# Associations between feeding practices and maternal and child weight among mothers who do and do not correctly identify their child's weight status

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## Summary

### Objective

This study aimed to explore factors associated with accuracy of maternal weight perception and determine if maternal feeding practices are associated with weight status.

### Methods

Overweight/obese mothers reported demographics and perception of their child's weight and completed a modified preschooler feeding questionnaire. Mother's and child's height and weight were measured. Logistic regression was used to explore associations between demographic factors and accuracy. Correlations between the preschooler feeding questionnaire scales and mom's body mass index (BMI) and child's BMI-percentile were explored for the total sample and accurate and underestimating moms.

### Results

Among mothers whose child was overweight or obese, only 20% of mothers correctly identified the child as overweight. Forty percent of moms were underestimators. There was a positive correlation between concern the child was overweight/overeating and the child's BMI-percentile among underestimating moms; in the total sample ( $r=0.32$ ,  $p<.001$ ) and accurate moms ( $r=0.52$ ,  $p<.001$ ). In underestimators only, there was a negative relationship between child BMI-percentile and pressure to eat ( $r=-0.30$ ,  $p<.001$ ) and concern about child underweight ( $r=-0.47$ ,  $p<.001$ ).

### Conclusions

This study identified different associations between child weight and mother's feeding practices in mothers accurately and inaccurately perceiving her child's weight. Intervention studies should explore targeting education on feeding practices based on these perceptions.

**Keywords:** Child feeding practices, maternal weight perception, obesity.

## Introduction

From 2011 to 2012, 24% of US children aged 2–5 years were overweight, and 11% were obese (1). The high prevalence of overweight and obesity in young children is associated with numerous health risks during childhood (2–6) and adulthood (7–9). Parental feeding practices can shape a child's dietary behaviours (10–13). Parents, especially mothers, typically control the family's food environment. Child dietary behaviours, such as

fruit and vegetable intake, are associated with parent feeding practices including dietary modelling, food rules and encouragement (12,14–16). Although studies suggest that mothers play an important role in shaping children's eating patterns (10–12), many are unaware of their children's weight status (17–25). This is particularly true for young children (18,23,24).

While considerable research has investigated the prevalence of parental underestimation of weight status, fewer studies have investigated the implications for this

underestimation in terms of healthy eating behaviours and obesity prevention (26,27). For example, a mother may be less motivated to promote healthier behaviours if she underestimates her child's weight status.(28) Despite the importance of parental feeding practices in shaping dietary behaviours, there is limited research into how these practices might be related to weight status among mothers who do and do not accurately perceive their child's weight status, and none among a sample of overweight and obese parents.(29–33)

To fill this gap, the purpose of this paper is to explore factors associated with accuracy of maternal perception of her child's weight, to determine whether maternal feeding practices are associated with maternal and/or child weight status, and to assess whether the association between maternal feeding practices and child weight status differs depending on accuracy of maternal weight perceptions of her child. We have outlined the hypothesized conceptual model for this work in Figure 1, which describes the hypothesized relationship between maternal factors and accuracy of maternal weight perception, and hypothesized associations between feeding practices and child weight status, which differs depending on the accuracy of the mother's perception of her child's weight status.

## Methods

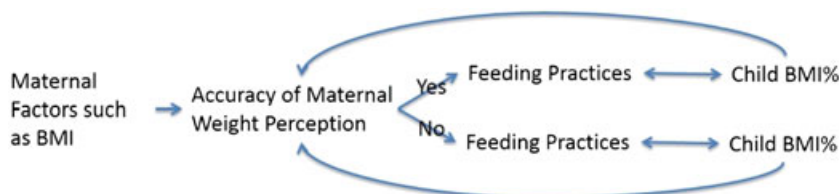
### Participants

This study was a cross-sectional, baseline analysis of the Healthy Eating and Active Living Taught at Home study, which evaluated the translation of the Diabetes Prevention Program into the Parents As Teachers child development programme. The Healthy Eating and Active Living Taught at Home study included 230 overweight and obese mothers and their preschool child living in the St. Louis region. To be eligible, mothers had a preschool-aged child at risk for obesity (60th to 84th percentile for body mass index (BMI)) (34) or already overweight or obese ( $\geq 85$ th percentile for BMI), and the mother had to

be able to read in English. Mothers were recruited through parent–child organizations, maternal child health care settings and through media outlets. All mothers provided informed consent, and baseline data was obtained on the mother and her youngest eligible child at one observation. During the consent process mothers were told that the purpose of the study was to evaluate the standard Parents as Teachers lessons plus additional information about how families can live healthy and active lives while reaching a healthy weight. This study was approved by the University's Human Research Protection Office. Participants received a \$50 gift card for completing the baseline survey.

### Measures

The demographic survey measures described in the following analyses were identical to those from our prior studies with Parents As Teachers and assessed age, race/ethnicity, current education level, employment status and number of children (35,36). Height and weight of the mother and preschooler were measured by trained staff in accordance with National Health And Nutrition Examination Survey procedures.(37). Mothers completed a survey that assessed her and her child's demographic characteristics, her perception of her child's weight (I think my child is; Very Underweight; A little Underweight; About the right weight; A little Overweight; Very Overweight), and included a modified version of the preschooler feeding questionnaire (PFQ) (Table S1). (38,39). The 32-item PFQ asked parents about feeding practices and beliefs and concerns about child's weight using a five-point scale. The tool assessed contextual factors, such as how, when and why children are fed. These included the following factors: (1) Difficulty in Child Feeding ( $\alpha=0.85$ ); (2) Concern about Child Overeating or Being Overweight ( $\alpha=0.81$ ); (3) Pushing the Child to Eat More ( $\alpha=0.67$ ); (4) Using Food to Calm the Child ( $\alpha=0.60$ ); (5) Concern about Child Being Underweight ( $\alpha=0.72$ ); (6) Child's Control of Feeding Interactions ( $\alpha=0.53$ ); (7) Structure During Feeding Interactions ( $\alpha=0.49$ ); and (8) Age-Inappropriate Feeding ( $\alpha=0.23$ ) (Table S1).



**Figure 1** Conceptual model for hypothesized relationship between maternal body mass index (BMI), accuracy of maternal weight perceptions, feeding practices and child weight status

**Table 1** Demographics of the 230 participants in the Healthy Eating and Active Living Taught at Home study

	Frequency	Percent
Child's gender		
Male	125	54.3
Female	105	45.7
Child's race/ethnicity		
Caucasian/non-Hispanic	110	47.8
African American/non-Hispanic	73	31.7
Other	47	20.4
Mom's race/ethnicity		
Caucasian/non-Hispanic	118	51.3
African American/not-Hispanic	72	31.3
Other	40	17.4
Number of children in the home		
0	64	27.8
1	94	40.9
2	41	17.8
≥3	31	13.5
Mom's education		
High school/GED or less	39	17.0
At least some college/tech	86	37.4
College/graduate school	103	44.8
Total	228	99.1
Missing	2	0.9
Mom's employment status		
No	78	33.9
Yes	150	65.2
Total	228	99.1
Missing	2	0.9
Number of hours mom works		
<30 h week <sup>-1</sup>	40	17.4
31–40 h week <sup>-1</sup>	76	33.0
>40 h week <sup>-1</sup>	34	14.8
Total	150	65.2
Missing	80	34.8
Income		
<\$19,999	62	27.0
\$20,000–\$49,999	63	27.4
\$50,000–\$74,999	44	19.1
> = \$75,000	50	21.7
Total	219	95.2
Missing	11	4.8
Mom's BMI category		
Overweight (≥25)	39	17.0
Obese (≥30)	89	38.7
Morbid obesity 1 (≥35)	62	27.0
Morbid obesity 2 (≥40)	40	17.4
Child's BMI percentile category		
At risk I (≥60)	88	38.3
At risk II (≥75)	43	18.7
Severe overweight (≥85)	54	23.5
Obese (≥95)	45	19.6
Worry child is overweight		
Disagree	173	75.2
No strong feelings either way	33	14.3
Agree	22	9.6

*Continues***Table 1.** *Continued*

	Frequency	Percent
Missing	2	0.9
I think my child is ...		
A little underweight	17	7.4
About the right weight	186	80.9
A little overweight	26	11.3
Total	229	99.6
Missing	1	0.4
Did he/she watch TV at meals?		
Never	62	27.0
Rarely	67	29.1
Sometimes	63	27.4
Often	30	13.0
Always	7	3.0
Total	229	99.6
Missing	1	0.4
Did you feed him/her yourself if he/she did not eat enough?		
Never	61	26.5
Rarely	60	26.1
Sometimes	78	33.9
Often	23	10.0
Always	6	2.6
Total	228	99.1
Missing	2	0.9
Total	230	100.0

BMI, body mass index.

## Analysis

Moms were categorized into three groups based on the accuracy of their perception of their child's weight, comparing the mother's categorization of her child's weight status with the measured weight status ([1] accurately perceiving their child as normal weight if the child was normal weight or accurately perceiving the child as overweight if the child was overweight; [2] perceiving the child as underweight or normal weight if the child was overweight or obese (underestimators); or [3] perceiving the child as overweight if the child was normal weight). Because of the very small number of participants falling in the third category, these mothers were not included in the stratified analyses. Unadjusted bivariate logistic regression was used to explore whether demographic factors predicted accuracy of mom's perception; these models were then adjusted (child's gender, child's race/ethnicity, number of children in the home, mom's education, mom's employment status, number of hours mom works and income), based on a priori hypotheses. Scales from the PFQ were used in the current analysis (38,39). The factors and their internal consistency are described in the Supporting Information. Correlations between the scores on each scale with mom's BMI and with her child's BMI percentile were explored for the total

sample. Then, to explore moderation, the sample was stratified based on accurately and inaccurately perceiving her child's weight, and the correlations were explored in each stratum. The presence of a significant association in one stratum, but not the other was used to compare the presence of a difference in the association between the strata.

## Results

Table 1 provides a summary of participant characteristics for mothers and their participating child. On average mothers were 32 years old ( $SD=6$ ), and children were 3.4 years old ( $SD=0.8$ ). Most mothers reported their race and the race of their child as Caucasian/non-Hispanic (51% and 48%, respectively) or African American/non-Hispanic (31% and 32%, respectively). Approximately half the children were male (54%). The income distribution of the sample was distributed relatively evenly from <\$20,000 to >\$75,000. The mean BMI for mothers was 35 ( $SD=5$ ). For children, the mean BMI percentile was 81 ( $SD=13$ ); all children had a BMI in at least the 60th percentile, and 23.5% of the sample is overweight (BMI %  $\geq 85$ ) and 19.6% obese (BMI%  $\geq 95$ ). Eighty-one percent of mothers thought their child was 'about the right weight', while 11% thought their child was a little overweight and 7% thought their child was a little underweight. When asked if they were worried their child was overweight, 75% of mothers disagreed, while only 9.6% agreed.

### Accuracy of mom's perception of her child weight

Only 57% of moms accurately identified their child's weight status (Table 2). Among mothers with a child who was at a healthy weight, 85% correctly identified

her child as normal weight, and among mothers with a child who was overweight or obese, 20% correctly identified her child as overweight. Only 3% of moms overestimated their child's weight. Forty-one percent of mom's underestimated their child's weight. Of these, most of the children were overweight (49%) or obese (34%); however, moms rated their child's weight as about right.

The child's BMI percentile was significantly associated with accuracy of prediction (Table 3), with greater likelihood of accuracy as BMI percentile increased; this strengthened after adjustment. No other demographic factors were associated with accuracy of prediction.

### Associations with the preschooler feeding questionnaire

Table 4 presents the correlations between feeding practices and weight status. There was a positive correlation between concern about the child being overweight or overeating and the child's BMI percentile in the total sample ( $r=0.32$ ,  $p < .001$ ) and among mothers who accurately identified the weight category for her child ( $r=0.52$ ,  $p < .001$ ). This indicates that mothers accurately perceiving their child's weight status were acting based on this perception (e.g. stopping their child from eating too much or getting upset when s/he ate too much). This association was not significant among underestimating moms.

Among underestimating mothers, there was a negative relationship between pressuring the child to eat more and a higher child's BMI percentile ( $r=-0.30$ ,  $p < .001$ ). There was also a negative relationship between the child BMI percentile and concern about the child being underweight ( $r=-0.47$ ,  $p < .001$ ) among underestimating mothers. Neither of these associations were significant in the total

**Table 2** Accuracy of mom's perception of child's weight by category of mom's weight status (% (n)) (n = 230)

Accuracy of categorization	Mom's BMI, obesity category				Total
	Overweight ( $\geq 25$ )	Obese ( $\geq 30$ )	Morbid obesity 1 ( $\geq 35$ )	Morbid obesity 2 ( $\geq 40$ )	
Correct	61.5% (24)	56.8% (50)	53.2% (33)	57.5% (23)	56.8% (130)
Healthy weight	56.4% (22)	48.9% (43)	43.5% (27)	45.0% (18)	84.6% (110)
Overweight	5.1% (2)	3.4% (3)	3.2% (2)	2.5% (1)	6.1% (8)
Obese	0.0% (0)	4.5% (4)	6.5% (4)	10.0% (4)	9.2% (12)
Underestimate	38.5% (15)	39.8% (35)	43.5% (27)	40.0% (16)	40.6% (93)
Healthy weight	7.7% (3)	10.2% (9)	3.2% (2)	2.5% (1)	16.1% (15)
Overweight	15.4% (6)	22.7% (20)	19.4% (12)	20.0% (8)	49.5% (46)
Obese	15.4% (6)	6.8% (6)	21.0% (13)	17.5% (7)	34.4% (32)
Overestimate*	0.0% (0)	3.4% (3)	3.2% (2)	2.5% (1)	2.6% (6)
Total	100.0% (39)	100.0% (88)	100.0% (62)	100.0% (40)	100.0% (229)

\*It was only possible for mothers to over-estimate the weight of their child if the child was normal weight (BMI < 85th percentile)  
BMI, body mass index.

**Table 3** Crude and adjusted\* associations between demographic characteristics and accuracy of mom's perceptions of her child's weight status (correct perception vs. underestimate) ( $n = 230$ )

Characteristic	OR (95% CI) for accuracy of weight status perception	Adjusted OR (95% CI) for accuracy of weight status perception
Mom's BMI	1.05 (0.80–1.39)	0.96 (0.66–1.41)
Child's BMI	<b>1.11 (1.08–1.14)</b>	<b>1.12 (1.08–1.17)</b>
Child's gender	0.68 (0.40–1.17)	
Child's race/ethnicity	1.16 (0.83–1.63)	
Mom's race/ethnicity	1.01 (0.71–1.43)	
Number of children in the home	1.10 (0.84–1.45)	
Mom's education	0.95 (0.66–1.36)	
Mom's employment status	0.85 (0.49–1.49)	
Number of hours mom works	1.39 (0.86–2.23)	
Income	0.79 (0.62–1.01)	

\*Adjusted for child's gender, child's race/ethnicity, number of children in the home, mom's education, mom's employment status, number of hours mom works, and income  
CI, confidence interval; OR, odd ratio.

sample or among mothers accurately perceiving their child's weight.

## Discussion

In a sample where 43% of the children were overweight or obese, only approximately 20% of mothers with an overweight or obese child considered their child to be overweight. The current study found that 41% of mothers underestimated their child's weight status. This is much lower (17) than some studies, which have found 79% of mothers underestimating, but much higher (18,19) than other studies, in which the rate of misreporting was

32–38%. The underestimating in the current study did not appear to be associated with any demographic characteristics aside from the child's actual BMI percentile including race/ethnicity. Mothers have been shown to underestimate the weight status of younger children and those with lower BMIs more frequently in national (USA), (18) school based, (22) and clinical (19) samples. Many other studies have found demographic factors to be associated with accuracy of perception of child weight. This is particularly true for factors reflecting maternal socioeconomic status such as education (40–43); however, the current study did not find such associations. Doolen *et al.* found associations between parental weight status and underestimation of the child's weight status (21). The current study included only mothers who were overweight or obese, which may, in part, explain the high rate of underestimation. This is also concerning in the light of recent research showing children of obese mothers were less likely to recognize their own weight as well as that of their mother and therefore may be related to shifting attitudes towards weight status, where overweight is less recognized because of its prevalence (44).

## Associations among accurately perceiving mothers

Several feeding practices appeared to be associated with child weight among mothers who accurately perceived her child's weight. Among those mothers, our results showed an increased concern that her child is overweight or overeats as the child's BMI percentile increased. The mothers' accurate perception of their child's weight status may be influencing these mothers to be more concerned about their child's weight and his/her eating behaviour. Although the current study did not assess the association between maternal concern about her child's weight status and feeding practices, such concern has

**Table 4** Correlations ( $r^*$ ) between PFQ factors scores and child BMI percentile for the total sample, and among moms accurately perceiving and underestimating her child's BMI

PFQ Factor	Total Sample	Only underestimate of child's weight	Only correct perception of child's weight
Difficulty in child feeding (F1)	–0.03	–0.11	–0.09
Concern about child overeating or being overweight (F2)	<b>0.32**</b>	0.16	<b>0.52**</b>
Pushing the child to eat more (F3)	–0.07	<b>–0.30**</b>	–0.10
Using food to calm the child (F4)	0.04	0.01	–0.05
Concern about child being underweight (F5)	–0.12	<b>–0.47**</b>	–0.06
Child's control of feeding interactions (F6)	0.03	0.04	0.02
Structure during feeding interactions (F7)	–0.06	–0.14	0.06
Age-inappropriate feeding (F8)	–0.01	–0.14	–0.06

\* $r$  = Pearson Correlation;

\*\* $p < .05$

BMI, body mass index; PFQ, preschooler feeding questionnaire.

been associated with restrictive feeding (45), which has been associated with unhealthy eating behaviours and increased weight status (46,47), particularly among obese mothers (29,48).

### Associations among in-accurately perceiving mothers

There appeared to be associations between the child's actual weight status and two of the mother's feeding practices even among the 41% of mothers that underestimated their child's weight status. Mothers who underestimated their child's weight status tended to report less pressure to eat and less concern about the child being underweight as the child's BMI percentile increased. In previous studies, pressure to eat has also shown negative associations with child BMI; these studies hypothesize that mothers pressure children who are thinner to eat more than children who are heavier (29,46–50). Similarly, these same mothers' concern that their child is underweight also decreased as the child's BMI increased, which is also consistent with previous work (45–47). That we only found this association in mothers underestimating their child's weight is interesting and may indicate that, although these mothers underestimated their child's weight status in relation to their BMI, they accurately worry less about the child being underweight and perceive less of a need to apply pressure to eat. Both of these findings indicate that although mothers may not consciously or accurately identify that their child was overweight/obese, their feeding behaviours and perceptions were related to the child's weight status, such that they are not pressuring their child to eat and were less concerned about the child being underweight. Their behaviour seems to indicate they were still recognizing something about their child's weight. This is consistent with an investigation by Webber *et al.* that found the association between child weight status and pressure to eat was not modified by maternal perception of the child's weight (29). The current study did not explore the association between accuracy of maternal perception of the child's weight status and feeding practices, thus it is not possible to conclude whether mothers who underestimate child weight status are less concerned about the child's weight status or use less pressure to eat.

### Associations in the total sample

The current study found that few maternal feeding practices were related to child weight, and that these differed depending on whether the mothers accurately perceived their child's weight status. Much of the literature has found associations with some feeding practices such as those

related to rewarding with food, pressure to eat, and control over feeding interactions with child weight and/or dietary behaviours, although the findings have largely been mixed (41,43,46–48,50–53). The mixed results from the literature as well as the lack of strong associations observed in the current study may be related to the survey measure and the difficulty in measuring parent-feeding practices. The population in the current study is also different from many previous studies, thus the survey may perform differently, leading to disparate conclusions. Other studies have found that the association between child weight and feeding practices such as restriction are mediated by maternal concern about the child being overweight (29,40,45). This may help explain the differential associations between child weight status and mom's feeding practices observed in the current study.

### Important feeding behaviours

Although not all factors were associated with maternal perception of child weight or with mom or child BMI, a number of potentially problematic feeding behaviours were very common in this diverse sample of overweight mothers. Forty-three percent of mothers reported that the child at least sometimes watches TV at meals. Further, nearly half (47%) of mothers reported feeding her child herself if she thought her child did not eat enough at least some of the time. These are feeding practices, which have been suggested to be related to development of obesigenic behaviours, and are frequent in the study population (46,47,53–56). This is particularly important in this study sample, as all children in the study had a BMI percentile of at least 60%, a cutoff that may be important to begin monitoring children for development of obesity (34).

### Strengths/limitations

The current study is not able to determine the direction of the relationships explored or whether the associations are causal, as it is cross-sectional. Additionally, the analysis relied on maternal report of feeding practices using self-report questionnaires. While these measures have some evidence for reliability and validity, issues with accuracy remain (39). Further, because this is a population of overweight and obese mothers participating in an intervention study, the findings may not be generalizable to all parents of young children. While this study assessed maternal weight perceptions, it did not assess perceptions from the child perspective as the children were very young (mean 3.4 years old, SD=0.8), which may be important for future obesity development. Also, the mothers were told about the purpose of the study before completing the questions, which could have

influenced their responses. This study is strengthened by the diverse sample of overweight mothers, which enhances the generalizability of the findings to a broader population and the objective measurement of height and weight.

## Conclusions

Nearly half of the mothers asked underestimated their child's weight, considering them to be about the right weight, when they were actually overweight or obese. The current study identified different associations between a child's actual weight status and the mother's reported feeding practices among mothers accurately and inaccurately perceiving her child's weight. Future intervention studies should explore screening participants for accuracy of their child's weight status and incorporating this information into education on feeding practices.

## Conflict of interest statement

No conflict of interest was declared.

## Author contributions

R. G. T. performed statistical analyses and drafted the manuscript. D. L. H. and C. D. S. contributed to the design of the study, interpretation of results and provided critical reviews of the manuscript.

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## Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site.

**Table S1:** Scales from the Preschooler Feeding Questionnaire by factor including item characteristics and internal consistency