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Parental Perceptions of Weight During the First Year of Life

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Abstract

Background—More than half of parents underestimate their overweight child's weight; however, prior research focuses on children greater than 2 years of age. The objective of this study was to assess whether parents of 2–12month-old infants are able to accurately perceive their children's weight status.

Methods—We performed a cross-sectional analysis of data collected from the Greenlight study, a cluster randomized obesity prevention trial, at 4 pediatric clinics serving diverse and low-income populations. Infants' length and weight were measured at well-child checks, and parents completed questionnaires including demographics and perception of their children's weight. Weight-for-length (WFL) percentile 5th– 95th was considered healthy weight and WFL percentile $>95^{th}$ was considered overweight. We used chi-squared tests to compare accuracy by weight category and performed logistic regression to assess accuracy at each time point.

Results—Approximately 85–90% of infants (N=853 at 2 months, N=563 at 12 months) were at a healthy WFL at all measurement times, and parents of these infants were more likely to have an accurate perception of their child's weight (accuracy 89–95%) than overweight children (accuracy

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7–26%, p<0.001 across time points). Approximately 10% of healthy weight infants were perceived as underweight by their parents at all time points. At 12 months, mothers who were overweight were significantly more likely to underestimate their child's weight status (p=0.008).

Conclusions—In our diverse and low-income sample, parents of overweight infants infrequently know that their infants are overweight. Future studies should examine how perception is related to feeding habits and weight status over time.

Clinical Trial Registration—Addressing Health Literacy and Numeracy to Prevent Childhood Obesity (GreenLight), NCT01040897

Keywords

infant; growth; weight; overweight; perception

INTRODUCTION

More than half of parents underestimate their overweight or obese child's weight between the ages of 3 and 10.[1–5] Parents who do not recognize that their children are overweight are less likely to be concerned about their children's health and to take steps toward a healthier weight.[6–8] In contrast, parents who believe that their children's weight is above average are significantly more likely to be willing to make healthy changes in their family.[9] Parental perceptions tend to be less accurate when children are younger,[4] when parents are overweight themselves,[1,2] when the child is male,[2] and when parents are Latino or African-American.[5] One previous study of children aged 6–27 months demonstrated that most parents (who were predominantly white and had at least a high school education) of children who weighed in the lowest quartile believed that their child weighed too little, and most parents of children who weighed in the top quartile believed that their child's weight was appropriate.[10] Another qualitative study of 76 overweight Hispanic children aged 14–47 months old found that most parents believed their child was healthy, and half were unconcerned about their child's weight.[11] However, most prior work examining parents' weight perceptions has focused on children older than 2 years, as this is the age at which obesity is first defined using standard body mass index (BMI) charts.[12] Establishment of a healthy weight trajectory during infancy is essential, as excessive weight gain during infancy has been associated with increased obesity and cardiometabolic risk later in life.[13–17] Little is known about parental weight perception during the infant and toddler periods—a time when parents look for feeding advice and growth information, visit their pediatric care providers frequently for preventive health services visits, and establish lifestyle patterns that may determine the child's future feeding habits.

The goal of this study is to assess whether parents of 2, 4, 6, 9, and 12-month old infants are able to accurately perceive their children's weight status in a poor and diverse population of four safety-net clinics participating in the GreenLight Study. Anticipating findings similar to what has been found in the literature for older children, we predicted that parents will have less accurate perceptions if they are overweight themselves, are Hispanic or African American, have a male child, and have less education.

METHODS

Greenlight Intervention Study

We performed a cross-sectional analysis of data collected from the Greenlight Intervention Study,[18] a cluster randomized trial of a low-literacy, primary care intervention to prevent early childhood obesity. Two-month old infants were enrolled at four United States pediatric primary care clinics in academic medical centers in North Carolina, Tennessee, Florida, and New York from 2010 to 2013. Participants were enrolled if parents spoke English or Spanish and were more than 18 years old at the time of the infants' 2-month well child check. Infants were excluded from participation in Greenlight if they were born before 34 weeks gestational age, had a birth weight <1500 g or were currently <3rd percentile per World Health Organization (WHO) growth charts, or had any chronic medical condition that could affect weight gain patterns, such as cardiac heart defects or failure to thrive.

Infants' weight and recumbent length were measured at preventive health services visits using procedures that were standardized across all 4 study sites.[19] Age and sex specific weight-for-age and weight-for-length were calculated for each time point. Improving weight perception was not a goal of the intervention. More details about the Greenlight methods have been previously published.[18]

Definitions

Based on WHO criteria for this age group,[20] weight-for-length (WFL) percentile 5th–<95th were considered healthy weight and WFL percentile ≥95th were considered overweight. While we considered this our primary definition of overweight for this study, we acknowledge that there are no standard definitions for overweight or obesity in infants. Therefore, we compared results using this definition to alternative definitions of WFL ≥99th percentile per WHO growth charts and weight-for-age ≥95th percentile per WHO growth charts (see Statistical Analysis, below).

Measures

At the initial 2-month visit parents completed questionnaires including demographic information (such as parental education, income, and weight) and history of the pregnancy, birth, and first 2 months of life, including breastfeeding status. The type of feeding was assessed by asking the question, "What type of milk does [child's first name] drink now?" with answer choices of "formula only," "mostly formula and some breast milk," "equal formula and breast milk," "mostly breast milk but some formula," and "breast milk only." Additional exact questions and measurement protocols are previously reported.[18,21] At the initial and all subsequent visits parents answered a question regarding their perception of their children's weight status ("Right now, do you think [child's first name] is underweight, healthy weight, or overweight?"). Parental weight perception was classified as underestimated, accurate, or overestimated depending on their assessment of their child's weight status categories and the child's actual measured WFL percentile. Parental weight perception was classified as accurate if parents correctly assessed their child's weight status (e.g., a healthy weight child with WFL 5th–>95th percentile was perceived as healthy

weight) or inaccurate if they misperceived their child's weight status (e.g., an overweight child with WFL $\geq$ 95th was perceived as healthy weight).

Maternal height and weight were self-reported by questionnaire. Maternal body mass index (BMI) was calculated by dividing weight in kilograms by height in meters, squared. Per standard definitions, a BMI of <18.5 was considered underweight, 18.5–24.9 was considered healthy weight, 25–29.9 was considered overweight, and >30 was considered obese. Maternal perception of her weight was obtained by asking "Do you consider yourself… underweight, healthy weight, overweight, or obese?"

Statistical Analysis

We used chi-squared tests to compare parents' accuracy of weight perception at each time point by weight category. Multivariable logistic regression was performed at 12 months to assess accuracy adjusting for study site, sex, race/ethnicity, income, and parent weight. As very few parents overestimated their child's weight status at 12 months (N=13), we examined predictors for underestimating their child's weight status (vs. having an accurate perception) in our logistic regression model. All reported p-values were based on two-tailed tests and compared to a significance level of 0.05. All statistical analysis was performed using Stata version 13.1.

There is no consensus as to how to define overweight in the first year of life, so we wanted to examine our logistic regression model using different definitions of overweight. Our model was initially run using a definition of overweight as weight-for-length $\geq$ 95th percentile per WHO growth charts. The model was repeated using alternate definitions of weight-for-length $\geq$ 99th percentile per WHO growth charts and weight-for-age $\geq$ 95th percentile per WHO growth charts. We compared results of the 3 models using receiver operating characteristic curves.

We chose to control for site in our model to account for intervention versus attention control status. Of note, we did run additional models controlling for intervention only, and there were no significant differences from the models controlling for site (data not shown). We only report models controlling for site in this paper to assist the reader's evaluation of between site differences.

Analysis by Various Cutoff Points for Overweight

The logistic regression model was initially run using a definition of overweight of weight-for-length $\geq$ 95th percentile and was then repeated using alternate definitions of weight-for-length $\geq$ 99th percentile and weight-for-age $\geq$ 95th percentile. Results from the model were similar for all three models (data not shown). Receiver Operating Characteristic (ROC) curves depicting the sensitivity and specificity for "parent perceiving child as overweight" with each of the three gold-standard definitions (> 95% weight-for-age, > 95% weight-for-length, > 99% weight-for-length) had very similar area under ROC curves (AUC) of 0.64, 0.69, and 0.69, respectively. Therefore, we used >95% weight-for-length as our main definition for overweight for the remainder of the analysis.

RESULTS

Patient and Family Characteristics

There were 865 2-month olds enrolled in Greenlight; 862 (99%) had complete height and weight data collected at 2 months. 563 (65%) remained enrolled with complete growth and perception data at 12 months. Forty-nine percent of the participants were male. Race/ethnicity of the participants was predominantly minority with 50% Hispanic, 27% black, and 16% white. Eighty-six percent of participants were insured by Medicaid, and most families (60%) reported an annual income less than $20,000. About half of mothers (54%) were breastfeeding at 2 months of age and 85% received some WIC services. At 2 months of age males were significantly more likely than females to be overweight (Table 1).

Weight Perception

Approximately 85–90% of infants were a healthy weight (WFL 5–95th percentile) at all measurement times. At the 2-month well child check, 12% of mothers underestimated their child's weight status (e.g., perceived their overweight child to be healthy weight), 81% had an accurate perception (e.g., correctly perceive their healthy weight child to be healthy weight), and 7% overestimated their child's weight status (e.g., perceived their healthy weight child to be overweight). At the 2-month well child check 2% of mothers perceived their child as underweight, 93% perceived their child as a healthy weight, and 5% perceived their child as overweight. Parents were significantly more likely to have an accurate perception of their child if he or she was at a healthy weight than if he or she was overweight at all time points, p<0.001 at all time points (table 2). For example, at 2 months 94% of healthy weight infants were accurately recognized as healthy weight but only 11% of overweight infants were accurately recognized as overweight.

At each time point healthy weight infants were recognized as such by their parents 89–95% of the time (see Figure 1). Throughout the first 6 months, parents of overweight infants developed an increasingly accurate perception of their child's weight status with 26% of parents correctly assessing their overweight infant as overweight. Accuracy then decreased, however, and was lowest at 12 months with only 7% of parents correctly assessing their overweight infant as overweight (see Figure 1).

At 12 months, 85% of children were a healthy weight. Of these children who were a healthy weight, 9% were perceived as underweight by their parents. Of these 45 healthy weight infants who were perceived as underweight, none had a WFL<5th percentile, 3 had a WFL<10th percentile and 8 had a WFL between the 10th and 25th percentile; none had a WFL>95th percentile. At 12 months, parents' odds of underestimating their child's weight status was not related to child sex, race, household income, or site at which the study was performed (Table 3). Mothers who were overweight had increased odds of underestimating their child's weight status (OR 22, 95%CI 1.2–3.8)

Accuracy of parental weight perception at 2, 4, 6, and 9 months was not related to race/ethnicity, sex income, or parent weight status. At 12 months, mothers who were overweight were significantly more likely to underestimate their child's weight status (p=0.008). At 12

months the accuracy of parental weight perception was not related to race/ethnicity, sex or income.

DISCUSSION

Summary of Evidence

Approximately 85–90% (depending on measurement time point) of infants in this diverse and low-income cohort were at a healthy WFL. Most parents perceived their infants as healthy weight, regardless of their child's actual weight. Because of this, parents of healthy weight children were significantly more likely to have an accurate perception of their child's weight (accuracy 89–95%) than parents of a child who was overweight (accuracy only 7–26%) at all time points. A significant percentage of healthy weight infants (10%) are perceived as underweight by their parents. Between 2 and 9 months of age the accuracy of parental weight perception did not differ significantly by race/ethnicity, income, or parents' weight status; however, at 12 months of age parental weight status was related to accuracy of weight perception.

In older children, recognition of a child's overweight status is important to adhering to dietary and physical activity recommendations.[6–9,22] We have demonstrated that most parents of overweight infants do not have an accurate perception of their child's weight status and that many parents of healthy weight infants believe their child is underweight. Additionally, accuracy of weight perception is lowest at 12 months, and this may be due to the physiologic dip in body mass index (BMI) that begins around this time when children often slim down and lose some of their "baby fat."

Limitations

This was cross-sectional analysis, so conclusions cannot be drawn about causation. We purposely defined healthy weight very broadly, including children in the 5th–95th percentiles for weight status, and this matched the three categories that were offered to ascertain weight perceptions from parents. Despite this advantage, it is difficult to assess nuances in parental weight perception. Thus, there may be children at the lower end of healthy weight (e.g. 7th percentile) whose parents describe them as underweight, and this would be considered a misperception in our study.

The question used to assess parent's perception of their child's weight included the term "healthy weight" as an option. The use of "healthy" in the term may have been confusing to parents, as they may assume that since their child is healthy, he is at a healthy weight. Additionally, while we made sure to assess our data using multiple definitions of overweight, there is not clarity on what a "healthy weight" for this population truly is, nor when it is necessary to intervene on overweight infants in an attempt to change their growth trajectory. Finally, the Greenlight cohort is more diverse and of lower socioeconomic status than the general population. However, we believe these results are important for a population at highest risk of later obesity.

Clinical Implications

Discussion of Weight Status—During the first year of life the child's primary care provider is uniquely positioned to deliver anticipatory guidance about appropriate feeding and weight, which may impact a child's long-term growth trajectory. Children see their primary care providers frequently during the first year of life and parents may be especially willing to modify behaviors during this time.[23] Additional research is needed to understand how providers can maximize counseling in the first year of life to improve parents perception of their child's weight and when providers should intervene on child weight gain during infancy. Because parents may have good reason (e.g., growth mindset, stigma avoidance) to retain a "normal-weight" bias for their overweight children – we may need to develop new culturally sensitive models for speaking about infant weight status.

Discussion of Potential Risks—Understanding weight gain in the first few years of life is important, as it is well-established that children who are overweight or obese at two years of age are five times more likely than their healthy weight peers to be overweight during adolescence.[24] Children and adolescents who are overweight or obese are more likely to be overweight or obese as adults.[25,26] The persistence of obesity into adulthood has associated increased morbidity and mortality;[27,28] comorbidities also often affect children before they reach adulthood.[29,30]

Discussion of Healthy Behaviors—An infant's breastfeeding status at two months (exclusively breastfeeding, exclusively formula feeding, or both) was not significantly associated with the odds of their parent having an inaccurate perception of their child's weight status at 12 months. This is important, as we know that this also influences feeding schedule[31] and feeding container[32] which likely all contribute to differential growth patterns between formula fed and breastfed infants.[33] Therefore, despite the many differences between formula fed and breastfed infants, all parents will likely benefit from increased counseling about their child's weight status and appropriate feeding behaviors.

Other feeding behaviors should be in explored in future studies. For example, pressuring-to-eat and overfeeding may place the child at increased risk for overweight and obesity later in life.[34] and it is not known how parents' perceptions of their children's weight may affect these feeding behaviors. These feeding behaviors are especially important during a child's first year of life, because: children are transitioning from breastmilk or formula to solid foods, parents understanding of appropriate portion sizes is poor,[35] and parents may be especially concerned that their children are not eating enough. Future research should examine if improving parental perception of weight decreases parents overfeeding or pressuring-to-eat.

Parents of healthy weight children who perceive their infants as underweight may be actively trying to have their child gain more weight, thereby establishing unhealthy patterns. Developing healthy behaviors at an early age is imperative, and the family environment plays a crucial role in this for infants and toddlers.[36] Pediatric primary care providers can play a critical role in reassuring parents about the healthy growth and weight status of their

child and counseling parents on the importance of establishing healthy family habits early in the child's life.

Conclusions

As is true for parents of older children, parents of overweight infants have a less accurate perception of their child's weight status than parents of healthy weight children in our diverse and low-income study population. Interventions by pediatricians to improve parental understanding of their child's weight status may help to improve healthy behaviors. Societal interventions may also be necessary to help parents, grandparents, and family members understand what healthy weight infants and children look like. Future research should examine whether improving parental perception of infant weight (or provider communication about infant weight status) influences the timing of adiposity rebound and later childhood overweight or obesity.

Acknowledgments

Abbreviations

WFL	Weight-for-length
WHO	World Health Organization
WFA	weight-for-age
BMI	body mass index

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What's New

Most parents of overweight infants do not perceive their child as overweight; many parents of healthy weight infants are concerned that their child is underweight. At 12 months, overweight mothers are significantly more likely to underestimate their child's weight status.
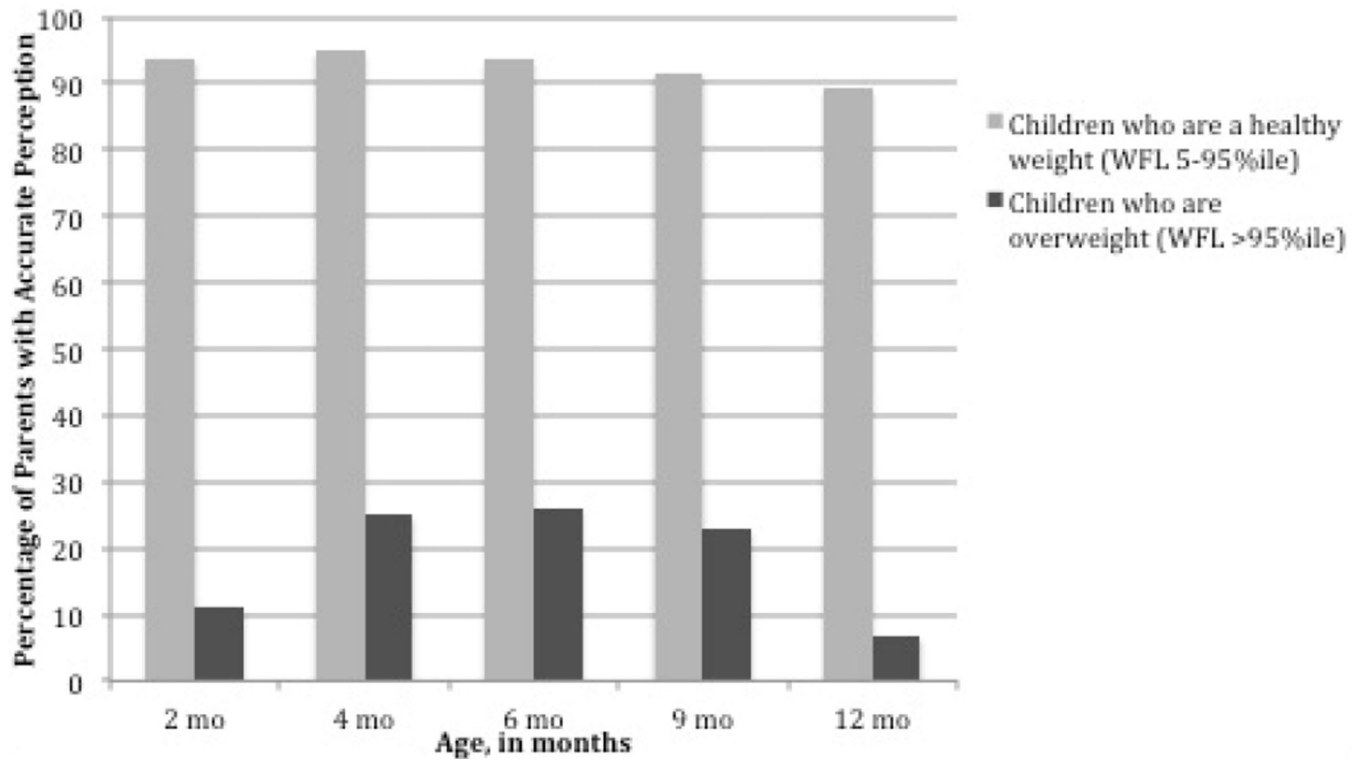
Figure 1.
Percentage of Parents with Accurate Perceptions of Their Child's Weight.

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Table 1

Demographics of the Overall Patient Population by Child Weight Status at Two Months of Age.

Characteristic	Overall Sample (%) N=862	Underweight (%) N=29	Healthy Weight (%) N=732	Overweight (%) N=101	p[a]
Sex of child					0.009
Male	49.0	48.3	47.0	63.4	
Race/ethnicity of Child					0.5
White	15.7	13.8	16.5	9.9	
Black	26.5	31.0	26.4	25.7	
Other	8.2	13.8	7.8	9.9	
Hispanic	49.7	41.4	49.3	54.5	
Breastfeeding Status					0.9
Breastmilk Only	19.3	17.2	19.0	21.8	
Formula Only	44.6	41.4	45.4	39.6	
Both	34.9	41.4	34.3	37.6	
Receives WIC Services					0.3
Mother Only	7.5	10.3	7.2	8.9	
Child Only	13.4	24.1	12.3	17.8	
Both	64.2	51.7	65.2	60.4	
Neither	15.0	13.8	15.3	12.9	
Type of Insurance					0.4
Medicaid	85.5	82.8	85.1	89.1	
Private Insurance	11.4	10.3	12.0	6.9	
None	3.2	6.9	2.9	4.0	
Household Income					0.8
Less than $10,000	32.1	27.6	31.7	36.0	
$10,000–19,999	27.6	31.0	27.8	25.0	
$20,000–39,999	24.4	34.5	23.8	26.0	
$40,000–59,999	8.4	3.5	8.9	6.0	
$60,000 or more	7.5	3.5	7.8	7.0	

Characteristic	Overall Sample (%) N=862	Underweight (%) N=29	Healthy Weight (%) N=732	Overweight (%) N=101	p^a
Maternal BMI					0.9
Underweight	0.9	0.0	1.1	0.0	
Healthy weight	31.8	34.6	31.7	32.2	
Overweight	32.9	34.6	32.4	35.6	
Obese	34.4	30.8	34.9	32.2	
Accuracy of Maternal Perception of her weight					0.8
Underestimate	32.6	42.1	31.8	36.5	
Correct	60.0	52.	60.7	57.1	
Overestimate	7.4	5.3	7.6	6.4	

BMI, body mass index

[a] Difference of demographics as compared to weight status by chi-square test

Table 2

Accuracy of Parental Weight Perception by Child's Weight Status and Maternal Perception of Child's Weight at Each Time Point

Characteristic	Overall Sample (%)	Underestimated Child WFL (%)[a]	Accurate Perception of Child WFL (%)[a]	Overestimated Child WFL (%)[a]
2 months	N=853	N=29	N=726	N=98
<5th	3.4	-	0.0	100
5th–<95th	85.1	1.7	93.8	4.5
>=95th	11.5	88.8	11.2	-
4 months	N= 685	N=27	N=610	N=48
<5th	3.9	-	11.1	88.9
5th–<95th	89.1	1.6	94.9	3.4
>=95th	7.0	75	25	-
6 months	N=630	N=18	N=566	N=46
<5th	2.9	-	11.1	88.9
5th–<95th	89.8	3.5	93.8	2.7
>=95th	7.3	73.9	26.1	-
9 months	N=583	N=9	N=517	N=57
<5th	1.5	-	33.3	66.7
5th–<95th	88.7	5.8	91.7	2.5
>=95th	9.8	77.2	22.8	-
12 months	N=563	N=11	N=477	N=75
<5th	2.0	-	36.4	63.6
5th–<95th	84.7	9.4	89.3	1.3
>=95th	13.3	93.3	6.7	-

WFL, weight-for-length

[a] Difference of Child's WFL as compared to accuracy of mother's weight perception by chi-square test was p<0.001 at all time points

Table 3

Logistic Regression Model Results Reporting Odds Ratio of Parents Underestimating Their Child's Weight Status at 12 months (N=489)

Characteristic	Odds Ratio	95% Confidence Interval	*P*
Sex of Child			
Male	0.9	0.6–1.4	0.6
Race/ethnicity of Child			
White	ref		
Black	0.9	0.4–1.9	0.8
Other	0.9	0.3–2.5	0.8
Hispanic	1.0	0.5–2.0	0.9
Household Income			
Less than $10,000	0.7	0.3–1.9	0.5
$10,000–19,999	0.4	0.2–1.1	0.07
$20,000–39,999	0.5	0.2–1.3	0.2
$40,000–59,999	0.3	0.08–0.9	0.04
$60,000 or more	Ref		
Maternal BMI			
Healthy weight	ref		
Overweight	2.2	1.2–3.8	0.008
Obese	1.1	0.6–2.1	0.6
Site			
Site 1	1.5	0.8–2.8	0.2
Site 2	Ref		
Site 3	1.6	0.9–3.1	0.1
Site 4	0.6	0.2–1.7	0.4

BMI, body mass index; Ref, reference standard