Published in final edited form as:

Am J Perinatol. 2016 December ; 33(14): 1371–1376. doi:10.1055/s-0036-1583187.

Parental Perceptions of Weight Status in Preterm Compared with Term Infants

Lindsey T. Murphy, MD¹, Asheley C. Skinner, PhD², Jennifer Check, MD³, Diane D. Warner, MD, MPH⁴, Eliana M. Perrin, MD, MPH⁴

¹Pediatrics Group of North Carolina, Moses Cone Neonatology, Greensboro, North Carolina

²Duke University Clinical Research Institute, Durham, North Carolina

³Department of Pediatrics, Wake Forest University Baptist Medical Center, Winston-Salem, North Carolina

⁴Department of Pediatrics, University of North Carolina School of Medicine, Chapel Hill, North Carolina

Abstract

Background—Parents of overweight children frequently under-recognize their child's overweight status. We hypothesized that parents of preterm children would be more likely than parents of term children to incorrectly perceive their child's weight.

Methods—We recruited parents of term and preterm when children were 2 months to 2 years of age. Small for gestational age infants were excluded. We compared parents' perceived weight category with child's actual weight category, based on normative data (underweight, normal weight, or overweight). We based analyses on encounters and adjusted for within-child clustering across repeated measures.

Results—In the preterm ($n = 94$) and term ($n = 1,263$) cohorts, 12 and 13% of children, respectively, were overweight (weight-for-length 95th percentile). Among parents of overweight children, 91% in the preterm cohort and 90% in the term cohort reported their child as healthy weight. Among healthy weight children (weight-for-length 6th–94th percentile), parents in the preterm cohort were more likely to report their child as underweight compared with parents in the term cohort (24 vs. 7%; $p < 0.001$).

Conclusion—Parental perception of weight status was impaired among parents of overweight children regardless of gestational age. However, parents were more likely to perceive their healthy weight child as underweight if their child was preterm.

Keywords

obesity; very low birth weight; preterm infant; weight perception

Obesity remains a critical health concern in the pediatric population, affecting 8.1% of children younger than 2 years and 16.9% of children 2 to 19 years of age.¹ This unacceptably high risk of obesity occurs even among prematurely born individuals. In addition, complications associated with obesity including insulin resistance, hypertension, and coronary heart disease affect infants born at extremely low gestational ages.²⁻⁴ Among premature infants, accelerated weight gain during infancy and early childhood is a risk factor for later obesity.⁵⁻⁷ Infants born at less than 32 weeks' gestational age are deficient in adipose tissue, and during catch-up growth experience accelerated fat gain and less lean mass.⁸ Premature infants who have rapid weight gain during the first 3 months after birth have a higher body mass index (BMI), higher percentage of body fat, more centralization of fat distribution, and higher insulin concentrations at 19 years of age.^{9,10} At 8 years of age, 20% of former preterm infants are overweight, and by 18 years of age, this increases to 30%.⁷

In the general population, parents of overweight children are limited in their ability to recognize that their child is overweight, and a recent meta-analysis revealed that only half of parents correctly identify their child's overweight status.¹¹ In addition, less than one-quarter of parents of overweight children report being told by a doctor that their child was overweight.¹² Parents of overweight children who recognize their child's overweight status are more likely to make lifestyle changes.¹³

For infants born prematurely, weight gain and "catch-up growth" are strongly emphasized during a hospitalization in the neonatal intensive care unit (NICU). Thus, we hypothesized that as compared with parents of children born at term, parents of former preterm children would be more likely to have incorrect perception of their child's weight status.

The objective of this study was to compare parental perceptions of weight of children age 2 months to 2 years who had been born prematurely with those of parents whose children were born at term.

Methods

We included parents of children from two cohorts, preterm and term. Between November 2012 and August 2013, a convenience sample of parents of former preterm children (gestational age < 30 weeks) age 2 months to 2 years corrected age were recruited from two university NICU follow-up clinics. Infants who were small for gestational age (SGA) were excluded. Term infants were considered SGA if their birth weight for birth length percentile was less than 3% based on World Health Organization (WHO) growth charts.¹⁴ Preterm infants were considered SGA if their birth weight was less than the 10th percentile based on intrauterine growth curves.¹⁵ Institutional review board approval was obtained from both follow-up sites.

Subjects for the term cohort came from participants in the Greenlight Study. The Greenlight Study is a cluster randomized trial of an obesity prevention intervention targeting healthy children during the first 2 years of age. Four university-affiliated pediatric clinics participated in the study, with two sites randomized to using a literacy and numeracy-

sensitive approach to obesity prevention and two sites addressing injury prevention as an active control. For the current study, we used data from children enrolled at a single center that was a control center so that no study-related obesity prevention measures were undertaken. This site was also a center for recruitment into the preterm cohort. Exclusion criteria for the Greenlight Study included infants who were SGA and prematurity (defined as <34 weeks' gestation). This study was approved by the institutional review board. For the purposes of the current study, all children born at less than 37 weeks' gestation were excluded from analysis so that the remaining Greenlight cohort represented a term cohort from the control site.

Parents in both cohorts responded during a clinic visit to the following written survey questions:

1. "Right now, do you think your child is underweight, healthy weight, or overweight?"
2. "Did your child's doctor ever tell you that your child is gaining weight too fast or is overweight?"
3. "Are you concerned that your child will someday be overweight?"
4. "Are you worried about your child's weight right now?"

Parental responses were compared with their child's actual weight status. Underweight was defined as a weight-for-length 5th percentile; healthy weight was defined as a weight-for-length of 6th to 94th percentile; overweight was defined as a weight-for-length 95th percentile.¹⁶ All weight-for-length definitions were based on the WHO growth charts, as recommended by the Centers for Disease Control and Prevention (CDC) for children younger than 2 years.¹⁷ Parents of preterm children responded once; parents of term participants responded at multiple visits.

We used bivariate cross-tabs to compare parental perceptions of weight between the term and preterm cohorts. We included all ages of children from the term cohort in the comparison, so all analyses were performed at the encounter level (as opposed to the child level). Statistical testing used Pearson chi-square tests with second-order Rao and Scott adjustment. This allowed for clustering by child, accounting for within-child similarities across the repeated measures in the term cohort.

Results

The term cohort included 219 children and 1,263 encounters in which weight, length, and weight perception were measured. The preterm cohort included 94 children and 94 such encounters. Table 1 compares demographics between children in the term cohort and children in the preterm cohort. Age and sex distributions were similar between cohorts. There were significantly more white children in the preterm cohort (52 vs. 25%; $p < 0.001$) and significantly more Hispanic children in the term cohort (39 vs. 11%; $p < 0.001$). However, when parental responses were examined by race and ethnicity, there were no differences in either cohort. The weight status distribution of each cohort was similar, with 1 to 2% of encounters underweight, 85 to 87% of encounters healthy weight, and 12 to 13% of

encounters overweight. Of the healthy weight participants, the average weight-for-length percentile of the term cohort was 55%, and the average weight-for-length percentile of the preterm cohort was 45% ($p < 0.01$).

Table 2 shows parental responses from the cohorts to question 1 (“Right now, do you think your child is underweight, healthy weight, or overweight?”). Despite a similar weight status distribution between the cohorts, 92% of parents of term children described their child as a healthy weight, versus 77% of parents of preterm children ($p < 0.001$). Data were further stratified by weight status (Table 2). No difference in weight perception was identified between cohorts in parents of overweight children or in parents of underweight children. Among parents of overweight children, 90% in the term cohort and 91% in the preterm cohort reported their child was a healthy weight. Among parents of healthy weight children, significant differences existed between cohorts. Parents in the preterm cohort were more likely to report their child as underweight compared with parents in the term cohort (24 vs. 7%; $p < 0.001$). Data were additionally stratified by corrected age. Among children younger than 6 months, 95% of parents of term children reported their child as a healthy weight, versus 77% of parents of preterm children ($p < 0.001$). Among children 6 to 12 months of age, 92% of parents of term children reported their child as healthy weight, versus 87% of parents of preterm children ($p = 0.2$). Among children older than 12 months, 89% of parents of term children reported their child as healthy weight, versus 71% of parents of preterm children ($p = 0.002$).

Parental responses to question 2 (“Did your child’s doctor ever tell you that your child is gaining weight too fast or is overweight?”) are shown in Table 3. No significant differences were found between cohorts, even after weight status stratification. A total of 6% of parents of term children and 7% of parents of preterm children reported physician concern. Among parents of overweight children, 17% in the term cohort and 27% in the preterm cohort ($p = 0.4$) reported physician concern.

Table 4 shows parental responses to question 3 (“Are you concerned that your child will someday be overweight?”). There were no significant differences between cohorts, regardless of weight status. A total of 13% of parents of term children and 15% of parents of preterm children were concerned that their child would someday be overweight. Among parents of overweight children, 27% in both cohorts were concerned their child would someday be overweight.

Parental responses to question 4 (“Are you concerned about your child’s weight status right now?”) are shown in Table 5. There was a trend toward greater concern among parents in the preterm cohort, with 19% of parents in the preterm cohort and 12% of parents in the term cohort concerned about their child’s weight status ($p = 0.06$). When stratified by weight status, there were no differences between cohorts among parents of overweight children or underweight children. However, among parents of healthy weight children, 22% of the parents in the preterm cohort and 11% of parents in the term cohort were concerned about their child’s weight status ($p = 0.01$). When stratified by corrected age, there were no significant differences in parental response between cohorts.

Discussion

Our data demonstrated that parents of young children born preterm were more likely than parents of children born at term to report their healthy weight child as underweight. Among overweight children, impaired parental perception of their child's weight status as being healthy weight similarly occurred for parents of children born preterm and those born at term. Our findings provide some support for our hypothesis that parents of former preterm infants would be more likely to have incorrect perception of their child's weight status. Somewhat surprising was our finding that the prevalence of overweight status was similar in the two cohorts (preterm and term), and was consistent with recent prevalence estimates in the general population.¹ The average weight-for-length of the healthy weight participants in the term cohort was greater than the average weight-for-length of the healthy weight participants in the preterm cohort (55th vs. 45th percentile; $p < 0.01$).

We speculate that the greater impaired perception among parents of former preterm children relates, at least in part, to emphasis placed on weight gain during the NICU hospitalization. Because rapid weight gain and linear growth early in life are associated with improved cognitive outcomes,^{7,18,19} the importance of early weight gain should not be minimized. However, children who are overweight by the preschool period are five times more likely to be overweight at 12 years of age when compared with those who are a healthy weight in preschool.²⁰

There are limitations to this study. The number of overweight children in the preterm cohort was small, and significant differences may have been missed when comparing the parental perceptions of weight status in overweight children. Although there were significant differences of race and ethnicity distribution between cohorts, there were no differences when parental responses were examined by race or ethnicity in either cohort. In this regard, our study agrees with some,^{21–24} but not other,^{22,25} prior studies of parent's perception of their child's weight.

The method of data collection might also pose a limitation to this study. Parents in the term cohort were asked the survey questions at multiple visits, and parents in the preterm cohort were asked the survey questions once. This use of repeated measures in the term cohort and a single measure in the preterm cohort creates the possibility of similar reports across time in the term group. Because we used this methodologic approach, we adjusted the standard errors in our analysis for individual clustering. While we adjusted statistically for multiple encounters, it is possible that in asking parents multiple times, parents become more cognizant of their child's weight status. Finally, we could not adjust for all confounders. Parental underestimation of weight status has been associated with male sex of the child, a younger age of the child, lower socioeconomic status, and higher parental BMI.^{11,21,22,26,27} Age and sex were similar between cohorts, but parental BMI was not measured and socioeconomic status was not obtained.

Further research is needed in the area of parental perceptions of weight status in former preterm infants. Important next steps include development of education strategies for parents and providers regarding risk for overweight and obesity, as well as healthy weight

trajectories. Parents should understand that their preterm infant is at risk for becoming overweight and that this can occur early in life. Parents of preterm infants who are healthy weight likely need reassurance about the appropriateness of their child's weight status.

Regardless of gestational age, an important finding from this study relates to physician education. Less than one-third of parents of overweight children reported that a doctor had ever told them that their child was overweight or gaining weight too fast. This echoes prior research describing poor communication between doctors and parents of overweight children.¹² It is possible that parents simply do not recall or process the information. More research is needed to determine how physicians can effectively educate parents of overweight children. Finally, much of the literature on parent perceived weight status focuses on children 2 to 18 years of age. Research evaluating parental perceptions of weight status in former preterm children who are preschool age or older would be helpful.

Conclusion

Parental perception of weight status is impaired among parents of overweight children regardless of gestational age. Additionally, parents are more likely to perceive their healthy weight child as underweight if the child was preterm. This first report of weight perception in parents of preterm infants suggests parents need specific education about healthy weight trajectories and reassurance about weight status to prevent overfeeding and unnecessary "fattening up" of former preterm children.

Acknowledgments

The authors would like to thank Dr. T. Michael O'Shea for thoughtful review of the article and the study research assistants of the Greenlight project.

Funding

This research was supported with funding from NIH/NICHD (R01HD049794) and NIH/National Center for Advancing Translational Sciences (NCATS UL1RR025747). Dr. Skinner was supported by a BIRCWH career development award (K12 HD01441).

References

1. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011–2012. *JAMA* 2014; 311(8):806–814 [PubMed: 24570244]
2. Hofman PL, Regan F, Jackson WE, et al. Premature birth and later insulin resistance. *N Engl J Med* 2004;351(21):2179–2186 [PubMed: 15548778]
3. Rotteveel J, van Weissenbruch MM, Twisk JW, Delemarre-Van de Waal HA. Infant and childhood growth patterns, insulin sensitivity, and blood pressure in prematurely born young adults. *Pediatrics* 2008;122(2):313–321 [PubMed: 18676549]
4. Bhatia J. Post-discharge nutrition of preterm infants. *J Perinatol* 2005;25(Suppl 2):S15–S16, discussion S17–S18 [PubMed: 15861162]
5. Gaskins RB, LaGasse LL, Liu J, et al. Small for gestational age and higher birth weight predict childhood obesity in preterm infants. *Am J Perinatol* 2010;27(9):721–730 [PubMed: 20408111]
6. Casey PH, Bradley RH, Whiteside-Mansell L, Barrett K, Gossett JM, Simpson PM. Evolution of obesity in a low birth weight cohort. *J Perinatol* 2012;32(2):91–96 [PubMed: 21660083]

7. Belfort MB, Gillman MW, Buka SL, Casey PH, McCormick MC. Preterm infant linear growth and adiposity gain: trade-offs for later weight status and intelligence quotient. *J Pediatr* 2013; 163(6):1564–1569.e2 [PubMed: 23910982]
8. Dulloo AG, Jacquet J, Seydoux J, Montani JP. The thrifty ‘catch-up fat’ phenotype: its impact on insulin sensitivity during growth trajectories to obesity and metabolic syndrome. *Int J Obes* 2006;30 (Suppl 4):S23–S35
9. Finken MJ, Keijzer-Veen MG, Dekker FW, et al.; Dutch POPS-19 Collaborative Study Group. Preterm birth and later insulin resistance: effects of birth weight and postnatal growth in a population based longitudinal study from birth into adult life. *Diabetologia* 2006;49(3):478–485 [PubMed: 16450090]
10. Euser AM, Finken MJ, Keijzer-Veen MG, Hille ET, Wit JM, Dekker FW; Dutch POPS-19 Collaborative Study Group. Associations between prenatal and infancy weight gain and BMI, fat mass, and fat distribution in young adulthood: a prospective cohort study in males and females born very preterm. *Am J Clin Nutr* 2005;81(2):480–487 [PubMed: 15699238]
11. Lundahl A, Kidwell KM, Nelson TD. Parental underestimates of child weight: a meta-analysis. *Pediatrics* 2014;133(3):e689–e703 [PubMed: 24488736]
12. Perrin EM, Skinner AC, Steiner MJ. Parental recall of doctor communication of weight status: national trends from 1999 through 2008. *Arch Pediatr Adolesc Med* 2012;166(4):317–322 [PubMed: 22147758]
13. Rhee KE, De Lago CW, Arscott-Mills T, Mehta SD, Davis RK. Factors associated with parental readiness to make changes for overweight children. *Pediatrics* 2005;116(1):e94–e101 [PubMed: 15995022]
14. The Center for Disease Control and Prevention. WHO Child Growth Standards. United States 11 1, 2009 Available online at: <http://www.who.int/childgrowth/en/> (cited March 7, 2014)
15. Olsen IE, Groveman SA, Lawson ML, Clark RH, Zemel BS. New intrauterine growth curves based on United States data. *Pediatrics* 2010;125(2):e214–e224 [PubMed: 20100760]
16. World Health Organization Multicentre Growth Reference Study Group. WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: methods and development. 2006 Available online at: http://www.who.int/childgrowth/standards/Technical_report.pdf?ua=1
17. National Center for Health Statistics. 2006 WHO growth charts: United States. Available online at: <http://www.cdc.gov/growthcharts/>
18. Latal-Hajnal B, von Siebenthal K, Kovari H, Bucher HU, Largo RH. Postnatal growth in VLBW infants: significant association with neurodevelopmental outcome. *J Pediatr* 2003;143(2): 163–170 [PubMed: 12970627]
19. Belfort MB, Martin CR, Smith VC, Gillman MW, McCormick MC. Infant weight gain and school-age blood pressure and cognition in former preterm infants. *Pediatrics* 2010;125(6):e1419–e1426 [PubMed: 20478940]
20. Nader PR, O’Brien M, Houts R, et al.; National Institute of Child Health and Human Development Early Child Care Research Network. Identifying risk for obesity in early childhood. *Pediatrics* 2006;118(3):e594–e601 [PubMed: 16950951]
21. Baughcum AE, Chamberlin LA, Deeks CM, Powers SW, Whitaker RC. Maternal perceptions of overweight preschool children. *Pediatrics* 2000;106(6):1380–1386 [PubMed: 11099592]
22. De La O A, Jordan KC, Ortiz K, et al. Do parents accurately perceive their child’s weight status? *J Pediatr Health Care* 2009;23(4): 216–221 [PubMed: 19559989]
23. Eckstein KC, Mikhail LM, Ariza AJ, Thomson JS, Millard SC, Binns HJ; Pediatric Practice Research Group. Parents’ perceptions of their child’s weight and health. *Pediatrics* 2006;117(3): 681–690 [PubMed: 16510647]
24. Maynard LM, Galuska DA, Blanck HM, Serdula MK. Maternal perceptions of weight status of children. *Pediatrics* 2003;111(5, Pt 2):1226–1231 [PubMed: 12728143]
25. Valdes XL, Nota MF, Franco SM. Parental perception of children’s weight as a function of ethnicity/race, gender, and age. *J Ky Med Assoc* 2009;107(12):485–489 [PubMed: 20067201]

26. Manios Y, Moschonis G, Grammatikaki E, Anastasiadou A, Liarigkovinos T. Determinants of childhood obesity and association with maternal perceptions of their children's weight status: the "GENESIS" study. *J Am Diet Assoc* 2010;110(10):1527–1531 [PubMed: 20869492]
27. Chaparro MP, Langellier BA, Kim LP, Whaley SE. Predictors of accurate maternal perception of their preschool child's weight status among Hispanic WIC participants. *Obesity (Silver Spring)* 2011;19(10):2026–2030 [PubMed: 21546937]

Table 1

Demographic data in term and preterm cohorts

	Term (<i>n</i> = 1,263)	Preterm (<i>n</i> = 94)	<i>p</i>-Value
Children, <i>n</i>	219	94	
Encounters, <i>n</i>	1,263	94	
Mean corrected age at encounter (mo)	11.0	11.5	0.507
< 6 mo (%)	32	28	0.328
6–12 mo (%)	28	24	0.342
> 12 mo (%)	40	48	0.518
Race			
White (%)	25	52	<0.001
Black (%)	34	37	0.550
Hispanic (%)	39	11	<0.001
Other(%)	2	0	0.485
Male (%)	51	53	0.532
Weight status			
Underweight (%)	2	1	0.531
Healthy weight (%)	85	87	0.581
Overweight (%)	13	12	0.741

Table 2

Parental responses to question 1 : “Right now, do you think your child is underweight, healthy weight, or overweight?”

	Term cohort (n = 1,263 encounters)			Preterm cohort (n = 94 encounters)			p-Value
	Underweight	Healthy weight	Overweight	Underweight	Healthy weight	Overweight	
All participants (%)	6	92	2	21	77	2	<0.001
w/1 5th percentile (%)	20	80	0	0	100	0	0.652
w/1 6th to 94th percentile (%)	7	92	1	24	74	1	<0.001
w/1 95th percentile (%)	1	90	9	0	91	9	0.966

Note: w/1, measured weight-for-length of child; w/1 5th percentile, underweight; w/1 6th to 94th percentile, healthy weight; w/1 95th percentile, overweight; rows may not add to 100 due to rounding.

Parental responses to question 2: “Did your child’s doctor ever tell you that your child is gaining weight too fast or is overweight?”

Table 3

	Term cohort (<i>n</i> = 1,263 encounters)		Preterm cohort (<i>n</i> = 94 encounters)		<i>p</i> -Value
	Yes	No	Yes	No	
All participants (%)	6	94	7	93	0.577
w/1 5th percentile (%)	11	89	0	100	0.789
w/1 6th to 94th percentile (%)	3	97	5	95	0.468
w/1 95th percentile (%)	17	83	27	73	0.447

Note: w/1, measured weight-for-length of child; w/1 5th percentile, underweight; w/1 6th to 94th percentile, healthy weight; w/1 95th percentile, overweight.

Parental responses to question 3: “Are you concerned that your child will someday be overweight?”

Table 4

	Term cohort (<i>n</i> = 1,263 encounters)		Preterm cohort (<i>n</i> = 94 encounters)		<i>p</i> -Value
	Yes	No	Yes	No	
All participants (%)	13	87	15	85	0.648
w/1 5th percentile (%)	0	100	0	100	-
w/1 6th to 94th percentile (%)	11	89	13	87	0.463
w/1 95th percentile (%)	27	73	27	73	0.984

Note: w/1, measured weight-for-length of child; w/1 5th percentile, underweight; w/1 6th to 94th percentile, healthy weight; w/1 95th percentile, overweight.

Parental responses to Question 4: “Are you worried about your child’s weight right now?”

Table 5

	Term cohort (<i>n</i> = 1,263 encounters)		Preterm cohort (<i>n</i> = 94 encounters)		<i>p</i> -Value
	Yes	No	Yes	No	
All participants (%)	12	88	19	81	0.055
w/1 5th percentile (%)	22	78	0	100	0.685
w/1 6th to 94th percentile (%)	11	89	22	78	0.012
w/1 95th percentile (%)	13	88	0	100	0.264

Note: w/1, measured weight-for-length of child; w/1 5th percentile, underweight; w/1 6th to 94th percentile, healthy weight; w/1 95th percentile, overweight; rows may not add to 100 due to rounding.