

# Racial and Ethnic Differences Associated With Feeding- and Activity-Related Behaviors in Infants

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## KEY WORDS

obesity, infants, parenting, feeding, physical activity, television, breastfeeding

## ABBREVIATIONS

AAP—American Academy of Pediatrics  
aOR—adjusted odds ratio  
CI—confidence interval  
IFSQ—Infant Feeding Style Questionnaire  
PO—proportional odds  
WIC—Supplemental Nutrition Program for Women, Infants, and Children

Dr Perrin helped conceptualize and design the study, helped design the data collection instruments, helped develop data collection protocols at all 4 sites, supervised data collection at 1 site, helped develop the analysis plan, drafted the initial manuscript, and reviewed and revised the manuscript according to feedback; Drs Rothman and Sanders helped conceptualize and design the study, helped design the data collection instruments, helped develop data collection protocols at all 4 sites, supervised data collection at 1 site, helped develop the analysis plan, and reviewed and revised the manuscript; Dr Skinner helped develop the analysis plan, helped analyze the data, helped draft the initial manuscript, and reviewed and revised the manuscript; Ms Eden helped develop the analysis plan, helped analyze the data, and reviewed and revised the manuscript; Dr Shintani supervised the development of the analysis plan, supervised the analysis of the data, and reviewed and revised the manuscript; Ms Throop supervised data collection at 1 site, and reviewed and revised the manuscript according to feedback; Dr Yin helped conceptualize and design the study, helped design the data collection instruments, helped develop data collection protocols at all 4 sites, supervised data collection at 1 site, helped develop the analysis plan, and reviewed and revised the manuscript; and all authors approved the final manuscript as submitted.

This trial has been registered at [www.clinicaltrials.gov](http://www.clinicaltrials.gov) (identifier NCT01040897).

(Continued on last page)



**WHAT'S KNOWN ON THIS SUBJECT:** Although expert consensus and previous literature document the importance of early feeding and activity behaviors and practices in preventing obesity and the risks of early rapid weight gain, few studies have rigorously assessed obesity-related behaviors by caregivers of infants.



**WHAT THIS STUDY ADDS:** This study demonstrates the high prevalence of behaviors thought to increase risk for obesity in a diverse, large sample of parent/2-month-old dyads and finds that many behaviors vary by race and ethnicity, suggesting the potential for culturally tailored interventions.

## abstract



**OBJECTIVE:** To examine parental reports of feeding and activity behaviors in a cohort of parents of 2-month-olds and how they differ by race/ethnicity.

**METHODS:** Parents participating in Greenlight, a cluster, randomized trial of obesity prevention at 4 health centers, were queried at enrollment about feeding and activity behaviors thought to increase obesity risk. Unadjusted associations between race/ethnicity and the outcomes of interest were performed by using Pearson  $\chi^2$  and Kruskal-Wallis tests. Adjusted analyses were performed by using proportional odds logistic regressions.

**RESULTS:** Eight hundred sixty-three parents (50% Hispanic, 27% black, 18% white; 86% Medicaid) were enrolled. Exclusive formula feeding was more than twice as common (45%) as exclusive breastfeeding (19%); 12% had already introduced solid food; 43% put infants to bed with bottles; 23% propped bottles; 20% always fed when the infant cried; 38% always tried to get children to finish milk; 90% were exposed to television (mean, 346 minutes/day); 50% reported active television watching (mean, 25 minutes/day); and 66% did not meet “tummy time” recommendations. Compared with white parents, black parents were more likely to put children to bed with a bottle (adjusted odds ratio [aOR] = 1.97,  $P < .004$ ; bottle propping, aOR = 3.1,  $P < .001$ ), and report more television watching (aOR = 1.6,  $P = .034$ ). Hispanic parents were more likely than white parents to encourage children to finish feeding (aOR = 1.9,  $P = .007$ ), bottle propping (aOR = 2.5,  $P = .009$ ), and report less tummy time (aOR = 0.6,  $P = .037$ ).

**CONCLUSIONS:** Behaviors thought to relate to later obesity were highly prevalent in this large, diverse sample and varied by race/ethnicity, suggesting the importance of early and culturally-adapted interventions. *Pediatrics* 2014;133:e857–e867

Among 2- to 5-year-old US children, 27% are overweight or obese, with higher rates for Hispanic and non-Hispanic black children,<sup>1</sup> illustrating the need for early obesity prevention and close examination for early racial/ethnic disparities in risk behaviors. Infancy may represent a critical period for obesity prevention.<sup>2-4</sup> Numerous studies<sup>5-9</sup> demonstrate that infants with rapid weight gain in the first year of life or with higher weight status are more likely to be overweight later in life.<sup>5</sup> A better understanding of the infant feeding and physical activity behaviors that may promote unnecessary weight gain, contextualized by ethnicity and culture, is critical to effective obesity prevention interventions.

Epidemiologic evidence from early infancy suggests that specific feeding content and feeding styles and practices may be related to obesity risk. Although there has been some controversy,<sup>10</sup> increased duration and exclusivity of breastfeeding, for example, has been demonstrated to be generally protective against childhood obesity.<sup>11-15</sup> In contrast, early introduction of solids<sup>16-20</sup> and consumption of fruit juice and sweet drinks<sup>20-22</sup> has been shown to be related to increased risk of obesity development.

Some studies have also suggested a relationship between early childhood obesity and caregiver feeding styles.<sup>23-26</sup> Pressured feeding styles (eg, encouraging the infant to finish feeding) and “bottle propping” (ie, leaning a bottle up against a blanket instead of holding it) have been independently associated with increased obesity risk, whereas responsive feeding style (eg, feeding the infant in response to satiety cues) is associated with decreased risk. Some behaviors, like putting an infant to bed with a bottle, have only been related to obesity in older children.<sup>27</sup> Similarly, the link between

physical activity and obesity are well established during later childhood,<sup>28-33</sup> yet less research has assessed the obesity risk associated with physical activity or sedentary activity (eg, screen time) during infancy.<sup>28-33</sup>

Ethnicity, race, and culture can play an important role in our identities and our health behaviors, including dietary and physical-activity behaviors that may potentiate obesity. Although these relationships are beginning to be understood among older children,<sup>34-37</sup> we know less about the role of race/ethnicity at the time when many of these behaviors are forged, namely the introduction of an infant into a family. We sought to examine the patterns of these behaviors theorized or known to have a relationship to later obesity in a diverse group of 2-month-old children and to assess how these patterns differed across parent-defined racial and ethnic groups.

## METHODS

### Sites and Sample

The analyses presented here are cross-sectional baseline data reported by caregivers participating in the Greenlight Intervention Study. The Greenlight Study is a cluster randomized trial of an obesity prevention intervention targeting children during their first 2 years of life. Four university-affiliated pediatric clinics (University of North Carolina at Chapel Hill, New York University/Bellevue Hospital Center, Vanderbilt University, and University of Miami/Jackson Memorial Medical Center) are participating in the study, with 2 sites randomized to using a literacy and numeracy-sensitive approach to obesity prevention and 2 sites randomized to address injury prevention as an active control. We enrolled caregivers (mostly mothers and  $\geq 18$  years old) of healthy infants at their infants' 2-month-old preventive services visit.

See Supplemental Information and Fig 1 for eligibility requirements and enrollment flow. Parents provided written and verbal consent according to institutional review board protocols approved at all 4 sites. Once consent was obtained, parents completed questionnaires with trained research assistants who were fluent in the language of parents' choice (English or Spanish). Data were managed through Research Electronic Data Capture, a secure, Web-based application designed to support data capture for research studies<sup>38</sup> hosted at Vanderbilt University.

## Measures

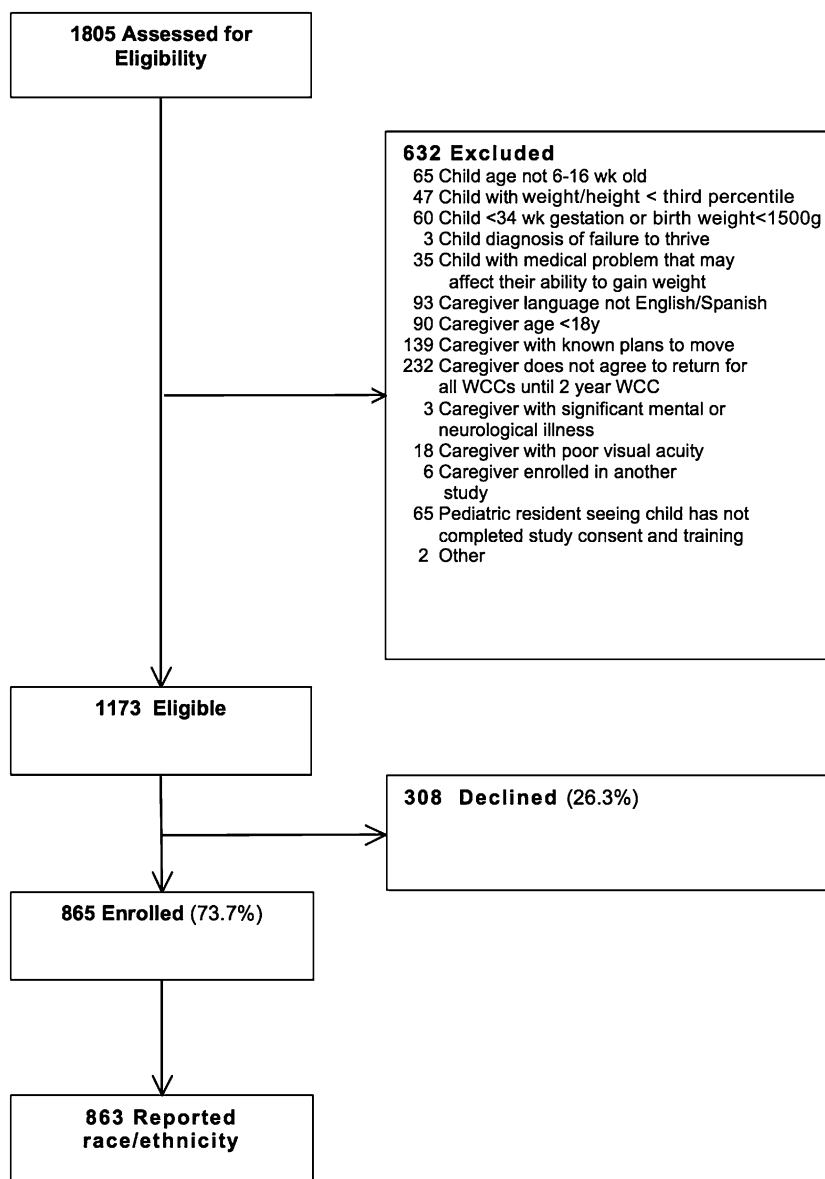
Previous literature on infant dietary and physical activity practices and relationship to obesity was reviewed<sup>21,24,39-44</sup> to create questionnaires that were based, whenever possible, on previously validated measures of infant feeding behaviors, feeding styles such as questions derived from the Infant Feeding Style Questionnaire (IFSQ), and activity and screen time.

### *Dietary Practices, Behaviors, and Attitudes*

Type of milk feeding, sweet drinks, early introduction of solids (including cereal in the bottle), and bottle-to-sleep behaviors were assessed. Parents were asked questions about how often they try to get their children to finish breast milk or formula, how often they watch television while feeding their infants, and how often they allow their infants to decide how much to eat. (See Supplemental Information for exact questions and response options.)

### *Physical Activity Practices and Sedentary Time*

Physical activity practices such as “tummy time,” television exposure (television on in the room the infant is in), and active television time (infant watching television) were assessed. In



**FIGURE 1**  
Eligibility requirements and enrollment flow. WCC, well child check.

In addition to reporting mean values, we chose to dichotomize television watching as any compared with none based on the American Academy of Pediatrics (AAP) evidence-based practice guidelines that discourage children under the age of 2 years watching any television,<sup>45</sup> and we chose to dichotomize tummy time at < versus  $\geq$  30 minutes because of AAP recommendations to get 30 minutes of tummy time each day.<sup>46</sup> See Supplemental Information for exact questions and response options.

### Independent Variables

The primary independent variable of interest for this analysis was parent race or ethnicity assessed with 2 questions: “Do you consider yourself Hispanic/Latino?” and “What race do you consider yourself to be?” The response options were then categorized as Hispanic, white non-Hispanic, black non-Hispanic, or other non-Hispanic. We did not analyze race and ethnicity separately because the vast majority of individuals identifying as Hispanic did

not also identify a race (eg, selected “other” and categorized themselves as “Hispanic” race).

### Statistical Analyses

Patient’s characteristics (age, gender, insurance) and respondent’s characteristics (relationship to child, whether born in the United States, education, the language of survey completion, use of out of home child care, enrollment in the Supplemental Nutrition Program for Women, Infants, and Children [WIC], household income, and the number of children and adults in the home) were summarized by using mean and SD for continuous variables and proportions for categorical variables.

To assess the association between race/ethnicity and the outcomes of interest, unadjusted analyses were performed by using Pearson  $\chi^2$  tests for all outcomes except active television watching, television exposure, and tummy time, for which Kruskal-Wallis tests were used. Adjusted analyses were performed by using proportional odds (PO) logistic regression.<sup>47</sup> The PO model is a suitable and widely used tool for analyzing responses when there is a natural ordering of the values. For the purpose of this analysis, all outcomes with categorical responses were considered ordinal. PO models were also used for continuous outcomes including active television watching, television exposure, and tummy time because the PO model works well also for continuous outcomes with skewed or sparse distributions. To prevent overfitting,<sup>48</sup> all models were adjusted for the following a priori defined set of covariates: child gender, child out of home care (any, none), WIC status (yes, no), parent age, race/ethnicity (Hispanic, black non-Hispanic, other non-Hispanic, white non-Hispanic), language (Spanish, English), household income (<\$10 000, \$10 000–\$19 999, \$20 000–\$39 999,

\$40 000 or more), number of adults in the home (1, 2, or more), number of children in the home (1, 2, or more), and study recruitment site (University of North Carolina at Chapel Hill, New York University/Bellevue Hospital Center, Vanderbilt University, and University of Miami/Jackson Memorial Medical Center). Parent age was modeled by using restricted cubic spline with 3 knots to detect if there was a nonlinear effect for age.<sup>48</sup> For each outcome, a complete case analysis was performed. Outcome of sweet drinks was not analyzed by using an adjusted model because of too few patients with positive responses. Results were presented by using odds ratios comparing each race category to white race. The *P* values and 95% confidence intervals (CIs) for odds ratios were calculated by using contrast. For each model, a global *P* value was reported to indicate significance of race variable before examining the pairwise comparisons between race categories. Data were analyzed by using R version 2.15 ([www.r-project.org](http://www.r-project.org)). For all analyses, a 2-tailed *P* value of  $< .05$  was considered statistically significant.

## RESULTS

A total of 865 parents of infants met inclusion criteria, consented to the study, and were enrolled at baseline, and 863 reported race/ethnicity (Fig 1). Of these, the majority of parents self-identified as Hispanic (49.8%), followed by black non-Hispanic (27.3%), white non-Hispanic (17.7%), and other race, non-Hispanic (5.1%). Across all sites, the largest Hispanic subgroup identified as North American/Mexican (55.7%), followed by Central American (19.8%), South American (14.5%), Caribbean (8.9%), and Peninsular (0.6%). Most infants were insured by Medicaid (85.6%) and lived in households with income under \$40 000 per year (84%). Use of WIC and family characteristics, including those that may influence

infant-care behaviors, varied significantly by race/ethnicity (Table 1).

### Dietary Practices

Table 2 shows behaviors for the complete sample and stratified by race and ethnicity. Type and exclusivity of feeding differed by race/ethnicity ( $P < .001$ ). Exclusive feeding with infant formula was more than twice as common (45%) than was exclusive breastfeeding (19%). Hispanic mothers were more likely to report any breastfeeding (69%), compared with black mothers (33%) and white mothers (46%). Twelve percent of parents reported feeding their infants with solid food (primarily in the form of cereal in the bottle), and these practices were far more common among non-Hispanic black (24%) and non-Hispanic white (16%) families, when compared with Hispanic families (4%). Only 3% of parents overall reported feeding their infants any sweet drinks (primarily juice).

### Feeding Styles and Practices

Some feeding styles thought to relate to later obesity were fairly common in the sample (Table 2). Forty-three percent of parents reported putting their infant to bed with a bottle at least sometimes, and more than 1 in 5 (23%) reported propping the bottle when feeding. Nearly half (46%) watch television at least half the time they are feeding. Black non-Hispanic parents were more likely to put their child to bed with a bottle at least once a day, compared with white non-Hispanic or Hispanic parents (37% vs 22%). Hispanic parents were more likely (69%) than black non-Hispanic parents (50%) and white non-Hispanic parents (29%) to encourage the infant to finish the bottle with almost every feed. Similarly, Hispanic parents were more likely (47%) than black non-Hispanic parents (19%) and white non-Hispanic parents (16%) to immediately feed their infant

with crying. Black non-Hispanic parents were more likely to ever prop their child's bottle (35%), compared with Hispanic parents (20%) and white non-Hispanic parents (15%). Finally, Hispanic parents were less likely to regularly (more than half the time) watch television while feeding (37%) than white non-Hispanic parents (53%) or black parents (61%).

### Physical Activity, Screen Time, and Sedentary Behaviors

Approximately half of all parents reported that their infants actively watched television, with an average of 25 minutes a day. Active television viewing also varied by race/ethnicity ( $P < .001$ ) and was lowest among Hispanic infants (41%) and highest among non-Hispanic black infants (68%). Additionally, over 90% of all infants were exposed to television, which also varied by race/ethnicity ( $P < .001$ ) with an average of 346 minutes per day (median of 180 minutes per day). Exposure was greatest among black non-Hispanic infants, with an average of 546 minutes per day, and least among Hispanic infants, with an average of 228 minutes/day. Approximately one-third (34%) of all parents reported that their infants were given at least 30 minutes daily of tummy time. Hispanic infants were least likely to exceed this threshold (22%), whereas black and white infants were more likely (45% and 46%, respectively).

### Adjusted Analyses

In the adjusted analysis (Table 3), race/ethnicity characteristics remained independently associated with all behaviors thought to promote or protect against obesity, except for tummy time ( $P < .05$ , joint tests for all race/ethnicity categories). Compared with white non-Hispanic parents, black parents (adjusted odds ratio [aOR] = 1.97; 95%

**TABLE 1** Characteristics of Study Population by Race/Ethnicity

	Total (N = 863) <sup>a</sup>	Race/Ethnicity				P
		Hispanic (N = 430)	White (N = 153)	Black (N = 236)	Other (N = 44)	
<b>Child characteristics</b>						
Age, mo, mean (SD)	2.1 (0.4)	2.1 (0.4)	2.1 (0.4)	2.2 (0.4)	2.1 (0.3)	.4
Gender, girl <sup>c</sup>	443 (51.3)	214 (49.8)	76 (49.7)	129 (54.7)	24 (54.5)	.6
Out of home child care, any <sup>d</sup>	79 (9.2)	26 (6.1)	18 (12.0)	34 (14.4)	1 (2.3)	<.001
WIC status, <sup>e</sup> any	729 (85.2)	389 (90.9)	96 (64.0)	216 (92.3)	28 (63.6)	<.001
Insurance <sup>d</sup>						<.001
Medicaid	735 (85.6)	381 (88.8)	110 (73.3)	215 (91.1)	29 (65.9)	—
Private (any)	97 (11.3)	31 (7.2)	35 (23.3)	19 (7.6)	13 (29.5)	—
None	27 (3.1)	17 (4.0)	5 (3.3)	3 (1.3)	2 (4.5)	—
<b>Parent characteristics</b>						
Age, <sup>e</sup> years, mean (SD)	27.6 (6.2)	28.2 (5.9)	26.7 (5.7)	26.6 (6.3)	30.0 (6.4)	<.001
Relationship to child						.3
Mother	825 (95.6)	413 (96.0)	148 (96.7)	226 (95.8)	38 (86.4)	—
Father	36 (4.2)	16 (3.7)	5 (3.3)	9 (3.8)	6 (13)	—
Other	2 (0.2)	1 (0.2)	0 (0.0)	1 (0.4)	0 (0.0)	—
Non-US born <sup>b</sup>	438 (51.0)	356 (83.0)	21 (14.0)	31 (13.1)	30 (68.2)	<.001
Race/ethnicity <sup>f</sup>						—
Hispanic	430 (49.8)	—	—	—	—	—
White, non-Hispanic	153 (17.7)	—	—	—	—	—
Black, non-Hispanic	236 (27.3)	—	—	—	—	—
Other, non-Hispanic	44 (5.1)	—	—	—	—	—
Spanish language <sup>g</sup>	302 (35.1)	302 (70.6)	0 (0.0)	0 (0.0)	0 (0.0)	<.001
Education <sup>h</sup>						<.001
Less than high school	225 (26.2)	176 (40.0)	13 (8.7)	35 (14.9)	1 (2.3)	—
HS graduate/General Educational Development	280 (32.6)	129 (30.1)	44 (29.3)	101 (43.0)	6 (13.6)	—
Some college	200 (23.3)	68 (15.9)	51 (34.0)	66 (28.1)	15 (34.1)	—
College or greater	153 (17.8)	56 (13.1)	42 (28.0)	33 (14.0)	22 (50.0)	—
<b>Household characteristics</b>						
Household income <sup>i</sup>						<.001
<\$10 000	265 (32.0)	149 (35.9)	18 (12.4)	86 (38.4)	12 (27.9)	—
\$10 000–19 999	228 (27.6)	133 (32.0)	32 (22.1)	59 (26.3)	4 (9.3)	—
\$20 000–39 999	202 (24.4)	89 (21.4)	46 (31.7)	57 (25.4)	10 (23.3)	—
\$40 000 or more	132 (16.0)	44 (10.6)	49 (33.8)	22 (9.8)	17 (39.5)	—
Children in household <sup>b</sup> (<18 years)						<.001
1 child	342 (39.8)	149 (34.7)	77 (51.3)	89 (37.7)	27 (61.4)	—
2 or more children	517 (60.2)	280 (65.3)	73 (48.7)	147 (62.3)	17 (38.6)	—
<b>Site characteristics</b>						
Site name						<.001
University of Miami	149 (17.3)	75 (17.4)	7 (4.6)	55 (23.3)	12 (27.3)	—
University of North Carolina– Chapel Hill	255 (29.5)	97 (22.6)	61 (39.9)	85 (36.0)	12 (27.3)	—
Vanderbilt University	230 (26.7)	78 (18.1)	70 (45.8)	74 (31.4)	8 (18.2)	—
New York University	229 (26.5)	180 (41.9)	15 (9.8)	22 (9.3)	12 (27.3)	—

Data presented as N (%) except as noted.

<sup>a</sup> After accounting for 2 subjects missing race/ethnicity.

<sup>b</sup> Missing for 7 subjects.

<sup>c</sup> Child or mother participating in WIC program; missing for 10 subjects.

<sup>d</sup> Child with any private insurance categorized as private; missing for 7 subjects.

<sup>e</sup> Missing for 6 subjects.

<sup>f</sup> Missing for 3 subjects.

<sup>g</sup> Parent answered Spanish questionnaires as opposed to English questionnaires.

<sup>h</sup> Missing for 8 subjects.

<sup>i</sup> Missing for 39 subjects.

CI: 1.25–3.12) and other race parents (aOR = 2.26; 95% CI: 1.12–4.57) were more likely to put their child to bed with a bottle. Hispanic parents (aOR = 1.93; 95% CI: 1.20–3.11) and black parents (aOR = 1.62; 95% CI: 1.09–2.41)

were more likely to encourage their child to finish breast milk or formula. Hispanic parents (aOR = 2.47; 95% CI: 1.25–4.88) and black non-Hispanic parents (aOR = 3.05; 95% CI: 1.71–5.43) were also more likely to bottle

prop. Parents who self-identified as non-Hispanic other race were more likely to feed their child immediately with crying (aOR = 3.08; 95% CI: 1.65–5.74) and less likely to report television viewing when feeding (aOR = 0.46; 95%



**TABLE 2** Eating and Activity Behaviors by Race/Ethnicity

	Total (N = 863)	Race/Ethnicity				P
		Hispanic (N = 430)	White (N = 153)	Black (N = 236)	Other (N = 44)	
<b>Diet-Related Practices</b>						
Type of feeding						<.001
Formula only	385 (44.6)	133 (30.9)	83 (54.2)	157 (66.5)	12 (27.3)	—
Mostly formula, and some breast milk	127 (14.7)	82 (19.1)	10 (6.5)	25 (10.6)	10 (22.7)	—
Equal formula and breast milk	11 (1.3)	9 (2.1)	0 (0.0)	2 (0.8)	0 (0.0)	—
Mostly breast milk, and some formula	175 (20.3)	120 (27.9)	18 (11.8)	29 (12.3)	8 (18.2)	—
Breast milk only	165 (19.1)	86 (20.0)	42 (27.5)	23 (9.7)	14 (31.8)	—
Sweet drinks						.9
Any	26 (3.0)	12 (2.8)	6 (3.9)	7 (3.0)	1 (2.3)	—
None	837 (97.0)	418 (97.2)	147 (96.1)	229 (97.0)	43 (97.7)	—
Early introduction of solids						<.001
Yes	98 (11.6)	16 (3.8)	24 (15.9)	55 (23.5)	3 (7.1)	—
No	748 (88.4)	403 (96.2)	127 (84.1)	179 (76.5)	39 (92.9)	—
<b>Infant feeding style and practices</b>						
In last 2 wk, how often was the infant put to sleep while drinking a bottle <sup>a</sup>						<.001
At most sleep times	108 (12.5)	51 (11.9)	18 (11.8)	32 (13.7)	7 (15.9)	—
Sometimes, at least once a day	119 (13.8)	41 (9.5)	15 (9.8)	54 (23.1)	9 (20.5)	—
Sometimes, but not every day	143 (16.6)	80 (18.6)	18 (11.8)	41 (17.5)	4 (9.1)	—
Never	491 (57.0)	258 (60.0)	102 (66.7)	107 (45.7)	24 (54.5)	—
I try to get my child to finish her breast milk or formula <sup>b</sup>						<.001
Always	324 (37.6)	223 (51.9)	21 (13.8)	70 (29.7)	10 (22.7)	—
Most of the time	149 (17.3)	73 (17.0)	23 (15.1)	47 (19.9)	6 (13.6)	—
Half of the time	75 (8.7)	21 (4.9)	19 (12.5)	31 (13.1)	4 (9.1)	—
Seldom or infrequently	103 (11.9)	37 (8.6)	37 (24.3)	25 (10.6)	4 (9.1)	—
Never	211 (24.5)	76 (17.7)	52 (34.2)	63 (26.7)	20 (45.5)	—
When my infant cries, I immediately feed him or her <sup>a</sup>						<.001
Always	175 (20.3)	133 (31.0)	9 (5.9)	22 (9.3)	11 (25.0)	—
Most of the time	119 (13.8)	67 (15.6)	16 (10.5)	23 (9.7)	13 (29.5)	—
Half of the time	184 (21.4)	68 (15.9)	42 (27.6)	65 (27.5)	9 (20.5)	—
Seldom or infrequently	176 (20.4)	86 (20.0)	32 (21.1)	52 (22.0)	6 (13.6)	—
Never	207 (24.0)	75 (17.5)	53 (34.9)	74 (31.4)	5 (11.4)	—
When my child has a bottle, I prop it up <sup>c</sup>						<.001
Always	31 (3.7)	16 (3.9)	0 (0.0)	13 (5.6)	2 (4.8)	—
Most of the time	24 (2.9)	9 (2.2)	3 (2.0)	11 (4.7)	1 (2.4)	—
Half of the time	37 (4.4)	13 (3.2)	3 (2.0)	21 (9.0)	0 (0.0)	—
Seldom or infrequently	102 (12.2)	43 (10.4)	17 (11.3)	36 (15.5)	6 (14.3)	—
Never	643 (76.8)	331 (80.3)	127 (84.7)	152 (65.2)	33 (78.6)	—
I watch television while feeding my infant <sup>b</sup>						<.001
Always	72 (8.4)	34 (7.9)	10 (6.6)	25 (10.6)	3 (6.8)	—
Most of the time	101 (11.7)	34 (7.9)	22 (14.5)	44 (18.6)	1 (2.3)	—
Half of the time	223 (25.9)	91 (21.2)	49 (32.2)	75 (31.8)	8 (18.2)	—
Seldom or infrequently	252 (29.2)	140 (32.6)	48 (31.6)	47 (19.9)	17 (38.6)	—
Never	214 (24.8)	131 (30.5)	23 (15.1)	45 (19.1)	15 (34.1)	—
<b>Physical activity-related practices</b>						
Tummy time, minutes, mean (SD)	37.5 (85.4)	26.2 (80.1)	44.9 (63.0)	52.2 (104.6)	44.2 (77.3)	<.001
Tummy time <sup>d</sup>						<.001
30 min or more	288 (33.5)	94 (22.0)	70 (46.1)	107 (45.3)	17 (39.5)	—
<30 min	571 (66.5)	334 (78.0)	82 (53.9)	129 (54.7)	26 (60.5)	—
Television exposure, <sup>a</sup> min, mean (SD)	346 (395)	228 (266)	397 (401)	546 (494)	267 (385)	<.001
Television watching, <sup>a</sup> min mean (SD)	25 (66)	11 (31)	24 (45)	51 (107)	16 (45)	<.001

TABLE 2 Continued

	Total (N = 863)	Race/Ethnicity				P
		Hispanic (N = 430)	White (N = 153)	Black (N = 236)	Other (N = 44)	
Television watching <sup>a</sup>						<.001
Any	429 (49.8)	174 (40.6)	78 (51.3)	161 (68.2)	16 (36.4)	—
None	432 (50.2)	255 (59.4)	74 (48.7)	75 (31.8)	28 (63.6)	—

Data presented as N (%) except as noted.

<sup>a</sup> Missing for 2 subjects.

<sup>b</sup> Missing for 1 subject.

<sup>c</sup> Missing for 26 subjects.

<sup>d</sup> Missing for 4 subjects.

CI: 0.24–0.87). Black parents reported more frequent television watching for their infants (aOR = 1.58; 95% CI: 1.04–2.41) than white non-Hispanic parents.

## DISCUSSION

In this multisite, large sample of geographically, racially, and ethnically diverse, low-income parents caring for 2-month-old infants, we discovered a high frequency of parent-reported behaviors that may increase their children's risk for obesity. Even after adjusting for potential confounders, including parent age and socioeconomic status, self-reported race and ethnicity were strongly and independently associated with many of these behaviors thought to relate to later obesity.

This study is one of the first in the United States to report such behaviors so early in infancy. We found that only 34% of parents adhere to the AAP-recommended 30 minutes or more of daily tummy time.<sup>46</sup> In addition, average television exposure for these infants was over 5 hours per day, and, perhaps more striking, half of all parents

expose their infant to “active TV viewing” for an average of more than 25 minutes per day. Already by 2 months, only 19% received breast milk exclusively, 38% were encouraged to finish a full bottle of formula or breast milk with every feeding, 23% had bottles propped in their crib or bassinet, and 12% were fed solid food.

Our findings add to a portrait of studies documenting eating and activity behaviors in the families of young children,<sup>37</sup> including ethnic disparities in these behaviors that some have argued may contribute significantly to the higher risk of obesity-related disease in ethnic minority communities.<sup>49</sup> If these behaviors are truly “obesogenic,” however, families from all races and ethnicities studied need early counseling, and the findings here also underscore the likely need for culturally sensitive health behavior counseling during early infancy. Particularly actionable are the specific behaviors that may be most sensitive to culturally adapted interventions: (1) infant exposure to television and other visual media; (2) breastfeeding initiation and

exclusivity; and (3) encouraging infants to finish bottles. Further research, using mixed method approaches that apply quantitative and qualitative techniques, may help elucidate whether cultural differences play a larger role than family history or other concerns arising from individual family behaviors that put children at high risk for cardiovascular disease and diabetes.

Although previous studies have revealed high rates of young children watching television,<sup>50–52</sup> our study results reveal surprisingly high rates of 2-month-old infants exposed to active television viewing and feeding while watching television, which may decrease responsive feeding. Meanwhile, although the AAP discourages television before age 2 years,<sup>45</sup> only 15% of parents report their pediatrician discussed media use with them.<sup>51</sup> These results suggest providers should begin counseling about screen time much earlier than is currently practiced, perhaps as part of routine newborn care.

As other studies have observed,<sup>37,53,54</sup> we found significant and complex ethnic

TABLE 3 PO Logistic Regression for Feeding and Activity Behaviors; White Non-Hispanic Is Referent

Outcome, N, Overall P for Race/Ethnicity	Hispanic, aOR (95% CI), P	Black, non-Hispanic, aOR (95% CI), P	Other, non-Hispanic, aOR (95% CI), P
More formula than breast milk, 820, .029	0.70 (0.43–1.17), .174	1.31 (0.82–2.10), .261	0.65 (0.33–1.26), .199
Bottle to bed, 819, .003	1.05 (0.61–1.78), .867	1.97 (1.25–3.12), .004	2.26 (1.12–4.57), .023
Finish breast milk/formula, 820, .012	1.93 (1.20–3.11), .007	1.62 (1.09–2.41), .018	0.88 (0.46–1.68), .698
Immediately feed, 819, .003	1.24 (0.78–1.96), .362	1.05 (0.70–1.57), .821	3.08 (1.65–5.74), <.001
Bottle propping, 797, .002	2.47 (1.25–4.88), .009	3.05 (1.71–5.43), <.001	2.26 (0.92–5.58), .076
Television while feeding, 820, .014	1.04 (0.66–1.63), .872	1.29 (0.87–1.92), .213	0.46 (0.24–0.86), .015
Active television watching, 819, .006	0.88 (0.53–1.43), .595	1.58 (1.04–2.41), .034	0.57 (0.28–1.19), .133
Tummy time, 817, .083	0.62 (0.40–0.97), .037	0.86 (0.58–1.28), .447	0.53 (0.28–1.003), .051

Outcomes are 5-point categorical variables for feeding behaviors; outcomes are continuous minutes of television watching and tummy time.

disparities in the patterns of infant exposure to potentially unhealthy behaviors. Although this study has identified important differences in infant feeding and activity behaviors by race/ethnicity, caution is needed when applying these findings to future clinical intervention. Because we do not yet know which of these behaviors are definitively linked to future obesity risk, we must be circumspect about designing any interventions based on racial, ethnic, or socioeconomic differences in the expression of these behaviors. Infants of Hispanic parents were protected from many behaviors thought to be related to later obesity. Compared with non-Hispanic parents, Hispanic parents were less likely to report exclusive formula feeding, less likely to report feeding solids, and less likely to report active and passive television viewing. However, Hispanic parents, compared with white parents, were more likely to report encouraging their infant to finish milk and bottle propping, and less likely to report providing their infants with as much tummy time each day. By contrast, although infants of black parents engaged in more daily tummy time, they were more likely to report some behaviors thought to be related to future obesity such as exclusive formula feeding, giving infants bottles to sleep, introducing solid foods, and watching television. Multiple explanations for these differences can be hypothesized and explained in part by their historical and environmental contexts.<sup>55</sup> In 1 study, for example, reasons cited for not breastfeeding varied by race/ethnicity, with Hispanic mothers less likely to cite household responsibilities as a barrier than black or white mothers.<sup>56</sup> And the high rates of television for infants of black mothers may be related to their own higher rates of television watching.<sup>57</sup> Clearly further qualitative research is needed to determine the relationships between

culture and health behaviors and whether behaviors are modifiable through culturally tailored early intervention.

Although this study included a large, diverse sample, there are limitations to consider. First, there are difficulties and variability in defining race and ethnicity in research.<sup>58</sup> As the Institute of Medicine argues,<sup>59</sup> race is a social and cultural context that can be difficult to align on a single dimension. Differences within subgroups likely come into play in a way that was not analyzed here. For example, discrepancies of behavior that relate to country or region of origin for those who identified as “Hispanic” or even white were masked by a broad stroke identification of that grouping within this study. Furthermore, the act of using “white” as the referent population is problematic both symbolically and because white children also have high rates of obesity. Doing so also likely hides any subgroup differences. Different subgroups of the various races and ethnicities may relate to differences in cultural practices of the behaviors measured. These differences obviously deserve further study, potentially through qualitative work.

Second, the relationships we note are clearly related to underlying community and familial environments, including confounding biases unmeasured in our study that may together result in “cumulative social adversity” found to be related to childhood obesity.<sup>60</sup> Furthermore, social desirability bias is often associated with self-reported behaviors, which means both that the prevalence of specific behaviors may be underestimated and the relative prevalence of these behaviors in different ethnic groups may be influenced by differential desirability bias across these groups. Although we modeled behaviors thought to be related to obesity according to previous literature, no previously validated scale for

several behaviors (including television “use”) was available at the time of the study for parents of such young infants, and some of the behaviors we looked at (such as tummy time) have not had documented relationships to obesity and were only theorized to be important. Certainly a validated measure would have lent additional rigor to our study. Although we have included several clinically relevant questions from the validated IFSQ,<sup>24</sup> we did not use the whole scale or complete subscales for specific feeding styles because of the respondent burden incurred from the rest of the intervention’s measures. Although the cohort is diverse, it is not nationally representative, so generalizability may be limited. Finally, although this study presents baseline data from a longitudinal cohort, its findings are cross-sectional, impairing any ability to infer causality. In future analyses, we hope to report on the relationship between early parent infant care behaviors and later indicators of child health, including weight status.

## CONCLUSIONS

Our findings add further texture to the conceptual models and actionable recommendations of several national efforts to address the nation’s obesity epidemic. The consensus Expert Panel, convened in 2008 by Shaping America’s Health and The Obesity Society, encouraged the use of a socioecological framework<sup>61</sup> to understand and address ethnic disparities in obesity and related behaviors. This model “views children in the context of their families, communities, and cultures, emphasizing the relationships among environmental, biological, and behavioral determinants of health” and “focuses on interactions between a person’s physical, social, and cultural surroundings.” Efforts to attenuate health disparities must attend to cultural



patterns of dietary and physical-activity behaviors that are often established and reinforced during infancy. A population-wide child health problem like obesity demands a population-based understanding of healthy behaviors of these children's environments: not merely at the level of ethnic and racial identity of their parents, but more importantly at the levels of the communities, neighborhoods, and families in which they live. Although office-based approaches to preventive care remain important, our results suggest that public health approaches should also account for the distinct cultural differences in

a community's collective behaviors. Through culturally relevant, low-literacy and low-numeracy counseling and materials that target these behaviors, the Greenlight intervention may help reduce the prevalence of such behaviors and even obesity itself at age 2 years.

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## **Racial and Ethnic Differences Associated With Feeding- and Activity-Related Behaviors in Infants**

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