Differences by Race and Ethnicity in the Relationship Between Breastfeeding and Obesity in Preschool Children

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Objective: To test the hypothesis that the relationship between breastfeeding and later obesity would differ by race/ethnicity.

Design: Data were obtained from the Fragile Families and Child Wellbeing Study, a prospective birth cohort study.

Setting: Twenty large US cities in 15 states.

Participants: The 2146 three-year-old children in the study were born between 1998 and 2000 and were either non-Hispanic White, non-Hispanic Black, or Hispanic (any race).

Main Outcome Measures: Obesity was defined as having a BMI $\geq 95^{th}$ percentile.

Results: Fifty-two percent of the children were ever breastfed and 18% were obese at 3 years of age. After adjustment for covariates (maternal BMI, smoking, age, relationship status, and education, plus the child's birth weight and the household income-to-poverty ratio), the relationship between breastfeeding and the prevalence of obesity was significantly different between White, Black, and Hispanic children ($P=.02$). The adjusted prevalence of obesity was lower in Hispanic children who were ever breastfed compared to those who were never breastfed (23.3% vs 33.0%, $P=.01$), but there was no significant association between breastfeeding and obesity in either White or Black children (16.6% vs 11.3%, $P=.18$ for Whites and 18.0% vs 14.5%, $P=.13$ for Blacks).

Conclusions: In this study we found that the relationship between breastfeeding and obesity differed by race/ethnicity. Future studies examining the relationship between breastfeeding and later adiposity should consider the possibility that this relationship may differ by race/ethnicity. (*Ethn Dis*. 2007;17:467–470)

Key Words: Overweight, Children, Breastfeeding, Ethnicity, Body Mass Index

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Introduction

Numerous observational studies suggest that being breastfed is associated with a reduced risk of obesity.[1] Many have tried to account for factors that might confound the relationship between breastfeeding and later obesity; however, less attention has been given to factors that might modify that relationship.

Two large US studies, which were both limited to low-income children living in households with incomes ≤ 1.85 times the US federal poverty guideline, suggest that the association between breastfeeding and obesity differs by race/ethnicity.[2,3] Grummer-Strawn and Mei, in a study of more than 12,000 four-year-olds in seven US states, found that being breastfed was associated with a reduced risk of obesity in non-Hispanic Whites but not in Hispanics or in non-Hispanic Blacks.[2] In more than 70,000 four-year-olds in Ohio, Bogen and colleagues showed that being breastfed was associated with a lower risk of obesity in non-Hispanic Whites but not in non-Hispanic Blacks.[3]

The exact mechanisms by which breastfeeding might reduce the risk of later obesity are unknown. If breastfeeding reduces the risk of obesity in some racial/ethnic groups but fails to reduce the risk, or even increases the risk, in other racial/ethnic groups, this might reflect differences between these groups in the role of breastfeeding in the infant diet. Further investigation into these differences may, in turn, yield insights into how breastfeeding influences later weight.

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Using a national US sample of urban, preschool children from a broader income range than in these two prior studies, we examined the relationship between breastfeeding and obesity and tested the hypothesis that this relationship would differ by race/ethnicity.

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Methods

Study Design and Sample

The Fragile Families and Child Wellbeing Study is a birth cohort study following children born in 1998 to 2000 in 20 large US cities in 15 states. The study design has been described elsewhere in detail.[4,5] Mothers were surveyed at delivery and again one year after delivery, when breastfeeding histories were obtained. Approximately three years after delivery, heights and weights were measured in the home on 2452 children and their mothers, using a standardized protocol.[4] The institutional review boards at all 75 birth hospitals, as well as those at Princeton and Columbia Universities, approved the study.

Study Measures

Mothers were asked if they breastfed their children and, if so, for how many

months. Children were categorized into 3 groups: never breastfed, breastfed <4 months, and breastfed ≥4 months. The cutoff of ≥4 months was selected because prior studies suggest that any protective effects of breastfeeding on later obesity are usually not seen at breastfeeding durations shorter than 4 months.[2,3,6,7] To facilitate comparisons with other studies, we also analyzed breastfeeding as a binary variable (ever/never).

Other variables were obtained from the survey at delivery: the child's race/ethnicity and birth weight, household income, and the mother's education, age, marital status, and smoking history during pregnancy. Each child's body mass index (BMI, kg/m^2) percentile and z score for age and sex were derived using the 2000 CDC growth reference.[8] Obesity was defined as having a BMI ≥95th percentile.[9]

Data Analysis

We excluded 75 children who were not non-Hispanic White, non-Hispanic Black, or Hispanic (any race). These three racial/ethnic groups are hereafter named White, Black, and Hispanic. We further excluded 231 children who did not have data on breastfeeding duration, leaving a final analytic sample of 2146 children. The prevalence of obesity among the 306 children who were excluded was not significantly different (P=.51) from the 2145 children in our analytic sample.

We used logistic regression models to examine the interaction between breastfeeding and race/ethnicity, and the test of interaction was based on the likelihood ratio statistic comparing two models. Each model was run on the entire sample and had child obesity as the dependent variable. The reduced model contained the variables for breastfeeding (never, <4 months, and ≥4 months) and for race/ethnicity (White, Black, Hispanic) in addition to all the other covariates. The full model contained all of the variables in

Table 1. Bivariate relationship between subjects' characteristics and children's breastfeeding, BMI, and obesity prevalence (BMI ≥95th percentile)

	Has characteristic n* (%)	Ever breastfed *n* (%)	BMI z Mean ± SD	Obese *n* (%)
Child characteristic				
Race/ethnicity				
White, non-Hispanic	419 (20)	274 (65)	.53 ± 1.1	62 (15)
Black, non-Hispanic	1182 (55)	498 (42)	.46 ± 1.3	189 (16)
Hispanic (any race)	545 (25)	340 (62)	.87 ± 1.3	147 (27)
P value†		<.001	<.001	<.001
Sex				
Male	1117 (52)	580 (52)	.59 ± 1.3	210 (19)
Female	1029 (48)	532 (52)	.57 ± 1.3	188 (18)
P value		.92	.65	.75
Birth weight				
<4000 grams	1988 (93)	1023 (52)	.54 ± 1.3	351 (18)
≥4000 grams	145 (7)	84 (58)	1.16 ± 1.1	45 (31)
P value		.13	<.001	<.001
Mother characteristic				
Age at child's birth				
<20 years	413 (19)	189 (46)	.48 ± 1.2	60 (15)
20–24 years	801 (37)	392 (49)	.61 ± 1.3	164 (21)
25–29 years	487 (23)	261 (54)	.56 ± 1.2	81 (17)
≥30 years	445 (21)	270 (61)	.63 ± 1.3	93 (21)
P value		<.001	.26	.03
Relationship status				
Cohabiting	818 (38)	406 (50)	.61 ± 1.3	160 (20)
Single	884 (41)	383 (43)	.56 ± 1.3	163 (18)
Married	444 (21)	323 (73)	.57 ± 1.2	75 (17)
P value		<.001	.68	.51
Education				
<High school	763 (36)	332 (44)	.64 ± 1.3	159 (21)
High school degree	691 (32)	298 (43)	.53 ± 1.2	117 (17)
Some college	513 (24)	331 (65)	.53 ± 1.3	95 (19)
≥College graduate	177 (8)	150 (85)	.66 ± 1.1	27 (15)
P value		<.001	.21	.16
Income‡				
<0.50	424 (20)	149 (35)	.52 ± 1.3	74 (18)
0.5–0.9	395 (18)	180 (46)	.56 ± 1.3	79 (20)
1.0–1.9	584 (27)	297 (51)	.64 ± 1.2	122 (21)
2.0–2.9	305 (14)	169 (55)	.59 ± 1.3	57 (19)
≥3.0	438 (21)	317 (72)	.56 ± 1.2	66 (15)
P value		<.001	.69	.16
Body mass index§				
<25.0	621 (31)	341 (33)	.31 ± 1.3	79 (13)
25.0–29.9	543 (27)	280 (27)	.56 ± 1.2	87 (16)
30.0–34.9	398 (20)	187 (18)	.66 ± 1.3	89 (22)
≥35.0	453 (22)	223 (22)	.81 ± 1.3	106 (23)
P value		.07	<.001	<.001
Smoked in pregnancy				
Yes	429 (20)	164 (38)	.51 ± 1.2	75 (18)
No	1712 (80)	943 (55)	.59 ± 1.3	321 (19)
P value		<.001	.24	.55

* If N<2146, some subjects were missing data on the covariate.

† *P* value for chi-square test (ever breastfed and percent obese) and ANOVA (BMI z).

‡ Household income expressed as a ratio of the reported income to the US poverty guideline based on the household size and the year of reporting.

§ Maternal BMI was based on self- reported weight in 157 mothers who were pregnant and in another 129 mothers who were not weighed. BMI data missing on 131 mothers.

Table 2. Unadjusted and adjusted* BMI z, obesity prevalence, and odds of obesity by breastfeeding status and by race/ethnicity

		BMI z ± SE		Obese (%)		Odds Ratio (95% CI)†	
	n	Unadj	Adj	Unadj	Adj	Unadj	Adj
White, non-Hispanic							
Never	145	0.48 ± .09	0.44 ± .10	13.8	11.5	1.00	1.00
<4 months	142	0.74 ± .10	0.74 ± .10	18.3	18.9	1.40 (0.74–2.64)	1.74 (0.86–3.52)
≥4 months	132	0.38 ± .10	0.42 ± .10	12.1	14.0	0.86 (0.43–1.74)	1.19 (0.53–2.67)
P value‡		.03	.03	.32	.23		
Black, non-Hispanic							
Never	684	0.40 ± .05	0.43 ± .05	14.2	14.5	1.00	1.00
<4 months	280	0.53 ± .08	0.50 ± .08	17.9	17.7	1.32 (0.91–1.91)	1.27 (0.85–1.88)
≥4 months	218	0.54 ± .09	0.50 ± .09	19.3	18.3	1.44 (0.97–2.15)	1.32 (0.87–2.01)
P value		.21	.64	.13	.32		
Hispanic							
Never	205	0.94 ± .09	1.00 ± .09	31.7	33.1	1.00	1.00
<4 months	200	0.85 ± .09	0.81 ± .09	25.5	24.2	0.74 (0.48–1.14)	0.60 (0.37–0.97)
≥4 months	140	0.78 ± .11	0.78 ± .11	22.1	22.1	0.61 (0.37–1.01)	0.54 (0.31–0.94)
P value		.53	.25	.12	.05		

* Adjusted for maternal BMI, smoking, age, relationship status, and education, plus the child's birth weight (grams) and the household income-to-poverty ratio. Maternal BMI was missing for 131 cases. In the logistic regression models, maternal BMI was entered as 4 dummy variables (25–29.9 kg/m^2, 30–34.9 kg/m^2, ≥35 kg/m^2, and missing BMI) with the omitted (reference) category being BMI <25 kg/m^2.

† Odds ratios are derived from separate logistic regression models for each race/ethnic groups using obesity (BMI ≥ 95th percentile) as the dependent variable.

‡ *P* values are for ANOVA (BMI z) and chi-square tests (percent obese) in the unadjusted analyses, and they are from generalized linear models in the adjusted analyses.

the reduced model plus the variables used to model the breastfeeding by race/ethnicity interaction. After comparing the full and reduced models to establish the significance of the interaction, we conducted separate multivariate analyses for each race/ethnic group. In these analyses, we used generalized linear models to compare the mean BMI z score and prevalence of obesity in different breastfeeding categories, after adjusting for covariates.

The adjusted odds ratio for obesity associated with each breastfeeding category was determined by separate logistic regression models for each race/ethnic group. The data analyses were conducted using SPSS, version 12.0 (Chicago, Ill).

RESULTS

The mean (± SD) age of the children was 38.5 (± 3.2) months at the time of BMI measurements, and 36% lived in households with incomes above 1.85 times the US poverty guideline. Fifty-two percent of the children were ever breastfed of whom 44% were breastfed for at least 4 months. The prevalence of obesity in the children was 18%.

Hispanics and Whites had a similar prevalence of breastfeeding and were more likely to breastfeed than Blacks (Table 1). In contrast, Hispanic children had the highest prevalence of obesity, while Black and White children had a similar prevalence. Mothers who were married, older, more educated, did not smoke during pregnancy, and had higher household incomes were more likely to breastfeed their children. However, maternal age was the only variable that was significantly related to child obesity. Mothers with higher BMI were less likely to breastfeed and had children with higher BMI z scores and obesity prevalence.

In comparing our full and reduced logistic regression models (one with and one without breastfeeding by race/ethnicity interaction terms), we found a statistically significant interaction between race/ethnicity and breastfeeding (likelihood ratio statistic = 8.24, df = 2, P=.02). This interaction remained significant in these models when breastfeeding was used as a binary variable (ever/never, P=.01) or as a continuous variable (months, P=.03). In Hispanic children breastfeeding was associated with a lower prevalence of obesity (Table 2). In contrast, there was no significant association between breastfeeding and obesity in either Black or White children. The adjusted prevalence of obesity was significantly lower in Hispanic children who were ever breastfed compared to those who were never breastfed (23.3% vs 33.0%, P=.01). Although the differences were not statistically significant, the adjusted prevalence of obesity tended to be higher in both White and Black children who were breastfed compared to those who were not (16.6% vs 11.3%, P=.18 for Whites and 18.0% vs 14.5%, P=.13 for Blacks).

DISCUSSION

We found that the relationship between breastfeeding and obesity differed by race/ethnicity. Consistent with

…we found no protective effect of breastfeeding on later obesity among Black preschool children… We found that breastfeeding was associated with a reduced risk of obesity in Hispanic children…

the two large studies that have examined the association of breastfeeding and obesity,[2,3] we found no protective effect of breastfeeding on later obesity among Black preschool children. Furthermore, our study showed that breastfeeding tended to be associated with an increased risk of obesity in Black children, as in the study of Bogen and colleagues.[3] We found that breastfeeding was associated with a reduced risk of obesity in Hispanic children, Grummer-Strawn and Mei[2] found no significant association in Hispanic children. Bogen and colleagues did not report on Hispanic children.

The lack of association between breastfeeding and obesity among White children in our study is not easily explained. While our study sample was smaller than those in the other two studies examining the interaction between breastfeeding and race/ethnicity, it included children in households with a broader income range. This difference in the study populations might explain some of the differences in the findings. In addition, the number of White children in the study may have been too small to detect a significant relationship between breastfeeding and obesity. Although no information was collected on the timing of the introduction of complementary foods, this aspect of the infant diet has not been shown to be significantly related to later adiposity.[10,11]

Breastfeeding is just one of many factors that influence obesity risk in preschool children. Furthermore, it is a single dietary behavior of limited duration. Therefore, the differing relationship between breastfeeding and obesity by race/ethnicity might be best explained by the fact that breastfeeding varies with and interacts with other risk factors for obesity that also differ across race/ethnic groups. Future studies examining the relationships between early dietary factors and later adiposity should consider the possibility that those relationships may differ by race/ethnicity.

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