

Food Insecurity and Obesogenic Maternal Infant Feeding Styles and Practices in Low-Income Families



WHAT'S KNOWN ON THIS SUBJECT: Food insecurity has been linked to childhood obesity in a number of studies. Few studies have explored potential pathways through which food insecurity is related to child weight, especially in low-income families with young infants.



WHAT THIS STUDY ADDS: We found that food insecurity was related to maternal controlling feeding styles and concerns about the infants' future weight. Early obesity prevention should aim to decrease food insecurity and to reduce controlling feeding styles in families who remain food insecure.

abstract

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OBJECTIVES: We explored the relationship between household food insecurity and maternal feeding styles, infant feeding practices, and perceptions and attitudes about infant weight in low-income mothers.

METHODS: Mothers participating in the Special Supplemental Food Program for Women, Infants, and Children with infants aged between 2 weeks and 6 months were interviewed. By using regression analyses, the following relationships were examined between food insecurity and: (1) controlling feeding styles (restrictive and pressuring); (2) infant feeding practices, including breastfeeding, juice consumption, and adding cereal to the bottle; and (3) perceptions and attitudes about infant weight. Path analysis was used to determine if perceptions and attitudes about infant weight mediated the relationships between food insecurity and controlling feeding styles.

RESULTS: The sample included 201 mother–infant pairs, with 35% reporting household food insecurity. Food-insecure mothers were more likely to exhibit restrictive (B [SE]: 0.18 [0.08]; 95% confidence interval [CI]: 0.02–0.34) and pressuring (B [SE]: 0.11 [0.06]; 95% CI: 0.001–0.22) feeding styles compared with food-secure mothers. No associations were found with feeding practices. Concern for their infant becoming overweight in the future was associated with food insecurity (adjusted odds ratio: 2.11 [95% CI: 1.02–4.38]). This concern mediated the relationship between food insecurity and both restrictive ($P = .009$) and pressuring ($P = .01$) feeding styles.

CONCLUSIONS: Increased concern about future overweight and controlling feeding styles represent potential mechanisms by which food insecurity could be related to obesity. Obesity prevention should aim to decrease food insecurity and to reduce controlling feeding styles in families who remain food insecure. *Pediatrics* 2012;130:254–261

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KEY WORDS

feeding, food insecurity, Hispanic, infant, pressure to eat, restriction

ABBREVIATIONS

CFQ—Child Feeding Questionnaire

CI—confidence interval

WIC—Special Supplemental Food Program for Women, Infants, and Children

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Food insecurity is defined as the limited or uncertain availability of nutritionally adequate and well-tolerated foods, or the ability to acquire such foods.¹ With increasing numbers of US families living in poverty, rates of households reporting food insecurity are high.² The Supplemental Nutrition Assistance Program and the Special Supplemental Food Program for Women, Infants, and Children (WIC), although not meant to alleviate all food needs, are designed to provide supplemental support to low-income families. Despite this support, food insecurity remains as high as 37% among participants in these programs.^{3,4}

Given the current overlap between communities with high rates of food insecurity and those with high rates of obesity, extensive research has been conducted to better understand the relationship between food insecurity and weight. In adults, food insecurity has been clearly associated with increased obesity, particularly in women.^{4,5} In children, many studies have demonstrated increased risk of obesity,^{6–13} although the results have been mixed.^{4,5,14–19} Less research has explored potential pathways through which household food insecurity is related to child weight, especially in families with young infants. Given that Hispanic infants are more likely to be overweight than infants of other ethnicities²⁰ and to live in food-insecure households,² it is particularly important to understand these potential pathways in this high-risk group.

Research has suggested a model through which 3 aspects of parenting have been related to childhood obesity.^{21–23} These include: (1) parent feeding practices; (2) parent controlling feeding styles; and (3) the influence of perception and attitudes about child weight on these parental feeding practices and feeding styles. Most studies on parenting and child obesity focus on older children, and few incorporate food insecurity.

Studies of food insecurity and feeding practices found that food-insecure households consume more low-cost, high-energy-dense foods,²⁴ more high-energy supplements,²⁵ had fewer food supplies,²⁶ and focus on “quantity” rather than “quality.”²⁷ Fewer studies have looked at food insecurity and parent feeding styles, both restrictive and pressuring. Restriction occurs when parents try to limit their child’s intake even if the child is hungry. Pressuring occurs when a parent encourages intake even if the child is not hungry. Food-insecure mothers of school-aged children were shown to exhibit both pressuring and restrictive feeding styles²⁵ and were more likely to worry that their child eats too much compared with food-secure households.²⁸ To the best of our knowledge, no studies have explored the relationship between food insecurity and maternal perceptions and attitudes regarding their child’s weight. We found only 1 previous study looking at potential pathways linking food insecurity and feeding in infants; however, this study did not focus on low-income Hispanic mothers with infants in their first 6 months.²⁹

We therefore sought to study the relationship between household food insecurity and maternal controlling feeding styles, infant feeding practices, and perceptions and attitudes about their infant’s weight in low-income, primarily Hispanic mothers of young infants participating in WIC. We hypothesized that: (1) mothers from food-insecure households would be more controlling over their infants’ feeding practices than mothers from food-secure households; (2) mothers from food-insecure households would have more early obesity-promoting feeding practices; and (3) these relationships would be mediated by maternal perception and attitudes about infant weight.

METHODS

Study Design and Sample

We performed a cross-sectional study of mother–infant dyads participating in WIC at a large urban medical center. Mothers of young infants at the WIC center were recruited between February 2009 and August 2010. Bilingual research assistants consecutively recruited mothers 1 or 2 times per week. Research assistants screened all mothers presenting with infants to the WIC center for eligibility criteria. Included were English- or Spanish-speaking mothers at least 18-years-old with a singleton full-term (≥ 37 weeks’ gestational age) infant between 2 weeks and 6 months of age. Infants with medical problems that may influence their feeding or weight were excluded.

Research assistants obtained informed written consent from all participating mothers. This study was approved by the New York University School of Medicine institutional review board and the Bellevue Hospital Center/Health and Hospital Corporation institutional review board.

Assessments

We obtained assessments through an interviewer-administered survey with the mothers.

Independent Variable

The main independent variable was household food insecurity during the 12 months before the interview. We used 2 questions from the Core Food Security Module,³⁰ the most widely used validated tool in English and Spanish,³¹ to measure food insecurity: “We worried whether our food would run out before we got money to buy more” and “We relied on only a few kinds of low-cost foods because we were running out of money to buy food.” Responses included often, sometimes, or never

true in the last 12 months. Mothers, who responded sometimes or often true to both of the questions, were classified as food insecure. A similar 2-item food insecurity screen was validated among low-income families with young children.³²

Dependent Variables

Maternal Controlling Feeding Styles

Two controlling feeding styles, restrictive and pressuring, were assessed. Statements were adapted from the Child Feeding Questionnaire (CFQ), which was designed to assess feeding style in mothers of older children³³ and validated in Hispanic populations.³⁴ Previous factor analysis of these adapted questions demonstrated that both restrictive and pressuring feeding styles remained stable in this younger age group.³⁵

Maternal Restrictive Feeding Style

Restrictive feeding style was assessed on the basis of maternal responses to 2 statements adapted from the CFQ: (1) If I did not guide or regulate my child's eating, he/she would eat much more than he/she should; and (2) I have to be especially careful to make sure my child does not eat too much. Responses to these statements were based on a 4-point Likert scale (strongly disagree, disagree, agree, and strongly agree). Responses to the statements were scored 1 (strongly disagree) to 4 (strongly agree), and mean scores for these 2 statements were generated.

Maternal Pressuring Feeding Style

Pressuring feeding style was assessed on the basis of maternal responses to 3 statements adapted from the CFQ: (1) I have to be especially careful to make sure my child eats enough; (2) If I did not guide or regulate my child's eating, he/she would eat much less than he/she should; and (3) Even when my child seems done, I try to feed him/her a little

bit more. Responses to the statements were scored 1 (strongly disagree) to 4 (strongly agree), and mean scores for these 3 statements were generated.

Infant Feeding Practices

Breastfeeding, at the time of the interview, was classified as exclusive breastfeeding, partial breastfeeding (both breast milk and formula), and no breastfeeding (formula only). We also collected the frequency of adding cereal to the bottle or giving juice in the 24 hours before the interview. Because almost no mothers gave juice or added cereal to the bottle in the first 3 months of life, analyses using these variables were restricted to mothers with infants between 4 and 6 months of age.

Perceptions and Attitudes About Infant Weight

Maternal perception of the infant's current weight and her attitudes about the infant's future weight were assessed by using questions adapted from the CFQ. Mothers were asked if they thought their child was currently underweight, overweight, or about the right weight. They were also asked if they were concerned about their infant becoming underweight or overweight in the future.

Potential Confounders

Infant Characteristics

Infant characteristics included age, gender, birth order (first born, older siblings) and birth weight. Measured infant weight and length were obtained from the WIC nutritionist or the child's medical record. Weight for length percentiles were determined by using year 2000 Centers for Disease Control and Prevention growth data (Epi Info software version 3.4.1) and were classified as underweight ($\leq 5\%$), normal weight (5%–94.9%), or overweight ($\geq 95\%$).³⁶

Maternal Characteristics

Maternal characteristics assessed were maternal age, ethnicity (Hispanic, non-Hispanic), country of birth (US born, non-US born), educational level (no school, 1–8 years, 9–11 years, graduated high school, some college, graduated college, professional degree), marital status (married, nonmarried), and employment (working, nonworking). Maternal BMI was calculated by using self-reported weight and height and was categorized on the basis of Centers for Disease Control and Prevention classifications of adult BMI: underweight (< 18.5), normal weight (18.5–24.9), overweight (25–29.9), and obese (≥ 30).³⁷ Maternal depression was assessed by using the Patient Health Questionnaire–2,³⁸ with a cutoff point of 2, which has been demonstrated to perform better in low-income mothers.³⁹

Statistical Analysis

The data were analyzed by using SPSS version 17.0 (SPSS Inc, Chicago, IL). We first examined bivariate relationships between household food insecurity and maternal controlling feeding styles, infant feeding practices, and maternal perceptions and attitudes about infant weight. These analyses were performed by using independent samples *t* tests, 1-way analysis of variance, and χ^2 analyses. Linear regression models were used to assess the relationship between food insecurity and both controlling feeding styles. Logistic regression models were used to assess the relationship between food insecurity and infant feeding practices, and perceptions and attitudes about infant weight. All models were adjusted for infant age and gender and maternal ethnicity, country of birth, and educational level; models also adjusted for depression to determine whether associations between food insecurity and infant feeding were independent of other common sources of toxic stress.⁴⁰ We added an

interaction term, which multiplies together the dichotomous variables for depression and food insecurity to determine if depression moderated the relationships between food insecurity and controlling feeding styles. Although maternal BMI was related to food insecurity, BMI was excluded in the reported models because 31% of the mothers did not know their own height. Therefore, BMI could not be calculated for those mothers. However, models that included maternal BMI had similar results. Path analysis was used to determine whether maternal perceptions and attitudes about infant weight mediated the relationship between food insecurity and controlling feeding styles. In our analysis, we followed Baron and Kenny's 4-step process for testing mediation hypotheses.⁴¹ Significance values for the standardized indirect effects were calculated with Amos 20 (Amos Development Corporation, Meadville, PA) by using bootstrapping techniques.

RESULTS

Food Security Status

Our sample included 201 mother–infant dyads. Most mothers (83%) were non–US born, with the majority from Mexico (43%), Ecuador (18%), and the Dominican Republic (4%). A description of the sample characteristics according to food security status is provided in Table 1. Seventy-one (35%) mothers reported household food insecurity. Food-insecure mothers were more likely to be non–US born, have less than a high school education, be depressed, and be overweight or obese than food-secure mothers.

Food Insecurity and Maternal Controlling Feeding Styles

Mothers reporting household food insecurity had higher restrictive feeding style (B [SE]: 0.18 [0.08]; 95% confidence interval [CI]: 0.02–0.34) and pressuring feeding style (B [SE]: 0.11 [0.06]; 95% CI: 0.001–0.22) scores than mothers who

TABLE 1 Family Characteristics Based on Food Security Status

Characteristic	Study Sample (N = 201)	Food Secure (n = 130)	Food Insecure (n = 71)	P
Infant characteristics				
Age, mo	3.02 ± 1.95	3.05 ± 1.99	3.02 ± 1.90	.91
Male	109 (54.2)	66 (50.8)	43 (60.6)	.24
First born	93 (46.5)	64 (49.2)	29 (41.4)	.30
Birth weight, kg	3.36 ± 0.46	3.34 ± 0.48	3.39 ± 0.43	.49
Weight status ^a				.22
Underweight	10 (6.5)	4 (4.0)	6 (10.9)	
Normal	134 (86.5)	88 (88.0)	46 (83.6)	
Overweight	11 (7.1)	8 (8.0)	3 (5.5)	
Maternal characteristics				
Age, y	27.7 ± 5.7	27.8 ± 5.6	27.5 ± 6.0	.78
Hispanic	168 (83.6)	104 (80.0)	64 (90.1)	.07
US born	34 (16.9)	30 (23.1)	4 (5.6)	.001*
Length of stay in US, y ^b	8.6 ± 5.4	8.9 ± 5.2	8.1 ± 5.7	.37
Education, < high school	61 (30.5)	33 (25.4)	28 (40.0)	.03*
Marital status, married	66 (33.2)	38 (29.5)	28 (40.0)	.16
Working	31 (15.5)	23 (17.7)	8 (11.4)	.31
Depression	50 (24.9)	20 (15.4)	30 (42.3)	<.001*
Weight category ^c				.007*
Underweight (BMI <18.5)	8 (5.7)	8 (8.0)	0 (0.0)	
Normal (BMI 18.5–24.9)	70 (49.6)	56 (56.0)	14 (34.1)	
Overweight (BMI 25–29.9)	38 (27.0)	21 (21.0)	17 (41.5)	
Obese (BMI ≥30)	25 (17.7)	15 (15.0)	10 (24.4)	

Data are presented as mean ± SD or n (%).

^a n = 155 with complete child weight and length data (food secure, n = 100; food insecure, n = 55).

^b Analysis was conducted only in the subset of non–US born mothers, n = 167 (food secure, n = 100; food insecure, n = 67).

^c n = 141 with complete maternal BMI data (food secure, n = 100; food insecure, n = 41).

*Significant at P < .05.

reported food security (Table 2). Depression did not moderate the relationships between food insecurity and controlling feeding styles when the interaction term was added.

Food Insecurity and Infant Feeding Practices

The majority (65%) of our sample partially breastfed their infants, and 24% of mothers with 4- to 6-month-olds had introduced juice and added cereal to the bottle. We did not find significant differences in the rates of breastfeeding, introducing juice, and adding cereal to the bottle based on household food security status (Table 3).

Food Insecurity and Perceptions and Attitudes About Infant Weight

The majority of the mothers perceived their infant to have a normal weight (92.5%). Very few perceived their infant to be underweight (0% food insecure; 4.6% food secure) or overweight (7.0%

food insecure; 3.1% food secure). Most mothers (83%) were accurate in their perception of their infant's weight. After adjusting for confounders, we found no significant difference in the perception of the child's current weight based on household food insecurity status (adjusted odds ratio: 3.31 [95% CI: 0.63–17.54]). When asked about their child's future weight, very few mothers worried that their child would become underweight (3.0% food insecure; 5.5% food secure). Mothers from food-insecure households were more likely to worry that their infant would become overweight in the future than mothers from food-secure households (38.8% food insecure; 21.9% food secure; adjusted odds ratio: 2.11 [95% CI: 1.02–4.38]).

Concern About Infant Future Weight as a Mediator

Path analysis was used to determine whether maternal concern about the infant becoming overweight in the

TABLE 2 Relationship Between Food Insecurity and Maternal Controlling Feeding Style

Feeding Style	Study Sample (<i>n</i> = 201)	Food Secure (<i>n</i> = 130)	Food Insecure (<i>n</i> = 71)	Unadjusted		Adjusted ^a	
	Mean Score (SD)	Mean Score (SD)	Mean Score (SD)	B (SE)	95% CI	B (SE)	95% CI
Restrictive ^b	2.66 (0.54)	2.58 (0.55)	2.79 (0.49)	0.21 (0.08)	0.05–0.36*	0.18 (0.08)	0.02–0.34*
Pressuring ^b	2.61 (0.39)	2.54 (0.41)	2.74 (0.33)	0.20 (0.06)	0.09–0.31*	0.11 (0.06)	0.001–0.22*

^a Models adjusted for infant age and gender and maternal ethnicity (Hispanic, non-Hispanic), country of birth (US-born, non-US born), educational level, and depression.

^b Mean scores for restrictive feeding style (mean of the 2 items) and pressuring feeding style (mean of the 3 items) are presented here. Scores ranged from 1 to 4 from strongly disagree to strongly agree.

*Significant at $P < .05$.

future mediated the relationship between household food insecurity and the 2 controlling feeding styles, restrictive and pressuring. Figure 1, which depicts the relationship between food insecurity and restrictive feeding style, demonstrated that the 4 standard criteria for mediation were met: (1) food insecurity was associated with restrictive feeding style in unadjusted analysis; (2) food insecurity was associated with maternal concern for infant becoming overweight in the future (the mediator); (3) concern about the infant becoming overweight in the future was associated with restrictive feeding style; and (4) food insecurity was no longer associated with restrictive feeding style after adjusting for maternal concern that the infant will become overweight in the future. The standardized indirect effect was 0.04 (95% CI: 0.01–0.09; $P = .009$). Figure 2 demonstrated that all 4 criteria were also met for the dependent variable pressuring feeding

style with a standardized indirect effect of 0.03 (95% CI: 0.01–0.08; $P = .01$).

DISCUSSION

In this study of low-income, primarily Hispanic mothers of young infants, we documented that household food insecurity is related to key aspects of parenting that are associated with childhood obesity. Consistent with our hypotheses, we found that food insecurity was associated with increased maternal controlling feeding styles, which are believed to disrupt the child's ability to self-regulate his or her own hunger and satiety.^{42,43} We also found that this relationship was mediated by maternal concern for the infant becoming overweight in the future. Contrary to our hypotheses, we found no differences in rates of breastfeeding, introducing juice, and adding cereal to the bottle based on food security status.

TABLE 3 Relationship Between Food Insecurity and Infant Feeding Practices

Infant Feeding Practices	Study Sample (<i>N</i> = 201)	Food Secure (<i>n</i> = 130)	Food Insecure (<i>n</i> = 71)	Unadjusted		Adjusted ^a	
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	OR	95% CI	OR	95% CI
Breastfeeding							
Exclusive	39 (19.5)	29 (22.5)	10 (14.1)	0.81	0.28–2.33	0.51	0.15–1.71
Partial	131 (65.5)	79 (61.2)	52 (73.2)	1.54	0.65–3.61	0.90	0.32–2.50
None	30 (15.0)	21 (16.3)	9 (12.7)	—	—	—	—
Juice ^b	18 (24.0)	11 (22.4)	7 (26.9)	1.27	0.43–3.81	1.54	0.43–5.58
Cereal in the bottle ^b	18 (24.0)	12 (24.5)	6 (23.1)	0.93	0.30–2.84	0.54	0.13–2.31

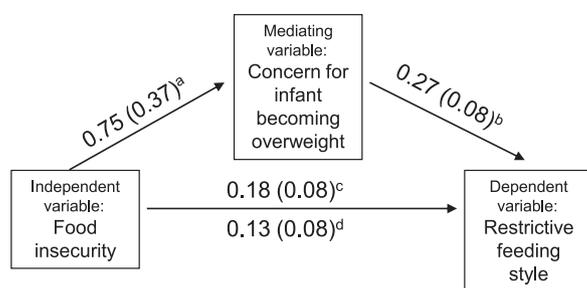
OR, odds ratio. —, reference category.

^a Models adjusted for infant age and gender and maternal ethnicity (Hispanic, non-Hispanic), country of birth (US-born, non-US born), educational level, and depression.

^b Analysis of juice intake and adding cereal to the bottle was limited to mothers of infants between 4 and 6 months of age (total sample, $N = 75$; food secure, $n = 49$; food insecure, $n = 26$).

Our findings that food-insecure mothers were more likely to have controlling feeding styles provides a potential pathway through which food insecurity may fit within the model linking feeding style to child obesity.²² These findings extend into infancy the limited knowledge about food insecurity and feeding styles in older children.^{25,28} Based on qualitative studies reporting variability in a child's diet depending on the changing influx of food at a given time,⁴⁴ perhaps food-insecure mothers with young infants display similar feeding patterns. They may pressure infants to feed when the food supply is high and restrict feeding when food is not available. Further research is needed to better understand controlling feeding styles in food-insecure households with young infants.

Maternal perception of child weight and her attitudes about the child's future weight have been associated with controlling feeding styles. Mothers generally use more restriction when they perceive their child as overweight or when they are concerned about the child becoming overweight in the future.^{35,45–48} Pressuring is more common in mothers who perceive their child as underweight.^{35,45,47} However, most of these studies have focused on higher income white families who are unlikely to be food insecure. This may help explain the seemingly counterintuitive relationship between maternal concern for the child becoming overweight and pressuring feeding style in our sample. Perhaps in the context of food insecurity, these relationships are more complex. Although food-insecure mothers would theoretically worry that their children would become underweight due to uncertain food availability, they may realize that relying on low-cost foods increases their child's risk of obesity. Because no other studies have looked at food insecurity and maternal attitudes about their infant's future weight, further research in this area is needed.

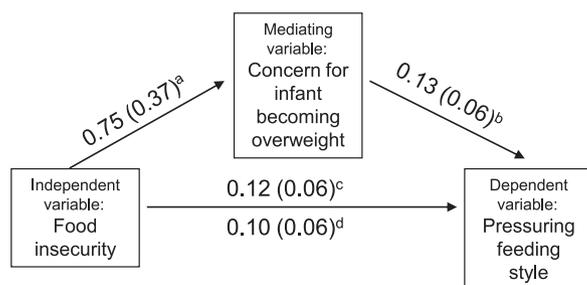
**FIGURE 1**

Path analysis: maternal concern for their infant becoming overweight in the future mediates the relationship between food insecurity and restrictive feeding style. Values shown are unstandardized regression coefficients (B [SE]). ^aUnadjusted, $P = .045$; ^bAdjusted for food insecurity, $P = .001$; ^cUnadjusted, $P = .03$; ^dAdjusted for concern for infant becoming overweight, $P = .10$. All of the regression analyses control for infant age and gender and maternal ethnicity, country of origin, education status, and depression.

Our hypothesis that food-insecure mothers would have increased obesogenic infant feeding practices, such as decreased exclusive breastfeeding, was not demonstrated. Some evidence suggests that food-insecure families encounter greater barriers to exclusive breastfeeding.⁴⁹ Other studies suggest that mothers participating in WIC may not exclusively breastfeed as a result of financial incentives to formula feed.⁵⁰ We found no relationship between food insecurity and exclusive breastfeeding. It is possible that recent changes in the WIC support packages, designed to increase incentives for exclusive breastfeeding, may have altered the effects of food insecurity on breastfeeding.⁵¹

This study has several limitations. Our results primarily apply to immigrant, low-income Hispanic mothers in New

York City and therefore are not necessarily generalizable to other racial, ethnic, or geographic groups. Although our results are consistent with others showing that immigrant households have more food insecurity,⁵² we did not find that length of stay in the United States was related to food insecurity. Contrary to a previous study linking depression to feeding style,⁵³ we did not find this relationship. Future studies are needed to further explore the relationships between food insecurity, depression, and infant feeding. Cultural attitudes may affect how Spanish-speaking people respond to the standardized measures. We addressed this limitation by using measures adapted from surveys validated in Spanish-speaking populations. Another limitation is that we did not collect information

**FIGURE 2**

Path analysis: maternal concern for their infant becoming overweight in the future mediates the relationship between food insecurity and pressuring feeding style. Values shown are unstandardized regression coefficients (B [SE]). ^aUnadjusted, $P = .045$; ^bAdjusted for food insecurity, $P = .03$; ^cUnadjusted, $P = .03$; ^dAdjusted for concern for infant becoming overweight, $P = .07$. All of the regression analyses control for infant age and gender and maternal ethnicity, country of origin, education status, and depression.

about perceived milk insufficiency, shown to be more common in Hispanic populations⁵⁴ and which might be associated with food insecurity. Given that maternal feeding practices and styles may vary depending on the infant's developmental stage, additional research is needed to understand the relationship between food insecurity and feeding styles in families with infants older than 6 months. The cross-sectional design of this study precludes us from making causal inferences.

CONCLUSIONS

These findings demonstrate that increased concern about future overweight and controlling feeding styles represent potential mechanisms by which food insecurity may relate to obesity. Longitudinal studies are needed to determine the role that household food insecurity plays in the development of child obesity and if food insecurity contributes to the disparities that disproportionately affect low-income Hispanic communities.^{20,55} As policy makers aim to prevent early obesity, it may be important to both decrease the overall rates of food insecurity and reduce controlling feeding styles in families who remain food insecure. As the pediatric community aims to reduce early toxic stress that affects many low-income children,⁴⁰ WIC may serve as an opportune place for family interventions focusing on reducing sources of stress. Understanding the role of household food insecurity in the development of child obesity in Hispanic populations would help to inform the design of effective culturally sensitive early obesity prevention strategies.

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REFERENCES

- Anderson SA. Core indicators of nutritional state for difficult-to-sample populations. *J Nutr*. 1990;120(suppl 11):1559–1600
- Nord M, Coleman-Jensen A, Andrews M, Carlson S. Household food security in the United States, 2009. ERR-108, US Department of Agriculture, Economic Research Service, November 2010. Available at: www.ers.usda.gov/publications/err108/. Accessed April 25, 2012
- Gundersen C, Kreider B, Pepper J. The economics of food insecurity in the United States. *Applied Economic Perspectives and Policy*. 2011;33(3):281–303
- Larson NI, Story MT. Food insecurity and weight status among U.S. children and families: a review of the literature. *Am J Prev Med*. 2011;40(2):166–173
- Eisenmann JC, Gundersen C, Lohman BJ, Garasky S, Stewart SD. Is food insecurity related to overweight and obesity in children and adolescents? A summary of studies, 1995–2009. *Obes Rev*. 2011;12(5):e73–e83
- Alaimo K, Olson CM, Frongillo EA Jr. Low family income and food insufficiency in relation to overweight in US children: is there a paradox? *Arch Pediatr Adolesc Med*. 2001;155(10):1161–1167
- Casey PH, Szeto K, Lensing S, Bogle M, Weber J. Children in food-insufficient, low-income families: prevalence, health, and nutrition status. *Arch Pediatr Adolesc Med*. 2001;155(4):508–514
- Bhattacharya J, Currie J, Haider S. Poverty, food insecurity, and nutritional outcomes in children and adults. *J Health Econ*. 2004;23(4):839–862
- Jyoti DF, Frongillo EA, Jones SJ. Food insecurity affects school children's academic performance, weight gain, and social skills. *J Nutr*. 2005;135(12):2831–2839
- Casey PH, Simpson PM, Gossett JM, et al. The association of child and household food insecurity with childhood overweight status. *Pediatrics*. 2006;118(5). Available at: www.pediatrics.org/cgi/content/full/118/5/e1406
- Dubois L, Farmer A, Girard M, Porcherie M. Family food insufficiency is related to overweight among preschoolers. *Soc Sci Med*. 2006;63(6):1503–1516
- Smith C, Richards R. Dietary intake, overweight status, and perceptions of food insecurity among homeless Minnesotan youth. *Am J Hum Biol*. 2008;20(5):550–563
- Metallinos-Katsaras E, Sherry B, Kallio J. Food insecurity is associated with overweight in children younger than 5 years of age. *J Am Diet Assoc*. 2009;109(10):1790–1794
- Rose D, Bodor JN. Household food insecurity and overweight status in young school children: results from the Early Childhood Longitudinal Study. *Pediatrics*. 2006;117(2):464–473
- Whitaker RC, Orzol SM. Obesity among US urban preschool children: relationships to race, ethnicity, and socioeconomic status. *Arch Pediatr Adolesc Med*. 2006;160(6):578–584
- Bhargava A, Jolliffe D, Howard LL. Socioeconomic, behavioural and environmental factors predicted body weights and household food insecurity scores in the Early Childhood Longitudinal Study-Kindergarten. *Br J Nutr*. 2008;100(2):438–444
- Gundersen C, Lohman BJ, Eisenmann JC, Garasky S, Stewart SD. Child-specific food insecurity and overweight are not associated in a sample of 10- to 15-year-old low-income youth. *J Nutr*. 2008;138(2):371–378
- Gundersen C, Lohman BJ, Garasky S, Stewart S, Eisenmann J. Food security, maternal stressors, and overweight among low-income US children: results from the National Health and Nutrition Examination Survey (1999–2002). *Pediatrics*. 2008;122(3). Available at: www.pediatrics.org/cgi/content/full/122/3/e529
- Kursmark M, Weitzman M. Recent findings concerning childhood food insecurity. *Curr Opin Clin Nutr Metab Care*. 2009;12(3):310–316
- Odgen CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999–2010. *JAMA*. 2012;307(5):483–490
- Costanzo PR, Woody EZ. Domain-specific parenting styles and their impact on the child's development of particular deviance: The example of obesity proneness. *J Soc Clin Psychol*. 1985;3(4):425–445
- Birch LL, Davison KK. Family environmental factors influencing the developing behavioral controls of food intake and childhood overweight. *Pediatr Clin North Am*. 2001;48(4):893–907
- Savage JS, Fisher JO, Birch LL. Parental influence on eating behavior: conception to adolescence. *J Law Med Ethics*. 2007;35(1):22–34
- Drewnowski A, Specter SE. Poverty and obesity: the role of energy density and energy costs. *Am J Clin Nutr*. 2004;79(1):6–16
- Feinberg E, Kavanagh PL, Young RL, Prudent N. Food insecurity and compensatory feeding practices among urban black families. *Pediatrics*. 2008;122(4). Available at: www.pediatrics.org/cgi/content/full/122/4/e854
- Matheson DM, Varady J, Varady A, Killen JD. Household food security and nutritional status of Hispanic children in the fifth grade. *Am J Clin Nutr*. 2002;76(1):210–217
- Matheson DM, Robinson TN, Varady A, Killen JD. Do Mexican-American mothers' food-related parenting practices influence their children's weight and dietary intake? *J Am Diet Assoc*. 2006;106(11):1861–1865
- Crawford PB, Lamp CL, Nicholson Y, Krathwohl S, Hudes M, Townsend MS. Food insecurity may be linked to childhood obesity in low-income Mexican-American families. *Calif Agric*. 2007;61(3):106–111
- Bronte-Tinkew J, Zaslow M, Capps R, Horowitz A, McNamara M. Food insecurity works through depression, parenting, and infant feeding to influence overweight and health in toddlers. *J Nutr*. 2007;137(9):2160–2165
- Bickel G, Nord M, Price C, Hamilton W, Cook J. *Guide to Measuring Household Food Security, Revised 2000*. Alexandria, VA: US Department of Agriculture, Food and Nutrition Service; 2000
- Harrison GG, Stormer A, Herman DR, Winham DM. Development of a Spanish-language version of the U.S. household food security survey module. *J Nutr*. 2003;133(4):1192–1197
- Hager ER, Quigg AM, Black MM, et al. Development and validity of a 2-item screen to identify families at risk for food insecurity. *Pediatrics*. 2010;126(1). Available at: www.pediatrics.org/cgi/content/full/126/1/e26
- Birch LL, Fisher JO, Grimm-Thomas K, Markey CN, Sawyer R, Johnson SL. Confirmatory factor analysis of the Child Feeding Questionnaire: a measure of parental attitudes, beliefs and practices about child feeding and obesity proneness. *Appetite*. 2001;36(3):201–210
- Anderson CB, Hughes SO, Fisher JO, Nicklas TA. Cross-cultural equivalence of feeding beliefs and practices: the psychometric properties of the child feeding questionnaire among Blacks and Hispanics. *Prev Med*. 2005;41(2):521–531
- Gross RS, Mendelsohn AL, Fierman AH, Messito MJ. Maternal controlling feeding styles during early infancy. *Clin Pediatr (Phila)*. 2011;50(12):1125–1133
- Barlow SE; Expert Committee. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics*. 2007;120(suppl 4):S164–S192

37. Kuczmarski RJ, Carroll MD, Flegal KM, Troiano RP. Varying body mass index cutoff points to describe overweight prevalence among U.S. adults: NHANES III (1988 to 1994). *Obes Res.* 1997;5(6):542–548
38. Kroenke K, Spitzer RL, Williams JB. The Patient Health Questionnaire-2: validity of a two-item depression screener. *Med Care.* 2003;41(11):1284–1292
39. Cutler CB, Legano LA, Dreyer BP, et al. Screening for maternal depression in a low education population using a two item questionnaire. *Arch Women Ment Health.* 2007;10(6):277–283
40. Shonkoff JP, Garner AS; Committee on Psychosocial Aspects of Child and Family Health; Committee on Early Childhood, Adoption, and Dependent Care; Section on Developmental and Behavioral Pediatrics. The lifelong effects of early childhood adversity and toxic stress. *Pediatrics.* 2012; 129(1). Available at: www.pediatrics.org/cgi/content/full/129/1/e232
41. Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol.* 1986;51(6):1173–1182
42. Birch LL, Fisher JO. Development of eating behaviors among children and adolescents. *Pediatrics.* 1998;101(3 pt 2):539–549
43. Faith MS, Scanlon KS, Birch LL, Francis LA, Sherry B. Parent-child feeding strategies and their relationships to child eating and weight status. *Obes Res.* 2004;12(11): 1711–1722
44. Olson CM, Bove CF, Miller EO. Growing up poor: long-term implications for eating patterns and body weight. *Appetite.* 2007;49 (1):198–207
45. Francis LA, Hofer SM, Birch LL. Predictors of maternal child-feeding style: maternal and child characteristics. *Appetite.* 2001;37(3): 231–243
46. May AL, Donohue M, Scanlon KS, et al. Child-feeding strategies are associated with maternal concern about children becoming overweight, but not children's weight status. *J Am Diet Assoc.* 2007;107(7):1167–1175
47. Gregory JE, Paxton SJ, Brozovic AM. Pressure to eat and restriction are associated with child eating behaviours and maternal concern about child weight, but not child body mass index, in 2- to 4-year-old children. *Appetite.* 2010;54(3):550–556
48. Webber L, Hill C, Cooke L, Carnell S, Wardle J. Associations between child weight and maternal feeding styles are mediated by maternal perceptions and concerns. *Eur J Clin Nutr.* 2010;64(3):259–265
49. Webb-Girard A, Cherobon A, Mbugua S, Kamau-Mbuthia E, Amin A, Sellen DW. Food insecurity is associated with attitudes towards exclusive breastfeeding among women in urban Kenya. *Matern Child Nutr.* 2010;8(20):199–214
50. Rose D, Bodor JN, Chilton M. Has the WIC incentive to formula-feed led to an increase in overweight children? *J Nutr.* 2006;136(4): 1086–1090
51. Department of Agriculture, Food and Nutrition Service. Special supplemental nutrition program for women, infants and children (WIC): Revisions in the WIC food packages; interim rule. *Fed Regist.* 2007;72(234): 68965–69032
52. Chilton M, Black MM, Berkowitz C, et al. Food insecurity and risk of poor health among US-born children of immigrants. *Am J Public Health.* 2009;99(3):556–562
53. Hurley KM, Black MM, Papas MA, Caulfield LE. Maternal symptoms of stress, depression, and anxiety are related to non-responsive feeding styles in a statewide sample of WIC participants [published correction appears in *J Nutr.* 2008;138(10): 1982]. *J Nutr.* 2008;138(4):799–805
54. Hurley KM, Black MM, Papas MA, Quigg AM. Variation in breastfeeding behaviours, perceptions, and experiences by race/ethnicity among a low-income statewide sample of Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) participants in the United States. *Matern Child Nutr.* 2008;4(2):95–105
55. Taveras EM, Gillman MW, Kleinman K, Rich-Edwards JW, Rifas-Shiman SL. Racial/ethnic differences in early-life risk factors for childhood obesity. *Pediatrics.* 2010;125(4):686–695

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