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Grandmothers, fathers and depressive symptoms are associated with food insecurity among low income first-time African-American mothers in North Carolina

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Abstract

African Americans experience household food insecurity—the limited availability of nutritionally adequate and safe food, or ability to acquire acceptable foods in socially acceptable ways—at three times the rate of non-Hispanic whites. Thirty percent of all African American children live in food insecurity households. The purpose of this study was to identify characteristics associated with household food insecurity among a high risk postpartum population. 206 low-income, African-American mother-infant dyads were recruited through WIC clinics. The six-item USDA food security scale was used to classify households as food secure, marginally food secure or food insecure. Multinomial logistic regression was used to estimate the association between selected maternal/household characteristics and household food security status. Fifty-three percent of households were food secure, 34% were marginally food secure and 13% were food insecure. Maternal education less than college (Relative Risk Ratio = 0.46, 95% Confidence Interval: 0.22, 0.98) was inversely associated with marginal food security. Depressive symptoms (RRR = 1.09, 95% CI: 1.02, 1.16) and having the baby's father in the household (RRR = 3.46, 95% CI: 1.22, 9.82) were associated with household food insecurity, while having a grandmother in the household (RRR = 0.15, 95% CI: 0.03, 0.80) was inversely associated with experiencing household food insecurity. Findings from this study suggest that young low-income African American families with only one child are particularly

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susceptible to experiencing household food insecurity. Intergenerational support and transfer of knowledge may be a key protective attribute among low-income African American households.

Keywords

household food insecurity; African American; infant; postpartum depressive symptoms

INTRODUCTION

Determinants of food insecurity have been consistently identified across studies. In 2005, about 11.0% of all US households, representing over 35.1 million people, experienced food insecurity (1), defined as “whenever the availability of nutritionally adequate and safe food, or the ability to acquire acceptable foods in socially acceptable ways, is limited or uncertain” (2). There is an extensive literature showing that psychosocial factors, low income levels, being African American, being a single head of household and having children are the strongest predictors of household food insecurity (3–9). In our previous study of pregnant women in central North Carolina, those who experienced food insecurity had significantly lower income levels, less education, and were more likely to be single, African American and report higher on perceived stress, anxiety, depressive symptoms and lower on self-esteem and mastery, than women from food secure households (9).

African Americans are at greater risk of experiencing household food insecurity. African Americans experience household food insecurity at three times the rate of non-Hispanic whites (1). Thirty percent of all African American children and 40% of all low-income children live in food insecurity households (10). Among children younger than 36 months, those from food insecure households had twice the odds of fair or poor health, and had a 30% increased odds of hospitalization since birth, compared to children from food secure households (11). North Carolina is one of ten states where household food insecurity is significantly higher (13.8%) than the national average (11%), and is one of 14 states that has had a significant increase in food insecurity since 1999 (1,12). Concurrent with the North Carolina food insecurity statistics, in 2004, almost 15% of North Carolina infants 0–2 years of age were overweight, defined as >85th percentile weight for height (13).

Many of the predictors of household food insecurity are the same risk factors that are associated with myriad chronic disease problems, including obesity. Overweight and obesity have rapidly increased over the past three decades to reach epidemic proportions (14–15). Household food insecurity has been associated with increased BMI (16,17) and an increased risk of overweight in women (18), but not in children (18–21). It has been hypothesized that although children might be protected from food insecurity within a household, the residual effect of the household experiencing food insecurity might influence eating behaviors, dietary and weight outcomes. For example, Allan et al. (22) found that more adults tended to hoard food and be overweight who experienced food insecurity than adults who did not experience food insecurity in the past. African-American first time mothers who are low-income are at a disproportionate risk of experiencing food insecurity. These mothers are also more likely to enter pregnancy at increased weight, gain excessive gestational weight, and deliver a preterm infant or an infant small-for-gestational age (23–27).

Since food insecurity has a high prevalence among low income, African American families with children, the purpose of the study was to understand characteristics associated with food insecurity among a cohort of young families at the highest risk for food insecurity. This analysis was conducted as part of a prospective cohort study that focused on risk factors of infant overweight born to first time African-American mothers from low-income households in

central North Carolina. The purpose of the study was to identify maternal and household characteristics that might distinguish household food security status among this high risk population. We hypothesized that women with younger ages, less education and signs of negative psychosocial factors would be associated with increased risk for household food insecurity. Furthermore, certain household characteristics, such as larger household size, presence of other adult members in the household, were hypothesized to be protective against household food insecurity. We also wanted to identify modifiable risk factors and resilient characteristics these households may display to overcome food insecurity.

MATERIALS AND METHODS

Study Design and Sample

This study used data from the Infant Care, Feeding, and Risk of Obesity, an observational study of mother-infant African-American dyads, followed at 3, 6, 9, 12 and 18 months postpartum. The parent study was designed to identify the constellation of household, caregiver, and infant characteristics associated with the infant risk of obesity and to identify the determinants and consequences of parenting and infant feeding styles associated with risk of infant obesity within the household environment, considering caregiver and infant characteristics.

Between 2003 and 2006, the Infant Care study recruited 217 African American mother/infant dyads. Study coordinators recruited healthy African-American women, between the ages of 18–35, who were first time mothers and had healthy infants. Participants were recruited through local WIC clinics (Supplemental Food Program for Women, Infant and Children). Flyers were posted WIC clinic waiting rooms and a website was created that featured recruitment and project contact information. Interested potential participants were screened and informed of general study procedures in-person at clinic waiting rooms. Eligibility criteria for the WIC program are having a household income less than 185% of the federal poverty guideline and one nutrition related health problem such as anemia. For inclusion into the study, mothers needed to be willing to participate in home visits and assessments, and have a healthy infant who had completed >35 weeks' gestation. Infants with Down's Syndrome, epilepsy, cleft lip or palate, cerebral palsy, failure to thrive, mental retardation, severe food allergies or any condition that might affect appetite, feeding or growth were excluded from the study. Details of the study have been reported elsewhere (28). Women were reimbursed \$60 for each completed visit.

Among the data collected at each time point were demographic data (household and caregiver), maternal and infant diet intake, maternal and infant anthropometric measurements, infant feeding styles, maternal depression, maternal self-esteem, and neighborhood safety. Food security assessments were done at the 3 month (baseline) and 18 month (endline) visits. The data entry program was designed using Blaise Version 4 series (Statistics Netherlands, 1999, Blaise Developers Guide, Blaise for Windows 4.1, A Survey Processing System), a computer-assisted-interviewing software, that was installed in each fieldwork laptop. At each home visit, the interviewer conducted the interviews by reading out questions from the laptops. The interviewers then entered responses directly to the laptops. For more sensitive questions, the respondents were given the choice to key in the responses themselves. The data entry program was designed to run consistency and range checks as responses are keyed in. This paper focused on the 3 month visit using an analysis sample of 206 mothers (out of the 217 baseline sample) with complete data for this analysis. The excluded cases were not significantly different in maternal characteristics from those who were retained in the analysis sample. The procedures followed for this study were in accordance with the ethical standards of the Institutional Review Board of the University of North Carolina School of Public Health.

Study Variables

Household Food Security—To calculate household food insecurity status, the six-item short form of the USDA Core Food Security Module (CFSM) for families was used (29,30). Questions were asked about the household's experience over the past 12 months. Examples include "I worried whether our food would run out before we got money to buy more," (the least severe question); "Did you or the other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food;" and "Were you ever hungry but did not eat because you couldn't afford enough food" (the most severe question). Consistent with the official definition for food security status, within our data household were classified as (a) food secure if the participant responded affirmatively to none of the questions; as (b) marginally food secure if the participant responded affirmatively to one question; and as (c) food insecure if the participant responded affirmatively to two or more questions (1). Within our sample, very few households were identified as food insecure with hunger, therefore, this category was excluded in the analyses.

Maternal characteristics—Maternal characteristics that have been previously established to have an influence on food security were assessed, these included: age, education, marital status, depressive symptoms (using Center for Epidemiologic Studies Depression Scale) (31), and self-esteem levels (using Rosenberg Self-Esteem Scale) (32). To serve as proxy for employment potential and since a number of women were not working at the 3 month postpartum visit, we used a dichotomous variable representing having ever worked.

Household characteristics—The analyses also included variables describing household composition (child's father living in the household, presence of child's grandmother in household, being in a nuclear family), and household size (number of other household members, in addition to father and grandmother). The majority of households in the study currently participated in WIC (94%), had ever participated in WIC (97%) or were WIC eligible and are therefore considered low-income.

Statistical Methods—Descriptive statistics were conducted to examine the association between food security status and each of the independent variables using analysis of variance and a Bonferroni correction for the continuous variables and χ^2 tests for the categorical variables. Correlations between continuous measures were tested using Pearson's correlation coefficient. Multinomial logistic regression was used to estimate the association between selected maternal/household characteristics and household food security status (food secure, marginally food secure, and food insecure). Due to strong negative correlation between depression score and self-esteem ($r > -0.5$) these variables were estimated in separate models and together in the final model. An estimate of the joint effect of depression score and self-esteem score on the outcomes was assessed with a Wald χ^2 test. The final model included maternal age, education, work status, and depression score, self-esteem as well as household composition characteristics presence of father, grandmother and household size. Marital status, nuclear family and father in the household were strongly correlated using χ^2 analysis. Marital status and nuclear family were excluded in the model because of collinearity with father in the household. Analyses were conducted using STATA Version 9.2 (Stata statistical software, release 9.2 for Windows. 2007, StataCorp LP: College Station, TX).

RESULTS

Fifty-three percent of the women were from households characterized as food secure, 34% marginally food insecure, and 13% food insecure. Table 1 reports the maternal and household characteristics stratified by food security status.

Women in this study did not differ significantly ($p < 0.05$) by food security status with regard to their age, education, work history or self-esteem. The proportion of single mothers appeared to decrease with increasing food insecurity; food insecure households had significantly less married partners compared to food secure households. Women from food insecure households scored significantly higher on the depression scale, averaging 16 points, which has been associated with risk of clinical depression among pregnant women (33). In terms of household characteristics, food insecure households were more likely to have fathers in the household, but were less likely to have a grandmother in the household. Very few households had both the baby's father and maternal grandmother living together (8%). Also, none of the married women in the sample had grandmothers living in the household. Correspondingly, food insecure households were more likely to be nuclear households and have smaller household sizes.

Table 2 shows the results of the multivariable model. Compared to food secure households, living with the child's grandmother was associated with decreased the risk of food insecurity (Relative Risk Ratio (RRR): 0.15 [95% CI: 0.03, 0.80]) but living with the father (RRR: 3.46 [95% CI: 1.22, 9.82]) and being depressed (RRR: 1.09 [95% CI: 1.02, 1.16]) was associated with increased risk. Compared to food secure households, having a college degree (RRR: 0.46 [95% CI: 0.22, 0.98]) appeared to be associated with decreased risk of marginal food insecurity.

The joint effect of depression and self-esteem on the outcomes was significant, the Wald χ^2 was 6.58 ($p < 0.04$) for marginal food security and 10.79 ($p < 0.004$) for food insecurity, suggesting that together the depression and self-esteem scores are jointly associated with food security status. In addition, since the depression score and the self-esteem scores were strongly and negatively correlated at $r > -0.5$, these variables were modeled separately (data not shown). In the fully adjusted models, the depression score was associated with both marginal food security and food insecurity (RRR 1.04, 95% CI: 1.00, 1.08, $p < 0.03$ and RRR 1.10, 95% CI: 1.04, 1.16, $p < 0.001$, respectively), and in a separate model the self-esteem score was associated with a decreased risk for both outcomes (RRR 0.91, 95% CI: 0.84, 0.98, $p < 0.02$ and RRR 0.89, 95% CI: 0.79, 0.99, $p < 0.04$, respectively). The coefficients on the other variables did not change in either model.

DISCUSSION

In this study, household and individual characteristics associated with household food insecurity were examined in a sample of 206 low-income, African-American, first-time mothers with 3 month old infants. Our findings suggest that having some years of education beyond high school was associated with a decreased risk of falling into the marginally food secure category, yet it was not associated with decreased risk of food insecurity. Education level has inconsistently shown a protective association against household food insecurity in a number of studies (4,7,9). In our study of a population characterized with attributes that are most commonly associated with household food insecurity, the usual socio-demographic predictors of age, education and marital status were not associated with experiencing food insecurity.

Depressive symptoms were associated with risk for both marginal food security and food insecurity. Several studies have found an association between households suffering from food insecurity and psychosocial stress, individuals are more likely to incur compromised psychosocial functioning (34–36), worse mental health (4,6,37,38), and depression (34,39). In previous research, perceived stress, trait anxiety, depressive symptoms and a locus of control perceiving that life events are given to chance were associated with increased risk of household food insecurity among pregnant women. Self-esteem and mastery were associated with

decreased risk of household food insecurity, after controlling for socioeconomic and demographic determinants of household food insecurity (9).

African American and Hispanic women have a higher prevalence of postpartum depressive symptoms compared to Caucasian women, and the disparities among the racial/ethnic groups were explained by lower-income, financial hardship and higher incidence of poor pregnancy outcomes (40). Social support has been found to mitigate the magnitude postpartum depressive symptoms (41). Higher rates of depression in the 3 month post partum period were expected, however, the average depressive symptom score among the food secure group was below the group mean, while the food insecure group averaged a score previously found to be associated with risk of clinical depression among pregnant women (33). While the causal direction of the association between food insecurity and depression cannot be determined since these cross sectional data, but also because not only can food insecurity exacerbate the effect of postpartum depressive symptoms, but depressive symptoms can also lead to increased perception of household food insecurity.

Household composition was associated with experiencing food insecurity; living with the child's grandmothers was inversely associated, while living with the infant's father was positively associated, with household food insecurity. Living with the child's grandmother may be how first-time mothers cope with the difficulties of being single and having a young infant. These results also stress the importance of financial and emotional support for these mothers especially in the postpartum period. The maternal grandmother may be indicative of not only assistance with material resources, but also support of feeding practices, child care and increasing confidence which would decrease risk of food insecurity. The intergenerational protective effect on health and child rearing has been well documented among adolescent African American mothers (42–44).

The majority of the women in the sample were not married to the baby's father, although he was a member of 33% of the households. Living with the baby's father was associated with living in a nuclear family. These young, low-income nuclear families may not have much experience and are perhaps isolated, with concern about many financial matters, food security being one of them, and lack extended family and resources. Being alone and lacking resources and a network of support may increase the risk for food insecurity. Alternatively, living with the baby's father might directly increase risk of food insecurity if the father does not have the means to support the new family and limits the new mother's access to extended resources from family, friends and the community. The father's inability to contribute to the household resources would increase anxiety about having enough food for the new mother. The baby's father lived in the same household with the grandmother in 17% of households with grandmothers. In a previous study, households where both the grandmother and the father of the infant reside, the mother's satisfaction with the father's involvement was associated with depression and with the grandmother's acceptance of the father (43). Edin and Reed (48) reported that among socioeconomically disadvantaged couples, most highly value marriage but desire higher incomes, financial stability, improved quality of their relationships before marriage in order to sustain the marriage and avoid divorce (45,46).

There are several limitations of this study. First, the study had a small sample and recruited only through WIC and therefore the finding may not be generalizable to most African American women, although African American women make up 40% of the WIC population in the southeastern US states (47). A measure of income was not obtained, which is an important predictor of household food insecurity, although all of the women were assumed to live at or below 185% of the income/poverty ratio which was \$37,208 for a family of three in 2005 (48). While the sample size was small, a strength of this study was that there were a number

of important covariates covering socioeconomic, demographic, household composition and psychosocial factors.

To understand the impact of household food insecurity it is important to understand household composition and structure. There is need for more ethnographic and anthropometric data to help us understand protective role of grandmothers and opposite of the father. For example, research is needed to identify measurable household traits and to understand the pathway through which grandmothers exert a protective role, especially with regard to household food security status.

CONCLUSION

Food insecurity is a multi-dimensional construct that may be predictive not only of poor access to enough food, poor diet quality, or lack of a balanced diet, but also of psychosocial risk factors (49). WIC nutritionists and other nutrition professionals should be aware of potential extenuating circumstances in the lives of low-income families and be prepared to refer clients for counseling. Women, in particular African American women, have been found to employ myriad coping strategies, such as multiple jobs, participation in federal food programs and co-habitation, to combat household food insecurity (49). Economic development programs and education programs for improving household food security status are needed in addition to WIC and Food Stamps programs in order for young families to live independent from food insecurity. Additionally, depressive symptoms in the presence of food insecurity may create insurmountable challenges to losing weight gained during pregnancy for some women. Weight loss and weight maintenance interventions for low-income African American women experiencing food insecurity may need to incorporate a stress reduction and/or psychosocial counseling component.

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REFERENCES

1. Nord, Mark. Household food security in the United States, 2005. Washington, DC: U.S. Department of Agriculture, Economic Research Service; 2006. Economic research report no. 29
2. Anderson SA. Core Indicators of Nutritional State for Difficult-to-Sample Populations. *J Nutr* 1990;120:1559S–1600S.
3. Gundersen, C.; Kreider, B. Food stamps and food insecurity what can be learned in the presence of nonclassical measurement error?. Madison, Wis.: University of Wisconsin-Madison, Institute for Research on Poverty; 2007.
4. Laraia BA, Siega-Riz AM, Evenson KR. Self-reported overweight and obesity are not associated with concern about enough food among adults in New York and Louisiana. *Prev Med* 2004;38(2):175–181. [PubMed: 14715209]
5. Dunifon R, Kowaleski-Jones L. The influences of participation in the National School Lunch Program and food insecurity on child well-being. *Soc Serv Rev* 2003;77:72–92.
6. Gundersen C, Weinreb L, Wehler C, Hosmer D. Homelessness and food insecurity. *J Housing Econ* 2003;12:250–272.
7. Evenson KR, Laraia BA, Welch VL, Perry AL. Statewide prevalences of concern about enough food. *Public Health Rep* 2002;117:358–365. [PubMed: 12477917]
8. Gundersen C, Oliveira V. The Food Stamp Program and food insufficiency. *Am J Ag Econ* 2001;84(3):875–887.

9. Laraia BA, Siega-Riz AM, Gundersen C, Dole N. Psychosocial factors and socioeconomic indicators are associated with household food insecurity among pregnant women. *J Nutr* 2006;136:177–182. [PubMed: 16365079]
10. Brown, LJ. The consequences of hunger and food insecurity for children: Evidence from recent scientific studies. Brandeis University: Center on Hunger and Poverty, Heller School for Social Policy and Management; 2002 Jun.
11. Cook JT, Frank DA, Berkowitz C, Black MM, Casey PH, Cutts DB, Meyers AF, Zaldivar N, Skalicky A, Levenson S, Heeren T, Nord M. Food insecurity is associated with adverse health outcomes among human infants and toddlers. *J Nutr* 2004;134(6):1432–1438. [PubMed: 15173408]
12. Hall, B. Hunger and food insecurity increase for 5th straight year. Center on Hunger and Poverty Bulletin; 2005 Oct [accessed 10/14/07]. <http://www.centeronhunger.org/pdf/Oct2005Bulletin.pdf>
13. Center for Disease Control and Prevention. 2004 Pediatric Nutrition Surveillance. 2005
14. Flegal KM, Carroll MD, Kuczmarski RJ, Johnson CL. Overweight and obesity in the United States: prevalence and trends, 1960–94. *J Obes Relat Metab Disord* 1998;22:39–47.
15. Mokdad AH, Serdula MK, Dietz WH, Bowman BA, Marks JS, Koplan JP. The spread of the obesity epidemic in the United States, 1991–1998. *JAMA* 1999;282:1519–1522. [PubMed: 10546690]
16. Olson CM. Nutrition and health outcomes associated with food insecurity and hunger. *J Nutr* 1999;129:512S–524S.
17. Holben DH, Pheley AM. Diabetes risk and obesity in food-insecure households in rural Appalachian Ohio. *Prev Chronic Dis* 2006;3(3):A82. [PubMed: 16776883]
18. Townsend MS, Peerson J, Love B, Achterberg C, Murphy SP. Food insecurity is positively related to overweight in women. *J Nutr* 2001;131:1738–1745. [PubMed: 11385061]
19. Jones SJ, Jahns L, Laraia BA, Haughton B. Lower risk of overweight in school-aged food insecure girls who participate in food assistance: results from the panel study of income dynamics child development supplement. *Arch Pediatr Adolesc Med* 2003;157(8):780–784. [PubMed: 12912784]
20. Alaimo K, Olson CM, Frongillo EA. 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. [PubMed: 11576013]
21. Casey P, 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;155:508–514. [PubMed: 11296080]
22. Allan MW, Wilson M. Materialism and food security. *Appetite* 2005;45:314–323. [PubMed: 16171902]
23. Brown HL, Chireau MV, Jallah Y, Howard D. The "Hispanic paradox": an investigation of racial disparity in pregnancy outcomes at a tertiary care medical center. *Am J Obstet Gynecol* 2007;197(2):e1–e7.197
24. Wolfe W, Sobal J, Olson C, Frongillo EA. Parity-associated body weight modification by sociodemographic and behavioral factors. *Obesity Research* 1997;5:131–141. [PubMed: 9112248]
25. Keppel KG, Taffel SM. Pregnancy-related weight gain and retention: implications of the 1990 Institute of Medicine guidelines. *Am J Pub Health* 1993;83:1100–1103. [PubMed: 8342716]
26. Lederman SA. The effect of pregnancy weight gain on later obesity. *Obstet Gynecol* 1993;82:148–155. [PubMed: 8515916]
27. Parker JD, Abrams B. Differences in postpartum weight retention between black and white mothers. *Obstet Gynecol* 1993;81:768–774. [PubMed: 8469470]
28. Sacco LM, Bentley ME, Carby-Shields K, Borja JB, Goldman BD. Assessment of infant feeding styles among low-income African-American mothers: comparing reported and observed behaviors. *Appetite* 2007;49(1):131–140. [PubMed: 17336423]
29. Bickel, G.; Nord, M.; Price, C.; Hamilton, W.; Cook, J. Guide to Measuring Household Food Security, Revised 2000. Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service; 2000 Mar. p. 1-82.
30. Blumberg SJ, Bialostosky K, Hamilton WL, Briefel RR. The effectiveness of a short form of the Household Food Security Scale. *Am J Pub Health* 1999;89(8):1231–1234. [PubMed: 10432912]

31. Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement* 1977;1:385–401.
32. Rosenberg, M. *Society and the adolescent self-image*. Princeton (NJ): Princeton University Press; 1965. For further information, see: www.bsos.umd.edu/socy/Rosenberg.html
33. Orr ST, Blazer DG, James SA, Reiter JP. Depressive symptoms and indicators of maternal health status during pregnancy. *J Womens Health* 2007;16(4):535–542.
34. Vozoris N, Tarasuk V. Household Food Insufficiency is associated with Poorer Health. *J Nutr* 2003;133(1):120–126. [PubMed: 12514278]
35. Kleinman RE, Murphy JM, Little M, Pagano M, Wehler CA, Regal K, Jellinek MS. Hunger in children in the United States: potential behavioral and emotional correlates. *Pediatr* 1998;101:e3.
36. Alaimo K, Olson CM, Frongillo EA Jr. Food insufficiency and American school-aged children's cognitive, academic, and psychosocial development. *Pediatr* 2001;108(1):44–53.
37. Casey P, Goolsby S, Berkowitz C, Frank D, Cook J, Cutts D, Black MM, Zaldivar N, Levenson S, et al. Maternal depression, changing public assistance, food security, and child health status. *Pediatr* 2004;113:298–304.
38. Stuff JE, Casey PH, Szeto KL, Gossett JM, Robbins JM, Simpson PM, Connell C, Bogle ML. Household food insecurity is associated with adult health status. *J Nutr* 2004;134:2330–2335. [PubMed: 15333724]
39. Che J, Chen J. Food insecurity in Canadian households. *Health Reports* 2002;12(4):11–21. [PubMed: 15069808]
40. Rich-Edwards JW, Kleinman K, Abrams A, Harlow BL, McLaughlin TJ, Joffe H, Gillman MW. Sociodemographic predictors of antenatal and postpartum depressive symptoms among women in a medical group practice. *J Epidemiol Community Health* 2006;60(3):221–227. [PubMed: 16476752]
41. Surkan PJ, Peterson KE, Hughes MD, Gottlieb BR. The role of social networks and support in postpartum women's depression: a multiethnic urban sample. *Matern Child Health J* 2006;10(4):375–383. [PubMed: 16404681]
42. Oberlander SE, Black MM, Starr RH Jr. African American adolescent mothers and grandmothers: a multigenerational approach to parenting. *Am J Community Psychol* 2007;39(1–2):37–46. [PubMed: 17437188]
43. Krishnakumar A, Black MM. Family processes within three-generation households and adolescent mothers' satisfaction with father involvement. *J Fam Psychol* 2003 Dec;17(4):488–498. [PubMed: 14640799]
44. Bentley M, Gavin L, Black MM, Teti L. Infant feeding practices of low-income, African-American, adolescent mothers: an ecological, multigenerational perspective. *Soc Sci Med* 1999;49(8):1085–1100. [PubMed: 10475672]
45. Edin K, Reed JM. Why don't they just get married? Barriers to marriage among the disadvantaged. *Future Child* 2005;15(2):117–137. [PubMed: 16158733]
46. Edin, K.; Kefalas, M. *Promises I Can Keep: Why Poor Women Put Motherhood Before Marriage*. Berkeley, CA: University of California Press; 2005.
47. Bartlett, S.; Brown-Lyons, M.; Moore, D.; Estacion, A. WIC Participant and Program Characteristics 1998. Nutrition Assistance Program Report Series. The Office of Analysis, Nutrition and Evaluation; 2000. Report No. WIC-00-PC
48. United States Department of Health and Human Services. The 2005 HHS Poverty Guidelines. [Accessed Oct. 19, 2007]. <http://aspe.hhs.gov/poverty/05poverty.shtml>
49. Zekeri AA. Livelihood strategies of food-insecure poor, female-headed families in rural Alabama. *Psychol Rep* 2007;101(3 Pt 2):1031–1036. [PubMed: 18361115]

Table 1

Mean value and standard deviation, or percentage of individuals, for each maternal or household characteristic, by food security status

	Food Secure (n=110) Mean (sd) or %	Marginally Food Secure (n=70) Mean (sd) or %	Food Insecure (n=26) Mean (sd) or %
Maternal Age	22.54 (3.64)	22.45 (3.89)	23.74 (4.03)
Some College			
No (referent)	53.64%	68.57%	42.31%
Yes	46.36%	31.43% ^a	57.69%
Single, never married			
No (referent)	7.27%	12.86%	26.92%
Yes	92.73%	87.14%	73.08% ^b
Ever Worked			
No (referent)	4.55%	7.14%	7.69%
Yes	95.45%	92.86%	92.31%
Depression Score ^c	10.50 (7.27)	13.47 (9.85) ^d	16.38 (9.84) ^e
Self esteem score ^c	34.98 (3.80)	33.36 (5.31) ^d	33.62 (4.41)
Father in Household			
No (referent)	72.73%	68.57%	34.62%
Yes	27.27%	31.43%	65.38% ^b
Grandmother in Household			
No (referent)	57.27%	50.00%	92.31%
Yes	42.73%	50.00%	7.69% ^b
Nuclear Family ^c			
No (referent)	63.64%	62.86%	23.08%
Yes	36.36%	37.14%	76.92% ^b
Number of household members c (other than mother, father and grandmother)	1.32 (1.68)	1.01 (1.32)	0.42 (0.86) ^e

^a significant at $p \leq 0.1$ compared to food secure group with no college using χ^2

^b significant at $p \leq 0.05$ compared to food secure group and not married using χ^2

^c Depression score was a continuous measure based on the CES-D, Self-esteem score is a continuous measure based on Rosenberg Self-Esteem, Nuclear Family was defined as either having the mother, infant and father, or having the mother and infant only; Household members are the total number of members other than the mother, father and grandmother

^d significantly different at $p \leq 0.1$ compared to food secure group using oneway analysis of variance with Bonferroni correction

^e significantly at $p < 0.05$ compared to food secure group using oneway analysis of variance with Bonferroni correction

Table 2

Relative risk ratios (RRR) and 95% confidence intervals (95% CI) for maternal and household characteristics by food security status^a

Exposure variables	Outcome variables	
	Marginally Food Secure RRR (95% CI) (n = 180)	Food Insecure RRR (95% CI) (n = 136)
Maternal age	1.01 [0.91, 1.12]	0.93 [0.80, 1.09]
Ever worked	1.03 [0.25, 4.25]	0.21 [0.02, 1.82]
Some college	0.46 [0.22, 0.98]	1.20 [0.37, 3.92]
Depression score ^b	1.02 [0.98, 1.07]	1.09 [1.02, 1.16]
Self-Esteem ^b	0.93 [0.84, 1.02]	0.98 [0.85, 1.11]
Baby's grandma in household	1.49 [0.72, 3.08]	0.15 [0.03, 0.80]
Baby's father in household	1.33 [0.64, 2.75]	3.46 [1.22, 9.82]
Number of household members ^b (other than mother, father or grandma)	0.75 [0.58, 0.97]	0.61 [0.35, 1.06]

^a Multinomial logistic regression model using 3 outcome categories: food secure, marginally food secure, food insecure. Food secure category was the base outcome (comparison group).

^b Depression Score was a continuous measure based on the CES-D, Self-Esteem is based on Rosenberg Self-Esteem score, Household members are the number of adults other than the mother, father and grandmother. Nuclear Family was dropped from the analysis due to collinearity.