

Food insecurity: special considerations for women^{1–4}

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ABSTRACT

Food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Food insecurity is the converse state, is often associated with poverty and low income, and has important implications for the health and nutrition of individuals. Given their contribution to food production and preparation, their role in society as child bearers and caregivers, the increasing number of female-headed households worldwide, and their disproportionately poor economic status, women need special consideration in discussions of food insecurity and its effect on health, nutrition, and behavior. This article reviews the scientific literature on issues related to women and food insecurity. Food insecurity is associated with obesity, anxiety, and depressive symptoms; risky sexual behavior; poor coping strategies; and negative pregnancy outcomes in women, although evidence about the direction and causality of associations is unclear. There is a lack of evidence and understanding of the effects of food insecurity in resource-poor settings, including its effect on weight, nutritional outcomes, and pregnancy outcomes, as well as its effect on progression of diseases such as HIV infection. More research is needed to guide efficient interventions that address food insecurity among women. However, practical experience suggests that both short-term assistance and longer-term strategies that improve livelihoods, address behavioral and coping strategies, acknowledge the mental health components of food insecurity, and attempt to ensure that women have the same economic opportunities, access to land, and economic power as men are important. *Am J Clin Nutr* 2011;94(suppl):1740S–4S.

INTRODUCTION

The term *food security* refers to the availability of and access to food. Since the term arose in the 1970s, the definition of food security has expanded to increasingly acknowledge in the concept the importance of availability, access, utilization, and stability, and the contribution of the vulnerability of individuals. A working definition from the FAO is that food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Food insecurity is often thought about foremost in reference to its effect on the nutrition of individuals; however, its effect on other health and behavior outcomes is increasingly being recognized (1–3).

A report supported by the USDA showed that in 2009 14.7% of all US households were food insecure some time during the year, 5.7% of which experienced “very low” food security (4). The

2010 FAO report “The State of Food Insecurity in the World” estimated that globally, 925 million people are undernourished. The FAO defines undernourishment as when caloric intake is below the minimum dietary energy requirement (2). Although food insecurity and undernourishment are different concepts, the 2 issues overlap geographically and are certainly related (5). Although developing countries carry 98% of the global burden of undernutrition, food insecurity is important to the health and well-being of individuals in both resource-poor and resource-rich environments (2).

Discussion of issues specific to women is critical in discussions of food insecurity, not least because they produce up to 80% of the food in developing countries. Despite the fact that they contribute to one-half of the world’s food production, they have more difficulty than men in accessing resources such as land, credit, and agricultural inputs and services (2, 6) and make up 70% of the world’s poor (7). Women’s traditional role in society as caregivers and preparers of food for the family, as well as an increasing recognition of their role as heads of households, further support the consideration of women as a special group to evaluate the effect, consequences, and areas for intervention in terms of food insecurity.

Food insecurity can be understood and addressed as its own entity but it should also be recognized as an important associate of health and nutrition outcomes (5, 8). In acknowledgment of these effects, the implications of policy and programmatic work to improve food security can be far reaching. In this supplement, Weiser et al (9) discuss a conceptual framework for understanding the effect of food insecurity on individuals in terms of nutrition, behavior, and mental health. This article discusses the specific issues for women that should be considered in relation to food security.

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MEASUREMENT OF FOOD INSECURITY

One of the challenges in a discussion of food insecurity and in quantification of the number of food insecure globally is the lack of a standardized measure relevant to all settings and cultures. Barrett (10) attributes this difficulty in measurement to the fact that food insecurity is a multidimensional concept that encompasses aspects of availability, access, and utilization. However, it is widely acknowledged that the establishment of an accurate, cross-culturally appropriate, measurement of food insecurity is of critical importance in the design and implementation of targeted interventions, and to evaluate programs (11, 12). Different measurement tools have different strengths and weaknesses and can often result in estimations or interpretations that differ significantly. This is due to both the varying emphasis on the 3 aspects of availability, access, and utilization and the different levels at which food insecurity can be assessed (national, community, household, or individual). The studies cited in this article used a variety of tools and methodologies, including the USDA Household Food Security Scale (or modifications of this scale), the Radimer/Cornell Hunger and Food Insecurity Instrument, and the Household Food Insecurity Access Scale.

FOOD INSECURITY AND NUTRIENT ADEQUACY

By its working definition, food security requires nutritional adequacy. This means that in the broadest sense any individual who is undernourished or has micronutrient deficiency can be interpreted as being food insecure. These deficiencies show the importance of understanding the dynamics of both household and individual food security as an unbalanced distribution of adequate amounts and types of food within the household, which may result in deficiencies in some but not all family members. Women of childbearing age and children under 5 y are at particular risk of poor health due to undernutrition and micronutrient deficiencies.

In a study of 3744 women in the United States, Rose and Oliveira (13) observed that food insecurity was associated with reduced micronutrient intake among women of childbearing age, based on a 24-h recall. Mean intakes of women from food-insufficient households were below two-thirds of the recommended daily allowance for calcium, iron, vitamin E, magnesium, and zinc, and women from these households were more likely to consume <50% of the recommended energy intake than were those from food-sufficient households. A study of the food insecurity and nutritional adequacy of 153 women in families receiving emergency food assistance in Canada also showed a high prevalence of inadequacies (>15%) for vitamin A, folate, iron, and magnesium in severely food-insecure households (14). McIntyre et al (15) used a merged data set of 226 Canadian women and observed a prevalence of inadequacy of >25% for iron, magnesium, thiamin, vitamin B-12, vitamin A, vitamin C, vitamin B-6, and zinc. Consumption of less than the recommended daily allowance for vitamin C was also shown in a cohort of women in rural New York, in addition to a decline in the frequency of fruit and vegetable consumption with an increase in food insecurity (16).

Additionally, nutrient deficiencies that can result from food insecurity and inadequate consumption of certain foods can be exacerbated by other medical conditions. HIV infection, for example, increases resting energy expenditure and also impairs the metabolic functions in absorption, storage, and utilization of nutrients (17, 18).

FOOD INSECURITY AND WEIGHT

If food security were to be considered only in terms of access to food in sufficient quantity, it might follow that food insecurity would be associated with being underweight. However, the relation between food insecurity and weight is more complex and not yet clearly defined. In cross-sectional studies in the United States, food insecurity has been associated with obesity among women, but the direction of the association and its causality are unclear. Meanwhile, few data exist to define the association between food insecurity and weight among individuals in resource-poor settings. Studies that have evaluated these associations are discussed here.

A cross-sectional study that used data from the 1994, 1995, and 1996 Continuing Survey of Food Intakes by Individuals showed that food insecurity was related to overweight status in women in the United States (however, not in men), and the prevalence of overweight status for women increased as food insecurity increased. Mildly food-insecure women were 30% more likely to be overweight than were those who were food secure (19). Marginal food security among women below medium height in the NHANES 1999–2002 was associated with at higher BMI (in kg/m^2). No association was shown between percentage body fat and food insecurity in women; however, BMI and percentage body fat decreased in increasingly food-insecure men (20). In a randomly selected sample of 8169 women in California, obesity was more prevalent in food-insecure (31.0%) than in food-secure women (16.2%) and was more likely to occur in nonwhite women (21).

In a population-based sample of 193 women of childbearing age in rural New York, women in food-insecure households were, on average, 2 BMI units heavier than women in households that were food secure after income level, educational level, single-parent status, and employment status were controlled for (22). Consistent with these findings, marginal food security was associated with being overweight and low food security was associated with being obese among 4172 women in the 1999–2002 NHANES (23).

Because cross-sectional studies cannot determine causality, longitudinal analyses have been performed to attempt to better define the relation between food security and weight in women. In a prospective cohort study of a population of 1707 urban women in 20 US cities, changes in food-security status were not associated with changes in weight (24). Longitudinal data from the 1999 and 2001 Panel Study of Income Dynamics, a nationally representative sample of households in the United States, also showed no significant differences in the percentage of women who gained a clinically significant amount of weight, based on food-insecurity status. However, among overweight women, those who were food insecure gained less weight than their food-secure counterparts, which suggests some relation (25).

Olson and Strawderman (26) used data from the Bassett Mothers Health Project in a prospective cohort study of 622 women of childbearing age living in rural upstate New York and determined that obesity leads to food insecurity, rather than the converse. Obesity combined with food insecurity presented the greatest risk of major weight gain. Qualitative in-depth interviews with 28 women living in rural poverty provided some insights into the relation of overweight with food insecurity and identified several factors that contribute to obesity, including

transportation difficulties, physical inactivity, social isolation, food insecurity, emotional eating, and disordered eating, often around times of flux in household food supplies (27).

In resource-poor settings in which food availability may be severely limited, even fewer data exist to define relationships between food insecurity as a quantitative measure and body weight. A cross-sectional study in urban Uganda to determine the relation between food insecurity and body composition showed that food-insecure women, but not men, were more likely to be overweight or to have an at-risk waist circumference compared with those who were food secure on univariate analysis. However, after adjustment for potentially confounding effects, there were no significant differences between the 2 groups (28). Among a sample of 200 women in rural Malaysia, 58% of food-insecure women were overweight or obese compared with 38% of food-secure women, and after confounding variables were controlled for food-insecure women were still significantly more likely to have an at-risk waist circumference than were women who were food secure but not obese (29).

FOOD INSECURITY, HOUSEHOLD ECONOMICS, AND RISKY COPING STRATEGIES

Implied in the concept of food insecurity is the vulnerability that results from a lack of reliable access to food, which puts individuals at risk of the use of coping strategies that are either risky or not sustainable. When there is limited or uncertain ability to acquire acceptable foods in "socially acceptable ways," a variety of coping strategies may be used. These can include withdrawal of children from school, a decrease in the intake of certain foods, the sale of assets to purchase food, theft, or exchange of sex for food or money (16, 30, 31). Women, as primary caretakers of children, responsible for the maintenance of the household and for food preparation and with less purchasing power than men, are particularly vulnerable to resorting to risky coping strategies, especially when they have low education and few economic opportunities. In the case in which risky coping strategies result in the female caretaker becoming HIV infected, the food security of the entire household is negatively affected because food production and the ability to prepare food decreases with illness (32).

Poverty and low income are associated with food insecurity, but adequate household income is not sufficient to ensure food security. In a cohort of 606 pregnant women with adequate incomes ($\leq 400\%$ of the United States poverty line), women from food-insecure or marginally food-secure households had significantly less income and education and were older than food-secure women. Socioeconomic and demographic predictors of food insecurity included income, black race, and age (33). In Shariff and Khor's (29) study in rural communities in Malaysia, food-insecure women had less education, lower household income, and a greater number of children than did women from food-secure households, and mothers were more likely to be housewives (as opposed to having other economic activities) (29).

The geographic epidemics of food insecurity and HIV overlap in many cases in countries in which the rights and economic status of women increase their vulnerability. Weiser et al (31) showed that food insecurity was associated with high-risk sexual behavior among women in Botswana and Swaziland. In Lagos, Nigeria, a survey of 320 female commercial sex workers showed

that 35% identified poverty and difficulty accessing food daily as their reason for joining that industry (34). In qualitative interviews with women living with HIV in Uganda, Miller et al (35) showed that food insecurity was associated with transactional sex, with lack of control over condom use, and with a likelihood of staying in abusive relationships (31, 35). Food insecurity has also been shown to contribute to nonadherence to antiretroviral therapy (36).

FOOD INSECURITY AND PREGNANCY

Food insecurity has been associated with poor pregnancy outcomes, including low birth weight and gestational diabetes (37, 38). Laraia et al (33) proposed 3 potential reasons why food insecurity might have particular importance for women during pregnancy: nutrient demands are higher, the effort required for food preparation may be more difficult, and pregnant women may be obliged to leave the workforce, especially in later pregnancy, which leads to financial strain. A population-based postpartum survey from California's Maternal and Infant Health Assessment to study income levels and hardships before or during pregnancy showed that ~35% of poor women and 20% of near-poor women reported food insecurity, compared with 8%, 4%, and 0.6% of women in the successively higher income groups (39). A prospective cohort study of 810 pregnant women in the United States with incomes $\leq 400\%$ of the income/poverty ratio showed 14% to be marginally food secure and 10% to be from food-insecure households. Income-to-poverty ratios represent the ratio of family or individual income to their appropriate poverty threshold. Food insecurity was associated with several health consequences, including severe pregravid obesity, higher gestational weight gain, and a higher adequacy of weight gain ratio. Gestational diabetes mellitus was significantly associated with those who were marginally food secure (38). Food insecurity has also been associated with an inability to return to pregravid weight status, although causality has not been determined (40).

Food insecurity in pregnant women also has negative consequences for the child. In a random sample of women receiving welfare in the United States, 294 delivered between 1999 and 2004. Among this cohort, food insecurity was significantly associated with a low-birth-weight delivery after adjustment for maternal age. Other factors associated with low birth weight included having a child with a chronic illness at home, increased crowding in the home, unemployment, and poor coping skills (37). A case-control study by Carmichael et al (41) of 1189 case mothers and 695 control mothers in the United States showed that maternal food insecurity was associated with an increased risk of certain birth defects, such as cleft palate, d-transposition of the great arteries, tetralogy of Fallot, spina bifida, and anencephaly, but not with cleft lip with or without cleft palate, after adjustment for maternal race-ethnicity, education, BMI, intake of folic acid-containing supplements, dietary intake of folate and energy, neighborhood crime, and stressful life events. For HIV-infected pregnant women, poor nutritional status that can result from being food insecure may increase the risk of vertical transmission of HIV to the child (42).

FOOD INSECURITY AND MENTAL HEALTH

Food insecurity is associated with important factors related to women's mental health and well-being. In a cross-sectional

survey of 2870 mothers of 3-y-old children in 18 US cities, the mothers were categorized as fully food secure (71%), marginally food secure (17%), or food insecure (12%). After adjustment for sociodemographic factors, the percentage of mothers with either a major depressive episode or generalized anxiety disorder increased as food insecurity category worsened, and 30.3% of food-insecure mothers suffered from one of these conditions (43).

Decreased mental health status in pregnant women and mothers is also associated with food insecurity. Perceived stress, trait anxiety, depressive symptoms, and a loss of control attributed to chance in pregnant women were all positively correlated with household food insecurity and showed a “dose–response” as food insecurity increased. Traits such as self-esteem were inversely associated with food insecurity (33). In a sample of 5306 mothers in the United States, maternal depression was associated with household food insecurity (44).

Hadley and Patil (45) studied 449 female caretakers in rural Tanzania and observed a strong positive correlation between food insecurity and anxiety and depression, which maintained true across the 4 ethnic groups in the sample. The authors proposed 3 explanations for the association: first, that food insecurity can lead to poor diet, which can then influence anxiety and depression; second, that food insecurity can lead to feelings of inequality that can then elevate anxiety and depression; and third, that women may use expressions of food insecurity as a way to express their anxiety and depression.

INTERVENTIONS

Despite gaps in the science that surrounds food insecurity and challenges in standardization of measurement, programs exist that attempt to address the issue with the goal of an improvement in the outcomes of individuals, households, and communities. In one of Africa’s largest and rapidly expanding HIV programs, with >50,000 patients in active care in 17 clinics in western Kenya, the Academic Model Providing Access to Health care has combined HIV care with a robust nutritional support program for food-insecure patients and their dependents. Of the 9623 patients enrolled to receive food during 2007, 73% were women (46). The Academic Model Providing Access to Health care has linked its food program with agriculture and business training programs to support livelihoods and facilitate successful discharge of patients from the food program to self-sufficiency, and has successfully “graduated” >2000 individuals from the program in 1 y. In Bangladesh, a homestead gardening program for women designed to control vitamin A deficiency had a positive effect on the food security of households 3 y after withdrawal of the program (47).

Nutrition education also has a role to play in food security. A US study of 219 female heads of households receiving food stamps who were randomly assigned to either receive or not receive education regarding food insecurity and nutrition showed significantly improved food security in the intervention group (48). Although evidence is limited on interventions with a proven effect on food insecurity in women with HIV, food assistance, livelihoods programs, education, and intergenerational support show evidence of success (46, 48). A prospective observational cohort study of 600 adults in rural Haiti showed that food assistance was associated with improved BMI, food security, and attendance at monthly clinic visits for both men and women living with HIV (49).

CONCLUSION

Food insecurity, independent of its association with poverty and low income, has important implications for the health and nutrition of individuals. Given their contribution to food production and preparation, their role in society as child bearers and caregivers, the increasing number of female-headed households worldwide, and their disproportionately poor economic status, women need special consideration in discussions of food insecurity and its effect on health, nutrition, and behavior. Gaps remain in understanding the direction of associations and causality of food insecurity and its associations in women with obesity, anxiety, and depressive symptoms. Existing evidence of associations between food insecurity, risky behavior, poor coping strategies, and negative pregnancy outcomes is sufficient to merit that efforts be undertaken to address the issue.

There remains no clear cross-cultural, standardized tool for the measurement of food insecurity, and this hampers scientific research on its effects and associations and on interventions that may reduce food insecurity and promote food security at individual and household levels. There is a lack of evidence and understanding of the quantitative effects of food insecurity in resource-poor settings, including its effect on weight, nutritional outcome, and pregnancy outcomes, as well as on disease progression (such as HIV infection). Such data are also lacking for men in these settings. There is also insufficient research to guide efficient interventions, and studies should be encouraged that would seek to better understand successful approaches to addressing the issue. It is clear, however, that a multifaceted approach is needed. This should include both short-term assistance to women with food insecurity, and longer-term development of strategies that will improve livelihoods, address behavioral and coping strategies, and acknowledge the mental health components of food insecurity, and that also attempt to ensure that women have the same economic opportunities, access to land, and economic power as do men. Rigorous monitoring and evaluation of existing programs, disaggregation of existing data by sex, and standardization of a food-security measurement tool can help add to this body of evidence.

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REFERENCES

1. Core indicators of nutritional state for difficult to sample populations. *J Nutr* 1990;120(suppl 11):1559S–600S.
2. FAO. The state of food insecurity in the world: addressing food insecurity in protracted crises. Rome, Italy: FAO, 2010.
3. Broca SS. Food insecurity, poverty and agriculture: a concept paper. Rome, Italy: FAO, 2002.
4. Nord M, Coleman-Jensen A, Andrews M, Carlson S. Household food security in the United States, 2009. EER-108. Washington, DC: USDA, Econ Res Serv, 2010.
5. Pinstrup-Andersen P. Food security: definition and measurement. *Food Security* 2009;1:5–7.
6. Lubbock A. Survival, change and decision-making in rural households: three village case studies from eastern Morocco. Rome, Italy: International Fund for Agricultural Development (IFAD), 1998.
7. UN Women. Women, poverty & economics. 2010. Available from: http://www.unifem.org/gender_issues/women_poverty_economics/ (cited 29 November 2010).

8. Campbell CC. Food insecurity: a nutritional outcome or a predictor variable? *J Nutr* 1991;121:408–15.
9. Weiser SD, Young SL, Cohen CR, Kushel MB, Tsai AC, Tien PC, Hatcher AM, Frongillo EA, Bangsberg DR. Conceptual framework for understanding the bidirectional links between food insecurity and HIV/AIDS. *Am J Clin Nutr* 2011;94(suppl):1729S–39S.
10. Barrett CB. Measuring food insecurity. *Science* 2010;327:825–8.
11. Webb P, Coates J, Frongillo EA, Rogers BL, Swindale A, Bilinsky P. Measuring household food insecurity: why it's so important and yet so difficult to do. *J Nutr* 2006;136(suppl):1404S–8S.
12. Coates J, Frongillo EA, Rogers BL, Webb P, Wilde PE, Houser R. Commonalities in the experience of household food insecurity across cultures: what are measures missing? *J Nutr* 2006;136(suppl):1438S–48S.
13. Rose D, Oliveira V. Nutrient intakes of individuals from food-insufficient households in the United States. *Am J Public Health* 1997;87:1956–61.
14. Tarasuk VS, Beaton GH. Women's dietary intakes in the context of household food insecurity. *J Nutr* 1999;129:672–9.
15. McIntyre L, Tarasuk V, Jinguang Li T. Improving the nutritional status of food-insecure women: first, let them eat what they like. *Public Health Nutr* 2007;10:1288–98.
16. Kendall A, Olson CM, Frongillo EA. Relationship of hunger and food insecurity to food availability and consumption. *J Am Diet Assoc* 1996;96:1019–24.
17. Katona P, Katona-Apte J. The interaction between nutrition and infection. *Clin Infect Dis* 2008;46:1582–8.
18. Piwoz E. Nutrition and HIV/AIDS: evidence, gaps and priority actions. Washington, DC: Academy for Educational Development, 2004.
19. Townsend MS, Peerson J, Love B, Achterberg C, Murphy S. Food insecurity is positively related to overweight in women. *J Nutr* 2001;131:1738–45.
20. Tayie FA, Zizza C. Height differences and the associations between food insecurity, percentage body fat and BMI among men and women. *Public Health Nutr* 2009;12:1855–61.
21. Adams EJ, Grummer-Strawn L, Chavez G. Food insecurity is associated with increased risk of obesity in California women. *J Nutr* 2003;133:1070–4.
22. Olson CM. Nutrition and health outcomes associated with food insecurity and hunger. *J Nutr* 1999;129(suppl):521S–4S.
23. Hanson KL, Sobal J, Frongillo EA. Gender and marital status clarify associations between food insecurity and body weight. *J Nutr* 2007;137:1460–5.
24. Whitaker RC, Sarin A. Change in food security status and change in weight are not associated in urban women with preschool children. *J Nutr* 2007;137:2134–9.
25. Jones SJ, Frongillo E. Food insecurity and subsequent weight gain in women. *Public Health Nutr* 2007;10:145–51.
26. Olson CM, Strawderman MS. The relationship between food insecurity and obesity in rural childbearing women. *J Rural Health* 2008;24:60–6.
27. Bove CF, Olson CM. Obesity in low-income rural women: qualitative insights about physical activity and eating patterns. *Women Health* 2006;44:57–78.
28. Chaput J-P, Gilbert J-A, Tremblay A. Relationship between food insecurity and body composition in Ugandans living in urban Kampala. *J Am Diet Assoc* 2007;107:1978–82.
29. Shariff ZM, Khor GL. Obesity and household food insecurity: evidence from a sample of rural households in Malaysia. *Eur J Clin Nutr* 2005;59:1049–58.
30. Salaam-Blyther T, Hanrahan CE. The impact of food insecurity and hunger on global health: issues for Congress. Congressional Research Service 2009. Available from: <https://www.hsdl.org/?view&did=232130> (cited 29 November 2010).
31. Weiser SD, Leiter K, Bangsberg DR, Butler LM, Percy-de Korte F, Hlanze Z, Phaladze N, Iacopino V, Heisler M. Food insufficiency is associated with high risk sexual behavior among women in Botswana and Swaziland. *PLoS Med* 2007;4:1589–97, discussion 1598.
32. Coon K, Ogden J, Odolon J, Obudi-Owor A, Otim C, Byakigga J, Spebanja P. Transcending boundaries to improve food security of HIV-affected households in rural Uganda: a case study. Washington, DC: International Center for Research on Women, 2007.
33. Laraia BA, Siega-Riz AM, Gunderson C, Dole N. Psychosocial factors and socioeconomic indicators are associated with household food insecurity among pregnant women. *J Nutr* 2006;136:177–82.
34. Oyefara JL. Food insecurity, HIV/AIDS pandemic and sexual behaviour of female commercial sex workers in Lagos metropolis, Nigeria. *SAHARA J* 2007;4:626–35.
35. Miller C, Bangsberg D, Tuller D, Senkungu J, Kawuma A, Frongillo E, Weiser S. Food insecurity and sexual risk in an HIV endemic community in Uganda. *AIDS Behav* 2010; (Epub ahead of print).
36. Weiser SD, Tuller DM, Frongillo EA, Senkungu J, Mukibi N, Bangsberg DR. Food insecurity as a barrier to sustained antiretroviral therapy adherence in Uganda. *PLoS ONE* 2010;5:e10340.
37. Borders AE, Grobman WA, Amsden LB, Holl JL. Chronic stress and low birth weight neonates in a low-income population of women. *Obstet Gynecol* 2007;109:331–8.
38. Laraia BA, Siega-Riz AM, Gunderson C. Household food insecurity is associated with self-reported pregravid weight status, gestational weight gain, and pregnancy complications. *J Am Diet Assoc* 2010;110:692–701.
39. Braveman P, Marchi K, Egerter S, Kim S, Metzler M, Stancil T, Libet M. Poverty, near-poverty, and hardship around the time of pregnancy. *Matern Child Health J* 2010;14:20–35.
40. Olson CM, Strawderman MS, Hinton PS, Pearson TA. Gestational weight gain and postpartum behaviors associated with weight change from early pregnancy to 1 y postpartum. *Int J Obes Relat Metab Disord* 2003;27:117–27.
41. Carmichael SL, Yang W, Herring A, Abrams B, Shaw GM. Maternal food insecurity is associated with increased risk of certain birth defects. *J Nutr* 2007;137:2087–92.
42. Gillespie S, Kadiyala S. HIV/AIDS and food and nutrition security: from evidence to action. Washington, DC: International Food Policy Research Institute, 2005.
43. Whitaker RC, Phillips SM, Orzol SM. Food insecurity and the risks of depression and anxiety in mothers and behavior problems in their preschool-aged children. *Pediatrics* 2006;118:e859–68.
44. Casey P, Goolsby S, Berkowitz C, Frank D, Cook J, Cutts D, Black M, Zaldivar N, Levenson S, Heeren T, et al. Maternal depression, changing public assistance, food security, and child health status. *Pediatrics* 2004;113:298–304.
45. Hadley C, Patil C. Food insecurity in rural Tanzania is associated with maternal anxiety and depression. *Am J Hum Biol* 2006;18:359–68.
46. Mamlin J, Kimaiyo S, Lewis S, Tadayo H, Jerop F, Gichunge C, Peterson T, Yih Y, Braitstein P, Einterz R. Integrating nutrition support for food-insecure patients and their dependents into an HIV care and treatment program in western Kenya. *Am J Public Health* 2009;99:215–21.
47. Bushamuka VN, de Pee S, Talukder A, Kiess L, Panagides D, Taher A, Bloem M. Impact of a homestead gardening program on household food security and empowerment of women in Bangladesh. *Food Nutr Bull* 2005;26:17–25.
48. Eicher-Miller HA, Mason AC, Abbott AR, McCabe GP, Boushey CJ. The effect of Food Stamp Nutrition Education on the food insecurity of low-income women participants. *J Nutr Educ Behav* 2009;41:161–8.
49. Ivers LC, Chang Y, Jerome J, Freedberg KA. Food assistance is associated with improved body mass index, food security and attendance at clinic in an HIV program in central Haiti: a prospective observational cohort study. *AIDS Res Ther* 2010;7:33.