Gender and Marital Status Clarify Associations between Food Insecurity and Body Weight\textsuperscript{1,2}

Karla L. Hanson,\textsuperscript{3,\*} Jeffery Sobal,\textsuperscript{3} and Edward A. Frongillo\textsuperscript{4}

\textsuperscript{3}Division of Nutritional Sciences, Cornell University, Ithaca, NY 14853 and \textsuperscript{4}Department of Health Promotion, Education, and Behavior, University of South Carolina, Columbia, SC 29208

Abstract

Prior research shows that food insecurity is associated with being overweight in women, with few and ambiguous results in men. Little is known about the characteristics and roles of individuals who are most likely to be both food insecure and overweight or obese. This study analyzed associations between food insecurity and body weight, and whether gender and marital status are involved in that relationship. Using multiple regression models, we examined food insecurity, marriage, and body weight among 4338 men and 4172 women aged \( \geq 20 \) y in the 1999–2002 NHANES. Married men were more likely to be overweight than men in all other marital-status categories except for those living with partners. Divorced men were more likely than never-married men to live in a household with very low food security. Compared with fully food-secure men, marginally food-secure men were heavier, whereas men with low food security were lighter. Compared with fully food-secure women, marginally food-secure women also showed a tendency to be overweight (\( P = 0.05 \)), whereas women with low food security were more likely to be obese. When considering the interaction between food insecurity and marital status, food insecurity was related to a greater likelihood of obesity among married women, those living with partners, and widows, when compared with never-married women. Sensitivity analyses suggest this effect was concentrated among marginally food-secure women. These findings indicate that food insecurity relates differently to body weight for men and women, and that partnering plays a strong part in this relationship for women. J. Nutr. 137: 1460–1465, 2007.

Introduction

Well over one-half of U.S. adults are overweight or obese (1), prompting concern about the public’s health and the associated costs (2,3). Concurrent with high body weights, 11% of U.S. households experience food insecurity at some point during the year (4). Food insecurity is the “limited or uncertain availability of nutritionally adequate and safe foods . . . resulting from financial resource constraint” (5). Mounting evidence shows that food insecurity and body weight are positively associated among women (6–11) with mildly food-insecure women generally more likely to be overweight (6–10). For men, the association is less clear. One study analyzed a combined sample of men and women and found food insecurity associated with a greater risk of obesity (12), whereas another study, which analyzed men separately, found no association between food insecurity and body weight (8). Increased professional and public discussion of the relationship between food insecurity and obesity has motivated a search for a better understanding of the processes involved (13).

One aspect of associations between food insecurity and body weight that has not been well examined is marital status. Growing evidence reveals an association between marital status and body weight (14,15). Cross-sectional investigations suggest that married people are heavier, particularly married men (16,17), whereas longitudinal analyses suggest that entering marriage is associated with weight gain and leaving marriage is related to weight loss (15,18,19). The extent to which marital status influences weight, or weight influences marital status, or both, is unclear (20). Spouses eat together and influence each others’ diet (21,22), suggesting that marriage may influence body weight through food intake.

Little is known about the association between marital status and food insecurity. One study reported a substantial variation in food insecurity across marital-status categories for women, from 2% of widows to 23% of separated women (23). Being married profoundly enhances family income and wealth (24–26). Long-term cohabiting partners typically share resources like spouses do, with the presence of a partner reducing economic hardship (27). Conversely, separation and divorce have negative economic consequences (26) that are disproportionately borne by women (28). Marriage and long-term partnerships also provide social support and other noneconomic resources that help individuals withstand periods of economic uncertainty or stress (29,30), but the benefits of marital support may be smaller for women than men (31,32). Dissolution of marriage or a long-term partnership may therefore exacerbate food insecurity and adversely affect the ability to cope with it. Given these associations, we expect the prevalence of food insecurity to be

\textsuperscript{1} The project was supported by the National Research Initiative of the USDA Cooperative State Research, Education and Extension Service, grant 2005-35215-15752.

\textsuperscript{2} Author disclosures: K. L. Hanson, J. Sobal, and E. A. Frongillo, no conflicts of interest.

\textsuperscript{\*} To whom correspondence should be addressed. E-mail: kh289@cornell.edu.
greatest among divorced and separated individuals, particularly women. Women are typically household food managers (21,33,34), a role that uniquely ties them to food insecurity dilemmas. Past research suggests that women sometimes deprive themselves to feed others, especially children, and establish food intake patterns that alternate between restriction in times of scarcity and binging when food is plentiful, with a resultant gain in weight (35). Given these role dynamics, we expect the association between food insecurity and body weight to be larger among women than men, and particularly women without spouses or partners to provide economic and social support.

Methods

Design. We analyzed cross-sectional data from NHANES for 1999–2002. The National Center for Health Statistics (NCHS) conducts NHANES annual surveys and medical examinations for a nationally representative sample of noninstitutionalized, civilian Americans. NHANES oversampled low-income persons, African Americans, Mexican Americans and people 60 y of age and older. This project was reviewed and exempted by the Cornell University Institutional Review Board.

Sample. NHANES 1999–2002 contained records for 10,291 adults aged 20 y or older. We excluded respondents if: 1) marital status was unknown (n = 553); 2) measured BMI and self-reported height and weight were both missing (n = 70); 3) women were pregnant or pregnancy status could not be ascertained (n = 746); and 4) household food security status was missing (n = 412). The final analytical sample included 4338 men and 4172 women. A comparison of available data on age, ethnicity, education, and income, for included and excluded men and women, revealed only one significant difference: excluded men were slightly younger than included men (P < 0.05).

Measures. Body weight is represented here as relative body weight, or BMI. NHANES included measured heights and weights for most (7699) respondents. We substituted self-reported heights and weights for 811 respondents (449 men and 362 women) who had no measured values. BMI was calculated as kg/m². For 53 respondents (17 men and 36 women) with extreme values, BMI was constrained to 50 kg/m². Respondents were classified as overweight if their BMI was ≥25 kg/m², and obese if their BMI was ≥30 kg/m² (36).

Respondents self-reported their current marital status in 6 categories: never married, living with a partner, married, separated, divorced, or widowed. Age was reported in years, with individuals 85 y or older coded as 85 y. Age-squared was included in multivariate models due to the nonlinear association between age and body weight. NCHS provided 5 race or ethnicity categories: Mexican American, Other Hispanic, White non-Hispanic, Black non-Hispanic and Other Race. Education was reported in 3 categories: less than high school, high school graduate or general equivalency diploma (GED), and more than high school. Family income was analyzed as a percentage of the federal poverty level for family size (% FPL). Family size was not publicly available from NCHS and was not used in these analyses.

The % FPL was missing for 1075 respondents (11%) and education was missing for 26 respondents; these were replaced with values obtained through an expectation-maximization (EM) imputation procedure (37). Imputed variables were simultaneously obtained using age, an indicator variable for whether a respondent’s income was$50,000 or ≥400% FPL, and biological motherhood. Data were imputed separately for men and women. These variables explained ~60% of the variation in family income for respondents with no missing data.

Food security was measured at the household level using an 18-question Food Security Survey Module (FSSM) that was condensed to a 4-category food-security measure considered valid for identifying food-insecure households (38–41). Food security was recorded as: 1) fully food secure, 2) marginally food secure (answered 1 or 2 questions about food insecurity affirmatively, suggesting the household is at-risk for food insecurity), 3) low food security (reported a concern for adequate household food supply, a need to adjust food management strategies, or indicated a decreased diet quality), or 4) very low food security (food intake reduced to the extent that ≥1 household members repeatedly experienced physical sensations of hunger). Households with higher incomes (≥$50,000 or ≥400% FPL) were not administered this survey module and were coded by NCHS as fully food secure. For analyses involving interaction effects, small cell sizes required combining respondents with marginal, low, and very low food security into 1 food-insecure category.

Analyses. All analyses examined men and women separately. Unadjusted differences in food security and body weight between marital categories were tested using Chi-square analysis and bivariate general linear regression models. Multiple logistic regression was used to assess demographic-adjusted differences in household food security across marital categories. Demographic adjustment included age, age-squared, race or ethnicity, education, and % FPL. Because neither being overweight nor obesity was a rare condition, multiple general linear regression models were used to predict BMI, being overweight, and obesity (42). Parameter estimates from multiple regressions can be interpreted in BMI units (kg/m²) or percentage point differences in predicted prevalence of overweight and obesity. Interactions between marital status and our indicator of any food insecurity were also tested. Differences with $P < 0.05$ were considered significant.

Data were weighted for unequal sample selection probabilities using 4-y sample weights computed by NCHS (43) standardized to this analytic sample. Variances were corrected for complex sampling using masked strata and pseudo primary sampling units provided by NHANES (43) and the SPSS complex samples module (version 14).

Three types of sensitivity analyses were performed on all multivariate models. First, considering the association between food insecurity and food-stamp receipt, we controlled for household receipt of food stamps in the past 12 mo in all multivariate models of food insecurity, with no change to the general pattern of findings. Analysis of the role of food stamps themselves on body weight is beyond the scope of this paper. Second, data about family size or composition were not publicly available in NHANES, but we did construct a variable reflecting childhood. Women were considered biological mothers if they reported a live birth, and not biological mothers if they were not yet menstruating, had never been pregnant, or never had a live birth. Biological motherhood was missing for 717 female respondents (18%) and was not imputed due to a lack of good predictors. For women with data, all analyses were repeated including biological motherhood as an independent variable, with no change to the results. Third, repeating the interaction analyses, while considering marginally food-secure households as food secure, tested the sensitivity of results from the analysis of “any household food insecurity.” This sensitivity analysis produced changes to one set of findings, which are noted in our results.

Results

Similar demographic patterns were observed across marital categories for men and women (Table 1). Married men and women were most likely to be white and to have higher incomes than other marital categories. Married men were heavier than other men. Separated men and women was the marital category most likely to be black and to report less than a high school education.

Never married, cohabiting, separated and divorced men and women, all reported lower levels of food security, with divorced and separated men and women most likely to report very low food security (7%). Separated women had the lowest mean income (172% FPL) and the lowest level of food security (66%), and also the highest level of overweight (76%). Widowed men and women were among the least educated and poorest, but also experienced relatively high levels of food security (90% of men and 88% of women).

Controlling for demographic characteristics, divorced men remained significantly more likely than never-married men to report very low food security (OR = 2.8, P < 0.05). Married

Gender, marital status, food insecurity, and body weight 1461
men remained more likely to be overweight than never-married men (+9.2 percentage points, \( P < 0.01 \)), and significantly more likely to be overweight than every other marital category except men living with partners (data not shown). Demographically adjusted differences did not occur in food security or body weight across marital categories for women (data not shown).

Compared with fully food-secure men (Table 2), marginally food-secure men had a higher mean BMI (1.2 kg/m\(^2\), \( P < 0.05 \)), and a tendency to be overweight (+6.4 percentage points, \( P = 0.06 \)) and obese (+6.5 percentage points, \( P = 0.08 \)). In contrast, compared with fully food-secure men, low food security was associated with lower BMI (−0.9 kg/m\(^2\), \( P < 0.05 \)) and a lesser likelihood of being overweight (−8.3 percentage points, \( P < 0.05 \)). Compared with fully food-secure women, marginally food-secure women tended to have higher BMI (+0.8 kg/m\(^2\), \( P = 0.10 \)) and to be overweight (+6.5 percentage points, \( P = 0.05 \)), whereas women with low food security were significantly more likely to be obese (+10.8 percentage points, \( P < 0.01 \)).

There were no significant interactions between marital status and any food insecurity in relation to body weight for men (data not shown). For women, the association between any food insecurity and body weight varied according to marital status.
(Fig. 1). With fully food-secure never-married women as the reference group, and after controlling for demographic characteristics, the interaction of being married and food-insecure was related to a higher likelihood of obesity among married women (P < 0.05). Likewise, interaction effects revealed a greater likelihood of obesity among food-insecure women living with partners (+20.0 percentage points, P < 0.05) and food-insecure widowed women (+16.9 percentage points, P < 0.05). These interactions did not maintain significance when marginally food-secure women were excluded from the “any food insecurity” category.

Discussion

Marital status was associated with food insecurity among men, but not women. Divorced men were more likely to report very low food security than never-married men. We hypothesized that divorced and separated individuals would have a higher prevalence of food insecurity but expected greater marital differences among women than men. For men, our control for reported income may not fully reflect the resources available for the purchase of food because some of that income may actually support children in other households. Also, a wife is often the primary confidante and conduit to a larger social network (30). Without wives, divorced men may experience very low food security at higher rates due to a lack of social supports to mediate periods of economic distress. Divorced men may be an important group toward which to target food assistance.

Consistent with prior research showing a link between mild food insecurity and being overweight among women (6–10), we found marginally food-secure women tended to be overweight and women with low food security were more likely to be obese. Adjusting for marital status did not explain away observed differences in women’s body weight by food security status.

There are several possible explanations for these observed associations. First, the major direction of causation may be that body weight influences reported food insecurity. Overweight and obese women may more often report food insecurity due to their eating habits and the importance of food in their lives. One study that directly addressed this hypothesis found that the association between household food stores and food insecurity did not differ between obese and nonobese women, suggesting that they perceived their food insecurity similarly (11).

Second, these associations may reflect an underlying dose-response relationship. Marginally food-secure women were more likely to be overweight, and women with low food security were more likely to be obese. Although initially appearing counterintuitive (we might expect food insecurity to lead to food restriction and lower body weights), increasingly severe food insecurity may cause declining diet quality and stress about food management rather than reduced energy intake (44) until a very low level of food security is reached.

Men in our sample showed a different pattern of associations between food insecurity and body weight. Like women, marginally food-secure men had heavier body weights than fully food-secure men, whereas men with low food security had lower body weights and a lower likelihood of overweight. Among men, marginal food security may be associated with deteriorating diet quality or irregular eating and therefore higher body weight, whereas low food insecurity may be associated with intake reduction and lower body weight.

The associations observed between food insecurity and body weight for men and women suggest that each gender uniquely experiences food insecurity. As the household food situation intensifies from marginal to low food security, men have lower weights and women higher weights. Although coping strategies vary widely, men more often isolate themselves from others and take individual action (30), which may lead to reducing food intake in response to deteriorating food security. Women more often engage their social network in coping with stress and gear their efforts toward the needs of others (30). As their food security gets worse, women may restrict their food intake in times of scarcity and binge when food is plentiful, with a resultant gain in weight (35). This suggests that an economic or food safety net may help men and women maintain orderly eating, with differential effects on their body weights.

Associations between food insecurity and body weight were not uniform across marital categories. Among married women, food insecurity was associated with a greater likelihood of obesity. This was the largest marital category and therefore statistical significance was most easily attained. Women living with a partner and widows (much smaller categories) had

![FIGURE 1](https://academic.oup.com/jn/article-abstract/137/6/1460/4664800)
similar associations between food insecurity and obesity. Although most prior studies did not report on marital status, many limited their samples to women aged 20–39 y with children living at home (6,7), women aged 19–55 y who did not live alone (10), or women with children aged 3 to 6 y (11), thereby overrepresenting married women relative to other marital categories. In light of the marital-specific effects observed here, the strength of associations between food insecurity and overweight found by previous authors may have been amplified by their sample frames.

When our definition of “any food insecurity” was changed to exclude the marginally food-secure, significant results were not maintained. This suggests that the interaction between food insecurity and partnerships, in relation to body weight, may be concentrated among the marginally food secure. Small cell sizes precluded examining the interaction between marital status and food security reflected in >2 categories.

We hypothesized stronger associations between food insecurity and body weight among women without partners, but found the opposite. Women may deprive themselves to feed adult partners, like they do for children (35). Women also may not reap the same benefits of social support in marriage as do men (31,32). Some men’s coping strategies may not integrate well with partners, which place women at increased risk for depression and feelings of loneliness and powerlessness (30). Depression is associated with obesity among women (45), although the direction of that association is unclear (46,47). Targeting nutrition assistance and education toward food-insecure women and their partners could address an important need.

Several limitations of this study deserve note. It used cross-sectional data, so the temporal order of food insecurity, marriage, and/or weight change cannot be discerned. Long-term measures of poverty, food insecurity, or weight gain or loss were not available. Duration measures might have strengthened our ability to extrapolate from these cross-sectional findings. Food insecurity questions were not asked of respondents with relatively higher household incomes and therefore the prevalence of the food-insecure may be underestimated. We had no good measure of family size or the presence of children in the household. Our measure of biological motherhood reflects only childbearing and we had no data about children for men. Some analyses report subgroup findings or interaction effects based upon small samples. For example, only 24 women were living with a partner, food insecure, and obese, limiting the strength of the conclusions drawn from interaction effects.

A prior review of the literature showed that body weight was known to be inversely related to socioeconomic status, with the most consistent relation among women (48). The prevalence of obesity has recently grown in the U.S., however, and most markedly among higher socioeconomic groups (49), thereby narrowing the gap in body weight between rich and poor. Our analyses use 1999–2002 data that show no differences in obesity across socioeconomic measures (49), and we find associations between food insecurity and body weight that are consistent with prior research. We think this reaffirms that the observed links between food insecurity and body weight reflect behavioral responses to food insecurity rather than uncontrolled differences in socioeconomic status. Programs and policies to address the growing prevalence of overweight and obesity would benefit from conjointly considering the problem of food insecurity. These data suggest that marginally food-secure women and men are heavier than their fully food-secure counterparts. This risk escalates for women who have low food security, and was concentrated among partnered women. More research is needed to better understand the temporal order and the processes involved in associations between gender, marital and nonmarital partnerships, food insecurity, and body weight in order to effectively address both obesity and food insecurity.

Acknowledgment
The authors thank Christine M. Olson for her helpful comments on an earlier draft of this manuscript.

Literature Cited


