Food insecurity and women's mental health in the Chitwan Valley of Nepal

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Abstract

Food insecurity is a major threat to global public health and sustainable development. As of 2022, 2.4 billion people worldwide experienced moderate to severe food insecurity. The occurrence and severity of food insecurity can depend greatly on power and social hierarchies, with women and girls often being less food secure than men and boys even within the same household. Moreover, social roles, such as the socialization of a mother to feed her children, impact food insecurity and its consequences. This study aims to uncover the relationships between food insecurity and mental health for women in the Chitwan Valley of Nepal. Utilizing longitudinal data from the Chitwan Valley Family Study, we connect food security data from 2015 with mental health data collected from 2016 to 2018. We find that women have a higher prevalence of major depressive disorder, generalized anxiety disorder, and panic attacks than men, especially if they are experiencing food insecurity. Among women, we find that those who have recently experienced severe food insecurity have a significantly higher likelihood of meeting diagnostic criteria for generalized anxiety disorder and panic attacks than food-secure women. However, women's food insecurity is not significantly correlated with major depressive disorder. Moreover, we find that food insecurity is likely to co-occur with women's agricultural and wage work. These findings suggest a need for gender-attentive policy and programs accounting for both causes and consequences of food insecurity.

Keywords

Gender; Gender roles; Food security; Mental health

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1. Introduction

Food insecurity is a major global public health concern and priority of international development organizations. Food security is defined as existing "when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food which meets their dietary needs and food preferences for an active and healthy life" (FAO, 2001). Food insecurity, conversely, exists when there is a lack of accessible and nutritious food to support an individual's health and wellbeing. The FAO et al. (2023) reports that as of 2022, around 2.4 billion people, or 30 percent of the world's population, are moderately or severely food insecure. In response to persistently high rates of food insecurity and hunger, the United Nations developed Sustainable Development Goal (SDG) 2, which strives to "end hunger, achieve food security and improved nutrition and promote sustainable agriculture" (UN, 2022). However, the world is not on track to meet this goal, as nearly 600 million people are projected to be chronically malnourished in 2030 (FAO, IFAD, UNICEF, WFP, WHO, 2023). Thus, understanding the consequences of food insecurity and remedying its causes is as urgent today as ever before.

Food insecurity is associated with myriad negative health consequences, including malnutrition (Martin and Lippert, 2012), stunting and wasting (Singh et al., 2014), adverse birth outcomes (Carmichael et al., 2007), and mental health conditions and mental distress (Aguiar et al., 2022; Atuoye and Luginaah, 2017; Hadley et al., 2008; Hadley and Patil, 2006; Hasan et al., 2021; Jones, 2017; Pourmotabbed et al., 2020). Of central concern to this study, research has examined a diversity of negative mental health outcomes associated with food insecurity in various cultural contexts. Jones' (2017) analysis of the relationship between food insecurity and negative mental health outcomes in 149 countries found a significant association between the two experiences consistent throughout all regions studied. In a meta-analysis of 18 studies, food insecurity was found to be significantly associated with depression and stress (Pourmotabbed et al., 2020). As the majority of this literature has used cross-sectional data, Weaver et al. (2021) utilized longitudinal case studies in Brazil and Ethiopia to examine the directionality of the relationship between food insecurity and mental health and their findings suggested that mental health outcomes are a negative consequence of food insecurity. The relationship between food insecurity and symptoms of anxiety and depression has also been demonstrated to have a seasonal effect in Tanzania, wherein as food security status changes seasonally, symptoms of anxiety and depression follow (Hadley and Patil, 2008). This seasonality was also found in Zambia, where agricultural households who were food insecure in a season where most households are food secure experienced greater negative impacts on mental health (Cole and Tembo, 2011). Moreover, recent work in India looking at associations between food security and a variety of health concerns found that the association between food insecurity and mental health is stronger than even that between food security and physical health (Selvamani and Elgar, 2023).

Effects of food insecurity on mental health have been found to vary based on other societal and individual factors. For instance, Carter et al. (2011) examined the relationship between food insecurity and psychological distress in New Zealand and found that, while both

food insecure men and women have higher odds of experiencing psychological distress, this effect was stronger for women. When studying food insecurity, Ivers and Cullen (2011) argued women must be given special consideration due to "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" (1743S). Women are more likely to be food insecure globally then men. Broussard (2019) utlilized data from 146 countries and found that women have a significantly higher probability of food insecurity compared to men, primarily due to differences in household income, individual educational attainment, and connections to social networks. Further, Botreau and Cohen (2020) argued that women involved in agriculture are particularly vulnerable to inequalities in food security, especially during shocks. Gendered food insecurity may also begin in childhood; Hadley et al. (2008) demonstrated that female children in food insecure households in Ethiopia are more likely to experience food insecurity than male children in the same households, reflecting household gendered discrimination in food allotment amongst children.

Given women's assigned social roles in planning and preparing food and ensuring children's needs are met, it is unsurprising that numerous studies demonstrate that women's mental health is more likely to suffer in cases of household food insecurity. Maynard et al.'s (2018) review of women's experiences of food insecurity-related mental health conditions in high-income countries found that depression, anxiety, and stress are correlated with food insecurity. Power et al. (2017) found that in the British context, food insecure pregnant women have worse mental health before, during, and after pregnancy. Turning to the Global South, gender biases in psychological impacts of food insecurity are also present. Atuoye and Luginaah (2017) found that female-headed households experiencing food insecurity in Ghana were more likely to have elevated mental distress than male-headed households. Similarly, amongst people living with HIV/AIDs in Uganda, there was a significant relationship between food insecurity and depression among women but not men (Tsai et al., 2012). In Nicaragua, Piperata et al. (2016) found that household food insecurity and maternal mental distress were strongly correlated. Their mixed-methods approach revealed that mothers felt shame and embarrassment at not being able to fulfill their perceived duties of feeding their families due to food insecurity (Piperata et al., 2016). Tsai et al. (2016) demonstrate food insufficiency was shown to be associated with depression amongst pregnant women in South Africa, though social support buffered this relationship. Hadley and Patil (2006) found a significant positive association between food insecurity and maternal anxiety and depression in Tanzania. In Bangladesh, household food insecurity was associated with a higher odds of pregnant women experiencing depression, anxiety, and stress (Hasan et al., 2021).

This study examines the relationship between mental health and food insecurity for women in an agricultural context of the Chitwan Valley of Nepal, adding to a growing body of literature documenting the gendered impacts of food insecurity on mental health. We utilize longitudinal data from the Chitwan Valley Family Study (CVFS) to offer novel insights into the links between food insecurity and major depressive disorder, generalized anxiety disorder, and panic attacks. We focus on Nepal, a geographic context of import given the lack of adequate mental health resources in the country (Luitel et al., 2015). Further, our

study complements other work in Nepal that demonstrates that other forms of resource scarcity and inaccessibility, such as water scarcity, has negative gendered psychological and physiological impacts, including impacts on women's stress, high blood pressure, and depression (Aihara et al., 2016; Brewis et al., 2019). Whereas many of the studies examining the relationship between food insecurity and mental health use cross-sectional data (Aguiar et al., 2022; Atuoye and Luginaah, 2017; Hadley and Patil, 2006; Hasan et al., 2021; Maynard et al., 2018; Piperata et al., 2016; Pourmotabbed et al., 2020), our use of longitudinal data allows us to understand the temporal ordering of the two experiences. This study thus addresses a limitation to cross-sectional studies, in which it remains unclear whether a mental health condition *precedes* or *results from* food insecurity. We posit that gender as a social process shapes the relationship between food security and mental health, wherein women's roles as food preparers and caretakers, in combination with discriminatory food allocation based on norms situating women as low status in the household, contribute to women's higher likelihood of mental distress resulting from household food insecurity.

2. Theoretical context

We contextualize the gendered analysis of our study within feminist studies engaging linkages between the gendered division of labor and food (in)security. Labor can generally be grouped into two separate yet unified categories: socially reproductive labor and productive labor. Social reproductive labor refers to the work required to reproduce and maintain the labor force, including provisioning of food and other essential goods and birthing and enculturating children into social systems (Bakker and Silvey, 2008). This work is highly gendered as 'women's work' and is often unpaid and undervalued (Mies, 1986). In contrast, productive labor refers to the labor which produces value in a market-system, which has historically been the domain of men due to the concept of "separate spheres," wherein men work outside of the home for pay and women work in the home unpaid (Fraser, 2017).

Following this logic, because social reproduction is largely unaccounted for and lacks value in the economic system, women, who are the primary social reproducers, are deemed lower status ideologically due to their disempowered material status (Mies, 1986). As such, women in various cultures often have lower food allocation status and suffer from a higher prevalence of food insecurity compared to men (Broussard, 2019; Harris-Fry et al., 2017). Moreover, because women, as social reproducers, are materially responsible for food provision and caregiving, they suffer unique stressors related to food insecurity as they experience worry, anxiety, shame and embarrassment when they are unable to feed everyone in their family (Ivers and Cullen, 2011; Piperata et al., 2016).

Key to the social division of productive and reproductive labor is an assumption of different motivations for why individuals do each form of work; while productive labor is motivated by pay, reproductive labor in the home is expected to be done for free out of love for a woman's spouse, children, and other dependents (Fraser, 2017; Mies, 1986). Thus, because of women's material roles as caretakers of children and food preparers, they are expected to act altruistically and sacrifice their own food consumption for their children—what Brickell and Chant (2010) call physical or corporeal altruism. In their study of mothers in the US,

Martin and Lippert (2012) demonstrate this form of altruism wherein mothers will sacrifice their own health in order to prioritize their children's health when experiencing food insecurity, resulting in higher rates of obesity among food insecure mothers. Food insecurity, poverty, and obesity are related in this context as healthy foods are more expensive than less healthy foods. Therefore, obesity amongst food insecure mothers without similar rates of obesity among their children suggests mothers are sacrificing their consumption of healthy foods to prioritize children's consumption.

Moreover, women are burdened with food decision-making, a source of stress and anxiety in scarcity situations. As part of women's caretaking roles, a major responsibility has been what DeVault (1991) calls *Feeding the Family*, inclusive of but not limited to: planning for meals, monitoring household food supplies, food shopping and the financial planning entailed, cooking, serving, and cleaning up after meals. By doing this work, women are not merely cooking, they are *feeding* others, a job which requires care and attention to balancing the various challenges of scarce resources, nutritional needs, and individual preferences (DeVault, 1991).

Because of social values which privilege productive labor, women also suffer from an ideological devaluation of reproductive labor; the majority of care work is unpaid and those jobs that do entail caring for others are typically low-paying and lack social status (Bakker and Silvey, 2008). This leads to poorer outcomes for girls and women in terms of their social status and their health. Families have been demonstrated to invest less in girls' education and health in a variety of contexts due to assumptions that investments in boys will result in a better return due to men's better work and pay opportunities, which can put girls in a poverty trap (Banerjee and Duflo, 2012). Understandably, women thus have disproportionately poorer health compared to men; as Anson et al. (1993) posits, these outcomes may be explained by "psychological and emotional risks [which] are embedded in women's position in the social structure …" (p 426) including social pressures promoting women's role in family and childrearing which conflict with cultural values favoring individual economic achievement.

Thus, as demonstrated in Fig. 1, the material relationship that women have to food provisioning due to social reproduction responsibilities creates stress and puts women in a position to sacrifice their own health for their children. Concurrently, the ideological devaluation of women's caregiving work as less important than paid work and motivated by love and virtue also promotes sacrifice and situates women as low status in intrahousehold food allocation. Together, these material and ideological pressures on women create unique stressors for their physical and mental health in situations of food insecurity.

3. Gender, food insecurity, and mental health in Nepal

We will test our theoretical framework arguing that women experience a double burden of food insecurity due to the material and ideological devaluation of social reproductive work can be demonstrated in the context of Nepal. Broussard's (2019) international examination of gender differences in food security found significantly higher rates of food insecurity amongst women in South Asia broadly compared to their male counterparts. While, to the

best of our knowledge, no national survey comparing food insecurity prevalence between genders in Nepal currently exists, food insecurity does seem to be a great challenge for women in the country. In a study of the prevalence of food insecurity amongst Nepali women, Pandey and Vincent (2020) found that 56 percent of all women had experienced food insecurity. Moreover, intrahousehold food hierarchies cause women to have a greater vulnerability to food insecurity compared to men in the same households in Nepal (Diamond-Smith et al., 2022; Harris-Fry et al., 2018). Caste, which can be understood as a hereditary system of social stratification based on a complex ethnic and religious hierarchy, also plays a significant role in food hierarchies; high-caste (such as Brahmin and Chettri) households have been found to have more rigid gendered food hierarchies compared to low-caste (such as Dalit) households in Nepal (Harris-Fry et al., 2017)

To understand how gendered hierarchies impact food allocation in Nepal, Harris-Fry et al. (2018) examined intrahousehold food allocation between household members. Their results demonstrated than men have the highest dietary adequacy, followed by mothers-in-law, then pregnant women (Harris-Fry et al., 2018). Echoing these findings, Diamond-Smith et al. (2022) found that in food hierarchies in Nepal, married young women ranked the lowest, with women often being the last to eat in their households. As their qualitative interviews demonstrated, women who do not earn their own income feel that they do not have the right to express their feelings about their food needs and wants (Diamond-Smith et al., 2022). Young women's low rank in food distribution occurs despite responsibility for the bulk of social reproductive tasks such as collecting firewood for cooking, food processing, water-fetching, cooking, and cleaning. As Gittelsohn (1991) describes, this social reproduction work is considered menial and ascribed the lowest status in the family labor hierarchy. There are mixed results in South Asia regarding the relationship between women's productive work and food allotment and eating order. Diamond-Smith et al. (2022) found that with regards to eating order, when women do productive work outside the home, this does make them significantly less likely to eat last in the house. However, Pattnaik and Lahiri-Dutt (2023) find that women's income-generating work outside of the home does not always increase their entitlement to food, as working women are often paid very little, and may simply not have time to eat given the demands on their time from both productive and reproductive labor responsibilities.

Studies of the impacts of scarcity of other resources in Nepal have demonstrated gendered stressors and challenges related to the tasks considered women's work. In Nepal, collecting and safeguarding the household's water supply is one the responsibilities that is expected to be done by women. As such, Brewis et al. (2019) found that water scarcity is linked with higher stress and blood pressure among women compared to men. Further, it has been demonstrated that women in households experiencing water insecurity had a higher likelihood of experiencing stress and depression and perceived themselves to have a lower quality of life compared to women in water secure households (Aihara et al., 2016).

While no studies have looked at the direct impacts of resource scarcity on mental health in Nepal, there is evidence of an unmet demand for mental health care in the country. Luitel et al. (2015) found that though a mental health policy plan was adopted in Nepal in 1997, the plan has not been implemented, meaning mental health care access remains a challenge.

This is noteworthy as recent research shows a gendered component to mental health needs, in that 2.8 percent of females compared to 1.8 percent of males have major depressive disorder and 4.5 of females compared to 3.0 percent of males have anxiety (Bhatta et al).

4. Hypotheses

Our key research questions examine whether food household insecurity contributes to negative mental health outcomes. We build off the theory that women have unique vulnerabilities to the mental health consequences of food insecurity due to their social roles to test two hypotheses.

Hypothesis 1.

Women in food insecure households will have a greater likelihood of negative mental health incomes including Major Depressive Disorder (MDD), Generalized Anxiety Disorder (GAD) and Panic Attacks (PAT) compared to women in food secure households.

Hypothesis 2.

Women in food insecure households will have different livelihood strategies and time-use patterns compared to women in food secure households.

5. Methods

5.1. Data

To test these hypotheses, we use household socioeconomic and food security data and individual-level mental health and demographic data from the Chitwan Valley Family Study (CVFS) from Nepal (Ghimire et al., 2018). The CVFS, developed by an interdisciplinary team of social scientists and based out of the University of Michigan, is a "comprehensive family panel study of individuals, households, and communities in the Chitwan Valley of Nepal" (Chitwan Valley Family Study, 2023). It began collection in 1997, with the most recent survey completed in 2018. The study population includes more than 10,000 individuals from 151 neighborhoods in the Chitwan Valley. The Chitwan Valley is located in the central region of Nepal's *terai*, or lowlands area and is primarily rural and agricultural. Despite the fact that the *terai* is known for its rich farmland and is considered 'bread-basket' of Nepal, the Chitwan Valley experiences some of the highest rates of food insecurity in the country (Chemjong and KC, 2020; Pain et al., 2014). The population sampled by the CVFS is largely representational of Nepal as a whole, though participants do have overall higher education attainment than those in Chitwan or Nepal (Scott et al., 2021).

We utilize datasets on household-level characteristics, including food security, collected from July–December 2015. Additionally, we used the Nepal-CIDI survey, conducted from 2016 to 2018 with individuals aged 15–59 years. This survey features the Nepal-Composite International Diagnostic Interview (CIDI) which is a culturally specific version of the World Health Organization's World Mental Health-Compositive International Diagnostic Interview created by the CVFS team (Scott et al., 2021). We use mental health data from 2016 to 2018 to test our hypothesis that food insecurity may be a driver for mental

health conditions. Unfortunately, a baseline mental health survey from the same period of the food security survey is not available, nor is data available on mental health prior to the food security survey, to provide a control. The CIDI structured diagnostic interview is conducted retrospectively and used to determine mental health disorder diagnoses and prevalence. The Nepal-CIDI was carefully translated through an iterative process to ensure accuracy and was validated to meet DSM-IV diagnostic accuracy (Ghimire et al., 2013). For our supplementary models, we used data from the Women's Time Use Survey Time 1, collected from August–December 2015. All data were accessed through the University of Michigan's Virtual Data Enclave per our approved IRB protocol (STUDY#00018892) and our data sharing agreement established with the University of Michigan's Inter-university Consortium for Political and Social Research.

5.2. Measures

Nepal CIDI data was recoded by the CVFS study team based on DSM-IV diagnostic criteria using a diagnostic algorithm. The diagnostic variables of interest were Major Depressive Disorder (MDD), Generalized Anxiety Disorder (GAD), and Panic Attack (PAT). All mental health questions referred to the 12-month period preceding the survey. The DSM-IV provides the following criteria for diagnosing each mental health disorder (American Psychiatric Association, 1994). Major Depressive Disorder is characterized by experiencing five or more depressive symptoms for two weeks or more. Depressive symptoms include depressed mood, loss of interest, over- or under-eating, over- or under-sleeping, impaired mental functioning, fatigue, feelings of worthlessness or guilt, diminished ability to think, and recurrent thoughts of death. Generalized Anxiety Disorder features "excessive anxiety and worry" on more days than not for a six-month period of time wherein the individual struggles to control the worry. Moreover, it includes three or more of the six following symptoms: restlessness, being easily fatigued, difficulty concentrating, irritability, muscle tension, and sleep disturbances. A panic attack refers to "a discrete period of intense fear or discomfort," wherein the individual experiencing four or more physical sensations. These include: a pounding or racing heart, sweating, trembling or shaking, a feeling of shortness of breath or smothering, a feeling of choking, chest pain or discomfort, nausea or abdominal distress, dizziness or unsteadiness, derealization or depersonalization, fear of losing control, fear of dying, numbness or tingling, or chills or hot flushes.

We created a measure of food insecurity in accordance with USAID's Household Food Insecurity Access Scale (Coates et al., 2007). This variable was created from a set of nine questions addressing occurrence, perceptions, and behavioral responses to food insecurity over the previous 4-week time frame. Questions include whether anyone in the household has: worried about not having enough food, been unable to eat preferred foods, had a limited variety of food, eaten undesirable food, eaten smaller meals, eaten fewer meals, had no food at home, gone to sleep hungry, or gone a day and night without eating, due to lack of resources. Households were classified into four categories based on their responses: food secure, mildly food insecure, moderately food insecure, and severely food insecure. As only 2 percent of the analytic sample was moderately food insecure, we further collapse these groups into food secure, mild or moderately food insecure, and severely food insecure.

Throughout our analysis, we use the term gender to make sense of the differences in roles and resulting experiences for men and women—yet it is important to note that the data we utilize uses a binary sex variable (male and female) that is self-reported by respondents. To account for other factors that may affect a woman's mental health we controlled for demographic variables collected in 2016–2018. Covariates include whether or not the household contained any young children (0–5 years of age), older children (6–11 years of age) and adolescents (12–18 years of age). We also include woman's age (ranging from 15 to 59), education (no education, less than school leaving certificate, school leaving certificate and above school leaving certificate) and marital status (currently married or not). Ethnicity/caste (Brahmin/Chettri, Hill Janajati, Terai Janajati, Dalit, and other) are included as controls and are representative of the population. Five household-level variables were utilized from the survey collected in 2015. First, the household-type, or whether the household was a single-generation or multi-generation household is included. To approximate household livelihood strategy, binary variables of whether a household received income from 1) farming and 2) foreign remittances are included. Lastly, we include two different binary variables of whether a home has 1) an improved floor as a proxy for socioeconomic status and 2) a well as a proxy for water insecurity.

For our supplementary models, we created binary variables related to a woman's time-use in the past month. These included measures of whether a woman engaged in agricultural work or worked for a wage.

5.3. Analytic strategy

We first estimate a set of binary logistic regression models predicting the likelihood that a woman respondent meets the diagnostic criteria of MDD, GAD, or PAT in the past twelve months based on the household's food security status. We include a set of individual- and household-level controls, described above. In addition, we cluster standard errors at the neighborhood level, which adjusts standard errors to account for the non-independence of households living in the same neighborhood. As the sample is representative of the population of Nepal, with the exception of education attainment (Scott et al., 2021), we do not use weights in our model. The analytic sample for these models includes 4587 women.

To further explore the individual- and household-level characteristics that may co-occur with food insecurity, we then estimate a set of binary logistic regression models predicting women's time use patterns based on household food security status measured during the same period. We examine whether a woman's time use included agricultural work or work for a wage. These models include the same individual- and household-level controls as our main models. The analytic sample for these models is slightly smaller, at 2,310, as not all women from the main models were selected to participate in the time-use survey.

6. Results

Fig. 2 depicts the prevalence of MDD, GAD, and PAT in the sample among men and women based on household food security status. The three mental health conditions are all more prevalent amongst women compared to men in the sample. Further, while food secure and mild or moderately food insecure women have similar prevalence as men of the three

conditions, women in severely food insecure households have higher prevalence of all three mental health conditions.

Descriptive statistics for the female-only analytic sample are provided in Table 1. The sample includes 4587 women. Approximately 4.3% of women meet the diagnostic criteria of having MDD, with 2.7% meeting the diagnostic criteria for GAD and 1.7% meeting diagnostic criteria for PAT. Seventy-one percent of women live in food secure households, with 22% living in households with mild or moderate food insecurity, and 7% living in households with severe food insecurity. The average age is 30 years. Women represent a variety of ethnicities with 43% Brahmin or Chettri, 18% Hill Janajati, 20% Terai Janajati, 12% Dalit, and the remaining 6% of other ethnicities. Approximately 20% of women have no education and 43% have some education but did not complete a school leaving certificate (equivalent to a high school diploma). About one-quarter of women have some higher education above a school leaving certificate and 14% ended their education at a school leaving certificate. Approximately 76% of women are married, with the remainder single, divorced, or widowed. Around half live in households with at least one child 5 years of age or younger, while 41% live in households with at least one child between ages 6–11 and 68% with children 12–18. Eighty-seven percent of women live in a single-generation household while 13% live in a multi-generation household. Approximately 83% live in households that earn income through farming and 44% live in households that earn income through foreign remittances. Most women (84%) live in a household with an unimproved floor while 16% live in a household with an improved floor. About one-fourth of women live in a home with a well.

Table 2 presents results from three binary logistic regression models of the relationship between food security status and the likelihood that a woman meets diagnostic criteria for MDD, GAD, and PAT. Our findings show mixed results regarding our first hypothesis. There is a significant and positive relationship between severe food insecurity and the likelihood that a woman is meets diagnostic criteria of GAD or PAT. Severely food insecure women have a 2.13 times higher odds of having generalized anxiety disorder and a 3.29 times higher odds of having panic attacks compared to food secure women. Contrary to our prediction, however, there is not a significant relationship between a woman living in a food insecure household and the odds that a woman meets diagnostic criteria of MDD.

Examining the control variables in each of the female-only models, we find that age has a significant positive relationship with the odds of meeting diagnostic criteria for MDD, GAD, and PAT and that this relationship is non-linear. Additionally, we find the odds that a woman experiences MDD, GAD, and PAT decreases for married women compared to single women. Women living in households with a livelihood including farming have lower odds of experiencing GAD compared to women whose household livelihood strategy does not include farming. Women in households with unimproved floors have higher odds of experiencing GAD than women in households with improved floors. Finally, compared to women in households with no young children, women in households with children 5 years of age and younger have higher odds of experiencing PAT.

To examine the magnitude of the relationships between household food security status and women's likelihood of meeting diagnostic criteria for GAD and PAT, we calculate the predicted probabilities of GAD and PAT for women by food security status, holding all other variables at their means. Figs. 3 and 4 display these results. As seen in Fig. 3, women in food secure households have a 2.6% predicted probability of meeting the criteria for GAD, while women in mild/moderately food insecure households have a 2.2% predicted probability, and women in severely food insecure households have a 5.2% predicted probability. Similarly, as shown in Fig. 4, women in food secure households have a 1.4% predicted probability of meeting the criteria for PAT, women in mild/moderately food insecure households have a 1.6% predicted probability, and women in severely food insecure households who have a 4.5% predicted probability.

Table 3 presents results from two binary logistic regression models of the relationship between a woman's household food security status and time-use. These models provide evidence to support our second hypothesis, as they demonstrate that severely food insecure women are 2.79 times more likely to be involved in wage work compared to women in food secure households, and this finding is statistically significant. Women in mild/ moderately food insecure households have significantly higher odds (1.43 times more likely) of performing in agricultural work compared to their food secure counterparts.

Finally, we estimate a set of models that includes men and women together (Appendix Table A3) and a set that restricts the sample to men (Appendix Table A4). Results from the model with both genders are consistent with our main models, however the size of the coefficients is smaller. In addition, we find that women are significantly more likely than men to meet the diagnostic criteria for all three outcomes. In the male-only models, we find no significant relationships between food security and any of the three mental health outcomes.

7. Discussion

Our findings add to a burgeoning body of literature demonstrating that women have unique experiences of food insecurity and consequential negative health outcomes. Specifically, we provide novel insight into the how Nepali women may feel the impacts of food insecurity, particularly on mental health, likely due in part to their caregiving roles and low status in food hierarchies. As our both-gender and male-only models in the appendix show, the significant relationship between food insecurity and mental health is unique to the women in our sample, whom we focus on in our analysis. Our work thus builds upon prior studies which discovered that women's and mother's mental health may especially suffer as a result of food insecurity (Hadley and Patil, 2006; Piperata et al., 2016; Power et al., 2017; Rahman et al., 2021; Tsai et al., 2012; Tsai et al., 2016). As such, the gendered pressures and stressers of caregiving in times of scarcity can result in conditions such as depression, anxiety, and mental distress. Specifically, we find that Nepali women in severely food insecure households are at a significantly higher risk of generalized anxiety disorder (GAD) and panic attacks (PAT) compared to women who are food secure and compared to food insecure men, providing insights into the specific types of mental health concerns that might be most affected by food insecurity based on women's caregiving roles and associated responsibilities as food provisioners and preparers.

Interestingly, food insecurity is not significantly associated with major depressive disorder (MDD) among women. While women in general have higher prevalence of MDD compared to men, women's risk of MDD is not significantly exacerbated by food insecurity. To understand this finding, we look to previous studies which have demonstrated stronger relationships between food insecurity and anxiety than with depressive symptoms (Aguiar et al., 2022; Hasan et al., 2021). In Portugal, anxiety symptoms were significantly associated with food insecurity while depressive symptoms were not (Aguiar et al., 2022). Similarly, in a study of pregnant women in Bangladesh, the odds of food insecure individuals experiencing anxiety were larger than the odds of experiencing depression (Hasan et al., 2021). These results suggest women may respond to food insecurity by focusing attention on securing resources, which may in turn lead them to develop worry and fear about their ability to access adequate food.

As GAD and PAT are both characterized by anxiety, worry, or fear, it is reasonable that these conditions may be triggered by the uncertainty caused by severe food insecurity, especially for those responsible for "feeding the family." A woman may have fear both about providing for her children given inadequate food resources, while additionally worrying about her own food consumption and health, and may feel pressure to practice physical altruism and sacrifice her share of food for her children. These worries and fears may in turn be compounded by having low food allocation status, as has been previously demonstrated for women in Nepal (Diamond-Smith et al., 2022; Harris-Fry et al., 2018). This anxiety and panic can be understood, returning to our theoretical concept of the double burden of food security, through gendered material and ideological pathways. Women experience the direct stress of making material decisions about provisioning scarce food to family members, as well as the stress of feeling less entitled to food compared to other family members, due to the ideology that women's household labor is not valuable to the family.

To provide insight into the types of women experiencing food insecurity in Nepal and how productive labor might mediate food insecurity, we examined whether women's time use is linked to food insecurity. We discovered that women in severely food insecure households are significantly more likely to have engaged in recent wage work than food secure women, and that women in mild or moderately food insecure households have higher odds of engaging in agricultural work compared to women in food secure households. This finding adds to our understanding of what kinds of women may be at risk of food insecurity, and resulting mental health conditions, as one may suppose that a working woman (working for a wage or on the farm) may have greater food security and entitlement to food in the household due to their productive work. However, our findings align with a study from neighboring India, which demonstrates that it is often those very women who are in the most poverty who must turn to unpaid agricultural work or wage work to survive (Pattnaik et al., 2018).

Moreover, research in India has demonstrated that though increasing women's work should theoretically increase their access to and allotment of food in their households, this is not always true. This is because women earn much less than men or the same work, and that women's increased time-burdens related to work may mean they do not have time to eat a full meal (Pattnaik and Lahiri-Dutt, 2023). In the context of our study, where women

are caregiving and food provisioning in circumstances of scarcity while simultaneously working on the farm or doing wage work, so it is understandable these same women may feel stressed, scared, and panicked about balancing these responsibilities, resulting in poor mental health.

Despite the importance of our findings, there are various limitations worth noting. First, the data that we utilize from the CVFS poses a limitation due to the methodology used to conduct longitudinal surveys. Participants who change households throughout the study period were assigned household identification numbers based on the household they were in at the time of their entry into the study cohort. Therefore, there is a possibility that some of the respondents in our sample have changed households throughout the study period and that change is not accounted for in our analysis. Second, the mental health survey was conducted in 2016–2018, following the collection of the food security data in 2015. While the longitudinal nature of the data allows for a time-ordered analysis, future research may focus on a narrower time frame for collection of mental health data, directly following the participant's experience of food insecurity.

Our analysis is also limited by the lack of baseline measurements of mental health, given that the mental health questionnaire was only conducted at one time point. Thus, we are unable to control for baseline mental health in our models. In addition, our analysis would be improved by covariate adjustment for prior levels of food security. However, as with the mental health questionnaire, food security was only assessed at one time point. We suggest that future research should collect repeated measures of both food security and mental health to better assess the relationship between the two. Repeated measures during different growing seasons could additionally speak to seasonal differences in the mental health impacts of food insecurity, as past research demonstrates agricultural season is an important mediator of this relationship (Cole and Tembo, 2011; Hadley and Patil, 2008).

In addition, our findings could potentially be explained by unobserved confounding. For example, we are not able to control for water insecurity, which is known to be associated with both food insecurity (Brewis et al., 2020) and mental health (Wutich et al., 2020). To assess this issue, we use the e-value method for sensitivity analysis (VanderWeele and Ding, 2017). Given our odds ratio for GAD of 2.13, an unobserved confounder would need to have an association of 3.68 with both food insecurity and GAD to explain the relationship we observe in our model. Similarly, given the odds ratio for PAT of 3.29, an unobserved confounder would necessitate an association of 6.03 with both food insecurity and PAT to explain the relationship we see. Though relationships of this strength are possible, it is more likely that including a confounder such as water insecurity would attenuate, but not completely explain, the relationship we observe between food insecurity and mental health.

Further, though we use detailed longitudinal data, qualitative data would provide deeper insight into the mechanisms and social processes underlying the link between food insecurity and negative mental health outcomes. We encourage future studies to use mixed methods to triangulate findings and further interrogate the complex relationship between these two experiences. Additionally, while food security is typically measured at the household level, research into intrahousehold food security dynamics and mental health

may allow for additional interrogation into the gendered nature of such phenomena. Further research should consider gender roles and responsibilities and how constructions of gender impact food security status and the consequences of food insecurity on mental health.

8. Conclusion

In this paper, we used longitudinal data from the CVFS to explore the relationship between household food security status and the likelihood that a woman meets the diagnostic criteria for a mental health disorder. We find a significant positive relationship between food insecurity and both generalized anxiety disorder and panic attacks, suggesting that women who are severely food insecure are at a significantly higher risk of these adverse mental health outcomes than their peers in food secure households. Our findings, in conjunction with previous studies demonstrating gendered food hierarchies in Nepal (Diamond-Smith et al., 2022; Harris-Fry et al., 2018), suggest a need for food security and mental health initiatives in the country that explicitly target women, especially pregnant women and mothers.

Attention to gender in food security and mental health policy is particularly important given other intersecting catastrophic events. It has been documented that Covid-19 has increased stress related to food insecurity (Rahman et al., 2021) and climate change and other environmental shocks threaten food security in Nepal (Bastakoti and Doneys, 2020; Randell et al., 2021). As Bastakoti and Doneys (2020) demonstrate, Nepal is a country with a high risk of climate change-related food insecurity, and further, women in particular are faced with greater food insecurity and greater stress as a result of climate change. While out-migration is a climate change adaptation strategy that may be used by men, women are less able to migrate out of areas experiencing increasing food insecurity and agricultural distress due to gendered barriers to mobility and wage-work (Bastakoti and Doneys, 2020; Southard and Randell, 2022). As women, and especially women in agriculture, are particularly vulnerable in times of shocks (Botreau and Cohen, 2020), women's experiences of food insecurity and resulting mental distress will be an important consideration as Nepal faces increasing challenges from climate change and other natural disasters.

Our findings further demonstrate that women from food insecure households are more likely to engage in agriculture work and wage work. This suggests that household food insecurity co-occurs with other factors—namely increased demands on women's time— which indicates that women in food insecure households may experience multiple stressors that collectively take a toll on mental health. Thus, women engaging in productive work may be at higher risk of food insecurity and should be explicitly targeted for food security interventions.

Finally, our findings suggest that women who engage in agricultural or wage work may be overburdened. Thus, increasing women's work responsibilities may not result in improved food security and mental health. We argue that women's roles related to social reproduction —namely food provisioning and care giving—are the primary mechanisms underlying the mental health burden of food insecurity. As such, we suggest improved social and political valuation of women's work through governmental and non-governmental programs. Policies

that promote the valuation of women's unpaid work may improve women's food security and resulting mental health consequences, as may efforts to encourage men's greater involvement in the social reproductive work of the household.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgement

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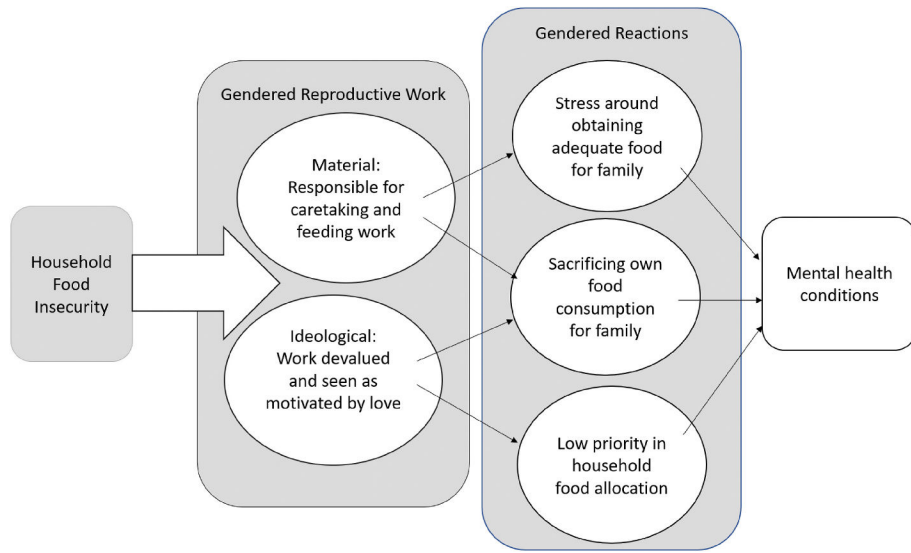
Fig. 1.
Conceptual framework linking food insecurity with women's mental health.
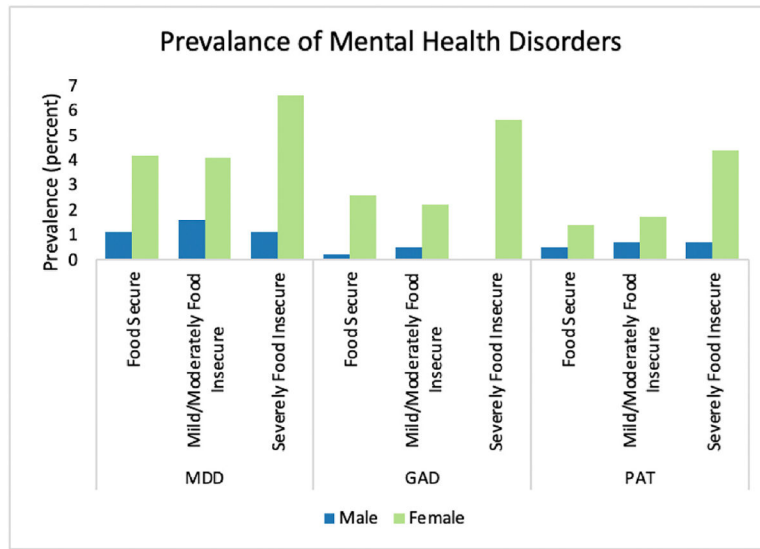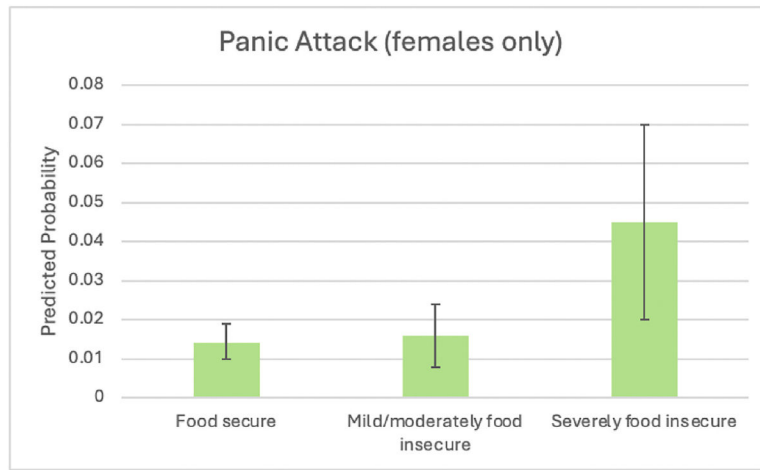
Fig. 2.
Prevalence of mental health disorders based on gender and household food security status.
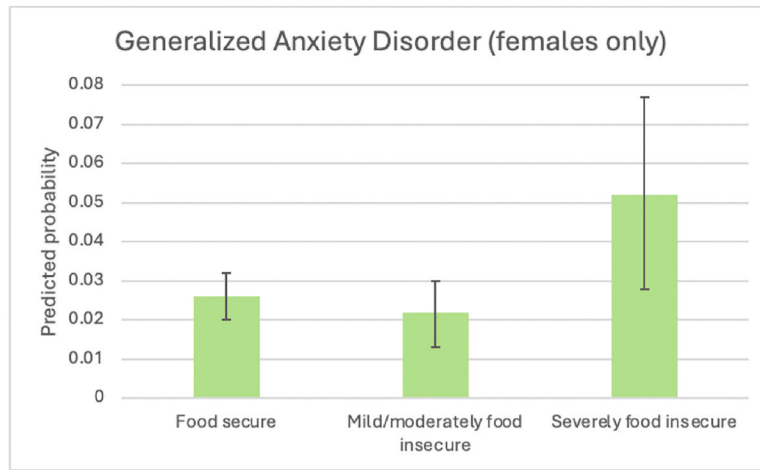
Fig. 3.
Predicted probability of Generalized Anxiety Disorder among women including 95% confidence intervals.

Fig. 4.
Predicted probability of Panic Attack among women including 95% confidence intervals.

Table 1

Descriptive statistics for the female sample (N = 4587).

	Mean	SD	Min.	Max.
Outcome variables				
MDD	0.04		0	1
GAD	0.03		0	1
PAT	0.02		0	1
Predictor variables				
Household food insecurity				
Food secure	0.71		0	1
Mild/Moderately food insecure	0.22		0	1
Severely food insecure	0.07		0	1
Control variables				
Respondent's characteristics:				
Age	30.38	11.64	15	59
Currently married	0.76		0	1
Ethnicity				
Brahmin/Chettri	0.43		0	1
Hill Janati	0.18		0	1
Terai Janati	0.20		0	1
Dalit	0.12		0	1
Other	0.06		0	1
Education				
No education	0.20		0	1
No school leaving certificate	0.43		0	1
School leaving certificate	0.14		0	1
Above school leaving certificate	0.24		0	1
Household characteristics:				
Number of young children (0–5)	0.47	0.69	0	3
Number of middle-aged children (6–11)	0.41	0.66	0	3
Number of older children (12–18)	0.68	0.86	0	3
Household type				
Single-family household	0.87		0	1
Multi-generation household	0.13		0	1
Household livelihood includes farming	0.83		0	1
Household livelihood includes foreign remittances	0.44		0	1
House has unimproved floor	0.16		0	1
House has well	0.24		0	1

Table 2

Binary logistic regression models predicting the odds of woman experiencing MDD, GAD, and PAT based on household food security status.

	Model 1: MDD		Model 2: GAD		Model 3: PAT	
	Odds Ratio	Std. Err.	Odds Ratio	Std. Err.	Odds Ratio	Std. Err.
Predictor variable						
Household food insecurity (reference: food secure)						
Mild/Moderately food insecure	0.91	0.17	0.83	0.19	1.14	0.33
Severely food insecure	1.39	0.34	2.13^{b}	0.60	3.29^{c}	1.07
Control variables						
Woman's characteristics:						
Age	1.17^{c}	0.05	1.26	0.70	0.95	0.05
Age x Age	1.00^{b}	0.00	1.00**	0.00	1.00	0.00
Ethnicity (reference: Brahmin/Chettri)						
Hill Janati	0.90	0.34	0.83	0.22	0.72	0.33
Terai Janati	0.69	0.16	0.83	0.18	1.13	0.34
Dalit	1.40	0.35	1.04	0.29	1.66	0.62
Other	1.04	0.34	0.57	0.31	0.77	0.42
Education (reference: no education)						
No school leaving certificate	1.03	0.18	1.14	0.27	0.73	0.25
School leaving certificate	0.80	0.24	1.47	0.52	0.92	0.42
Above school leaving certificate	0.51^{a}	0.15	0.52	0.24	0.45	0.23
Currently married	0.47^{c}	0.09	0.39	0.09	0.67	0.20
Household characteristics:						
Number of young children (0–5)	0.97	0.11	1.22	0.18	1.39^{a}	0.20
Number of middle-aged children (6–11)	1.14	0.12	1.03	0.15	1.07	0.18
Number of older children (12–18)	1.08	0.10	0.97	0.10	0.93	0.13
Household type (reference: single-generation household)						
Multi-generation household	1.22	0.25	1.14	0.30	1.02	0.41
Household livelihood includes farming	0.85	0.16	0.53^{b}	0.12	0.79	0.25
Household livelihood includes foreign remittances	0.88	0.13	1.16	0.23	0.68	0.19
House has unimproved floor	1.27	0.24	1.69^{a}	0.41	0.47	0.19
House has well	1.08	0.21	1.03	0.24	0.82	0.24
Pseudo R^2	0.04		0.09		0.08	
N	4587		4587		4587	

Note: Standard errors are clustered at the neighborhood level.

[a] $p < 0.05$.

[b] $p < 0.01$.

[c] $p < 0.001$.

Table 3

Supplementary models on women's time use.

	Model 1: Wage work		Model 2: Farm work	
	Odds Ratio	**Std. Err.**	**Odds Ratio**	**Std. Err.**
Predictor variable				
Household food insecurity (reference: food secure)				
Mild/Moderately food insecure	1.28	0.21	1.43[b]	0.17
Severely food insecure	2.79[c]	0.59	1.03	0.19
Control variables				
Woman's characteristics:				
Age	1.32[c]	0.06	1.08*	0.03
Age x Age	0.99[c]	0.00	0.99*	0.00
Ethnicity (reference: Brahmin/Chettri)				
Hill Janati	1.35	0.27	1.32	0.19
Terai Janati	2.32[c]	0.54	1.40	0.24
Dalit	2.14[b]	0.52	0.97	0.18
Other	1.22	0.39	1.06	0.21
Education (reference: no education)				
No school leaving certificate	0.62[b]	0.10	1.19	0.16
School leaving certificate	0.62	0.18	1.24	0.25
Above school leaving certificate	1.28	0.33	0.79	0.16
Currently married	0.33[a]	0.15	1.48	0.48
Household characteristics:				
Number of young children (0–5)	0.84	0.08	0.82[b]	0.05
Number of middle-aged children (6–11)	1.07	0.09	1.07	0.07
Number of older children (12–18)	0.97	0.07	1.04	0.07
Household type (reference: single-generation household)				
Multi-generation household	1.21	0.19	0.92	0.12
Household livelihood includes farming	0.85	0.14	5.96[c]	0.89
Household livelihood includes foreign remittances	1.08	0.14	1.15	0.12
House has unimproved floor	1.70[b]	0.28	0.84	0.10
House has well	0.81	0.15	1.04	0.13
Pseudo R^2	0.10		0.09	
N	2310		2310	

Note: Standard errors are clustered at the neighborhood level.

[a] $p < 0.05$.

[b] $p < 0.01$.

[c] $p < 0.001$.