

Research Article

Determinants of Household Food Insecurity and Depression in Mothers: Evidence from Ghana

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Background. Household food insecurity (FI) and maternal depression are serious public health problems, especially in low-income countries. The aims of this study were to determine the determinants of household FI and depression in mothers and the association between these constructs in Savelugu Municipality, Ghana. **Methods.** An analytical, community-based, cross-sectional survey was conducted to collect data on 364 mothers of under-five children selected using the multistage method in the municipal. Household FI and maternal depression were measured using the FI Experience Scale and Patient Health Questionnaire 9-item in personal interviews. Logistic regression analysis was used to identify the factors associated with household FI and maternal depression and the association between these two constructs. **Results.** The mean age of mothers was 30.1(±6.5) years with almost all practising Islamic religion (96.2%) and were married (96.7%). The prevalence of household FI and maternal depression were 51.6% and 25.3%, respectively. The determinants of household FI were mother's self-health rating, social support, nutrition knowledge, and household's source of drinking water, while those of maternal depression were the mother's work, place of residence, self-health rating, and nutrition knowledge. In multivariable adjusted logistic regression analysis, women in food insecure households were about three times more likely than women in food secure households to be depressed (adjusted odds ratio = 2.49; 95% confidence interval: 1.36–4.55; and $p = 0.003$). **Conclusion.** The current study shows a high prevalence of both household FI and depression in mothers in Savelugu Municipality. Both personal and household characteristics of the women are associated with household FI and maternal depression statuses, and the two constructs are highly correlated. It is recommended to include depression assessment in interventions for FI.

1. Introduction

Food security is all people having physical, social, and economic access to sufficient, safe, and nutritious food at all times to meet their dietary needs and food preferences for a healthy life [1]. It encompasses food availability and affordability, the cultural norms on acceptable means of food acquisition, and food use [2]. Although much effort has been made over the past twenty-five years to increase global food production, over 820 million people worldwide have insufficient food access [3]. Conflicts, insecurity, climate shocks, and economic turbulence are the recent main drivers of food insecurity (FI) at the national level [4].

The determinants of FI include age, educational level, body mass index, marital status, self-rated health status, smoking status, household composition [5, 6], unemployment, childbirth, and loss of social benefits [7, 8]. Individuals who have less cash to spend on food are constrained not exclusively to purchase less expensive food, regularly with higher substance of fat and basic sugars, but even to decrease their food admission [9]. Besides, a few examinations reported lower purchases of natural products, vegetables, and dairy items in food-uncertain family units, resulting in poorer well-being results, including increment in interminable disease [10, 11]. There are studies linking FI and diseases including corpulence, hypertension, and

diabetes mellitus [12]. A considerably progressively major issue is that young children belonging to food insecure families are at greater risk for wellbeing, formative, and conduct issues [12, 13].

“Depression is a mental disorder characterised by low mood, loss of interest or enjoyment, and reduced energy, leading to increased fatigue, reduced activity, and marked functional impairment” [14]. It is associated with reduced concentration, negative self-esteem, feeling of unworthiness, self-harm ideation, disturbed sleep, disturbed appetite, and irritability. The consequences of depression in mothers include spontaneous abortion, preterm delivery, low birth weight, and stillbirth.

FI experienced by a mother may impact seriously not only her physical appearance but also her mental health and may correlate with poor mental health [15, 16]. FI has been reported to correlate with poor mental health among some vulnerable populations in sub-Saharan Africa i.e., pregnant and postpartum women [17–19] and this may in the long run affect the nutritional status of household members, especially of children [20].

The association between FI and depression among women is of particular concern for some reasons. Firstly, women are disproportionately affected by FI. Secondly, poverty negatively impacts food security, and poverty is more prevalent among women compared to men [21]. In Ghana, women from minority groups and single mothers have been noted to experience high rates of poverty [22].

Savelugu Municipal in the Northern Region of Ghana has experienced perennial flooding in recent years, and households in this area could be experiencing some form of FI [21]. There is however no known study that determined the FI situation or its determinants in the area. Similarly, depression in women is less studied, and its determinants in the study area are largely unknown. Also, information on how household FI relates to depression in women in Northern Ghana at large is scarce. It is therefore prudent to conduct a study to this effect to fill these research gaps. This study investigated the magnitude and factors associated with household FI and depression and their association with one another.

2. Methodology

2.1. Study Design, Population, and Setting. An analytical, community-based, cross-sectional design was employed for this study involving women with children (6–59 months) in Savelugu Municipal, Northern Region, Ghana. The municipality shares boundaries with West Mamprusi, Karaga, and Kumbungu Districts and then Sagnarigu Municipal [23].

2.2. Sample Size Determination and Sampling Procedure. It was estimated to study 364 mothers of children under five years. The study used a 3-stage sampling procedure to select communities, households, and mothers [24]. Twenty-five communities were randomly selected, with 14 households/

mothers per community using systematic random sampling. The households in the selected communities were enumerated and numbered. The number of households in a community was divided by the sample size for the community ($n=14$) to determine the sampling interval. To identify the first household for visitation, a number within the sampling interval was randomly selected. The next household for visitation was identified by adding the sampling interval to the selected number, and the procedure was repeated until the 14 households needed from each community were recruited. In the selected households, mothers of children under 5 years were identified and interviewed. In households with more than one eligible study participant, one respondent was selected using simple random sampling.

2.3. Data Collection Procedure, Questionnaires, and Description of Variables. Data collection took place in the period of January to March, 2019. After sampling and informed consent, personal interviews were carried out in the homes of respondents using validated questionnaires. Data were collected on depression, household FI, social support, autonomy, and socio-demographic characteristics of respondents. Information was also collected on water source for the households, nutritional knowledge, and nutritional status of the respondents. The interviews were conducted in the local language spoken in the study area by 4 enumerators and two supervisors. The enumerators were graduates of the BSc Community Nutrition programme and the supervisor lecturers from the Department of Nutritional Sciences, UDS, Tamale. Prior to the data collection fieldwork, the research team underwent 3 days of training. The independent determinants of the study were depression and household FI. The rest of the variables assessed were used as potential determinants of household FI and maternal depression statuses.

2.3.1. Depression. Patient Health Questionnaire 9-item (PHQ-9) was used to assess the depression status of respondents [25]. The PHQ-9 is a 9-item scale with nine criteria including suicidal ideation, feelings of worthlessness, and depressed mood on which the diagnosis of depressive disorder is based. The women were asked how often they experienced the depressive symptoms in the last two weeks. The responses to the scale consist of four-point Likert scale “Never,” “Several days,” “More than half the days,” and “Nearly every day” which are scored “0,” “1,” “2,” and “3,” respectively. The total score for the PHQ-9 ranges from 0 (no symptom present) to 27 (symptoms present nearly every day), with a higher score depicting increasing risk of depression. A cut-off score of 10 is used to screen for depression: i.e., score <10 depression not present and score ≥ 10 depression present. The scale is widely used in screening and monitoring the severity of depression [26] and has acceptable level of validity and reliability. It has previously been validated in large studies [27] and used in some studies in Africa [28].

2.3.2. Household Food Security. The FI Experience Scale (FIES) was used to measure respondents' household food security. The FIES was developed to be used in monitoring hunger worldwide [29] and is part of the annual Gallup World Poll in 150 countries [30]. FIES consists of 8 items and elicits self-reported experiences and behaviours on food access due to lack of resources (including money), over a reference period. The women answered "yes" or "no" to the 8 questions on the household's food access over the last one month before survey with a "no" response scoring "0" and "yes" response scoring "1." The responses were summed up to give total scores in the range of 0–8, with a higher score indicating greater probability of household FI. Household FI was classified into two (2) categories: food secure (total score <4) and food insecure (total score ≥4) [29].

2.3.3. Self-Health Rating. This was assessed using the self-health rating question which is a single question that captures how healthy people think they are. The question is, "In general, would you say your health is poor, fair, good, very good, or excellent?" The respondents rate their own physical health using a 5-point scale ("excellent" = 1; "very good" = 2; "good" = 3; "fair" = 4; and "poor" = 5). The responses were grouped into three: excellent, good/very good, and poor/fair for statistical analysis.

2.3.4. Social Support. The social support scale was used to measure perceived social support received by the respondents [31]. This tool consists of fourteen (14) items and measures feeling loved, cared for, and valued; tangible help or assistance with tasks; and advice or guidance from experts and elders among the sample. For each item, respondents were asked to say the amount of support that they received, relative to what they anticipated to have received i.e., "as much as I would like" = 5, "almost as much as I would like" = 4, "some but I would like more" = 3, "less than I would like" = 2, and "much less than I would like" = 1. The scores, when added up, range between 14 and 70, with a higher score indicating an increased amount of support perceived to have been received. A cut-off of 35 is used to determine the amount of support received, raw score <35 indicates inadequate social support, and raw score ≥35 indicates adequate social support.

2.3.5. Maternal Autonomy. Maternal autonomy was measured using a scale on whether the women are involved in making a decision in the household i.e., deciding on how money is to be spent, seeking health care, making purchases, and family visits [32]. The scale involves eight questions and was scored 2 points when a decision was made by only the woman, 1 point when made by the couple, and no points when made by other household members. The scores were aggregated, and the sum ranges from 0 to 16. Women having scores of 8 or more were considered to have adequate autonomy; otherwise, they had inadequate autonomy.

2.3.6. Household Drinking Water. Household drinking water type was assessed by adopting the guidelines proposed

by the UNICEF Global Framework for Urban Water, Sanitation and Hygiene [33]. Drinking water source was classified as "improved" if it included the following: piped water, packaged water, boreholes, and protected dug wells; otherwise, it was classified as "unimproved."

Nutrition knowledge: Knowledge on nutrition was measured based on 15 "true" or "false" response questions on the importance of nutrients and their food sources, healthy meal proportion and serving sizes, and food safety practices. A correct answer scored "1" and a wrong answer "0." The scores were summed up, and the mean score (12) was used to divide the women into inadequate (score <12) and adequate (score ≥12) nutrition knowledge categories.

2.3.7. Body Mass Index. With regards to nutritional status, the body mass index was used as a proxy. Height measurement to the nearest 0.1 cm and later converted to meters using a stadiometer was taken, while the weight of the respondents to the nearest 0.1 kg was also measured using a Seca scale. The body mass index values were then calculated to the nearest kg/m² using the formula weight (kilogrammes) divided by height (metres) squared. Body mass index categories: <18.5 kg/m², 18.5–24.9 kg/m², and ≥25.0 kg/m² were classified as underweight, normal weight, and overweight/obesity, respectively, based on WHO recommendations.

Socio-demographic and -economic characteristics: Data were collected on age (in years), religion, ethnic group, marital status, physiological state, and parity of the respondents and on educational levels and occupations of both respondents and their partners.

To assess the socio-economic status of respondents, data were collected on the possession of 13 household items i.e., television set, satellite dish, radio, DVD player, motorcycle, bicycle, refrigerator, sewing machine, electric fan, personal computer, mattress, animal-drawn cart, and car. Possession of each item was scored "1," and nonpossession was scored "0." Principal component analysis was used to derive wealth scores which were ranked and divided into tertiles: low, medium, and high.

2.4. Ethics Approval and Consent to Participate. The research process complied with the ethical principles of Helsinki Declaration. Ethical clearance was obtained from the Committee on Human Research, Publications and Ethics, Kwame Nkrumah University of Science and Technology and Komfo Anokye Teaching Hospital, Ghana (CHRPE/AP/601/21). Written informed consent was obtained from the study participants before the interviews were conducted.

2.5. Data Analysis. The data were analyzed using Stata, version 15 (Stata Corp). The results were presented using descriptive statistics. To identify the determinants of household FI, all potential determinants of household FI were entered into the model and stepwise backward selection logistic regression was performed. This procedure was also repeated to identify the determinants of depression. To

explore the association between household FI and depression, logistic regression was carried out and the determinants of both household FI and depression were controlled for. The outputs of the logistic regression analyses were presented as adjusted odds ratios (AORs) with 95% confidence intervals (CIs). Model fit was evaluated using Hosmer–Lemeshow goodness of fit test. Associations were considered statistically significant at p values <0.05 .

3. Results

3.1. Sociodemographic and- Economic Characteristics of Respondents. The mean age of mothers was 30.1 (± 6.5) years with more than a quarter (26.9%) in the 25–29 years age group (Table 1). The study participants consisted predominantly of married mothers (96.7%), Muslims (96.2%), and persons from the Dagomba ethnic origin (95.9%).

With regards to the education and occupation of the mothers, two-thirds (67.0%) of them had no education and the majority (43.4%) were farmers. More than half (53.8%) of the respondents' partners had no education and 62.4% were engaged in farming activities (Table 1). Most mothers (41.8%) rated their health as very good/good, with similar proportions reporting adequate autonomy and social support (40.1% and 42.3%), respectively. Almost nine in every ten (88.2%) of the sampled mothers were currently breastfeeding, while most (45.3%) had delivered three or four children. The average body mass index of the sampled participants was $22.5 \pm 3.5 \text{ kg/m}^2$, with 19.0% and 22.0% classified as thin and overweight/obese, respectively. On nutrition knowledge, about half (51.9%) of the respondents were classified to have adequate nutrition knowledge.

Sampled households were large, with 87.6% having at least 7 occupants. On the household wealth index, the majority (37.6%) were on the middle tertile. About two-thirds (64.0%) of the households had safe drinking water with 94.2% living in homes with unimproved toilet facilities.

3.2. Prevalence and Determinants of Household Food Insecurity. About half of the households (51.6%) were identified to have some form of FI, with a third (29.9%) having severe FI. In the multivariate analysis, age, nutrition knowledge, self-health rating, social support, and type of drinking water were statistically associated with household FI (Table 2). Younger mothers (≤ 24 years) were about three times more likely to report household FI compared to those aged 30–34 years (AOR = 2.68; 95% CI 1.45–4.96; and $p = 0.002$). The odds of FI were higher among mothers who rated their health as good/very good compared to those who rated their health as excellent (AOR = 2.42; 95% CI: 1.41–4.14; and $p = 0.001$). Social support indicates some protection against FI. Women from households with inadequate social support were more likely to experience FI compared to mothers who reported adequate support (AOR = 2.85; 95% CI: 1.73–4.69; and $p < 0.001$). Again, women who had inadequate nutrition knowledge were almost five times more likely to be food insecure as compared to those who had adequate nutrition knowledge

TABLE 1: General background characteristics of respondents.

Characteristic	Frequency (n)	Percentage
Age group (years)		
≤ 24	81	22.3
25–29	98	26.9
30–34	71	19.5
35–39	78	21.4
≥ 40	36	9.9
Marital status		
Not married	12	3.3
Married	352	96.7
Educational level		
None	244	67.0
Primary and above	120	33.0
Religion		
Other	14	3.8
Islam	350	96.2
Ethnicity		
Dagomba	349	95.9
Other (Mamprusi, Akan, and Gonja)	15	4.1
Work		
Farming	158	43.4
Trading	68	18.7
Unemployed	78	21.4
Other	60	16.5
Parity		
1–2	80	22.0
3–4	165	45.3
≥ 5	119	32.7
Self-health rating		
Excellent	99	27.2
Good/very good	152	41.8
Poor/fair	113	31.0
Nutrition knowledge		
Inadequate	175	48.1
Adequate	189	51.9
Social support		
Inadequate	210	57.7
Adequate	154	42.3
Autonomy		
Inadequate	218	59.9
Adequate	146	40.1
Nutritional status		
Underweight	69	19.0
Normal weight	215	59.1
Overweight/obesity	80	22.0
Physiological state		
Lactating	321	88.2
Pregnant	13	3.6
Nonpregnant and nonlactating	30	8.2
Spouse/partner's educational level		
None	196	53.8
Primary	45	12.4
Junior high school and above	123	33.8
Spouse/partner's work		
Farming	227	62.4
Other	137	37.6
Number in the household		
Less than 7	45	12.4
At least 7	319	87.6
Drinking water source		

TABLE 1: Continued.

Characteristic	Frequency (<i>n</i>)	Percentage
Improved	235	64.6
Unimproved	129	35.4
Toilet type		
Improved	21	5.8
Unimproved	343	94.2
Household wealth index (tertile)		
Low	124	34.1
Middle	137	37.6
High	103	28.3
Residence area		
Rural	191	52.5
Urban	173	47.5

(AOR = 5.23; 95% CI: 3.15–8.68; and $p < 0.001$). Mothers from households with unsafe drinking water were about three times more likely to experience FI as compared to those who had safe drinking water (AOR = 2.70; 95% CI: 1.62–4.48; and $p < 0.001$).

3.3. Prevalence and Determinants of Depression. A fourth of the respondents screened positive for depression (25.3%), with 8.0% having moderately severe depression. Multivariable analysis has identified self-health rating, nutrition knowledge, autonomy, work, spouse/partner's work, and residential area to be statistically associated with depression (Table 3). The odds of depression increase with the poorness of the self-health rating; women who rated their health as good/very good (AOR = 3.05; 95% CI: 1.36–6.85; and $p = 0.007$) and poor/fair (AOR = 4.38; 95% CI: 1.96–9.81; and $p < 0.001$) were three and four times, respectively, more likely to have depression compared to those who rated their health as excellent. Similarly, the risk of depression in mothers with inadequate autonomy was significantly higher compared to those with adequate autonomy (AOR = 1.99; 95% CI: 1.10–3.60; and $p = 0.022$). The risk of depression in mothers was significantly higher among those with inadequate nutrition knowledge compared to those with adequate nutrition knowledge (AOR = 3.81; 95% CI: 2.17–6.69; and $p < 0.001$). While trading was protective of depression in the mothers (AOR = 0.25; 95% CI: 0.10–0.62; and $p = 0.003$), partners/spouses engaged in work classified as “others” had a higher risk of depression (AOR = 2.16; 95% CI: 1.20–3.88; and $p = 0.010$). Mothers residing in rural areas had almost twice the risk of depression compared to their urban counterparts (AOR = 1.96; 95% CI: 1.14–3.37; and $p = 0.015$).

3.4. Association between Household Food Insecurity and Depression Status. In unadjusted logistic regression analyses, mothers from households with FI were four times more likely to experience depression as compared to those from food secure households (OR = 4.15, 95% CI: 2.43–7.10, and $p < 0.001$) (Table 4). However, in the adjusted model, the risk of depression decreased but not attenuated; the mothers

from food insecure household were about three times more likely to experience depression compared to those from food secure households (AOR = 2.49, 95% CI: 1.36–4.55, and $p = 0.003$).

4. Discussion

4.1. Prevalence and Determinants of Household Food Insecurity. This study revealed that about half of the study households have FI. The estimated prevalence of FI in this study however compares well with a previous study among mothers in the Tamale Metropolis in which 54.0% were reported to be food insecure [34]. Again, data from the 2012 Feed the Future baseline survey conducted in the Northern region of Ghana estimated household FI at 36.0% [35]. The high prevalence of FI recorded in this study population may have several potential causes including climate shocks, frequent flooding, bush fires, droughts, and the recent devastating effects of the fall army worms. Also, the survey conducted in the lean season which may have contributed to the high prevalence of FI observed as seasonality is documented to influence household food availability [36].

Self-health rating and social support were statistically associated with household FI. The risk of FI is higher among mothers with poor self-health rating. Similar results have been reported in India among low-income women [37] and among the Appalachian Ohio populace [38] where FI was significantly associated with poorer self-health rating. The finding of the current work may be explained by the women's inability to work due to health issues and its attendant lack of financial capabilities to procure food and access health care. Good health ensures increased productivity and sufficient household income which in the long run ensures household food security. The needed attention on health promotion among respondents is crucial for the attainment of long-term food security. On the other hand, it is possible that there is a bidirectional relationship between health and FI, making women without adequate food resources to experience nutritional deficiencies leading to mental health issues. The work of Walker and colleagues in the Appalachian Ohio population also suggests that more social support is strongly associated with high household food sufficiency [38]. In this study, adequate social support provided some insulation against FI; women with adequate social support were less likely to experience household FI compared to mothers who reported inadequate support. This finding is in line with a cross-sectional study in Nicaragua by Ziaei and colleagues which showed that women with the lowest social support were more likely to be found in food insecure households [39]. Also, a study among Ugandan mothers showed that mothers with higher social support scores were more likely to be food secure [40].

Other determinants of food insecurity were nutrition knowledge, age, and source of drinking water. Women who had inadequate nutrition knowledge were more likely to be food insecure as compared to mothers who had adequate knowledge in nutrition. While it is not clear how these two are related, it is possible that the same factor predisposing the women to have inadequate nutrition knowledge, e.g.,

TABLE 2: Determinants of household food insecurity.

Household food insecurity	Adjusted odds ratio	95% confidence interval for the adjusted odds ratio	<i>p</i> value
Self-health rating			
Excellent	1.00		
Good/very good	2.42	1.41–4.14	0.001
Social support			
Adequate	1.00		
Inadequate	2.85	1.73–4.69	<0.001
Nutrition knowledge			
Adequate	1.00		
Inadequate	5.23	3.15–8.68	<0.001
Age group (years)			
30–34	1.00		
≤24	2.68	1.45–4.96	0.002
Drinking water source			
Improved	1.00		
Unimproved	2.70	1.62–4.48	<0.001

*Variables entered into the model: age, marital status, educational level, occupation, parity, self-health rating, nutrition knowledge, social support, autonomy, nutritional status, husband's educational level, husband's occupation, household size, household drinking water, and residential area type.

TABLE 3: Determinants of depression.

Depression	Adjusted odds ratio	95% confidence interval of the adjusted odds ratio	<i>p</i> value
Self-health rating			
Excellent	1.00		
Good/very good	3.05	1.36–6.85	0.007
Poor/fair	4.38	1.96–9.81	<0.001
Autonomy			
Adequate	1.00		
Inadequate	1.99	1.10–3.60	0.022
Work			
Farming	1.00		
Trading	0.25	0.10–0.62	0.003
Nutrition knowledge			
Adequate	1.00		
Inadequate	3.81	2.17–6.69	<0.001
Residential area			
Urban	1.00		
Rural	1.96	1.14–3.37	0.015
Spouse/partner's work			
Farming	1.00		
Other	2.16	1.20–3.88	0.010

*Variables entered into the model: age, marital status, educational level, occupation, parity, self-health rating, nutrition knowledge, social support, autonomy, nutritional status, husband's educational level, husband's occupation, household size, household drinking water, and residential area type.

educational attainment, may also be contributing to household FI, hence the correlation among them.

Younger mothers are more likely to experience household FI compared to older ones. Being younger could be associated with FI because the young women may not have a regular source of income or may not be married and therefore lack spousal support. Mothers from households

with an unsafe source of drinking water were more likely to be food insecure as compared to those from households with safe drinking water sources. This is consistent with the findings in South Africa that reported a positive association between safe drinking water and household food security [41]. The use of unsafe water can predispose to water-borne diseases potentially depriving the women participation in

TABLE 4: Association between household food insecurity and depression status.

Depression	Odds ratio	95% confidence interval of the odds ratio	<i>p</i> value
Crude model			
Household food insecurity			
No	1.00		
Yes	4.15	2.43–7.10	<0.001
Adjusted model			
Household food insecurity			
No	1.00		
Yes	2.49	1.36–4.55	0.003

Adjustment was done for residential area, self-health rating, nutrition knowledge, autonomy, work, and spouse/partner's work.

income earning activities which may impact the ability to procure food. Another possible explanation for the observed association is that access to unsafe water and household FI both occurred as a result of the same underlying factor (lack of financial resources), hence the correlation among them.

4.2. Prevalence and Determinants of Depression.

Depression prevalence in this study was high with 25.3% of the mothers identified as depressed. This calls for greater attention as similar results have been found in the study region in previous studies (16.8% [42] and 28.7% [43]). The consequences of the high prevalence of depression observed in this study may not only place a significant burden on affected mothers but also significantly affect their infants and children.

Self-health rating, autonomy, work, nutrition knowledge, residential area of the women, and spouse/partner's work were found to be associated with depression. The odds of depression were higher among mothers with fair/poor and very good/good self-health ratings compared to those with excellent health rating. Similar to these findings are the data from the United States reporting high depressive symptoms among those with low self-health rating [44]. Self-health rating significantly correlates with poor health, so these women may be living with chronic diseases, making it difficult for them to work and earn income for buying food, hence its association with FI. We also found autonomy status to be related to depression status; women with lower autonomy were more likely to be depressed. Similar to our finding, Bou Malhab et al found that Lebanese women with low autonomy had significantly higher perceived stress, anxiety, and probable depression [45]. The possible link between autonomy and depression appears to be through health decision-making; the more autonomous women can quickly seek treatment for illness compared to those with lower level of autonomy. In this study, the kind of job mothers or their partners engaged in impacted their risk of depression. The odds of depression were significantly lower among mothers engaged in trading and significantly higher for the partners engaged in other work compared to farming. A review to assess social determinants of mental health identified job as a determinant of depression [46]. Trading appears to be a relatively easier work compared to farming which requires a lot of physical exertion probably increasing the odds of depression for the mothers. Mothers' nutrition

knowledge was identified to have an impact on their depression status; mothers with inadequate nutrition knowledge have higher risks of depression compared to those with adequate knowledge. The nature of this link is not clear, but it is possible that the same factor led to the occurrence of the two, hence their correlation with one another. The type of place a mother stays has effects on the risk of depression. Rural mothers were more likely than their urban counterparts to be depressed. This is similar to findings elsewhere [47]. In contrary to this finding, Vigod and colleagues found high prevalence of postpartum depression among women living in urban areas compared to those living in rural areas [48]. It is possible that women in urban settings had better educational attainment, socio-economic conditions, and easy access to health care, making the onset and severity of depression less than for women in rural settings.

4.3. Association between Household Food Insecurity and Depression.

Mothers from food insecure households had three times the chance of experiencing depression as compared to those from food secure households. This is similar to a study in South Africa which revealed that the odds of depression among food insecure individuals were more than four when compared to food secure households (AOR=4.51 and 95% CI: 2.01–10.09) [17]. Similarly, Khan and Flora reported that household food insufficiency impacted negatively on self-reported depressive symptoms among mothers, with mothers from food insecure homes having about five times the odds of having maternal common mental disorder [49]. Our finding is however contrary to the finding of no association between FI and mental illness which was reported by another study conducted in Ghana, Nigeria, and Uganda [50].

The possible mechanism for the association between household FI and poor mental health has been suggested to be bidirectional [15]. On the one hand, the stress and anxiety related to FI may increase the risk of or predispose these women to poor mental health challenges, including depression [51], and on the other, women with poor mental health may be predisposed to FI because they are less likely to work or to access food and other supportive resources due to their condition. It is also possible that FI could cause insufficient nutrient intake, leading to the lack of critical nutrients for good mental health and consequently predisposing to mental health challenges.

4.4. Strengths and Limitations of the Study. The main strength of this analysis is the use of four widely validated international scales for data collection. With respect to limitations, the cross-sectional nature of the study design used is not appropriate for studying causation, so the study reported statistical associations.

5. Conclusions

About half of the respondents reported household FI, and a quarter screened positive for depression making these prevalent in the Savelugu Municipality. The determinants of household FI were mothers' self-health rating, social support, nutrition knowledge, and household's source of drinking water, while those of maternal depression were the mother's work, place of residence, self-health rating, and nutrition knowledge. Both household and personal characteristics of the women were associated with household FI and depression statuses, and the two constructs are highly correlated. It is recommended to include depression assessment in interventions for FI.

Abbreviations

AOR: Adjusted odds ratio
 CI: Confidence interval
 FIES: Food insecurity experience scale
 PHQ-9: Patient health questionnaire 9-item.

Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

AW designed the study, and IAM and VA oversaw the data collection. AW analysed the data, and IAM drafted the initial manuscript which was reviewed extensively by AW. All authors reviewed the manuscript.

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