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Stressor or succour? Examining the association between conflict, livestock assets, and farmers' mental health in Nigeria

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ABSTRACT

Farmers are disproportionately vulnerable to violent attacks in the conflict situation in Nigeria, with potential traumatising effects due to the destruction of agricultural livelihoods. In this study, we conceptualise the links between conflict exposure, livestock assets, and depression, using a cross-sectional nationally representative survey of 3021 Nigerian farmers to quantify the relationships. We highlight three main findings. First, conflict exposure is significantly associated with farmers exhibiting depressive symptoms. Second, holding higher herds of livestock, more cattle, and more sheep and goats while exposed to conflict is associated with higher risk of depression. Third, keeping more poultry is negatively associated with depressive symptoms. Finally, this study accentuates the significance of psychosocial support for farmers in conflict situations. The relationships between different livestock species and farmers' mental health may interest further research in strengthening the evidence.

1. Introduction

The farming population is disproportionately vulnerable to violent attacks in contemporary conflict situations in Africa, as attacks on food systems are also a weapon of war used by conflict actors (Kemmerling et al., 2022). Particularly in Nigeria, terrorism and conflict between farmers and herders are more concentrated among the farming communities and often lead to the destruction of human capital and livelihood assets such as livestock. While the economic impact of conflict on agricultural livelihoods has been quantified (e.g., Adelaja and George, 2019; Fadare et al., 2022), the psychological effect of conflict among the farming population, especially in low- and middle-income countries (LMICs), has not received adequate research attention. This study will expand the evidence on this neglected topic while highlighting key risk and protective factors associated with depression among farmers in Nigeria.

Unarguably, exposure to conflict has a negative psychological effect on the general population, as it leaves one in five people with one or more symptoms of mental disorders such as depression, anxiety, or post-traumatic stress disorder (PTSD) (Charlson et al., 2019). However, the psychological effect of conflict exposure may be severe for the farming population. This is because farming, more than many occupations, involves working in a hazardous and stressful environment (Olowogbon et al., 2019; Reed and Claunch, 2020), including exposure to pesticides, which is associated with depressive symptoms among farming households (Fuhrimann et al., 2022; Petarli et al., 2022). Additionally, perceived stress from uncertainty around financial strain, lack of social support, and threat to sources of livelihood are strong risk factors for depression for farmers (Hagen et al., 2021; Wang et al., 2019).

Exposure to conflict poses a significant threat to farmers' livelihoods and may reinforce mental stress through critical channels. First, conflict may lead to a significant financial shock to farmers and disengage them from social ties (Andersen et al., 2020). Especially given that farmers have limited access to insurance schemes or any form of social protection from the government to mitigate conflict risk (Agarwal et al., 2022; Bierbaum et al., 2021). Second, many farmers' store of wealth is their livestock assets, and there is a high likelihood of losing them. For example, in the prevailing conflict between farmers and herders and the targeting of cattle by terrorist groups to finance arms purchases in Nigeria (FATF-GIABA-GABAC, 2016; Okoli, 2019).

Consequently, farmers with more herds of livestock may be more psychologically stressed due to perceived threats to their livestock assets than those with less herd size. At the same time, fewer livestock holdings may correlate with poverty (Ellis and Mdoe, 2003; Randolph et al.,

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2007), while poor people may be more inclined to poor mental health (Haushofer and Fehr, 2014; Lund et al., 2010). However, holding more herds of livestock can improve farmers' mental health (Nuvey et al., 2020) owing to the many benefits livestock provide (Hidoto, 2015; Maass et al., 2012). Additionally, farmers with more herds of livestock in conflict situations may diversify livestock assets to smaller species as a risk mitigation strategy and to reduce psychological stress (Rockmore, 2020; Fadare et al., 2022). Given also that different livestock species have peculiar characteristics, farmers may leverage these to increase resilience.

Evidence suggests that small livestock species are more resilient to conflict risk (Cox, 2012; Maass et al., 2012) and may have psychological benefits beyond the income they provide in distressing situations (Glass et al., 2014, 2017). There are some additional insights from the studies by Alders et al. (2021) and Cacciatore et al. (2020) on the therapeutic benefits of keeping livestock. However, understanding the links between conflict exposure, livestock assets, and the psychological well-being of farmers is crucial. More importantly, there is a need for research to improve evidence of farmers' mental health state and their determinants in LMICs, where stressful events among the farming population have significantly increased.

In this study, we examine the association between conflict, livestock assets and depression among farmers in Nigeria, a country where attacks from terrorism and farmer-herder conflict have increased significantly in the recent decade. Using cross-sectional agricultural household data and georeferenced conflict data, we measure conflict exposure (objective measure) as a binary variable, which classifies farmers as living in conflict locations or not. Additionally, we employ self-reported conflict experienced (subjective measure) binary variable to capture farmers that relocated to non-conflict locations. The livestock variables are measured using the livestock diversification index, total livestock herd size, and three categories of livestock species – cattle, sheep and goats, and poultry. Needless to say, the cross-sectional nature of our data presents significant challenges for causal identification in our empirical models. In particular, we cannot adequately account for biases resulting from omitted variables, sample selection, and simultaneity. However, we include a rich set of control variables and employ objective and subjective measures of conflict to reduce biases.

We find that two in five farmers (41%) in Nigeria fall in the probable depression category or are at risk of depression, that is, have the 10-item Center for Epidemiological Studies-Depression Scale (CES-D) score greater or equal to eight. The regression results show that exposure to conflict has a significant association with farmers exhibiting depressive symptoms or being at risk of depression, evidence strongly supported by a recent study among the general adult population in Nigeria (Sato et al., 2022). However, among the farming population, closely related to our findings are results in the studies by Hagen et al. (2021), Nuvey et al. (2020), and Olff et al. (2005). The authors found a significant association between livestock farmers' exposure to disease outbreaks and poor mental health.

Our findings further show that conflict-exposed farmers with more herds of livestock, particularly cattle, are at a higher risk of depression. However, such an association may not be generalised for some adverse events farmers face. For example, a study conducted by Nuvey et al. (2020) in Ghana revealed a positive correlation between the number of cattle herds possessed by farmers and their mental well-being in the context of disease outbreaks. This association may be due to the fact that farmers with a larger number of livestock assets have greater capability to mitigate the adverse effects of disease outbreaks by accessing veterinary services and purchasing necessary drugs. The ability to control such adverse situation can lead to improved mental health, as farmers are able to continue to derive social and economic benefits from their livestock. Additionally, this study also finds evidence supporting the hypothesis that keeping more poultry birds can have a negative impact on farmers' depressive symptoms. The coefficient of livestock diversification is negatively associated with depression. However, this relationship is not statistically significant, suggesting that the trend towards diversification into smaller livestock species may not induce stress among farmers in conflict situations.

Our study extends the current knowledge on the factors associated with depression among the farming population by examining the mental health of livestock owners in conflict context. We provide new evidence to suggest that livestock holdings may serve as both protective and risk factors for depression among farmers depending on the circumstances at play, a significant contribution to the literature in LMICs. More importantly, in Nigeria, this is the first attempt to quantify the mental health state of farmers using a nationally representative data. Evidence can serve as a reference for policy interventions and programmes on the mental health of farmers in Nigeria, especially those exposed to traumatic events such as conflict. Finally, this study also strengthens our understanding of the link between agriculture and a less studied dimension of human health (mental health) in LMICs, and the findings can motivate further research in this area.

2. Related literature

Studies on the mental health of farmers have long been an important research theme but have gained significant interest in recent years. This is because farmers across the world are increasingly being exposed to stressors that often lead to mental disorders and suicide at the extreme. While the majority of the studies on farmers' mental health are carried out in developed countries, as evidenced by the recent systematic review of the literature (see Liang et al., 2021; Reed and Claunch, 2020; Santos et al., 2021), studies on the mental health of farmers in LMICs, particularly, Sub-Sharan Africa are just emerging. According to a systematic review of the literature on key risk factors affecting farmers' mental health globally from 1979 to April 2019, only a few studies contributed to the literature in Africa (Daghagh Yazd et al., 2019).

Unlike workers in most occupations, farmers are more exposed to stressors and distressing events such as crop pest and livestock disease outbreaks, extreme weather events, price shocks, and violent conflict, often resulting in losses of agricultural products and assets. According to the study conducted in 70 farming communities in Nigeria, almost all the farmers interviewed could identify stressors in farming, and 80% thought they had been affected by agricultural stressors in several ways (Olowogbon et al., 2019). Studies have also shown that experiences of adverse events such as disease outbreaks, cattle theft, and land-related conflict resulted in farmers' poor mental health (Nuvey et al., 2020; Olff et al., 2005). A recent study among 6413 beneficiaries of mental health and psychosocial support programme in the Democratic Republic of the Congo (DRC), Mali, and Nigeria reveals that 49% of the conflict victims were farmers (Andersen et al., 2022).

Conflict situations can be traumatising for farmers as their livestock assets become vulnerable to attacks. Evidence in northern Nigeria shows that livestock rustling, emaciation, disease, death, and distress sale are ways farmers lose livestock in conflict situations (Anne-Judith and Kinsumba, 2019). Further studies suggest a significant relationship between increased cattle rustling and farmer-herder conflict (George et al., 2021) or terrorist attacks in Nigeria (Okoli, 2019). Thus, farmers living in areas prone to farmer-herder conflict may be apprehensive and lose control over managing big livestock. Coping with conflict is also challenging as farmers may be displaced from their homes and livelihood activities, e.g., from accessing farmland or pasture. According to Sweetland et al. (2019), farmers' inability to cope with farming-related stressors hurts their livelihood outcomes – food security, income, asset accumulation, and by extension, their physical and mental health.

2.1. The role of livestock assets in the social and economic lives of households

Livestock assets play significant roles in human societies, the complexity of which is increasingly gaining recognition (Alders et al.,

2021). The literature suggests that for many livestock-holding households in Africa, cattle herds signify a store of wealth and play many other roles in households' social and economic lives. They serve as a means of land exchange and can function as draught animal power for ploughing, harvesting, transportation and hauling, including providing organic fertiliser for crop production. In some African cultures, cattle are used as payment for bride price, and social prestige is associated with the size of cattle holdings (Hidoto, 2015). Additionally, income from cattle sales and daily earnings from milk sales can meet the food and non-food need of households for smoothing consumption in most shock situations (Islam and Maitra, 2012), conflict situations being an exception since cattle are highly vulnerable to conflict.

Furthermore, sheep, goats, and poultry, even though they may not command a high monetary value per unit herd as cattle, are part of most households' social and economic lives. Poultry ownership can ensure households have regular access to animal-source food consumption and daily income from selling eggs. Similarly, small livestock requires less land and capital to rear and are mostly used for humanitarian support for the victims of conflict or extreme climate events (Watson and Catley, 2009). In addition, they have the advantage of generating income quickly. Studies have shown that in the long run, livestock species such as poultry and small ruminants could help boost and rebuild household wealth in conflict and post-conflict situations (Maass et al., 2012). These species are primarily relied upon for income generation, food, and other needs in the event cattle assets become susceptible to attacks, thus playing substituting or supplementary roles and helping households build resilience to conflict (Cox, 2012).

In Nigeria, livestock keeping, largely practised as subsistence and complementary to other non-farm activities, contributes significantly to food security and the general well-being of farming households. About 13 million households, or approximately 70% of agricultural households in Nigeria, own and manage at least one species of livestock (FAO, 2019), mostly chicken, goats, sheep, and cattle, as these are in high demand for meeting different human needs with no cultural barrier to their production. More importantly, the sales of livestock assets are the most important coping strategy in shock situations, next to assistance from family and friends (NBS, 2016). Even though livestock assets are vulnerable to conflict risk, their dynamic characteristics mean they can be used to build resilience.

3. The conceptual framework linking conflict, livestock assets, and depression

While the aetiology of depression remains complex (Kessler and Bromet, 2013), epidemiologic studies of depression show that 40–50% of depression risk is genetic. The study by van den Bosch and Meyer-Lindenberg (2019) depicts how exposure to environmental stressors can alter brain structures and functioning to induce depression or depressive symptoms through a biological pathway called chronic stress. Furthermore, chronic stress induces a state of chronic inflammation in the brain and triggers depressive symptoms and, subsequently, depression (Slavich and Irwin, 2014). According to Cohen and Wills (1985), stress is triggered when an individual considers a situation, such as protracted adverse situations, as threatening or demanding without an appropriate coping response, including feelings of helplessness.

We draw on the works of Cohen and Wills (1985) and van den Bosch and Meyer-Lindenberg (2019) to develop a conceptual framework for understanding the pathways through which conflict may induce depression among farmers. In Fig. 1, we show that following conflict exposure, a stressful event, livestock keepers undergo a situation appraisal process based on the different livestock assets they own, the perceived hazards, and the likely social support available from family and friends and community members. The outcome of such appraisal is a psychological response that determines the level of stress farmers develop.

In adverse situations, such as conflict, livestock assets may not guarantee positive well-being outcomes (Kazianga and Udry, 2006) except through another support system, including friends and family or social networks (Kutek et al., 2011), which provides financial aid, material resources, and needed services (Cohen and Wills, 1985). Cattle, in particular, are most vulnerable to attacks and cumbersome to manage in

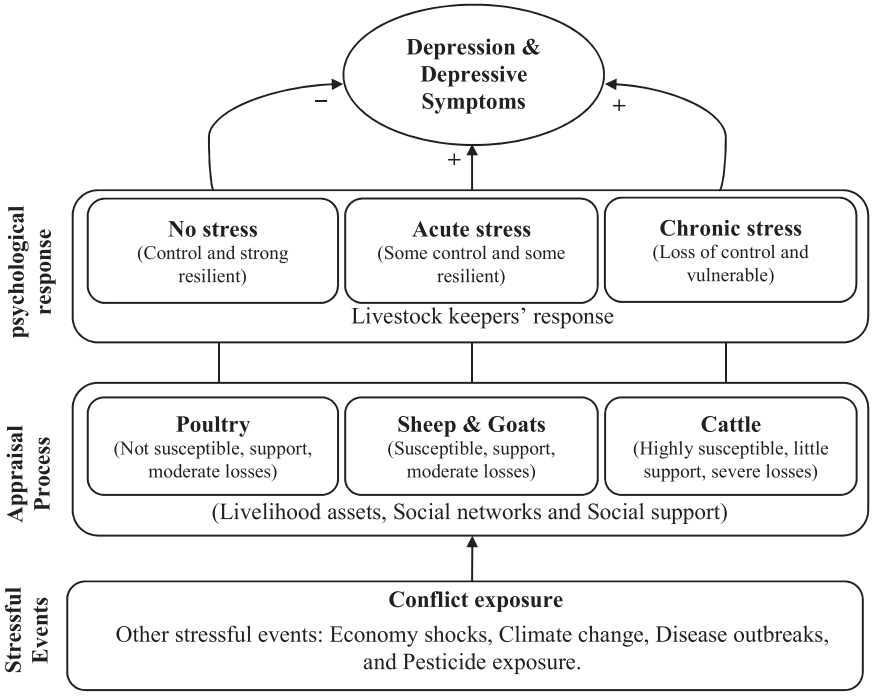

Fig. 1. Conceptual framework of the association between conflict exposure, livestock assets and depression. *Note:* Other stressful events listed are non-exhaustive but as captured in the literature review.
Source: Authors.

conflict situations because of their size, pastoralism production system, and economic and social-cultural value. They are also less likely to be given as a restocking relief in humanitarian programmes. Instead, cattle destocking is encouraged as a strategy to help households convert them to cash and minimise losses to events of conflict or drought (Watson and Catley, 2009). In the absence of intervention or support mechanisms, cattle holders may suffer huge losses and build up chronic stress and depression. Thus, we posit that holding more cattle in conflict situation can increase psychological stress for farmers.

While holdings of sheep and goats may subject farmers to a level of mental stress as cattle holdings if raised in the pastoralism production system, nevertheless, evidence shows that small livestock, including poultry, are more resilient in conflict situations. Hence, they may maintain a support system for farming households based on their peculiar characteristics and can be used in rebuilding stocks in the long run (Cox, 2012). Farmers may have a level of control in minimising their losses and appraise conflict situations as less stressful, especially if they diversify livestock holdings to smaller species to mitigate conflict risk. We posit that in conflict situation, sheep and goats owners with larger herd sizes may experience acute stress, while keepers of more poultry birds may not experience stress.

4. Conflict context, data, and empirical strategy

4.1. Conflict context in Nigeria

During the time of the survey, terrorism from Boko Haram and farmer-herder conflict are the prevailing violent conflict events in Nigeria. Terrorist attacks by the Islamic State and al-Qaeda-linked Boko Haram jihadist sects are directed mainly at civilians and vulnerable people. As of 2019, the group has carried out over 3000 attacks (UNDP, 2019) and has killed more than 27,000 civilians since 2009 (ICON and PSJ, 2020). Likewise, clashes between farmers and herders over pastureland and water often result in significant casualties. Since 2009, conflicts in Nigeria have resulted in over 3 million internally displaced persons (IDPs) (UNHCR, 2021), and many households have suffered abuses and lost assets, livelihoods, and family members. Violent conflict negatively impacts agricultural livelihoods in Nigeria, with major consequences for livestock assets. Key channels of attacks on livestock result from the pastoralism system of livestock production, which escalates land and water use conflict between farmers and herders and cattle rustling by terrorists to finance arms purchases.

4.2. Data

We use data from two sources: (i) agricultural household-level data from the 2016 survey round of the Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA) for Nigeria (NBS, 2016) and (ii) a global georeferenced conflict data collected from the Armed Conflict Location and Event Data, ACLED (Raleigh et al., 2010). The data were merged based on event time (year) and location (Local Government Area code, LGA) (ACLED, 2019). The LSMS-ISA is a nationally representative longitudinal data collected from 5000 households, out of which about 65% are agriculture households, with about 70% owning at least one livestock species. The agricultural household sub-section of the data collected in the 2016 round of the survey contains mental health questionnaire and captures 3021 households, which we employ in the analysis. The respondents for the mental health questionnaire were the heads of households or most senior members whom we identified as livestock keepers and managers of farmland. Hence, our primary unit of analysis is a farmer per household.

4.2.1. Measurement of depression symptoms

The LSMS-ISA adopted the 10-item Centre for Epidemiological Studies-Depression (CES-D) scale developed by Andresen et al. (1994) from the original 20-item CES-D scale developed by Radloff (1977). The 10-item CES-D scale has shown robust psychometric properties, predictive accuracy, and high correlations with the 20-item CES-D scale in community populations and has been validated in Africa (Baron et al., 2017). CES-D questionnaires are used as screening tools for detecting depression in general populations and are meant to identify symptomatic persons who may not otherwise be recognised and show the probability that they should ideally be referred to for psychosocial support. (Table 1).

The CES-D screening tool is composed of 10 questions on symptoms of depression. Respondents were asked the number of days during the last seven days they felt or behaved in a particular way to suggest they exhibited any of the symptoms (Table A in the Appendix contains the questions and the scoring procedures). A binary variable was generated for each of the depressive symptoms to categorise respondents as having depressive symptoms or not, and a CES-D score that ranges from 0 to 30 was generated by aggregating the ten depressive symptoms. A score of

Table 1
Description of variables used for analysis.

Variable	Description
CES-D score	Centre for Epidemiological Studies-Depression (CES-D) score
CES-D score≥ 8	1 if probable depression (CES-D score ≥8)
Main determining factors	
Conflict experienced	1 if respondent experienced at least one form of conflict between 2014 and 2016
Conflict exposure	1 if respondent lives in LGA that experienced at least one violent conflict attack within the past 12 months preceding the survey
Poultry	Tropical Livestock Unit (TLU) of poultry
Sheep-goats	Tropical Livestock Unit (TLU) of sheep and goats
Cattle	Tropical Livestock Unit (TLU) of cattle
All livestock	Tropical Livestock Unit (TLU) of all livestock species
LD Index	Livestock Diversification Index
Individual level factors	
Years of education	Years of education completed by respondents
Aged below 35 years	1 if respondent is below 35 years, 0 if otherwise
Aged between 35 and 64 years	1 if respondent is between 35 and 64 years, 0 if otherwise
Aged above 64 years	1 if respondent above 64 years, 0 if otherwise
Female	1 if respondent is female
Married	1 if respondent is married
Ill-health	1 if respondent suffered an illness/injury in the past 4 weeks
Experienced shocks	1 if respondent experienced at least one idiosyncratic or covariate shock between 2014 and 2016
Christianity	1 if respondent practices Christianity, 0 if other religions
Cooperative society member	1 if respondent is a member of a cooperative society
Household level factors	
Value of crops produced	Total value of crops produced by households over the last cropping season in Naira
Salary income	Total household annual income from salary in Naira
Other income sources	Total household annual income from other sources in Naira
HH dietary diversity	Household dietary diversity score measured using a 7-day recall period
Wealth index[a]	Household wealth index calculated from a set of durable assets excluding livestock assets
Household size	Number of household members
Rural location	Household is in rural area
Regional level factors	
North-central	Household is in North-central
North-east	Household is in North-east
North-west	Household is in North-west
South-east	Household is in South-east
South-south	Household is in South-south
South-west	Household is in South-west

[a] Household durable assets employed in computing the wealth index are type of materials used for housing wall, roofing, and flooring; ownership of car, motor-bike, bicycle, sewing machine, furniture, generator, mattress, fan, radio, cassette recorder, television set, iron, refrigerator, phone, wheelbarrow, cutlass, and hoe; and use of or access to public facilities.

30 on the 10-item CES-D score signifies a high risk of depression. Going by the cut-off point of the CES-D, a CES-D score ≥ 8[1] indicates probable depression category. We employ both the binary and the continuous outcome variables in our regression analysis. Table 2 shows the proportion of farmers exhibiting each of the depressive symptoms.

4.2.2. Measurement of conflict exposure

The *conflict exposure* variable is an objective measure and is defined as households in LGA that experienced at least one violent conflict attack in the last 12 months preceding the survey. This measure is used against a subjective measure where there may be a possibility of biased reporting of violence experienced by victims of traumatising events if talking about the situations will bring back pain. However, we capture farmers who have relocated to non-conflict areas by using subjective measure, *conflict experienced* variable, defined as self-reported violent conflict experienced by households between 2014 and 2016 (see Table B in the Appendix). This measure also serves as a robustness check for our analysis. In addition, incidents of conflict experienced within the LGA and by households are used for the bivariate analysis of the relationship between risk of depression (CES-D score) and conflict incidents.

4.2.3. Measurement of livestock assets

We employ the Tropical Livestock Unit (TLU) to measure the total livestock holdings and, separately, the sizes of cattle, sheep and goats, and poultry holdings. TLU is used to describe livestock numbers across species to quantify the total livestock holdings (see Rothman-Ostrow et al., 2020). Using TLU against the count of species also enables us to capture other minor species into the category of livestock they fit based on their sizes and management characteristics. In the data, cattle holdings are made up of a few donkeys, horses, and camels (5.2%), sheep and goats include 2% pigs, while poultry includes 3% rabbits and other smaller species (see Table C in the Appendix for the livestock species composition). The livestock diversification index (LD Index) was calculated using the share of the value of livestock species in the total value of livestock owned by households, following the computation approach in Fadare et al. (2022). The LD Index takes values from 0 to 1, with zero (0) representing high level of species specialisation while high level of diversification tends towards one (1).

4.3. Empirical strategy

The empirical analysis of the relationship between conflict, livestock assets, and mental health is not straightforward. Theoretically, conflict is endogenous in the mental health econometric model. Specifically, in the context of this study, conflict incidents are not random as there may be endogenous targeting for attack agropastoral communities with more livestock assets holdings or active farming activities (Eberle et al., 2020), subjecting the model to selection bias. There is also the possibility of omitted variables bias, measurement error, and simultaneity in the model. Examining the relationship using cross-sectional data limits the extent to which we can adequately account for possible biases. Against the complexity of the relationship examined, some steps were taken to ameliorate the biases. Aside from taking the sample from the farming population, which to a larger extent shares similar characteristics, we include several control variables in the models. We also test different models' specifications, using an objective and subjective measure of conflict. Nevertheless, we avoid making causal inferences from the findings and interpret results as association.

We employ both the logit and OLS regression models in estimating the relationship between conflict, livestock assets and depression symptoms. The models are specified as follows. Model (i) contains no interactions of livestock and conflict variables, while model specification (ii) contains conflict and livestock variables interaction terms.

$$D_{il} = \beta_0 + \beta_1 Conflict_{il} + \beta_2 \boldsymbol{L_{il}} + \beta_3 \boldsymbol{X_{ilhhh}} + \beta_4 \boldsymbol{Y_{ilhhh}} + \beta_5 \boldsymbol{Z_{lhhh}} + u_{il} \quad (1)$$

$$D_{il} = \beta_0 + \beta_1 Conflict_{il} + \beta_2 \boldsymbol{L_{il}} + \gamma Conflict_{il} * \boldsymbol{L_{il}} + \beta_3 \boldsymbol{X_{ilhhh}} + \beta_4 \boldsymbol{Y_{ilhhh}} + \beta_5 \boldsymbol{Z_{lhhh}} + u_{il} \quad (2)$$

Here, D_{il} represents depression variables; as binary outcomes, it takes the value of 1 if individual i in LGA l exhibited one of the depressive symptoms or has CES-D score ≥ 8 (i.e., is in probable depression), and 0 otherwise, while as a continuous outcome, it captures CES-D score, which ranges from 0 to 30. The main risk factor examined is conflict exposure or experienced, $Conflict_{il}$, with the value of 1 if individual i in LGA l is exposed to conflict or had experienced conflict, and 0 otherwise. Vector $\boldsymbol{L_{il}}$ contains livestock variables, which include the TLU of cattle, the TLU of sheep and goats, and the TLU of poultry of individual i in LGA l. While in alternative model specifications, livestock variable is entered as either TLU of all livestock species or as livestock diversification index.

We control for other factors that may determine depression in all the models. Vector $\boldsymbol{X_{ilhhh}}$ includes individual-level control variables, which are respondents' years of education, age categories, gender, marital status, health status, and shocks experienced, i.e., idiosyncratic and covariate shocks experienced by respondents' households (Table D in the Appendix contains the list of shocks experienced), religious affiliation, and cooperative society membership. Vector $\boldsymbol{Y_{ilhhh}}$ represents household-level control variables, including the total value of annual household crops produced, total annual household salary income and income from other sources, household size, food consumption in the past seven days – household dietary diversity, household wealth index, computed using principal components analysis on durable household assets, and rural or urban location. Lastly, $\boldsymbol{Z_{lhhh}}$ is a set of regional dummies representing the six geopolitical regions in Nigeria where a household is located. β_0 is the intercept, while β_{1-5} and γ are the estimated coefficients of the parameters, with γ being for the interaction terms, and u_l is the random-error term. Variables description and measurements are in Table 1.

Table 2
Percentages of farmers that exhibited symptoms of depression in the last seven days.

Depressive symptoms	Symptoms code	Yes (%)
Was disturbed by things that do not normally bother me	Disturbed	42
Had trouble keeping my mind on what I was doing	Troubled	41
Felt depressed	Depressed	49
Felt that everything I did was a burden	Burdened	38
Felt hopeful about the future	Hopeless	48
Felt afraid	Afraid	36
Had restless sleep	Restless sleep	56
Was unhappy	Unhappy	51
Felt lonely	Lonely	34
Did not feel like getting up in the morning	Not getting going	53

5. Results

5.1. Descriptive results

The descriptive results are reported in Tables 2 and 3, and in Fig. 2A and 2B. Table 2 shows that '*restless sleep* (56%), '*not getting going*' (53%), and '*unhappy*' (51%) are the top prevailing symptoms of depression exhibited by farmers, while '*burdened*' (38%), '*afraid*' (36%), and '*lonely*' (34%) are the least. Some studies have likewise reported a high prevalence of a few of these depressive symptoms among farmers.

[1] This cut-off point has shown good sensitivity and specificity and high internal consistency across age categories (Lewinsohn et al., 1997)

Table 3
Summary statistics of variables with mean difference between conflict and non-conflict exposed groups.

Variable (minimum/maximum of the full sample)	Full Sample		Conflict Exposed (33%)		Non-exposed (67%)		Mean difference
	Mean	SD	Mean	SD	Mean	SD	
Outcome variables							
CES-D score (0/30)	7.13	5.13	7.57	5.39	6.92	4.99	-0.65 ***
CES-D score ≥ 8 (0/1)	0.41	0.49	0.45	0.50	0.39	0.49	-0.06 ***
Main determining factors							
Incidents of conflict exposure (0/11)	0.53	0.92	1.53	1.38	0.0	0.0	-1.53 ***
Incidents of conflict experienced (0/8)	0.10	0.48	0.16	0.64	0.07	0.37	-0.09 ***
Conflict experienced (0/1)	0.07	0.25	0.10	0.30	0.05	0.22	-0.05 ***
Poultry TLU (0/0.71)	0.08	0.12	0.08	0.12	0.08	0.13	0.003
Sheep-goats TLU (0/5.2)	0.52	0.86	0.50	0.87	0.53	0.86	0.03
Cattle TLU (0/21)	1.42	8.04	0.83	4.56	1.71	9.26	0.88 ***
All livestock (0/25)	1.85	4.95	1.45	4.95	2.04	5.44	0.59 ***
Livestock diversification index (0/0.70)	0.12	0.18	0.11	0.17	0.13	0.18	0.02 **
Individual level factors							
Years of education (0/18)	5.94	6.28	6.31	6.43	5.77	6.20	-0.55 **
Household head age in year (16/93)	53.32	14.32	53.29	13.79	53.34	14.58	0.04
Aged below 35 years (0/1)	0.08	0.28	0.07	0.26	0.09	0.29	0.02 **
Aged between 35 and 64 years (0/1)	0.68	0.47	0.70	0.46	0.67	0.47	-0.03 *
Aged above 64 years (0/1)	0.23	0.42	0.23	0.42	0.24	0.43	0.01
Female (0/1)	0.16	0.37	0.17	0.38	0.16	0.37	-0.01
Married (0/1)	0.77	0.42	0.76	0.43	0.77	0.42	0.01
Ill-health (0/1)	0.20	0.40	0.21	0.41	0.20	0.40	-0.01
Experienced shock (0/1)	0.35	0.48	0.38	0.49	0.34	0.47	-0.05 ***
Christianity (0/1)	0.51	0.50	0.60	0.49	0.47	0.50	-0.13 ***
Cooperative society member (0/1)	0.09	0.28	0.08	0.27	0.09	0.29	0.01
Household level factors							
Value of crops produced '10,000 (0/76)	15.46	17.00	17.38	18.78	14.53	15.98	-2.85 ***
Salary income '10,000 (0/904)	51.18	1280	96.36	2130	29.16	471.24	-67.2
Other income sources '10,000 (0/162)	2.97	54.97	6.32	95.11	1.33	8.93	-4.99 **
Household dietary diversity score (1/12)	7.93	1.91	7.80	1.95	7.99	1.89	0.19 ***
Wealth index (−4.14/5.01)	-0.53	2.17	-0.46	2.17	-0.56	2.17	-0.10
Household size (1/34)	7.74	3.61	7.96	3.60	7.63	3.61	-0.34 **
Rural location (0/1)	0.86	0.34	0.90	0.31	0.85	0.36	-0.05 ***
Regional level factors							
Northcentral (0/1)	0.18	0.38	0.23	0.42	0.16	0.36	-0.07 ***
Northeast (0/1)	0.17	0.38	0.25	0.43	0.14	0.35	-0.11 ***
Northwest (0/1)	0.25	0.43	0.14	0.35	0.30	0.46	0.16 ***
Southeast (0/1)	0.19	0.39	0.19	0.39	0.19	0.40	0.01
Southsouth (0/1)	0.13	0.34	0.17	0.37	0.11	0.32	-0.06 ***
Southwest (0/1) (base category)	0.08	0.27	0.03	0.18	0.10	0.30	0.07 ***
Sample size	3021		990		2031		

Note: The mean difference in the characteristics of conflict-exposed and non-exposed farmers, based on independent sample t-tests for continuous variables and Pearson chi-square test for categorical variables. SD = standard deviation.*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ denote significance at 1%, 5% and 10% levels respectively.

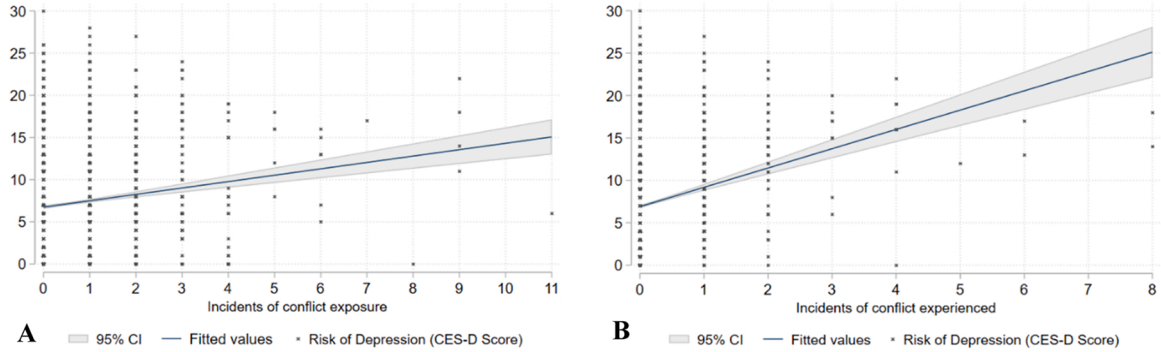

Fig. 2. A. Bivariate relationship between incidents of conflict exposure and risk of depression. B. Bivariate relationship between incidents of conflict experienced and risk of depression. *Note:* The shaded region represents 95% confidence intervals.

Particularly, high prevalence of restless sleep has been reported among farmers in Nigeria (Olowogbon et al., 2019), Uganda (Fuhrimann et al., 2022), and America (Chengane et al., 2021). Restless sleep or sleep deprivation is also shown to be associated with exposure to pesticides (Fuhrimann et al., 2022) and musculoskeletal pain and discomfort (Chengane et al., 2021). Furthermore, while farming population in many developed countries is mostly lonely (Wheeler et al., 2022), most farmers in Nigeria are not lonely. It is not surprising that loneliness is the least of the depressive symptoms in Nigeria. The reasons may be that farm locations are less isolated from the general population, and farmers still largely employ farm labourers for farming activities, with the advantage of social interaction, unlike in the developed countries where farming is technology-driven and farms are in isolated areas from the general population (Wheeler et al., 2022).

In Fig. 2, we show a positive linear relationship between risk of depression and incidents of conflict exposure (Fig. 2A), and incidents of conflict experienced (Fig. 2B). The results also suggest that relative to conflict-exposed farmers, farmers who were directly affected by conflict may exhibit more depressive symptoms.

Table 2 shows that 41% of farmers have a CES-D score ≥ 8 (i.e., the prevalence of farmers with probable depression), while the prevalence of probable depression among conflict-exposed farmers was 45%. About 33% of farmers are exposed to conflict, and 7% reported experiencing conflict. Among the farmers not exposed to conflict, 5% have experienced conflict, suggesting they relocated to non-conflict areas. A study in Uganda shows that the prevalence of depression among people exposed to war was as high as 52% (Njenga et al., 2006). In Nigeria, the prevalence of depression among victims of violent conflict in the North-Central region was 38.5% and 45% among heads of households (Taru et al., 2018), the same as the prevalence obtained using national representative data in this study.

We further show in Table 3 that poultry, and sheep and goat holdings are not significantly different between farmers in conflict locations and those in non-conflict locations. However, conflict-exposed farmers owned less livestock and cattle, and diversified livestock less than farmers not exposed to conflict. This result suggests losses of cattle to conflict in conflict locations, as evidenced in the study by Fadare et al. (2022), which found a reduction in cattle herd size as conflict increases in Nigeria. Furthermore, conflict-exposed farmers relative to non-exposed are more educated, within the 35–64 age brackets, experienced more shocks, are more among the Christians, produced more crops, earned more salary and other income, owned more durable assets, had more members, and are more in the rural areas, the north-central, north-east, and south-south regions. On the other hand, conflict-exposed farmers are less among young farmers aged below 35 years, less in households consumed more diverse diets, and locations in north-west south-west regions.

5.2. Regression results

5.2.1. The association between conflict events, livestock assets, and depression

We first present the results of the association between conflict, livestock assets, and the 10 depressive symptoms in Fig. 3 as Average Marginal Effects (AME) estimates of logit model specification (ii). Fig. 3 shows that conflict exposure has a significant association with farmers being '*disturbed* (1)', '*troubled* (2)', and '*afraid* (6)', while conflict experienced has a positive association with all the depressive symptoms except '*not getting going* (10)'. Having more poultry while exposed to or having experienced conflict is negatively associated with all the depressive symptoms except '*disturbed* (1)', '*burdened* (4)', '*hopeless* (5)' and '*afraid* (6)'. Conversely, there is a positive association between having more herds of sheep and goats in conflict situations and '*unhappy* (8)' and '*lonely* (9)', while having more cattle in conflict situations is associated with '*disturbed* (1)' and '*troubled* (2)'.

Next, we present the results of model specifications (i) and (ii) for the aggregated depression symptoms in Table 4A (logit models) and Table 4B (OLS models), while the robustness checks results are in Tables 5A and 5B, logit and OLS models respectively. In all the results tables, column (1) presents the results of the model specification (i), and columns (2) and (3) are the alternative models. Similarly, column (4) presents the results of model specification (ii), while columns (5) and (6) are the alternative models. However, we report the results of model specification (ii) as AME in column (7) and the alternative models in columns (8) and (9). The results in column (7) are further represented in Fig. 4 as predicted probability for intuitive interpretation.

Results across all the models specified in the results tables show that conflict exposure or experienced is statistically associated with probable depression or risk of depression at 5% level. Also, having more poultry is negatively and statistically associated with probable depression and risk of depression across the models specified at 5% level of significance. However, the association is stronger (at 1% level) in the OLS models. Furthermore, Table 4A shows a significant association between holding more livestock and cattle in conflict-exposed locations and farmers exhibiting depression symptoms at 5% level of statistical significance, with the robustness checks' results in Table 5A showing similar significance. However, our descriptive statistics show that farmers not exposed to conflict have more livestock assets and cattle than their conflict-exposed counterparts. Therefore, to underscore our hypothesis that more herds of cattle may increase mental stress for farmers due to perceived threats to cattle, it may be possible that farmers with more cattle in locations not exposed to conflict also feel apprehensive on

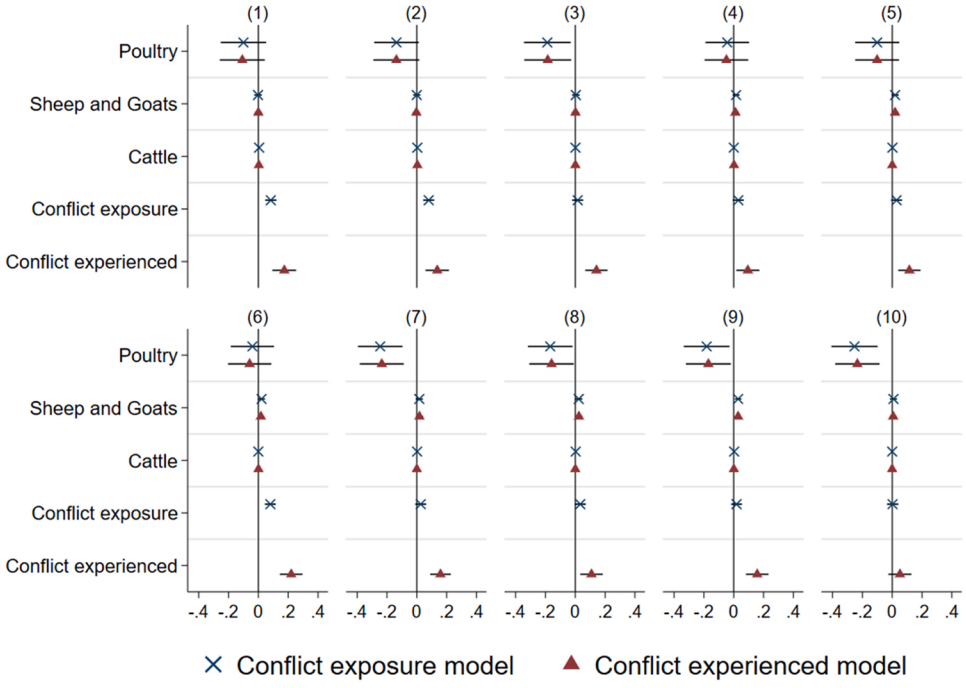

Fig. 3. AME results of the estimates of the logit regression models for the association between conflict exposure/experienced, livestock assets, and the 10 depressive symptoms, representing *(1)* Was disturbed by things that don't normally bother me, *(2)* Had trouble keeping my mind on what I was doing, *(3)* Felt depressed, *(4)* Felt that everything I did was a burden, *(5)* Felt hopeful about the future, *(6)* Felt afraid, *(7)* Had a restless sleep, (8) Was unhappy, *(9)* Felt lonely, and *(10)* Did not feel like getting up in the morning. *Note:* Confidence intervals (CIs) are set at 95%. The stars and triangles with their CIs represent coefficients at different significant levels. Coefficients with CIs outside the vertical lines, at the edge, and on the vertical line are statistically significant at 1%, 5%, and 10% levels, respectively. Coefficients with CIs across the vertical lines are insignificant. Tables E1 and E2 in the Appendix contain full results.

Table 4A
Logit regression results of the association between conflict exposure, livestock assets, and depression (CES-D score ≥8).

	Models with no interaction terms			Models with interaction terms			Average Marginal Effects of models with interaction terms		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Conflict exposure	0.183 **	0.184 **	0.171 **	0.232 **	0.172 *	0.150	0.043 **	0.042 **	0.039 **
	(0.085)	(0.085)	(0.085)	(0.105)	(0.091)	(0.101)	(0.019)	(0.019)	(0.019)
Poultry	-0.688 **			-0.207			-0.162 **		
	(0.347)			(0.418)			(0.077)		
Conflict exposure*Poultry				-1.571 **					
				(0.755)					
Sheep-Goats	0.089 *			0.048			0.017		
	(0.053)			(0.065)			(0.012)		
Conflict exposure*Sheep-Goats				0.087					
				(0.107)					
Cattle	0.013 **			0.012 **			0.005 **		
	(0.006)			(0.006)			(0.002)		
Conflict exposure*Cattle				0.031					
				(0.028)					
All livestock		0.021 ***			0.020 **			0.005 ***	
		(0.008)			(0.009)			(0.002)	
Conflict exposure*All livestock					0.008				
					(0.020)				
LD Index			-0.078			-0.139			-0.017
			(0.236)			(0.282)			(0.053)
Conflict exposure*LD Index						0.183			
						(0.466)			
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.0627	0.0611	0.0596	0.0640	0.0612	0.0612			
Number of observations	3021	3021	3021	3021	3021	3021	3021	3021	3021

Note: Numbers in parenthesis are robust standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ represent significance at 1%, 5% and 10% level respectively. Control variables are education, age, sex, marital status, physical health status, the experience of shocks, religious affiliation, cooperative society membership, value of crops production, salary income, other income, dietary diversity, wealth index, household size, rural-urban location, and geopolitical zone binary variables. Full results are in Table F1 in the Appendix.

Table 4B
OLS regression results of the association between conflict exposure, livestock assets, and depression (CES-D score).

	Models with no interaction terms			Models with interaction terms			Average Marginal Effects of models with interaction terms		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Conflict exposure	0.414 **	0.426 **	0.409 **	0.440 *	0.313	0.352	0.430 **	0.448 **	0.413 **
	(0.197)	(0.198)	(0.197)	(0.244)	(0.211)	(0.236)	(0.198)	(0.198)	(0.197)
Poultry	-2.310 ***			-1.911 **			-2.338 ***		
	(0.724)			(0.826)			(0.729)		
Conflict exposure*Poultry				-1.304					
				(1.653)					
Sheep-Goats	0.279 **			0.237			0.262 **		
	(0.127)			(0.149)			(0.128)		
Conflict exposure*Sheep-Goats				0.079					
				(0.260)					
Cattle	0.012			0.009			0.021		
	(0.010)			(0.011)			(0.014)		
Conflict exposure*Cattle				0.036					
				(0.038)					
All livestock		0.030			0.017			0.041 *	
		(0.020)			(0.022)			(0.021)	
Conflict exposure*All livestock					0.073				
					(0.047)				
LD Index			0.040			-0.121			0.041
			(0.519)			(0.594)			(0.520)
Conflict exposure*LD Index						0.494			
						(1.058)			
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.114	0.111	0.110	0.114	0.111	0.110			
Number of observations	3021	3021	3021	3021	3021	3021	3021	3021	3021

Note: Numbers in parenthesis are robust standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ represent significance at 1%, 5% and 10% level respectively. Control variables are as used in Table 4A. Full results are in Table F2 in the Appendix.

account of the tragic news of livestock losses suffered by farmers in non-conflict locations.

In addition, Table 4B shows that higher livestock, and sheep and goats holdings while exposed to conflict have a significant association with the risk of depression. The association between livestock assets and mental health of farmers has been reported in different contexts. A study by Majbauddin et al. (2020) in rural Ethiopia found a non-statistically significant association between higher livestock units and farmers' mental health in no specific shock context. However, Hagen et al. (2021), Nuvey et al. (2020), and Olff et al. (2005) in Canada, Ghana, and United Kingdom, respectively, show a significant association between livestock farmers' exposure to disease outbreaks and farmers exhibiting poor mental health.

Furthermore, we find a non-statistically significant association

Table 5A
Logit regression results of the association between conflict experienced, livestock assets, and depression (CES-D score ≥8).

	Models with no interaction terms			Models with interaction terms			Average Marginal Effects of models with interaction terms		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Conflict experienced	1.054 ***	1.052 ***	1.061 ***	0.769 ***	0.919 ***	0.837 ***	0.215 ***	0.230 ***	0.231 ***
	(0.170)	(0.169)	(0.170)	(0.230)	(0.189)	(0.219)	(0.039)	(0.037)	(0.038)
Poultry	-0.705 **			-0.690 *			-0.155 **		
	(0.351)			(0.365)			(0.077)		
Conflict experienced*Poultry				-0.331					
				(1.489)					
Sheep-Goats	0.068			0.031			0.013		
	(0.053)			(0.057)			(0.012)		
Conflict experienced*Sheep-Goats				0.438 **					
				(0.201)					
Cattle	0.013 **			0.014 **			0.003 **		
	(0.006)			(0.006)			(0.001)		
Conflict experienced*Cattle				-0.005					
				(0.048)					
All livestock		0.019 **			0.016 *			0.004 **	
		(0.008)			(0.008)			(0.002)	
Conflict experienced*All livestock					0.064				
					(0.044)				
LD Index			-0.128			-0.229			-0.031
			(0.239)			(0.249)			(0.053)
Conflict experienced*LD Index						1.452			
						(0.925)			
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.0690	0.0718	0.0702	0.0696	0.0731	0.0708			
Number of observations	3021	3021	3021	3021	3021	3021	3021	3021	3021

Note: Numbers in parenthesis are robust standard errors. *** p < 0.01, ** p < 0.05, * p < 0.1 represent significance at 1%, 5% and 10% level respectively. Control variables are as used in Table 4A. Full results are in Table F3 in the Appendix.

Table 5B
OLS regression results of the association between conflict experienced, livestock assets, and depression (CES-D score).

	Models with no interaction terms			Models with interaction terms			Average Marginal Effects of models with interaction terms		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Conflict experienced	3.310 ***	3.321 ***	3.334 ***	3.242 ***	3.019 ***	3.174 ***	3.284 ***	3.220 ***	3.298 ***
	(0.436)	(0.434)	(0.435)	(0.633)	(0.479)	(0.588)	(0.487)	(0.444)	(0.456)
Poultry	-2.306 ***			-2.184 ***			-2.350 ***		
	(0.712)			(0.731)			(0.715)		
Conflict experienced*Poultry				-2.465					
				(3.253)					
Sheep-Goats	0.208 *			0.160			0.170		
	(0.122)			(0.128)			(0.123)		
Conflict experienced*Sheep-Goats				0.143					
				(0.441)					
Cattle	0.014			0.012			0.020 *		
	(0.010)			(0.010)			(0.011)		
Conflict experienced*Cattle				0.112					
				(0.070)					
All livestock		0.024			0.012			0.020	
		(0.019)			(0.020)			(0.019)	
Conflict experienced*All livestock					0.109 **				
					(0.044)				
LD Index			-0.109			-0.187			-0.119
			(0.513)			(0.526)			(0.512)
Conflict experienced*LD Index						1.009			
						(1.948)			
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.132	0.136	0.133	0.133	0.137	0.134			
Number of observations	3021	3021	3021	3021	3021	3021	3021	3021	3021

Note: Numbers in parenthesis are robust standard errors. *** p < 0.01, ** p < 0.05, * p < 0.1 represent significance at 1%, 5% and 10% level respectively. Control variables are as used in Table 4A. Full results are in Table F4 in the Appendix.

between livestock diversification and depression across all the models specified, even though the coefficients are mostly negative. While a positive correlation between livelihood/income diversification and food security or better physical health has been reported (Adem et al., 2018; Manlosa et al., 2019; Majbauddin et al., 2020), we find no study on the association between livestock diversification and mental health. Close to reporting on this association is the work of Majbauddin et al. (2020) in rural Ethiopia, which shows no significant association between livelihood diversification, consisting of farm and non-farm income-generated activities, and farmers' mental health.

Further depiction of the results in Fig. 4 shows that the predicted probability of farmers being at risk of depression when not exposed to conflict or experienced conflict is 40% on average, regardless of the size of livestock holdings (represented by the blue dashed lines). While the probability of farmers being at risk of depression when exposed to conflict is approximately 45% on average (represented by the maroon

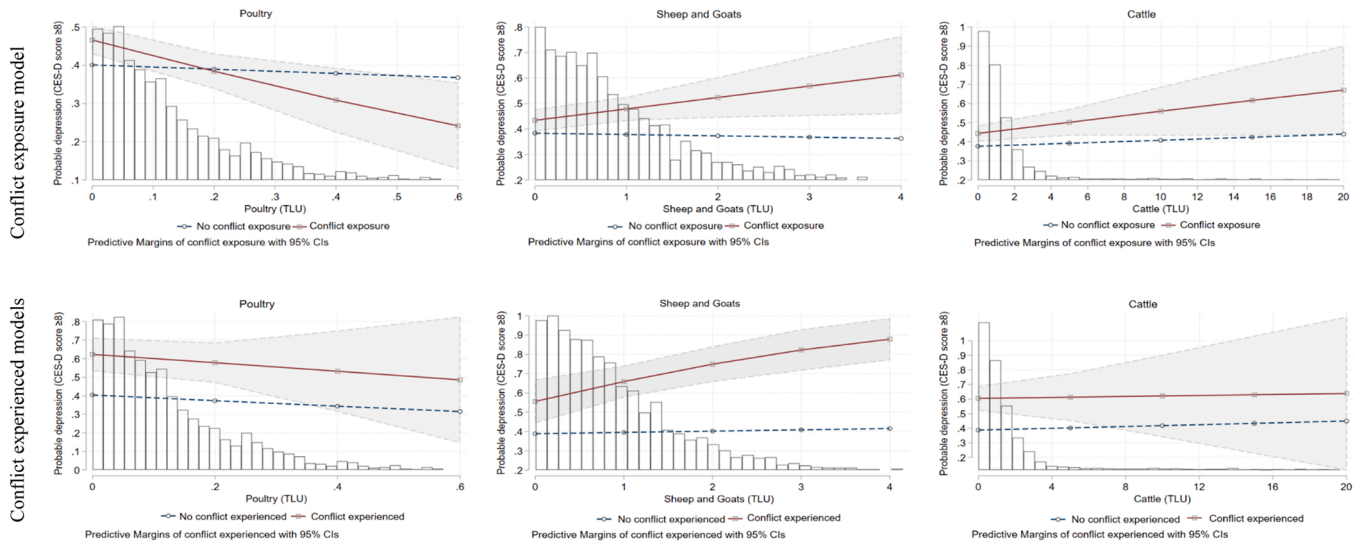

Fig. 4. The association between conflict, livestock assets, and depression, based on column (7) in Table 4A (conflict exposure model) and column (7) in Table 5A (conflict experienced model). *Note*:Shaded regions represent 95% confidence intervals.

lines). However, the probability decreases to less than 25% for farmers with higher poultry flocks, while it increases beyond 60% for farmers that own more herds of sheep and goats, and cattle.

5.2.2. Other determinants of depression

Some of the covariates are statistically significant as risk or protective factors of depression (see Tables F1 to F4 in the Appendix). The results show that farmers with more years of education, more farm produce, and more durable assets, Christians against those practising other religions, and farmers whose households consume diverse diets are at a lower risk of exhibiting depressive symptoms. However, farmers in the age bracket of 36–64 years, those with physical ill health, and who have experienced shocks, reside in the northern region, south-east, and south-south as against residents in the south-west are at a higher risk of being depressed. It is not surprising to see that some important well-being indicators, such as education, asset ownership, and adequate dietary consumption, are protective factors for depression. The finding that farmers in their active years are more at risk of depression is instructive and has implications for food security.

6. Discussion

There are about 300 million people in the world suffering from depression, and 5% of the world's adult population is depressed (WHO, 2021), making depression a major public health concern. More importantly, the world is more exposed to traumatic events such as the recent covid-19 pandemic, droughts or floods, and conflict, which disproportionately affect the livelihoods of many people in LMICs. The livelihoods of the farming population, in particular, are mostly affected by the contemporary conflict situations in Africa, with significant implications for their psychological well-being. Evidence on the mental health effects of violent conflict across different demographic and socio-cultural settings is well-documented. However, this study extending the evidence to the farming population fills important gaps in the literature.

We provide evidence of the vulnerability to conflict, an important livelihood asset, livestock, and how it may affect farmers' mental health. The evidence is important for improving psychosocial support and resilience for the farming population. This study shows that conflict exposure leaves about 45% of farmers at risk of depression, only 6% higher than farmers not exposed to conflict, suggesting that farmers are faced with other risk factors for depression. Exposure to pesticides, diseases outbreak, financial loss, poor physical health, and sustained injuries are identified risk factors for depression in developed and developing countries (Hagen et al., 2019; Reed and Claunch, 2020; Olff et al., 2005). Our study further shows that exposure to conflict is associated with a higher risk of depression and holding more herds of livestock, cattle in particular, in conflict situations is a major reinforcing factor for an increased likelihood of depression symptoms.

Similar to our study are studies that found a significant association between exposure to disease outbreaks as a traumatic event and poor mental health of farmers (Hagen et al., 2021; Nuvey et al., 2020; Olff et al., 2005). However, these studies do not examine the association between farmers' mental health and the size of livestock holdings or the different livestock species owned by the exposed farmers, except for the study by Nuvey et al. (2020) that shows that more herds of cattle improve mental health for the Ghanaian farmers. Holding more cattle can boost farmers' social and economic status, resulting in psychological well-being if the nature of adverse events farmers face is controllable.

However, unlike in conflict situations, where there is a disruption to the systems that support livestock production, increased risk and uncertainty for cattle owners can trigger stress. Thus, holdings more cattle can be cumbersome to manage as they can be directly attacked or indirectly destroyed through emaciation and diseases due to lack of access to pasture, water, other inputs and supporting services such as market and extension services. A salient finding in our results is that holding more herds of cattle in conflict situations produces similar psychological responses as exposure to conflict, supporting the positive relationship between more cattle herds and higher risk of depression in conflict situations.

The weak association between holding more herds of sheep and goats while in conflict situations and depression conforms with the conceptual understanding of the characteristics of these livestock species and the extent of their vulnerability to conflict. An inverse relationship with depression may be expected based on their income generation and resilience capability as they are not in the extreme case of 'high-valued' but vulnerable cattle and 'low-valued' but resilient poultry. The strong association between higher poultry assets and lower risk of depression aligns with the conceptual understanding that poultry birds demonstrate more resilience to conflict and may possess some characteristics that maintain good mental health for the keepers.

There are anecdotes about poultry keeping being associated with a reduced risk of depression symptoms which may be further validated through experimental evidence. For example, available grey literature suggests that poultry keeping can have a calming effect on their keepers

and may reduce depression. Also, a recent study suggests white meat reduces the risk of depression symptoms (Kazemi et al., 2021), and poultry meat consumption may represent another potential pathway through which poultry can reduce the likelihood of depression. Evidence from Nigeria shows that poultry meat is often consumed in farming households more than meat from cattle, sheep and goats (Fadare et al., 2019). This evidence may interest further research and intervention promoting small-scale livestock production for human nutrition and health.

7. Concluding remarks

There is a growing recognition of the need to monitor and ensure farmers have good mental health, as also imperative in the fight against hunger, food insecurity and malnutrition in LMICs (Sparling et al., 2021). Our study extends the current knowledge on the risk and protective factors of depression among the farming population. The key points from this study include the appreciation of the magnitude of mental health challenges the Nigerian farmers are subjected to by factors such as conflict. Another is the scope for building resilience using livestock assets to mitigate the potential effect of conflict on farmers' mental health. More importantly, this study informs the need for psychosocial support for farmers in conflict situations as an essential input in peacebuilding, livelihoods recovery, and food security and nutrition (Hertog, 2017; Sparling et al., 2021; UNDP, 2022).

The primary aim of the CES-D screening tool used in this study is to identify the population at risk of depression that may require psychosocial support, which is an important policy implication of this study. Given the limited information on mental health in Nigeria, policy options in this direction may include awareness creation and re-orientation on the mental health issue, especially among the farming population. Additional support for victims of conflict may include mental health evaluation, and psychosocial support, among others. Moreover, people clinically diagnosed with depression may be referred for mental health treatment and psychoeducation. Recent evidence in some African countries suggests that mental health and psychosocial intervention for victims of conflict have been effective (Andersen et al., 2022).

Finally, this study provides additional evidence for humanitarian intervention on the typology of livestock that may be used as relief in protracted conflict situations. However, more research is required to generate sufficient evidence on the pathways from livestock assets to depression in conflict contexts or similar shock situations. As previously highlighted, the empirical analysis is limited to using cross-sectional data, which precludes us from investigating the temporal relationship between depression, conflict, and livestock assets. However, the study, being the first in Nigeria to quantify the prevalence of depression symptoms among farmers and their risk factors using a nationally representative data, is significant and could motivate future investments in a cohort study on the mental health of farmers in Nigeria.

Ethics approval

Not required. Analysis presented in the manuscript used de-identified secondary data and was exempt from institutional review board approval.

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CRediT authorship contribution statement

Olusegun Fadare: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Visualization, Writing – original draft, Writing – review & editing. **Giacomo Zanello:** Conceptualization, Funding acquisition, Resources, Supervision, Validation, Visualization, Writing – review & editing. **Chittur Srinivasan:** Conceptualization, Funding acquisition, Resources, Supervision, Validation, Visualization, Writing – review & editing.

Declaration of Interest

None.

Data Availability

Data will be made available on request.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ehb.2023.101234.

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