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Fulani Herdsmen Counter-productive Activities and Food Insecurity among Food Crop Farmers: Evidence from Ekiti and Ondo States, Nigeria

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Abstract
Herder counter-productive activities-induced food insecurity is a threat to achieving the number 2 SDGs (zero hunger) in Nigeria. Although studies have been conducted to address the herder-farmer conflict challenge, however, the studies focused majorly on North central Nigeria while not many studies have been done in Southwestern Nigeria. Thus, this study examines herder counter-productive-induced food insecurity in Ekiti and Ondo states, Nigeria to add to the existing knowledge on this challenge. A multistage sampling procedure was used to select respondents for the study. Primary data were collected from 380 farmers in the study area. Descriptive statistics and a probit regression model were used to analyze the socio-economic characteristics of the respondents and the effects of the Fulani herdsmen's counter-productive activities on farmers' food security status respectively. The result showed that herder counter-productive activities have a positive and significant influence on the farmers' food insecurity. The results also showed that while factors such as off-farm income, safety net programme, private transfer, farmers' group membership, and asset ownership reduce food insecurity, household size and Fulani herdsmen attacks increase food insecurity. The government should do more in terms of providing a safety net for victims of herdsmen attacks while farmers should diversify their livelihood activities as well as join groups to access the benefits inherent in groups. Keeping cattle in ranches by the herders also has the potential to resolve the challenge in Nigeria.

Keywords: Counter-Productive, Food Insecurity, Herder, Probit Regression, Nigeria

1. Introduction
Food ranks first among the basic needs of human beings. Thus, access to adequate food (food security) occupies center stage in the development agenda of many nations of the world. Food security is said to exist when all people have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 2001) [1]. Maintaining food security at whichever level is challenging particularly among the developing economies of the world (Zakari *et al*., 2014; Shausi, 2020) [12, 3]. A report on food security conditions shows that 26.4% of the world's population, is food insecure, and 52.5% of them live in Sub-Saharan Africa (FAO, IFAD, UNICEF, WFP, and WHO (2019) [2]. Another report linked to the negative impact of COVID-19 shows that on a global scale, an increase in the number of food insecure people as about 720–811 million people suffered hunger, implying that 118 million more people suffered hunger in 2020 relative to 2019 (FAO *et al*. 2021) [4]. Sub-Saharan Africa, in particular, witnessed a rise in the number of malnourished people by 23.4 million in 2015, while in 2018, 239.1 million people were malnourished (Food and Agriculture Organization, 2019). Nigeria was not immune to food insecurity experience as food insecurity incidence increased by 130% in 2020 compared to 2019 (Owoo, 2021) [6].
While still grappling with the challenge of food security in sub-Saharan Africa, farmer-herder conflict reared its ugly head and complicated the challenge. In Nigeria for example, climate change effects such as desert encroachment and soil degradation have put pressure on the livelihood of the herders necessitating their migration towards the southern region where the weather is relatively favourable to their livelihood activities (Olaniyan and Okeke-Uzodike., 2020) [14]. Farmers in turn, while responding to the need to provide food for the growing population have extended cultivation to the grazing routes of the herder's cattle thereby creating competition for land and water resources resulting in damage to farmers' crops and attack on

herders' cattle in turn by the farmers (George, Adelaja & Awokuse, 2021) [15]. The conflict has incapacitated farmers to cultivate on a full scale and in some cases, it has led to the displacement of farmers and abandonment of farms thereby impacting food security negatively (Olaniyan and Okeke-Uzodike, 2020 [14]; George *et al*., 2021 [15]; Nnaji *et al*., 2022) the foregoing food insecurity scenarios present a daunting challenge for Nigeria in meeting the target of the Sustainable Development Goals (SDGs) number two that is concerned with achieving zero hunger by the year 2030.

Several efforts have been directed towards resolving farmer-herder conflicts by the southwest (Ekiti, Ogun, Ondo, Osun, and Oyo states) governments in Nigeria. Some of the efforts include signing the anti-grazing bill to law, town hall meetings with stakeholders, and establishment of 'Amotekun corps'. The anti-grazing law prohibits open grazing of cattle in the states and imposes heavy fines on offenders. Yet, herders are not deterred as they continue with the practice while cases of farmer-herder clashes are being reported from time to time. Studies have been carried out on farmer-herder conflicts and food security but they concentrated their efforts on the northern part of Nigeria (Adelaja and George, 2019, Adeoye, 2017, Adisa and Adekunle, 2010, Yusuf, Audu, and Akuva, 2020, Ajala, 2020) [7, 8, 9, 23, 10]. A few studies conducted on farmer-herder conflict and food production/security in southern Nigeria (Obi-egbedi *et al*., 2023; Adeloye *et al*., 2023) [5, 11] focussed on Oyo state, Nigeria. It is important to mention that cases of farmer-herder conflict exist in Ekiti and Ondo states too and these cases which have received little or no empirical investigation have the potential to contribute to farmer-herder conflict literature as well as suggest policy options aimed at resolving the lingering conflict. Therefore, this study examines the effects of farmer-herder conflict on the food security status of food crop farmers in Ekiti and Ondo state, Nigeria.

2. Research Methodology

2.1 Study area

The research took place in both Ekiti and Ondo States, which were originally a single entity until 1996 when Ekiti State was created from the former Ondo State. These states are situated in the eastern part of the southwestern Nigeria geopolitical zone, spreading between longitu $4^0 23'$- $02'$ E and latitudes $50'$N Ekiti and Ondo States have land areas of 6,353 and 15,820 square kilometers, respectively, and populations of 2,384,212 and 3,441,024 million according to the 2006 Census. Ekiti State comprises 16 Local Government Areas (LGAs), while Ondo State has 18 LGAs. Both states experience a tropical climate characterized by two distinct seasons: A rainy season from March/April to October/November and a dry season from November to March, influenced by moist south-westerly monsoon winds and dry north-east continental winds blowing across Nigeria, respectively. Mean annual rainfall ranges from 1,250 mm in the northern extreme to 2,000 mm on the coast, with temperatures typically between 21^0-28ºC. The natural vegetation varies with latitudinal extent, moving from mangrove and freshwater swamp forests in the southernmost coastal areas to lowland forests in the central region, and derived savannah and guinea savannah in the northern and north-eastern parts.

2.2 Sampling procedure

A multi-stage sampling procedure was used in selecting samples for the study. The first stage involved a purposive sampling of local government areas (LGAs) in both states where Fulani herdsmen counter-productive activities were reported often. In the second stage of the sampling, a simple random sampling was done to select two (2) LGAs from each state. The LGAs include Ose and Akoko North-west in Ondo state and Ikole and Ileje-meje in Ekiti state. The third stage involved a simple random selection of five communities from each of the selected LGAs. The fourth (last) stage involved a snowball (non-random) sampling of nineteen (19) farmers from each of the selected communities. Snowball sampling was adopted because of the non-availability of a sampling frame for the farmers. At the end of the sampling, three hundred and eighty farmers were selected for the study.

2.3 Sources of data

Primary data were collected for this study with the aid of a well-structured questionnaire and interview schedule. Data on farmers' socio-economic characteristics, farmers' experience of Fulani herdsmen attacks, and food consumption were collected.

2.4 Method of data analysis

The data collected for this study were analyzed using descriptive statistics, the food security index (FSI), and the probit regression model.

2.4.1 Food Security Index

The FSI was used to estimate the food security status of the arable crop farmers. Data on the caloric content of commonly consumed food in the study area were collected, and parameters converting edible portions into calories were applied. The quantity of food consumed was obtained and recorded in kilograms which was converted to calories thereafter (Oguntona and Akinyele, 1985). Then, calorie adequacy was estimated by dividing the calories available for the household by the family size adjusted for adult equivalent with the aid of the consumption factor for age and sex categories (Ojeleye, 2019) [24]. The recommended minimum daily energy intake for a moderately active adult is 2850 Kilocalories (FAO-WHO-UNU, 1985). Therefore, following Azeem (2016) and Ojo *et al*. (2024) [25], this value defines the food security benchmark as households who consumed fewer calories than this benchmark were classified as food insecure households while the households whose calorie consumption was equal to or more than it was classified as food secure households. Thus, following Wudil *et al* (2023) [26]; and Obi-Egbedi *et al.* (2023) [5], a household's food security status was determined according to the following expression:

$$Z_i = \frac{Household\ s\ daily\ per\ capita\ calorie\ avaibility\ (A)}{Household\ s\ daily\ per\ capita\ calorie\ requirement\ (R)} \quad (1)$$

Where Z_i denotes the status of i^{th} household food security (Z ≥1 food secure and Z<1 food insecure). The shortfall/surplus index, S, was determined, and individual households' food security indices were constructed using Z:

$$S_i = \frac{1}{n}\sum_{i=1}^{n} CC_i \quad (2)$$

Where S_i denotes the shortfall or surplus index for the i^{th} household,

$CC = \frac{C_{Ai}-L}{L} =$ Mean calories consumed by the household.

n = the number of households that are food secure (excess index) or food insecure (deficit index).

L= the food security line (2,850 kcal/capita/day).

C_{Ai} = calorie availability to i^{th} household,

The Headcount ratio (H) is given as $H = \frac{n}{N}$ (3)

Where n = the number of food-secure or insecure members of the sample.

N = Sample size.

2.4.2 Probit model

The probit model which can also be referred to as the cumulative distribution function of the standard normal distribution, was used in this study as the tool for analyzing the effects of Fulani herdsmen's counter-productive activities on food crops farmers' food security status. A probit model is appropriate for the analysis because of the binary nature of the dependent variable i.e. food security status variable. Following Yusuf *et al.* (2022) [27], the probit model can be expressed thus:

$$y_i = \begin{pmatrix} y_i^* = \beta x_i + u_i if \ \ y_i^* > 0 \\ 0 \ \ if \ \ otherwise \end{pmatrix} \quad (4)$$

Where y^* is the unobserved latent variable assuming a value of 1 for a food secure households and 0 for food insecure households. x_i denotes the vector of the explanatory variables, u_i denotes the random error term. The explanatory variables x_i are the factors influencing food security? The model can be explicitly expressed as:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_{11} X_{11} + \mu_i \quad (5)$$

Where;

Y_i = Food security status is binary (1= food secure, 0 if otherwise)

β_0 = Intercept

β_1_β_{11} = vector of parameters to be estimated

X_1_X_{11} = explanatory variables

μ_i = error term

The explanatory variables are stated as follows:

$X_1 = Age\ of\ the\ respondents\ (in\ years)$;

$X_2 = Gender\ of\ household\ head\ (male = 1, 0,\ otherwise)$;

$X_3 =$ Marital status (married =1, 0, otherwise);

$X_4 = Years\ of\ formal\ education\ (years)$;

$X_5 =$ Off-farm income

$X_6 = Herder\ challenge$

$X_7 = household\ size\ (number)$;

$X_8 = Farmers'\ group\ membership$

$X_9 = Asset\ ownership\ (Yes = 1; 0, otherwise)$

$X_{10} = Access\ to\ safety\ net\ programme\ (Yes = 1; 0, otherwise)$

$X_{11} = Access\ to\ private\ transfer\ (Yes = 1; 0, otherwise)$

3. Result and Discussion

3.1 Socio-economic Characteristics of Farmers

Table 1 presents the socio-economic characteristics of the farmers. The distribution concerning the age of the farmers indicates that the majority (88.95%) of the farmers are within the age of 60 years. This implies that they have the strength/vigour to engage in productive and economic activities that can guarantee their access to food. Also, the distribution of the farmers by sex is presented in Table 1. The distribution shows that there are more male (64.21%) farmers than female farmers in the study area. This implies that men are more inclined to engage in farming and due to this, they are likely to have access to more food than women who are less inclined to farming. In terms of marital status, the distribution indicates that 50% of the farmers are married. This means that the married farmers would work as a team to contribute resources to meet their households' food requirements.

Household size is also presented in Table 1. The distribution shows that more than half (57.63%) of the farming households comprised of 5-8 members. This household composition is large and has the potential to lower per capita food consumption of the household. On account of years of formal education, the distribution shows that the majority (89.74%) of the farmers have different levels of formal education. This means that farmers' access to information relating to capacity building aimed at improving access to food would be enhanced.

Table 1: Socio-economic characteristics of farmers

Variable	Frequency	Percentage
Age		
≤ 30	28	7. 37
31 – 40	87	22.89
41 – 50	141	37.11
51 – 60	82	21.58
> 60	42	11.05
Sex		
Male	244	64.21
Female	136	35.79
Marital Status		
Never Married	68	17.90
Married	190	50.00
Divorced	64	16.84
Widowed	58	15.26
Household Size		
1 – 4	60	15.79
5 – 8	219	57.63
9 – 12	80	21.05
> 12	21	5.53
Years of Formal Education		
0	39	10.26
1 – 6	156	41.05
7 – 12	113	29.74
> 12	72	18.95

Source: Author's compilation

3.2 Fulani Herdsmen Counter-productive Activities in the Study Area

Table 2 presents the distribution of Fulani herdsmen's counter-productive activities. The results show that damage

to farmers' crops by Fulani herdsmen cattle ranks highest among the counter-productive activities. This finding underscores the prevalence of food security in Nigeria as the destruction of farms has a debilitating effect on the availability of food and a hike in food prices. Also, some farmers experienced stealing of their farm produce (17%) and physical assault (11.3%), others suffered trampling (by cattle) on prepared land for planting (8.5%), destruction of farmstead (4.7%) and contamination of water points (13.2%) These counter-productive activities of herdsmen being suffered by farmers could lead to frustration and make them give up farming. The consequence of giving up farming is a food crisis – hunger.

Table 2: Herdsmen Counter-productive Activities distribution

S. No	Herdsmen Counter-productive Activities	Frequency	Percentage %
1	Crop damage by cattle	48	45.3
2	Stealing farm produce	18	17.0
3	Physical assault	12	11.3
4	Trampling (by cattle) on prepared land for planting	9	8.5
5	Destruction of farmstead	5	4.7
6	Water points contamination	14	13.2
	Total	106	100.00

Source: Author's compilation

3.3 Fulani Herdsmen Attack Experience and Food Security Status of Farmers

Table 3 presents the distribution of farmers by Fulani attack experience and food security status. The distribution reveals that 27.9% of the farmers experienced Fulani herdsmen attack while 72.1% of them did not experience it. The result shows further that more than half (56.6%) of the farmers who experienced Fulani herdsmen attack were food insecure while the remaining 43.4% were food secure. The finding implies that the Fulani herdsmen attack is sabotaging efforts towards achieving the zero-hunger target of the Sustainable Development Goals (SDGs) as a result of its undue addition to the food security challenges to be overcome. This finding is similar to previous studies by Obi-Egbedi *et al*. (2023) [5]; and Nnaji *et al.* (2022). Also, the distribution shows that 79.6% of the farmers who did not experience Fulani herdsmen attack were food secure while the remaining 20.4% were food insecure. Overall, 69.5% and 30.5% of the farmers were food secure and food insecure respectively regardless of their Fulani herdsmen attack status. This finding suggests that the Fulani herdsmen's counter-productive activities have compounded the Nigerian food security challenge as about one-third of the farmers are food insecure. The finding is consistent with (Obi-Egbedi *et al*., 2023) [5].

Table 3: Fulani herdsmen attack experience and food security status of farmers

Fulani attack/ food security status	Fulani attack	No Fulani attack	Total
Food secure	46 (43.4%)	218 (79.6%)	264(69.5%)
Food insecure	60 (56.6%)	56 (20.4%)	116 (30.5%)
Total	106 (27.9%)	274 (72.1%)	380 (100.0%)

Source: Author's compilation

3.4 Effects of Fulani Herdsmen Counter-productive Activities on Farmers' Food Security Status

Herder attack is positively and significantly related to food insecurity at a 1% level of significance (Table 4). This implies that households who experienced Fulani herdsmen attack are more likely to be food insecure than their counterparts whom Fulani herdsmen did not attack. This could be because Fulani herdsmen's attacks come in the form of indiscriminate grazing of crops, maiming, kidnapping, and killing. All of these are associated with the loss of crops inability to go to farm/spending money on treatment of maimed household members at the expense of feeding or borrowing money or spending money meant for food and productive/economic activities for ransom or rendering households vulnerable to food insecurity and later food insecurity as a result of the death of the head of household (the breadwinner). This result aligns with Nnaji *et al*. (2022) who found that the incidence of herder conflict increased food insecurity.

Off-farm income negatively and significantly influenced food insecurity at a 1% level of significance. This means that households who earn off-farm income are less likely to be food insecure than households who do not earn off-farm income. This could be attributed to the fact that some households engage in other livelihood activities besides farming from which they earn income that may be spent on purchasing food to supplement their own-produced food to eat adequate food. This result agrees with Opaluwa *et al*. (2019) [22] who found that off-farm income improved food security. Gender influences food insecurity negatively and significantly at a 10% level of significance. This implies that male-headed households are less likely to be food insecure. This could be possible as a result of the fact that men are more favoured in terms of access to production resources than women. This result is in tandem with the findings of Ashagidigbi *et al*. (2022) [17] that male-headed households are more in a food-secure group than their female-headed counterparts.

Household size is positively and significantly related to food insecurity at a 1% level of significance. This implies that large-size households are more likely to be food insecure than their small-size counterparts. This result could be explained from the viewpoint of the challenge of meeting the recommended daily per capita calorie that large-size family may face compared to their small-size counterparts. This result supports the findings of Ogunniyi *et al*., (2021) [18] that large household size is associated with a higher level of food insecurity. Participation in safety net programmes is negatively and significantly related to food insecurity at a 5% level of significance. This implies that farmers that participate in safety net programmes are less likely to be food insecure than their counterparts who do not participate. This may be attributed to the fact that farmers who participate in safety net programmes receive cash that they can spend on food items to supplement those available at home. This result agrees with Ahmed *et al*. (2022) who reported that they found an association between safety net and food insecurity.

Private transfer is negatively and significantly related to food insecurity at a 1% level of significance. This implies

that households who received private transfers from relations living away from 'home' are less likely to be food insecure than their counterparts who did not receive it. This could be a result of the fact that the money received through private transfer could be spent on food or invested in income-generating activities so that the proceeds can be used to buy food for the family. Some families who receive money from their relations regularly can use such money to purchase food before they run out of food or when they run out of food. This result is consistent with Ahmed *et al*., (2022) who found that private transfer reduced food insecurity of the recipients before the COVID-19 pandemic. Marital status is negatively and significantly related to food insecurity at a 1% level of significance. This means that married households are less likely to be food insecure than unmarried households. This is possible because spouses in married households tend to complement each other's efforts to ensure that the family acquires adequate food for consumption. This result is in accord with Obayelu, Akpan, and Ojo (2021) [16] who found that being married reduces the probability of being food insecure.

Farmers' group membership is negatively and significantly related to food insecurity at a 1% level of significance. This means that belonging to the farmers' group is associated with less food insecurity likelihood. This can be linked to the objectives of group formation which include solidarity and support for group members who face one challenge or the other including herder attack and the resulting food insecurity. This result agrees with Sumim *et al*., (2021) [19] who found that farmers who are members of the association have less likelihood of being food insecure. Asset ownership is negative and significantly influences food insecurity at a level of significance. This implies that farmers who own assets have less likelihood of being food insecure than their counterparts who do not own assets. This could be explained by the fact that assets can be sold to earn money for the purchase of food when in distress/ dire need of money for food. This result supports Amao *et al*., (2023) [20] who reported that asset ownership reduces food insecurity as households consume more diversified diets.

Table 4: Effect of Fulani herdsmen counter-productive activities on farmers' food security

Variable	Coefficient	Z
Herder challenge	0.3572731*** (1.509892)	4.23
Off-farm income	0.0000125*** (0.000423)	3.38
Years of formal education	0.0617766 (0.0453082)	0.73
Age	0.025342 (0.0198376)	0.78
Gender	0.3598826* (-0.6834943)	-1.90
Household size	0.0619348*** (0.1947489)	3.14
Safety net programmes	0.0805541** (-0.1679758)	-2.09
Private transfer	0.0000562*** (-0.0002413)	-4.29
Marital status	0.4254429*** (-1.611646)	-3.79
Farmers' group membership	0.0000129*** (-0.000055)	-4.26
Asset ownership	0.5059846*** (-2.695311)	-5.33
Constant	1.973856 (2.860634)	1.45
No of obs = 380		
Log likelihood = -52.065803 $\boldsymbol{Chi^2}$ (11) = 439.72		
Prob>$\boldsymbol{Chi^2}$=0.0000		
Pseudo $\boldsymbol{R^2}$=0.8085		

Source: Author's compilation

***, ** and * implies significant at 1%, 5% and 10% level of probability respectively.

4. Conclusion

In this study, the effect of farmer-herder conflicts on the food security status of food crop farmers in Ekiti and Ondo states, Nigeria was examined using cross-sectional data. Results of the food security analysis show four different food security index values based on the farmers 'status of herders' attacks. First, farmers who were not attacked by herders are food secure by 29% points above the food security line. Second, farmers who were attacked by herders but are food secure by 24.3% points above the food security line. Third, farmers who were not attacked by herders and food insecure by 18.9% points below the food security line. Fourth, farmers who were attacked by herders and food insecure by 14.9% points below the food security line. The results show further that food insecurity incidence in the study is 30.5% and that 56.6% of the food insecure farmers have suffered herders' attacks.

The probit regression results indicate that herders' attacks have a positive and significant influence on farmers' food insecurity. Similarly, large household size has a positive and significant influence on farmers' food insecurity. However, male-headedness of households, being married, asset ownership, access to private transfer, access to off-farm income, access to safety net programmes, and membership in farmers' groups have negative and significant relationships with food insecurity (implying that they reduce food insecurity). Moreover, the results indicate that farmers used different coping strategies to move on in the face of herders' attacks. The coping mechanisms include; engaging in off-farm jobs; using counter-attacks; relying on local vigilantes for protection, and arrest by police. Other coping mechanisms are fortifying the self with metaphysical powers, relying on the working of the state intervention, and going to the farm only, after receiving a safety signal.

The findings that herders' attacks influenced food insecurity point to the need to address the cause of the attack. The coping mechanisms used by farmers to move on with their livelihood present scenarios of total abandonment of farms or partial engagement in farming. If this trend continues, food insecurity will worsen and the SDG zero hunger target will be a mirage. Therefore, the government should legislate ownership of ranches for cattle farmers as a way to resolve the lingering farmer-herder conflicts. Also, the government should provide farmers who are victims of herders' attacks with cash and/or food assistance as a short-term solution to the challenge while farmers should diversify their income-earning engagement to off-farm jobs as well as join farmers' groups through which they can benefit from both government and NGOs food security programmes.

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