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Role of Women in Ensuring Food Sufficiency in Fragile and Conflict-Affected Areas of Northeast Nigeria

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Abstract

This article examines women's contributions to household food provision, barriers to food access, and participation in agribusinesses and cooperatives among households in Northeast Nigeria study. The analysis uses descriptive statistics and logistic regression models with robust standard errors. The outcome is having enough food on all 30 days. Overall, 30.99% of households met this criterion. Households that consumed food the respondent helped produce had higher adjusted odds of food sufficiency (OR = 7.05, 95% CI 3.76–13.20), while severe insecurity was associated with lower odds (OR = 0.34, 95% CI 0.18–0.64). Participation in both an agribusiness and a cooperative was associated with an estimated 13.00-percentage-point increase in the adjusted probability of food sufficiency relative to participation in neither (95% CI −1.05 to 27.05). In conclusion, consumption of food that women helped produce was associated with higher odds of household food sufficiency, while severe insecurity was associated with lower odds. The study recommends that government should prioritise farm inputs, extension services, and storage for women farmers. Authorities should work with communities to improve safe access to farms and markets.

Keywords: Household food sufficiency, women's agricultural participation, insecurity, agribusiness, agricultural cooperatives

1.0 Introduction

In conflict-affected areas of Northeast Nigeria, a household's ability to obtain enough food depends on what it can produce, what it can afford to buy, and whether it can reach farms and markets safely. Insecurity may interrupt cultivation, transport and trade at the same time. Food prices can restrict purchases even where markets remain accessible. The distinction matters because an intervention that improves purchasing power addresses a different constraint from one that restores access to land or markets.

Women contribute to these food systems through cultivation, livestock rearing, processing, storage, trading and household purchasing. Food retained from production enters household consumption directly, while agricultural earnings support purchases when households can reach functioning markets. Both channels depend on access to land, inputs, labour and finance. Gender and Development scholarship further distinguishes women's participation in agricultural work from their control over what is produced, sold or retained (Moser, 1993; Rathgeber, 1990).

Agribusinesses and cooperatives offer a further route through which women may support household food provision. Enterprises may create outlets for produce and sources of income, while cooperatives may provide shared inputs, savings or marketing services. Women can participate in either arrangement or in both. The sustainable livelihoods framework helps explain why these activities might complement one another, while recognising that households with different resources face different opportunities to participate (Chambers & Conway, 1992; Ellis, 2000).

The literature reviewed here documents women's productive roles, unequal access to resources and the disruption of agrifood systems during conflict. It leaves a more specific analytical question open: how do direct consumption of food women helped produce, severe access barriers, and different forms of organisational participation relate to the same measure of household food sufficiency? A further distinction concerns perceived importance and statistical association. A frequently named barrier may differ from the barrier most strongly associated with food sufficiency after accounting for household characteristics.

This article addresses that question through a quantitative analysis of 384 households in Northeast Nigeria. It examines three sets of associations: the contribution of household production and agricultural earnings, the severity of insecurity and food-price barriers, and participation in women-led agribusinesses and cooperatives. Each model uses the same binary outcome, whether a household had enough food on all 30 days of the reference period. This common outcome allows a consistent comparison of how the three sets of factors are examined. The analysis illustrates an empirical strategy that can be tested with data collected from households.

The next section reviews the literature and theoretical framework. Materials and Methods defines the outcome, explanatory variables and three logistic regression specifications. Results and Discussion presents the descriptive statistics and model estimates, then interprets the findings across the three specifications.

2.0 Literature Review and Theoretical Framework

2.1 Women's Role in Food Security and Agricultural Production

Women play a fundamental role in food security across sub-Saharan Africa, engaging in various aspects of agricultural production, including planting, weeding, harvesting, processing, and marketing of farm produce (FAO, 2024). Despite their significant contributions, women's access to productive resources remains disproportionately low compared to their male counterparts, thereby limiting their potential to enhance food sufficiency (Agarwal, 2020). Research indicates that women are responsible for producing approximately 60–80% of food in developing countries, yet they own less than 20% of the land and receive only 10% of available credit (World Bank, 2021). In conflict-affected regions like Northeast Nigeria, where displacement and insecurity have disrupted farming activities, the role of women in ensuring household food security becomes even more critical (UNDP, 2022).

2.2 Conflict and Its Impact on Agricultural Productivity

Armed conflict remains a major driver of food insecurity, particularly in fragile regions. The Boko Haram insurgency in Northeast Nigeria has led to large-scale displacement, destruction of farmland, and restricted access to agricultural inputs, significantly reducing food production (CSIS, 2020). Empirical studies indicate that women are disproportionately affected by such disruptions as they often bear the dual responsibility of sustaining agricultural activities and managing household food supplies (Omotayo & Olayemi, 2021). A study by Moses, Ja'afar-Furo, and Ntasimda (2024) revealed that insecurity reduced rural women's crop productivity by up to 89%, underscoring the urgent need for interventions that enhance women's resilience in food production.

2.3 Gender Inequality and Women's Access to Agricultural Resources

Structural inequalities in land ownership, access to finance, and extension services further constrain women's ability to contribute effectively to food security (Agarwal, 2020). Research by Doss et al. (2021) highlights that in many African countries, discriminatory customary laws prevent women from inheriting or owning land, limiting their capacity to engage in commercial farming. In Northeast Nigeria, these disparities are exacerbated by socio-cultural norms that restrict women's mobility and economic participation, further reducing agricultural productivity (UN Women, 2023). Studies have shown that granting women equal access to agricultural resources could increase total food production by up to 30% and significantly reduce food insecurity (FAO, 2024).

2.4 Women's Involvement in Agribusiness and Market Linkages

Women's participation in agribusiness offers a viable strategy for enhancing food security, particularly in conflict-affected regions. FAO (2024) reports that women's engagement in food processing and value chain development not only boosts household income but also strengthens food supply systems. Empirical evidence from Yobe State, Nigeria, indicates that women-led agribusiness initiatives, such as groundnut oil processing and fish farming, have improved household food availability and economic stability (UNDP, 2022). However, market access constraints, including inadequate infrastructure and gender-biased trade policies, often hinder women's ability to scale their agribusiness enterprises (World Bank, 2021).

2.5 Climate Change and Its Implications for Women in Agriculture

Climate variability presents an additional challenge to food security in Northeast Nigeria. The shrinking of the Lake Chad Basin by nearly 90% over the past six decades has disrupted traditional farming, fishing, and livestock-rearing activities, disproportionately affecting women who depend on these resources (CSIS, 2020). A study by Nyong et al. (2021) found that climate-induced droughts and floods have further reduced crop yields, exacerbating food shortages and increasing dependence on humanitarian aid. Women's limited access to climate-resilient agricultural practices and early warning systems constrains their ability to adapt to these environmental changes (FAO, 2024).

2.6 Empowering Women through Agricultural Extension Services

One of the major challenges in improving women's agricultural productivity is the lack of access to extension services. Research shows that female farmers receive less than 5% of available agricultural training, despite their significant role in food production (Doss et al., 2021). In conflict-affected areas, where access to information is further restricted, the situation worsens. FAO (2024) recommends the implementation of gender-responsive extension programs that provide women with training on improved farming techniques, post-harvest management, and financial literacy. Studies have demonstrated that when women receive targeted agricultural training, their productivity increases by up to 25%, directly contributing to food sufficiency (Omotayo & Olayemi, 2021).

2.7 The Role of Policy Interventions in Enhancing Women's Food Security Contributions

Government policies and international interventions play a crucial role in enhancing food security through gender-inclusive agricultural programs. However, most policies in Nigeria fail to sufficiently address gender disparities in agricultural resource allocation (UN Women, 2023). The Nigerian government's Agricultural Promotion Policy (APP) aims to boost food production, but critics argue that it does not adequately integrate women-specific interventions (World Bank, 2021). Comparative studies from Kenya and Ethiopia indicate that countries with gender-responsive agricultural policies have witnessed higher food productivity and economic growth (Agarwal, 2020). This suggests the need for Nigeria to strengthen its policy frameworks to support women's participation in agriculture.

2.8 Women's Cooperatives and Community-Led Initiatives in Food Security

Women-led cooperatives have emerged as effective mechanisms for enhancing food security in conflict-affected regions. Studies show that women's groups that engage in cooperative farming, microfinance, and agro-processing contribute significantly to food availability and household income stability (FAO, 2024). In Northeast Nigeria, organizations such as the Nigerian Women Agropreneurs Network (NWAN) have facilitated access to credit and market linkages for women farmers, improving food security outcomes (UNDP, 2022). These findings highlight the potential of community-driven approaches in mitigating the impacts of conflict on food production.

2.9 Technology and Innovation in Women's Agricultural Empowerment

Emerging agricultural technologies, including precision farming, mobile-based extension services, and climate-smart innovations, have the potential to enhance women's contributions to food sufficiency. Digital tools that provide market information, weather forecasts, and financial services have been found to improve women's productivity by enabling better decision-making (Nyong et al., 2021). However, studies indicate that the digital gender divide remains a significant barrier, as women in rural areas have limited access to smartphones and internet services (World Bank, 2021). Addressing these technological gaps through inclusive digital literacy programs could further enhance women's role in food security.

2.10 Theoretical Framework

This study is anchored on the Gender and Development (GAD) Theory, which provides a comprehensive framework for analyzing the role of women in food security, particularly in fragile and conflict-affected regions. The GAD theory, which emerged in response to the limitations of the Women in Development (WID) approach, focuses on the structural inequalities and socio-economic barriers that hinder women's full participation in development processes (Moser, 1993). It emphasizes the need for gender-responsive policies that integrate both men and women into sustainable development, recognizing that gender roles are socially constructed and subject to change (Rathgeber, 1990). The relevance of this theory to the present study lies in its ability to examine the systemic constraints—such as unequal access to land, finance, and extension services—that undermine women's contributions to food sufficiency in Northeast Nigeria.

Several studies have utilized the GAD framework to analyze gender disparities in agricultural productivity and food security. For instance, Doss et al. (2021) applied the theory in their study on gendered access to agricultural resources in sub-Saharan Africa. Their findings revealed that women farmers often receive disproportionately lower inputs and financial support compared to men, leading to reduced productivity and economic marginalization. Similarly, Agarwal (2020) employed the GAD approach to examine land tenure insecurity among women in South Asia and found that discriminatory inheritance laws significantly constrain women's ability to engage in commercial farming. These studies underscore the importance of institutional reforms and gender-inclusive policies in enhancing agricultural resilience and food sufficiency.

In the Nigerian context, Omotayo and Olayemi (2021) applied the GAD perspective to investigate gender disparities in agricultural financing in the North-Central region. Their study highlighted that cultural norms and financial exclusion limit women's access to credit facilities, thereby restricting their ability to expand farming activities. The findings align with the present study's objective of exploring how systemic barriers affect women's role in food security in Northeast Nigeria. Furthermore, a study by UNDP (2022) using the GAD framework demonstrated that women's participation in agribusiness significantly improves household food security, yet structural inequalities continue to hinder their economic empowerment. This evidence supports the argument that gender-responsive interventions are essential for achieving sustainable food sufficiency.

Additionally, the Sustainable Livelihoods Approach (SLA) complements the GAD theory by providing insights into how women in conflict-affected regions navigate livelihood constraints. The SLA, developed by Chambers and Conway (1992), posits that individuals and households require access to five key asset categories—human, social, natural, physical, and financial capital—to achieve sustainable livelihoods. Studies such as that of Ellis (2000) have applied the SLA to examine rural livelihood diversification strategies in developing economies. Findings indicate that when women gain access to multiple livelihood assets, their capacity to contribute to food production and security improves. The SLA is particularly relevant in Northeast Nigeria, where conflict-induced displacement has disrupted traditional agricultural activities, compelling women to adopt alternative food production and income-generation strategies.

Nyong et al. (2021) utilized the SLA framework in analyzing climate change adaptation strategies among women farmers in West Africa. Their study found that access to climate-smart agricultural technologies, financial support, and social networks significantly enhanced women's ability to mitigate food insecurity. This aligns with the current study's objective of assessing the extent to which women's engagement in agribusiness, cooperative farming, and extension services influences food sufficiency in conflict-prone areas. Furthermore, UN Women (2023) used the SLA approach to assess the role of women-led cooperatives in agricultural resilience, demonstrating that cooperative-based interventions improve women's financial stability and food availability.

By integrating the Gender and Development (GAD) Theory with the Sustainable Livelihoods Approach (SLA), this study provides a robust analytical framework for understanding the structural and livelihood challenges that women face in ensuring food sufficiency in Northeast Nigeria. While the GAD theory highlights the systemic gender inequalities that constrain women's agricultural productivity, the SLA offers insights into how women navigate these constraints to sustain food production. The combined theoretical perspectives will guide the study in identifying policy recommendations that enhance women's contributions to food security through gender-responsive interventions, improved resource access, and livelihood diversification strategies.

3.0 Methodology

3.1 Study Setting and Dataset

The analysis draws on 384 households for Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe.

The dependent variable Y_i equals 1 if household i had enough food on all 30 days of the reference period and 0 if it had enough food on fewer days. All three models adjust for age group, education, household size, displacement status and state as categorical covariates. Reference categories are age 18–24 years, no education, one-member household, never displaced and Adamawa, respectively.

3.2 Model Specification and Estimation

Let p_{im} denote the probability that household i had enough food on all 30 days under specification m. X_i is the common vector of categorical controls. Each equation models the log odds of food sufficiency. The coefficients and intercept are estimated separately in each model.

3.3 Women's Contributions to Household Food Provision

$$\ln[p_{i1}/(1 - p_{i1})] = \alpha_1 + \beta_1 P_i + \beta_2 E_i + X_i'\gamma_1 \quad (1)$$

P_i equals 1 when the household consumed food the woman helped produce. E_i equals 1 when she used agricultural or food-related earnings to buy household food. Both indicators use "No" as the reference.

3.4 Insecurity and Food Price Barriers

$$\ln[p_{i2}/(1 - p_{i2})] = \alpha_2 + \delta_1 I_i + \delta_2 F_i + X_i'\gamma_2 \quad (2)$$

I_i and F_i equal 1 when the respondent rated insecurity or high food prices, respectively, as affecting household food sufficiency "a lot." For each barrier, the reference combines "not at all," "a little" and "moderately."

3.5 Agribusiness and Cooperative Participation

$$\ln[p_{i3}/(1 - p_{i3})] = \alpha_3 + \theta_1 A_i + \theta_2 C_i + \theta_3 B_i + X_i'\gamma_3 \quad (3)$$

A_i, C_i and B_i indicate mutually exclusive participation in agribusiness only, a cooperative only, or both, respectively. Households in the reference group participated in neither.

Frequencies and percentages summarise the sample and study measures. Each logistic model uses complete data for its own outcome and covariates. Results are presented as adjusted odds ratios, obtained by exponentiating the logit coefficients, with robust standard errors and 95% confidence intervals. For Model 3, adjusted probabilities are averaged over the estimation sample's covariate distribution. A joint Wald test assesses whether the three participation coefficients equal zero. The overall Wald tests assess all non-intercept coefficients in their respective models.

4.0 Results and Discussion

The results describe the characteristics of the 384 households, women's contributions to food provision, barriers to food access, and participation in agribusinesses and cooperatives. Logistic models estimate the adjusted odds of having enough food on all 30 days.

4.1 Socioeconomic and Demographic Characteristics

Table 1. Characteristics of women respondents

Characteristic and category	Frequency	Percent (%)
Age group		
18–24 years	53	13.80
25–34 years	117	30.47
35–44 years	121	31.51
45–54 years	52	13.54
55–64 years	30	7.81
65 years or older	11	2.86
Highest education level completed		
No education	80	20.83
Non-formal education only	53	13.80
Primary	78	20.31
Secondary	115	29.95
Post-secondary	53	13.80

Characteristic and category	Frequency	Percent (%)
Don't know	4	1.04
Declined	1	0.26
Marital status		
Never married	67	17.45
Married or living with a partner	247	64.32
Separated or divorced	32	8.33
Widowed	31	8.07
Don't know	3	0.78
Declined	4	1.04
Household size		
One member	20	5.21
Two to four members	125	32.55
Five to seven members	183	47.66
Eight or more members	56	14.58
Household members under age 18		
None	69	17.97
One or two	162	42.19
Three or four	120	31.25
Five or more	33	8.59
Displacement status		
Never displaced	239	62.24
Currently displaced	60	15.63
Returned to former community	55	14.32
Resettled elsewhere after displacement	30	7.81
State of interview		
Adamawa	78	20.31
Bauchi	41	10.68
Borno	105	27.34
Gombe	24	6.25
Taraba	43	11.20
Yobe	93	24.22
Total respondents in each characteristic	**384**	**100.00**

Percentages use all 384 household records, including "Don't know" and "Declined" where recorded.

4.2 Women's Contributions to Household Food Provision

Table 2. Agricultural activities, food provision and household food sufficiency

Indicator or response category	Frequency	Percent (%)
Agricultural and food-related activities (n = 384)		
Bought food	300	78.13
Produced crops	192	50.00

Indicator or response category	Frequency	Percent (%)
Stored food	183	47.66
Processed or preserved food	170	44.27
Raised livestock or poultry	168	43.75
Sold food	165	42.97
Collected wild foods	57	14.84
Engaged in fishing	24	6.25
Contributions to household food provision		
Household ate food the respondent helped produce (n = 384)	234	60.94
Used agricultural or food-related earnings to buy household food (n = 379)	170	44.85
Months the household ate food the respondent helped produce (n = 234)		
1–3 months	49	20.94
4–6 months	70	29.91
7–9 months	73	31.20
10–12 months	42	17.95
Share of household food the respondent helped provide (n = 379)		
None	32	8.44
Less than half	120	31.66
About half	123	32.45
More than half but less than all	79	20.84
All	25	6.60
Who decides how to use or sell the food produced (n = 289)		
Respondent alone	79	27.34
Respondent jointly with others	140	48.44
Another person or group	53	18.34
Varies by product	17	5.88
Days the household had enough food in the past 30 days (n = 384)		
1–7 days	3	0.78
8–14 days	28	7.29
15–21 days	100	26.04
22–29 days	134	34.90
All 30 days	119	30.99
Months the household had difficulty getting enough food (n = 384)		
None	29	7.55
1–3 months	115	29.95
4–6 months	150	39.06
7–9 months	64	16.67
10–12 months	26	6.77
Household experiences due to limited food resources (n = 384)		
A household member ate a smaller meal	164	42.71
A household member skipped a meal	79	20.57
A household member went a whole day without eating	22	5.73

Percentages use the valid sample size shown for each item. Respondents could report more than one activity.

4.3 Women's Contributions and Household Food Sufficiency

Table 3. Logistic regression of household food sufficiency on women's contributions

Predictor	Odds ratio	Robust SE	z	p-value	95% CI
Household ate food the respondent helped produce (ref. No)					
Yes	7.0487	2.2554	6.10	<0.001	3.7649–13.1968
Used agricultural or food-related earnings to buy household food (ref. No)					
Yes	1.6942	0.4645	1.92	0.054	0.9899–2.8995
Age group (ref. 18–24 years)					
25–34 years	0.8744	0.3870	-0.30	0.762	0.3673–2.0820
35–44 years	1.1421	0.4962	0.31	0.760	0.4874–2.6763
45–54 years	1.2478	0.6606	0.42	0.676	0.4421–3.5217
55–64 years	1.2067	0.7307	0.31	0.756	0.3683–3.9540
65 years or older	0.1450	0.1659	-1.69	0.091	0.0154–1.3653
Education level (ref. No education)					
Non-formal only	0.4191	0.2080	-1.75	0.080	0.1584–1.1086
Primary	1.0843	0.4406	0.20	0.842	0.4889–2.4045
Secondary	1.0015	0.3733	0.00	0.997	0.4824–2.0793
Post-secondary	1.6849	0.7457	1.18	0.238	0.7077–4.0114
Household size (ref. One member)					
Two to four	0.3308	0.2212	-1.65	0.098	0.0892–1.2266
Five to seven	0.2324	0.1529	-2.22	0.027	0.0640–0.8436
Eight or more	0.2275	0.1623	-2.08	0.038	0.0562–0.9207
Displacement status (ref. Never displaced)					
Currently displaced	0.5570	0.2334	-1.40	0.162	0.2451–1.2661
Returned to former community	0.7066	0.2621	-0.94	0.349	0.3415–1.4618
Resettled elsewhere after displacement	0.9595	0.4865	-0.08	0.935	0.3552–2.5921
State (ref. Adamawa)					
Bauchi	4.8976	2.5885	3.01	0.003	1.7382–13.7995
Borno	0.2401	0.1031	-3.32	0.001	0.1035–0.5570
Gombe	2.0255	1.1144	1.28	0.200	0.6890–5.9548
Taraba	0.9536	0.4491	-0.10	0.920	0.3789–2.4000
Yobe	0.6001	0.2172	-1.41	0.158	0.2952–1.2196
Constant	0.4489	0.3734	-0.96	0.336	0.0879–2.2920

Outcome is having enough food on all 30 days. Estimates use robust standard errors. N = 374. Wald $\chi^2(22) = 70.03$, $p < 0.001$. Pseudo $R^2 = 0.2387$. Log pseudolikelihood = −176.9150. CI denotes confidence interval.

4.4 Barriers to Household Food Sufficiency

Table 4. Main barriers, insecurity disruptions and coping responses

Indicator or response category	Frequency	Percent (%)
Single most limiting barrier to providing food (n = 384)		
High food prices	84	21.88
Insecurity	65	16.93
Difficulty obtaining finance	44	11.46
Cost or shortage of farm inputs	41	10.68
Unpaid care or domestic work	28	7.29
Poor market access or transport	24	6.25
Displacement or loss of assets	21	5.47
Inadequate storage or processing	17	4.43
Weather shocks	17	4.43
Restrictions on women's work or mobility	15	3.91
Land access	12	3.13
Water access	8	2.08
Limited advice or training	8	2.08
Frequency of insecurity-related access disruptions (n = 384)		
Never	131	34.11
Once	81	21.09
Two or three times	79	20.57
Four or more times	93	24.22
Responses to food shortages (n = 384)		
Bought food on credit	128	33.33
Borrowed food or money	101	26.30
Used savings	70	18.23
Received food or cash assistance	65	16.93
Sold a productive asset	34	8.85
None of the listed responses	147	38.28

Each respondent could name one main barrier and select multiple coping responses.

4.5 Barriers Associated with Household Food Sufficiency

Table 5. Logistic regression of household food sufficiency on selected barriers

Predictor	Odds ratio	Robust SE	z	p-value	95% CI
Barrier severity (ref. not at all, a little or moderately)					
Insecurity rated "A lot"	0.3352	0.1096	-3.34	0.001	0.1766–0.6361
High food prices rated "A lot"	0.7434	0.1947	-1.13	0.258	0.4449–1.2423
Age group (ref. 18–24 years)					
25–34 years	1.0830	0.4373	0.20	0.844	0.4908–2.3897

Predictor	Odds ratio	Robust SE	z	p-value	95% CI
35–44 years	1.1641	0.4724	0.37	0.708	0.5255–2.5786
45–54 years	1.7338	0.8297	1.15	0.250	0.6786–4.4295
55–64 years	1.3453	0.7698	0.52	0.604	0.4383–4.1292
65 years or older	0.2750	0.2388	-1.49	0.137	0.0501–1.5084
Education level (ref. no education)					
Non-formal only	0.4963	0.2304	-1.51	0.131	0.1998–1.2327
Primary	1.1374	0.4290	0.34	0.733	0.5431–2.3820
Secondary	0.9840	0.3529	-0.04	0.964	0.4872–1.9874
Post-secondary	2.0081	0.8827	1.59	0.113	0.8485–4.7528
Household size (ref. one member)					
Two to four	0.2441	0.1306	-2.64	0.008	0.0855–0.6967
Five to seven	0.1853	0.0953	-3.28	0.001	0.0676–0.5076
Eight or more	0.1574	0.0943	-3.09	0.002	0.0487–0.5093
Displacement status (ref. never displaced)					
Currently displaced	0.6496	0.2371	-1.18	0.237	0.3176–1.3285
Returned to former community	0.8596	0.3361	-0.39	0.699	0.3994–1.8497
Resettled elsewhere after displacement	1.0870	0.5728	0.16	0.874	0.3870–3.0533
State (ref. Adamawa)					
Bauchi	3.8230	1.8083	2.84	0.005	1.5128–9.6609
Borno	0.2993	0.1251	-2.89	0.004	0.1319–0.6790
Gombe	1.5039	0.7746	0.79	0.428	0.5480–4.1270
Taraba	0.8275	0.3570	-0.44	0.661	0.3552–1.9277
Yobe	0.6558	0.2332	-1.19	0.235	0.3266–1.3166
Constant	3.2219	2.0747	1.82	0.069	0.9120–11.3825

Outcome is having enough food on all 30 days. Estimates use robust standard errors. N = 379. Wald $\chi^2(22) = 61.04$, $p < 0.001$. Pseudo $R^2 = 0.1560$. Log pseudolikelihood = −198.3850. CI denotes confidence interval.

4.6 Participation in Women Led Agribusinesses and Cooperatives

Table 6. Participation and household food sufficiency

Indicator or category	Frequency	Percent (%)
Agribusiness and cooperative participation (n = 384)		
Neither	165	42.97
Agribusiness only	92	23.96
Cooperative only	67	17.45
Both	60	15.63
Days the household had enough food in the past 30 days (n = 384)		
Fewer than 30 days	265	69.01
All 30 days	119	30.99

4.7 Participation and Household Food Sufficiency

Table 7. Logistic regression of household food sufficiency on participation

Predictor	Odds ratio	Robust SE	z	p-value	95% CI
Participation (ref. neither)					
Agribusiness only	1.1255	0.3527	0.38	0.706	0.6089–2.0803
Cooperative only	1.5092	0.5561	1.12	0.264	0.7330–3.1073
Both	2.0084	0.7557	1.85	0.064	0.9607–4.1989
Age group (ref. 18–24 years)					
25–34 years	1.1112	0.4524	0.26	0.796	0.5003–2.4680
35–44 years	1.2768	0.5199	0.60	0.548	0.5748–2.8361
45–54 years	1.3704	0.6419	0.67	0.501	0.5471–3.4322
55–64 years	1.2746	0.7172	0.43	0.666	0.4230–3.8400
65 years or older	0.3354	0.2797	-1.31	0.190	0.0654–1.7191
Education level (ref. no education)					
Non-formal only	0.4296	0.2043	-1.78	0.076	0.1691–1.0913
Primary	1.1213	0.4063	0.32	0.752	0.5512–2.2811
Secondary	0.9501	0.3276	-0.15	0.882	0.4833–1.8677
Post-secondary	1.5687	0.6779	1.04	0.297	0.6725–3.6594
Household size (ref. one member)					
Two to four	0.2656	0.1490	-2.36	0.018	0.0884–0.7977
Five to seven	0.1992	0.1098	-2.93	0.003	0.0676–0.5867
Eight or more	0.1645	0.1005	-2.95	0.003	0.0497–0.5449
Displacement status (ref. never displaced)					
Currently displaced	0.6127	0.2273	-1.32	0.187	0.2961–1.2677
Returned to former community	0.6995	0.2728	-0.92	0.359	0.3257–1.5024
Resettled elsewhere after displacement	0.7661	0.3917	-0.52	0.602	0.2813–2.0869
State (ref. Adamawa)					
Bauchi	3.6267	1.6207	2.88	0.004	1.5105–8.7078
Borno	0.2551	0.1052	-3.31	0.001	0.1137–0.5725
Gombe	1.6586	0.8456	0.99	0.321	0.6106–4.5052
Taraba	0.8871	0.3811	-0.28	0.780	0.3822–2.0588
Yobe	0.6739	0.2391	-1.11	0.266	0.3361–1.3510
Constant	1.9504	1.3362	0.98	0.330	0.5093–7.4694

Outcome is having enough food on all 30 days. Estimates use robust standard errors. N = 379. Wald $\chi^2(23) = 53.33$, $p = 0.0003$. Pseudo $R^2 = 0.1364$. Log pseudolikelihood = −202.9782. CI denotes confidence interval. The joint Wald test for the three participation indicators yielded $\chi^2(3) = 4.00$ ($p = 0.2612$).

4.8 Discussion of Findings

The respondent profile provides context for interpreting household food sufficiency. Nearly half of the women lived in households with five to seven members, and more than a third had experienced displacement. In each adjusted model, households with five to seven members and those with eight or more had lower estimated odds of having enough food throughout the month than one-person households. A larger household may need more food and cash to sustain consumption, although household size alone gives no information about the number of earners, economies of scale, or how resources are shared. The concentration of observations in Borno and Yobe also matters when reading pooled percentages. Those percentages describe the composition of these records and cannot establish the prevalence of food sufficiency across Northeast Nigeria.

The descriptive results point to two ways women help provide household food. Buying food was the most common activity, while half of respondents produced crops and about three in five households ate food the respondent helped produce. Women were also involved in food processing, storage and sales. These activities can support consumption at different times of the year. For example, food kept for household use can supplement purchases, while sales can provide cash for food the household does not produce. Joint decisions about using or selling food were more common than decisions made by the respondent alone. This indicates that contributing labour or produce and controlling how the resulting food is used are distinct aspects of women's role in household food provision.

The regression reinforces the distinction between food consumed from household production and earnings spent on food. Eating food the respondent helped produce was associated with about seven times the adjusted odds of having enough food throughout the month. The confidence interval excludes an odds ratio of 1 but spans a substantial range, so the magnitude remains uncertain. For spending agricultural or food-related earnings on food, the estimate was positive and the interval included 1. The strength of the production association is compatible with direct access to food when purchases are difficult. It could also reflect differences in land, assets or labour available to households. The models provide no basis for attributing the observed differences entirely to women's production or spending decisions.

Price pressure and insecurity describe different constraints on food access. High prices were the most frequently selected main barrier, while insecurity had the clearer adjusted association with monthly food sufficiency. A price increase can reduce purchasing power even when markets are accessible. Insecurity can affect whether households reach farms, transport produce or obtain supplies in the first place. The reported frequency of access disruptions and the use of credit or borrowing are consistent with households facing both physical and financial obstacles. The food-price coefficient remains imprecise, and its confidence interval permits both lower and higher adjusted odds. Its uncertainty should be considered alongside the descriptive finding that many respondents identified prices as their most limiting barrier.

The coping responses give further insight into how households manage shortages. Buying food on credit and borrowing food or money were the most common reported actions. Both can preserve

consumption in the short run, but their longer-term consequences depend on repayment terms, whether households have stable income and whether they can replenish savings. Selling a productive asset was less common and may have more lasting consequences if it reduces the ability to farm or earn. The results record whether respondents used each strategy. They provide no direct measure of how often it was used, the scale of the resources involved, or whether it restored adequate consumption. These distinctions matter when interpreting coping as a response to hardship.

The estimates for participation were highest for households involved in both an agribusiness and a cooperative. Their adjusted probability of having enough food throughout the month was about 13 percentage points above the group involved in neither. The confidence interval included zero and the joint test for the three participation categories gave $p = 0.2612$. The pattern is compatible with complementary benefits from enterprise and cooperative activity, but the results cannot distinguish those benefits from differences in who participates. No completed tabulation of benefits or community food availability was available. The participation estimates therefore apply to the household food outcome, and they provide no direct estimate of changes in the wider community food supply.

Taken together, the results distinguish three channels that can be examined in subsequent research. Direct provision through women's production has the clearest positive association with sufficient food throughout the month. Insecurity appears to constrain access even after accounting for the measured household characteristics and state. Participation in women-led enterprises and cooperatives shows a positive pattern whose magnitude remains uncertain. Measuring land access, income stability, market travel, benefits received and food purchases over time would help establish how these channels interact. The outcome used here captures continuity of food sufficiency over 30 days, while dietary quality, nutritional adequacy and longer-term resilience require separate measures.

5.0 Conclusion

The analysis identifies direct household consumption of food women helped produce and insecurity-related barriers as the clearest correlates of having enough food throughout the month. High food prices were frequently named as the main barrier, while the adjusted estimate for severe price pressure remained uncertain. Participation in both an agribusiness and a cooperative had the highest estimated probability of food sufficiency, with substantial uncertainty around the difference.

6.0 Recommendations

Agricultural support programmes should pilot input, storage and extension packages for women who produce food for household use. Local authorities and programme partners should assess the routes and times at which women face difficulty reaching farms and markets. The assessment can guide safer locations and schedules for extension, input distribution and produce collection.

Food assistance programmes should monitor food prices alongside household borrowing and purchases on credit. Where affordability is the main barrier, they should test targeted support and track whether it reduces reliance on debt or asset sales.

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