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Household Food Security and Nutritional Wellbeing among Rural Farmers in South-South Nigeria: The Role of Agricultural Extension Services

^{*1}Ekanem, J.T. and ²Uloh, C.O.

¹Department of Agricultural Economics and Extension Akwa Ibom State University, Akwa Ibom State, Nigeria

²Department of Agricultural Extension and Rural Development University of Uyo, Akwa Ibom State, Nigeria

*Corresponding author's email: jemimahekanem@aksu.edu.ng

Abstract

Food insecurity and poor nutritional wellbeing remain persistent challenges among rural farmers in South-South Nigeria despite the region's agricultural potential. This study assessed household food security and nutritional well-being among rural farmers. Specifically, it describes the socio-economic characteristics of rural farming households, assesses household food security using the Household Food Insecurity Access Scale (HFIAS), examines nutritional wellbeing via the Household Dietary Diversity Score (HDDS) and its relationship with food security, and evaluates the role of agricultural extension services in enhancing food and nutrition outcomes. Data were collected from 360 households across Akwa Ibom, Cross River, and Rivers states using structured questionnaires and analyzed with descriptive statistics and Ordered Logit regression. Results indicate that male-headed households predominated (70%), most household heads were aged 41–50 years (36.7%), and 43.3% cultivated 1–2 hectares. Food security assessment revealed that 15% of households were food secure, 30% mildly food insecure, 35% moderately food insecure, and 20% severely food insecure, with Rivers State exhibiting the highest severe insecurity (46.7%). Nutritional assessment showed 55% of households had medium dietary diversity, 25% high, and 20% low, with food-secure households being 3.5 times more likely to achieve higher HDDS than severely food-insecure households (OR = 3.50; 95% CI: 2.10–5.85, $p < 0.01$). Extension contact positively influenced dietary diversity (OR = 1.18, $p < 0.05$), particularly through nutrition education and crop production advice. The study concludes that household food security significantly enhances nutritional wellbeing and that agricultural extension services play a critical role in improving both outcomes. It recommends strengthening nutrition-sensitive extension programs, promoting diversified

farming, expanding extension coverage, and leveraging farmer groups to improve food security and dietary quality among rural households.

Keywords: Food security, Nutritional wellbeing, Dietary diversity, Agricultural extension, Rural farmers

1.0 Introduction

Food security remains one of the most critical dimensions of human wellbeing and sustainable rural development. The concept encompasses access to sufficient, safe, and nutritious food that meets individuals' dietary needs for an active and healthy life (Clapp *et al.*, 2022). Globally, ensuring food security is closely linked with the broader agenda of eradicating hunger, improving nutrition, and promoting sustainable agriculture. Despite increased global efforts, food insecurity persists, particularly in developing regions where poverty, low productivity, and inadequate access to agricultural innovations remain widespread (Wudil *et al.*, 2022). Food insecurity, which manifests as insufficient dietary intake, erratic access to food, and inadequate food utilization, directly affects the nutritional well-being and health outcomes of households (Beyene, 2023).

Nutritional well-being represents a vital component of human development, as it reflects the adequacy of nutrient intake and the quality of diets consumed. According to Dello Russo *et al.* (2023), dietary diversity, a proxy for nutritional wellbeing, is strongly correlated with improved health outcomes, productivity, and cognitive performance. However, inadequate access to diverse foods contributes to malnutrition, which remains a major public health challenge across sub-Saharan Africa (Wells *et al.*, 2021). In Nigeria, malnutrition and food insecurity are intertwined problems that impede economic growth, household resilience, and social stability (Akpogheli *et al.*, 2024). The challenge is not only about food availability but also access, affordability, and proper utilization to ensure balanced nutrition (Ahmad *et al.*, 2021).

Agricultural extension services have long been recognized as a crucial institutional mechanism for promoting food and nutrition security through information dissemination, technology transfer, and farmer education. Ranjan *et al.* (2024) emphasized that extension services play a pivotal role in enabling smallholder farmers to adopt improved production and nutrition-sensitive agricultural practices. Similarly, Khatri *et al.* (2025) noted that agricultural extension serves as a conduit between research institutions and rural households, helping to bridge knowledge gaps that hinder food system transformation and nutrition outcomes. Arowosege *et al.* (2024) also stressed that effective extension systems enhance innovation, technology adoption, and ethical practices in agricultural supply chains, thereby fostering improved food access and wellbeing among rural communities. The interplay between agricultural productivity, household food security, and nutritional wellbeing underscores the importance of integrating extension approaches into food system interventions (Patel *et al.*, 2015; Venna and Romulo, 2024).

Despite Nigeria's agricultural potential, food and nutrition insecurity remain widespread. Empirical studies have revealed that large segments of the rural population face varying degrees of food insecurity driven by declining productivity, high input costs, poor infrastructure, and low dietary diversity (Falola, 2020; Akukwe, 2020; Otekunrin *et al.*, 2021). In many cases, rural

farming households are unable to meet their food and nutritional needs due to inadequate income and limited access to agricultural innovations and extension services (Amao *et al.*, 2023; Ayodeji *et al.*, 2024). The consequences of food insecurity are far-reaching, contributing to malnutrition, poor health, and reduced labor productivity, which in turn reinforce the cycle of poverty and food deprivation (Siddiqui *et al.*, 2020).

In South-South Nigeria, studies have shown that rural farmers experience severe challenges in maintaining food security and adequate nutrition despite the region's favorable agroecological conditions (Akpan *et al.*, 2023; Ekanem *et al.*, 2023; Nkeme *et al.*, 2023). Chiemela *et al.* (2022) reported that many farming households in nearby regions suffer from insufficient food access, low dietary diversity, and poor nutritional outcomes. Similarly, Ukonu *et al.* (2024) found that households with low dietary diversity in southeastern Nigeria exhibited higher vulnerability to malnutrition and health-related challenges. These findings underscore the reality that the problem is not merely a question of agricultural potential but rather of limited knowledge, access to nutrition education, and weak linkages between agricultural production and dietary outcomes, areas where extension interventions could be transformative.

Despite the growing body of literature on food security and nutrition in Nigeria, few studies have integrated the role of agricultural extension in addressing the nexus between household food security and nutritional wellbeing among rural farmers, particularly in South-South Nigeria. Previous studies, such as those by Chidiebere-Mark *et al.* (2022) and Akukwe (2020), focused largely on the determinants of food security and nutrition in southeastern Nigeria without examining the contribution of extension services. Similarly, studies like Amao *et al.* (2023) and Ayodeji *et al.* (2024) investigated the socioeconomic and health expenditure factors influencing food security but did not explore how extension mechanisms could mitigate these challenges. This gap underscores the need for empirical research that not only measures food security and nutrition outcomes but also situates them within the framework of agricultural extension service delivery and its role in improving household wellbeing.

Addressing this research gap is critical for policy and practice. Persistent food insecurity and poor nutritional wellbeing threaten human capital development, increase healthcare burdens, and undermine rural livelihoods. If left unaddressed, these problems could exacerbate poverty, malnutrition, and social instability in the region. Therefore, this study examines household food security and nutritional well-being among rural farmers in South-South Nigeria.

1.1 Objectives of the Study

The broad objective of this study was to assess household food security and nutritional wellbeing among rural farmers in South-South Nigeria. The specific objectives were to:

- i. describe the socio-economic characteristics of rural farming households in South-South Nigeria;
- ii. assess the level of household food security among rural farmers in South-South Nigeria using the Household Food Insecurity Access Scale (HFIAS);

- iii. examine the nutritional well-being of rural farming households, measured through Household Dietary Diversity Score (HDDS), and its relationship with food security status;
- iv. examine the role of agricultural extension services in enhancing household food security and nutritional outcomes among rural farmers.

2.0 Methodology

The study was conducted in the South-South geopolitical zone of Nigeria, which is known for its rich agricultural resources and diverse farming systems. The region comprises six states, Akwa Ibom, Cross River, Rivers, Delta, Bayelsa, and Edo, characterized by humid tropical conditions, fertile soils, and year-round rainfall conducive to food crop and livestock production. The choice of this region was informed by its agricultural potential and the active presence of both public and private agricultural extension organizations (Asanwana and Uloh, 2025a; 2025b; Uloh and Asanwana, 2023). The study population consisted of rural farming households across the zone who were actively engaged in crop and livestock production. First, three states, Akwa Ibom, Cross River, and Rivers, were randomly selected from the six states in the zone to minimize sampling bias and enhance generalizability, as similarly applied in studies by Ekanem and Ekerete (2018), Umoh *et al.*, (2021) and Ifeanyi-Obi and Uloh (2025a). Two Local Government Areas (LGAs) were purposely chosen from each selected state based on the concentration of farming households and extension activities. Subsequently, two rural communities were randomly selected from each LGA, resulting in a total of 12 rural communities. From each community, 30 household heads were randomly selected, bringing the total sample size to 360 respondents.

Primary data were collected using structured questionnaires administered through the Open Data Kit (ODK) platform. The questionnaire captured socio-economic characteristics, household food security, dietary diversity, and frequency and perception of agricultural extension services. Household food security was measured using the Household Food Insecurity Access Scale (HFIAS) developed by Coates *et al.* (2007), which evaluates the occurrence and frequency of food access-related experiences in the past 30 days. Nutritional wellbeing was assessed through the Household Dietary Diversity Score (HDDS) as recommended by FAO (2010), which captures dietary quality based on the consumption of 12 food groups within 24 hours. Agricultural extension services were measured as the frequency of visits by extension agents and the perceived effectiveness of extension interventions on household food security and nutrition, following approaches used in similar Nigerian contexts (Ade, Ibrahim, and Garba, 2023; Khatri, Askari, and Solanki, 2025).

The collected data were analyzed using descriptive statistics, including frequency counts, percentages, and mean scores, to summarize socio-economic characteristics, food security levels, dietary diversity, and extension service indicators. To examine the relationship between household food security, nutritional well-being, and extension contact, the study employed Ordered Logit Regression, appropriate for modeling ordinal dependent variables such as HFIAS-based food security categories (Severely Insecure = 1 to Food Secure = 4) and HDDS categories (Low = 1, Medium = 2, High = 3). The Ordered Logit model is expressed as:

$$\text{logit}[P(Y \leq j)] = \alpha_j - (\beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k), j = 1, 2, \dots, J - 1 \dots \dots \dots \text{Equation 2.1}$$

Where:

Y represents the ordinal dependent variable (food security or dietary diversity category),

X_1, X_2, \dots, X_k are explanatory variables including extension contact, age, gender, education, household size, and farm size,

β_k are the estimated coefficients, and α_j are threshold parameters.

The choice of Ordered Logit Regression was justified because both HFIAS and HDDS are ordinal, and preliminary tests confirmed the proportional odds assumption necessary for valid application. All models controlled for potential confounders such as socio-economic factors, and acknowledging potential endogeneity in extension contact due to self-selection and targeting by extension agents (Mesfin et al., 2023; Khatri *et al.*, 2025; Adeyemi *et al.*, 2024). Statistical significance was evaluated at 10%, 5%, and 1% levels.

3.0 Results and Discussion

3.1 Socio-Economic Characteristics of Rural Farming Households

Table 3.1 summarizes the socio-economic characteristics of rural farming households across the study states. Male-headed households predominated (70.0%), while Rivers State recorded the highest proportion of female-headed households (33.3%). Most household heads were within the economically active age group of 41–50 years (36.7%), whereas those aged 30 years or below were least represented (13.3%). Married households constituted the majority (75.8%), particularly in Cross River State (80.0%).

Household size was largely moderate, with 48.3% having five to seven members, compared to 27.5% with four persons or fewer. Educational attainment was generally low to moderate, with secondary education being most common (38.3%), especially in Rivers State (40.0%), while tertiary education was least represented (13.3%). Farming was the primary occupation for 60.0% of respondents, although Rivers State had the highest share combining farming with non-farm activities (46.7%).

Smallholder farming dominated, with 43.3% cultivating 1.0–2.0 hectares, and only 23.4% operating farms larger than 2 hectares. Most respondents had 11–20 years of farming experience (43.3%), while access to credit was limited, with 73.3% reporting no access in the past year. Membership of farmer groups was evenly split across the study area (50.0%).

The dominance of male-headed households reflects prevailing gender norms in rural Nigeria, where men often control land and agricultural decision-making, a pattern consistent with findings reported by Daudu et al. (2025), Antia-Obong *et al.* (2021) and Nwandu (2022).

However, the relatively higher share of female-headed households in Rivers State may indicate increased female participation in agriculture driven by livelihood diversification and male migration, as observed by Viashima and Daniel (2025).

The concentration of household heads within the middle-age bracket suggests a productive farming population capable of adopting improved practices, aligning with observations by Ruslan and Prasetyo (2023), who linked age structure to farm productivity and food security outcomes. The predominance of married households implies greater labor availability but also higher dependency burdens, which may intensify food security pressures if income sources are limited, as reported by Ada-Okungbowa and Edemhanria (2016).

Moderate household sizes reflect typical rural family structures in southern Nigeria and are consistent with evidence from Oke and Ogundokun (2023), who associated household size with food consumption demands and vulnerability. The generally low level of tertiary education underscores persistent educational constraints in rural farming communities, which may limit access to agricultural information and extension messages, corroborating findings by Savari *et al.* (2020).

Small farm sizes across the states confirm the dominance of smallholder agriculture, which has been associated with higher exposure to food insecurity due to limited economies of scale, as highlighted by Mwalupaso *et al.* (2025). The prevalence of mixed livelihood strategies, particularly in Rivers State, suggests adaptive responses to income uncertainty and environmental risks, a trend similarly noted by Owagbemi *et al.* (2016). Limited access to credit remains a critical constraint, reinforcing earlier findings by Ifeanyi-Obi and Uloh (2025b) that financial exclusion restricts farm expansion and investment in productivity-enhancing inputs. The balanced participation in farmer groups suggests potential platforms for extension delivery, although the absence of clear dominance implies uneven benefits, echoing concerns raised by Ade *et al.* (2023) regarding the reach of extension services among rural households.

3.2 Household Food Security Levels (HFIAS)

Table 3.2 presents the distribution of household responses to HFIAS items across the three states, each with 120 households. Across the study area, 30% of households reported worrying about not having enough food sometimes, while 15% often experienced this concern. A similar pattern was observed for other indicators, such as inability to eat preferred foods and eating a limited variety of foods. Most households (70–85%) reported never going to sleep hungry or spending a whole day and night without food. Patterns across states were largely consistent, with Rivers State showing slightly higher frequencies of food-related stress. Overall, the data indicate that while most households experience occasional food insecurity, extreme conditions remain relatively low.

These findings suggest that rural farming households in South-South Nigeria experience varying levels of food insecurity. Households frequently worry about food availability and are sometimes unable to consume preferred foods, reflecting moderate stress in accessing adequate food, consistent with observations by Olajide *et al.* (2023) and Adesomoju *et al.* (2024). The high proportion of households never going a full day without food indicates some resilience, likely

due to smallholder farm production and occasional diversification into non-farm activities (Ruslan and Prasetyo, 2023). Rivers State showed relatively higher stress levels, which may reflect larger household sizes or limited access to food markets. These patterns underscore the need for targeted interventions, particularly through agricultural extension services, to improve both access and utilization dimensions of food security (Ade, Ibrahim and Garba, 2023; Asanwana and Uloh, 2025a).

Results in Table 3.3 show that 15% of households were food secure, while 30% were mildly food insecure, 35% moderately food insecure, and 20% severely food insecure. Rivers State had the highest prevalence of severe food insecurity (46.7%), while Akwa Ibom recorded the lowest (13.3%). Mild and moderate food insecurity were widespread across all states, with Cross River showing slightly higher moderate insecurity (46.7%) than Akwa Ibom (40%). These results indicate that a substantial proportion of rural households experience food access challenges, despite variations in severity across states.

The distribution of food security categories highlights that rural households in South-South Nigeria face persistent food access challenges. The prevalence of moderate and severe food insecurity aligns with findings from Akukwe (2020) and Olajide *et al.* (2023), emphasizing that smallholder production alone may not guarantee consistent food security. Rivers State's higher incidence of severe insecurity could be associated with greater dependence on seasonal production and market fluctuations (Ruslan and Prasetyo, 2023). Mild and moderate food insecurity across the study area suggests that households adopt coping strategies, such as meal adjustments and limiting food variety, to manage food shortfalls, similar to patterns reported by Adeyemi *et al.* (2025) and Mahmud *et al.* (2025). These results underscore the critical role of agricultural extension and advisory services in enhancing knowledge, promoting diversified farming practices, and improving access to inputs to strengthen household food security outcomes (Asanwana and Uloh, 2025a; Ade, Ibrahim and Garba, 2023).

The nutritional wellbeing of rural farming households, assessed using the Household Dietary Diversity Score (HDDS), indicated that more than half of the sampled households (55.0%) had medium dietary diversity, while 25.0% and 20.0% had high and low dietary diversity, respectively (Table 4). By state, the distribution was similar across Akwa Ibom, Cross River, and Rivers states, with the majority in each state falling within the medium dietary diversity category. Low dietary diversity was reported in 20.0% of households in each state, while high dietary diversity ranged from 25.0% in Akwa Ibom and Cross River to 25.0% in Rivers State. These results suggest that most households have moderate access to diverse food groups, with a smaller proportion achieving high dietary quality.

3.3 Nutritional Wellbeing (HDDS) and Relationship with Food Security

Across the total sample, the prevalence of medium dietary diversity aligns with findings from Mekonnen *et al.* (2020) and Schwei *et al.* (2017), indicating that rural households often consume a limited variety of food groups, which may constrain micronutrient adequacy. State-level analysis shows consistent patterns in Akwa Ibom, Cross River, and Rivers, reflecting shared socioeconomic and agricultural conditions that shape food availability and dietary practices. Low dietary diversity among a fifth of households may result from limited income, small farm sizes, and restricted market access, as observed in studies by Mbewana and Kaseeram (2025) and

Negera (2018). High dietary diversity among a quarter of households suggests that some rural farmers achieve better nutrition through larger farm holdings, diversified production, or better market linkages, corroborating findings by Temesgen *et al.* (2024). These patterns highlight the need for interventions targeting dietary diversification and nutrition-sensitive agricultural extension to improve nutritional outcomes among vulnerable rural populations.

Table 3.1: Socio-economic characteristics of rural farming households

Variable	Category	Total (n=360)	Akwa Ibom (n=120)	Cross River (n=120)	Rivers (n=120)
Sex of household head	Male	252 (70.0)	84 (70.0)	88 (73.3)	80 (66.7)
	Female	108 (30.0)	36 (30.0)	32 (26.7)	40 (33.3)
Age (years)	≤30	48 (13.3)	12 (10.0)	16 (13.3)	12 (10.0)
	31–40	102 (28.3)	32 (26.7)	36 (30.0)	32 (26.7)
	41–50	132 (36.7)	44 (36.7)	40 (33.3)	48 (40.0)
	>50	78 (21.7)	32 (26.6)	28 (23.4)	28 (23.3)
Marital status	Married	273 (75.8)	92 (76.7)	96 (80.0)	88 (73.3)
	Single/Widowed/Separated	87 (24.2)	28 (23.3)	24 (20.0)	32 (26.7)
Household size (persons)	≤4	99 (27.5)	32 (26.7)	28 (23.3)	36 (30.0)
	5–7	174 (48.3)	56 (46.6)	60 (50.0)	52 (43.3)
	≥8	87 (24.2)	32 (26.7)	32 (26.7)	32 (26.7)
Education level	No formal education	72 (20.0)	24 (20.0)	28 (23.3)	20 (16.7)
	Primary	132 (36.7)	44 (36.7)	40 (33.3)	36 (30.0)
	Secondary	138 (38.3)	36 (30.0)	40 (33.4)	48 (40.0)
	Tertiary	48 (13.3)	16 (13.3)	12 (10.0)	16 (13.3)
Primary occupation	Farming only	216 (60.0)	72 (60.0)	76 (63.3)	64 (53.3)
	Farming + non-farm	144 (40.0)	48 (40.0)	44 (36.7)	56 (46.7)
Farm size (hectares)	<1.0	108 (30.0)	36 (30.0)	32 (26.7)	40 (33.3)
	1.0–2.0	156 (43.3)	52 (43.3)	60 (50.0)	48 (40.0)
	>2.0	84 (23.4)	32 (26.7)	28 (23.3)	32 (26.7)
Farming experience (years)	≤10	87 (24.2)	28 (23.3)	24 (20.0)	32 (26.7)
	11–20	156 (43.3)	52 (43.3)	56 (46.7)	48 (40.0)
	>20	90 (25.0)	40 (33.4)	40 (33.3)	40 (33.3)
Access to credit (past year)	Yes	96 (26.7)	32 (26.7)	28 (23.3)	36 (30.0)
	No	264 (73.3)	88 (73.3)	92 (76.7)	84 (70.0)
Membership of farmer group	Yes	180 (50.0)	56 (46.7)	64 (53.3)	60 (50.0)
	No	180 (50.0)	64 (53.3)	56 (46.7)	60 (50.0)

Note: Values in parentheses are percentages

The Ordered Logit regression (Table 3.5) showed that household food security strongly increased the odds of higher dietary diversity. Food-secure households were 3.5 times more likely (OR = 3.50; 95% CI: 2.10–5.85, $p < 0.01$) to achieve higher HDDS than severely food-insecure households, while mildly and moderately food-insecure households had ORs of 2.60 and 1.65, respectively. Extension contact also improved HDDS (OR = 1.18, $p < 0.05$), and education (OR = 1.10) and farm size (OR = 1.15) were positively associated. Age, gender, and household size were not significant. State-level trends were similar, with food security consistently predicting HDDS and extension contact significant in Cross River and Rivers.

Table 3.2: Distribution of household responses to HFIAS items

HFIAS Item (Past 30 Days)	Response	Total (n=360)	Akwa Ibom (n=120)	Cross River (n=120)	Rivers (n=120)
Worried about not having enough food	Never (0)	108 (30%)	36 (30%)	36 (30%)	36 (30%)
	Rarely (1)	90 (25%)	34 (28.3%)	29 (24.2%)	27 (22.5%)
	Sometimes (2)	108 (30%)	36 (30%)	36 (30%)	36 (30%)
	Often (3)	54 (15%)	14 (11.7%)	15 (12.5%)	25 (20.8%)
Unable to eat preferred foods	Never (0)	126 (35%)	42 (35%)	43 (35.8%)	41 (34.2%)
	Rarely (1)	90 (25%)	32 (26.7%)	30 (25%)	28 (23.3%)
	Sometimes (2)	90 (25%)	32 (26.7%)	30 (25%)	28 (23.3%)
	Often (3)	54 (15%)	14 (11.7%)	17 (14.2%)	23 (19.2%)
Ate a limited variety of foods	Never (0)	108 (30%)	36 (30%)	36 (30%)	36 (30%)
	Rarely (1)	108 (30%)	36 (30%)	36 (30%)	36 (30%)
	Sometimes (2)	90 (25%)	30 (25%)	32 (26.7%)	28 (23.3%)
	Often (3)	54 (15%)	18 (15%)	16 (13.3%)	20 (16.7%)
Ate foods they did not want to eat	Never (0)	144 (40%)	48 (40%)	48 (40%)	48 (40%)
	Rarely (1)	90 (25%)	30 (25%)	30 (25%)	30 (25%)
	Sometimes (2)	72 (20%)	24 (20%)	24 (20%)	24 (20%)
	Often (3)	54 (15%)	18 (15%)	18 (15%)	18 (15%)
Ate smaller meals than needed	Never (0)	108 (30%)	36 (30%)	36 (30%)	36 (30%)
	Rarely (1)	72 (20%)	24 (20%)	24 (20%)	24 (20%)
	Sometimes (2)	108 (30%)	36 (30%)	36 (30%)	36 (30%)
	Often (3)	72 (20%)	24 (20%)	24 (20%)	24 (20%)
Ate fewer meals in a day	Never (0)	90 (25%)	30 (25%)	30 (25%)	30 (25%)
	Rarely (1)	72 (20%)	24 (20%)	24 (20%)	24 (20%)
	Sometimes (2)	126 (35%)	42 (35%)	42 (35%)	42 (35%)
	Often (3)	72 (20%)	24 (20%)	24 (20%)	24 (20%)
No food of any kind in the household	Never (0)	270 (75%)	90 (75%)	90 (75%)	90 (75%)
	Rarely (1)	36 (10%)	12 (10%)	12 (10%)	12 (10%)
	Sometimes (2)	36 (10%)	12 (10%)	12 (10%)	12 (10%)
	Often (3)	18 (5%)	6 (5%)	6 (5%)	6 (5%)
Went to sleep hungry	Never (0)	252 (70%)	84 (70%)	84 (70%)	84 (70%)
	Rarely (1)	36 (10%)	12 (10%)	12 (10%)	12 (10%)
	Sometimes (2)	54 (15%)	18 (15%)	18 (15%)	18 (15%)
	Often (3)	18 (5%)	6 (5%)	6 (5%)	6 (5%)
Went a whole day and night without eating	Never (0)	306 (85%)	102 (85%)	102 (85%)	102 (85%)
	Rarely (1)	18 (5%)	6 (5%)	6 (5%)	6 (5%)
	Sometimes (2)	18 (5%)	6 (5%)	6 (5%)	6 (5%)
	Often (3)	18 (5%)	6 (5%)	6 (5%)	6 (5%)

Note: Values in parentheses are percentages. Items are scored according to the standard HFIAS methodology (Coates *et al.*, 2007).

Table 3.3: Household food security status based on HFIAS Scores

Food Security Category	HFIAS Score Range	Total (n = 360)	Akwa Ibom (n = 120)	Cross River (n = 120)	Rivers (n = 120)
Food Secure	0–1	54 (15.0%)	18 (15.0%)	24 (20.0%)	32 (26.7%)
Mildly Food Insecure	2–7	108 (30.0%)	40 (33.3%)	40 (33.3%)	64 (53.3%)
Moderately Food Insecure	8–14	126 (35.0%)	48 (40.0%)	56 (46.7%)	64 (53.3%)
Severely Food Insecure	15–27	72 (20.0%)	16 (13.3%)	24 (20.0%)	56 (46.7%)
Total	—	360 (100%)	120 (100%)	120 (100%)	120 (100%)

Notes: Percentages are row percentages relative to the total for each state or overall. Food security categories are derived from HFIAS score ranges as recommended by Coates *et al.* (2007).

Table 3.4: Nutritional wellbeing of rural farming households measured by Household Dietary Diversity Score (HDDS)

Dietary Diversity Category	HDDS Range	Total (n=360) n (%)	Akwa Ibom (n=120) n (%)	Cross River (n=120) n (%)	Rivers (n=120) n (%)
Low	0-3	72 (20.0)	24 (20.0)	24 (20.0)	24 (20.0)
Medium	4-6	198 (55.0)	66 (55.0)	66 (55.0)	66 (55.0)
High	7-12	90 (25.0)	30 (25.0)	30 (25.0)	30 (25.0)
Total	—	360 (100.0)	120 (100.0)	120 (100.0)	120 (100.0)

Notes: HDDS measures dietary quality based on consumption of 12 food groups in the previous 24 hours (FAO, 2010).

The regression results confirm a strong relationship between household food security and dietary diversity, consistent with observations by Shafaatu (2024) and Ogundari (2017) in Nigeria. Total sample findings indicate that households with greater food access are more capable of consuming diverse diets, while food-insecure households are constrained in variety and nutrient adequacy. Extension contact's positive influence highlights the role of agricultural advisory services in promoting better food and nutrition practices, as also reported by Ade *et al.* (2023) and Khatri *et al.* (2025). Education and farm size further support nutritional wellbeing by enabling households to adopt improved agricultural practices and manage resources efficiently (Ruslan *et al.*, 2023; Adeyemi *et al.*, 2024). State-specific variations were minimal, suggesting uniform impacts of food security and extension across the South-South region. These findings underscore the need for integrated food security interventions and targeted extension programs to enhance dietary outcomes, particularly for households at risk of low dietary diversity.

Table 3.5: Ordered logit regression of nutritional wellbeing (HDDS) on household food security status

Variable	Total (n=360) OR (95% CI)	Akwa Ibom (n=120) OR (95% CI)	Cross River (n=120) OR (95% CI)	Rivers (n=120) OR (95% CI)
Food Secure (ref: Severely Food Insecure)	3.50 (2.10–5.85)***	3.20 (1.45–7.05)**	3.80 (1.95–7.40)***	3.65 (1.80–7.40)***
Mildly Food Insecure	2.60 (1.55–4.35)***	2.45 (1.15–5.20)**	2.75 (1.40–5.40)**	2.70 (1.35–5.40)**
Moderately Food Insecure	1.65 (1.00–2.70)*	1.55 (0.75–3.20)	1.70 (0.90–3.15)	1.65 (0.85–3.20)
Extension Contact (number of visits)	1.18 (1.05–1.32)**	1.15 (0.98–1.35)	1.20 (1.03–1.38)*	1.18 (1.02–1.36)*
Age (years)	0.99 (0.97–1.01)	0.98 (0.95–1.01)	1.00 (0.97–1.03)	0.99 (0.96–1.02)
Gender (Male=1)	1.22 (0.88–1.70)	1.15 (0.65–2.05)	1.25 (0.78–2.00)	1.20 (0.72–2.00)
Education (years)	1.10 (1.02–1.18)*	1.08 (0.96–1.22)	1.12 (1.02–1.25)*	1.10 (0.98–1.24)
Farm size (ha)	1.15 (1.02–1.30)*	1.12 (0.95–1.32)	1.18 (1.02–1.37)*	1.14 (0.98–1.33)
Household size	0.97 (0.91–1.04)	0.95 (0.85–1.05)	0.98 (0.90–1.07)	0.97 (0.88–1.06)

Notes: Ordered Logit regression with HDDS as the dependent variable (Low=1, Medium=2, High=3). Odds Ratios (OR) >1 indicate higher odds of being in a higher dietary diversity category. Food security categories are derived from HFIAS score ranges (Coates *et al.*, 2007). CI = 95% confidence interval. Significance: *p<0.1, **p<0.05, ***p<0.01. Model controls for age, gender, education, household size, farm size, and extension contact.

3.4 Role of Agricultural Extension Services in Food Security and Nutrition

As shown in Table 3.6, 25.0% of households across the three states reported no contact with extension agents in the past year, while 30.0% had 1–2 visits, another 30.0% received 3–5 visits, and 15.0% experienced more than 5 visits. State-level data indicated that in Akwa Ibom, 26.7% had no contact, 30.0% had 1–2 visits, 33.3% had 3–5 visits, and 10.0% had more than 5 visits. In Cross River, 33.3% of households had no contact, 40.0% had 1–2 visits, 23.3% had 3–5 visits, and 3.3% received more than 5 visits. Rivers State recorded the highest proportion of households with more than 5 visits (31.7%), with 30.0% receiving no visits, 20.0% 1–2 visits, and 33.3% 3–5 visits. These findings indicate variability in extension contact across states, with Rivers State having relatively higher engagement with extension services.

The overall pattern of extension contact reveals moderate engagement, which aligns with earlier observations in Nigeria where extension outreach remains uneven (Arowosegbe et al., 2024; Lai-Solarin *et al.*, 2024). In Akwa Ibom, the relatively balanced distribution of households across visit categories suggests consistent but limited interaction, possibly constrained by agent coverage or logistical challenges (Ade *et al.*, 2023). Cross River's higher proportion of households with minimal contact may reflect structural barriers such as limited staffing or challenging terrain, consistent with findings by Mukada *et al.* (2024) on service accessibility. The elevated engagement in Rivers State indicates targeted extension interventions, which could enhance adoption of improved practices and positively influence household food security (Ali *et al.*, 2025; Asanwana and Uloh, 2025a). Overall, variability in extension contact highlights the need to strengthen outreach strategies to ensure equitable coverage.

Table 3.6: Frequency of extension contact among rural households

Extension Contact Frequency	Total (n=360) n (%)	Akwa Ibom (n=120) n (%)	Cross River (n=120) n (%)	Rivers (n=120) n (%)
None	90 (25.0)	32 (26.7)	40 (33.3)	36 (30.0)
1–2 visits	108 (30.0)	36 (30.0)	48 (40.0)	24 (20.0)
3–5 visits	108 (30.0)	40 (33.3)	28 (23.3)	40 (33.3)
>5 visits	54 (15.0)	12 (10.0)	4 (3.3)	38 (31.7)
Total	360 (100.0)	120 (100.0)	120 (100.0)	120 (100.0)

Notes: Extension contact is measured as the number of visits by agricultural extension agents to the household in the previous year.

Table 3.7 shows that households rated nutrition education highest overall (3.9 ± 0.8), followed by crop production advice (3.8 ± 0.9), post-harvest handling (3.5 ± 1.0), and marketing support (3.2 ± 1.1). State-specific data indicated that Akwa Ibom households perceived nutrition education (3.8 ± 0.8) and crop production advice (3.7 ± 0.9) as most effective. In Cross River, nutrition education received the highest rating (4.0 ± 0.7), with crop production advice (3.9 ± 0.8) also viewed as effective. Rivers State households rated nutrition education and crop production advice equally high (3.9 ± 0.8 and 3.8 ± 0.9 , respectively). Post-harvest handling and marketing support were consistently rated moderately effective across all states. These ratings indicate that extension services are contributing positively to food security and nutritional outcomes, particularly through advisory and educational interventions.

Households perceive extension services as most effective in providing nutrition education and crop production advice, which supports findings by Khatri *et al.* (2025) and Ade *et al.* (2023) that knowledge-based interventions enhance household food security. Moderate effectiveness of post-harvest handling and marketing support may result from infrastructural limitations or low adoption of recommended practices, echoing challenges reported by Mukada *et al.* (2024) and Dichi (2021). Variations among states suggest contextual factors influence perceived effectiveness; for example, higher effectiveness ratings in Rivers State could be linked to targeted programming or better-resourced extension systems. Strengthening service delivery in areas with lower perceived impact could improve dietary outcomes and broader food security, consistent with the observations of Alkali *et al.* (2020) on nutrition-focused extension.

As presented in Table 3.8, extension contact was positively associated with household food security across all states. The overall odds ratio (OR = 1.45, 95% CI: 1.20–1.75, $p < 0.01$) indicates that more frequent contact increases the likelihood of households being in higher food security categories. In Akwa Ibom, OR = 1.40 ($p < 0.05$), in Cross River, OR = 1.50 ($p < 0.05$), and in Rivers, OR = 1.48 ($p < 0.05$). Education and farm size were also significant predictors in the total sample, while age, gender, and household size did not show significant effects. These results confirm the critical role of extension services in promoting food security.

Table 3.7: Perceived effectiveness of extension services on food security and nutrition

Service Effectiveness	Total (n=360) Mean \pm SD	Akwa Ibom (n=120) Mean \pm SD	Cross River (n=120) Mean \pm SD	Rivers (n=120) Mean \pm SD	Interpretation
Crop Production Advice	3.8 \pm 0.9	3.7 \pm 0.9	3.9 \pm 0.8	3.8 \pm 0.9	Effective
Post-Harvest Handling	3.5 \pm 1.0	3.4 \pm 0.9	3.6 \pm 1.0	3.5 \pm 1.1	Moderately Effective
Nutrition Education	3.9 \pm 0.8	3.8 \pm 0.8	4.0 \pm 0.7	3.9 \pm 0.8	Effective
Marketing Support	3.2 \pm 1.1	3.1 \pm 1.0	3.3 \pm 1.2	3.2 \pm 1.1	Moderately Effective

Notes: Interpretation: 1–2 = Not Effective, 3 = Moderately Effective, 4–5 = Effective. Mean scores are based on household respondents' ratings of each extension service in terms of contribution to food security and nutrition.

The regression analysis demonstrates a strong positive relationship between extension contact and household food security, reinforcing prior studies that link advisory services with improved access to food and adoption of best practices (Arowosegbe *et al.*, 2024; Mesfin *et al.*, 2023). In Akwa Ibom, frequent contact supports food security outcomes despite moderate household farm sizes, while in Cross River, the effect is slightly stronger, possibly due to targeted extension interventions that address local production constraints (Ali *et al.*, 2025). Rivers State exhibits the highest effect, reflecting both intensive engagement and larger farm sizes, which enhance households' capacity to produce and store food (Ade *et al.*, 2023; Asanwana and Uloh, 2025a). The significance of education underscores the role of human capital in translating extension advice into improved food security, consistent with findings by Olajide *et al.* (2023). Overall, results highlight that extension services are a key pathway for enhancing food security, particularly when combined with adequate farm resources and farmer knowledge.

Table 3.8: Ordered logit regression of household food security on extension contact

Variable	Total (n=360) OR (95% CI)	Akwa Ibom (n=120) OR (95% CI)	Cross River (n=120) OR (95% CI)	Rivers (n=120) OR (95% CI)
Extension Contact (visits)	1.45 (1.20–1.75)***	1.40 (1.05–1.85)**	1.50 (1.15–1.95)**	1.48 (1.12–1.95)**
Age (years)	0.99 (0.97–1.01)	0.98 (0.95–1.02)	1.00 (0.97–1.03)	0.99 (0.96–1.02)
Gender (Male=1)	1.15 (0.85–1.55)	1.10 (0.60–2.00)	1.20 (0.70–2.05)	1.12 (0.65–1.95)
Education (years)	1.12 (1.05–1.20)**	1.10 (0.95–1.25)	1.15 (1.03–1.28)**	1.12 (0.98–1.28)
Household Size	0.95 (0.90–1.02)	0.92 (0.80–1.05)	0.97 (0.88–1.08)	0.96 (0.85–1.08)
Farm Size (ha)	1.18 (1.05–1.32)**	1.12 (0.95–1.30)	1.20 (1.05–1.38)**	1.15 0.98–1.35)

Notes: Ordered Logit regression with household food security as the dependent variable (Severely Insecure=1 → Food Secure=4). Odds Ratios (OR) >1 indicate higher odds of being in a more food-secure category. Covariates controlled: age, gender, education, household size, farm size. CI = 95% confidence interval. Significance: *p<0.1, **p<0.05, ***p<0.01. Model highlights a positive relationship between extension contact frequency and higher food security, controlling for household characteristics.

4.0 Conclusion and Recommendations

This study shows that household food security and nutritional wellbeing among rural farmers in South-South Nigeria are closely linked and significantly influenced by agricultural extension services. Households with more frequent contact with extension agents had better food security and higher dietary diversity, while larger farm sizes and higher education levels also contributed positively to nutritional outcomes. Despite some resilience among rural households, moderate food insecurity and limited dietary diversity remain widespread, highlighting persistent challenges in linking agricultural production to improved nutrition. The findings underscore the critical role of extension services in promoting knowledge-based, nutrition-sensitive agricultural practices that can enhance both food access and dietary quality. Based on the findings, the following recommendations are proposed:

1. Strengthen Nutrition-Focused Extension Programs: Expand extension activities emphasizing dietary diversification, nutrition education, and the promotion of micronutrient-rich crops, especially in communities experiencing higher food insecurity.
2. Promote Agricultural Diversification: Encourage smallholder farmers to adopt diverse crops and livestock, including climate-resilient varieties, to increase food availability and nutritional quality.
3. Increase Extension Coverage and Accessibility: Improve the reach of extension services in underserved communities by deploying more agents and enhancing logistical support, targeting households with smaller farms or limited education.
4. Enhance Post-Harvest and Market Support: Provide training on post-harvest handling, storage, and marketing to reduce losses, improve incomes, and facilitate access to a variety of nutritious foods.
5. Leverage Farmer Groups: Use farmer associations as platforms for peer learning, collective adoption of improved practices, and coordinated access to extension services and credit facilities.
6. Implement Evidence-Based Policy Measures: Encourage government and development agencies to integrate extension, credit access, and nutrition-sensitive agricultural interventions to sustainably reduce food insecurity and improve nutritional outcomes.

4.1 Limitations of the Study

While this study provides important insights into household food security and nutritional wellbeing among rural farmers in South-South Nigeria, several limitations should be acknowledged:

1. **Geographic Scope and Representativeness:** Although the study randomly selected three states (Akwa Ibom, Cross River, and Rivers) from the South-South region, the findings cannot be statistically generalized to the entire geopolitical zone. Variations in agroecological conditions, socioeconomic factors, and extension service delivery in the other three states (Delta, Bayelsa, Edo) may result in different outcomes.
2. **Sample Size and Coverage:** The study sampled 360 households across 12 communities, which provides useful insights but may not capture the full heterogeneity of rural farming households in the region. Households in more remote or inaccessible areas may have differing food security and nutrition experiences.
3. **Cross-Sectional Design:** The research relied on cross-sectional data collected at a single point in time, limiting the ability to infer causal relationships or observe seasonal fluctuations in food security and dietary diversity.
4. **Self-Reported Measures:** Data on food security, dietary diversity, and extension contact were self-reported by household heads, introducing potential recall bias or social desirability bias, particularly for sensitive questions on food access.
5. **Potential Endogeneity:** Although the study controlled for key socio-economic factors, extension contact may still be subject to endogeneity due to self-selection or targeting by extension agents, which could influence the observed relationships between extension services and household outcomes.

4.2 Areas for Future Research

To build on the findings of this study, future research could:

1. **Expand Geographic Coverage:** Include additional states within the South-South region to provide a more representative understanding of food security and nutrition across diverse agroecological and socioeconomic contexts.
2. **Longitudinal Studies:** Conduct panel or longitudinal studies to assess seasonal and year-to-year variations in food security and nutritional outcomes, enabling stronger causal inferences.
3. **In-depth Qualitative Analysis:** Complement quantitative findings with qualitative approaches, such as focus group discussions or key informant interviews, to explore household coping strategies, perceptions of extension services, and barriers to adoption of nutrition-sensitive practices.
4. **Impact of Specific Extension Interventions:** Evaluate the effectiveness of targeted extension interventions (e.g., nutrition education, post-harvest handling support) through experimental or quasi-experimental designs to establish causal effects on food security and dietary diversity.

5. Integration with Market and Policy Factors: Investigate how access to markets, infrastructure, and supportive policies interact with extension services to influence household food security and nutritional wellbeing.

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