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EFFECTS OF AGRICULTURAL EXTENSION ACTIVITIES ON FOOD SECURITY STATUS OF RURAL FARMERS IN FEDERAL CAPITAL TERRITORY (FCT) ABUJA, NIGERIA

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ABSTRACT

This study assessed agricultural extension activities and food security status among rural farmers in the Federal Capital Territory (FCT), Abuja, Nigeria. The three-stage sampling procedure was employed to select 145 rural farmers, on which a structured questionnaire was administered and complemented with an interview schedule. Primary data collected were analysed using descriptive statistics and a logit regression model. Findings from the study revealed that the mean age of the respondents was 40 years, implying that the respondents are still actively engaged in agriculture. In contrast, the mean farm size was 3.0 hectares, implying medium-scale farming operation and the mean annual income was ₦646,483, implying a relatively fair income considering the country's minimum wage. The results of the extension activities to the farmers in the study area revealed that the majority (93.1%) of the respondents had contact with extension agents and benefitted from various extension services. Some of the extension activities they benefited from include extension advice on the use of improved fertilizer (97.9%), animal health management (97.2%), training and outreach (97.2%), crop protection (95.9%), the use of improved seeds (94.5%), storage and preservation (94.5%) and sales of crop produce (93.1%) among others. Based on the estimated FGT food security line of

₦15,946.80, the majority (77.9%) of the respondents were found to be above the line, hence food secured, while 22.1% were found to be below the line, hence food insecure. Logit regression result revealed that sex (-2.16, p<0.05), household size (-2.45, p<0.05), education (3.25, p<0.01), farming experience (2.54, p<0.01), and extension activities (2.02, p<0.05) were statistically significant and influenced food security status of the farmers in FCT, Nigeria. In conclusion, the study revealed a positive and significant impact of agricultural extension services on the food security status of the respondents. It was therefore recommended that relevant extension agencies, in partnership with NGOs, and with the active involvement of the audience, implement robust extension activities that guarantee self-sufficiency in food production.

Keywords: Effects, Agricultural extension activities, food security status, rural farmers

INTRODUCTION

Agricultural extension is the application of scientific research and new knowledge to agricultural practices through farmer education. Rivera and Alex (2004) state that extension is the political and organizational tools implemented to facilitate development. It ranges from the transfer of mono-crop technology to participatory problem-solving educational approaches, which aim at reducing poverty and increasing community involvement in development processes. Nwuzor (2009) views agricultural extension as a service or system that assists farm people through educational procedures in improving their farming methods and techniques, increasing their production efficiency and income, and bettering their levels of living. It also helps to lift the social and educational lives of rural people. It ensures information obtained and assembled from research studies based on experience is tried and demonstrated to extend knowledge to rural dwellers.

It may not always be possible to quantify the precise contribution of extension services to agricultural development, but effective extension service contributes significantly to the production of crops and livestock. According to Muhammed *et al.* (2019), a practical extension information service meets farmers' needs, and the content of the information is specific, straightforward, and valuable. Ibrahim *et al.* (2015) posited that agricultural extension education is a teaching and learning process in which the farmers are taught better farming methods to raise their productivity and standard of living. Agricultural extension activities have become a strategy for transforming traditional agriculture into a progressive and modern one.

It is also a rural transformation and development strategy in which the entire rural areas, including human and non-human resources, are improved (Ibrahim *et al.,* 2015). Thus, it enhances farmer's capacity to produce more and impacts their standard of living.

In recent times, agricultural extension activities have gone beyond educating and teaching farmers. It involves the transfer of scientific knowledge farmers require to utilize modern technologies. Undoubtedly, farming is associated with problems, and for local farmers to solve the farming problems within them, they need comprehensive information on the use of modern technology. Therefore, agricultural extension integrates innovations into extension services delivery to promote agriculture and make it a lasting solution to crises such as food shortage and low yield. According to the Federal Ministry of Agriculture and Rural Development (FMARD) (2018), food production has not kept pace with population growth, resulting in rising food imports and declining levels of national food self-sufficiency. The main factors undermining production could be over-reliance on rain-fed agriculture, small landholding, low productivity due to poor planting material and date, low fertilizer application, and weak agricultural extension system.

According to Mgbenka and Mbah (2016), about 90% of Nigeria's agricultural output comes from smallholder farmers operating small farms. Most rural farmers need more access to fertilizers, irrigation, modern inputs, and extension services. They could not produce enough food for their family's consumption and sales, leading to food insecurity due to unavailability or poor access to food. Food and Agriculture Organization (FAO) (2015) defined food security as "all people at all times having both physical and economic access to the basic food they need." However, Saleh and Mustapha (2018) posited that food security entails producing food that will go around every citizen in terms of quality and quantity. In a broader sense, food security has to do with having an adequate level of food products at all times to meet increasing consumption demand and mitigate fluctuation in output and price (Fashina *et al.,* 2020).

There is a significant problem of food insecurity in Nigeria, as demonstrated by the widening food gap that is bridged chiefly through food importation. It is worth noting that the government's past agricultural strategies and extension activities for economic development have yet to lead to a drastic turnaround in the agricultural sector. Meanwhile, the current emphasis on private sector extension activities to achieve agricultural development aligns with the worldwide approach. Still, it poses some problems for Nigeria's resource-poor farmers, who

need help securing production assistance. Thus, the increasing lack of access to agricultural extension services by rural farmers has hindered increased food production and the realization of self-sufficiency, thereby leading to food insecurity. There is a severe knowledge gap that must be filled to ensure food security. It is against this backdrop that this study was conceived, and the specific objectives of the study were to:

i. Describe the socio-economic characteristics of the rural farmers in the study area;
ii. examine the various agricultural extension activities available to the rural farmers;
iii. estimate the food security status of the rural farmers, and
iv. determine the effects of agricultural extension activities on the food security status of rural farmers in the study area.

METHODOLOGY

Study Area

The study was carried out in Federal Capital Territory (FCT), Abuja, which lies between Latitudes 8°25′and 9°25′ North of the equator and Longitudes 6°45′and 7°45′ East of the Greenwich Meridian with a population of 3,950,249 (National Population Commission (NPC), 2006). The projected population as of 2022 was 6,144,893, given growth rates of 2.8% (National Bureau of Statistics (NBS), 2023). The major ethnic groups are Amwamwa, Bassa, Gade, Ganagana, Gbagyi, Gwandara, and Koro, although other minor ethnic groups also settle in the area. Federal Capital Territory covers a total land area of 8,000 square kilometres and the vegetation falls mainly on Savanna Zones. It experiences three weather conditions annually; the rainy season and dry season, and in between the two seasons, there is a brief interlude of harmattan occasioned by the North East Trade Wind, with the main feature of dust haze, intensified coldness, and dryness. The rainfall ranges between 1100mm to 1600mm, while the average temperature is about 32oC. Agriculture is the main occupation of the people as most of the communities are predominantly rural.

Sampling Procedure and Sample Size

A three-stage sampling procedure was used to select respondents for this study. The first stage randomly selected two Area Councils of FCT Abuja (Kuje and Bwari). In the second stage, three (3) communities were randomly selected from each of the Area Councils to get six communities. The third stage was a proportionate selection of respondents based on a total list of 483 registered rural farmers (238 from Kuje and 245 from Bwari Area Councils) obtained from FCTADP using Yamane (1967) sample size determination formula as used by Muhammed

et al. (2019) at 7% level of precision. This gave a total of 145 rural farmers (72 from Kuje and 73 from Bwari Area Councils) used as respondents for the study. The Yamane's formula was used (equation 1):

$$n = \frac{N}{1+N(e)^2} \quad (1)$$

Where;

n = sample size

N = finite population

e = limit of tolerable error (level of precision at 0.07 probability)

Method of Data Collection and Analysis

This study used a cross-sectional survey in which primary data were obtained directly from the respondents, using a structured questionnaire complemented with an interview schedule. It is a type of data collection in which the researcher has complete control over its accuracy and usage. The primary data collected were analysed using descriptive statistics such as frequency counts, percentages, and mean to achieve objectives I and ii. The Foster Greer and Thorbecke (FGT) formula was used to achieve objectives ii, and the advanced inferential statistics of the Logit regression model was used to achieve objectives iv, demonstrating the depth of our analysis.

Model Specification

Foster Greer and Thorbecke (FGT)

The Foster et *al*. (1984) FGT formula, a key component of this study, was used to estimate the food security status of rural farmers. The FGT formula, as used by Ajayi *et al.* (2023), is expressed in equation (2):

$$F\alpha = \frac{1}{N}\sum_{i=1}^{q}\left(\frac{Z-y_1}{z}\right)^{\alpha} \quad (2)$$

Where;

Fα = food security Index

N = total number of households

q = the number of households below the food security line

z = the food security line for the household

y_i = household expenditure

Σ = summation sign

α = food security aversion parameter takes on value of 0, 1, 2 representing incidence, gap and severity of the food insecurity respectively. The measure relates to different dimensions of food security status.

Thus, when α = 0 representing food security incidence, FGT model is expressed in equation (3):

$$F_O = \frac{Ho}{N} \quad (3)$$

Where;

F_0 = food security incidence

Ho = number of households below food security line

N = total number of households

when α = 1 representing food insecurity gap, FGT model is expressed in equation (4):

$$F_1 = \frac{1}{N}\sum_{i=1}^{q}\left(\frac{Z-y_1}{z}\right)^1 \quad (4)$$

Where;

F_1 = food insecurity gap

when α = 2 representing food insecurity severity, FGT model is expressed in equation (5):

$$F_2 = \frac{1}{N}\sum_{i=1}^{q}\left(\frac{Z-y_1}{z}\right)^2 \quad (5)$$

Where;

F_2 = food insecurity severity

Logit Regression Model

The logit regression model was used to determine the effects of agricultural extension activities on the food security status of rural farmers. It is a model used to estimate the probability of an event based on a dichotomous dependent variable. A dichotomous dependent variable assumes only two values of zero or one. The Logit model is specified implicitly in equation (6):

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8) \quad (6)$$

The explicit form of the Logit model is presented in equation (7):

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + e \quad (7)$$

Where;

Y is food security status of the rural farmers measured as dichotomous variable of 1 if food secured, 0 if otherwise.

β_0 = Intercept

$\beta_1 - \beta_8$ = Coefficient of the independent variables

$X_1 - X_8$ = Independent variables

X_1 = Age of the respondent (years)

X_2 = Sex (1 if male, 0 if otherwise)

X_3 = Household size (numbers)

X_4 = Education (years)

X_5 = Farming experience (years)

X_6 = Distance from residence to farm (kilometers)

X_7 = Extension activities (number)

X_8 = Cooperative membership (years)

e = error term

RESULTS AND DISCUSSION

Socio-Economic Characteristics of the Respondents

The socio-economic characteristics of the respondents described include age, gender, marital status, household size, education, farming experience, farm size, extension contact, and cooperative membership. Table 1 reveals that 44.8% of the respondents were 36–55, with a mean age of 40. This implies that the rural farmers were agile at this age and could do much farm work for increased output, ensuring food security. This result agrees with the work of Fashina *et al.*(2020), who reported that the mean age of the respondents in their study area is 40 years, indicating an active farming age. The majority (83.4%) of the respondents were males, implying that males were more involved in farming than females, hence their dominance. This result agrees with the work of Ofune (2010), who reported that males dominated the workforce in Nigeria's agricultural communities. Also, the majority (73.8%) of the respondents were married, which, in essence, is for the procreation of younger ones who will assist in future farming. This finding agrees with Odoemekun and Anyim (2019), who reported in their study that most respondents were married purposely for the procreation of young ones who will assist in future farming activities.

As revealed in Table 1, more than half (55.2%) of the respondents had household sizes ranging between 6–10, with a mean household size of 6 people. This relatively large household size could provide the needed family labor to minimize cost and maximize output toward achieving food security. The majority (89.0%) of the respondents acquired formal education (primary, secondary, and tertiary), a significant factor in promoting food security. This high literacy level,

with most respondents having acquired secondary education, is fundamental to enhancing food production. This result aligns with the work of Ajayi *et al.* (2023), who reported a similar trend in their study area. More so, Table 1 revealed that more than half (51.0%) of the respondents had farming experience of less than 11 years, although with a mean farming experience of 15 years. This implies that an average proportion of the respondents had been into farming for a relatively long period, which could help them make rational decisions regarding their farming operations that will ensure food security. This finding agrees with the study of Olaosebikan *et al*. (2019), who reported that most of the respondents in their study area had long years of farming experience, which enabled them to make sound decisions regarding farming operations.

The majority (78.6%) of the respondents had farm sizes between 1.1 – 3.0 hectares, with a mean farm size of 2.2 hectares. This implies that a more significant proportion of the rural farmers were operating at a small-scale production level. Small farm size impedes productivity, crop diversification, and consequently, the food security status of rural households. This finding agrees with the work of Kolade and Harpham (2014), who reported that small to medium-scale farmers make up a significant proportion of Nigeria's food production.

Regarding institutional variables assessed by the respondents, the majority (93.1%) had contact with an extension agent, a positive sign of the transfer of scientific knowledge required by farmers to understand the use of modern technology. Additionally, 84.1% were members of cooperative societies, a factor that significantly influences agricultural production among rural farmers. This finding underscores the potential for collective action to enhance food security. **Socio-Economic**

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Table 1: Distribution of the respondents based on socio-economic characteristics (n = 145)

Variables	Frequency	Percentages	Mean
Age (years)			
< 36	60	41.4	
36 – 45	35	24.1	
46 – 55	30	20.7	
> 55	20	13.8	40
Sex			
Male	121	83.4	
Female	24	16.6	
Marital status			
Married	107	73.8	
Single	29	20.0	
Widower	7	4.8	
Divorced	2	1.4	
Household Size (number)			
< 6	62	42.7	
6 – 10	80	55.2	
> 10	3	2.1	6
Educational Status			
No Formal	16	11.0	
Primary	15	10.3	
Secondary	81	55.9	
Tertiary	33	22.8	
Farming Experience (years)			
< 11	74	51.0	
11 – 20	46	31.7	
21 – 30	18	12.5	
> 30	7	4.8	15
Farm Size (hectares)			
< 1.1	29	20.0	
1.1 – 3.0	114	78.6	
> 3.0	2	1.4	3.2

Source: Field Survey, 2019

Table 2: Distribution of Respondents Based on Institutional Variables Assessed (n = 145)

Variables	Frequency	Percentages
Extension contact		
Contact	135	93.1
No contact	10	6.9
Cooperative membership		
Member	122	84.1
Not member	23	15.9

Source: Field Survey, 2019

Agricultural Extension Activities received by the respondents

The distribution of the respondents based on agricultural extension activities received from extension agents is shown in Figure 1. It revealed that advisory services on the use of improved fertilizer (97.9%), advisory services on animal health management (97.2%), outreach and extension training (97.2%), and advisory services on crop protection (95.9%)were the top most agricultural extension activities received by the respondents in the study area. Others include advisory services on storage and preservation of produce (94.5%), advisory services on the use of agricultural seeds (94.5%), advisory services on sales of crop produce (93.1%), advisory services on sales of livestock produce (87.6%) and advisory services on the use of improved animal breeds (75.2%). This implies that various extension activities are being implemented through the change agents to ensure the food security of rural farmers in the study area. This finding agrees with the work of Ayinde (2016), who reported that the objective of extension programme or activities is to make the farmers have a positive attitude towards farming to increase output. The most minor agricultural extension activities received by the respondents was training on the use of farming technologies (10.3%), implying poor dissemination of agricultural technologies that could have boosted food production and ensured security.

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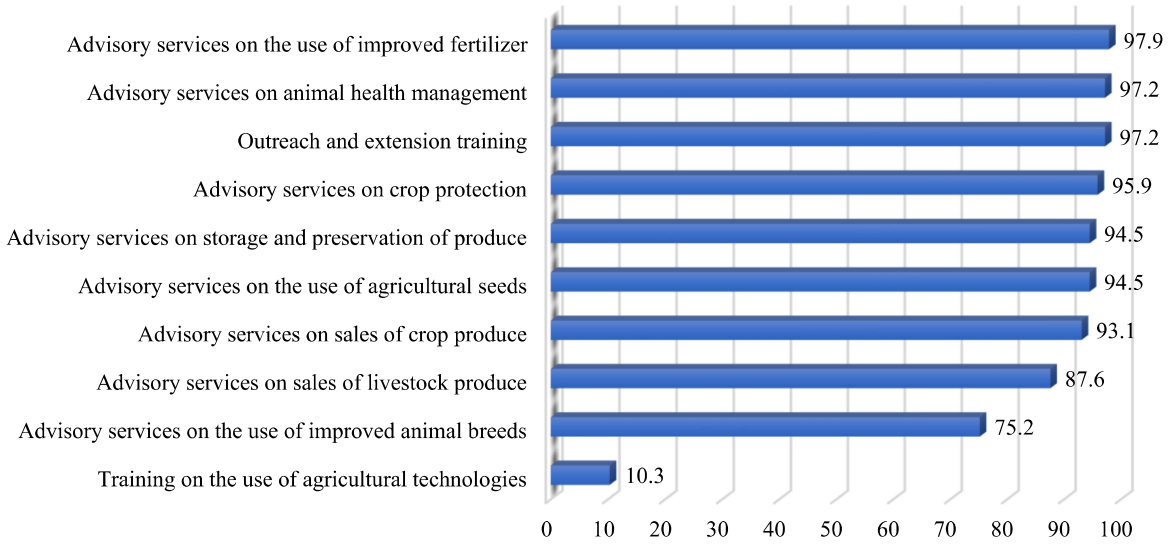

Figure 1: Extension Activities received by the respondents

Food Security Status of the Respondents

The results of the food security status of the respondents are presented in Table 2. A food security line was calculated to categorize the respondents' food security status at the household level. The household's monthly consumption expenditure was used to establish the food security line, which was ₦15,946.80. Thus, based on the food security line, the majority (77.9%) of the rural farmers were found to be food-secured, while 22.1% of the rural farmers were food-secured. The food security incidence was 0.2207, implying that about 22.0% of the rural farmers were food insecure. The food security gap, which measures the extent to which the respondents were below the food security line, was 0.0876. It implies that about 9% of the food security line (₦15,946.80), which is ₦1,435.20, is required to bring the food insecure households to the food security line. The depth of food insecurity given as a severity of 0.0513 implies that about 5% of the rural farmers were severely food insecure. This finding underscores the urgent need for further action to improve the food security situation. It also contrasts with the work of Saleh and Mustafa (2018), who found that a larger proportion of the households in their study area were food insecure.

Table 3: Distribution of the Respondents Based on Food Security Status

Categorization	Frequency	Percentages
Food secure	113	77.9
Food insecure	32	22.1
Total	145	100.0
Food Security Indices		
Food security line / month	₦15,946.80	
Food insecurity incidence	0.2207	
Food insecurity gap	0.0876	
Food insecurity severity	0.0513	

Source: Field Survey, 2019

Effects of Agricultural Extension Activities on the Food Security Status of the Respondents

The result of Logit regression analysis on the effects of agricultural extension activities on the food security status of the respondents in the study area is presented in Table 3. It revealed a Pseudo R-square value of 0.5917, implying that about 59% of the variation in the food security status of the respondents was explained by the predictor variables included in the model. From z – the value of the regression, five out of the eight independent variables included in the model were found to be statistically significant. Sex (-2.16), household (-2.45), and extension activities (2.02) were significant at 5%, while education (3.25) and farming experience (2.54) were significant at a 1% level of probability.

The coefficient of sex (-1.2266) was negative and significant at a 5% probability level, hence inversely influencing the food security status. This implies that more male farmers decreased the probability of being food-secured. Thus, male farming households are more likely to be food insecure due to several factors, including caring for more prominent families. This finding disagrees with the work of Fashina *et al.* (2020), who reported that the food insecurity situation in their study area is worse for female-headed households than for male-headed household heads.

The coefficient of household (-0.2508) was also negative and significant at a 5% probability level, hence inversely influencing the food security status. This implies a higher probability of a more enormous household being food insecure. Large household size translates into more mouths to feed, leading to higher consumption and expenditure. This agrees with the work of Ahmed (2011), who reported that large household size is related to increased household consumption expenditure that could negatively influence the food security status of rural farmers.

Table 4: Logit Estimates of Effects of Agricultural Extension Activities on Food Security Status

Variables	Coefficient	Standard error	z-value	Marginal effects
Constant	-4.1564	3.1213	-1.33	-
Age	-0.0203	0.0205	-0.99	-0.0562 (-1.32)
Sex	-1.2266	0.5690	-2.16**	-1.4682 (-2.35**)
Household size	-0.2508	0.1025	-2.45**	-0.4732 (-2.68***)
Education	0.1602	0.0492	3.25***	0.1965 (3.54***)
Farming experience	0.0654	0.0258	2.54***	0.1672 (2.71***)
Farm size	0.2935	0.2789	1.05	0.4165 (1.32)
Extension activities	0.6626	0.3282	2.02**	0.8152 (2.27**)
Cooperative membership	0.0155	0.0479	0.32	0.0346 (0.67)
Pseudo R^2	0.5917			
LR Chi^2	89.04***			
Prob > chi^2	0.0000			

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

The positive and significant coefficient of education (0.1602) at a 1% probability level directly influences the food security status. This finding underscores the crucial role of education in enhancing food security among rural farmers. It suggests that the more educated the respondents are, the higher the likelihood of being food-secured. Educated households are better equipped to secure additional jobs that can supplement farm income and make efficient use of available resources for higher yields. This aligns with the findings of Ishaya (2014), who also found a positive correlation between education and food security in his study area.

The positive and significant coefficient of farming experience (0.0654) at a 1% probability level directly influences the food security status. This finding underscores the importance of practical knowledge in ensuring food security among rural farmers. It suggests that the more experienced the respondents are in farming, the higher the likelihood of being food-secured. Households with more farming experience are likely to have accumulated the skills necessary for effective farm operations, leading to better resource use and higher output, thereby enhancing food security. This finding is consistent with the work of Fashina et *al.* (2020), who also found a positive relationship between farming experience and food security in their study area.

The positive and significant coefficient of extension activities (0.6626) at a 5% probability level directly influences the food security status. This finding underscores the significant role of extension activities in improving food security among rural farmers. It suggests that an increase

in the number of extension activities or services received by the respondents leads to a higher likelihood of being food-secured. Agricultural extension activities or services play a crucial role in educating rural farmers on improved farming methods and techniques, thereby increasing their production efficiency, income, and food security. This finding is in line with the work of Muhammed *et al* .(2019), who also found that effective extension services significantly influence the food security status of farmers.

CONCLUSION AND RECOMMENDATIONS

Based on the empirical evidence from the study's findings, most farmers were in their most active and productive age, which determines the quality and quantity of farm operations needed to be food secure. They were predominantly males, married, and acquired formal education fundamental to promoting food security. Several agricultural extension activities were rendered through extension agents and received by the rural farmers in the study area. However, poor technology dissemination was a component of the extension activities. Meanwhile, a larger proportion of the rural farmers were food-secured, which could be due to the agricultural extension activities and advisory services received, with very few percentages experiencing severe food insecurity. Socio-economic and institutional factors that significantly affected the food security status of the rural farmers were sex and household size, which had inverse effects. In contrast, education, farming experience, and extension activities had direct effects. Therefore, several extension activities received by the rural farmers positively and significantly affected their food security status. The study, therefore, recommended that relevant agricultural extension agencies, in partnership with Non-Governmental Organizations (NGOs), should scale up the implementation of robust extension activities with emphasis on disseminating improved farming technologies that will guarantee self-sufficiency in food production. More so, improving the food security status of the rural farmers depends on their economic and social environment. Therefore, stakeholders like financial institutions and NGOs should facilitate increased access to finance, productive resources, extension services, and cooperative membership by poor resource farmers.

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