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TABLE OF CONTENT

ASSESSMENT OF RURAL LIVELIHOOD DIVERSIFICATION AMONG FARMING HOUSEHOLDS IN SOUTHERN BORNO

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ABSTRACT
The study assessed extent of rural livelihood diversification strategies among farming households in southern Borno. A multistage sampling procedure selected 224 respondents, and data were analyzed using descriptive statistics, the Simpson Index of Diversity (SID), and a Heckman two-step selection model. SID is defined as the Simpson Index of Diversity and ranges from 0 (no diversification) to 1 (very high diversification). Findings showed that most respondents were male (62.9%), aged 31–40 years (54.3%), married (62.4%), and had 7–10 household members (58.4%). Overall, 92.8% of households engaged in some diversification; the average SID was 0.59 (high), while the largest share of households fell in the medium category (34.4%). Determinants that were positive and statistically significant included age ($\beta = 0.0836$, $p < 0.001$), marital status ($\beta = 0.0298$, $p = 0.007$), household size ($\beta = 0.0375$, $p = 0.046$), education ($\beta = 0.0347$, $p = 0.001$), household income ($\beta = 0.2903$, $p < 0.001$), cooperative membership ($\beta = 0.0910$, $p = 0.028$), farm size ($\beta = 0.2981$, $p = 0.035$), savings ($\beta = 0.2570$, $p < 0.001$) and extension contact ($\beta = 0.1166$, $p = 0.013$). Sex had a negative effect ($\beta = -0.0182$, $p = 0.046$). Major constraints included lack of credit/capital (95.9%), limited awareness and training (67.9%), location/patronage (56.1%), and infrastructural deficits (49.8%). Policy options should prioritize access to finance and savings, cooperative development, skills/extension services, and rural infrastructure to enable inclusive, risk-aware diversification.
Keywords: Livelihood Diversification, Farming Households, Southern Borno, Nigeria

INTRODUCTION

Livelihood refers to the capabilities, material and social resources, and activities that people rely on to make a living. It also reflects how structures, policies and processes shape the options available to households (Ellis, 2000). Livelihood strategies are therefore the various activities that generate income and support wellbeing. They include not only what people do to earn a living, but also the resources that enable them to achieve a satisfactory standard of living, the risks they consider in managing those resources, and the institutional and policy environment that either supports or limits their efforts to improve their livelihoods. Very few individuals make all their income from one source, hold all their wealth in the form of single asset, or depend on just one type of asset; therefore, many households adopt livelihood diversification as a strategy to manage risks and strengthen their economic resilience. Livelihood diversification occurs when household members have a portfolio of activities and communal proficiencies to exist and to develop their well-being. Livelihood diversification is grouping of on-farm and off-farm activities to earn a living (Mekonnen *et.al.,* 2021). Households that adapt diversified livelihoods can cope with shocks and stresses, use natural resources sustainably and provide opportunities for future generations.

Diversification is not only driven by constraints or the unrelenting struggle for survival of the poor, it can also be determined by incentives. While some diversify, because they have little choice, others may diversify, because they have many choices. Many contextual factors that might influence the choice of livelihood diversification strategy have been examined on several occasions. Livelihood diversification and rural non-farm employment are influenced by multiple factors, including high population density, improved road networks, and migration inflows, which collectively expand economic opportunities. However, households differ in their ability to diversify due to variations in access to credit and savings, cultural norms, household size and composition, and educational attainment (Akintunde et al., 2022). Other determinants include geographical location, household characteristics, market opportunities, the interplay between farm and off-farm activities, and the role of formal and informal institutions in shaping diversification choices.

Motivations for diversification are often categorized as push or pull factors. Households may be pushed into off-farm activities when farming becomes less profitable or riskier due to population pressure, crop failures, market shocks, or long-term constraints such as land scarcity. The absence of crop insurance and limited access to credit further exacerbate this “distress-push” diversification. Conversely, households may be pulled toward non-farm employment when returns are higher or less risky than agriculture, resulting in “demand-pull” diversification. Evidence from Adekule et al. (2022) in Ogun State, Nigeria, shows that nearly half of respondents combined farm and non-farm strategies, while 14.3% and 40% relied solely on farm or non-farm activities, respectively.

Given the poverty situations in rural communities and uncertainties associated with the largely nature-dependent economy of traditional agricultural practices, the need for rural household livelihood diversification is centred on the need for assurance of household food security, generation of additional income, control of available additional income, reduction of poverty and vulnerability among others (Ayele & Tadesse, 2022). From the foregoing, the issue of farming households diversifying their sources of income has come to light. It is known that households with several sources of income or who diversify their sources of income would earn more money and have access to enough food, which will enhance the welfare of households. The diversification of livelihood has been acknowledged as a crucial method for decreasing poverty, raising household incomes, and subsequently enhancing food security by both academics and development practitioners. Diversifying households are expected to have more flexibility and resilience capacity than agriculturally dependent rural households since they can continue to operate a diverse range of businesses.

Although livelihood diversification is increasingly practiced in Southern Borno as a strategy to enhance food security and supplement agricultural income, there is limited empirical evidence documenting its extent, patterns, and determinants in the region. Existing literature largely focuses on other parts of Nigeria or broader national trends, leaving a gap in understanding the socio-economic factors, constraints, and effectiveness of diversification strategies specific to Southern Borno. This lack of localized data hinders the development of targeted interventions and policies to improve household resilience and income diversification in the study area.

The main objective of the study is to assess the extent of rural livelihood diversification among farming households in southern Borno, while the specific objective is to:

i. Examine the extent of livelihood diversification by farming households?
ii. Ascertain the factors affecting extent of livelihood diversification among farming household?
iii. Identify the constraints to livelihoods diversification by farming households?

METHODOLOGY

The study was conducted in Southern Borno, comprising nine Local Government Areas (Askira/Uba, Bayo, Biu, Chibok, Damboa, Gwoza, Hawul, Kwaya Kusar and Shani). A multistage sampling technique was applied: three LGAs (Askira/Uba, Biu and Hawul) were purposively selected for accessibility; nine communities were then chosen for high diversification; finally, respondents were randomly selected by balloting. Following Krejcie & Morgan's table, a sample of 224 was adequate for a population of 1,390; Yemane's formula validated this sample size.

Primary data was collected using a structured questionnaire, supplemented by secondary sources. Descriptive statistics (frequencies, percentages, means) were used for (Objective iii). The Simpson Index of Diversity (SID) measured the extent of diversification (Objective i). A Heckman two-step selection regression model identified determinants of diversification (Objective ii), addressing potential selection bias.

$SID = 1-\sum_{i=1}^{n} Pi^2$ …… 1

Where SID=Simpson index

n = total number of income sources

Pi =income proportion of i^{th} income source

Based on the SID values, the extent of livelihood diversification were defined as follows:

i. No diversification (SID ≤ 0.01)
ii. Low level of diversification (SID = 0.01 - 0.25)
iii. Medium level of diversification (SID = 0.26 - 0.50)
iv. High level of diversification (SID = 0.51 - 0.75)
v. Very high level of diversification (SID > 0.75)

Heckman (two-step) Selection Regression Model

$Y_i = B_O + B_1 X_1 + B_2 X_2 + B_3 X_3 + B_4 X_4 + B_5 X_5 + B_6 X_6 + B_7 X_7 + B_8 X_8 + B_9 X_9 + e_i$ .....

Where,

Y_i = 1 if household diversify their livelihood, and 0 otherwise

X_1 = age (years)

X_2 = marital status (1 or 0)

X_3 = household size (No)

X_4 = level of education (years spent)

X_5 = household income (N)

X_6 = cooperative membership (1 or 0)

X_7 = farming experience (years)

X_8 = household savings (N)

B_O …B_9 = estimated coefficient

ei = error term

RESULTS AND DISCUSSION

Extent of livelihood diversification by farming households

The result on the extent of livelihood diversification engaged by farming households is presented in Table 1. The result reveals that 9.5% of the respondents had very high level of diversification (SID > 0.75), 29.4% had high level of diversification (SID = 0.51 - 0.75), 34.4% which constituted the majority had medium level of diversification (SID = 0.26 - 0.50) and 19.5% had low level of diversification (SID = 0.01 - 0.25). Respondents with no diversification (SID ≤ 0.01) were only 7.2%, meaning that they earned income from just one source for their livelihoods. The study recorded an average diversification index of 0.59.

Table 1: Distribution of Respondents by Extent of Livelihood Diversification

Diversification index	Frequency (No.)	Percent	Mean
No diversification (SID < = 0.01)	19	7.2	0.59
Low level of diversification (SID = 0.01 - 0.25)	43	19.5	
Medium level of diversification (SID = 0.26 - 0.50)	76	34.4	
High level of diversification (SID = 0.51 - 0.75)	65	29.4	
Very high level of diversification (SID > 0.75)	21	9.5	
Total	**224**	**100.0**	

Source: Field Survey, 2023

The result implies that majority of households had diversified livelihoods at medium level and have more than one livelihood activity. This finding corroborates with that of Arowolo *et al*. (2022) who reported that majority of the rural households diversified livelihoods into several activities and earned significant amounts of income from multiple sources.

Factors affecting extent of livelihood diversification by rural households

The results on factors affecting the extent of livelihood diversification among farming households is presented in Table 2. The rho of the regression model indicated the overall goodness of fit of the model and it was statistically significant at 1% level. The Wald test is ($\chi 2$ (10) = 76.02) confirmed that the coefficients of the level of diversification were significantly different from zero; indicated that the model fulfilled condition of good fit. The value of lambda and sigma are also statistically significant; this clearly indicated the model reliability.

The coefficient of age was found to have a statistically significant effect on livelihood diversification. However, evidence from recent studies suggests that this effect is often negative rather than positive. Older household heads may have limited physical capacity and risk-taking ability, which can reduce their participation in diversified income-generating activities. For example, empirical findings from Ethiopia indicate that age negatively and significantly influences the probability of engaging in non-farm activities, as younger household heads are generally more flexible and willing to adopt new livelihood strategies (Washo et al., 2021; Minyiwab et al., 2024). Nevertheless, in some contexts, age can be associated with accumulated experience and social capital, which may enhance access to certain opportunities, particularly in traditional or skill-based sectors (Habib et al., 2023).

Similarly, marital status has been shown to exert a positive and significant influence on livelihood diversification. Married household heads often face greater responsibilities for family welfare, which creates incentives to seek multiple income sources to ensure household food security and stability. Studies in Ethiopia and Nigeria confirm that marital status significantly increases the likelihood of participating in off-farm and non-farm activities, as these households aim to meet higher consumption needs and mitigate income risks (Washo et al., 2021).

The coefficient of household size was found to be positive and significant, influencing the decision for livelihood diversification at the 5% level. An addition of one member to the household could lead to an increase in the probability of livelihood diversification of households by 3.8%. This implies that farmers who operate on a relatively large household size maintained higher levels of diversification, probably due to large volume of labour which led to allocation of multiple tasks across different types of livelihood activities. Some empirical evidence indicated that the number of household members positively affected diversification of farming households, subsequently increasing household income (Ayele & Tadesse, 2022).

The coefficient of education level was positive and significant at the 1% level. An increase in formal education by one year led to a 3.5% increase in the level of diversification of the households. This clearly implies that education of household heads in the study area enhances their ability to adopt new and complex livelihood activities beyond farming, thereby improving household income. This finding aligns with evidence from Nigeria: Chinalurum et al. (2024) reported that education level significantly influences livelihood diversification among farming households.

Household total income variable was found to have positive and significant influence on household's livelihood diversification strategies at less than 1% level. The positive coefficient implied that households with better income are more likely to diversify their livelihood enterprises. The possible reason could be because farm households with better income can easily invest in non-farm activities.

Member of Cooperative was significant and positively influenced the probability of household heads to diversify their sources of livelihood. Being a member of a cooperative increases the probability of farming households to diversify their livelihood by 9.1%. This is probably because membership of cooperative provides a better chance of accessing capital and information to set up a new business enterprise to enhance households' income.

Estimated coefficient of farm size has positive and significant effect on livelihood diversification decision of the farming households. An addition of one hectare of land brought to an increase in the probability of livelihood diversification by 29.8%. This implied that large farm size might enable households to allot their lands to multiple sources of income generating activities. This coincides with that of Onunka and Olumba (2017), who observed that farm size was found to have a significant effect on livelihood diversification among farming households in Enugu State Nigeria.

Household savings, whether informal or formal, were found in our study to positively affect livelihood diversification by 25.7%. This likely reflects the fact that many households use their own savings as capital to finance off-farm businesses as alternative income sources. Extension contacts also positively and significantly affected livelihood diversification at the 5% level: households with extension contact had an 11.7% higher probability of diversification. This shows that extension services, by providing access to new technologies, information, and linkages, facilitate the adoption of diversified livelihood strategies. These findings are broadly consistent with external evidence: Do (2023) shows that households with greater savings are more likely to diversify income portfolios, and Ongachi & Belinder (2025) conclude that agricultural extension services play a pivotal role in enabling diversification and rural development.

Table 2: Factors influencing the extent of livelihood diversification

Variables	Coefficient	Std. Err	Z
Age	0.0836	0.0100	8.4***
Sex	-0.0182	0.0093	-2.0**
Marital status	0.0298	0.0111	2.7***
Household size	0.0375	0.0188	2.0**
Educational level	0.0347	0.0108	3.2***
Household Income	0.2903	0.0841	3.5***
Membership of Cooperative	0.0910	0.0409	2.2**
Farm size(ha)	0.2981	0.1446	2.1**
Household saving	0.2570	0.0578	4.5***
Extension contacts	0.1166	0.0460	2.5**
_cons	-0.0701	0.0275	-2.6***
Lambda	0.1858	0.0538	3.5***
Rho	0.0786	0.0299	
Sigma	0.2450	0.0662	
Wald chi2(10) =	76.02		

Note: ** and *** are significant at 5% and 1% respectively
Source: Field Survey, 2023

Constraints to livelihoods diversification by farming households

Result on constraints to livelihood diversification is presented in Table 3. The result revealed that the major constraints to livelihood diversification in the study area include lack of credit facilities or capital (95.9%), lack of awareness and training (67.9%), and location and patronage (56.1%). Risk involved in the diversification (3.6%), was the least constraint to livelihood diversification. The study agrees with that of Zewdie (2021), who identified inadequate capital/credit access, lack of training/skills, and systemic constraints as major barriers to livelihood diversification among rural households. Capital is a backbone of any livelihood activity because, without it, input cannot be procured.

Table 3: Constraints to Livelihood Diversification by Farming Households

Problems	Frequency	*Percentage
Lack of credit facilities or capital	212	95.9
Lack of awareness and training	150	67.9
Location and patronage	124	56.1
Infrastructural problem	110	49.8
Culture and religion	80	36.2
Risk involves in the diversification	8	3.6

Source: Field survey, 2023.
*Multiple responses existed

CONCLUSION AND RECOMMENDATIONS

Based on the findings, it is concluded that livelihood diversification among farming households in southern Borno constitutes a pivotal adaptive strategy for mitigating economic vulnerability and enhancing household resilience. The evidence demonstrates that households engaged in diversified livelihood portfolios exhibit comparatively higher income stability and improved socio-economic outcomes than those dependent exclusively on farming activities only as a source of income.

The study, therefore, makes the following recommendations:

i. Livelihood diversification to be encouraged among farming household by agricultural extension agents. This will go along away in enhancing livelihood diversification as farmers can take opportunity to build resilience and diversify.
ii. Agricultural extension service providers should incorporate the promotion of various sources of income into their extension programs. This can help farmers diversify their sources of income and increased resilience.
iii. It's critical that development actors concentrate on providing basic infrastructure, such as electricity, access roads, portable drinking water, health facilities, and schools, among others, to promote diversification of livelihood.

REFERENCES

Adekule, C. P., & Shittu, A. M. (2022). Patterns and determinants of livelihood diversification among farm households in Odeda Local Government Area, Ogun State, Nigeria. Journal of Agricultural Science and Environment, 14(1). https://doi.org/10.51406/jagse.v14i1.1219

Akintunde, O., Ajayi, F., Bamiwuye, O. and Olanrewaju, K. (2022). Factors Influencing Livelihood Diversification among Farming Households in Ejigbo Local Government Area of Osun State, Nigeria. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, 22 (3): 15- 22.

Arowolo, A. O., Ibrahim, S. B., Aminu, R. O., Olanrewaju A. E., Ashimiu, S. M. and Kadiri, O. J. (2022). Effect of Financial Inclusion on Livelihood Diversification among Smallholder Farming Households in Oyo State, Nigeria. *Nigerian Agricultural Journal*, 53(1):67-75

Ayele, E., & Tadesse, S. (2022). Livelihood diversification and its impact on household food security among farming households in Kalu Wereda, South Wollo, Ethiopia. Journal of Economics and Sustainable Development, 13(5). https://doi.org/10.7176/JESD/13-5-03 (iiste.org)

Belinder, I. (2025). Agricultural extension as a pathway to livelihood diversification and sustainable development in rural communities: A systematic review. BMC Agriculture, 1(6). https://doi.org/10.1186/s44399-025-00005-x

Benjamin T. A., Kwame N., and Joshua A. N. (2020). Does Off-Farm Work Improve Farm Income? Empirical Evidence from Tolon District in Northern Ghana. Advances in Agriculture Volume 2020, Article ID 1406594, 8 pages

Chinalurum, C. A., Ojoko, E. A., & Junaidu, M. (2024). Determinants of livelihood diversification among farming households in Nigeria. Journal of Agripreneurship and Sustainable Development, 7(2), 78–85. https://doi.org/10.59331/jasd.v7i2.750

Do, M. H. (2023). The role of savings and income diversification in households' resilience strategies: Evidence from rural Vietnam. Social Indicators Research, 168, 353–388. https://doi.org/10.1007/s11205-023-03141-6

Habib, N., Ariyawardana, A., & Aziz, A. (2023). The influence and impact of livelihood capitals on livelihood diversification strategies in developing countries: A systematic literature review. *Environmental Science and Pollution Research*, 30(12), 27638–27652. https://doi.org/10.1007/s11356-023-27638-2

Mbewana, V., & Kaseeram, I. (2024). The determinants of livelihood diversification among small-scale rural farmers in Alfred Nzo and King Cetshwayo District, South Africa. Cogent Economics & Finance, 12(1), Article 2368901. https://doi.org/10.1080/23322039.2024.2368901

Mekonnen, H., & Tadesse, B. (2021). Determinants of rural livelihood diversification strategies among Chewaka resettlers' communities of southwestern Ethiopia. Agriculture & Food Security, 10(1), Article 36. https://doi.org/10.1186/s40066-021-00305-w

Minyiwab, A. D., et al. (2024). The effect of livelihood diversification on food security: Evidence from Ethiopia. *Cogent Economics & Finance*, 12(1), 2345304. https://doi.org/10.1080/23322039.2024.2345304

Mohammed A. & Fentahun T. (2020). Intensity of Income Diversification among Small-holder Farmers in Asayita Woreda, Afar Region, Ethiopia. *Cogent Economics & Finance*, 8(1): 1759394, DOI: 10.1080/23322039.2020.1759394

Musumba, M., Palm, C. A., & Komarek, A. M. (2022). Household livelihood diversification in rural Africa. Agricultural Economics, 53(2), 246–256. https://doi.org/10.1111/agec.12694.

Ongachi, W., & Belinder, I. (2025). Agricultural extension as a pathway to livelihood diversification and sustainable development in rural communities: A systematic review. BMC Agriculture, 1, Article 6. https://doi.org/10.1186/s44399-025-00005-x

Tebeje, A., & Worku, E. (2022). A double-hurdle estimation of crop diversification decisions by smallholder wheat farmers in Sinana District, Bale Zone, Ethiopia. CABI Agriculture and Bioscience. https://doi.org/10.1186/s43170-022-00098-3

Washo, J. A., et al. (2021). Determinants of rural households' livelihood diversification decision: The case of Didessa and Bedelle District, Ethiopia. *African Journal of Agricultural Research*, 16(11), 1504–1514. https://www.researchgate.net/publication/375424262

Zewdie Goba, Z. (2021). Review on determinants of rural livelihood diversification strategies in Ethiopia. International Journal of Science, Technology and Society, 9(2), 98–106. https://doi.org/10.11648/j.ijsts.20211002.17

PSYCHOLOGICAL EFFECTS OF FOOD INFLATION ON THE WELL-BEING STATUS OF FACULTY OF AGRICULTURE STUDENTS, UNIVERSITY OF IBADAN, NIGERIA

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ABSTRACT
Food inflation is a growing global concern which threatens individuals' well-being, particularly among vulnerable groups like students. It is against this backdrop the study assessed the psychological effects of food inflation on the well-being status of Agricultural students at University of Ibadan, Nigeria. This study employed a multistage sampling procedure to select one hundred and twenty respondents. A well-structured questionnaire was used to obtain data on respondents' personal characteristics, perception on food inflation, wellbeing status, psychological effect and coping strategies of food inflation which were analysed using both descriptive and inferential statistical tools. Findings showed that the mean age of respondents was 21.33 ± 3.01years, 64.2% and 57.5% were female and living in the hall of residence, respectively. More than half (53.3%) of the respondents had unfavourable perception about food inflation. Planning meals carefully to minimize food waste ($\bar{x}$=4.20) and preparing meals at home rather than eating outside ($\bar{x}$=4.16) were the most employed coping strategies for food inflation. Food inflation resulted in stress ($\bar{x}$= 3.39), anxiety ($\bar{x}$=2.96) and emotional toll ($\bar{x}$=2.99) among the students. Similarly, an average (51.7%) of the respondents had low well-being status. There exists a significant relationship between sex (χ^2= 43.78), religion (χ^2 = 150.60), perception on food inflation (r= 0.37) and well-being status. The study concluded that stress is the most experienced psychological effects of food inflation by the respondents with low well-being status. The study recommends that stakeholders like religious organisations should provide subsidised food options within campus markets to mitigate stress associated with inflation which will make students have better wellbeing.
Keyword: Anxiety, coping strategies, emotional tolls, food inflation, students' wellbeing

INTRODUCTION

Food inflation is the persistent rise in the cost of food over time which has become a critical issue around the world. Globally, food prices have soared in recent years due to several interconnected factors ranging from COVID-19 pandemic, extreme weather events, geopolitical tensions such as Russian invasion of Ukraine, trade restrictions in key food-producing region, to currency depreciation in low-income countries. This is resulting in disruptions in supply chain, labour shortages, transportation delays, production challenges and reduced agricultural yields (Food and Agriculture Organisation, FAO, 2021).

The effect of food inflation is felt by both developed and developing nations. In developed nations, the severity is low due to more resilient economies and diversified food sources. However, these countries still face challenges of supply chain disruptions and global market fluctuations. On the other hand, developing nations often bear the brunt of food inflation due to their higher dependency on imported foods and lower economic resilience. For instance, many African countries import a significant portion of their food, making them highly susceptible to global price increase. When global food prices rise, these countries face increased importation costs, which can lead to higher domestic food prices and worsen food insecurity (FAO, 2021; World Bank, 2021).

Nigeria being the Africa's most populous nation and one of its largest economies is not left out of this conundrum (Gad & Israel, 2024). In 2021, food inflation rate climbed to 22.95%, soaring to 23.43% in 2022 (NBS, 2021, NBS, 2022). By 2023, the rate slightly declined to 22.10% but remained markedly high compared to historical averages (NBS, 2023). As of June 2024, the rate has risen significantly, reaching 40.87% (NBS, 2024). The escalation in food prices has exacerbated food insecurity, particularly among low-income and vulnerable groups. Many Nigerians, particularly those in rural areas and informal sectors, struggle to afford basic food items. The World Food Programme (WFP) reported worsening food insecurity, with millions of Nigerians experiencing difficulties in accessing sufficient and nutritious food (WFP, 2023). The surge in food prices has significantly stretched household budgets, pushing many Nigerians further into poverty. As food costs increase, most households allocate a larger portion of their income to food, reducing their ability to spend on other essential needs such as education, healthcare, and housing (Gad & Israel, 2024).

The effects of food inflation extend beyond the economic impact, it also delves into the realm of psychology. Worries about food security and the ability to afford adequate and nourishing meals contribute to various psychological issues such as anxiety and depression. This particularly concerns students who often have limited financial resources and struggle to manage increased expenses. The repercussions of food inflation are particularly pronounced for vulnerable groups of which university students are a part of, as majority of them are dependents on their parents or sponsors who are

already struggling with the rising cost of living (Ojebuyi & Salami, 2022). This not only hampers their capability to procure sufficient and nourishing food but also takes a toll on their general well-being, academic achievement, and mental health. Studies have indicated that financial insecurity, particularly related to food, is closely associated with heightened stress, anxiety, and depression (Smith, Pritchard & Perry, 2020). These mental health challenges, in turn, significantly diminish students' academic performance and social engagement (Aziz *et al*, 2025). Addressing this problem is crucial not only to safeguard students' mental and social well-being but also to ensure that their academic success is not compromised due to the rising cost of food.

Despite the importance of addressing these psychological effects, there is a notable gap in research specifically focusing on the psychological effects of food inflation on the well-being of students. Previous studies have predominantly examined the economic dimensions of food inflation, without fully exploring its psychological and social impacts. The general objective of this study is to investigate the psychological effects of food inflation on the well-being of Agriculture students in University of Ibadan. The specific objectives of the study are to describe the personal characteristics of respondents, assess the perception of respondents on food inflation, ascertain their well-being status, determine the psychological effects of food inflation on respondents and explore the coping strategies used by respondents in response to food inflation. The hypotheses of the study state that there is no significant relationship between personal characteristics/perception of food inflation of respondents and well-being of respondents.

METHODOLOGY

The study area was the Faculty of Agriculture, University of Ibadan, Oyo State. It is one of the seventeen (17) faculties within the University of Ibadan having six departments: Animal Science, Agricultural Economics, Agricultural Extension and Rural Development, Crop Protection and Environmental Biology, Crop and Horticultural Science and Soil Resources Management. The population of the study included all students in the Faculty of Agriculture.

A two-stage sampling procedure was used for this study. In the first stage, simple random sampling was used to select 50% of the departments in the faculty, which are Animal Science (ANS), Crop Protection and Environmental Biology (CPEB) and Agricultural Extension and Rural Development (AERD). At the second stage, 20% of the students at each level (100-500 level) were randomly selected from the list of students in each department (ANS = 54, CPEB =31, AERD = 35) to give 120 respondents that forms the sample for this study.

Measurement of variables

Perception on food inflation: list of perception statements like food inflation refers to the rising cost of food items over time, reduced agricultural productivity contributes to food inflation etc. were provided which was operationalised using a five-point Likert scale of Strongly Agreed (SA) =5, Agreed (A) = 4, Undecided (U) = 3, Disagreed (D) = 2 and Strongly Disagreed (SD) = 1 for positively worded statements and reverse for negatively worded statements. The mean score was generated and used to categorise respondents into those having favourable and unfavourable perception of food inflation.

Coping strategies to food inflation: list of coping strategies like planning of meals to prevent wastage, preparing meals instead of buying outside, skipping meals due to cost etc. were provided which was operationalised using a three-point Likert-type scale of never (0), occasionally (1) and always (2).

Psychological effects of food inflation was measured by using three domains: stress, anxiety and emotional toll which was operationalised using five Likert scale of Strongly Disagree (5), Disagree (4), Neutral (3), Agree (2) and Strongly Agree (1) for positively worded statements and reverse for negatively worded statements. Mean score was generated for each domain and used to identify the effect that is the strongest among the three.

The dependent variable is well-being status: which was operationalised using five Likert scale of Strongly Disagree (5), Disagree (4), Neutral (3), Agree (2) and Strongly Agree (1) for positively worded statements and reverse for negatively worded statements. Mean score was obtained and used to categorise respondents into those having low and high well-being status.

Data was collected using structured questionnaire and analysed using frequency distribution, percentage, mean and standard deviation, chi-square and Pearson Product-Moment Correlation (PPMC).

RESULTS AND DISCUSSION

Personal characteristics of the respondents

The result in Table 1 reveals that the mean age of respondents was 21.33 $\pm$ 3.013 years. Findings from UN (2020) found that majority of youths worldwide fall within the age range of 15-24 years, which implies that majority of the respondents are youths who are active and agile. The department distribution reveals that 45.0% of the respondents were from Animal science, 29.2% from Agricultural Extension and Rural Development and 25.8% from Crop Protection and Environmental Biology, indicating that respondents were selected from Agriculture related field and could have a better

understanding of food inflation. Furthermore, majority (86.7%) practice Christianity while 12.5% practice Islam, suggesting that religion-based coping mechanisms (e.g., prayer, faith in divine provision and occasional distribution of food items) might play a role in how students manage the psychological effects of food inflation which is in line with the study of Buckley (2021) that students who are involve in religious communities will be able to cope well during food inflation. The year of study shows that 26.7% of respondents were in 500 level and 22.5% were in 400 level, implying that they are more likely to have experienced changes in food prices over time, affecting their perception and coping strategies. Additionally, the distribution of respondents' place of residence indicated that more than half of respondents reside in the hall, 41.7% of respondents reside off-campus and 0.8% of respondents reside with family which indicates that most respondents reside in the hall, suggesting that food may be more expensive from food vendors than food prepared at home which may inform their decisions to adopt cost-cutting strategies to food inflation. In addition, majority (86.7%) of respondents' source of income is from parent/guardian, implying that most respondents depend on parents for upkeeps and feeding, which is in line with the findings of Adamu, Babatimehin and Adeoye (2024) that parents, guardians or caregivers are compelled to giving more pocket money to their wards who are in the universities as a result of taking care of their unending needs. The mean income is ₦20,693.33±₦18372.109, implying that most respondents are low monthly income earners as they depend on what is given by parents or guardians for survival.

Table 1: Personal characteristics of respondents

Variables	Frequency	Percentage (%)	Mean	SD
Age				
16-20	45	37.5	21.33	±3.013
21-24	62	51.7		
25-28	12	10.0		
29-32	1	0.8		
Department				
AERD	35	29.2		
ANS	54	45.0		
CPEB	31	25.8		
Sex				
Male	43	35.8		
Female	77	64.2		
Religion				
Christianity	104	86.7		
Islam	15	12.5		
Others	1	0.8		
Year of study				
100 level	20	16.7		
200 level	20	16.7		
300 level	21	17.5		
400 level	27	22.5		
500 level	32	26.7		
Place of Residence				
Hall	69	57.5		
Off-Campus	50	41.7		
With Family	1	0.8		
Source of income				
Self-sponsored	16	13.4		
Parent/guardian	104	86.7		
Monthly Income (₦)				
<10,000	22	68.3	₦20,693.33±₦18372.109	
10000-20000	27	22.5		
20001-40000	33	4.2		
40001-100000	31	3.3		
100001 and above	7	1.7		

Source: Field Survey, 2024

Perception of respondents on food inflation

Table 2 shows that 41.7% of respondents strongly agreed that food inflation refers to the rising cost of food items over time and exchange rate affects the price of imported food. Also, 57.5% agreed that reduced agricultural productivity and high transportation costs contribute to food inflation. Likewise, 46.7% of respondents also agreed that insurgency contributed to food inflation and food inflation affects the prices of other essential items. These implies that a significant proportion of respondents have a better understanding of what food inflation is and its underlying causes due to their level of exposure, education and probably field of study. Furthermore, the categorisation of respondents on perception about food inflation shows that 64.0% had unfavourable perception towards food inflation which implies that respondents are not pleased with the impacts and long-term effects of food inflation. This is in line with findings by Baldelamar *et al* (2024) that students demonstrated remarkable adaptability in coping with inflation due to their adequate awareness.

Table 2: Perception of respondents on food inflation

Statement	SA	A	N	D	SD
Food inflation refers to the rising cost of food items over time	41.7	50.0	2.5	3.3	2.5
Food inflation affects the prices of other essential food items	44.2	45.8	3.3	2.5	4.2
Food inflation reduces purchasing power	30.0	56.7	5.0	5.0	3.3
High transportation costs contribute to food inflation	38.3	50.8	5.0	2.5	3.3
Exchange rate affects the prices of imported food	40.0	50.8	5.8	0.8	2.5
Supply chain disruptions contribute to food inflation	20.0	56.7	20.8	0.8	1.7
Global events, COVID-19 pandemic has contributed to food inflation	18.3	47.5	26.7	7.5	0.00
Reduced agricultural production contributes to rising food prices	32.5	57.5	6.7	2.5	0.8
Insurgency has contributed to food inflation	41.7	46.7	6.7	3.3	1.7
Food inflation increases the risk of food insecurity	30.0	46.7	17.5	5.0	0.8
Ukraine-Russia war contributed to food inflation	7.5	31.7	43.3	16.7	0.8

Source: Field survey, 2024

Table 3: Categorisation of perception of respondents on food inflation

Categorisation	Frequency	Percentage	Minimum value	Maximum value	Mean ±SD
Unfavourable (15.0-44.36)	64.0	53.3	15.0	55.0	44.36±6.310
Favourable (44.37- 55.0)	36.0	46.7			

Coping strategies of respondents to food inflation

Table 4 reveals that respondents always plan meals carefully to minimise food waste ($\bar{x}$=4.20), they also prepare meals at home rather than eating outside ($\bar{x}$=4.16*)*, prioritise essential food items over luxury foods ($\bar{x}$=3.97) and often compare prices at different stores to find the cheapest options ($\bar{x}$=3.85*)*. This implies that students are adopting cost-effective methods to manage food inflation while also actively managing limited resources by reallocating budgets and seeking cheaper alternatives. This is in line with the findings of Elias *et al* (2023) that the most used coping strategies to food inflation among students are those that help reduce spending of money such as eating fewer meals and food pooling.

Table 4: Coping strategies to food inflation

Statement	Never	Occasionally	Always	Mean	SD
Planning meals carefully to minimise food waste	0.00	22(18.4)	98(81.7)	4.20	0.77
Preparing meals at home rather than eating outside	1(0.8)	19(15.8)	100(83.3)	4.16	0.83
Prioritising essential food items over luxury foods	3(2.5)	28(23.3)	89(74.1)	3.97	0.93
Comparing prices at different stores to find the cheapest options	4(3.3)	30(25.0)	86(71.7)	3.85	1.05
Prioritising food expenses over other essentials	3(2.5)	40(33.3)	77(64.2)	3.75	1.05
Avoiding social gatherings that involve spending on food	14(11.7)	68(56.6)	38(31.6)	2.88	1.10
Skipping meals or eating less due to cost	17(14.2)	65(54.1)	38(31.7)	2.87	1.19
Participating in food-sharing programs	28(23.3)	76(63.3)	6(13.3)	2.28	1.02
Purchase of less nutritious food	20(16.7)	93(77.5)	7(5.8)	2.33	0.82
Purchasing food stuff on credit	85 (70.8)	32 (26.7)	3 (2.5)	1.43	0.76

Source: Field survey, 2024

Psychological effects of food inflation on respondents

Table 5 shows that for stress, 45.0% and 44.2% agreed that they are overwhelmed by the effects of food inflation on their budget and worrying about running out of food before the next income. Also, 32.5% of respondents agreed that they find it difficult to cope with the stress of buying enough food and 20.8% disagreed that they feel pressured to skip meals to save money. For anxiety, 35.8% of respondents disagree that they worry about not being able to afford food in the future and 36.7% affirmed not being able to buy healthy food. Also, for emotional toll, 51.7% of agreed that they feel discouraged by financial strain and 34.2% have a reduced sense of loss due to reduced food options. This indicates that food inflation imposes significant stress and anxiety on the respondents, affecting their financial stability and well-being. The inability to cope with rising food costs may lead to increased stress levels and increased emotional toll which have been linked to poor mental health, reduced academic performance and unhealthy coping strategies such as meal skipping. This corroborates the findings of Ciciurkaite and Brown (2022) that food inflation is linked with diminished psychosocial coping resources, resulting in more psychological distress

The grand mean values of each domain: anxiety ($\bar{x}$=2.96), stress ($\bar{x}$=3.39) and emotional toll ($\bar{x}$=2.99) reveal that stress has the highest mean which shows that stress has a stronger effect, followed by emotional toll and anxiety. These findings suggest that food inflation contributes to stress among respondents which may add to other stress experienced in other areas of their lives especially educational stress, leading to feelings of helplessness, social withdrawal and academic failure. This is in line with Brakespear and Cachia (2021) that social isolation and loneliness have profound impact on adolescents' health including increasing the risk of mental health issues such as stress and anxiety.

Table 5: Psychological effects of food inflation on respondents

Statements	SA	A	N	D	SD	Mean	SD
Stress							
I feel overwhelmed by the effect of food inflation on my budget	22(18.3)	54(45.0)	29(24.2)	11(9.2)	4(3.3)	3.66	0.99
I worry about food expenses more than other expenses in my life	17(14.2)	46(38.3)	36(30.0)	14(11.7)	7(5.8)	3.43	1.06
I find myself unable to cope with the stress of buying enough food	11(9.2)	39(32.5)	32(26.7)	28(23.3)	10(8.3)	3.11	1.12
Rising food costs make me feel unable to handle my finances well	16(13.3)	51(42.5)	26(21.7)	21(17.5)	6(5.0)	3.42	1.08
I often feel my efforts to manage food expenses are not making a difference	11(9.2)	49(40.8)	29(24.2)	24(20.0)	7(5.8)	3.27	1.07
I often worry about running out of food before the next income comes in	25(20.8)	53(44.2)	14(11.7)	20(16.7)	8(6.7)	3.56	1.19
I often feel pressured to skip meals to save money	19(15.8)	45(37.5)	20(16.7)	25(20.8)	11(9.2)	3.30	1.23
Grand Mean						**3.39**	
Anxiety							
I worry frequently about my inability to afford food in the future	6(5.0)	19(15.8)	33(27.5)	43(35.8)	19(15.8)	2.58	1.01
The thought of not being able to buy healthy food worries me	6(5.0)	44(36.7)	34(28.3)	26(21.7)	10(8.3)	3.08	1.12
I feel restless due to food concerns	4(3.3)	25(20.8)	36(30.0)	43(35.8)	12(10.0)	2.72	1.21
I become easily annoyed or irritable when thinking about food prices	11(9.2)	56(46.7)	23(19.2)	20(16.7)	10(8.3)	3.32	1.03
I find it difficult to concentrate on my studies due to food related worries	12(10.0)	24(20.0)	16(13.3)	53(44.2)	15(12.5)	2.71	1.11
I feel uneasy about the uncertainty of food prices	13(10.8)	55(45.8)	27(22.5)	20(16.7)	5(4.2)	3.42	1.06
I feel fearful of not being able to afford food during exam periods	6(5.0)	36(30.0)	28(23.3)	37(30.8)	13(10.8)	2.88	1.10
Grand Mean						**2.96**	
Emotional toll							
I feel emotionally drained by the constant rise in food prices	4(3.3)	46(38.3)	34(28.3)	24(20.0)	12(10.0)	3.05	0.91

Statements	SA	A	N	D	SD	Mean	SD
I feel frustrated when I cannot afford to buy nutritious food	9(7.5)	49(40.8)	26(21.7)	27(22.5)	9(7.5)	3.18	1.06
I feel discouraged by the financial strain that food prices place on me	8(6.7)	62(51.7)	26(21.7)	18(15.0)	6(5.0)	3.40	1.10
I feel a sense of loss due to reduced food options	9(7.5)	41(34.2)	31(25.8)	33(27.5)	6(5.0)	3.12	0.99
I feel withdrawn from social activities due to food affordability concerns	3(2.5)	20(16.7)	44(36.7)	45(37.5)	8(6.7)	2.71	1.06
I feel embarrassed about not being able to afford food with friends on campus	5(4.2)	21(17.5)	27(22.5)	51(42.5)	16(13.3)	2.57	1.12
I feel frustrated when searching for affordable food options on campus	7(5.8)	33(27.5)	35(29.2)	32(26.7)	13(10.8)	2.91	1.08
Grand Mean						**2.99**	
Overall mean = 3.11							

Field survey, 2024

Well-being status

Table 6 reveals that 65.0% agree that they feel that they have enough energy to manage their responsibilities, 56.7% agree that they are able to perform their daily activities without physical discomfort and 30.0% agree that they are tired or fatigued most of the time. This implies that while physical well-being is relatively good for many, fatigue persists among a notable portion of the respondents. For mental and emotional well-being, 65.0% agree that they feel optimistic about their future, 58.3% agree that they feel good about themselves and their abilities, 62.5% agree that they are able to find moments of happiness and contentment each day. This implies that majority of respondents maintain a positive outlook about themselves. For social well-being, 62.5% agree they have meaningful relationships that enhance their well-being, 62.5% agree that they feel respected and valued by others regardless of financial status and 49.2% agree that they feel a sense of belonging in their social environment. This implies that the majority of the respondents have a strong social network and capital.

Table 7 reveals that 51.7% of respondents have low wellbeing status which implies that respondents' well-being has been affected due to food inflation. This may contribute to their psychological distress, challenges and overall mental, social and physical health. This is in tandem with Jackson *et al* (2025) that food inflation contributes to mental and emotional health challenges of students in Hungary.

Table 6: Respondents' well-being status

Statement	SA	A	N	D	SD	Mean	SD
Physical well-being							
I am able to perform my daily activities without physical discomfort	7(5.8)	8(6.7)	14(11.7)	68(56.7)	23(19.2)	3.77	1.03
I feel tired or fatigued most of the time	11(9.2)	33(27.5)	34(28.3)	36(30.0)	6(5.0)	3.06	1.07
My physical health limits my social activities	6(5.0)	24(20.0)	24(20.0)	52(43.3)	14(11.7)	2.63	1.08
My diet provides me with the necessary nutrition to stay healthy	2(1.7)	5(4.2)	40(33.3)	57(47.5)	16(13.3)	3.67	0.82
Grand Mean						*3.38*	
Mental and emotional well-being							
I feel optimistic about my future	4(3.3)	5(4.2)	24(20.0)	78(65.0)	12(10.0)	4.06	0.99
I am generally able to stay calm and relaxed under pressure	1(0.8)	12(10.0)	24(20.0)	58(48.3)	25(20.8)	3.78	0.92
I feel good about myself and my abilities	0.00	6(5.0)	14(11.7)	70(58.3)	30(25.0)	4.03	0.76
I feel in control of my emotions even during stressful times	0.00	10(8.3)	32(26.7)	58(48.3)	20(16.7)	3.73	0.84
I feel I can handle uncertainties	-	3(2.5)	43(35.8)	57(47.5)	17(14.2)	3.73	0.73
I am able to concentrate on my studies without distractions	1(0.8)	11(9.2)	31(25.8)	63(52.5)	14(11.7)	3.65	0.84
Grand Mean						*3.85*	

Statement	SA	A	N	D	SD	Mean	SD
Social well-being							
I feel like an important part of my social circle	1(0.8)	6(5.0)	25(20.8)	67(55.8)	21(17.5)	3.84	0.80
I have meaningful relationships that enhance my well-being	1(0.8)	1(0.8)	15(12.5)	75(62.5)	28(23.3)	4.07	0.68
I feel a sense of belonging in my social environment	0.00	4(3.3)	30(25.0)	59(49.2)	27(22.5)	3.91	0.78
I am comfortable discussing my challenges with those close to me	0.00	16(13.3)	37(30.8)	47(39.2)	20(16.7)	3.59	0.92
I participate in social activities	3(2.5)	7(5.8)	50(41.7)	51(42.5)	9(7.5)	3.47	0.82
I feel respected and valued by others regardless of financial status	2(1.7)	1(0.8)	16(13.3)	75(62.5)	26(21.7)	4.02	0.73
I feel that social connections have remained strong despite my challenges	0.00	3(2.5)	35(29.2)	60(50.0)	22(18.3)	3.84	0.75
Grand Mean						*3.82*	

Source: Field survey, 2024

Table 7: Categorisation of well-being of respondents

Categorisation	Frequency	Percentage	Minimum value	Maximum value	Mean ±S.D
Low (36.0 -70.59)	62.0	51.7	36.0	95.0	70.59±8.602
High (70.60 – 95.0)	58.0	48.3			

Field survey, 2024

Hypothesis testing

Personal characteristics of respondents and the well-being of respondents

In Table 8, a significant relationship exists between sex (χ^2=43.79), religion (χ^2=150.60) and the wellbeing of respondents. This suggests that male and female students experience different financial pressures, social expectations and psychological stressors which is in line with findings by Roke *et al* (2025) that differences occur in the financial stress experienced by both males and females. Students belonging to religious communities may benefit from spiritual coping mechanisms and community-based assistance which is in line with findings by Buckley (2021) that religious organisations always serve as a source of succor in providing food items for their members as need arises.

Table 8: Relationship between personal characteristics and the well-being of respondents

Variables	χ^2	df	p-value	Decision
Sex	43.787	1	0.050	Significant
Religion	150.60	3	0.000	Significant
Source of Income	70.639	2	0.164	Not Significant

Relationship between perception of food inflation and the wellbeing of respondents

The result on Table 9 shows that significant relationship exists between respondents' perception of food inflation (r=-0.377) and wellbeing status. This implies that the respondent's food inflation perception significantly influences their wellbeing status. A favourable perception will lead to an increase in their well-being. This is in line with findings by Olufemi-Phillips *et al* (2024) that those with a better understanding or acceptance of food inflation cope more effectively.

Table 9: Relationship between perception of food inflation and wellbeing of respondents

Variable	r-value	p-value	Decision
Perception of food inflation	0.377	0.000	Significant

Source: Field Survey, 2024

CONCLUSION AND RECOMMENDATIONS

Students of Agriculture, University of Ibadan, experienced low well-being status with majority having an unfavourable perception about food inflation. Planning and preparation of meals personally were the most employed coping strategies to food inflation though it came with stress. The study recommends that stakeholders like religious organisations should provide subsidised food options within campus markets to reduce stress caused by inflation and to ensure that students have better wellbeing.

REFERENCES

Adamu, C. D., Babatimehin, T., Adeoye, & P. O (2024). Analysis of Spending Pattern among Undergraduate Students of Nigeria: A Case Study of University of Nigeria, Nsukka. *Bulgarian Journal of Science and Education Policy (BJSEP), Volume 14, Number 2, 2020.*

Aziz, S. Q. A., Taha, M. N., Sandramogan, T., Kasim, M. N., & Harun, S. A. (2025). Financial Issues and Students' Stress Among Private University Students in Selangor, Malaysia. *International Journal of Research and Innovation in Social Science (IJRISS)*, 9(04), 6982-6990. https://doi.org/https://dx.doi.org/10.47772/IJRISS.2025.90400514

Baldelamar, A. V., Cabarce, M., Jovie, G. A., Edios, J. T., Guro D. A., Ozarraga, R. J., Timonera, P., Seveses, & J. M. (2024). Inflation Crisis: Perceptions, Challenges and Coping Strategies of Students.https://www.researchgate.net/publication/378736795_inflation_crisis_perceptions_challenges_and_coping_strategies_of_students

Brakespear, G. & Cachia, M. (2021). Young adults dealing with loneliness at university. *New Vistas* 7(1) :31-36. doi: 10.36828/newvistas.23

Buckley, S. (2021). The impact of religion on wellbeing: A gendered analysis. *Journal of Gender Studies,* 25(2), 147-162

Ciciurkaite, G., & Brown, R. L. (2022). The link between food insecurity and psychological distress: The role of stress exposure and coping resources. *Journal of community psychology*, 50 (3), 1626–1639. https://doi.org/10.1002/jcop.22741

Elias, S. M. S., Ibrahim, S. N., & Sutantri, S. (2023). Food insecurity and coping strategies amongst undergraduate students during the COVID-19 pandemic in Malaysia, *Malaysian Journal of Medicine and Health Sciences*, 19 (2):242-249. DOI:10.47836/mjmhs.19.2.35

Food and Agriculture Organization (FAO) (2023). World Food Price Index Annual Report. Retrieved from www.fao.org.

Food and Agriculture Organization of the United Nations (FAO). (2021). The State of Food Security and Nutrition in the World 2021: Transforming food systems for affordable healthy diets. Rome, FAO. https://doi.org/10.4060/cb4474en

Food and Agriculture Organization of the United Nations (FAO). (2022). *FAO Food Price Index – March 2022.* FAO Website

Food and Agriculture Organization of the United Nations (FAO). (2024). *FAO Food Price Index – May 2024.* FAO Website https://www.researchgate.net/publication/379749931_analysis_of_spending_pattern_among_undergraduate_students_of_nigeria:_a_case_study_of_university_of_nigeria_nsukka

Gad, C. & Israel, K. E. (2024). Food inflation and the Nigerian Economy. An empirical investigation, *International Journal of Research and Innovation in Social Science,* Vol. VIII. Issue XI, DOI: 10.47772/IJRISS.

Jackson, K., Kelemen, Z. & Nagy, Á. (2025). Inflation, food insecurity and mental health: Generation Z's burden in emerging Europe. *Humanity Soc. Sci. Commun.* 12, 1552, https://doi.org/10.1057/s41599-025-05858-w

National Bureau of Statistics (NBS). (2021). *Consumer Price Index and Inflation Report.* NBS

National Bureau of Statistics (NBS). (2022). *Consumer Price Index and Inflation Report.* NBS

National Bureau of Statistics (NBS). (2023). *Consumer Price Index and Inflation Report.* NBS

National Bureau of Statistics (NBS) (2024). Nigeria's Consumer Price Index and Food Inflation Trends. Retrieved from www.nigerianstat.gov.ng

Ojebuyi & Salami (2022). Food Inflation, Social Engagement and Mental Health among Nigerian University Students. *Journal of Education and Human Development*, 11 (5)

Olufemi-Phillips, A. Q., Igwe, A. N., Ofodile, C. O., Eyo-Udo, L. N., Toromade, A. S. & (2024). Analysing economic inflation's impact on food security and accessibility through econometric modeling, *GSC Advanced Research and Reviews,* 2024, 21(02), 102-128, https://doi.org/10.30574/gscarr.2024.21.2.0411

Roke, L.B., Lasma L., Anita B. & Iveta L. A. (2025). Financial Stress in College Students: examining gender differences in relation to socio-economic factors. *Education Innovation Diversity,* 99-112. 10.17770/eid2025.1.8385.

Smith, R., Pritchard, M., & Perry, A. (2020). Food insecurity and psychological distress: A study of university students. *Journal of College Health*, 68 (5), 489-495.

United Nations (UN). (2020). World Youth Report 2020: Youth and the 2030 Agenda for Sustainable Development. New York: UN.

World Bank. (2021). Responding to the Emerging Food Security Crisis. World Bank. https://blogs.worldbank.org

World Food Programme (2023). WFP Annual Review 2023: Keeping Pace with Soaring Humanitarian Challenges amid shrinking resources. https://publications.wfp.org/2023/en/annual-report/#slide-10

INTEGRATION OF INDIGENOUS KNOWLEDGE (IK) WITH CLIMATE-SMART AGRICULTURAL (CSA) PRACTICES ACROSS TWO CONTRASTING AGRO-ECOLOGICAL ZONES OF OYO AND OGUN STATES, NIGERIA

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ABSTRACT
This study investigated the synergistic potential of integrating Indigenous Knowledge (IK) with Climate-Smart Agriculture (CSA) practices across two contrasting agro-ecological zones in Southwestern Nigeria, precisely the semi-arid Oyo and the humid Ogun States. It was posited that an integrated IK-CSA approach would outperform singular systems, but that the specific benefits would be shaped by local ecological and socio-economic contexts. Using participatory action research methodology, three farmer groups (IK-only, CSA-only, and Integrated IK-CSA) across 180 farms (90 per state) was established. Data was collected over two cropping seasons (2022-2023) on soil health, yields of maize and cassava, and household economics. Findings indicate that the Integrated system significantly ($p<0.05$) improved soil organic matter (22-28%) and crop yields (25-45%) in both states compared to control groups. However, the magnitude of benefits and the most impactful specific practices differed. In semi-arid Oyo, IK water harvesting techniques combined with CSA drought-tolerant seeds were paramount. In humid Ogun, IK pest management and CSA soil conservation practices showed the strongest synergy. The study concludes that while the principle of integration is universally beneficial, a successful framework must be context adaptive. The study recommends that national frameworks such as the *National Agricultural Technology Adoption Policy (NATAP)* must fund community-driven adaptation platforms enabling flexible blending of IK and CSA according to local conditions. Also, the Federal Government should introduce Willingness to Accept (WTA) for the adoption of integrated IK-CSA system of agriculture in order to make their farming system more sustainable.
Keywords: Indigenous Knowledge, Climate-Smart Agriculture, Agro-Ecology, Smallholder Farmers.

INTRODUCTION

Nigeria's agricultural sector, which employs over two-thirds of the labour force and contributes significantly to GDP, is increasingly threatened by climate change (Adejuwon, 2022). Rising temperatures, erratic rainfall, and recurrent droughts disrupt food production, particularly in the semi-arid and humid zones of Oyo and Ogun States. Smallholder farmers, who form the backbone of the nation's food system, remain the most vulnerable due to limited adaptive capacity and reliance on rain-fed systems. In recent discussions, international and national agencies define Climate-Smart Agriculture (CSA, as conceptualized by Food and Agriculture Organization/FAO, 2025) as an integrated approach that aims to transform agri-food systems so they become more climate-resilient, sustainable, and efficient. Yet, adoption of CSA in Nigeria remains uneven, hindered by cost barriers, limited local adaptation, and weak participatory engagement (Ajayi et al., 2024).

Conversely, farming communities hold a deep reservoir of Indigenous Knowledge (IK): local, experience-based practices built up over generations. These include context-specific soil fertility techniques (example use of manure, crop rotation or inter-/mixed-cropping), water harvesting and moisture-management systems, and botanical or organic pest-control methods. Despite their demonstrated value for soil health, climate resilience, sustainable resource use, and community well-being, IK practices remain marginalized or undervalued in many formal agricultural extension and research frameworks: formal integration is still rare and often not institutionalized (Adefila et al, 2024).

This study maintains that sustainable adaptation does not hinge on a binary "traditional-versus-modern" divide but on deliberate integration. Combining IK and CSA can yield hybrid systems that are productive, affordable, and resilient. While the theoretical rationale for integration is well established, empirical evidence comparing outcomes across agro-ecologies remains limited. The study sought to identify and document indigenous knowledge practices that support climate adaptation and soil management, assess soil health conditions under indigenous-only, climate-smart agriculture–only, and integrated IK–CSA systems, and evaluate both the agronomic and economic performance of these approaches across the two ecological zones.

Nigeria's agricultural production is acutely climate-sensitive (Adejuwon, 2006). Semi-arid regions like Oyo face drought and heat stress, while humid zones like Ogun contend with flooding, erosion, and pest pressures (Nzeadibe et al., 2022). These differentiated impacts demand location-specific adaptation strategies rather than blanket interventions. CSA promotes improved seeds, conservation tillage, and integrated soil fertility management (FAO, 2013). However, top-down implementation often disregards local socioeconomic realities (Taylor, 2021), leading to poor adoption and dependency on costly external inputs (Ajayi et al., 2023).

Additionally, IK represents cumulative, place-based wisdom on farming systems (Makondo &

Thomas, 2022). Practices such as organic manuring, fallowing, and use of plant extracts for pest control have demonstrated ecological sustainability (Altieri, 2024). IK's contextual relevance and low-cost nature make it indispensable for smallholder adaptation. Integration of IK and CSA aligns with the "dialogue of knowledge systems" concept (Sillitoe, 2023). IK provides ecological understanding, while CSA offers scientific validation and improved efficiency. Synergizing both can strengthen productivity and resilience (Tengö et al., 2024). Yet comparative empirical evidence across contrasting ecologies is scarce, a gap this study addresses.

METHODOLOGY

This study employed a comparative case-study design across two contrasting agro-ecological zones in Southwestern Nigeria: Oyo and Ogun States. In Oyo State (semi-arid case), research was conducted in the Ogbomoso Agro-Ecological Zone, characterised by derived savanna vegetation, 900–1200 mm of bimodal but highly erratic rainfall (March–July; September–November), and predominantly alfisol soils prone to leaching and compaction. Key climate challenges include drought, heat stress, and soil-moisture deficits, with major crops such as cassava, maize, yam, and sorghum. In Ogun State (humid case), the study took place in the Ikenne Agro-Ecological Zone within the humid tropical forest belt, receiving 1500–2000 mm of intense bimodal rainfall, which creates risks of waterlogging and erosion. Ultisol soils dominate, characterised by acidity and high nutrient-leaching potential. Climate constraints include pest and disease pressure, soil acidity, and periodic flooding, with major crops including cassava, maize, vegetables, cocoa, and oil palm.

A mixed-methods, participatory action research (PAR) approach was adopted to integrate quantitative assessments of biophysical and economic performance (Objectives 2 and 3) with qualitative exploration of socio-economic conditions, farmer perceptions, and knowledge systems (Objective 1). The PAR framework also ensured meaningful farmer participation in co-designing and evaluating the integrated systems and facilitated the establishment of on-farm participatory trials across all study locations. This approach strengthened relevance, adaptability, and real-world applicability of the tested farming systems.

A multistage sampling technique guided farmer selection. First, two maize- and cassava-producing LGAs were purposively selected from each state: Ikenne and Obafemi-Owode (Ogun), and Ogbomoso North and South (Oyo). Second, two communities were randomly selected from each LGA, giving eight communities across both states. Third, farmers within each community were purposively selected based on growing maize/cassava, owning at least 0.5 ha of farmland, and willingness to participate for two seasons. In total, 180 farmers (90 per state) were recruited and randomly assigned to three treatment groups: Group A (IK-only), Group B (CSA-only), and Group C (Integrated), with 30 farmers per group in each state. The sample size was adequate to detect statistically significant differences across treatment groups within agricultural field trials.

The analytical techniques employed in this study involves the combination of qualitative thematic analysis with inferential statistics and economic analysis. This integration allowed the study to explore both *the depth* (qualitative meaning and rationale behind Indigenous practices) and *the breadth* (quantitative magnitude of their agronomic and economic effects) of IK–CSA integration.

Data from (8) Focus Group Discussions (FGDs), (4) Key Informant Interviews (KIIs), and Participatory Rural Appraisal (PRA) sessions were transcribed verbatim, reviewed for completeness, and analyzed using Thematic Content Analysis (TCA) following the six-phase model proposed by Braun and Clarke (2022). These includes: i) Familiarization; ii) Generating Initial Codes; iii) Searching for Themes; iv) Reviewing Themes; v) Defining and Naming Themes; and vi) Producing the Report. However, inter-coder reliability was tested by re-coding 20% of transcripts by a second researcher, yielding a Cohen's Kappa value of 0.83, indicating high consistency. Thematic saturation was achieved when no new codes emerged after the eighth FGD. The qualitative analysis provided a rich inventory of Indigenous adaptation practices and their ecological rationale, which directly informed the interpretation of quantitative findings (Objectives 2 and 3) Quantitative data derived from soil laboratory analyses, yield measurements, and economic characteristics adhered to a 95% confidence level ($\alpha = 0.05$).

Means, standard deviations (SD), and coefficients of variation (CV) were computed for soil, yield, and profit indicators. Descriptive summaries using mean, frequencies and percentages were presented in tables and graphs to show central tendencies and dispersion across the three treatment groups (IK-only, CSA-only, and Integrated). Thus, these provided preliminary insights into trends before hypothesis testing.

The inferential statistical tools employed for the study are Analysis of Variance, Post-Hoc Comparisons (Tukey's HSD Test); and Correlation and Regression diagnostics.

A one-way ANOVA was conducted to determine whether statistically significant differences existed in mean values of Soil Organic Carbon (SOC), Moisture Retention, Maize Yield,

and Net Profit among the three farming systems. The model is expressed as:

$Y_{ij} = \mu + \tau_i + \varepsilon_{ij}$

Where:

Y_{ij} = observed value of the dependent variable (SOC, yield, or profit)

μ = Overall mean

τ_i = Treatment effect (IK-only, CSA-only, Integrated)

ε_{ij} = random error.

Following significant ANOVA results ($p < 0.05$), Tukey's Honestly Significant Difference (HSD) test was employed to pinpoint pairwise differences between treatment means. This test was chosen for its robustness in controlling the family-wise error rate when comparing multiple means.

Simple correlation analysis (Pearson's *r*) was conducted to examine the relationship between soil organic carbon, moisture retention, and yield. A positive and significant correlation indicates that improvements in soil quality indicators translate directly into higher yields. Additionally, a multiple linear regression model was fitted to quantify the contribution of soil variables to yield outcomes: the model is specified as:

$Y_i = \beta_0 + \beta_1 (SOC_i) + \beta_2 (MR_i) + \beta_3 (Treatment_i) + \varepsilon_i$

Where:

Y_i = Yield (t/ha)

SOC_i = Soil organic carbon (%)

MR_i = Moisture retention (%)

$Treatment_i$ = Categorical variable representing system type

ε_i = random error term.

This regression allowed the study to isolate the predictive strength of soil quality improvements under the integrated system, complementing the mean-based inference from ANOVA.

Economic Analysis

Economic performance was evaluated through two key indices: Net Profit (π) and Benefit–Cost Ratio (BCR).

1. Net Profit was computed as:

$\pi = TR - TC$, Where:

TR = Py × Y (Total Revenue), and TC = total cost of inputs (fertilizer, seeds, labour, pesticides, and transportation).

2. Benefit–Cost Ratio (BCR) was calculated as:

$$BCR = \frac{TR}{TC},$$

BCR > 1 implies economic viability, with higher values indicating greater profitability per unit of cost incurred. Descriptive statistics were used to compare mean profits and BCR across treatments and states, while ANOVA determined whether observed differences were statistically significant.

RESULTS AND DISCUSSION

Indigenous Knowledge Practices

Across both states, farmers demonstrated rich IK repertoires including mulching with crop residues, composting, inter-cropping legumes, use of ash for pest control, and seed selection for drought tolerance. Oyo farmers emphasised water-harvesting pits and early planting with indigenous drought-resilient maize varieties. Ogun farmers prioritised pest management using neem and pepper extracts, coupled with organic mulch for soil cooling.

These findings confirm that IK is ecologically grounded and functionally adaptive. Many practices align closely with CSA principles: conservation tillage, organic inputs, and integrated pest management, indicating natural compatibility between the two systems (Altieri, 2024).

Soil health indicators of farms in the study area

The result in Table 1 shows that Soil Organic Carbon increased by about 23% in Oyo and 24% in Ogun under the integrated system compared to CSA-only. This improvement arises from combining IK organic inputs with CSA conservation tillage. Increased SOC enhances moisture retention, nutrient buffering, and microbial activity, corroborating Pretty (2023) and Altieri (2004).

The CSA-only system recorded the lowest SOC because inorganic fertilizers lack organic matter contribution. IK-only plots performed moderately better due to sustained manure and compost use. However, the integrated approach achieved optimal balance, leveraging organic matter build-up from IK and nutrient efficiency from CSA inputs.

The integrated approach outperformed CSA-only by 27–30% in yield and by ₦80,000–₦100,000 ha^{-1} in profit. In Oyo, integration enhanced drought resilience through higher soil moisture, enabling maize survival during dry spells. In Ogun, it reduced pesticide expenses via botanical extracts, enhancing net returns.

The results on the agronomic and economic performance of farmers in the study area are presented in Tables 2 and 3. From the findings, the integrated system yielded the highest productivity and profitability in both agro-ecologies.

Table 1. Mean Post-Intervention Soil Organic Carbon (SOC) and Moisture Retention by State and Treatment Group

State	Treatment Group	Mean SOC (%) ±SD	Mean Moisture Retention (%) ±SD
Oyo	IK-only	1.50 ± 0.10	35.0 ± 3.0
	CSA-only	1.38 ± 0.09	39.5 ± 2.5
	Integrated	**1.85 ± 0.12**	**48.0 ± 3.5**
Ogun	IK-only	1.70 ± 0.15	45.5 ± 4.0
	CSA-only	1.55 ± 0.11	48.0 ± 3.0
	Integrated	**2.10 ± 0.18**	**51.5 ± 3.8**

Source: Field Survey, 2024.

Table 2. Agronomic and economic performance of maize across zones

State	Treatment	Mean Yield (t/ha) ±SD	Mean Net Profit (₦/ha)
Oyo	IK-only	1.80 ± 0.30	₦125,000
	CSA-only	2.50 ± 0.35	₦165,000
	Integrated	**3.30 ± 0.40**	**₦245,000**
Ogun	IK-only	2.00 ± 0.40	₦145,000
	CSA-only	3.10 ± 0.50	₦210,000
	Integrated	**4.00 ± 0.45**	**₦310,000**

Source: Field Survey, 2024.

Table 3. Comparison of Maize Yield by Treatment and State

State	F-value	p-value	Significance
Oyo	15.72	0.001	Significant
Ogun	17.05	0.001	Significant

Source: Field Survey, 2024.

The significant p-values (< 0.05) confirm that mean yield differences across treatments are not due to chance. Integrated systems allowed CSA's genetic potential to express under improved soil and water conditions provided by IK.

Economically, integrated systems combined higher yields with reduced costs from local organic inputs and pest control. These dual savings strengthen livelihood resilience by lowering dependence on volatile input markets (Ajayi et al., 2022).

Although integration produced universal benefits, their expression differed by ecology. In Oyo, improved moisture retention mitigated drought stress, aligning with dryland success stories from the Sahel (Reij et al., 2022). In Ogun, the key gain was reduced pest incidence through ethnobotanical control. Thus, while the mechanism varies, the integrated approach universally enhances resilience and profitability. These outcomes echo global findings that hybrid systems outperform mono-knowledge strategies in sustainability and adoption potential (Makondo & Thomas, 2018; Sutherland et al., 2020). Integration therefore represents a pathway toward equitable climate adaptation that values farmers as co-innovators rather than passive adopters.

CONCLUSION AND RECOMMENDATIONS

Integrating Indigenous Knowledge with Climate-Smart Agriculture substantially enhances soil health, productivity, and profitability across semi-arid and humid agro-ecological zones of Oyo and Ogun States respectively.

Yet mechanisms of resilience remain context-specific: drought buffering in Oyo and pest suppression in Ogun. Policy implications are profound. Extension systems should evolve from technology transfer to innovation facilitation, training agents as knowledge brokers who foster co-learning between scientists and farmers. National frameworks such as the *National Agricultural Technology Adoption Policy (NATAP)* must fund community-driven adaptation platforms enabling flexible blending of IK and CSA according to local conditions.

The study thus contributes evidence for a paradigm shift toward knowledge co-production, proving that sustainability in Nigeria agriculture will emerge not from replacing tradition with science but from reconciling and integrating both.

REFERENCES

Adefila AO, Ajayi OO, Toromade AS, Sam-Bulya NJ. Integrating traditional knowledge with modern agricultural practices: a sociocultural framework for sustainable development. World J Biol Pharm Health Sci. 2024;20(02):125–35.

Adejuwon, J. O. (2006). Food crop production in Nigeria. *Climate Research*, 32(3), 229-245.

Adejuwon, J. O. (2022). Climate change and food security challenges in Nigeria. *Journal of Environmental Science*, 45(2), 15-29.

Adger, W. N., Brown, K., & Nelson, D. R. (2022). Resilience and adaptation in socio-ecological systems. *Annual Review of Environment and Resources*, 47, 33-58.

Ajayi, M. T., Akinnifesi, F. K., Sileshi, G. & Kanjipite, W. (2023). Labour inputs and financial profitability of conventional and agroforestry-based soil fertility management practices in Zambia. *Agrekon*, 46(2), 240-253.

Altieri, M. A. (2024). Linking ecologists and traditional farmers in the search for sustainable agriculture. *Frontiers in Ecology and the Environment*, 2(1), 35-42.

Altieri, M. A. (2024). Agroecological transitions and indigenous innovation. *Agriculture, Ecosystems & Environment*, 361, 109874.

Apata, T. G. (2011). Effects of global climate change on Nigerian agriculture: An empirical analysis. *Journal of Agricultural Science*, 3(1), 1-11.

Bationo, A., Vlek, P. L., & Mokwunye, A. (2021). Strategies for improving soil fertility and crop productivity in Africa. *Soil Science Society of America Journal*, 85(3), 612-626.

FAO. (2023). *Climate-Smart Agriculture for Resilient Food Systems in Africa.* Rome: FAO.

Makondo, C. C., & Thomas, D. S. G. (2018). Climate change adaptation: Linking indigenous knowledge with western science. *Environmental Science & Policy*, 88, 83-91.

Makondo, C. C., & Thomas, D. S. G. (2022). Indigenous knowledge and climate adaptation. *Environmental Policy and Governance*, 32(4), 401–412.

Méndez, V. E., Bacon, C. M., & Cohen, R. (2022). Agroecology as a transdisciplinary science. *Agriculture and Human Values*, 39(1), 203–218.

Nguyen, H. T., Dang, T. D., & Hoang, N. (2020). Soil organic carbon and nutrient retention in humid tropical systems. *Catena*, 189, 104474.

Nyong, A., Adesina, F., & Osman, B. (2021). The value of indigenous knowledge in climate adaptation. *Mitigation and Adaptation Strategies for Global Change*, 26(5), 815–831.

Nzeadibe, T. C., Egbule, C. L., Chukwuone, N. A., & Agu, V. C. (2022). Climate change awareness and adaptation in Nigeria. *African Technology Policy Studies Network*, 57.

Pretty, J. (2023). Agricultural sustainability: Concepts, principles, and evidence. *Philosophical Transactions of the Royal Society B*, 363(1491), 447-465.

Reij, C., Tappan, G., & Smale, M. (2022). *Agro-environmental transformation in the Sahel.* IFPRI Discussion Paper 00914.

Sillitoe, P. (2020). Indigenous knowledge and sustainable development. *Sustainability Science*, 15(3), 789–800.

Sutherland, W. J., Shackelford, G., & Rose, D. C. (2020). Collaborating with communities: Co-production or co-assessment? *Oryx*, 51(4), 569–570.

Taylor, M. (2021). Climate-Smart Agriculture: What is it good for? *The Journal of Peasant Studies*, 45(1), 89–107.

Tengö, M., Brondizio, E. S., Elmqvist, T., Malmer, P. & Spierenburg, M. (2024). Connecting diverse knowledge systems for enhanced ecosystem governance. *Ambio*, 43(5), 579-591.

Van der Ploeg, J. D. (2023). The importance of soil organic matter for smallholder resilience. *Agroecology and Sustainable Food Systems*, 47(6), 811–828.

UTILISATION OF SOCIAL MEDIA FOR SKILL ACQUISITION AMONG FASHION DESIGNERS IN LAGOS AND OYO STATE

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ABSTRACT
The study examined the utilisation of social media for skill acquisition among fashion designers in Lagos and Oyo States. A multi-stage sampling procedure was used to select a total of 230 fashion designers from the Nigerian Union of Tailors. Data were obtained using a questionnaire and interview schedule. Percentage, Mean and PPMC (α=0.05) were used to analyse the data. Most (60.4%) of the respondents were females with a mean age of 34.5±8.44 years. WhatsApp (93.9%) and Facebook (73.5%) were the most used platforms. Respondents' engagement of social media included connection with other fashion designers (1.957), collection and save of style (1.865), interact with customers (1.830). Business size (1.261), finance (1.226) and data (0.939) were the factors influencing utilisation of social media for skill acquisition. Benefits derived included gain knowledge/information on fashion designing (1.439), more customers (1.409) and increasing income (1.374). Improper time management (=0.883), time consumption (= 0.848) and insufficient data (=0.765) were constraints to social media utilisation. There was low level of utilisation of social media for skill acquisition among 58.3% of respondents. Respondents' age (-0.165) and household size (-0.134) significantly correlated with utilisation of social media. Significant relationship existed between level of engagement (0.159), factors influencing the use of social media (0.656), benefit derived (0.446), challenges faced (0.265) and utilisation of social media for skill acquisition. Respondents exhibited low utilisation of social media for skill acquisition despite high engagement on social media. Need for sensitisation through campaigns and provision of network hubs to access internet services.
Keywords: Fashion designers, skill acquisition, social media utilisation, WhatsApp, Facebook

INTRODUCTION

The world has become a global village, with the advent of information technology; this has completely revolutionised livelihoods and communication strategies among people (Onodi, 2023). The advent of the internet and advancements in communication technology in the late 20th century brought dramatic changes in the way the world interacted, traded, communicated, and exchanged ideas (Lubinga, 2023). An integral part of the global transformation in information and communication technology is the gradual rise of social media platforms as primary channels for social interaction, commerce, entertainment, and idea sharing through the building of virtual networks and communities (Akintayo, 2021). Vocational skills such as hair styling, event planning, fashion designing, makeup artistry, and cooking skills can today be acquired on social media. Social media is increasingly being used by fashion designers for different purposes such as marketing, communication, advertisement and sales, among others (Oluwafemi, 2024).

Consequently, skill acquisition, such as fashion designing, entails the progressive development of competencies and proficiency through engagement in diverse experiential and educational contexts (Nwachukwu & Okoli, 2021). Hence, fashion design is one of the acquired entrepreneurial skills that lives with the individual for ages and can generate income when applied to commercial use, especially with the use of social media. (Unimna, Essien, Opoh & Unimke, 2021). The power of social media lies in its ability to connect and share information with anyone or many people simultaneously. According to the Data Reportal (2020), more than 4.5 billion people were using the internet at the start of 2020, while social media users had passed the 3.8 billion. The use of social media by fashion designers has been centred more on marketing aspects, interaction with customers, exploration of styles, and sales. Many social networking platforms like Facebook, LinkedIn, WhatsApp, and Google+, microblogging platforms like Twitter, photo sharing platforms like Instagram, Snapchat, and Pinterest, and video sharing platforms like YouTube, Facebook Live and Periscope have been explored by fashion designers (Ranavaade, 2024).

Fashion designing though comes with a lot of benefits, such as economics empowerment, creativity, cultural promotion, and so on, but its physical learning has been marred with some challenges such as tough experiences during master-apprentice training, long years of training, withholding of technical information by masters, seniority among apprentice, running errands for masters and seniors, to mention a few thus, many potential youth learners patronize online training media. In addition, many fashion designers lack relevant and recent knowledge and skills about the current trends, techniques, and concepts in fashion designing. In addition, despite the increasing popularity of social media platforms among fashion designers, studies on their use have been centred more on marketing aspects, interaction with customers, exploration of styles, and sales. There is the need to explore the state of the literature on why and how social media stands out for skill acquisition.

There is insufficient research on utilisation of social media platforms for skill acquisition in the fashion industry and how different social media platforms can be leveraged for different skill acquisition in the study area. It then becomes a necessity to research on extent of utilisation of social media to acquire skills such as fabric cutting, joining, lining of fabrics, drafting patterns, taking accurate measurements, machine maintenance, fabric and textile selection, colour combination, and so on in fashion designing. Social media stands out in skill acquisition due to its ability to provide low-cost, visually driven, interactive, and globally accessible learning opportunities that promote practical, self-paced, and market-relevant skill development. The general objective of the study is to examine the use of social media for skill acquisition among fashion designers and specific objectives are:

1. describe socio-economic characteristics of the fashion designers,
2. identify the social media platforms used by fashion designers,
3. determine the factors influencing the choice of utilisation of social media platforms for skill acquisition in fashion designing,
4. ascertain the benefits derived from utilisation of social media in fashion designing,
5. identify challenges faced in the utilisation of social media platforms by fashion designers.

METHODOLOGY

This study was carried out in Lagos and Oyo States, Nigeria. The states are located in the southwestern geopolitical zone of Nigeria. Lagos is the most economically important state of the country and the nation's largest urban area with a population of 15 million. Lagos lies approximately between latitudes 6° 22′ N and 6° 52′ N, and longitudes 2° 42′ E and 3° 42′ E. Its capital is Ikeja, and it has 20 local government areas. It is the hub of technology and businesses in Nigeria. While Oyo State is the Zonal headquarter of the southwestern states in Nigeria. Its capital is Ibadan, and Ibadan is the third most populous city of Oyo with a total population of 7, 840 864 residents (National Bureau of Statistics 2016). The state lies between latitudes 7 ^{0}31 and 21 north and longitudes 2 ^{0} 471 and 4 ^{0} 231 east of the meridian. Oyo state has 33 Local Government Areas with eleven Local Governments in the Ibadan Metropolitan area that consist of five urban local governments in the city and six semi-urban local governments in the less city. It is also one of the city's housing a wide population of fashion designers.

The population of the study comprised registered members of the Nigeria Union of Tailors (NUT) in Lagos and Oyo States. A multi-stage sampling technique was employed. In Lagos State, 50% of the metropolitan Local Government Areas (7 out of 14) were selected through simple random sampling. Thereafter, 10% of the towns in each selected LGA and 10% of the registered fashion designers in each town were randomly selected, yielding 140 respondents.

In Oyo State, Ibadan metropolis was purposively selected due to the concentration of fashion designers. Subsequently, 50% of the urban LGAs (3 out of 5) and 50% of the semi-urban LGAs (3 out of 6) were randomly selected. From each selected LGA, 10% of the towns and 10% of the registered designers per town were randomly selected, resulting in 90 respondents. The total sample size was 230 fashion designers

RESULTS AND DISCUSSIONS

Socioeconomic characteristics

The result in Table 1 shows that nearly half (49.1 %) of the fashion designers held secondary-school credentials, 36.5% had tertiary education, while 3.0% had no formal education. Thus, most respondents have an appreciable level of education, which may enhance the social-media utilisation. The age distribution indicated the $\bar{x}$ age was 34.5, pointing to a relatively young and productive cohort. Gender-wise, females dominated at 60.4 %, implying that Women were more actively involved than men in the trade. This female predominance aligns with recent research highlighting the growing entrepreneurial presence of women in Nigeria's fashion industry (Abdulraheem, 2024).

Utilised social media platforms by respondents

Results in Table 2 revealed that fashion designers mostly utilised WhatsApp (93.9%), Facebook (73.5%), Instagram (52.6%), TikTok (57.8%) and television (56.5%) platforms. However, some respondents used Telegram (30.0%), Pinterest (8.3%) and YouTube (45.7%). It implies that social media platforms are a useful tool for fashion designers. Findings of this study are in consonance with the findings of Adegbola and Adegbola (2021), who opined that social media sites, especially Instagram, have played a significant role in promoting Nigerian fashion and linking designers with potential clients.

Table 1: Distribution of Respondents by socioeconomic characteristics

Variables	Frequency	Percentage	Mean
Age Group			
20years below	6	2.6	34.5±8.44
21-30years	82	35.7	
31-40years	88	38.3	
Above 40years	54	23.5	
Sex of respondent			
Male	91	39.6	
Female	139	60.4	
Religion			
Christianity	110	47.8	
Islam	119	51.7	
None	1	0.4	
Marital Status			
Single	61	26.5	
Married	163	70.9	
Divorced	1	0.4	
Widowed	1	0.4	
Separated	4	1.7	
Educational Background			
No formal Education	7	3.0	
Adult Education	5	2.2	
Primary Education	21	9.1	
Secondary Education	113	49.1	
Tertiary Education	84	36.5	
Years of Experience			
0-5years	57	24.8	
6-10years	79	34.3	
11years and above	94	40.9	
Estimated Monthly Income			
0-10,000	21	9.1	21, 783
10,001-20,000	32	13.9	
20,001 and above	177	77	
Household Size Group			
1-3 household size	113	49.1	3.8±1.9
4-6 Household size	98	42.6	
7-9 Household size	17	7.4	
Above 9 household size	2	0.9	

Source: Field survey (2023)

Table 2: **Distribution of respondents by social media platforms used**

Available social media platform	Yes (%)	No (%)
WhatsApp	93.9	6.1
Facebook	73.5	26.5
Tik Tok	57.8	42.2
Television	56.5	43.5
Telegram	30	70
Pinterest	8.3	91.7

Source: Field survey (2023)

Factors influencing the choice of utilisation of social media for skill acquisition

The result in Table 3 shows that business size ($\bar{x}$=1.261), finance ($\bar{x}$=1.226), insufficient data ($\bar{x}$=0.939), internet service ($\bar{x}$=0.891), education ($\bar{x}$=0.826), time ($\bar{x}$=0.648), and social media addiction ($\bar{x}$=0.570) influenced social media utilisation among fashion designers. Designers with reliable internet access used social media more effectively for skill acquisition. Platforms requiring high data and time commitments (e.g., YouTube) were less used than those demanding lower data and education levels (e.g., Facebook, WhatsApp). Larger businesses and better-educated designers showed higher adoption due to greater resources and digital literacy. Conversely, limited finance, poor

internet and low education restricted use. These findings align with Adeyemi, Akinola, and Oluyemi (2021) and Olaleye et al. (2021), who emphasised that access to digital technology significantly enhances fashion designers' ability to learn using social media.

Table 3: Distribution of respondents by factors influencing utilisation of social media for skill acquisition

Factors influencing the choice of media utilization	Great Factor (%)	Lesser factor (%)	Not a factor (%)	Mean	SD	Rank
Business size	51.7	22.6	25.6	1.261	0.842	1st
Finance	49.1	24.3	26.5	1.226	0.842	2nd
Data availability	33	27.8	39.1	0.939	0.849	3rd
Internet service	25.2	38.7	36.1	0.891	0.777	4th
Level of Education	23.9	34.8	41.3	0.826	0.790	5th
Time	20	24.8	55.2	0.648	0.794	6th
Addiction to social media	10.9	35.2	53.9	0.570	0.682	7th
Age	13.9	15.7	70.4	0.435	0.725	8th
Flair for social media	10.4	22.2	67.4	0.430	0.675	9th
Fear of social media	12.2	18.3	69.6	0.426	0.700	10th

Source: Field survey (2023)

Benefits derived from the utilisation of social media for skill acquisition in fashion designing

Results from Table 4 revealed a high benefit (70.9%) derived from using social media by fashion designers for their business. This implies that the utilisation of social media by fashion designers comes with lots of benefits, such as improving networks, getting feedback, easy access to information, brand building, acquiring skills, exposure to new trends, and so much more. A study by Ogunrinde, & Omotoso (2021) revealed that fashion designers have access to tutorials, how-to videos, and online training programs. The results show that fashion designers derived numerous benefits from the utilisation of social media platforms, with varying levels of intensity.

The most highly ranked benefit is gaining knowledge and information on fashion designing, with a $\bar{x}$ score of 1.439, indicating that a large proportion of respondents perceived social media as a major source of learning and professional development. This implies that social media plays a critical role in improving technical and creative competencies among fashion designers.

The benefits of establishing good customer service and expansion of business through attracting more customers were jointly ranked 2nd with a $\bar{x}$ score of 1.409 each. This suggests that social media significantly enhances customer relations and business growth by creating direct interaction between designers and clients, as well as widening their market reach.

The least ranked benefit was improved visibility, which ranked 10th with a $\bar{x}$ score of 1.126. Although these benefits were perceived to a lesser extent, they still indicate that social media contributes to branding, market awareness, and personal recognition.

Table 4: Distribution of the benefits derived from utilisation of social media for skill acquisition in Fashion designing

Benefits derived	Large %	Small %	Not a benefit %	Mean	Rank
Gain knowledge/information on fashion designing	68.7	6.52	24.8	1.439	1st
Establish good customer service	64.3	11.3	23.5	1.409	2nd
Expansion of business/more customers	61.7	10.4	24.3	1.409	2nd
improve sales				1.404	4th
Establish good communication with other fashion designers/sharing knowledge and information	63.9	11.3	24.8		
Increase income	61.7	13.9	24.3	1.374	5th
Knowledge of trendy styles	54.8	22.2	23	1.317	6th
Learn to take accurate Measurement of clients	50.9	24.8	24.3	1.265	7th
Adequate access to market information	40	33.9	26.1	1.139	8th
Improve social status	38.7	36.1	25.2	1.135	9th
Marketing of products	40.9	31.7	27.4	1.135	9th
Improve visibility	38.7	35.2	26.1	1.126	10th

Source: Field survey (2023)

Table 4b shows that a large majority of the respondents (70.9%) derived high benefits from using social media, while only 29.1% experienced low benefits. This indicates that social media is generally perceived as highly beneficial by most respondents. The mean benefit score of 15.5 with a standard deviation of 9.1 suggests a moderate spread in the level of benefits derived, implying that although most respondents benefit greatly, the degree of benefit varies among individuals. Overall, the table highlights that social media plays a significant and positive role in benefiting the respondents.

Table 4b: Categorisation based on benefit derived from using social media

Benefits categories	Percentage	Mean	SD
Low benefit	29.1	15.5	9.1
High benefit	70.9		
Total	100.0		

Source: Field survey (2023)

Challenges of social media for skill acquisition

Results in Table 5 indicate that the most severe challenges faced by fashion designers in the study area include *time constraints* ($\bar{x}$=0.883), implying that a significant proportion of respondents are too busy with daily responsibilities to actively engage in social media-based learning. Although 43% indicated that it is not a challenge, the combined proportion of those who experience it as severe or mild (58%) shows that time remains a major limiting factor. The second is *time consuming* ($\bar{x}$=0.848), suggesting that many respondents perceive the process of learning skills via social media as requiring excessive time. This perception may discourage sustained participation and reduce the effectiveness of social media as a tool for continuous skill development. This was followed by *network issues* ($\bar{x}$=0.822). Next is *inadequate power supply* ($\bar{x}$=0.783), *insufficient data* ($\bar{x}$=0.765), *limited digital literacy* ($\bar{x}$=0.691), and lastly, *cyberbullying* ($\bar{x}$=0.657).

There is a difference between lack of power supply and battery issues in the table lies in their severity level, prevalence, and overall impact on social media use for skill acquisition:

Lack of power supply is a more serious and widespread challenge. It has 20.4% of respondents reporting it as severe, A higher mean score of 0.783, and it is ranked 4th among all challenges. This shows that poor electricity supply is a major infrastructural barrier affecting many respondents.

Battery issues, on the other hand, are a less severe and less common challenge. It records only 9.1% as severe, A much lower mean score of 0.383, and it is ranked 15th (last) among the challenges. This suggests that battery problems have a relatively minor effect on respondents compared to power supply problems in Nigeria as a major barrier to fashion designers' use of social media for career advancement.

Table 5: Distribution of respondents based on challenges faced in the utilisation of social media for skill acquisition

Challenges faced	Severe %	Mild %	Not a challenge %	Mean	SD	Rank
Do not have the time	31.3	26.7	43	0.883	0.856	1st
Time consuming	21.3	42.1	36.5	0.848	0.747	2nd
Network issues	20	42.1	37.8	0.822	0.741	3rd
Lack of power supply	20.4	37.4	42.2	0.783	0.763	4th
Insufficient data	15.7	45.2	39.1	0.765	0.704	5th
Low knowledge of use	14.3	40.4	45.2	0.691	0.709	6th
Cyberbullying	12.6	40.4	47	0.657	0.693	7th
Blurry illustrations	15.7	33	51.3	0.644	0.738	8th
High cost of subscription	18.3	21.7	60	0.583	0.782	9th
Expensive to use	16.5	20.4	63	0.535	0.763	10th
Short attention span	15.7	22.1	62.2	0.535	0.751	10th
Lack of trust of customers	15.7	18.7	65.7	0.500	0.752	12th
Do not have internet-based phones	13	17.0	70	0.430	0.713	13th
Exposure to fraudsters	9.1	21.7	69.1	0.400	0.652	14th
Battery issues	9.1	20	70.9	0.383	0.649	15th

Source: Field survey (2023)

Relationship between socioeconomic characteristics and utilisation of social media by respondents

The result in Table 6 shows a significant relationship between estimated monthly income (x^2= 6.812, p< 0.05) and utilisation of social media. However, fashion designers' estimated income influences the use of social media for their business, as the urge to make more profit and the number of responsibilities they face can prompt them to look for ways to expand their business and increase profits.

Table 6: Relationship between the socio-economic characteristics of respondents and the utilisation of social media.

Variable	χ^2 value	p-value	df
Sex	1.856	0.173	1
Religion	2.352	0.309	2
Marital Status	3.920	0.417	4
Education Background	9.224	0.056	4
Years of Experience	1.785	0.410	2
Estimated monthly income	6.812	0.033	2

Source: Field survey (2023)

CONCLUSION AND RECOMMENDATION

The study concluded that fashion designers used social media platforms. Although, the overall level of utilisation of social media for skill acquisition was low, fashion designers specifically utilised YouTube, Instagram, Facebook, WhatsApp, Pinterest, and TikTok to acquire technical and creative skills such as sewing trendy styles, pattern drafting, and textile knowledge. The benefits of social media such as increased sales, income, visibility, and social recognition motivate continued engagement. Despite these benefits, they experienced challenges like limited time and high data costs in the course of social media usage. The study recommends that designers of all ages should engage multiple platforms for diverse learning, there should be financial and infrastructural support from network providers to promote affordable access, continuous learning, and greater participation in online fashion communities.

REFERENCES

Abdulraheem, I., Usman, A. H., Mustapha, R., Oladeji, O. S., & Omotosho, A. O. (2024). *Entrepreneurship and female fashion designers in Nigeria: Thematic study. African Journal* of *Management and Business Research, 15(1), 105–115.* https://doi.org/10.62154/40h5zs89

Adegbola, O., & Adegbola, T. (2021). The impact of social media on the growth of the Nigerian fashion industry. Journal of Fashion Marketing and Management: An International Journal, Advance online publication.

Adegoke, B. A., & Owoeye, T. F. (2021). Utilisation of Social Media for Skill Acquisition among Fashion Designers in Nigeria. *Journal of Educational and Social Research*, 11(1), 1-8.

Adeyemi, T., Akinola, G., & Oluyemi, O. (2021). Social media as a tool for skill acquisition among fashion designers in Lagos State, Nigeria. *Journal of Information Technology and Economic Development*, 12(1), 1-18.

Akintayo, B. J., Ekeh, C. M., & Osunfisan, A. O. (2021). Influence of YouTube videos on skills acquisition among youths in Ogun State, Nigeria. African Scholar Publications & Research International, 22(2), 131–144.

Data Reportal (2020): Digital 2020: Global Digital Overview. Retrieved January 30,2020 from https://datareportal.com/reports/digital-2020-global-digital-overview.

Fashion innovation (2021). Summary of the biggest innovations of 2021 in the fashion industry. Retrieved from https://fashinnovation.nyc/biggest-innovations/

Lubinga, E. (2023). Introduction to communication studies (3rd ed.). Juta & Company. Print ISBN: 9781485130130 eBook ISBN: 9781485130147

Nwachukwu, C., & Okoli, C. (2021). Impact of Social Media on Skill Acquisition among Fashion Designers in Nigeria. Journal of Business and Management, 23(2), 1-9.

Ogunrinde, T. A., & Omotoso, O. I. (2021). The impact of social media on skill acquisition among fashion designers in Nigeria. *Journal of African Studies and Sustainable Development*, 2(2), 81-91. https://doi.org/10.46656/jassd.v2i2.73

Olaleye, S. A., Fatusin, A. F., & Oladipo, O. (2021). Social media utilisation for skill acquisition by fashion designers in Nigeria. *Journal of African Studies and Sustainable Development*, 5(2), 165-175.

Oluwafemi, T. O. (2024). Social media use for vocational skills acquisition and entrepreneurial intention among final-year university students in Nigeria. International Journal of Educational Research & Practice, 5(8).

Onodi, B. E., Okafor, V. I., & Ezinando, E. E. (2023). Forensics auditing techniques and audit quality of public sector establishments in Nigeria. Journal of Contemporary Issues in Accounting, 4(2), 68–87.

Oyeyemi, O., & Olajubu, A. (202). Social media use and skill acquisition among fashion designers in Lagos State, Nigeria. *Journal of Humanities and Social Sciences Research*, 2(1), 1-12.

Ranavaade, V. (2024, January 6). Fashion and social media: Leveraging platforms for brand building and networking. Chitkara University (blog).

Unimna, F.A., Essien, Ekpenyong E., Opoh, c A., Unimke, S. A. (2021). Fashion Designing Skills' Acquisition and Employability of Social Studies Graduates In Labour Markets In Calabar Education Zone Of Cross River State, NIGERIA 1,2,3,4. Department of Social Science Education, Faculty of Education, University of Calabar.

DIGITAL COMMUNICATION TOOLS UTILISATION BY POULTRY FARMERS IN OGUN STATE, NIGERIA

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ABSTRACT
Digital Communication Tools (DCTs) are increasingly transforming agricultural production by improving information flow, farm management and market access. This study assessed poultry farmers' utilisation of DCTs in Ogun State, Nigeria, highlighting their perception, extent of DCTs use and associated challenges. A two-stage sampling procedure was employed to select 120 respondents. Data were collected using a well-structured questionnaire and analysed using descriptive statistics (percentages, frequency counts and mean) and Pearson Product Moment Correlation. Respondents had a mean age of 43±9.55 years, a household size of 6±2.20 persons, and 11±4.69 years of formal education. More than half (60.7%) of the respondents had favourable perceptions of DCTs use. The extent of DCTs use was low among 59.2% of respondents, while a majority (64.9%) experienced a high level of constraints in their use. The major constraints identified were high service costs ($\bar{x}$ = 1.58), erratic power supply ($\bar{x}$ = 1.26), high initial investment in digital tools ($\bar{x}$ = 1.24) and limited internet access ($\bar{x}$ = 1.01). Correlation analysis showed that age (r = –0.284) household size (r = 0.011) and years of education (r = 0.052) were significantly related to the extent of DCT utilisation for poultry production. Enhancing poultry farmers' utilisation of DCTs requires affordable services, reliable electricity, financing support and rural internet. Government and agricultural organisations should address these gaps through targeted interventions to reduce adoption constraints and strengthen digital tool use in poultry production.
Keywords: Digital communication tools, Poultry farmers, Adoption constraints, Agricultural innovation

INTRODUCTION

Nigeria, often referred to as the "Giant of Africa," boasts of a diverse and rich agricultural landscape (Jekayinfa *et al.,* 2020). Agriculture in Nigeria encompasses a wide range of activities, including crop cultivation, livestock rearing, fisheries and forestry, contributing significantly to employment, food security and economic growth. With a favourable climate, abundant natural resources and a large population dependent on agriculture for livelihood, the sector plays a pivotal role in the country's economy (Adamaagashi *et al.,* 2023). Among the various agricultural activities in Nigeria, poultry farming holds particular significance. The poultry industry is a vital sector in many economies, providing a source of protein for millions of people around the world and a significant contributor to food security and the economy in many countries (Birhanu *et al.*, 2022). Poultry farming involves the rearing of domesticated birds such as chickens, turkeys, ducks and geese for meat and egg production. The sector has witnessed substantial growth in recent decades, driven by increasing demand for poultry products, rising urbanisation and changing dietary preferences (FAO, 2022). Poultry farming not only provides a vital source of protein but also offers employment opportunities, especially for smallholder farmers and rural communities (Ajala, 2021 and FAO, 2022).

Despite its importance, poultry farming in Nigeria faces numerous challenges that hinder its full potential with one of the primary challenges being disease outbreaks, including avian influenza (bird flu) and Newcastle disease, which can decimate poultry populations and disrupt production (Ekiri *et al.,* 2021). Additionally, inadequate infrastructure, such as poor road networks, electricity supply and storage facilities, pose logistical challenges for poultry farmers, particularly in remote and rural areas. Market access issues, including price volatility and limited market information, further exacerbate the challenges faced by poultry farmers in Nigeria (Anosike *et al.,* 2020).

Traditionally, poultry farming in Nigeria has been characterised by small-scale, backyard operations, often using rudimentary techniques and practices. While these traditional methods remain prevalent, there is a growing recognition of the need to modernise the poultry sector to improve productivity, efficiency and profitability (Otunaruke *et al.,* 2023). Modernisation efforts include the adoption of improved breeds, better management practices and the use of technology and innovation to address existing challenges and enhance competitiveness (George and George, 2023).

The role of technology in agriculture has become increasingly prominent in recent years, both globally and within Nigeria. Digital Communication Tools are pivotal in revolutionising agricultural practices, offering unprecedented opportunities for communication, market access and productivity enhancements (Umar, 2022). Digital Communication Tools refer to a variety of digital technologies and platforms utilised for communication, collaboration and information exchange.

These tools encompass a wide range of applications, including but not limited to social media platforms, mobile applications, websites and digital management software. In the context of agriculture, these tools enable farmers to access real-time information on market prices, weather forecasts, pest and disease management and best agricultural practices. Additionally, digital platforms facilitate communication and collaboration among stakeholders across the agricultural value chain, from input suppliers and farmers to traders and consumers (Rajkhowa and Qaim, 2021). Digital technologies via ICTs offer numerous opportunities for farmers, investors and entrepreneurs to enhance the efficiency of production and marketing of agricultural products. This approach aligns with the innovation system thinking as described by Akinwale *et al.,* (2023).

In the Nigerian context, where access to traditional agricultural extension services is limited, technology-mediated solutions have the potential to bridge information gaps, facilitate market linkages and empower farmers with knowledge and resources (Umar, 2022). While DCTs hold immense potential for driving innovation in poultry farming, there is limited literature available on farmers' consideration of DCTs in poultry farming in Nigeria, particularly regarding their adoption and effective utilisation in Nigeria (Olanrewaju *et al.,* 2021). Furthermore, there is a gap in knowledge on how Nigerian poultry farmers perceive, access, and utilise DCTs to innovate within their farming practices. It is in this context that the following objectives guided this study:

The specific objectives were to:

1. assessed DCTs' utilisation by poultry farmers in the study area;
2. determined respondents' perception of the use of DCTs in the study area;
3. determined the extent of DCTs use;
4. identified the constraints faced by respondents in the use of DCTs.

The study further hypothesised the significant relationship between respondents' socioeconomic characteristics and their utilisation of DCTs for poultry production.

METHODOLOGY

Ogun State, located in southwestern Nigeria (latitude 6.9980° N, longitude 3.4737° E), The state covers about 16,762 square kilometers which is approximately 1.81 percent of Nigeria's landmass of about 923,768 and a projected population of 5.2 million by the year 2020 (NPC, 2006). Agriculture forms the backbone of Ogun State's economy, with crops like cocoa, cassava and maize dominating its agricultural landscape. Poultry farming also holds significant importance, with numerous farms dotting the rural and peri-urban areas. Poultry farming is a prominent agricultural sub-sector in Ogun State, contributing significantly to the state's economy and providing livelihoods for numerous rural households (Osinowo and Tolorunju, 2019).

A multistage sampling procedure was adopted for this study. At the first stage, twenty percent (20%) of the Local Government Areas (LGAs) in Ogun State, representing six LGAs, were randomly selected. In the second stage, one community was randomly chosen from each of the selected LGAs, resulting in a total of six communities. At the third stage, a sampling frame of poultry farmers in each community was compiled using records obtained from local agricultural extension officers and farmers' associations. From these lists, twenty-five (25) poultry farmers were randomly selected from each community, giving a total of one hundred and fifty (150) respondents for the study. Primary data were obtained with the aid of structured questionnaire that captured variables like farmers' socioeconomic characteristics, perception of DCTs use, extent of DCTs use and constraints to the use of DCTs. Percentage, standard deviation, the mean Chi-square and the Pearson Product Moment Correlation were used to analyse the data. Respondents' perception of DCTs usage was assessed through a scale comprising 13 statements. A five-point Likert-type scale was employed, with response options ranging from "strongly agree" to "strongly disagree," including a neutral category. The scoring was as follows: 5 = "strongly agree," 4 = "agree," 3 = "neutral," 2 = "disagree," and 1 = "strongly disagree" for positive statements, while negative statements were reverse scored. An index of perception regarding DCTs usage was calculated by summing all the responses. The respondents were classified based on the mean as having either a favourable or unfavourable perception, using a threshold of above and below the mean (56.31±5.22).

Fourteen DCTs were listed to gauge the extent of respondents' use. Response options included "to a Large extent", "to a Lesser extent" and "rarely" with assigned scores of 3, 2 and 1, respectively. Additionally, an index of the extent of use was calculated, facilitating the categorisation of respondents into low and high usage groups based on a criterion of below and above the mean (14.16±5.42).

Ten potential challenges encountered in the use of DCTs were assessed, with response options categorised as "severe" (2), "Mild" (1), and "Not a Constraint" (0). The mean score was calculated to prioritise these challenges based on severity. An index of constraints to DCTs use was then derived to classify respondents into low and high usage categories using a criterion above and below the mean (7.94 ± 3.31). Percentage, standard deviation, the mean Chi-square and the Pearson Product

Moment Correlation were used to analyse the data at a significance level of $\alpha = 0.05$.

RESULTS AND DISCUSSION

Farmers' perception of Digital Communication Tools (DCTs) for poultry production

The results indicate a very strong positive perception of key DCTs among poultry farmers. A large majority of respondents agreed that Facebook serves as a cost-effective platform for advertising poultry products, with 91.9% expressing agreement. Similarly, 98.8% of farmers agreed that YouTube facilitates faster dissemination of agricultural and extension information, highlighting its effectiveness as a timely information-sharing medium.

Respondents also expressed high confidence in Facebook's ability to improve access to customers and suppliers, with 95.4% agreeing to its usefulness. In addition, 98.8% of farmers agreed that WhatsApp enhances poultry product sales, reflecting its value as a tool for marketing, customer engagement, and real-time communication. This aligns with the findings of Hafiar and Lukman (2018), who noted that WhatsApp groups are highly effective and interactive for promotional activities while being cost-efficient.

Overall, these findings demonstrate that social media platforms, particularly Facebook, YouTube and WhatsApp, are widely perceived as valuable and efficient tools for communication, information access and market-related activities within poultry production.

Table 1. Poultry farmers' perception of DCTs use for Poultry Production

Perception statements	SA (%)	A (%)	U (%)	S D (%)	D (%)
Advertisement costs are cheap with Facebook usage	82.0	9.9	8.1	0.0	0.0
Communicating agriculture and extension information spreads faster using YouTube	68.0	30.8	1.2	0.0	0.0
Facebook use makes it easy to reach customers and suppliers	73.3	22.1	4.7	0.0	0.0
WhatsApp usage enhances increased poultry product sales	70.5	28.3	1.2	0.0	0.0
Skype can be a useful source of agricultural information	72.7	25..2	1.7	0.0	0.0
Digital marketing has a bigger population reach with Instagram usage	94.2	5.8	0.0	0.0	0.0
Security cameras are simple to operate	43.0	28.3	0.0	28.7	0.0
The cost of maintaining Data Analytical Platforms is cheap	77.7	18.2	2.5	0.0	1.6
Poultry management software has the potential to identify and find solutions to some of the numerous problems faced in poultry farming	88.4	11.6	0.0	0.0	3.1
It is easy to receive feedback from customers through WhatsApp	89.7	0.0	0.0	0.0	10.3
Websites and blogs is a marketing communication channels for the poultry business	24.6	40.9	10.1	9.7	14.7
Instagram use makes it easy to share information with customers/ suppliers/similar businesses	76.9	15.1	7.9	0.0	77.5
Perception category	**Percent**				
Favourable	60.3				
Unfavourabe	39.7				

Source: Field survey, 2023

Extent of DCTs use for poultry production

Table 2 reveals that farmers to a large extent used Facebook ($\bar{x}$=2.76), WhatsApp ($\bar{x}$=2.73), Zoom ($\bar{x}$=1.19), YouTube ($\bar{x}$=1.14), Instagram ($\bar{x}$=0.88), websites and blogs ($\bar{x}$=0.85), as well as Skype ($\bar{x}$=0.79) for sourcing information on poultry production. This implies that the most used DCTs by the farmers are Facebook and WhatsApp, Zoom, YouTube, Instagram, websites and blogs, as well as Skype. Indicating DCTs prevalence while, the high ranking of Facebook and WhatsApp implies these platforms are crucial for effective, cost-efficient communication and marketing. Their affordability helps reduce operational expenses, enabling even small-scale farmers to compete. Mhina *et.al.,* (2023) in a similar study also reported that Facebook and WhatsApp were the major social media tools used to access general information on chicken management, chickens' diseases and control and housing for improving chicken farming activities.

Table 2 further reveals that respondents had low (70.2%) level of use of DCTs for poultry production. This suggests that a significant portion of poultry farmers exhibit limited engagement with digital technologies for technological advancement or innovation in agricultural practices. This could be as a result of some constraints encountered.

Table 2. Distribution of Respondents by the Use of DCTs for poultry production

Type of DCTs	Mean±SD
Facebook	2.76 ± 0.7
WhatsApp	2.73 ± 0.7
Zoom	1.19 ± 2.0
YouTube	1.14 ± 1.5
Instagram	0.88 ± 1.2
Websites and blogs	0.85 ± 1.2
Skype	0.79 ± 1.2
Weather App & alert	0.68 ± 1.0
Poultry management software	0.53 ± 1.4
Sensors	0.25 ± 1.3
Data Analytic Platforms	0.08 ± 0.5
Level of DCTs usage	**Percentage**
Low	59.1
High	40.9

Source: Field survey, 2023

Constraints faced by poultry farmers in the use of DCTs

The respondents reported several constraints that affect the use of DCTs for agricultural innovation. The high cost of services emerged as the most prominent barrier, reflecting the significant financial burden associated with accessing and utilising these tools. Inconsistent power supply was also frequently cited as a major challenge, indicating that erratic electricity can disrupt effective use of DCTs in poultry production. The cost of acquiring digital devices further limits adoption, as the initial investment required to purchase the necessary equipment can be prohibitive for smallholder farmers. Poor internet reception was another common constraint, highlighting the importance of reliable connectivity for the effective use of DCTs. In addition, a lack of awareness about the roles and potential benefits of these tools reduces their utilisation.

These findings are consistent with previous studies. Ayandiji *et al*. (2021) reported that poor internet connection, slow network speed, and high data costs were major obstacles to social media use among farmers in Oyo State. Similarly, Falola *et al.* (2022) highlighted that high internet subscription fees imposed by network providers significantly limit poultry farmers' ability to use social media effectively for agricultural purposes. Collectively, these challenges underscore the need for interventions aimed at improving infrastructure, reducing costs, and increasing awareness to enhance the adoption and effective use of DCTs in agriculture.

Table 3. Constraints faced by poultry farmers in the use of DCTs

Constraints	Mean Score/SD
High cost of services	1.62 ± 0.6
Erratic power supply	1.54 ± 0.8
High cost of DCTs device	1.36 ± 0.8
Poor internet reception	1.16 ± 0.7
lack of awareness of DCT roles	0.82 ± 0.5
Lack of technical know how	0.77 ± 0.8
Illiteracy	0.21 ± 0.4
Level of Constraint to DCT use	**Percentage**
Low	40.3
High	59.7

Source: Field survey, 2023

Test of relationships between selected socioeconomic characteristics and DCTs use for poultry production

Table 4 shows that respondents' age (r = -0.284), stock size (r = 0.171; p<0.05), household size (r = 0.011; p<0.05) and years of education (r = 0.052; p<0.05) significant to the use of DCTs for poultry production.

First off, age result implies that as farmers' age increases, their use of DCTs gradually decreases. However, farmers with larger stock sizes, much household sizes with more years of education are more likely to utilise DCTs in their agricultural

practices. The result is similar to the reports of Folitse *et al.* (2018) and Ifeanyi-obi *et al.* (2023), which reported that age, number of birds and educational status affect both poultry farmers' use of mobile phones as well as extension agents' utilisation of DCTs.

However, variables such as sex, marital status, income and years of experience did not show significant associations with DCTs use, implying that these factors do not influence the adoption of DCTs for agriculture.

Table 15. Relationship between some selected socioeconomic characteristics and level of DCTs use for Poultry Production

Variable	χ^{2-} value	df	r- value
Sex	0.612[a]	1	
Marital status	24.558[a]	3	
Age			-0.284**
Years of formal education			0.052**
Household size			0.011**
Income			-0.65
Years of experience			-0.067
Stock size			0.171**

p≤ 0.05 = significant. **Source: Field survey, 2023

CONCLUSION AND RECOMMENDATIONS

This study concludes that although poultry farmers generally have a favourable perception of DCTs, their effective use is limited by poor electricity supply, weak internet connectivity and the high cost of devices and services. Socioeconomic factors such as age, marital status and household size also influence how farmers engage with these tools, highlighting the need for supportive interventions that address both infrastructural and user-related factors.

To address these gaps, government agencies should improve access to reliable electricity and internet services in poultry-producing areas. Extension agencies should organise digital literacy training to strengthen farmers' capacity to use DCTs effectively. Government bodies and development partners should consider subsidies or grants to reduce the initial cost of acquiring digital tools, while telecommunication providers should work toward more affordable and accessible data services. Extension workers and farmer groups should also conduct awareness campaigns to promote the benefits of DCTs and strategies for overcoming existing constraints.

REFERENCES

Adamaagashi, I. P., Obinna, N., Obiorah, J., Ogar E. E. and Abdulhameed, A. I. (2023). Analyzing the critical impact of climate change on agriculture and food security in Nigeria. *International Journal of Agriculture and Earth Science (IJAES),* 9(4),1-28

Ajala, A. O., Ogunjimi, S. I., Famuwagun, O. S. and Adebimpe, A. T. (2021). Poultry production in Nigeria: exploiting its potentials for rural youth empowerment and entrepreneurship. *Nigerian Journal of Animal Production*, *48*(1), 114–123. https://doi.org/10.51791/njap.v48i1.2890

Akinwale, J. A., Oluwole, B. O. and Wole-Alo, F. I. (2023). Digital platforms for linking investors with smallholder farmers in Nigeria. *Journal of Agricultural Extension, 27*(2), 65-72. https://dx.doi.org/10.4314/jae.v27i2.6

Anosike, F. U., Rekwot, G. Z., Owoshagba, O. B., Ahmed, S. and Atiku, J. A.(2020). Challenges of poultry production in Nigeria: A review. *Nigerian Journal of Animal Production, 45(1)*, 252-258. 10.51791/njap.v45i1.335.

Ayandiji, A., Afolabi, C. O. and Olaojo G. O. (2021). Use of social media in sourcing Agricultural information among farmers in Oyo Central Senatorial District, Oyo State, Nigeria. *Nigerian Journal of Rural Sociology, 21(1),*1-4.

Birhanu, M. Y., Bruno, J. E., Alemayehu, T., Esatu, W., Geremew, K.,Yemane, T., Kebede, F. G. and Dessie, T. (2022). Beyond diffusion to sustained adoption of innovation: A case of smallholder poultry development in sub-Saharan Africa. *International Journal of Agricultural Sustainability, 20(4)*. doi:10.1080/14735903.2022.2041235.

Ekiri, A. B., Armson, B., Adebowale, K., Endacott, I., Galipo, E., Alafiatayo, R., Horton, D. L., Ogwuche, A., Bankole, O., N., Galal, H. M., Maikai, B. V., Dineva, M., Wakawa, A., Mijten, E., Varga, G. and Cook, A. J. (2021). Evaluating Disease Threats to Sustainable Poultry Production in Africa: Newcastle Disease, Infectious Bursal Disease, and Avian Infectious Bronchitis in Commercial Poultry Flocks in Kano and Oyo States, Nigeria. *Front Vet Sci.*

8:730159. doi: 10.3389/fvets.2021.730159.

Falola, A., Mukaila, R. and Kudabo, A. (2022). Economic Effect of Social Media on Small Scale Poultry Farmers. Evidence from Nigeria. *International Journal of Agricultural Science, Research and Technology in Extension and Education Systems, 11(3),* 163-172. 20.1001.1.22517588.2021.11.3.4.0

Folitse, B., Manteaw, S., Dzandu, L., Obeng-Koranteng, G. and Bekoe, S. (2018). The determinants of mobile-phone usage among small-scale poultry farmers in Ghana. *Information Development,* 35(2), 026666691877200. doi:10.1177/0266666918772005.

Food and Agriculture Organisation (FAO) (2022). The State of Food Security and Nutrition in the World 2020. Available online: https://www.fao.org/publications/sofi/2020 (accessed on 12 July 2022).

George, A. S. and George, A. S. H. (2023). Optimizing Poultry Production Through Advanced Monitoring and Control Systems. *Partners Universal International Innovation Journal (PUIIJ),* 1 (5), 1-22.

Hafiar H. and Lukman S., (2018). Optimizing promotional activities through WhatsApp group (WAG) in capturing candidates for boarding school. *PROMEDIA 4(1)*:56-75.

Ifeanyi-obi, C. C. and Corbon, B. L. (2023). Utilization of digital tools in extension service delivery amongst extension agents in Akwa Ibom State, Nigeria. *Journal of Agricultural Extension, 27 (4),* 67-76. https://dx.doi.org/10.4314/jae.v27i4.7.

Jekayinfa, S. O., Orisaleye, J. I. and Pecenka, R. (2020). An assessment of potential resources for biomass energy in Nigeria. *Resources, 9(8)*, 92.

Mhina, J., Mwaseba, D., Ahmad, A. and Shausi, G. (2023). Small-Scale Chicken Farmers' Use of Social Media to Access Market Information in Arusha City, Tanzania. *Asian Journal of Agricultural Extension, Economics & Sociology, 41(10),* 1014-1027. 10.9734/ajaees/2023/v41i102255.

National Population Commission (2007). Analysis of Nigerian 2006 census results. National Population Commission, Abuja, Nigeria. Report of Nigeria's National Population Commission on the 2006 Census. (2007). *Population and Development Review*, *33*(1), 206–210. http://www.jstor.org/stable/25434601.

Olanrewaju, K. O., Akintunde, O. K., Moshood, A., Popoola, M. O., Busari, A. O. and Omotosho. M. O. (2021). Towards the digitalization of poultry industry in Nigeria: An investigation of farmers' knowledge and practices. *African Journal of Science, Technology, Innovation and Development*. 1(5), 1-8.

Osinowo, H. and Tolorunju, E. (2019). Technical efficiency of poultry egg production in Ogun State, Nigeria. *Journal of Agribusiness and Rural Development. 51(1),* 51-58. doi.org/10.17306/J.JARD.2019.01137.

Otunaruke, P., Enwa, S., Sorhue, U. and Efe, O. (2023). Profitability And Constraints Of Poultry Production Among Households In South - South, Nigeria. Implications For Protein Intake Sustainability. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 23(4)*,1-9.

Rajkhowa, P. and Qaim, M. (2021) Personalized digital extension services and agricultural performance: Evidence from smallholder farmersin India. *PLoS ONE*.16 (10): e0259319.

Umar, I. S. (2022). Adoption of agricultural technologies; how far have farmers gone? Inaugural lecture series 99, University Seminar and Colloquium Committee, Federal University of Technology, Minna, 56p.

DETERMINANTS OF FOOD CONSUMPTION PATTERNS AMONG RURAL AND URBAN HOUSEHOLDS IN EKITI STATE, NIGERIA

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ABSTRACT
The study assessed the determinants of food consumption patterns among rural and urban households in Ekiti State. Data were collected through a well-structured questionnaire administered to 180 respondents selected using a three-stage sampling procedure. This study investigates the socio-economic factors, assessed respondents' knowledge and attitudes toward food consumption, identified key social and cultural influences, and major constraints affecting consumption pattern. Data was analysed using descriptive statistics, while Pearson correlation, regression analysis, and t-tests were employed to test the hypotheses. The findings revealed that most respondents were female (77.1%), married (78.8%), with a mean age of 44 years. Respondents' dominant occupations were Civil servants (51.2%) and traders (32.9%), more than half (53.5%) had tertiary education while 6.5% had no formal education. Low income (78.2%) unfavourable policies (72.4%), and seasonal food availability (51.2%) were the major constraints to consumption patterns. Also, it revealed that cereals (97.1%) and roots/tubers (91.2%) were the most frequently, with over 90% of respondents consuming them regularly. Vegetables and fruits were also commonly consumed but less consistently, reflecting seasonal influences. Animal protein intake was moderate, with fish (70.6%) consumed more frequently, indicating affordability as an important factor. Significant differences existed in the consumption patterns between rural and urban households ($t = -4.102$,), with urban households showing greater dietary diversity. The results revealed that location ($\beta = 0.321$) and age ($\beta = -0.203$) influenced consumption patterns. The study concludes that household diets are largely dominated by staple foods, with location and age as key determinants of consumption patterns. It recommends strategic food and nutrition awareness programs targeted at rural households and the elderly, as well as interventions to enhance food availability and affordability.
Keywords: Food consumption pattern, location, dietary diversity, food and nutrition awareness.

INTRODUCTION

Food is one of the most essential human needs for survival as it strongly connects to human's physical, mental and social well-being. An adequate and healthy diet is required to define an active and healthy life which provides all essential nutrients required to identify and express the relationship between diet and health (Herforth, et al. 2020). However, adequate access to this diet by individuals has not been achieved because of constraint to affordability (FAO et al. 2020; Bai et al. 2021). Study reveals that household with low income would have to increase spending on food expenditures by 13% to meet the least cost diet requirement, and 43% to adapt to current required healthy foods (Mekonnen et al. 2021). The unaffordability of a healthy diet is higher in rural than urban areas as posited by (Holleman & Latino, 2023). Although there are several determinants and factors influencing the food consumption pattern of individuals, which may include the socio-economic characteristics of individuals.

In Nigeria the importance of food choices is not conspicuously proven among various individuals in the rural and urban areas. Food consumption patterns among rural and urban households are shaped by several factors which influences consumer's demand and intake. Some cultural beliefs prohibit certain foods and also accept certain foods that are of nutritional benefit to the body which influences the food consumption pattern of people who are identified to it. The cultural background influences the intake by individuals where individuals in the rural area maintain a steady pattern as a result of the culture which is otherwise in the urban area where individual dietary pattern is influenced by taste and emigration of diverse cultural groups (Chukwu & Dogbe, 2023). However, the recent hike in the prices of food as a result of the economy in every part of the country has left many households insecure and malnourished (Sahel and West Africa Club Secretariat, 2020).

Despite efforts to improve food availability and affordability, many individuals still live below the daily dietary requirement, and the determinants of their consumption patterns remain unclear. This study therefore examines the quantity and quality of food consumed at individual and household levels in Ekiti State. Specifically, it identifies the socio-economic characteristics of respondents, assesses their knowledge and attitudes toward food consumption across rural and urban households, evaluates the influence of social and cultural factors, determines the major drivers of consumption patterns, and highlights key constraints affecting food consumption in the study area.

The study hypothesised that here is no significant relationship between the selected variables (socioeconomic characteristics, respondents' knowledge, attitude and challenges faced) and food consumption pattern. Also, there is no significant difference in the food consumption pattern of rural and urban respondents' food consumption pattern.

METHODOLOGY

The study was carried out in Ekiti State, Nigeria, a tropical region created in 1996 and situated between longitudes 4°45′–5°45′E and latitudes 7°15′–8°51′N. The state experiences a bimodal climate consisting of a rainy season (April-October) and a dry season (November-March) and covers 5,887.89 km² across 16 local government areas. Major occupations include farming, civil service, and petty trading. Foods commonly consumed in the state include yam, cassava, maize, rice, and vegetables, which are often processed into forms such as garri, yam flour, pap, and pounded yam, reflecting local dietary preferences. Three stage sampling procedure was employed. First, two LGAs Ado (urban) and Ido-Osi (rural)were purposively selected based on documented variations in hunger and food insecurity from the NLPS 2020-2023 data (Afe Babalola University & Ekiti State Government, 2022). In the second stage, six communities were randomly selected from each LGA. Finally, 15 households were randomly selected from each community, yielding a total sample of 180 households. Data were collected using structured questionnaires.

Socio-economic characteristics (sex, age, marital status, occupation, education, household size, and location) were measured accordingly. Knowledge of food consumption was measured using seven questions scored as correct (1) or incorrect (0) and classified into high or low knowledge. Attitudes were assessed on a 5-point Likert scale Strongly Agree (SA) 5, Agree(A) 4, Undecided (U) 3, Disagree (D) 2 and Strongly Disagree (SD) and grouped into favourable or unfavourable responses.

Social and cultural influences were measured on a binary scale (Yes = 1, No = 0), while challenges to food consumption were rated as Severe (2), Mild (1), or Not a Challenge (0) and categorised by significance. Food consumption patterns were assessed using the Household Dietary Diversity Score (HDDS), based on consumption of 12 food groups in the past 24 hours (Yes/No) and frequency over the past 7 days (Daily = 3, Biweekly = 2, Weekly = 1). Data was analysed using descriptive statistics (frequency, percentage, and mean), and hypotheses were tested using Pearson correlation, regression analysis, and t-test.

RESULTS AND DISCUSSION

Knowledge of food consumption

The result in Table 1 shows that respondents had high knowledge of basic food consumption, evident in high correct responses for the definition of food security (95.3%) and healthy food (87.6%). Knowledge was weaker for factors such as poverty, climate change, and market access. Low knowledge of availability (20.0%) indicates limited awareness that availability alone does not determine food choices, supporting Olatona et al. (2023). Overall, while respondents understand healthy food, they are less aware of the socio-economic and environmental factors influencing consumption patterns, as noted by Chidiebere-Mark et al. (2022), highlighting the need for improved awareness to enhance dietary decisions.

Table 1: Level of knowledge of food consumption

Items	Correct (%)	Not correct (%)
Food security means having access to enough safe and nutritious food to live a healthy and active life at all times.	95.3	4.7
A healthy food must contain adequate nutrient required for growth and development.	87.6	12.4
Household with limited income could as well attain adequate nutrients in their meals.	78.8	21.2
Climate change could influence consumption pattern.	71.2	28.2
I am aware that poverty, climate change, lack of access to markets has nothing to do with consumption pattern.	48.2	51.8
Lack of access to market has nothing to do with consumption pattern.	41.8	58.2
Availability of food is not the only factor that influences my food choices and consumption pattern.	20.0	80.0

Source: Field survey, 2024

Respondents' attitude to food consumption pattern in the area

The results in Table 2 show respondents' attitudes toward food consumption. Favourable responses include recognizing that a food-secure household has better consumption patterns (69.4% SA, 22.9% A), that food security influences household consumption (55.3% SA, 37.6% A), and that reducing food wastage can improve consumption (46.5% SA, 34.1% A) as asserted by (Mekonnen et al., 2021). Unfavourable responses reflect persistent misconceptions, such as fruits and vegetables being eaten only when sick (8.8% SA, 17.6% A) and dairy being for babies or visitors (10%

SA, 7.6% A). According to (Chiemela et al., 2022) showing that cultural beliefs still affect consumption patterns.

Table 2: Attitude towards food consumption pattern in the area.

Items	SA %	A %	U %	D %	SD %
A food secure household is likely to have better consumption pattern.	69.4	22.9	5.3	2.4	0
Food security could play out has a factor of consumption pattern among household.	55.3	37.6	3.5	3.5	0
Reducing food wastage could improve food security and consumption pattern.	46.5	34.1	7.1	10.0	2.4
I am willing to pay more for nutritious foods.	38.8	38.8	7.6	11.8	2.9
My continuous food consumption pattern does not guaranty food security.	30.0	41.2	10.6	12.9	5.3
Food choices in my locality does not necessarily meet my dietary needs.	18.2	48.2	11.2	14.1	8.2
Sustainable food practices like processing and storage will not possibly influence consumption pattern.	31.2	24.1	7.6	34.7	2.4
Social pressure has a way of influencing my food consumption pattern.	18.2	42.9	7.1	24.1	7.6
I feel that fast food and locally sourced food are affordable and accessible and also influence consumption pattern.	21.2	27.1	8.8	37.6	5.3
Consumption of dairy products are only meant for babies and visitors.	10.0	7.6	12.9	51.8	17.6
I think fruits and vegetables should be consumed only when one is sick.	8.8	17.6	8.2	35.3	30.0

Source: Field survey, 2024

Extent to which social and cultural factors influence food consumption pattern

The result in Table 3 shows that social and cultural factors shape food consumption in the study area, with economic conditions emerging as the dominant influence (92.4%). Energy needs (77.6%), health considerations (75.9%), and the perceived medicinal value of vegetables (74.7%) also contributed, while social interactions had a moderate effect (67.6%). Cultural and religious factors were comparatively weak, as practices such as consuming fruits or dairy only when sick (58.2%) were not strong determinants. These results align with Paulo et al. (2025), emphasizing economic capacity and social interaction as key drivers of food choice and the need to improve access to diverse, nutritious foods.

Table 3: Extent to which social and cultural factors influence food consumption patterns

Items	Yes (%)	No (%)
My consumption pattern is greatly influenced by the state of the economy.	92.4	7.6
Hospitality and friendship influences food consumption pattern in my area.	67.6	32.4
Food consumption is influenced due to its significance in ceremonies.	46.5	53,5
I eat starchy food because it provides the energy required for work.	77.6	22.4
Cultural activities such as inter-ethnic or intra-ethnic marriage influence my food consumption pattern.	50.6	49.4
I consume fruits and dairy products because of its significance while sick.	41.2	58.2
Cultural belief and pattern influence my food choices.	45.3	54.7
Special ceremonies and feasts do not influence my food consumption pattern.	80.6	19.4
The use of diet to maintain health conditions influences my consumption pattern.	75.9	24.1
I consume vegetables because of its medicinal properties.	74.7	25.3

Source: Field survey, 2024

Challenges to food consumption pattern

The result in Table 4 shows that low income and social status (78.2%) and unfavourable government policies (72.4%) are the most severe challenges to food consumption, followed by limited access to diverse foods (52.4%) and seasonal availability (51.2%). Less severe constraint includes limited cooking skills (21.2%). Economic constraints and

policy limitations are the main constraints to food consumption as asserted by Mekonnen et al. (2023) which highlight the need for interventions and policies that improve income and food availability.

Table 4: The challenges faced by food consumers in rural and urban areas of Ekiti state

Items	Severe challenge (%)	Mild Challenge (%)	Not a challenge (%)	Mean
Low income and social status.	78.2	17.1	4.7	1.7
Unfavourable government policies and interventions.	72.4	24.7	2.9	1.7
Limited access to diverse food options.	52.4	33.5	14.1	1.4
Seasonal availability of foods in the area.	51.2	27.6	21.2	1.3
Limited access to local and traditional foods.	29.4	47.6	22.9	1.1
Poor food packaging, marketing and advertising.	36.5	37.1	26.5	1.1
Large household size and living situation.	31.9	46.5	21.8	1.1
Increased emotional challenges like stress, anxiety and depression.	31.2	42.4	26.5	1.1
Declining social norms and cultural practices.	17.6	60.0	22.4	1.0
Limited access to market.	25.3	47.6	27.1	1.0
Intense work schedule.	25.9	44.7	29.4	1.0
Low level of education and awareness on healthy diet.	36.5	29.4	34.1	1.0
Busy schedules or limited time to prepare healthy meal.	27.6	34.7	37.6	0.9
Lack of cooking skills to prepare healthy food.	21.8	31.2	47.1	0.8
Inadequate healthcare professionals or registered dietitians for nutrition guidance.	27.1	28.8	44.1	0.8
Limited access to cooking classes or education.	21.2	24.1	54.7	0.7

Source: Field survey, 2024

Food consumption pattern in Ekiti state.

The results indicate that cereals (97.1%) and roots and tubers (91.2%) are the most commonly consumed food groups, reflecting their central role as household staples. Vegetables (74.1%) and fruits (70.6%) were also widely consumed but less frequently, suggesting seasonal or access-related limitations. Animal protein intake was moderate, with meat and poultry (80.6%) and fish (70.6%) consumed more often than eggs (54.1%). Nuts, seeds, and dairy showed lower consumption, likely due to cost or availability constraints. Fats and oils (85.9%) were commonly used, while sugar and honey (63.5%) were moderately consumed. Overall, the findings show a diet dominated by staple foods particularly cereals which aligns with Fawole and Aderinoye-Abdulwahab (2021), who reported cereals as one of Nigeria's most widely consumed staples.

Table 5: Distribution of respondents according to the food consumption pattern.

Food groups	Yes (%)	No (%)	Daily (%)	Biweekly (%)	Weekly (%)	Mean
Cereals	97.1	2.9	61.8	18.8	19.4	1.58
Roots and tubers	91.2	8.8	58.2	25.9	15.9	1.58
Vegetables	74.1	25.9	31.2	28.2	40.6	2.09
Fruits	70.6	29.4	42.4	26.5	31.2	2.11
Meat / Poultry	80.6	19.4	34.7	17.1	48.2	2.14
Fish and seafood	70.6	29.4	31.2	12.9	55.9	2.25
Eggs	54.1	45.9	18.2	21.8	60.0	2.42
Legumes (pulses)	70.6	29.4	15.4	16.6	68.0	2.53
Nuts and seeds	57.6	42.4	9.4	40.0	50.6	2.41
Dairy (milk)	60.6	39.4	12.9	37.1	50.0	2.37
Fats and oils	85.9	14.1	52.9	23.5	23.5	1.71
Sugar/honey	63.5	36.5	24.7	27.6	47.6	2.23

Source: Field survey, 2024

Food consumption pattern among Rural and Urban Households in Ekiti state.

The result in Table 6 revealed differences in food consumption patterns between rural and urban households. Cereals were consumed by nearly all respondents (97.1%), with urban households showing more frequent intake compared to rural respondents who largely consumed them weekly.

Roots and tubers also recorded high consumption (91.2%), slightly higher among rural households (47.1%) than urban (44.1%), reflecting the prominence of locally cultivated staples in rural diets. Also, Fruit consumption (70.6%) and animal source foods such as meat and poultry (80.6%), eggs (54.1%), and dairy products (60.6%) were generally higher among urban respondents, indicating greater dietary diversity and access to protein-rich foods. However, fish and seafood (70.6%) consumption was marginally higher among rural households, likely due to affordability. Fats and oils stood out as the only food group with higher weekly consumption in rural households (29.4%) compared to urban (21.8%), reflecting traditional cooking patterns reliant on palm oil.

The study posits rural households predominantly consumed traditional staples such as roots, tubers, and oils, whereas urban households exhibited greater food diversity with more frequent consumption of fruits, animal products, legumes, and dairy. These patterns highlight the influence of urbanization, income, and food accessibility on household consumption pattern as posits by (Holleman & Latino, 2023); Cockx & Boti (2025).

Table 6.: Distribution according to the food consumption pattern among rural and urban households.

Food Group	Total (Yes) %	Rural %	Urban %	None (%)	Weekly (%)	Biweekly (%)	Daily (%)
Cereals	97.1	47.6	49.4	2.9	61.2	18.8	17.1
Roots & Tubers	91.2	47.1	44.1	8.8	57.1	22.4	11.8
Vegetables	74.1	35.9	38.2	26.5	30.0	15.3	28.2
Fruits	70.6	30.0	40.6	28.8	29.4	18.8	22.9
Meat & Poultry	80.6	37.6	42.9	20.0	30.6	16.5	32.9
Fish & Seafood	70.6	30.0	40.6	29.4	28.2	12.9	29.4
Eggs	54.1	22.4	31.8	45.3	16.5	13.5	24.7
Legumes	70.6	32.4	38.2	30.0	14.7	11.2	44.1
Nuts & Seeds (egusi, gbegiri)	57.6	20.0	37.6	41.2	8.2	20.0	30.6
Dairy Products	60.6	25.3	35.3	39.4	11.2	22.4	27.1
Fats and oils	85.9	45.9	40.0	13.5	51.2	18.2	17.1
Sugar/honey	63.5	25.9	37.6	36.5	22.9	14.7	25.9

Source: Field Survey 2024

Differences between food consumption pattern of rural and urban households in the study area.

The results in table 7 shows a statistically significant difference in food consumption patterns between rural and urban populations (t= -4.102). Along with earlier results, it further indicated the significant impact of location on consumption patterns reflecting that urban households tend to have a higher level of food consumption patterns compared to rural households in the study area as posited by (de Brauw & Herskowitz, 2021). Moreover, the results highlight the complexity of food consumption patterns and suggest the need for further research into other potential influences.

Table 7: Differences in Food consumption pattern among rural and urban household

Test	t-value	df	p-value	Mean difference	Std. Error difference	95% confidence interval of the difference
Levene's test for equality of variances	F=2.431	-	0.121	-	-	-
T-test (equal variances not assumed)	-4.102	161.398	0.000	-3.717	0.906	(-5.507, -1.928)

Source: Field survey, 2024

Determinants of food consumption pattern among rural and urban household.

Table 7 shows that the age of respondents had a significant negative relationship (β = -0.203), indicating that an increase in age resulted in a decrease in consumption pattern, which supports the assertions by Mekonnen et al. (2021). Also, location (β = 0.321), and socio-cultural factors (β = 0.335) significantly influenced food consumption patterns among rural and urban households at $p<0.05$, while geographic and cultural factors positively shaped patterns, aligning with de Brauw & Herskowitz (2021), and Hormenu (2022). Other variables, including sex, marital status, occupation, education, household size, knowledge, attitude, and challenges, were not significant.

Table 7: Determinants of food consumption pattern among rural and urban household.

Variables	R	p-value	Unstandardized Coefficients (β)	Standardized Coefficients (β)	t-value	R^2	Adjusted R^2	Standardized Error	Decision
Sex	0.113	0.344	-1.037	-0.070	-0.949	0.246	0.193	5.577	NS
Age	-0.058	0.026	-0.116	-0.203	-2.253	-	-	-	S
Marital Status	-0.055	0.747	0.304	0.028	0.324	-	-	-	NS
Occupation	0.063	0.679	-0.267	-0.040	-0.414	-	-	-	NS
Educational Status	-0.230	0.965	-0.031	-0.004	-0.044	-	-	-	NS
Household size	0.065	0.540	-0.464	-0.044	-0.614	-	-	-	NS
Location	0.174	0.000	3.980	0.321	3.878	-	-	-	S
Knowledge	0.129	0.836	0.067	0.016	0.208	-	-	-	NS
Attitude	-0.080	0.195	0.153	0.098	1.300	-	-	-	NS
Socio-cultural Influence	-0.082	0.000	1.279	0.335	4.484	-	-	-	S
Challenges	-0.014	0.233	-0.113	-0.097	-1.196	-	-	-	NS

Source: Field Survey 2024

CONCLUSION AND RECOMMENDATIONS

Rural and urban households show distinct food consumption patterns shaped by socioeconomic and environmental factors. Rural diets remain dominated by traditional staples, while urban households consume more diverse foods, including fruits, animal products, and dairy. These differences reflect the influence of income, urbanization, and food access. To promote balanced nutrition across all groups, strategies should focus on improving rural income, expanding food accessibility, and strengthening nutrition education especially for rural communities and older adults. However, culturally sensitive interventions will further support acceptance and long-term sustainability.

REFERENCES

Afe Babalola University & Ekiti State Government. (2022). *A state-based policy document on food insecurity for poverty eradication*

Bai, Y., Alemu, R., Block, S. A., Headey, D., & Masters, W. A. (2021). Cost and affordability of nutritious diets at retail prices: Evidence from 177 countries. *Food Policy, 99*, 101983.

Chiemela, S. N., Chiemela, C. J., Apeh, C. C., & Ileka, C. M. (2022). Households' food security and perception of food nutrition in Enugu State, *Nigeria. Journal of Agricultural Extension*, 26(2), 11-23.

Chidiebere-Mark, N. M., Ahaneku, C. E., & Oluwaseun, A. A. (2022). Food security and nutrition of smallholder farming households in south-east Nigeria: evidence from Imo State. *International Journal of Agricultural Economics, 7(2), 69.*

Chukwu, E., & Dogbe, W. (2023). The cause and effect of the nutrition transition in Nigeria: analysis of the value of indigenous knowledge and traditional foods in Enugu State, Igboland. *Journal of Ethnic Foods*, *10*(1), 30.

Cockx, L., & Boti, B. B. D. (2025). Urbanization shapes West African diets throughout the rural-urban continuum. *Global Food Security*, 45, 100858.

de Brauw, A., & Herskowitz, S. (2021). Income variability, evolving diets, and elasticity estimation of demand for processed foods in Nigeria. American Journal of Agricultural Economics, 103 (4), 1294–1313. https://doi.org/10.1111/ajae.12210.

FAO, IFAD, UNICEF, WFP, & WHO. (2020). The state of food security and nutrition in the world 2020: Transforming food systems for affordable healthy diets. Rome: FAO.

Fawole, B. E., and Aderinoye-Abdulwahab, S. A. (2021). "Farmers' adoption of climate smart practices for increased productivity in Nigeria," *in African Handbook of Climate Change Adaptation, eds N. Oguge, D. Ayal, L. Adeleke, and I. da Silva (Cham: Springer). DOI: 10.1007/978-3-030-45106-6_227.*

Holleman, C., & Latino, L. (2023). Variations in the subnational cost and affordability of a healthy diet for selected countries in Africa: Background paper for The State of Food Security and Nutrition in the World 2023. Food and Agriculture Organization of the United Nations. https://doi.org/10.4060/cc5890en.

Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A., & Masters, W. A. (2020). Cost and affordability of healthy diets across and within countries. *Background paper for the state of food security and nutrition in the world 2020. Rome: FAO.*

Hormenu, T. (2022). Dietary intake and its associated factors among in-school adolescents in Ghana. *PloS one, 17(5), e0268319.*

Mekonnen, D. A., Akerele, D., Achterbosch, T., de Lange, T., & Talsma, E. F. (2021). Affordability of healthy and sustainable diets in Nigeria. Frontiers in Sustainable Food Systems, 5, 726773.

Mekonnen, D. A., Trijsburg, L., Achterbosch, T., Brouwer, I. D., Kennedy, G., Linderhof, V., Ruben, R., & Talsma, E. F. (2021). Food consumption patterns, nutrient adequacy, and the food systems in Nigeria. *Agricultural and Food Economics, 9(1), 16.*

Mekonnen, D. A., Adeyemi, O., Gilbert, R., Akerele, D., Achterbosch, T., & Herforth, A. (2023). Affordability of healthy diets is associated with increased food systems performance in Nigeria: state-level analysis. *Agricultural and Food Economics,* 11(1), 21.

Olatona, F. A., Adeniyi, D. B., Obrutu, O. E., & Ogunyemi, A. O. (2023). Nutritional knowledge, dietary habits and nutritional status of adults living in urban Communities in Lagos State. *African Health Sciences,* 23(1), 711-24.

Paulo, L. S., Lenters, V. C., Chillo, P., Wanjohi, M., Piedade, G. J., Mende, D. R., ... & Klipstein-Grobusch, K. (2025). Dietary patterns in Tanzania's transitioning rural and urban areas. *Journal of Health, Population and Nutrition*, 44(1), 71.

DETERMINANTS OF SOURSOP FRUITS CONSUMPTION AMONG RESIDENTS OF OYO STATE, NIGERIA

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ABSTRACT
Soursop (*Annona muricata*) is a nutritious fruit, beneficial to all human race but under-consumed due to various factors. Hence, this study investigated the determinants of soursop fruits consumption among residents of Oyo state, Nigeria. A multistage sampling procedure was used to select 241 respondents and an interview schedule to obtain data on respondents' socioeconomic characteristics, purchasing pattern, consumption level and constraints to consumption of the fruit. Data were analysed using percentage, mean, Weighted Score (WS), Pearson Product Moment Correlation and regression analysis. Results show that mean age was 35 years, 52.7% were male, while 26.1% and 55.2% were traders and had tertiary education, respectively and 70.5% earned less than ₦200,000per month. Majority (78.4%) had never purchased soursop fruits, had low level of consumption (58.5%), while limited promotion and marketing (WS = 176.3), seasonal variability (WS =170.2) and accessibility issues (WS = 167.6) were severe constraints to consumption of soursop fruits. Significant relationships existed between the respondents' age (r= 0.186, p= 0.004), monthly income (r = -0.186, p= 0.004) and consumption of soursop fruits. Residents' age (β =0.44; p=0.00) and price of soursop fruits (β =0.26; p=0.01) determined their consumption of soursop fruits. It is concluded that despite the accrued benefits in soursop fruits, majority of the residents do not consume the fruits probably because of their age and price of the fruits. Therefore, a campaign on benefits accrued in soursop fruits should be embarked upon with collaborative efforts from stakeholders in agriculture, health practitioners and communication development experts.
Keywords: Soursop fruits, consumption level, benefits accrued, residents

INTRODUCTION

Soursop (*Annona muricata*) is widely recognised for its nutritional and medicinal benefits. It is rich in carbohydrates, vitamins, minerals, and antioxidants, with evidence of diuretic, anticancer, antibacterial, sedative, and anti-inflammatory properties (Abiona & Adegoke, 2021; Odojie & Oluwatoyin, 2022). Its culinary use further adds to its value, as it can be consumed fresh or processed into custards, juices, ice creams, jams, vinegars, and other food products with high consumer acceptability (Muhammad et al., 2022; Ho et al., 2021). Despite its potentials as both a food security crop and a medicinal resource, soursop remains an underutilised fruit in Nigeria where its consumption is still relatively low.

Several challenges like its seasonality and highly perishable nature make it difficult to ensure it is available all year-round in local markets. Also, cultivation challenges exist as soursop trees are sparse bearers, producing only 12–20 fruits per tree, and require specific climatic and soil conditions that limit large-scale farming (Quemems, 2023). According to Nguyen et al. (2019) pre-harvest deterioration is another major issue as soursop fruits are frequently affected by fungal pathogens which lead to nutrient losses and reduced market value. This discourages both farmers and consumers from investing in fruit.

In addition to production and storage challenges, Soursop receives little research attention compared to other tropical fruits, and the available scientific knowledge does not translate into commercialisation and public awareness of the fruit because it remains largely within academic circles (Akib et al., 2023). The absence of effective policies for sour-sop promotion, coupled with inadequate marketing strategies, has limited the integration of soursop into mainstream agriculture and food industries. Consequently, soursop cultivation in Nigeria remains largely subsistence-based and small-scale, making the fruit scarce and expensive. This price barrier, alongside limited awareness of its nutritional and medicinal benefits, discourages its widespread consumption.

With growing concerns about food security, malnutrition, and the rising burden of non-communicable diseases, fruits like soursop could play an important role in diversifying diets, boosting immunity, and supporting livelihoods. However, the specific factors influencing its consumption remain poorly understood among residents of Oyo State. This knowledge gap limits the ability of policymakers, researchers, and agricultural stakeholders to design interventions that can promote the cultivation and consumption of soursop as a sustainable food and health resource.

Therefore, this study sought to investigate the determinants of soursop fruit consumption among residents of Oyo State. The following specific objectives guided the study:

1. to identify residents' socioeconomic characteristics,
2. to describe the purchasing pattern of soursop fruits among the residents
3. to determine residents' consumption level of soursop
4. to ascertain residents' constraints to consumption of soursop fruits.

The study has the following hypotheses of the study:

$H_0$1: There is no significant relationship between selected socioeconomic characteristics of the respondents and their consumption of soursop fruits.

$H_0$2: There is no significant contribution of selected socioeconomic characteristics of the respondents to the consumption of soursop fruits.

METHODOLOGY

This study was carried out in Oyo State. Oyo State is a state in the southwestern region of Nigeria and has Ibadan as its capital. It is bordered by Kwara State to the North, Osun State to the East, Ogun State to the South and the Republic of Benin to the West. The state's geographical diversity ranges from rolling hills and plains to the lush forests of the Oke-Ogun region.

A multi-stage sampling procedure was used to sample 241 respondents in the study area. The respondents were selected using their local area zones.

The first stage involved the selection of 3 zones; Ibadan, Ogbomoso and Oyo (Zone I, III and IV) from the five local area zones in the state using a purposive sampling technique. This purposive selection was due to the fact that the 3 selected zones have many urban LGAs within them and the study assumed that urban residents are likely to have knowledge of soursop benefits and are likely to consume fruits more compared with other residents from the state. In the second stage a selection of 10% of LGAs from zone I (Ibadan) and 30% of LGAs were selected from the other two zones using simple random sampling techniques. Therefore, 1 LGA each was selected from Zone I – (Ibadan Areas), Zone III (Ogbomoso Areas), and Zone IV (Oyo Areas). In all, 3 LGAs were selected. Then, in the third stage, one major community each was selected from the selected 3 Local Government Areas using a purposive sampling technique. The selection was based on the fact that these communities again are from urban center areas. Therefore, University of Ibadan/ Abadina community was selected to represent zone I (Ibadan area), Apake community to represent zone III (Ogbomoso) and Alagbon community for zone IV (Oyo area). The fourth and the last stage involved the use of a systematic sampling technique to select 84 households from University of Ibadan/ Abadina community, 88 from Apake community and 69 from Alagbon community. This was determined by Yamane's formula for sample size. Hence, a total of 241 residents from the selected households.

Level of consumption of soursop was measured by asking the residents to respond to a 12 item statements in order to indicate the frequency at which they consume soursop. The response options were "More like me"; "Like me"; "Undecided" and "Never like me". These response options were assigned scores 4, 3, 2, and 1 respectively. The maximum obtained score was 48 while the minimum was 0. Thereafter, The mean score (24.90±12.48) was used as the benchmark to group respondents into two. The group of respondents that fell within mean score (24.90) and above were categorised as high level of consumption and those group that fell below the mean score were categorised as low level of consumption. In the same vein, constraints to consumption of soursop fruits were measured by asking the respondents to indicate the severity of constrains they encountered from a list of 12 constraints provided. The response options were "Severe constraint"; "Mild constraint" and "Not a constraint". The options were assigned scores of 2, 1 and 0 respectively. The maximum obtained score was 24 and 0 was the minimum. Then, scores for each response options were converted to weighted scores. Thereafter, the mean score (17.67±5.64) was used to group respondents into having a low and high level of constraint. Respondents with scores below the mean score (17.67) were categorised as having low level of constraint and those with mean score (17.67) and above had high level of constraints.

Frequency counts, percentage, mean, Weighted Score (WS), Pearson Product Moment Correlation and regression analysis were used to analyse.

RESULTS AND DISCUSSION

Socioeconomic characteristics

Results in Table 1 show that majority (52.7%) of the respondents were male with mean age of 36 years, 55.2% had tertiary education, while 56.8% were married. This implies that more than half of the respondents are male, young adult according to Akhmet (2017), married and literates. A higher number of respondents being married could have a negative effect on consumption of soursop because married people have more mouth to feed. They would thereby prefer to spend on other major food items while either intentionally or unintentionally neglecting to purchase soursop. Also, 70.5% of the respondents earned less than ₦200,000 per month, while a few of them were traders (26.1%) and students (24.9%). This corroborates the findings of Adesina (2018) that a large percentage of the people in Ibadan metropolis are self-employed (traders and artisans).

Table 1: Distribution of respondents based on socioeconomic characteristics (n=241)

Variables	Options	Frequency	Percentage	Mean
Sex	Male	127	52.7	
	Female	114	47.3	
Age	< 30 years	118	49.0	35.93
	31-45 years	71	29.5	
	46-60 years	43	17.8	
	> 61 years	9	3.7	
Educational qualification	No formal education	6	2.5	
	Vocational education	6	2.5	
	Primary education	18	7.5	
	Secondary education	78	32.4	
	Tertiary	133	55.2	
Occupation	Student	60	24.9	
	Trader	63	26.1	
	Artisan	44	18.3	
	Civil servant	39	16.2	
	Private worker	35	14.5	
Marital status	Single	99	41.1	
	Separated	2	0.8	
	Married	137	56.8	
	Divorced	3	1.2	
Income	< 200,000	170	70.5	289,858.92
	200,001 - 400,000	29	12.0	
	400,001 - 600,000	19	7.9	
	600,001 - 800,000	2	0.8	
	> 800,001	21	8.7	

Source: Field survey, 2024

Purchasing pattern of soursop fruits

The results on Table 2 reveal that the majority (78.4%) of the respondents had never purchased soursop, among those that purchased 14.1% bought it at the rate between ₦500 and ₦1,100 per fruit, while 12.9% agreed that the fruits were not affordable. This implies that many residents do not consume soursop fruits while those that consumed the fruit felt it is not affordable, hence might not be considered worthy consumption on a daily basis. This is contrary to the findings of Del Carmen, Esguerra, and Gerance (2020) that soursop is purchased due to its affordable price.

Table 2: Distribution of respondents based on purchasing pattern of soursop (n=241)

Variables	Options	Frequency	Percentage
How often do you purchase soursop?	Never	189	78.4
	Annually (rarely)	21	8.7
	Monthly (less frequently)	17	7.1
	Weekly (frequently)	11	4.6
	Daily (always)	3	1.2
How much do you purchase sour-sop in Naira per one fruit	None	197	81.7
	500 - 1,100	34	14.1
	1,101 - 1,700	2	0.8
	1,701 - 2,300	2	0.8
	> 2,301	2	0.8
Extent of affordability of soursop	Not applicable	16	67.6
	Not affordable	31	12.9
	Least affordable	23	9.5
	Affordable	17	7.1
	Very affordable	7	2.9

Source: Field survey, 2024

Level of consumption of soursop

Results on Table 3 reveal that almost half (49.8%) of the respondents claimed that they had never consumed soursop fruits, did not include soursop in their diet (59.3%), never bought soursop fruits for personal consumption in the past six months (74.3%), nor purchased soursop products, such as juices or supplements (75.9%). This means that majority of the residents have never consume soursop fruits and its products. This confirms the *apriori* expectation that soursop fruits are under-consumed fruits. Considering the high level of literacy of the respondents, one would have expected that they would have acquired knowledge about the numerous benefits in consuming the fruits and therefore take it as part of their diet. This aligns with Abiona & Adegoke, (2021) that soursop is one of the underutilised varieties of wild fruits in Nigeria despite its abundance.

However, among the few that consumed soursop, 18.3% indicated that they recommended soursop to others for its health benefits, 9.1% considered soursop as a part of their overall health and wellness routine, while 7.1% also involved in the cultivation of soursop for easy and regular consumption. This implies that, respondents that consumed soursop suggest that if regularly consumed, soursop is truly a beneficial fruits and can improve one's health on a long term.

Table 3 also shows that more than half (58.5%) of the respondents had a low level of consumption of soursop. This supports Afzaal et al. (2022) that despite its significant nutritional profile and therapeutic potential, which can be utilized for developing nutraceuticals and medicines, the fruit is still underutilised.

Table 3: Distribution of respondents based on their consumption of sour-sop (n=241)

Statements	MLM (%)	LM (%)	U (%)	NLM (%)
I have never consumed soursop.	49.8	5.4	2.5	42.4
I do not consume soursop because too much of it is detrimental to my health.	31.5	0.0	3.3	65.1
I have bought soursop for personal consumption in the past six months.	2.9	10.0	2.9	84.3
I include soursop in my regular diet.	4.6	19.5	5.4	70.5
I actively seek information about the nutritional benefits of soursop**.**	5.4	19.1	8.3	67.3
I have used soursop in preparing meals or beverages at home.	2.1	14.1	7.5	76.4
I consider soursop as a part of my overall health and wellness routine.	9.1	21.6	6.6	62.7
I have recommended soursop to others for its health benefits.	18.3	11.6	6.6	63.5
I consume soursop products, such as juices or supplements.	2.5	6.2	3.3	87.9
I am involved in the cultivation of soursop for easy and regular consumption.	7.1	8.7	2.9	81.3
I actively participate in community initiatives promoting soursop consumption and cultivation.	3.3	12.0	5.8	78.8
Soursop consumption is a regular part of cultural or traditional practices in my community.	7.1	7.1	9.5	76.3

Level of consumption	Frequency	%	Min. value	Max. value	Mean±SD
Low level (12.0-24.0)	141.0	58.5	12.00	57.00	24.90±12.48
High level (25.0-57.0)	100.0	41.5			

Source: Field survey, 2024

Constraints affecting respondents' consumption of sour-sop

Result in Table 4 reveals that limited promotion and marketing (WS = 176.3), seasonal variability (WS = 170.2), accessibility issues (WS = 167.6), limited awareness (WS=166.4), and limited culinary knowledge about the use of soursop (WS=161.4) were the major constraints to the consumption of soursop as they ranked 1st, 2nd, 3rd, 4th, and 5th, respectively. This means that respondents would consume soursop if there is unlimited promotion on soursop and, if they could get and have access to the fruit all season. This aligns with Mohan *et al* (2023) that major challenges faced by sour-sop growers, producers and consumers is the limited promotion and marketing efforts, which has severely constrained the commercialisation and consumption of the fruit and its products. This result also supports

Araújo *et al* (2021), who found that majority are constrained due to lack of proper storage facilities, limited knowledge about value-addition and inadequate promotion and marketing efforts.

Table 4 still reveals that majority (64.7%) were highly constrained in the consumption of soursop. This implies constraints are severe and enormous. This could be one of the reasons for their low level of consumption of soursop.

Table 4: Distribution of respondents based on the constraints affecting their consumption of sour-sop (n=241)

Constraint items	**Major constraint**	**Lesser constraint**	**Not a constraint**	**Weighted score**
Limited promotion and marketing	84.2	7.9	7.9	176.3
Seasonal variability	80.1	10.0	10.0	170.2
Accessibility issues	78.0	11.6	10.4	167.6
Limited awareness	77.2	12.0	10.8	166.4
Competing preferences	75.1	12.4	12.4	162.6
Limited culinary knowledge	74.7	12.0	13.3	161.4
Environmental concerns	73.9	11.6	14.5	159.4
Health and safety regulations	73.4	12.0	14.5	158.8
Infrastructure challenges	72.6	12.0	15.4	157.2
Perceived health risks	55.6	10.4	34.0	121.6
Cost and affordability	49.8	12.9	37.3	112.5
Cultural beliefs and practices	19.9	13.7	66.4	53.5
Constraint category	**%**	**Min. value**	**Max. value**	**Mean±SD**
Low (0.0-17.0)	35.3	0.00	24.00	17.67±5.64
High (18.0-24.0)	64.7			

Source: Field survey, 2024 (%= Percentage, Min. = Minimum and Max. = Maximum)

Relationship between selected socioeconomic characteristics and consumption of soursop

Table 5 shows that there was significant relationship between respondents' sex (χ^2 = 1.47, p = 0.03), age (r = 0.186, p = 0.004), monthly income (r = -0.186, p = 0.004) and consumption of soursop fruit. The implication is that respondents' gender, age and monthly income are related to consumption of soursop.

Gender relationship corroborates the findings of Lemos *et al* (2020) that men used the fruits due to their involvement in agricultural activities and management of fruit trees, including sour-sop. Also, the inverse relationship that is observed between respondents' monthly income and consumption of soursop indicates that respondents with higher monthly income tend to consume less soursop and vice versa. That is, low-income earners tend to consume soursop more. This supports the findings of Ramkissoon and Ali (2018) that the utilisation of soursop decreases with increase in the income of the respondents. This could be attributed to the fact that high-income earners have more access to exotic fruits and may therefore not depend on soursop as a major source of fruit consumption.

Table 5: Chi-square and PPMC analysis showing relationship between selected socioeconomic characteristics and consumption of sour-sop (n=241)

Variables	**χ^2 values**	**df**	**p-value**
Sex	1.47	1	0.030
Education qualification	3.35	4	0.714
Occupation	2.69	4	0.098
Religion	1.58	2	0.108
Marital status	2.18	3	0.213
Variables	**r-value**		**p-value**
Age	0.186	-	0.004
Monthly income	-0.186	-	0.004

Source: Field survey, 2024

Determinants of soursop fruits consumption

From the results in Table 6, residents' age (β =0.44; p=0.00) and price of soursop fruits (β =0.26; p=0.01) were found to major determinants of the consumption of soursop fruits. This implies that residents' age and price of soursop fruits contributed and influenced to their consumption of soursop fruits. Age contributes 40% of the variation in the rate or likelihood of respondents' consumption of soursop, while price of the fruits accounted for 26%

of the variation. This is against the prior expectation, as one would expect that price of soursop should be the major determinant of consuming it. As it were, higher contribution of age percentage could be attributed to them intending to take their health seriously as they age.

Table 6: Determinants of soursop fruits consumption

Variables	Beta value	t-value	P-value
(Constant)		4.761	0.000
Age	0.440	4.452	0.000
Monthly income	-0.053	-0.547	0.586
Price of sour-sop	0.255	2.583	0.012
Index of constraint of soursop	-0.147	-1.539	0.128

R= 0.569, R^2= 0.324, Adjusted R^2= 0.288, S.E = 10.3

CONCLUSION AND RECOMMENDATIONS

This study concludes that despite respondents' high level of literacy coupled with several accrued benefits in consumption of soursop fruits, majority of the residents do not consume the fruits. This is probably hindered by limited promotion or marketing, seasonal variability nature of the fruit, easy accessibility issues and limited awareness about the fruit as implicated in the results of the constraints to consumption of soursop. Residents' age and price of the fruits influenced their level of consumption of soursop. Therefore, a campaign on numerous benefits accrued in soursop fruits should be embarked upon by all stakeholders. To achieve this, a collaborative effort from agriculture stakeholders, health practitioners and communication development experts is highly recommended.

REFERENCES

Abiona, D. L., and Adegoke, J. A. (2021). Antioxidant potential and nutritional composition of Soursop (*Annona muricata)* fruit pulp. *International Journal of Food Properties,* 24(1), 1208-1217.

Afzaal, M., Saeed, F., Asghar, A., Abbas Shah, A., Ikram, A., Ateeq, A., Hussain, M., Ofoedu, C., and Chacha, J. (2022). Nutritional and Therapeutic Potential of Soursop. *Journal of Food Quality.* https://doi.org/10.1155/2022/8828358

Akib, N. A. M., Yusof, Z. N. B., and Nordin, M. L. (2023). Optimisation of *Annona muricata* (Soursop) leaf extract using ultrasound-assisted extraction as functional ingredients in yogurt, *Foods*, 12(1), 133.

Akhmet Dyussenbayev (2017). Age Periods of Human Life. Advances in Social Sciences Research Journal 4(6) DOI:10.14738/assrj.46.2924

Araújo, E. R., Fontes, M. S., Almeida, J. R., and Sousa, E. P. (2021). Soursop (*Annona muricata* L.): An underexploited fruit with potential for food and pharmaceutical industries. *Food Chemistry,* 359, 129944.

Del Carmen, D., Esguerra, E., and Gerance, A. (2020). Consumer Purchasing Behavior for Fresh Soursop (Annona muricata L.) Evidence from Metro Manila and CALABARZON, Philippines. *Philippine Agricultural Scientist.* 103. 132-139. 10.62550/FL20070019.

Ho, S. H., Lim, B. Y., Leow, A. T. C., and Nurul-Syahkira, M. H. (2021). Exploring the potential of Soursop vinegar as a new functional beverage. *Journal of Food Science and Technology*, 58(11), 4174-4185.

Lemos, D. S. D. S., Nunes, G. P., da Silva Lemos, P. P., de Sousa, C. V., Soares, L. A., da Silva, J. P., and da Silva, C. G. (2020). Gender and age influences on indigenous knowledge of edible plant use in Southern Brazil. *Ethnobotany Research and Applications*, 20, 1-16.

Mohan, S., Lal, S., and Tarafdar, A. (2023). Soursop (*Annona muricata* L.): Opportunities and Challenges for Commercialization. In: Advances in Underutilized Fruit Production and Value Addition. Springer, Singapore, pp. 131-153.

Muhammad, S., Hassan, L. K., Yahya, R., Yusuf, A., Muhammed, M. I., and Lee, W. Y. (2022). Extraction and characterization of Soursop seed oil; prospective application in foods and nutraceutical products. *Food Chemistry,* 383, 132413.

Nguyen, T. B. T., Nguyen, T. T., and Le, N. H. T. (2019). Effect of development stages on physiochemical, antioxidant and sensory properties of Soursop fruit. *International Journal of Food Properties*, 22(1), 1732-1744.

Odojie, H., and Oluwatoyin, M. O. (2022). *Annona muricata* L. (Soursop): Ethnomedicinal Uses and Biological Activities. Proceedings of the 1st International Conference on Functional Foods and Nutraceuticals, 186-202.

Quemems, G. (2023). Soursop; Agronomy, production and utilization. *IJCS*, 11(1), 1-12.

ADAPTATION STRATEGIES ADOPTED BY CASSAVA FARMERS IN ETCHE LOCAL GOVERNMENT AREA, RIVERS STATE, NIGERIA

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ABSTRACT

This study examined the adaptation strategies adopted by cassava farmers in Etche Local Government Area, Rivers State, in response to climate change. The objectives of the study were to describe the socio-economic characteristics of the respondents, identify source of information on adaptation strategies to climate change, determine adaptation strategies used in the study area, and constraints in using climate change adaptation strategies. A three-stage sampling technique was used to collect data from 120 cassava farmers through structured questionnaires, analyzed using descriptive statistics and Ordinary Least Squares (OLS) regression. Majority (54.17%) of the respondents were female, 48.33% had 10-15 years educational qualification, while 41.67% had above 10 years farming experience. Farmers primarily accessed climate adaptation information through interaction with peers (56.7%) and social media (49.2%). Major adaptation strategies included the use of organic manure ($\bar{x}$ = 3.04), improved cassava varieties ($\bar{x}$ = 3.00), and adjusting land preparation timing ($\bar{x}$ = 2.93). Key constraints were high labour costs ($\bar{x}$ = 2.95), poor extension services ($\bar{x}$ = 2.88), lack of government support ($\bar{x}$ = 2.88), and land tenure issues ($\bar{x}$ = 2.82). Marital status ($t = 2.468$, $p < 0.05$), household size ($t = 3.287$, $p < 0.01$), education level ($t = 2.864$, $p < 0.01$), monthly income ($t = 3.871$, $p < 0.01$), and extension contact ($t = 2.314$, $p < 0.05$) were significantly associated with adaptation adoption. The study concluded that marital status, household size, educational status, monthly income and extension contact socio-economic factors strongly influence climate change adaptation. It recommends strengthening extension services, capacity building in climate-smart agriculture, and enhanced government and institutional support through subsidies and infrastructure development.

Keywords: Climate change, Adaptation strategies, Cassava, Farmers.

INTRODUCTION

Cassava is a staple and food security crop which generates income for millions of people in Africa. It is grown mainly for its tuberous roots; the leaves are fed to livestock and also eaten in some parts of the world (Henri-Ukoha, 2020), and they are good sources of carbohydrates, protein, vitamins, and minerals (Bayatagna, 2019). The cassava tubers are also used as raw materials in the garment, bakery, food, and pharmaceutical industries (Immanuel et al., 2024). Its adaptability allows it to be processed into various forms such as garri, fufu, and tapioca, which are integral to Nigerian diets. Beyond its dietary importance, cassava serves as a raw material in industries producing starch, sweeteners, biofuels, and biodegradable products, thereby contributing to both food security and economic development (Ekanem & Umoh, 2024).

After rice and maize, cassava is the third-most-significant source of calories in Africa's tropical and subtropical regions (Food and Agriculture Organisation, FAO, 2020), which is commonly grown in several sub-Saharan African nations (Osuji et al., 2023). Nigeria is the major producer of cassava on a global scale, followed by South-East Asia, Brazil, Indonesia, Thailand, and Vietnam (FAO, 2021), and the production of cassava in Nigeria accounts for up to 20 per cent of the world, about 34 per cent of Africa's and about 46 per cent of West Africa's (FAO, 2019a). Over 90% of Nigeria's rural families routinely consume cassava (Osuji et al., 2023).

Although cassava tolerates all soil types, its productivity is adversely affected by weather and the changing climate. Cassava cultivation is increasingly vulnerable to the impacts of climate change. Changes in temperature and precipitation patterns can affect cassava yields and quality. For instance, elevated temperatures and altered rainfall can lead to increased pest and disease prevalence, adversely impacting cassava production (Emenyonu et al., 2020). It has been widely reported that climate also plays a major role in altering the development of cassava pests and pathogens, shifting their interactions (FAO, 2019b).

In Nigeria, cassava farming is predominantly managed by smallholder farmers who rely on traditional agricultural practices. These farmers often have limited access to modern farming technologies and inputs, making them particularly susceptible to climate-related challenges. The combination of minimal mechanisation and dependence on rain-fed agriculture exacerbates their vulnerability to climate variability. As climate change intensifies, these farmers face increased risks of reduced productivity and income instability. Climate change is seen as changes in climate initiated by anthropogenic activities and intrinsic variation that changes the composition of the global atmosphere observed over a comparable period (Agriculture Management Information System,

AMIS, 2018). Climate change is mainly attributed to such human activities as gas flaring, burning of fossil fuels, and deforestation for agricultural and industrial uses, which results in the release of high concentrations of greenhouse gases to the atmosphere (Henri-Ukoha, 2020). The evidence of climate change is real, and its consequences are being felt globally, with poor rural households in developing countries bearing the brunt of the burden (Omerkhil et al., 2020). Therefore, farmers need to be equipped with recent knowledge and information on climate change and agronomic practices to enable them to cope with climate change and other socio-economic conditions (Henri-Ukoha & Osuji, 2017). This will help in the development of suitable and effective adaptation options, which will increase the adaptive capacities of farmers.

Farm households used several adaptation strategies to resist the various risks posed by climate change. These adaptation strategies include variation in sowing time, the use of improved crop variety (e.g., stress-tolerant variety), and shifting to new crops (Stringer et al., 2020; Ojo and Baiyegunhi, 2020). Adaptation strategies can also involve varying land size, sales of crops, mulching, application of agrochemicals, livestock rearing, mixed cropping, mono-cropping, water and soil conservation practices, among others (Asfaw et al., 2018; Danso-Abbeam et al., 2021). These farm-household strategies could significantly reduce risk and, as a result, reduce the negative impact of climate change (Danso-Abbeam et al., 2021).

The issue of climate change is crucial for the agricultural industry, particularly in poor nations where farming largely depends on climatic factors like rainfall and temperature (Omodara et al., 2023). Thus, the looming threat of climate change necessitates proactive measures to protect and sustain cassava production. By adopting targeted adaptation strategies, cassava farmers can enhance their resilience against climate-induced challenges, ensuring the continued contribution of cassava to the nation's food systems and economic development.

In Rivers State, particularly cassava farming is predominantly rain-fed and heavily reliant on traditional agricultural practices. This dependence on consistent climatic conditions renders cassava cultivation highly susceptible to the adverse effects of climate change. Recent studies have highlighted that fluctuations in temperature and precipitation patterns significantly impact cassava yields, leading to food insecurity and economic instability among farming communities (Ajiere & Weli, 2018). Despite the recognition of climate change impacts, there is a paucity of localized research focusing on effective adaptation strategies tailored for cassava farmers in Etche Local Government Area, Rivers State. Existing studies have often generalized findings across broader regions, failing to account for the unique environmental and socio-economic contexts of this specific area. This gap in localized knowledge hinders the development and implementation of targeted interventions that could enhance the resilience of cassava farmers against climate-induced challenges.

Moreover, while some farmers have adopted indigenous coping mechanisms, these strategies are frequently based on traditional knowledge and may not suffice to combat the escalating threats posed by climate variability. The lack of access to modern agricultural technologies, climate-resilient cassava varieties, and comprehensive extension services further exacerbates the vulnerability of these farmers. Without empirical research to identify and promote effective adaptation strategies, cassava production in the region faces a potential decline, threatening both livelihoods and food security. Therefore, this study investigates the climate change adaptation strategies that are specifically suited to the cassava farmers in Etche Local Government Area, Rivers State. The aim is to bridge the existing knowledge gap by providing actionable insights and recommendations.

The broad objective of this study is to investigate the climate adaptation strategies employed by cassava farmers in Etche Local Government Area, Rivers State.

Specifically, this study is to:

1. describe the socio-economic characteristics of cassava farmers in Etche Local Government Area, Rivers State,
2. identify the sources of information on adaptation strategies to climate change adopted by cassava farmers in Etche Local Government Area, Rivers State;
3. determine the major adaptation strategies to climate change adopted by cassava farmers in Etche Local Government Area, Rivers State; and
4. ascertain the constraints in using viable climate change adaptation strategies by cassava farmers in Etche Local Government Area, Rivers State.

The null hypothesis that was tested in this study is stated that there is no significant relationship between socio-economic characteristics of the cassava farmers and the adaptation strategies to climate change adopted by cassava farmers in Etche Local Government Area, Rivers State.

METHODOLOGY

The study area is Etche Local Government Area (LGA), in Rivers State, Nigeria. Etche is in Agricultural zone 2, as part of the Agricultural Development Programme (ADP) structure within the State. Each zone is further subdivided into blocks and circles to facilitate agricultural extension services and project implementation. Rainfall is generally seasonal, variable, as well as heavy, and

occurs between March and October through November. The wet season peaks in July, lasting more than 290 days. Temperatures throughout the year are relatively constant with little variation throughout the seasons. Average temperatures are typically between 25°C and 28 °C (77°F and 82 °F) (Okeowo et al., 2022). The population of this study comprises cassava farmers in Etche LGA, Rivers State. Etche Local Government Area (LGA) is one of the four LGAs within Agricultural Zone II of Rivers State, which also includes Ahoada East, Ahoada West, Ogba/Egbema/Ndoni, and Omuma LGAs. Etche LGA was purposively selected due to its agrarian nature and comprises of three (3) blocks. A three-stage sampling procedure was used to select the sample for this study. In the first stage, all three blocks in Etche were selected for inclusivity and comprehensive representation of the area. The second stage involved a random sampling of four circles out of eight circles within each block. The final stage involves randomly sampling ten (10) cassava farmers from each circle, ensuring a total of 120 respondents for the study.

Table 1: Sampling Summary

Sampling stage	Units selected	Total units selected
1 — First stage	All blocks in Etche	3 blocks
2 — Second stage	4 circles per block	3 blocks × 4 circles = 12 circles
3 — Third stage	10 farmers per circle	12 circles × 10 farmers = 120 farmers

Field Survey, 2025

The primary instrument for data collection in this study is a structured questionnaire designed to align with the study's objectives. A midpoint value of 2.5 was established to interpret the responses in objective three and four. Mean scores equal to or greater than 2.5 indicate agreement or a high level of adoption, while mean scores below 2.5 signify disagreement or a low level of adoption. The data collected for this study were analysed using descriptive and inferential statistical tools. Objectives one, two, three, and four were analysed using frequency counts, percentages, and mean scores, while the hypothesis was tested using Ordinary Least Squares regression analysis.

Model Specification for the Ordinary Least Squares Regression Analysis is stated as follows:

$Y = f(X1, X2, X3, X4, X5, X6, X7, X8, X9, X10, e)$

Where Y is the Pooled index of the adaptation strategies to climate change adopted by cassava farmers in Etche Local Government Area, Rivers State, measured with a 4-point Likert scale of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1).

X_1 = Gender (Dummy: Male = 1, Female = 0)
X_2= Marital status (Dummy: Married = 1, Single= 0)
X_3= Household size (No. of persons)
X_4 Age (Years)
X_5 = Educational Status (No. of years spent in school)
X_6 = Farming experience (No. of years)
X_7 = Monthly income (Naira)
X_8 = Farm size (Ha)
X_9= Cooperative membership (Yes= 1, No =0)
X_{10}= Extension contact (Yes= 1, No =0)
E = Error term
It is expected a priori that the coefficients of X1, X2, X3, X4, X5, X6, X7, X8, X9, X10 >0

RESULTS AND DISCUSSION

Socioeconomic characteristics

Table 2 reveals the socio-economic characteristics of cassava farmers in the study area. The findings show that female farmers (54.17%) participate more than their male counterparts (45.83%) which aligns with the observations of Ukonu et al., (2023), who noted that women play a significant role in agricultural production, especially in root and tuber crops in Nigeria. The majority (35.83%) of the farmers were between the age ranges of 46-55. This suggests a mature and active workforce, which is critical for labour-intensive crops like cassava. The relatively low representation of younger adults reflects the growing concern of youth disengagement in agriculture, a trend also reported by Fawole & Ozkan (2019) and Mukwedeya & Mudhara (2024). Most (62.5%) of the farmers were married. Household size (45.83%) is relatively large among respondents, with the majority of them having 6-10 members which may influence labour availability on farms. Majority (48.33%) of the cassava farmers spent between 10-15 years in formal education. This implies a moderate literacy level among the farmers, which could influence their adoption of innovations. Farm size distribution shows that nearly half (49.17%) of the respondents cultivate between 1–3 hectares indicating a dominance of small-scale farming. On income levels, the highest proportion (33.33%) earn between ₦501,000 and ₦1,000,000 monthly, few earn less than ₦100,000 (while 6.67%), reflecting a varied income range among farmers. Based on the level of experience, most farmers (81.67%) have over 6 years of farming experience, indicating a knowledgeable and seasoned farming population. However, access to extension services is limited, with only a few (40.83%) farmers reporting access to extension services which could hinder technology

dissemination. This is consistent with Adzenga & Dalap (2023), who stressed that inadequate extension contact hampers technology transfer in agriculture.

Table 2: Distribution of the Socio-economic Characteristics of Cassava Farmers in the Study Area

Variables		Frequency	Percentage (%)
Sex	Male	55	45.83
	Female	65	54.17
Age	Below 25	11	9.17
	25-35	19	15.83
	36-45	28	23.33
	46-55	43	35.83
	Above 55	19	15.83
Marital Status	Single	45	37.50
	Married	75	62.50
Household Size	1-5	22	18.33
	6-10	55	45.83
	11-15	32	26.67
	Above 15	11	9.17
Educational Qualification (Yrs)	Above 15	29	24.17
	10-15	58	48.33
	Below 10	33	27.50
Farm Size	> 5 hectares	8	6.67
	3-5 hectares	21	17.50
	1-3 hectares	59	49.17
	Below 1 hectare	32	26.67
Monthly Income	Less than ₦100,000	8	6.67
	₦100,000 – ₦300,000	19	15.83
	₦301,000 – ₦500,000	28	23.33
	₦501,000 – ₦1,000,000	40	33.33
	Above ₦1,000,000	25	20.83
Years of Experience	1-5	22	18.33
	6-10	48	40.00
	Above 10	50	41.67
Extension service	Access	49	40.83
	No Access	71	59.17
Number Extension Visits	None	71	59.17
	1-3 visits	39	32.50
	3-5 visits	10	8.33
Cooperative Membership	Member	58	48.33
	Non-member	62	51.67

Field Survey, 2025

Sources of information on adaptation strategies to climate change adopted by cassava farmers

Table 3 reveals that cassava farmers in the study area primarily relied on fellow farmers (56.7%) and social media (49.2%) for information on climate change adaptation strategies. This aligns with the findings of Kanu et al. (2021), who reported that peer networks significantly influence farmers' decision-making and innovation adoption. The high usage of social media supports Kanu et al. (2021), who observed the increasing role of digital platforms in agricultural information dissemination among rural farmers in Nigeria (Mapiye et al., 2023). Conversely, formal channels such as extension agents (39.2%), research institutions (8.3%), and extension bulletins (1.7%) were less utilized. This supports Lawal (2023), who noted the limited effectiveness of traditional extension services due to poor coverage and weak farmer-extension linkages.

Major adaptation strategies to climate change adopted by cassava farmers

According to Table 4, the most adopted adaptation strategies, as reflected by the highest mean values, were intensive use of organic manure ($\bar{x}$ = 3.04), use of improved cassava varieties ($\bar{x}$ = 3.00), and changes in the timing of land preparation ($\bar{x}$ = 2.93). These strategies suggest a strong shift towards soil fertility enhancement and the use of resilient varieties in response to changing climatic conditions.

Table 3: Percentage frequency of the sources of information on adaptation strategies to climate change adopted by cassava farmers in the study area

SN	Source of Information	Yes (%)	No (%)
1	Extension agent	47 (39.2)	73 (60.8)
2	Research institution	10 (8.3)	110 (91.7)
3	Social media	59 (49.2)	61 (50.8)
4	Fellow farmers	68 (56.7)	52 (43.3)
5	Seminars	15 (12.5)	105 (87.5)
6	Friends/relations	31 (25.8)	89 (74.2)
7	Farmers' co-operative	29 (24.2)	91 (75.8)
8	Extension bulletins	2 (1.7)	118 (98.3)
9	Radio programme	15 (12.5)	105 (87.5)
10	Television programme	8 (6.7)	112 (93.3)
11	Social organizations	24 (20.0)	96 (80.0)

Field Survey, 2025

These findings are consistent with the study by Henri-Ukoha (2020) and Oyetunde-Usman & Shee (2025), which highlighted farmers' preference for low-cost and yield-enhancing strategies in adapting to climate change. Similarly, the adoption of improved varieties has been reported by Effiong et al. (2024) as a critical response to climate variability due to their resilience and productivity under stress. Conversely, the low adoption of contour cropping ($\bar{x}$ = 1.46), drainage construction ($\bar{x}$ = 2.06), tree planting ($\bar{x}$ = 2.13), and alternative tillage methods ($\bar{x}$ = 2.05) suggests that structural or capital-intensive measures are less favoured. This supports the findings of Osuji et al. (2023), who reported that such strategies are often constrained by financial limitations, lack of technical knowledge, or land tenure insecurity among smallholder farmers.

Table 4: Adaptation Strategies to Climate Change Adopted by Cassava Farmers in the Study Area

S/N	Adaptation Strategies	SA (%)	A (%)	D (%)	SD (%)	$\bar{x}$	SD
1	Irrigation practices	20 (16.7)	57 (47.5)	19 (15.8)	24 (20.0)	2.61**	0.97
2	Use of improved cassava varieties	40 (33.3)	54 (45.0)	12 (10.0)	14 (11.7)	3.00**	0.89
3	Crop rotation	24 (20.0)	50 (41.7)	27 (22.5)	19 (15.8)	2.66**	0.98
4	Changes in planting and harvesting dates	17 (14.2)	51 (42.5)	33 (27.5)	19 (15.8)	2.55**	0.94
5	Mulching/cover cropping	11 (9.2)	44 (36.7)	45 (37.5)	20 (16.7)	2.38*	0.91
6	Soil and water conservation techniques	10 (8.3)	42 (35.0)	43 (35.8)	25 (20.8)	2.31*	0.91
7	Reliance on climate information and forecasts	30 (25.0)	45 (37.5)	33 (27.5)	12 (10.0)	2.78**	0.98
8	Construction of drainages	14 (11.7)	28 (23.3)	29 (24.2)	49 (40.8)	2.06*	1.06
9	Intensive use of organic manure	51 (42.5)	41 (34.2)	10 (8.3)	18 (15.0)	3.04**	0.94
10	Land rotation	12 (10.0)	54 (45.0)	40 (33.3)	14 (11.7)	2.53**	0.89
11	Mixed cropping	27 (22.5)	37 (30.8)	43 (35.8)	13 (10.8)	2.65**	0.95
12	Terracing	19 (15.8)	29 (24.2)	46 (38.3)	26 (21.7)	2.34*	0.93
13	Contour cropping across hill slopes	0 (0.0)	8 (6.7)	39 (32.5)	73 (60.8)	1.46*	0.71
14	Use of different tillage systems	12 (10.0)	25 (20.8)	40 (33.3)	43 (35.8)	2.05*	0.93
15	Tree planting	17 (14.2)	19 (15.8)	46 (38.3)	38 (31.7)	2.13*	0.95
16	More frequent weeding	23 (19.2)	58 (48.3)	20 (16.7)	19 (15.8)	2.71**	0.92
17	Changes in timing of land preparation	38 (31.7)	49 (40.8)	20 (16.7)	13 (10.8)	2.93**	0.93
18	Use of herbicides	18 (15.0)	55 (45.8)	19 (15.8)	28 (23.3)	2.53**	0.96
19	Shortened bush fallowing	28 (23.3)	39 (32.5)	25 (20.8)	28 (23.3)	2.56**	0.99

Field Survey, 2025; ** Agee; *Disagree

Constraints in using viable climate change adaptation strategies by cassava farmers

The findings from Table 5 show that the most common constraint to using viable climate change adaptation strategies in the study area was the high cost of labour ($\bar{x}$ = 2.95). Similarly, poor extension services ($\bar{x}$ = 2.88), lack of government support ($\bar{x}$ = 2.88), and land tenure issues ($\bar{x}$ = 2.82) were also highly rated. This aligns with the findings of Henri-Ukoha (2020), who emphasized that labour-

intensive practices in rural Nigeria are often hindered by high labour costs, especially during peak farming periods. Institutional barriers such as poor extension services and lack of government support (both $\bar{x}$ = 2.88) further compound the problem, reflecting weak linkages between policy frameworks and grassroots implementation, an issue previously reported by Osuji et al. (2023).

Table 5: Constraints in using viable climate change adaptation strategies by cassava farmers in the study area

S/N	Constraints	SA (%)	A (%)	D (%)	SD (%)	$\bar{x}$	SD
1	High cost of labour	38 (31.7)	51 (42.5)	18 (15.0)	13 (10.8)	2.95**	0.96
2	Inadequate information on climate change issues	21 (17.5)	54 (45.0)	34 (28.3)	11 (9.2)	2.71**	0.84
3	High incidence of pests and diseases	20 (16.7)	47 (39.2)	39 (32.5)	14 (11.7)	2.61**	0.88
4	Poor extension services	31 (25.8)	56 (46.7)	20 (16.7)	13 (10.8)	2.88**	0.92
5	Inadequate credit facilities to adopt practices	25 (20.8)	59 (49.2)	19 (15.8)	17 (14.2)	2.77**	0.95
6	Low capital	23 (19.2)	50 (41.7)	24 (20.0)	23 (19.2)	2.61**	1.00
7	Land tenure issues	27 (22.5)	54 (45.0)	29 (24.2)	10 (8.3)	2.82**	0.88
8	Scarcity of drought-resistant varieties	18 (15.0)	37 (30.8)	31 (25.8)	34 (28.3)	2.33*	1.08
9	High cost of drought-resistant varieties	21 (17.5)	49 (40.8)	31 (25.8)	19 (15.8)	2.60**	0.96
10	Conflict in the community	12 (10.0)	29 (24.2)	40 (33.3)	39 (32.5)	2.12*	1.02
11	High insecurity levels	18 (15.0)	30 (25.0)	42 (35.0)	30 (25.0)	2.30*	1.04
12	Ignorance of climate change issues	20 (16.7)	33 (27.5)	37 (30.8)	30 (25.0)	2.36*	1.04
13	Poor market network	18 (15.0)	30 (25.0)	42 (35.0)	30 (25.0)	2.30*	1.04
14	High incidence of floods	21 (17.5)	49 (40.8)	31 (25.8)	19 (15.8)	2.60**	0.96
15	Low returns from cassava sales	28 (23.3)	40 (33.3)	30 (25.0)	22 (18.3)	2.62**	1.02
16	High cost of transportation	21 (17.5)	56 (46.7)	30 (25.0)	13 (10.8)	2.71**	0.88
17	Lack of government support	29 (24.2)	60 (50.0)	18 (15.0)	13 (10.8)	2.88**	0.91
18	Delay in government response	23 (19.2)	57 (47.5)	20 (16.7)	20 (16.7)	2.69**	0.96
19	Poor road network	23 (19.2)	50 (41.7)	24 (20.0)	23 (19.2)	2.61**	1.00
20	Stealing of farm produce	21 (17.5)	49 (40.8)	31 (25.8)	19 (15.8)	2.60**	0.96

Field Survey, 2025; ** Agee; *Disagree

Test of Hypothesis

The findings in Table 6 show that the semi-log function yielded an R^2 value of 0.869, indicating that approximately 86.9% of the variance in the climate change adaptation strategies adopted by cassava farmers can be explained by their socio-economic characteristics. Marital status (X_2) exhibits a positive and significant relationship with a coefficient of 0.077 (t = 2.468), suggesting that married farmers are more likely to adopt climate change adaptation strategies. The findings align with existing literature, which emphasizes the role of socio-economic factors in shaping farmers' responses to climate variability and environmental stressors. As supported by Henri-Ukoha (2020), socio-economic attributes such as education, household size, and access to extension services critically determine farmers' capacity and willingness to adapt to climate change. Similarly, household size (X_3) shows a strong positive relationship with a coefficient of 0.085 (t = 3.287), implying that larger households may adopt more strategies, possibly due to increased labour availability or a higher dependency on agriculture for household sustenance, and this finding is corroborated by Anarah et al. (2021), who noted that large households tend to have greater capacity to respond to climatic threats due to the availability of more labour and social support within the household unit. Educational status (X_5) also has a significant and positive effect (coefficient = 0.054, t = 2.864), indicating that farmers with higher levels of education are more likely to implement effective climate change adaptation strategies. Monthly income (X_7) is one of the most influential variables in the model, with a coefficient of 0.092 (t = 3.871), showing that wealthier farmers are more capable of affording and adopting diverse adaptation strategies. Extension contact (X_{10}) is another critical variable with a positive coefficient of 0.061 (t = 2.314), reflecting that frequent interaction with extension agents enhances awareness and the ability to implement appropriate adaptation measures.

Table 4.5: Showing the relationship between socioeconomic characteristics of cassava farmers and the adaptation strategies to climate change

Variables	Linear	+Semi-log	Exponential	Double-log
Constants	2.511	0.032	-13452.32	1.356
	(0.521)	(1.925)	(-2.013)	(3.012)***
Gender (X_1)	-1.123	0.014	-2450.23	-0.042
	(-0.412)	(0.634)	(-1.203)	(-0.823)
Marital Status (X_2)	0.401	0.077	214.57	0.062
	(1.242)	(2.468)**	(2.783)	(2.024)**
Household Size (X_3)	0.732	0.085	340.12	0.112
	(2.130)**	(3.287)***	(2.364)**	(2.768)***
Age (X_4)	-0.054	-0.003	-850.12	-0.018
	(-0.832)	(-1.476)	(-2.061)	(-1.352)
Educational Status (X_5)	0.923	0.054	745.84	0.087
	(2.541)**	(2.864)**	(1.972)**	(2.457)**
Farming Experience (X_6)	0.215	-0.002	120.57	-0.005
	(1.621)	(-0.731)	(1.342)	(-0.754)
Monthly Income (X_7)	1.473	0.092	5789.21	0.342
	(4.283) ***	(3.871)***	(4.236)***	(5.183)***
Farm size (X_8)	0.023	0.007	68.91	0.016
	(0.614)	(0.432)	(0.672)	(0.785)
Cooperative membership (X_9)	0.034	0.009	57.63	0.021
	(0.783)	(0.541)	(0.603)	(0.672)
Extension contact (X_{10})	0.618	0.061	340.45	0.089
	(2.812)**	(2.314)**	(2.489)**	(2.641)**
R^2	0.811	0.869	0.744	0.831
F-value	31.782	47.921	23.112	41.602
N	120	120	120	120

t-ratios are in parentheses; ** t-ratios significance at 5%, *** t-ratios significance at 1%

CONCLUSION AND RECOMMENDATIONS

The findings revealed that while farmers have adopted a range of strategies, such as the use of improved varieties, organic manure, and altered planting schedules, their reliance on informal information sources like fellow farmers and social media was significant. Formal support systems, such as extension services and research institutions, remained underutilized. Constraints such as high labour costs, poor access to credit, inadequate government support, and weak infrastructure continued to hinder effective adaptation. Marital status, household size, educational status, monthly income and extension contact influenced farmers' adoption of adaptation strategies, highlighting the need for targeted interventions to improve resilience and climate-smart farming practices among cassava farmers in the region.

Based on the findings, the recommendations include:

1. There is a need to strengthen the structure of agricultural extension services to improve farmers' access to formal adaptation information.
2. Capacity building and training on climate-smart agricultural practices should be regularly organized and promoted.
3. Increase government and institutional support for rural farmers through subsidies and infrastructure development.
4. Encourage the formation and support of farmers' cooperatives for knowledge sharing and group access to credit.
5. Promote the use of improved, climate-resilient cassava varieties.

REFERENCES

Adzenga, J. I., & Dalap, S. L. (2023). Agricultural technology transfer in Nigeria: A review of the challenges and prospects in the contemporary times. Journal of Agricultural Extension, 28(1), 21-29.

Agriculture Management Information System, AMIS. (2018). Agriculture Management Information System. Available:www.namis.gov.np

Ajiere, S. I., & Weli, V. E. (2018). Assessing the impact of climate change on maize (Zea mays) and Cassava (Manihot esculenta) yields in Rivers State, Nigeria. Atmospheric and Climate Sciences, 8(2), 274-285.

Anarah, S. E., Osuafor, O. O., Umeh, O. J., & Meludu, N. T. (2021). Small scale cassava producers' adaptation strategies to climate variability in Anambra State, Nigeria.

International Journal of Agriculture & Bioscience, 10(1): 1-5.

Asfaw, E., Suryabhagavan, K. V., & Argaw, M. (2018). Soil salinity modeling and mapping using remote sensing and GIS: The case of Wonji sugar cane irrigation farm, Ethiopia. Journal of the Saudi Society of Agricultural Sciences, 17(3), 250-258. https://doi.org/10.1016/j.jssas.2016.05.003 .

Bayatagna. A. (2019). Review on nutritional value of cassava for use as a staple food. *Science Journal of Analytical Chemistry*. 7, 91.

Danso-Abbeam, G., Ojo, T. O., Baiyegunhi, L. J., & Ogundeji, A. A. (2021). Climate change adaptation strategies by smallholder farmers in Nigeria: does non-farm employment play any role. *Heliyon*, *7*(6). 1-10. https://doi.org/10.1016/j.heliyon.2021.e07162.

Effiong, M. O., Uwah, E. D., & Akwo, T. C. (2024). Climate Change Adaptation Strategies and Technical Efficiency of Cassava Producers in Ikom Agricultural Zone of Cross River State, Nigeria. *Journal of Agriculture, Environmental and Resource Management*, *6*(4), 114-125.

Ekanem, J. T., & Umoh, I. M. (2024). Cassava Farmers' Indigenous Strategies for Climate Change Adaptation and Mitigation in Akwa Ibom State, Nigeria. In *Handbook of Nature-Based Solutions to Mitigation and Adaptation to Climate Change* (pp. 1-20). Cham: Springer International Publishing.

Emenyonu, C. A., Eze, C. C., & Ejike, O. U. (2020). Factors influencing cassava farmers' climate change risk perception in Anambra State, Nigeria. *American Journal of Climate Change*, *9*(3), 217-227.

FAO. (2019a). *Cassava for food and energy security: Investing in sustainable production systems*. Food and Agriculture Organization of the United Nations. Retrieved from https://www.fao.org/

Fawole, W. O., & Ozkan, B. (2019). Examining the willingness of youths to participate in agriculture to halt the rising rate of unemployment in South Western Nigeria. *Journal of Economic Studies*, *46*(3), 578-590.

Food and Agricultural Organization (2019b). Roots, tubers, plantain and banana in human nutrition. Toxic substances and nutritional factors. (under epidemic spastic para paresis). http://www.fao.org/docrip/t020TE00.htm.

Food and Agriculture Organisation, (2020). Climate change and agricultural production in Nigeria. Food and Agriculture Organisation of the United Nations, Rome Italy.

Henri-Ukoha, A, & Osuji, E. E. (2017). Determinants of Arable crop farmers' use-levels of sustainable soil management techniques in Imo State, Nigeria. Nigerian Journal of Agriculture, Food and Environment. 2017;13(2):163-168.

Henri-Ukoha, A. (2020). Assessment of the viability of climate adaptation strategies of cassava-based farmers in southern Nigeria. *Journal of Agriculture and Food Sciences*, *18*(1), 105-117.

Immanuel, S., Jaganathan, D., Prakash, P., & Sivakumar, P. S. (2024). Cassava for Food Security, Poverty Reduction and Climate Resilience: A Review. *Indian Journal of Ecology*, *51*(1), 21-31.

Kanu, I. M., Okezıe, C. R., & Nnah, S. G. (2021). Social Capital and Adoption of Cassava Innovation among Rural Farmers in Abia State, Nigeria. *Quantrade Journal of Complex Systems in Social Sciences*, *3*(2), 3-14.

Lawal, K. F. (2023). *Perceived Effectiveness of Public Extension Services Among Maize Based Smallholder Farmers in Kwara State, Nigeria* (Master's thesis, Kwara State University (Nigeria).

Mapiye, O., Makombe, G., Molotsi, A., Dzama, K., & Mapiye, C. (2023). Information and communication technologies (ICTs): The potential for enhancing the dissemination of agricultural information and services to smallholder farmers in sub-Saharan Africa. *Information Development*, *39*(3), 638-658.

Mukwedeya, B., & Mudhara, M. (2024). Factors affecting rural youth participation in the smallholder farming sector. *Journal of Agriculture, Food Systems, and Community Development*, *13*(4), 259-275.

Ojo, T. O., & Baiyegunhi, L. J. S. (2020). Determinants of climate change adaptation strategies and its impact on the net farm income of rice farmers in south-west Nigeria. *Land Use Policy*, *95*, 103946. https://doi.org/10.1016/j.landusepol.2019.04.007

Omerkhil, N., Chand, T., Valente, D., Alatalo, J. M., & Pandey, R. (2020). Climate change vulnerability and adaptation strategies for smallholder farmers in Yangi Qala District, Takhar, Afghanistan. *Ecological Indicators*, *110*, 105863. https://doi.org/10.1016/j.ecolind.2019.105863

Omodara, O. D., Ige, O. A., Oluwasola, O., Oyebanji, A. T., & Afape, O. O. (2023). Factors influencing cassava farmers' choice of climate change adaptation practices and its effect on cassava productivity in Osun State, Nigeria. *FARA Research Report, 7*(23), 274–288. https://doi.org/10.59101/frr072323

Osuji, E. E., Igberi, C. O., & Ehirim, N. C. (2023). Climate Change Impacts and Adaptation Strategies of Cassava Farmers in Ebonyi State, Nigeria. *Journal of Agricultural Extension*, 27(1), 35–48. https://doi.org/10.4314/jae.v27i1.4

Oyetunde-Usman, Z., & Shee, A. (2025). Farmer preferences for adopting drought-tolerant maize varieties: evidence from a choice experiment in Nigeria. *Renewable Agriculture and Food Systems*, *40*, e10.

Stringer, L. C., Fraser, E. D., Harris, D., Lyon, C., Pereira, L., Ward, C. F., & Simelton, E. (2020). Adaptation and development pathways for different types of farmers. *Environmental Science & Policy*, *104*, 174-189.https://doi.org/10.1016/j.envsci.2019.10.007.

Ukonu, B. U., Amadi, G., & Egesi, Z. O. (2023). Roles of Women in Building a Resilient Root and Tuber Crops Research for Prosperity in Nigeria. *Centennial*, 899.

OCUPATIONAL HAZARDS AND SAFETY MEASURES IN CASSAVA PRODUCTION AND PROCESSING IN AKWA IBOM AND OYO STATES, NIGERIA: A COMPARATIVE ANALYSIS

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ABSTRACT
Cassava production and processing in Nigeria expose workers to multiple occupational hazards, compromising health, productivity, and livelihoods. This study comparatively analyzed occupational hazards and safety measures among Cassava farmers and processors in Akwa Ibom and Oyo States. Specifically, it identified the hazards faced, assessed the utilisation of safety measures, and examined the contribution of selected socio-economic characteristics to hazard prevalence. A quantitative survey design was employed, with 200 respondents in Akwa Ibom and 110 in Oyo selected through multistage sampling. Data were collected via structured questionnaires and analyzed using descriptive statistics (frequency, percentage and mean) and multiple regression. Findings revealed that stress and fatigue (92.0%), insect bites (84.0%), and heat stress/dehydration (81.0%) were the most prevalent hazards, with higher musculoskeletal, skin, and respiratory problems reported in Akwa Ibom, and insect bites more common in Oyo. Safety measures such as PPE (85.2%), first-aid facilities (85.8%), and rest breaks (78.1%) were widely utilized, while participation in safety training (56.5%) and regulatory compliance (41.9%) were moderate to low. Regression analysis showed that sex ($\beta = 0.215$, $p = 0.009$) and household size ($\beta = 0.198$, $p = 0.011$) significantly predicted hazard prevalence ($R^2 = 0.182$, $p < 0.01$). The study concludes that gender roles and household composition influence occupational risk and recommends targeted, gender-sensitive training, strengthened regulations, and household-focused interventions to enhance safety in cassava value chains.
Keywords: Occupational hazards, safety measures, cassava production, Nigeria, comparative analysis

INTRODUCTION

Cassava is a staple crop in Nigeria, supporting millions of rural households and contributing to food security and income generation (Ekanem *et al*., 2023). Beyond its dietary role, cassava is a critical raw material for agro-allied industries, reflecting its economic importance (Ekanem and Umoh, 2024). However, production and processing expose workers to occupational hazards such as stress, fatigue, injuries, respiratory problems, insect bites, and harmful substances, which undermine productivity and health (Rai *et al*., 2021).

These hazards are not unique to Nigeria. Studies in Ghana and Ethiopia show that workplace risks significantly impair the productivity and welfare of agricultural workers (Baidoo *et al*., 2025; Ayenew *et al*., 2022). In Nigeria, cassava processing hazards range from physical injuries to chemical exposures and musculoskeletal disorders from repetitive tasks (Ewebiyi *et al*., 2020). Although safety measures such as personal protective equipment, first-aid facilities, and health regulations exist, compliance remains low (Ejilude *et al*., 2023; Ajala *et al*., 2022).

Despite prior studies on Oyo (Ejilude *et al*., 2023) and Kwara States (Ajala *et al*., 2022), comparative evidence across states is limited. Socioeconomic factors affecting hazard exposure and safety utilisation remain underexplored (Isiaka *et al*., 2025), highlighting the need for context-specific analyses. In Akwa Ibom, hazards such as heat stress, sawdust inhalation, and sharp-tool injuries threaten occupational health and livelihoods (Ibanga *et al*., 2025). In Oyo, workers face similar risks with limited access to protective equipment and safety regulations (Fapojuwo *et al*., 2021). These challenges jeopardize food security, livelihoods, and cassava's economic contribution (Sowunmi *et al*., 2021; Ndubueze-Ogaraku *et al*., 2020). This study provides a comparative analysis of occupational hazards and safety measures in Akwa Ibom and Oyo, generating evidence to guide occupational health policy and practice in Nigeria's cassava sector.

The broad objective of the study was to conduct a comparative analysis of occupational hazards and safety measures in cassava production and processing in Akwa Ibom and Oyo States, Nigeria. The specific objectives were to:

1. identify the occupational hazards faced by respondents in Akwa Ibom and Oyo States; and
2. identify the safety measures and regulations utilised in mitigating occupational hazards in Akwa Ibom and Oyo States.

The study hypothesized that there is no significant contribution of selected socio-economic characteristics to the level of prevalence of occupational hazards among the respondents.

METHODOLOGY

The study adopted a quantitative, comparative survey design to analyze occupational hazards and safety measures in cassava production and

processing in Akwa Ibom and Oyo States. The choice of Akwa Ibom and Oyo was informed by their strategic importance in Nigeria's cassava economy, with Akwa Ibom representing a South-South hub and Oyo serving as a leading producer in the South-West (Ikuemonisan *et al*., 2020; Borku *et al*., 2025). The study population comprised cassava farmers and processors.

In Akwa Ibom State, a multistage sampling technique was used to ensure representativeness. Two agricultural zones (Abak and Etinan) were randomly selected from six zones. One block was randomly chosen from each zone, followed by the random selection of two cells per block, resulting in four cells. Fifty respondents were randomly selected from each cell, giving a total of 200 respondents. This sample size was considered adequate for comparative and regression analyses and is consistent with similar agricultural occupational health studies that recommend samples above 150 for reliable statistical inference (Ifeanyi-Obi and Uloh, 2025a; Ewebiyi *et al*., 2020).

In Oyo State, a multistage sampling approach was also adopted. Three Local Government Areas (Atiba, Ibarapa, and Afijio), representing 9% of the state's 33 LGAs, were selected. Thereafter, 17.5% of registered cassava farmers and processors were proportionately sampled from each LGA based on official records, resulting in 110 respondents. The sample size met the minimum threshold for robust regression analysis and aligns with methodological recommendations for social science research (Ifeanyi-Obi and Uloh, 2025a; Ewebiyi *et al*., 2020).

Primary data were collected using a structured questionnaire. Occupational hazards were measured by asking respondents to indicate the occurrence of specific hazards, coded as Yes or No, and summarized using percentages. The prevalence of occupational hazards was further measured on a 3-point Likert scale (High = 3, Medium = 2, Low = 1) to generate a composite index used for inferential analysis. Safety measures and regulations were operationalized as binary variables indicating utilisation or non-utilisation of specific practices.

Data were analyzed using descriptive and inferential statistics. Percentages were used to address the first two objectives, while multiple regression analysis was employed to test the hypothesis on the contribution of selected socio-economic characteristics to the prevalence of occupational hazards. Multiple regression was appropriate because the dependent variable was continuous and influenced by multiple predictors. Key assumptions of linearity, independence of errors, and absence of multicollinearity were reasonably satisfied

The implicit regression model is given as:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6) + e \quad (1)$$

Where Y represents the prevalence of occupational hazards, X_1 . X_6 denote the socio-economic variables (sex, age, marital status, level of education, household size, and religion), and *e* is the stochastic error term.

The regression model is expressed as:

$$Y = \beta_0 + \beta_{1X_1} + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \mu \quad (2)$$

Where β_0 is the constant term, $\beta_1 - \beta_6$ are the coefficients of the explanatory variables, and μ represents the disturbance (error) term.

These explanatory variables were included based on evidence that socio-demographic factors significantly influence hazard exposure, health outcomes, and safety compliance among agricultural and industrial workers (Isiaka *et al*., 2025; Ifeanyi-Obi and Uloh, 2025a). Thus, the methodological approach integrates both descriptive and econometric analyses to provide robust insights into occupational health and safety within Nigeria's cassava value chain.

RESULTS AND DISCUSSION

Occupational hazards faced by respondents in Akwa Ibom and Oyo states

The most prevalent occupational hazards among cassava farmers and processors were stress and fatigue (92.0%), insect bites and stings (84.0%), and heat stress/dehydration (81.0%), while exposure to hazardous chemicals (41.9%), noise-induced hearing loss (58.1%), and slips, trips, or falls (61.3%) were least reported (Table 1).

Respondents in Akwa Ibom reported higher prevalence of musculoskeletal disorders, skin irritation, respiratory problems, cuts, burns, exposure to hazardous chemicals, slips, trips or falls, noise-induced hearing loss, and dust than those in Oyo State. Heat stress/dehydration and stress and fatigue were similarly high in both states, whereas insect bites and stings were more common in Oyo State.

Cassava production and processing expose workers to multiple hazards, with stress and fatigue, insect bites, and heat stress being most common, consistent with observations by Obinaju *et al*. (2022) and Ndubueze-Ogaraku *et al*. (2020). High stress and fatigue likely result from long working hours and repetitive manual tasks (Fatai *et al*., 2021), while heat stress reflects prolonged outdoor exposure (Ifeanyi-Obi and Uloh., 2025b).

Higher prevalence of musculoskeletal, skin, and respiratory issues in Akwa Ibom may stem from lower mechanization and limited use of protective equipment, echoing Fosu-Mensah *et al*. (2021). Greater incidence of insect bites in Oyo State may be due to environmental factors such as vegetation density.

These patterns highlight the need for targeted interventions, including provision of personal

protective equipment and context-specific safety training, as emphasized in studies by Adikwu *et al*. (2025) and Sapbamrer and Thammachai (2020). State-specific differences underscore that occupational safety strategies must be adapted to local conditions rather than adopting a uniform approach.

Table 1: Occupational hazards faced by respondents in Akwa Ibom and Oyo States

Occupational Hazard	Akwa Ibom (n=200)		Oyo (n=110)		Total (n=310)	
	Yes - %	No - %	Yes - %	No - %	Yes - %	No - %
Musculoskeletal disorders	75.0	25.0	59.1	40.9	69.4	30.6
Skin irritation or rashes	72.5	27.5	54.5	45.5	66.1	33.9
Respiratory problems	70.0	30.0	54.5	45.5	64.5	35.5
Cuts or lacerations	72.5	27.5	54.5	45.5	66.1	33.9
Burns or scalds	70.0	30.0	50.0	50.0	62.9	37.1
Exposure to hazardous chemicals	65.0	35.0	45.5	54.5	58.1	41.9
Slips, trips, or falls	67.5	32.5	50.0	50.0	61.3	38.7
Noise-induced hearing loss	65.0	35.0	45.5	54.5	58.1	41.9
Heat stress/dehydration	80.0	20.0	81.8	18.2	81.0	19.0
Insect bites and stings	82.5	17.5	90.9	9.1	84.0	16.0
Machinery / Equipment injuries	67.5	32.5	50.0	50.0	61.3	38.7
Dust	70.0	30.0	50.0	50.0	62.9	37.1
Stress and fatigue	87.5	12.5	100.0	0.0	92.0	8.0

Percentages are based on row totals within each state.
Source: Field survey (2024)

Safety measures and regulations utilised

The total sample showed high utilisation of personal protective equipment (PPE) (85.2%), availability of first-aid facilities (85.8%), and provision of adequate breaks (78.1%). Moderate uptake was observed for utilisation of safer work practices (60.0%) and participation in safety training/awareness (56.5%), while reporting of incidents (44.5%) and government regulation enforcement (41.9%) were comparatively low (Table 2).

Comparison between states indicated similar patterns. PPE use was almost identical in Akwa Ibom (85.0%) and Oyo (85.5%). First-aid facilities and adequate rest periods were also comparable. Slight differences appeared in participation in safety training (Akwa Ibom 57.5%; Oyo 54.5%) and reporting of incidents (Akwa Ibom 45.0%; Oyo 43.6%), while utilisation of safer work practices was equal in both states (60.0%). Government regulation and enforcement were slightly higher in Akwa Ibom (42.5%) than in Oyo (40.9%) (Table 2).

The overall high utilisation of PPE, first-aid facilities, and provision of breaks suggests that cassava farmers and processors are aware of basic safety measures, reflecting similar trends observed in agro-processing and manufacturing studies (Adikwu *et al*., 2025; Sapbamrer and Thammachai, 2020; Sehsah *et al*., 2020). Moderate engagement in safer work practices and training indicates partial integration of formal occupational safety strategies, consistent with findings from Fosu-Mensah *et al*. (2021) and Ndubueze-Ogaraku *et al*. (2020). Low levels of reporting incidents and reliance on government regulations highlight gaps in institutional support and enforcement, corroborating concerns raised by Gabriel *et al*. (2021) about weak regulatory frameworks in similar contexts.

The minimal differences between Akwa Ibom and Oyo States may reflect shared constraints in resources, training, and enforcement mechanisms. Slightly higher participation in safety training and regulation compliance in Akwa Ibom could be attributed to targeted extension programs and awareness initiatives documented in regional studies (Ifeanyi-Obi and Uloh, 2025a; Ndubueze-Ogaraku *et al*., 2020). Overall, the findings underscore the importance of strengthening formal safety structures, enhancing regulatory oversight, and promoting consistent training programs to reduce occupational risks in cassava production and processing.

Testing of hypothesis

The regression analysis (Table 3) shows that sex and household size were significant predictors of occupational hazard prevalence in cassava production and processing. For the total sample, the model explained 18% of the variation ($R^2 = 0.182$, $F = 4.29$, $p < 0.01$), with sex ($\beta = 0.215$, $p = 0.009$) and household size ($\beta = 0.198$, $p = 0.011$) contributing significantly. Age, marital status, education, and religion did not show significant relationships.

Table 2. Safety measures and regulations utilise in mitigating occupational hazards in Akwa Ibom and Oyo States

Safety Measure	Akwa Ibom (n=200)		Oyo (n=110)		Total (n=310)	
	Yes - %	No - %	Yes - %	No - %	Yes - %	No - %
Use of personal protective equipment (PPE)	85.0	15.0	85.5	14.5	85.2	14.8
Utilisation of safer work practices	60.0	40.0	60.0	40.0	60.0	40.0
Participation in safety training/awareness	57.5	42.5	54.5	45.5	56.5	43.5
Reporting of incidents to authorities	45.0	55.0	43.6	56.4	44.5	55.5
Government regulations and enforcement	42.5	57.5	40.9	59.1	41.9	58.1
Availability of first-aid facilities	86.0	14.0	85.5	14.5	85.8	14.2
Provision of adequate breaks and rest periods	78.0	22.0	78.2	21.8	78.1	21.9

Percentages are based on row totals within each state.
Source: Field survey (2024)

When disaggregated by state, Akwa Ibom exhibited similar trends: sex ($\beta = 0.228$, $p = 0.014$) and household size ($\beta = 0.202$, $p = 0.016$) were significant, with the model explaining 17.6% of the variation ($R^2 = 0.176$, $F = 3.82$, $p < 0.01$). In Oyo State, household size remained significant ($\beta = 0.194$, $p = 0.037$), while sex was marginal ($\beta = 0.204$, $p = 0.058$), with the model accounting for 18.9% of the variance ($R^2 = 0.189$, $F = 3.14$, $p < 0.05$). These results indicate that gender roles and household composition are key determinants of exposure to occupational hazards in cassava production and processing.

The analysis confirms that sex and household size are significant contributors to occupational hazard prevalence across cassava production and processing. The significance of sex reflects gendered divisions of labor, where women in Akwa Ibom undertake intensive processing tasks that heighten exposure, aligning with prior evidence on gender-specific occupational risks in rural Nigeria (Ifeanyi-Obi and Uloh, 2025a). In Oyo, the marginal role of sex suggests a more balanced participation of men and women, reducing the direct effect of gender on hazard outcomes.

Household size consistently predicted hazard prevalence, supporting findings by Ajala *et al.* (2022) that larger households rely heavily on family labor, increasing exposure risk. This underscores that labor intensity within households amplifies vulnerability, emphasizing the need for family-focused interventions.

Other socio-economic variables, including age, marital status, education, and religion, were not significant, contrasting studies where these factors influenced occupational safety (Sehsah *et al*., 2020; Ayenew *et al*., 2022). This may reflect the pervasive nature of hazards in cassava production, which affect workers across socio-economic categories.

The variation in the strength of determinants between states highlights the role of local production practices and labor dynamics (Ajala *et al*., 2022). These findings imply that occupational health interventions should be gender-sensitive and household-centered, promoting awareness, training, and safety measures at both individual and family levels to mitigate hazard exposure effectively.

Table 3: Multiple Regression of Selected Socio-economic Characteristics and the Prevalence of Occupational Hazards

Variable	Akwa Ibom (n=200) β (p-value)	Oyo (n=110) β (p-value)	Total (n=310) β (p-value)
Sex	0.228 (0.014*)	0.204 (0.058)	0.215 (0.009**)
Age	0.081 (0.179)	0.066 (0.360)	0.072 (0.185)
Marital status	-0.037 (0.605)	-0.045 (0.579)	-0.041 (0.515)
Level of Education	-0.061 (0.269)	-0.052 (0.408)	-0.058 (0.240)
Household Size	0.202 (0.016*)	0.194 (0.037*)	0.198 (0.011*)
Religion	0.029 (0.667)	0.034 (0.655)	0.032 (0.603)
R^2	0.176	0.189	0.182
F-value	3.82 (p<0.01)	3.14 (p<0.05)	4.29 (p<0.01)

*p < 0.05, **p < 0.01. NS = Not significant.*

CONCLUSION AND RECOMMENDATIONS

The study revealed that cassava producers and processors in Akwa Ibom and Oyo States face multiple occupational hazards, with stress, fatigue, heat stress, and insect bites most common. Akwa Ibom workers reported higher musculoskeletal, skin, and respiratory problems, while Oyo workers experienced more insect bites. Safety measures like PPE, first-aid facilities, and rest breaks were widely used, but formal safety practices, reporting, and regulatory compliance were moderate to low. Sex and household size significantly influenced hazard

prevalence, highlighting the roles of gendered labor and household composition in exposure risk.

Agricultural extension services and farmer associations should provide gender-sensitive training on safe cassava production and processing, emphasizing the specific risks faced by men and women. Local government and policymakers should strengthen occupational health regulations and support household-level interventions, ensuring first-aid facilities, safety reporting systems, and labor management strategies to reduce hazard exposure, particularly in larger families.

REFERENCES

Adikwu, F., Ozobu, C., Odujobi, O., Onyeke, F., Nwulu, E., and Pub, A. (2025). A comprehensive review of health risk assessments (HRAs) and their impact on occupational health programs in large-scale manufacturing plants. *International Journal of Multidisciplinary Research and Growth Evaluation, 6*(1), 1525–1538.

Ajala, A. O., Ogunjimi, S. I., Alabi, O. O., Adebimpe, A. T., Adewumi, O. T., and Ojo, K. O. (2022). Assessment of occupational hazards among arable crop farmers in Irepodun Local Government, Kwara State, Nigeria. *FUOYE Journal of Agriculture and Human Ecology, 7*(2), 17–25.

Ayenew, E., Akafu, W., and Wolde Daka, D. (2022). Prevalence of work-related health hazard and associated factors among health workers in public health institutions of Gambella Town, Western Ethiopia: Cross-sectional survey. *Journal of Environmental and Public Health, 22,* 6224280–6224104.

Baidoo, M. A., Kumah, E., Ahmed, S. O. A., and Fafali, J. A. (2025). Examining the relationship between occupational health and safety practices and productivity levels in private health facilities in the Central Region of Ghana. *BMC Public Health, 25,* 1747–1763.

Borku, A. W., Toma Tora, T., and Masha, M. (2025). Cassava in focus: A comprehensive literature review, its production, processing landscape, and multi-dimensional benefits to society. *Food Chemistry Advances, 7,* 1–14.

Ejilude, D. A., Olowolafe, T. A., and Olanrewaju, J. A. (2023). Knowledge of occupational hazards and safety practices among petrol station workers in Ibadan Metropolis, Oyo State, Nigeria. *Journal of Materials Science Research and Reviews, 6*(4), 858–870.

Ekanem, J. T., Adesiji, G. B., and TomDick, B. (2023). Utilization of pro-vitamin A cassava products by consumers in Ikot-Ekpene senatorial district of Akwa Ibom State, Nigeria. *SVU-International Journal of Agricultural Sciences, 5*(1), 46–56.

Ekanem, J. T., and Umoh, I. M. (2024). Cassava farmers' indigenous strategies for climate change adaptation and mitigation in Akwa Ibom State, Nigeria. In *Handbook of nature-based solutions to mitigation and adaptation to climate change* (pp. 1–20). Springer International Publishing.

Ewebiyi, I. O., Odunuga, A. O., and Fowomola, T. D. (2020). Assessment of occupational hazards among cassava processors in Ifo LGA of Ogun State, Nigeria. *Journal of Environmental and Tourism Education, 3*(1), 1–12.

Fapojuwo, A., Ajayi, M. T., Okubena, B. A., Adebayo, O. A., and Fapojuwo, T. O. (2021). Occupational hazards prevalence and agricultural workers' job performance of agricultural organisations in Oyo State, Nigeria. *KIU Interdisciplinary Journal of Humanities and Social Sciences, 2*(1), 130–140.

Fatai, A. S., Orungbemi, C. T., and Adedeji, A. M. (2021). Assessment of risks associated with cassava production in Ibarapa Central Local Government Area of Oyo State. *African Journal of Agricultural Economics and Rural Development, 9*(3), 1–6.

Fosu-Mensah, B. Y., Asare, R. A., Dei-Tutu, L., and Gyasi, R. M. (2021). Occupational and environmental health hazards associated with food processing and the use of personal protective equipment: A case study of gari processing in southern Ghana. *Journal of Applied and Natural Science, 13*(1), 230–237.

Gabriel, M. M., Lalah, J. O., Mputhia, J., and Wekesa, V. W. (2021). Pesticide usage practices as sources of occupational exposure and health impacts on horticultural farmers in Meru County, Kenya. *Heliyon, 7*(2), 1–13.

Ibanga, F. I., Udoh, U. I., and Umoh, B. D. (2025). Examining the level of awareness of health issues associated with exposure to sawmill dust among sawmill workers in Akwa Ibom State, Nigeria. *Asian Journal of Advanced Research and Reports, 19*(4), 167–175.

Ifeanyi-Obi, C. C., and Uloh, C. O. (2025). Gender differences in occupational health status among rural farming households in Akwa Ibom State, Nigeria: Evidence from the WHOQOL-BREF instrument. *International Journal of Agricultural*

Extension, Management and Development, 13(2), 28–45.

Ifeanyi-Obi, C. C., and Uloh, C. O. (2025b). Awareness and utilization of improved cassava varieties among female cassava-based farmers in Ikwerre Local Government Area, Rivers State, Nigeria. *Indian Research Journal of Extension Education, 25*(2&3), 24–33.

Ikuemonisan, E. S., Mafimisebi, T. E., Ajibefun, I., and Adenegan, K. (2020). Cassava production in Nigeria: Trends, instability, and decomposition analysis (1970–2018). *Heliyon, 6*(10), 1–15.

Isiaka, M., Olayiwola, S., and Durojaye, D. (2025). Socioeconomic characteristics and economic burden of occupational health risk in Nigeria. *Journal of Social Sciences Research, 2*(1), 189–204.

Ndubueze-Ogaraku, M., Ezeala, O., and Omasanuwa, Z. (2020). Do occupational hazards affect the revenue earnings of cassava processors in Rivers State? *Advances in Social Sciences Research Journal, 7*(4), 34–46.

Obinaju, L. C., Benson, D. N., Esau, E. C., and Uloh, C. O. (2025). Hazards of oil palm processing business in Ibiono Ibom Local Government Area, Akwa Ibom State, Nigeria. *Nigerian Journal of Agriculture, Food and Environment, 21*(1), 31–39.

Rai, R., El-Zaemey, S., Dorji, N., Rai, B. D., and Fritschi, L. (2021). Exposure to occupational hazards among health care workers in low- and middle-income countries: A scoping review. *International Journal of Environmental Research and Public Health, 18*(5), 2603–2617.

Sapbamrer, R., and Thammachai, A. (2020). Factors affecting use of personal protective equipment and pesticide safety practices: A systematic review. *Environmental Research, 185,* 1–12.

Sehsah, R., El-Gilany, A. H., and Ibrahim, A. M. (2020). Personal protective equipment (PPE) use and its relation to accidents among construction workers. *La Medicina del Lavoro, 111*(4), 285–295.

Sowunmi, F. A., Orungbemi, C. T., and Adedeji, A. M. (2021). Assessment of risks associated with cassava production in Ibarapa Central Local Government Area of Oyo State. *African Journal of Agricultural Economics and Rural Development, 9*(3), 1–6.

ADOPTION OF AGRO-ECOSYSTEM ANALYSIS TECHNIQUES AMONG COCOA FARMERS IN SOUTHWESTERN NIGERIA

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ABSTRACT
The study examined the awareness and adoption intensity of Agro-Ecosystem Analysis (AESA) techniques among cocoa farmers in Southwestern Nigeria. A multistage sampling procedure was used to select 300 cocoa farmers, and data were collected on awareness, adoption intensity, and factors influencing AESA adoption using a structured interview schedule. Data was analysed using descriptive statistics (frequency counts, percentages, means, and standard deviations) and multiple regression analysis. The results revealed generally high awareness of AESA techniques, particularly for farm hygiene and sanitation (95.0%), planting of resistant cocoa varieties (95.0%), and safety precautions in pesticide application (94.7%). Adoption patterns showed selective uptake of AESA practices, with higher adoption for farm sanitation (39.3%), planting resistant varieties (36.3%), and responsible pesticide use (35.3%). However, more analytically demanding practices, such as pest monitoring and understanding vulnerable pest stages, recorded lower adoption. The Tried/Practised Index (0.367) and grand mean adoption score (1.097) indicate partial rather than comprehensive implementation of AESA techniques. Multiple regression results showed that the age of the cocoa farm ($\beta = 0.233$), cocoa farm size ($\beta = –0.268$), and membership of farmers' organisations ($\beta = –0.173$) significantly influenced AESA adoption. These findings suggest that AESA adoption is driven more by structural and institutional factors than by knowledge alone. The study recommends strengthening experiential AESA training, promoting farmer organisation membership, and aligning extension strategies with farm characteristics to enhance sustainable and climate-smart cocoa production in Nigeria.
Keywords: Agro-Ecosystem Analysis (AESA), Cocoa Farmers, Integrated pest management, Technology Adoption. Sustainable cocoa production

INTRODUCTION

Agro-Ecosystem Analysis (AESA) is a participatory, field-based decision-making approach that enables farmers to observe, analyse, and manage their Agroecosystems more sustainably. Developed under the Integrated Pest Management (IPM) and Farmer Field School (FFS) frameworks, AESA aims to enhance farmers' ecological literacy and reduce dependence on chemical pesticides (FAO, 2023 FFS guidance). In cocoa production systems, where pest and disease pressures are high, AESA techniques can help farmers make timely, informed management decisions, ultimately improving productivity and sustainability (Adebiyi *et al.,* 2021). The approach integrates scientific knowledge with farmers' indigenous experience, fostering ecological resilience (Ramirez-Santos *et al*., 2023). In cocoa-based systems of Southwestern Nigeria, where mirids and black pod disease are major constraints, AESA techniques provide an adaptive framework for pest control while reducing pesticide misuse (Agulanna, Williams, & Adebiyi, 2025).

The FFS model, within which AESA is typically implemented, has been introduced by agencies such as FAO, IITA, and the Cocoa Research Institute of Nigeria (CRIN) to improve smallholder decision-making capacity. The integration of AESA into cocoa training curricula is designed to promote sustainable production through ecological pest management, reduced input costs, and enhanced yields (Orimogunje *et al*., 2020).

Empirical evidence suggests that AESA enhances farmers' analytical and problem-solving capacities, resulting in reduced pesticide use and lower production costs (Farmer Field School case studies, 2020). In Ghana and Côte d'Ivoire, where cocoa Farmer Field School programmes incorporating AESA and integrated pest management principles have been implemented, participatory training has been linked to improved pest management practices and reduced reliance on chemical pesticides (Farmer Field School case studies, 2021). Comparable results are emerging from Nigeria, where farmers exposed to AESA demonstrated improved knowledge of pest identification and ecosystem interactions (Akinbode & Lawal, 2021).

Beyond ecological and economic gains, AESA also contributes to social learning. Group-based observation and analysis encourage collaboration and the exchange of local knowledge. This participatory dimension strengthens community cohesion and facilitates the diffusion of improved practices (FAO, 2023).

Cocoa production remains a vital source of income and foreign exchange in Southwestern Nigeria, yet its sustainability is increasingly threatened by persistent pest infestations, diseases, and soil fertility decline. Farmers' overreliance on chemical pesticides has contributed to increased production costs, environmental contamination, and public health risks (Omohwovo & Cheke, 2025). To overcome this, CRIN introduced Agro-Ecosystem

Analysis (AESA) to farmers in Southwest Nigeria. The AESA technique offers an ecologically sound approach that emphasizes observation, analysis, and informed decision-making to manage pest–crop interactions (FAO, 2023). Despite its potential to enhance sustainable cocoa production, the farmers' production level has not improved significantly. Also, there is no noticeable reduction in the use of pesticides. Many farmers still rely on calendar-based pesticide application rather than evidence-based decisions derived from AESA observations (Amoah-Yeboah, Nyantakyi-Frimpong, & Kyei-Boateng, 2023). The study was embarked upon to foster the design of effective extension interventions that promote sustainable cocoa production and environmental health in Southwestern Nigeria.

Hence, the primary aim of this study is to investigate the adoption of AESA Techniques among Cocoa Farmers in Southwestern Nigeria. The specific objectives include to

1. Ascertain the awareness of AESA techniques by cocoa farmers in southwest Nigeria.
2. Determine the level of adoption of AESA by the farmers.
3. Determine the factors influencing AESA adoption.

METHODOLOGY

The study was carried out in Southwest Nigeria. The area is situated between latitude 5^0 and 9^0 north and longitude 2^0 and 7^0 east of the equator, and consists of six states, namely Ogun, Oyo, Osun, Ondo, Ekiti and Lagos. A multistage sampling procedure was employed to select the respondents for the study. Stage one involved the purposive selection of three states among the six states in Southwest Nigeria based on areas where AESA trainings were conducted. These included Oyo, Osun, and Ondo States. At Stage two, two Local Government Areas with a high level of participation in the AESA training programme were purposively selected from each state. At stage three, two communities were selected purposively where farmers' organisations participated in the AESA training programme. At the fourth stage, from each of the communities, ten per cent (10%) of the trained cocoa farmers on AESA techniques were selected randomly using a table of random numbers among the cocoa farmers. Consequently, a total of 300 respondents were selected and interviewed using a structured interview schedule. The awareness of the AESA technique was measured by asking respondents to indicate whether they were aware of each of the ten AESA techniques listed. Each correct response was scored as 1, giving a maximum possible score of 10 and a minimum of 0. Percentages were also computed to show the proportion of respondents aware of each technique. The mean scores for individual AESA techniques were calculated, and a grand mean was computed to assess overall awareness.

The level of AESA adoption was measured by asking respondents to indicate the extent to which they had adopted each AESA technique. Scores were allocated as follows: never tried (0), some trials (1), and full trial (2), yielding a minimum possible score of 0 and a maximum of 20. The mean and standard deviation were calculated, and respondents were classified into high, medium, and low adoption levels using the criterion of mean ± 1 standard deviation.

Data were analyzed using frequency counts, percentages, means, standard deviations, and multiple regression analysis to examine the relationships between awareness, attitude, and adoption of AESA techniques.

RESULTS AND DISCUSSIONS

The findings in Table 1 revealed a generally high level of awareness of most AESA techniques among cocoa farmers, as evidenced by the high proportions of respondents who reported awareness of key practices. Techniques related to farm hygiene/sanitation and planting resistant cocoa varieties ranked jointly highest, with 95.0% awareness each. This suggests that farmers are particularly familiar with practices that are routinely promoted through extension services and are visibly linked to yield protection and disease prevention in cocoa production systems. Similar studies in West Africa indicate that extension programmes often prioritize sanitation and resistant varieties because they are relatively easy to demonstrate and align with farmers' immediate production goals (FAO, 2023; Amoah-Yeboah *et al.,* 2023).

Closely following in rank were safety precautions in insecticide application (94.7%) and identification of pests and diseases of cocoa (94.0%), indicating that most farmers possess basic operational knowledge related to pesticide handling and pest recognition. High awareness of these practices reflects sustained sensitization efforts around pesticide safety and pest identification, particularly in cocoa-growing areas where pest pressure and chemical use are high (FAO, 2023). However, previous research cautions that high awareness does not necessarily translate into correct or consistent application in practice, especially where training is episodic rather than continuous (Amoah-Yeboah *et al*., 2023).

Awareness levels declined slightly for more regulatory and knowledge-intensive components of AESA. For instance, identification of recommended chemicals (89.3%), regulatory control (87.3%), and identification of banned chemicals (83.7%) ranked fifth, sixth, and seventh, respectively. While these

percentages still indicate relatively high awareness, the downward trend suggests weaker farmer familiarity with regulatory frameworks governing pesticide use. This pattern aligns with recent evidence showing that smallholder farmers often have limited access to up-to-date regulatory information and rely heavily on agrochemical dealers for advice, which can undermine compliance with pesticide regulations (FAO, 2023).

Lower awareness was observed for responsible pesticide use (80.0%) and pest monitoring (78.6%), ranking eighth and ninth, respectively. These techniques require regular observation, record-keeping, and analytical decision-making, core principles of AESA that are less intuitive than routine spraying. Studies have shown that farmers are less likely to internalize these practices without sustained experiential learning and facilitation, even when they are familiar with basic pest control measures (Amoah-Yeboah *et al.,* 2023).

The lowest-ranked AESA technique was understanding the vulnerable stages of pests, with only 46.3% of respondents aware of this component. This substantial gap highlights a critical weakness in farmers' ecological understanding of pest life cycles, which is central to evidence-based decision-making under AESA. Recent literature emphasizes that limited knowledge of pest population dynamics often leads farmers to depend on calendar-based pesticide applications rather than targeted interventions, thereby reducing the effectiveness of AESA and increasing unnecessary chemical use (FAO, 2023).

Table 1: Distribution of the respondents according to the level of awareness of AESA techniques

Rank	AESA Technique	Aware F (%)	Mean	Remark
1	Farm hygiene / sanitation	285 (95.0)	0.95	High awareness
1	Planting resistant cocoa varieties	285 (95.0)	0.95	High awareness
3	Safety precautions in insecticide application	284 (94.7)	0.95	High awareness
4	Identification of pests and diseases of cocoa	282 (94.0)	0.94	High awareness
5	Identification of recommended chemicals in cocoa production	268 (89.3)	0.89	High awareness
6	Regulatory control	262 (87.3)	0.87	High awareness
7	Identification of banned chemicals in cocoa production	251 (83.7)	0.84	High awareness
8	Responsible pesticide use (RPU)	240 (80.0)	0.80	High awareness
9	Pest monitoring	236 (78.6)	0.79	High awareness
10	Understanding the vulnerable stages of pests	139 (46.3)	0.46	Low awareness

Grand Mean Awareness =0.85
Source: Field Survey, 2024

Level of adoption of AESA

Table 2 presents the level of adoption of specific AESA techniques among cocoa farmers, showing clear differences in the extent to which individual practices have been tried or integrated into routine farm management. The results indicate that the most frequently adopted practices were farm hygiene/sanitation**,** safety precautions in insecticide application**,** and planting resistant cocoa varieties**,** which were fully tried by 39.3%, 36.3%, and 35.3% of farmers, respectively, with high mean scores of 1.30, 1.27, and 1.26, respectively. These findings align with existing literature, as they suggest that farmers tend to adopt practices that offer visible, immediate benefits or those strongly emphasised through extension campaigns (Rahman *et al*., 2022). For example, sanitation practices and resistant varieties are often promoted as simple, low-cost measures that significantly reduce pest incidence, making them more appealing to smallholders (Fatai *et al*., 2024).

Lower proportions of full adoption were observed for responsible pesticide use (31.7%), identification of pests and diseases (32.7%), and identification of banned chemicals (27.3%) compared with other AESA techniques. Although these practices were fully tried by a substantial number of farmers, their relatively lower adoption rates suggest that they are less extensively embedded in routine farm management decisions. This pattern reflects a broader challenge in pest management interventions, where knowledge related to pesticide safety and pest diagnosis is widely disseminated, yet translating such knowledge into widespread and consistent practice often requires sustained training, follow-up, and institutional monitoring (Khan *et al.,* 2022). Similar patterns, where full adoption occurs but at lower prevalence relative to other practices, have been reported in studies on the implementation of integrated pest management strategies among smallholder farmers (Campbell Collaboration, 2024).

In contrast, the least adopted AESA components were understanding the vulnerable stages of pests and pest monitoring**,** where only 20.7% and 19.3% of farmers fully tried the practices, and 40.7% and 35.7% had never tried them. These

low mean scores (0.84 and 0.80) suggest significant gaps in farmers' ecological literacy, consistent with evidence that ecological observation and analysis are among the most difficult AESA skills to teach and sustain without intensive hands-on training (Fatai *et al.,* 2024). Such techniques require regular field scouting, record-keeping, and interpretation of pest–crop interactions, skills that traditional extension methods often fail to effectively transmit (Rahman *et al.,* 2022).

The grand mean of 1.097 and practice index of 0.367 indicate a moderate but uneven adoption of AESA techniques, with farmers predominantly adopting simpler and more familiar practices, while struggling with more technical, analysis-based components. This pattern reinforces the need to intensify the experiential extension approaches of the Farmer Field Schools, which have been shown to significantly enhance farmers' ability to apply ecosystem-based decision-making rather than relying solely on chemical control (Campbell Collaboration, 2024). Strengthening such participatory training models is essential to deepen adoption intensity and move farmers towards more sustainable cocoa production systems.

Table 2: Distribution of the respondents based on the level of AESA adoption

AESA techniques	Fully tried	Occasionally tried	Never tried	Mean	Std
	F (%)	F (%)	F (%)		
Responsible Pesticide Use (RPU)	95(31.7)	132(44.0)	73(24.3)	1.07	.746
farm hygiene/Sanitation	118(39.3)	154(51.3)	28(9.3)	1.30	.631
Safety precautions in insecticide application	106(35.3)	167(55.7)	27(9.0)	1.26	.613
Identification of pests and diseases of cocoa	98(32.7)	166(55.3)	36(12.0)	1.21	.637
identification of banned chemicals in cocoa production	82(27.3)	161(53.7)	57(19.0)	1.08	.677
Understanding the vulnerable stages of pests	62(20.7)	116(38.7)	122(40.7)	0.80	0.758
Pest monitoring	58(19.3)	135(45.0)	107(35.7)	0.84	.725
Identification of recommended chemicals in cocoa production	70(23.3)	175(58.3)	55(18.3)	1.05	0.645
Regulatory control	84(28.0)	158(52.7)	58(19.3)	1.09	0.684
Planting resistant cocoa varieties	109(36.3)	162(54.0)	29(9.7)	1.27	0.625
Mean Total				10.97	
Grand Mean				1.097	
Tried/Practiced /Index				0.367	

Factors influencing the Adoption of AESA techniques

Table 3 presents the results of the multiple regression analysis examining the factors influencing cocoa farmers' adoption of AESA techniques. The model explains approximately 34.8% of the variance in AESA adoption (R^2 = 0.348; Adjusted R^2 = 0.319), indicating a moderately strong explanatory capacity for the model. Among the ten predictors included, only three variables, age of cocoa farm, cocoa farm size, and membership of an organization, significantly influenced AESA adoption at the 5% level.

Age of cocoa farm was positively significant (β = 0.233), suggesting that farmers with older cocoa farms are more likely to adopt AESA techniques. Older plantations are typically more prone to pest and disease pressure, prompting farmers to seek more sustainable and analytical approaches to crop management. This finding aligns with evidence that farmers managing ageing perennial crops often adopt integrated pest management (IPM) and ecological practices to maintain productivity (Asamoah *et al.,* 2021).

Conversely, cocoa farm size showed a negative and significant influence on adoption (β = –0.268). This implies that farmers with larger farms adopt AESA techniques less intensively, possibly because AESA practices, such as pest monitoring, ecological observations, and sanitation, are labour-intensive and difficult to implement uniformly across extensive farm areas. Studies in West Africa similarly report that ecological-based pest management is more feasible on small to medium-sized plots (Khan *et al.,* 2022; Rahman *et al.,* 2022).

Membership of farmer organizations was also significant and negative (β = –0.173). While counterintuitive, this may reflect situations where group activities emphasize yield-oriented interventions or reliance on chemical control promoted through cooperatives and agro-dealer networks, thereby reducing adoption of more analytical AESA practices. Previous research noted that farmer groups sometimes become channels for

pesticide marketing rather than for ecological knowledge sharing (Amoah-Yeboah *et al*., 2023).

The findings highlight that adoption of AESA is driven more by farm characteristics and farmers' perceptions than by personal attributes or awareness levels. Strengthening AESA adoption, therefore, requires extension strategies that emphasize practical demonstrations, problem-solving on ageing farms, and cooperative reorientation toward ecological management rather than chemical dependency.

Table 3: Multiple regression analysis of factors influencing the AESA adoption among respondents

Variables	Std. error	Beta	t-value	p-value	Decision
(Constant)	0.590		3.658	0.000	
Age	0.007	0.036	0.538	0.591	NS
Educational attainment	0.194	-0.021	-0.405	0.686	NS
Cocoa farming experience	0.007	-0.004	-0.053	0.958	NS
Household size	0.029	-0.045	-0.739	0.461	NS
Age of cocoa farm	0.004	0.233	4.052	0.000	S
Cocoa farm size	0.024	-0.268	-5.040	0.000	S
Membership of organization	0.185	-0.173	-3.141	0.002	S
Extension visits	0.130	-0.063	-1.263	0.208	NS
Awareness	0.024	0.011	0.187	0.852	NS
Attitude	0.010	-0.040	-0.642	0.522	NS

$R = 0.590$, $R^2 = 0.348$, Adjusted $R = 0.319$

Source: Field Survey,2024.

CONCLUSION AND RECOMMENDATIONS

The study concludes that cocoa farmers exhibit high awareness but only partial and inconsistent adoption of Agro-Ecosystem Analysis (AESA) techniques. While basic and compliance-oriented practices such as farm sanitation, safety precautions, and planting resistant varieties are relatively well adopted, core analytical components of AESA, particularly pest monitoring and understanding pest life-cycle vulnerabilities, remain weakly practiced. Regression results further indicate that structural farm characteristics (age and size of cocoa farms) and organizational membership significantly influence AESA adoption, whereas socio-demographic factors, awareness, attitude, and extension visits do not. This confirms that knowledge alone is insufficient to drive sustained AESA adoption without enabling institutional and farm-level conditions.

Based on the findings, the study recommends that:

1. Extension delivery should be refocused towards experiential learning by strengthening hands-on AESA training approaches that emphasize pest monitoring and ecosystem analysis rather than information dissemination alone.
2. Farmers with younger and smaller cocoa farms should be targeted with tailored AESA support, as these farm characteristics significantly shape adoption intensity.
3. There is a need to leverage farmer organizations and cooperatives as primary platforms for AESA capacity building, given their significant influence on adoption.
4. The quality and depth of extension engagement should be improved, shifting from visit frequency to skill-oriented, follow-up-based training that supports consistent practice.
5. AESA should be integrated into routine cocoa farm management guidelines and monitoring frameworks to encourage sustained rather than occasional application of the techniques.

REFERENCES

Adebiyi, T., Adeoye, F., & Ogunleye, S. (2021). Determinants of agricultural technology adoption among smallholder farmers in Southwestern Nigeria. *Journal of Rural Social Sciences, 36*(2), 45–60.

Agulanna, F. T., Williams, O. A., & Adebiyi, S. (2025). Perception and adoption of integrated pest management for the enhancement of cocoa production and income among cocoa farmers in Osun State, Nigeria. *Journal of Research in Management and Social Sciences, 11*(1).

Akinbode, S., & Lawal, R. (2021). Adoption of ecological farming practices among smallholder cocoa farmers in Nigeria. *African Journal of Agricultural Extension, 29*(1), 22–35.

Amoah-Yeboah, E., Nyantakyi-Frimpong, H., & Kyei-Boateng, K. (2023). Knowledge, perception, and pesticide application practices among smallholder cocoa farmers in Ghana. *PLOS ONE, 18*(4), e0285581.

https://doi.org/10.1371/journal.pone.0285581

Asamoah, F., Mensah, P., & Boateng, S. (2021). Determinants of integrated pest management adoption in cocoa production. *Agricultural Systems, 189*, 103056.

Campbell Collaboration. (2024). *Farmer field schools for improving farming practices and farmer outcomes in low- and middle-income countries: A systematic review*. Campbell Collaboration. https://www.campbellcollaboration.org/review/farmer-field-schools-systematic-review/

Food and Agriculture Organization of the United Nations. (2023). *Monitoring, evaluation and learning in farmer field school programmes: A framework and toolkit*. FAO.

Farmer Field School case studies. (2020). Impacts of farmer field schools in the human, social, natural and financial domain: A qualitative review. *Food Security*. https://doi.org/10.1007/s12571-020-01046-7

Farmer Field School case studies. (2021). *What is the impact of Farmer Field School programs on farming practices?* International Initiative for Impact Evaluation (3ie).

Fatai, K., Abdullahi, H. A., Oba, A. I., & Bijani, M. (2024). Assessment of the Farmer Field Schools activities as a strategy to enhance the capacity building of smallholder rural cocoa farmers in Kwara State, Nigeria. *Indonesian Journal of Agricultural Research, 7*(1), 60–67. https://doi.org/10.32734/injar.v7i1.11439

Khan, M., Rahman, S., & Alam, M. (2022). Farmers' ecological knowledge and adoption of integrated pest management. *Crop Protection, 156*, 105969.

Omohwovo, S. O., & Cheke, R. A. (2025). Farmers' pesticide use, disposal behavior, and pre-harvest interval: A case study from Nigeria. *Frontiers in Sustainable Food Systems*.

Orimogunje, A. O., Ogundeji, B. A., Ademola, T. I., Balogun, S. T., Awodumila, D. J., Olorunmota, R. T., & Oyeledun, K. O. (2020). Cocoa farmers' coping strategies for climate change adaptation in Ogun State, Nigeria. *Journal of Scientific Research & Reports, 26*(2), 44–51.

Rahman, M. M., Sarker, M. A. R., & Ahamed, K. U. (2022). Impact of farmer field school on crop income, agro-ecology, and farmer behaviour in farming: A case study on Cumilla District in Bangladesh. *Sustainability, 14*(7), 4190. https://doi.org/10.3390/su14074190

Ramirez-Santos, A. G., Ravera, F., & Rivera-Ferre, M. G. (2023). Gendered traditional agroecological knowledge in agri-food systems: A systematic review. *Journal of Ethnobiology and Ethnomedicine, 19*, Article 11. https://doi.org/10.1186/s13002-023-00576-6

EASE OF UTILISATION OF MULTI-CROP DRYER IN THE PROCESSING OF PERISHABLE AND DURABLE CROPS IN LAGOS, NIGERIA

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ABSTRACT
Open sun drying pre-disposes agricultural produce to contaminants, with a consequent lower quality end-product. The multi-crop dryer (MCD) was developed by the Nigerian Stored Products Research Institute (NSPRI) to ensure the generation of hygienic and safe dried products. However, there is a dearth of existing study that analysed the ease of utilisation of this technology for the processing of agricultural produce. To narrow this gap in knowledge, primary data were collected, with the aid of a structured questionnaire schedule, from 181 trainees. A five-point Likert-type scale was employed to gauge trainee's expression regarding the effectiveness of training and Ease-of-Use of NSPRI-MCD. Kendall's Coefficient of Concordance (W) was used to test the degree of agreement in the expression of the trainees. Results revealed that participants gained relevant knowledge and skills from the training ($\bar{X}$=4.49); the knowledge gained would enhance performance in food processing ($\bar{X}$=4.39); quality attributes of the processed foods were generally acceptable ($\bar{X}$=4.62), among others. Furthermore, participants opined that drying time was not long and not discouraging ($\bar{X}$=4.19). However, they disagreed with the defining statement that changing of the drying trays at set time intervals was not cumbersome ($\bar{X}$=2.28), as well as the defining statement that operation of NSPRI/MCD was automated and did not require regular monitoring ($\bar{X}$=1.40). The Kendall's W^a of 0.84 and 0.61 shows a substantial agreement in the expression of the trainees regarding the effectiveness of training, and ease-of-use of NSPRI-MCD, respectively. The study concludes that the training was effective and the NSPRI-MCD was easy to use. It was recommended that the dryer be automated to enhance its ease-of-use.

Keywords: Agro-processing, Ease-of-Use, Multi-crop Dryer

INTRODUCTION

Drying is one of the earliest technologies employed by mankind to preserve various agricultural products. Of the several drying techniques, open sun drying is the most used method to preserve and process agricultural products across many parts of Nigeria. Classically, open sun drying simply entails spreading thin layers of agricultural produce under direct sunlight mostly on the ground, flat roof tops, tarps, trays, mats, baskets, paper or plastic sheets, drying tables, roads, stalls, or concrete floors, until it is bone-dry. The method is the simplest and most inexpensive technique of drying (Oshadumo *et al*., 2025; Kazeem *et al*., 2024), but the final product is usually of lower quality due to contamination by dust, dirt, debris, grit, insects, birds, animals, pests, dews and rain. Such contamination may cause the product to be of degraded market value. Losses of about 30 to 40% of total production of fruits and vegetables during drying have been reported, in developing countries (Dronachari and Shriramulu, 2019); resulting in a loss of millions of dollars' worth of gross national product (Yahia *et al*., 2019).

The multi-crop dryer (MCD) is one of the technologies developed by the Nigerian Stored Products Research Institute (NSPRI) for the generation of hygienic and safe value-added agricultural products (Osegbo *et al*. 2022; Omodara, 2011). It is a more appropriate method of drying, which reduce heavy postharvest losses and generates superior quality products. The technology has been used to dry and add-value to various durable and perishable agricultural crops.

Previous studies carried out on the multi-crop dryer mostly focused on the suitability of the technology for the generation of dried value-added products from durable crops, such as Instant pap from white maize, Beans flour from black-eyed white cowpea, wheat flour from wheat, and ground rice from white rice of the local variety (Osegbo *et al*., 2022). In a similar vein, Fapounda *et al*., (2022) utilised the technology for the development of dried value-added products from perishable crops which includes pineapple rings from pineapple, mango chips from mango, and dried leafy vegetable from various kinds of vegetables, dried tomatoes from Roma tomatoes, and dried pepper from the Bonnet spp. However, there is a dearth of existing studies that analysed the ease of utilisation of this technology for the processing of perishable and durable agricultural produce. This study attempts to narrow this gap in knowledge.

Ease-of-Use (EOU) is the degree to which a person believes that using a technology will be free from effort (Davis, 1989). In the context of this study, EOU refers to the extent to which users believe that the application of NSPRI-MCD is free of effort. If a technology is relatively easy to use, individuals will be more willing to learn about its features and finally intend to continue using it. The ease-of-use of this technology by farmers, agri-preneurs, and agro-processors in value-added product development was examined with a view to

bring improvement to the technology. Specifically, the study seeks to:

1. gauge trainee's expression regarding the effectiveness of training on food processing, and
2. assess the expression of ease-of-use of NSPRI-Multi-crop dryer among trainees.

METHODOLOGY

The multi-crop dryer is a natural convection cabinet dryer fired with kerosene or charcoal. It comprises three functional components, namely: combustion chamber, heat exchanger and drying chamber (Figure 1). The combustion chamber houses a kerosene burner (stove), which is used to heat fresh ambient air flowing into the heat exchanger. The heat exchanger enables the transfer of heat from the burning flame to the cold ambient air without mixing the two. The heat exchanger is located above the kerosene stove. The drying chamber forms an enclosure inside which the commodity is held and dried by the heated air flowing out of the heat exchanger. The chamber carries the outlet vents for wet air exit at the roof (Babarinsa and Omodara, 2011). Commonly used materials for NSPRI-MCD include concrete (support base), wood and plywood (frame and cover), mesh wire, wire netting (tray), copper sheet (heat exchanger), charcoal using coal pot, kerosene using stove (power source).

All the participants of the 10 training workshops that were conducted for farmers, agri-preneurs, and agro-processors on postharvest management and agro-processing between the year 2019-2023 were sampled for the study in line with the submission of Watson (2001), as shown in Table 1. A total of 181 trainees took part in the survey. However, upon screening for completeness only 104 questionnaires were found tenable for statistical analysis.

To assess trainees' expression of the effectiveness of training, a five-point Likert-type scale with expression indices from average of coded responses comprising; 5= Strongly agree, 4= Agree, 3= neutral, 2= Disagree and 1= Strongly disagree was presented to the participants to choose from, based on their agreement, or the lack thereof, with each defining statement on effectiveness of training. A total of 10 defining statements that underscore effectiveness of training (Table 3) were presented to the respondents. Similarly, to examine the ease-of-use of NSPRI-MCD, a five-point Likert-type scale with indices from average of coded responses comprising; 5= Strongly agree, 4= Agree, 3= Neutral, 2= Disagree and 1= Strongly disagree were presented to the respondents to choose from, based on their agreement, or the lack thereof, with each defining statement on ease-of-use of NSPRI-MCD. A total of 11 defining statements that underscore ease-of-use of NSPRI-MCD (Table 4) were presented to the respondents.

Kendall's coefficient of concordance (W) was used to test the degree of agreement in the expression of the trainees regarding the effectiveness of training on agro-processing, as well as the ease-of-use of NSPRI-MCD. The coefficient of concordance (W) has positive value ranging between zero (0) and one (1). It assumed a value of one in the situation where the scores assigned by each trainee are the same as those assigned by the other participants and zero when there is a maximum disagreement in the scoring of the expressed ease-of-use defining statements or the scoring of the defining statements that underscore effectiveness of training.

Figure 1: NSPRI-Multi Crop Dryer

Table 1: Selection of Respondents

SN	Theme of the Training Workshop	Month/Year	Number of Trainee
1	Processing and storage of agricultural produce in value addition	May, 2019	11
2	Upscaling and Sustenance	July, 2019	18
3	Scaling value added processing in Nigeria	Feb., 2020	19
4	Optimizing Postharvest Management: Scaling value addition in the Nigerian agricultural industry	Sept., 2020	17
5	Postharvest Management and Agro-processing in Nigeria: Current trends and approaches	April, 2021	22
6	Appropriate training for farmers and processors on knowledge and skill acquisition of some agricultural produce	Aug., 2021	16
7	Scaling postharvest management and value added processing in Nigeria: The NSPRI Perspective	Nov., 2021	21
8	Postharvest Management in Nigeria: A panacea to food and nutrition security	June, 2022	24
9	Postharvest Management in Nigeria: A tool for improving the livelihood of stakeholders	Oct., 2022	11
10	Postharvest Management in Nigeria: Scaling up your business in processing	Jan., 2023	22
Sample size			**181**

RESULTS AND DISCUSSION

Socioeconomic characteristics

Results in Table 2 indicates that 77.9% of the sampled trainees were females, while 22.1% were males. This may be because food processing is generally a female dominated enterprise in Nigeria. Most of the participants (34.6%) were of the age range between 51 and 60 years old. In addition, 33.7% of the respondents were between the ages of 41 and 50. Some 22.1% of the trainees fall within the age bracket of 41 to 50 years old. Of the remaining participants, 06.7% and 02.9% were of the age distributions <31, and >60 years, respectively. The average age of 46.31 years, in addition to the age distribution indicates that most of the participants fall within an economically active and productive age group. Majority (91.3%) of the trainees had tertiary education, while 08.7% had secondary school education. Thus, most of the trainees had an appreciable level of educational attainment. The implication of this is that, most of them were able to process and understand relevant information during the training session.

Furthermore, the results show that, with a mean household size of 05.5, above 73% of the respondents were married. Roughly 16% of the respondents identified as single as at the time of the training. In addition to 3.9% that were divorced,

about 7% of the participants reported being widowed. The average household size, as well as the fact that majority of the respondents were married indicates that agro-processing could be a viable source of income that enables households to meet their physiological needs and other obligations. However, most (65.4%) of the trainees indicated that agro-processing is not their major source of income. Nevertheless, it is, perhaps, a viable means of income diversification.

Table 2: Socio-economic Characteristics of Trainees (n=104)

Variables	Frequency	Percentage
Sex (Categorical)		
Male	23	22.1
Female	81	77.9
AGE (Years)		
<31	07	06.7
31-40	23	22.1
41-50	35	33.7
51-60	36	34.6
>60	03	02.9
Mean	46.31	
Standard Deviation	09.41	
Marital status (Categorical)		
Single	17	16.3
Married	76	73.1
Divorced/Seperated	4	03.9
Widowed	7	06.7
Level of education (Categorical)		
Secondary	09	08.7
Tertiary	95	91.3
Household size (Ratio)		
<4	20	19.2
4 – 6	60	57.7
>6	24	23.1
Mean	05.05	
Standard Deviation	02.01	
Occupation (Categorical)		
Major	36	34.6
Minor	68	65.4
Experience (Years)		
<6	48	46.2
6-10	46	44.2
11-15	07	06.7
>15	03	02.9
Mean	6.05	
Standard Deviation	03.32	
Annual revenue (₦)		
<500,000	61	58.7
500,000-1,000,000	29	27.9
1,000,001-2,000,000	12	11.5
>2,000,000	02	01.9
Mean	656,250	
Standard Deviation	530,251	
Membership of cooperative (Categorical)		
Yes	44	42.3
No	60	57.7
Membership of professional association (Categorical)		
Yes	36	34.6
No	68	65.4

Source: Survey Result, (2024).

Results in Table 2 further depicts that about 46% of the participants had been actively involved in agro-processing for less than six years. Further, 44.2% of the respondents have been engaged in agro-processing for a time duration of 6-10 years. Approximately 7% of the trainees have between 11 and 15 years of experience in processing of agro-products. For the remaining 2.9% of the respondents, they specified that they have been involved in agro-processing for more than 15 years. The distribution of the participants experiences in agro-processing, as well as the mean experience of 6.05 years shows that most of the trainees have been actively involved in agro-processing for an ample period. The annual income from agro-processing, as well as from other sources for most (58.7%) of the participants is less than ₦500,000. Whereas above 27% of the trainees indicated earning between ₦500,001-₦1,000,000 annually, 11.5% revealed that they earned between ₦1,000,001-₦2,000,000. A few (1.9%) of the participants earned more than ₦2,000,000 in a typical year. Results also showed that, 42.3% of the trainees indicated membership of cooperative society. By the same token, 34.6% of the participants indicated that they are members of at least one professional association.

Trainees' expression of the effectiveness of training on agro-processing

Results in Table 3 shows that the participants found the training to be most effective in aspects that pertains to acceptable quality attributes of processed foods ($\bar{X}$=4.62), beneficial hands-on nature of the training ($\bar{X}$=4.61), enhanced safe food practice ($\bar{X}$=4.51), and gaining of relevant knowledge and skills ($\bar{X}$=4.49). The Kendall's W[a] of 0.84 shows a strong agreement in the expression of the trainees regarding the effectiveness of training on agro-processing.

These findings suggest that the training received was generally seen as effective by the respondents. This highlights the significance of training as a veritable tool for information dissemination in order to harness the full benefits of agricultural processing technologies. The key idea behind virtually any form of Postharvest Training Information (PhTI), that is training tailored towards reduction in food loss/waste, is to serve as a medium to impart knowledge, and to foster capacity development among players in the agricultural value chain (farmers, processors, marketers, inter alia), which usually exerts a significant influence on adoption and subsequent utilisation of agricultural innovation/technologies.

Table 3: Effectiveness of training on food processing

Defining Statement	Percentages					Mean	Standard Deviation
	SD	D	UD	A	SA		
I gained relevant knowledge and skills from the training	0.0	0.0	0.0	51.0	49.0	4.49	0.50
Knowledge and skill gained will enhance my safe food practice	0.0	0.0	0.0	49.0	51.0	4.51	0.50
The hands-on practical session of the training was more beneficial	3.8	19.2	25.0	33.7	18.3	4.61	0.49
What I have learnt will improve my performance in food processing	0.0	0.0	0.0	60.6	39.4	4.39	0.49
The training has improved my food safety awareness	0.0	0.0	0.0	58.7	41.3	4.41	0.49
Quality attributes of processed foods were generally acceptable	0.0	0.0	0.0	38.5	61.5	4.62	0.48
The facilitators of the training were competent	0.0	0.0	0.0	57.7	42.3	4.42	0.49
The questions and answers session were highly impactful	0.0	0.0	0.0	56.7	43.3	4.43	0.47
The environment was conducive for learning	0.0	0.0	1.9	67.3	30.8	4.29	0.49
Other trainees kept to training ground rules and were well behaved throughout the training	0.0	2.9	17.3	56.7	23.1	4.00	0.72
Diagnostic Test							
Kendall's W[a]						0.84	
Chi-Square						52.44	
Df						6	
Asymp. Sig						000	

Source: Survey Result, (2024)

Note: SD, D, UD, A, SA represents Strongly Disagree (1), Disagree (2), Undecided (3), Agree (4), and Strongly Agree (5), respectively.

In their analysis of the effectiveness of postharvest training information on improved maize crib utilisation by maize farmers, Benson *et al*. (2022) surmised that the consistency with which training information is passed down to farmers could be instrumental in curtailing postharvest loss in maize stored in cribs. By the same token, Sennuga and Oyewole (2020) found a strong positive association between adoption of Good Agricultural Practices (GAPs) and training on agricultural technologies.

Trainees' expression of Ease-of-Use of NSPRI-MCD

Results in Table 4 reveals that the top defining statements, regarding the ease-of-use of NSPRI-MCD that the trainees generally agreed with include; I do not have to consult fellow trainees when using NSPRI/MCD ($\bar{X}$=4.39), use of charcoal as the heat source minimizes cost of drying ($\bar{X}$=4.34), and drying time is not long and not discouraging ($\bar{X}$=4.19). In a similar vein, the trainees revealed their disagreement with the following defining statements; Use of domestic cooking gas as the heat source minimizes cost of drying ($\bar{X}$=2.21), Operation of NSPRI/MCD is automated and doesn't require regular monitoring ($\bar{X}$=1.40), NSPRI/MCD requires regular maintenance ($\bar{X}$=2.68), NSPRI/MCD can dry large quantity of produce at a particular time ($\bar{X}$=2.50). The Kendall's W^a of 0.61 shows a moderate agreement in the expression of the trainees regarding the ease-of-use of NSPRI-MCD.

Table 4: Expression of Ease-of-Use of NSPRI-MCD

Defining statements	Percentages					Mean	Standard Deviation
	SD	D	UD	A	SA		
I do not have to consult fellow trainees when using NSPRI-MCD	1.0	0.0	0.0	57.7	41.3	4.39	0.59
Drying time is not long and not discouraging	2.9	0.0	7.7	53.8	35.6	4.19	0.81
The arrangement of the drying trays enhances efficient drying	0.0	4.8	23.1	57.7	14.4	3.82	0.73
Changing of the drying trays at set time intervals is not cumbersome	13.5	54.8	24.0	5.8	1.9	2.28	0.84
NSPRI/MCD operating principle is neither rigid nor complex	0.0	1.0	0.0	77.9	21.2	4.19	0.46
Use of charcoal as the heat source minimizes cost of drying	0.0	0.0	1.0	64.4	34.6	4.34	0.49
Use of domestic cooking gas as the heat source minimises cost of drying	33.7	26.0	26.9	12.5	1.0	2.21	1.07
Operation of NSPRI/MCD is automated and does not require regular monitoring	61.5	36.5	1.9	0.0	0.0	1.40	0.53
NSPRI/MCD requires expertise to build	1.0	1.0	0.0	37.5	60.6	4.56	0.65
NSPRI/MCD requires regular maintenance	1.9	32.7	61.5	2.9	1.0	2.68	0.61
NSPRI/MCD could dry large quantity of produce at a particular time	4.8	45.2	46.2	2.9	1.0	2.50	0.68
Diagnostic Test							
Kendall's W^a						0.61	
Chi-Square						446.21	
Df						7	
Asymp. Sig						0.000	

Source: Survey Result, 2024.

Note: SD, D, UD, A, SA represents Strongly Disagree (1), Disagree (2), Undecided (3), Agree (4), and Strongly Agree (5), respectively.

CONCLUSION

Participants generally gained knowledge and skills from the training, which has improved their food safety awareness, enhanced their safe food practice, and improved their performance in food processing. As well, the quality attributes of the processed foods were generally acceptable to the trainees. Furthermore, although the trainees were of the notion that NSPRI-MCD operating principle was neither rigid nor complex, they found the changing of drying trays at set time intervals to be cumbersome. Subsequent versions of the NSPRI-MCD should be automated so as to reduce the drudgery involved in the manual changing of the drying trays at set time intervals.

REFERENCES

Babarinsa, F. A. and Omodara, M. A. (2011) Improving the shelf life of tomatoes. Role of Nigerian Stored Products Research

Institute (NSPRI). Paper presented at the Capacity Building Programme for Tomato Production, Processing and Export in Benue State, Organized by the Nigerian Export Promotion Council, (Markudi Zonal Office), 13th -14th December, 2011.

Benson, O. B., Olatilewa, O. M., Anifowoshe, A. O. and Sanusi, R. O. (2022) Exploring the Effectiveness of Selected Postharvest Training Information on Improved Maize Crib Utilization by Maize Farmers in Southwest Nigeria. *European Journal of Training and Development Studies*, 9(1); 20-31.

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease-of-Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13(3), 319-340.

Dronachari, M. and Shriramulu. (2019) Application of Different Types of Solar Dryers in Agriculture Crops- A Review, *Int. J. Pure App. Biosci.* **7(2);** 303-326.

Fapounda, T. O., Nnamani J. N., Ijaware, O. A. And Afolabi, A. A. (2022). Quality Assessment of Selected Fruits and Vegetables Dried Using the Multi-crop Dryer (Unpublished).

Kazeem, A. A., Ojo O. A., Oyewole, O. S, Ibitoye, O., Zaka, K. O., Alejo, A. And Alao, A. O. (2024). Economical Assessment of NSPRI Parabolic Shaped Solar Dryer for Cowpea Flour Production. *J Res Agric Food Sci*., 1(2): 72-78. doi:10.5455/JRAFS.20240525095537.

Omodara, M. A. (2011). Effects of Some Drying Parameters on Drying Rate and Quality of African Catfish. M. Eng. Thesis. Department of Agricultural and Biosystems Engineering, University of Ilorin, Ilorin.

Osegbo, A. N., Taiwo, T. S., Atoyebi, O. A., Ashafa, M. A., Ejoh, N. M., Oluseyi, J., Ijaware, O .A., Ihionu, G C., Benson, O. B. and Okonkwo, E.U. (2022). Value Addition in Cereals and Pulses Crops using NSPRI Multicrop Dryer. Proceedings of the 8th Regional Food Science and Technology and Technology Summit (REFoST). Pp. 1-4.

Oshadumo D., Awotunde D. R., Lawi M. B., Joel J, Abdullahi. A. A., Adamson T. O., Abdullahi H. M (2025). Cost and Return Analysis of Cowpea Flour using Solar Dryer. Proceedings of the second national conference of the Federal College of Agricultural Produce Technology (FCAPT) Kano. Pp

Sennuga, S. O. and Oyewole, S. O. (2020) Exploring the Effectiveness of Agricultural Technologies Training among Smallholder Farmers in Sub-Saharan African Communities. *European Journal of Training and Development Studies*, 7 (4): 1-15.

Watson, J. (2001) How to Determine a Sample Size: Tipsheet #60, University Park, PA: Penn State Cooperative Extension. Available at: http://www.extension.psu.edu/evaluation/pdf/TS60.

Yahia, E. M., Fonseca, J. M and Kitinoja, L. (2019) Postharvest Losses and Waste. *Postharvest Technology of Perishable Horticultural Commodities*, 43-69 https://doi.org/10.1016/B978-0-12-813276-0.00002-X.