

Effect of Agricultural Commercialization on Dietary Diversity Among Rural Farm Households in Ido Local Government Area, Oyo State, Nigeria

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Abstract

This research evaluates the effect of agricultural commercialization on the dietary diversity of rural farm households in the Ido Local Government Area of Oyo State, Nigeria. The dietary diversity, which is recognized conventionally as the key indicator of food security, was determined using the Household Dietary Diversity Scores (HDDS), which enumerate the food group consumption over the specified period. The data represented 240 rural respondents, with 66.7% male and 33.3% female, of which 75% of the study population was married, with an average size of five members per household. About 97.9% of the respondents earned less than ₦50,000 monthly. Results indicate that 74.2% of the respondents had a commercialization index between 0.81 and 1.00, and 65.0% had medium dietary diversity. Results indicate a negative relationship between agricultural commercialization and dietary diversity, and that improved market participation does not necessarily lead to better nutritional outcomes. This study concludes that although commercialization increases income opportunities among farmers, farmers should be urged to allocate increased agricultural income to purchase diverse and nutritious foodstuffs.

Keywords: Agricultural Commercialization, Dietary Diversity, Rural Farm Households, Food Security, Nutrient Adequacy, Ido LGA.

Introduction

Agriculture remains the backbone of the Nigerian economy, being the key source of employment, food production, foreign earnings, and materials used by industries. Though the contribution to Gross Domestic Product (GDP) declined from 48% in 1970 to 20.6% in 1980 and to 23.3% in the year 2005, the sector still plays an important role in national development. About 60–70% of the Nigerians are engaged in agriculture and are majorly smallholder farmers (National Bureau of Statistics [NBS], 2023; CBN, 2022). During October to December 2020, the agricultural sector contributed 26.95% to the overall GDP of Nigeria, an increase of almost one percentage point from the corresponding period of the year 2019 (NBS, 2021).

Since 70% of the population of Nigeria is sustained by agriculture, economic growth and poverty reduction are strongly related to agricultural performance. The country's fertile arable lands, water resources, and human capital present significant opportunities for agricultural expansion (FAO, 2022; World Bank, 2023). Agriculture contributes approximately 40% to GDP and is the principal economic activity within the rurally dominant zones where about half the country's population resides. Agricultural commercialization has become central to discussions of food security and rural development.

Agricultural commercialization is the transition of agriculture from subsistence production to market-oriented production (Pingali, 2015). Commercialization is when farmers become more involved with input and output markets and make production decisions to maximize profit (Bellemare & Novak, 2017). Commercialization has been considered as a way to increase income, nutrition, and food security, where market barriers are minimized (Ogutu & Qaim, 2019; Davis et al., 2021). For smallholders to be competitive in modern markets, they must produce for markets rather than market what they produce (FAO, 2020). Farmer organization advocacy can be helpful to smallholder farmers to get economies of scale and higher bargaining power. Research has demonstrated that commercialization can enhance household income, improve dietary diversity, and reduce poverty (Muriithi & Matz, 2015; Ogutu et al., 2020; Wainaina et al., 2021).

Dietary diversity, the number of different food groups consumed within a reference interval, has long been an accepted measure of diet quality and food security (FAO & FHI 360, 2016). Both macro- and micronutrient adequacy are captured by dietary diversity, with higher diversity usually corresponding to better nutrition (Herforth et al., 2020; Ruel et al., 2018). Increasing the diversity of food consumed within and between food groups is advised by nutritionists to provide sufficient nutrient intake and good health (FAO & WHO, 2019; Global Nutrition Report, 2021). Yet low-income households in the developing countries rely so much on starchy staples with few animal products, fruits, and vegetables, which result in nutritional deficiencies. Comprehending the effect agricultural commercialization has on dietary diversity is crucial to connecting agricultural policy with nutrition outcomes.

Problem Statement

Low dietary diversity is a perennial Nigerian and developing world challenge, as it leads to diets that rely heavily on starchy staples and are poor in animal products or vegetables and fruits, leading to widespread micronutrient malnutrition and adverse health outcomes (FAO, 2021; Herforth et al., 2020). While agricultural commercialization can boost incomes and welfare, its impact on dietary diversity is not automatic. Commercialization policies that are promoted cannot assume simultaneous improvements in nutrition. This outcome is market, food choice dependent, as well as expenditure patterns in households (Ogutu & Qaim, 2019; Muriithi & Matz, 2015). Commercialization could affect nutrition in various ways, such as household income, access to home-produced foods, and distribution of resources within the household (von Braun et al., 2021). Increased incomes could translate to better access to food; however, when there's a shift from home-produced foods and meals to commercial foods, there could be an increased calorie consumption at the expense of nutritional quality (Remans et al., 2015).

Given the above complexities, assessing the impacts of agricultural commercialization on household food access and diet diversity becomes crucial to the development of agricultural and nutrition policies. This research focuses on the effects of agricultural commercialization on the dietary diversity of farm households located in the rural part of the Ido Local Government Area of Oyo State.

Objectives of the Study

To determine the effect of agricultural commercialization on dietary diversity among rural farm households. Accordingly, the research is guided by the following research questions:

1. What are the socio-economic characteristics of rural farm households?
2. What is the level of agricultural commercialization among rural farm households?
3. What is the dietary diversity status of rural farm households?

4. What is the effect of agricultural commercialization on the dietary diversity of the rural farm households?

Theoretical Framework

This study is founded on two integrated theories, the Agricultural Household Model and the Utility Maximization Theory. The two theories clarify the choices of small-scale farmers in aspects of production and consumption activities affecting income and nutrition levels.

The Agricultural Household Model (AHM), proposed by Singh, Squire, & Strauss (1986), illustrates how the farm household can be both a production and consumption unit, maximizing total utility with production, marketing, and other resource constraints. In these respects, the farm household also maximizes the quantity of agricultural production that will be marketed or consumed, taking into account prices, the number of household members, food preferences, and the availability of food infrastructure (Barrett et al., 2021). Enhanced accessibility to the market boosts the process of commercialization, with the farm household converting agricultural production into financial resources to acquire food in the process.

However, the AHM recognizes that the relation between higher income and improved dietary diversification is not assured. Market failures, food supply limitations, and food distribution inequalities may affect the positive relation between commercialization and nutrient intake (Hirvonen & Hoddinott, 2017). The Utility Maximization Theory justifies the above theory with its explanation of the households' consumption practices. The Utility Maximization Theory states that consumer units attempt to maximize satisfaction or utilities from the consumption of commodities within their budget constraint. Hence, due to the increased commercialization from farm households, income increment, and the expanded commercialized process, the farm households can diversify their diets by consuming more nutritious commodities of fruits, vegetables, and meat products from the markets. However, the allocation of income on different food commodities is dependent on price and food preferences (Ruel et al., 2018).

In sum, these two theories show that agricultural commercialization may have the potential to enhance dietary diversity and nutritional quality, but these are conditional on the interaction between income, markets, and decision-making dynamics within households.

Agricultural Commercialization

Agricultural commercialization refers to the process of transforming subsistence agriculture to market-oriented agriculture (Pingali, 2015). It involves increasing the participation of farmers in input markets as well as output markets, while making farming decisions with the aim of maximizing profits. Commercialized agriculture can be assessed on the farm or household levels, and is the most important element of agricultural transformation or rural development (von Braun et al., 2021).

Commercialization can be measured based on the indices such as the Household Commercialization Index (HCI) and Market Orientation Index (MOI) (Govere et al., 1999). The HCI measures the proportion of the total agricultural production that is marketed. The MOI measures the proportion of the land dedicated to the growing of market-oriented crops and differentiates the land under crops and the land under pasture, grassland, and marketable crops (Govere et al., 1999). Market-oriented agricultural development has also been referred to as a method of improving income and productivity in the rural areas (Ogutu & Qaim, 2019). Enhancing financial capital and technology availability could contribute to increased levels of productivity and income. Increased levels of income could therefore translate to increased levels of food

security because a household can purchase diverse diets (Muriithi & Matz, 2015; Wainaina et al., 2021).

Despite the advantages that can come with commercialization, there could also exist potential threats. Small-scale farmers might have difficulties with price volatility, bargaining power, and demand for their home-produced foods if their land and labor are used exclusively for the growing of commercial goods (Carletto et al., 2017). Additionally, commercialization might neglect the improved nutritional levels if the extra earnings are not spent on nutritional food sources (Sibhatu & Qaim, 2018). As a result, the incorporation of nutrition-sensitive agricultural strategies must take place within the structures of policies that ensure the potential of commercialization on both income and dietary quality.

Dietary Diversity

Dietary diversity (DD) can be defined as the variety of food groups eaten during a given time. It is used as an indicator of the quality of the diets and nutrient adequacy (FAO & FHI 360, 2016). The Household Dietary Diversity Score (HDDS) measures the availability of diverse foods and the economic capacity of the household to afford a nutritionally sufficient diet (FAO, 2021). A total of 12 food groups are considered in calculating the total HDDS. They include: cereals, roots/tubers, vegetables, fruits, meat, eggs, fish, legumes/nuts, dairy products, oils/fats, sugar/honey, and miscellaneous.

Diversified diets provide adequate macronutrient and micronutrient intake. Research shows that higher dietary diversity is linked to improved nutritional achievements, especially among developing countries whose diets consist of starchy staples (Herforth et al., 2020; Headey et al., 2022). Despite the importance, many rural households in Nigeria have continued to rely on diets comprised of relatively limited animal foods, fruits, and vegetables. The impact has led to rampant micronutrient malnutrition and poor health status. A diversified diet is, therefore, only possible based on both income and market accessibility of nutritious foods.

Analytical Framework

The framework applied for analyzing the relationship between Agricultural commercialization and Dietary diversity has three components:

Measurement of Commercialization: using the Household Commercialization Index (HCI), which measures the percentage of total crop production sold (Govere et al., 1999).

Measurement of Dietary Diversity: derived from the Household Dietary Diversity Score (HDDS), which focuses on the kinds of food group consumption within a certain period of time (FAO & FHI 360, 2016).

Econometric Model (Ordered Logit Regression Model): This econometric model is utilized for analyzing the impact of commercialization on the diversity of diets, as the HDDS has an ordinal variable (Ogutu et al., 2020).

These analytical tools determine whether the effect of commercialization improves the quality of diets in the households or just leads to the consumption of more calories.

Empirical Review

Empirical studies involving agricultural commercialization and nutrition show diverse findings. Ogutu and Qaim (2019) discovered that commercialization contributed significantly to improving the dietary diversity of farm households in Kenya through higher income and better market access. Similarly, Muriithi and Matz (2015) found that the commercialization of vegetables promoted both the welfare and the dietary diversity of households in Kenya. On the contrary, Carletto et al. (2017) found that the effect of commercialization on dietary quality is very much dependent on the level of market accessibility and consumption patterns. In other instances, commercialization reduced dietary diversity as farmers moved from the production of food crops to the production of cash crops. Sibhatu and Qaim (2018) also found that the income derived from the commercialization of agriculture does not necessarily improve diets, especially where markets are not supplied with healthy foods. In the Nigerian situation, most studies concentrate on the income effects of commercialization rather than the nutritional outcome. As Nigeria has a mainly rural population reliant on small-scale agriculture, the relationship between commercialization and dietary diversity offers important information for the formulation of agricultural policies towards improving diets (FAO, 2022; Qaim, 2023).

Agricultural commercialization is an important aspect of transformation in the agricultural sector, increasing productivity and income levels for the agricultural sector. Income generation realized through the commercialization of agriculture can provide numerous benefits in improving the quality of diets available to or consumed by consumers. However, due to constraints such as inaccessibility to markets, gender inequality, or unawareness about the importance of nutrition, its achievement can be hampered. Hence, there is a need for an interdisciplinary approach to agricultural and nutritional policy linkages in realizing economic, as well as nutritional outcomes.

Methodology

The research was conducted in Oyo State, in the Ido Local Government Area in Nigeria. Ido L.G.A has a total landmass of about 986.00 km² with a total population of 155,761, according to the National Bureau of Statistics (2023). It is bordered by other Local Government Areas in Oyo State, which include Oluyole, Ibarapa East, Akinyele, Ibadan South-West, Ibadan North-West, and Odeda in Ogun State. Other major towns in the Ido Local Government Area include Ijokodo, Ido, Omi-Adio, and Apata. Its soil is fertile enough to support food crops, plantations, trees, cassava, corn, rice, cocoa, palm oil, kola nut, livestock, and fruits, thereby having adequate agricultural land for agricultural development. Ido Local Government Area generally has good agricultural land, having favorable geographical elements, hence being widely known as "the food basket" of Oyo State (Oyo State Government, 2022; NBS, 2023; FAO, 2021).

Sampling Technique and Sample Size

Multistage random sampling was adopted to gather data from 240 respondents.

Stage 1: One farming zone (Ibadan/Ibarapa) was chosen at random from four zones in Oyo State.

Stage 2: One block (Ido) was selected from the identified zone.

Stage 3: Six cells were chosen randomly, which are Omi-Adio, Akufo, Alagbaa, Bakatari, Erinwusi, and Olowofela.

Stage 4: A sample size consisting of 240 participants was randomly picked from among forty rural farm families in each cell.

S/N	Objectives	Analytical tool	Variables
1.	To describe the socio-economic characteristics of rural farm households.	Descriptive Statistics.	Age, sex, household size, marital status.
2.	To assess the level of agricultural commercialization.	Household Commercialization Index (HCI)	Quantity of crops produced, prices sold.
3.	To evaluate the dietary diversity status of rural farm households.	Household dietary diversity score (HDDS).	Number of food groups consumed.
4.	To determine the effect of agricultural commercialization on dietary diversity.	Ordered Logit Regression model.	HCI, HDDS, Non-Farm Income, cooperative membership, age, sex, household size, marital status.

Source of Data

Structured questionnaires were administered to farm families to gather primary data. Data included socioeconomic variables such as age, sex, education, size of farms, income, and cooperative memberships.

Source: Field Survey, 2021

Analytical Techniques

Data analysis entailed the application of the Household Commercialization Index (HCI), Household Dietary Diversity Score (HDDS), Descriptive Statistics, and Ordered Logit Regression.

Household Commercialization Index (HCI)

According to Von Braun (1994):

$$HCI = \frac{\text{Value of crops sold}}{\text{Total value of crops produced}}$$

HCI values range from 0, for non-commercialized, to 1, for fully commercialized.

Household Dietary Diversity Score (HDDS)

The HDDS measures access to numerous foods and provides an indirect estimate of nutrient adequacy (FAO & FHI 360, 2016). It employs 12 food groups: cereals, roots/tubers, vegetables, fruits, meat, eggs, fish, legumes/nuts, dairy, oils/fats, sugar, and miscellaneous.

For each group, 1 indicates consumption while 0 indicates non-consumption:

$$HDDS = \text{Sum (A+B+C+D+E+F+G+H+I+J+K+L)}$$

Category	Score Range
Low	≤ 4
Medium	5-8
High	9-12

Source: Field Survey, 2021

Ordered Logit Regression Model

To determine the effect of agricultural commercialization on dietary diversity, an ordered logit model was utilized:

$$y_i^* = X_i' \beta + \varepsilon_i$$

$$y_i = \begin{cases} 0 & \text{if } y^* \leq 0 \\ 1 & \text{if } 0 < y^* \leq \mu_1 \\ 2 & \text{if } \mu_1 < y^* \leq \mu_2 \\ 3 & \text{if } y^* > \mu_2 \end{cases}$$

Thus, the model is explicitly stated thus:

$$y_i = \beta_0 + \beta_1 X_i + \varepsilon$$

Where Y_i = dietary diversity level (0 = low, 1 = medium, 2 = high), and explanatory variables include:

- X_1 : Agricultural commercialization index
- X_2 : Age
- X_3 : Marital status
- X_4 : Household size
- X_5 : Education level
- X_6 : Farm size
- X_7 : Access to extension services
- X_8 : Access to credit
- X_9 : Cooperative membership
- X_{10} : Off-farm income
- X_{11} : Gender

Results and Discussion

Socio-economic Characteristics of Respondents

The socio-economic characteristics of the 240 respondents represent the demographic and economic composition of the rural farm households in the Ido L.G.A. Household heads were mainly between the ages of 31 and 60 years (74.6%), with the average age of 53 years. This shows that the respondents are within productive age but are approaching lower labor capability because of age. This confirms Ayanlade & Radeny (2020), who indicated that the level of agricultural production declines within the later stages of life.

Approximately 66.7% are male participants, indicating that agricultural production in the region is male-oriented. 75% are married, which shows that there are increased labor opportunities within households, but increased demand for consumption. Household size was found to average a family size of five members. This fits well with the mean value reported nationally according to the National Bureau of Statistics (NBS, 2022).

In terms of educational attainment, there were 43.8% with secondary education, 27.9% finished tertiary education, 15.4% finished primary education, and 10% never finished education. Evidently, most farmers have some level of literacy, which would be beneficial in improving technology adoption and resource management.

Most of the respondents (94.2%) did not have contact with agricultural extension officials, thereby preventing them from accessing technical advice. Notably, 88.3% did not have credit facilities, while only 11.7% among those with credit obtained credit mainly from cooperative groups (42.9%) or from relations (28.6%). Farming experience ranged between 10-30 years for 44% among those who took part in the interviews, indicating that those interviewed have substantial agricultural experience.

Generally, the survey participants included small farmers, given that 89.6% of them cultivated less than two hectares of land, while 97.9% of them received less than ₦50,000 per month, which showed their low-income level and subsistence agricultural production.

Summary of Key Socio-Economic Characteristics

Variable	Dominant Category / Mean	Percentage (%)
Age	31–60 years	74.6
Sex	Male	66.7
Marital Status	Married	75.0
Household Size	4–6 persons (mean = 5)	56.7
Education	Secondary	43.8
Farm Size	1.01–2 ha	47.5
Income	< ₦50,000	97.9
Credit Access	No	88.3
Extension Contact	No	94.2

Source: Field Survey, 2021

Level of Agricultural Commercialization

From the results, the participation rate for maize was 92.5% while for cassava, it was 92.1%. The mean quantity of maize harvested was 0.397 tons, while 0.361 tons were sold at a mean price of ₦74,609 per ton. In cassava, the mean quantity harvested was 3.839 tons. From this quantity, 3.574 tons were sold at a mean price of ₦125,661 per ton.

The mean value for the commercialization index was 0.876, which indicates a high level of commercialization amongst the farmers. From the commercialization index values for all the categories, 74.2% farmers' commercialization indices stood between 0.81-1.00, 25.4% between 0.51-0.80, and less than 0.5 for 0.4% farmers. This shows that most farmers sold most of their products.

Summary of Commercialization Indicators

Indicator	Mean Value
Value of Crops Harvested (₦)	172,979.8
Value of Crops Sold (₦)	160,321.6
Commercialization Index	0.876

Source: Field Survey, 2021

Dietary Diversity Status

The result for Household Dietary Diversity Score (HDDS) indicates that 65.0% of the households possess medium dietary diversity (5-8 food groups), 33.8% possess high dietary diversity (9-12), but only 1.3% possess low dietary diversity (≤ 4). It shows that households possess access to relatively balanced diets but not to highly diverse diets.

Distribution of Dietary Diversity

Category	HDDS Range	Percentage (%)
Low	≤ 4	1.3
Medium	5–8	65.0
High	9–12	33.8

Source: Field Survey, 2021

These findings indicate that commercialization can lead to improvements in income but not necessarily to improved diet diversity.

Impact of Commercialization of Agriculture on Dietary Diversity

An ordered logit regression was estimated to determine what characteristics of the households are influential in terms of dietary diversity. The finding shows that the agriculture commercialization index had a negative and significant relationship with food variety ($\beta = -2.81$, $p < 0.05$), indicating that high commercialization can lead to lower dietary diversity. It could be implied that financial gains realized from agricultural sales are used to meet other expenditure needs, thereby resulting in low food variety.

Farm size was a significant and positively related factor ($\beta = 0.59$, $p < 0.01$), which means that farm-owning families with large farms are likely to eat different food types due to enhanced production and income opportunities. Other indicators, such as education, access to credit, and food expenditures, had positively, though not significantly, influenced food dietary diversity.

Summary of Ordered Logit Regression Results

Variable	Coefficient (β)	Significance	Interpretation
Agricultural Commercialization Index	-2.81	$p < 0.05$	Higher commercialization leads to lower dietary diversity
Farm Size	0.59	$p < 0.01$	Larger farms result in greater dietary diversity

Variable	Coefficient (β)	Significance	Interpretation
Age	-0.02	ns	Older age reduces dietary variety slightly
Education	0.04	ns	Higher education increases dietary diversity
Credit Access	0.49	ns	Positive but not significant

Model diagnostics: Wald χ^2 (10) = 22.37, p = 0.0133; Pseudo R^2 = 0.0803. Log pseudolikelihood = -154.80921

Source: Field Survey, 2021

Discussion

The results show that though agricultural commercialization can lead to improved farmers' earning capacities or economic status, it does not necessarily mean that there will be an improved diet. A major percentage of farmers believe in non-food expenditures that include education, housing, and other social commitments, compared to an improved diet. This postulates that the vulnerability of nutritional impacts induced by commercialization remains context-dependent based on market access or income allocation channels. As specified by Ogutu & Qaim (2019), Remans et al. (2015), the vulnerability impacts remain sensitive based on market access or income channels.

In the Ido Local Government Area, the level of commercialization is high among farmers who grow major staple foods such as cassava and maize. However, the level of dietary diversity did not increase with an increased level of market participation, indicating the presence of behavioral and structural mediated effects between income and nutrition outcomes, such as lack of nutrition awareness, absence of diverse foods sold in local markets, and gender expenditure preference, where male heads of the house tend to consume non-food expenditure rather than nutritional expenditure.

This finding validates the research by Carletto et al. (2017) and Gelli et al. (2020), who both assert that sole income growth cannot enhance nutrition without the aspect of nutrition-sensitive agricultural policy interventions. It also validates the results of the study made by Aurino et al. (2019), who found that women's management of farm incomes ensures higher probabilities of improved family nutrition.

Additionally, the negative correlation between the level of commercialization and dietary diversity might be associated with market risk, where high costs of inputs and an unreliable price of food reduce the purchasing power of small farmers. Hirvonen et al. (2022) highlight that in households facing inconsistent market situations, the quality of the diet is sacrificed to ensure food quantity. Such nutrition literacy programs should be upheld alongside the policy for promoting commercialization among farmers.

Conclusion and Recommendations

The survey examined the effect of agricultural commercialization on the dietary diversity of rural farm households of the Ido Local Government of Oyo State, Nigeria. Most respondents were male (66.7%), aged between 46 and 60, and married. They were mainly of the secondary level of education and had an average of 10 years of experience in farming. Household sizes were average, ranging between four to six people, and most farmers (97.9%) earned less than ₦50,000 during the last farming season.

The analysis showed 74.2% of the farmers were highly commercialized, predominantly growing cassava and maize. Dietary diversity scores indicated that 1.3% of households had low diversity, 65.0% had medium diversity, and 33.8% had high diversity. Findings from the ordered logit regression revealed that the agricultural commercialization index and farm size were significant determinants of dietary diversity. Farm size positively affected the diversity level, and larger farms had higher diversity, while commercialization negatively affected the diversity level, and crop sales were not always spent on improving dietary diversity.

The paper concludes that while agricultural commercialization increases the potential for incomes, it doesn't ensure nutritional improvements for small farmers in the given study area. The evidence shows that although large land size increases the availability of food, the aspect of dietary diversity could be negatively impacted through agricultural commercialization whenever farmers do not allocate their incomes to nutritious food diversity.

However, the misalignment between income and the improvement of nutrition points to the importance of having nutrition-sensitive agricultural approaches for both production and consumption aspects. Strengthening nutrition knowledge, improving market access for various categories of foods, and women's decision-making powers are essential for ensuring that the positive results of the process of commercialization are achieved in improving diets and living standards. Based on the findings and the conclusion, the following are recommended:

1. Farmers should be encouraged, via nutrition campaigns in local communities and agricultural extension schemes, to dedicate part of their agricultural income toward the purchase of nutritious food, including fruits, vegetables, dairy products, and meat.
2. The government and development organizations should increase the availability of land, water, and agricultural equipment to allow small farmers to produce more for sustainable incomes.
3. Extension services must incorporate nutrition education into production advice so that farmers are made aware of the value of diet diversity and income growth.
4. The rural markets involving food products and investments in transportation should focus on promoting access to affordable and diverse food items rather than focusing on starchy foods.
5. Policies should enable women in farming households to make decisions concerning spending and nutrition because there are indications that women's decision-making concerning economic issues positively impacts the quality of food and child nutrition.

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