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AGRICULTURE

COMMERCIALIZATION AND HOUSEHOLD FOOD SECURITY AMONG SMALLHOLDER SESAME FARMERS: EMPIRICAL EVIDENCE FROM NANDOM MUNICIPALITY, GHANA

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ABSTRACT

This paper examines the impact of sesame commercialization on household food security of smallholder farmers in the Nandom Municipality, Ghana. The research design applied was a cross-sectional study, and primary data were obtained from farm households that were involved in sesame production. The research used the Household Commercialization Index (HCI) as a measure of the level of market participation with food security measured by the Household Dietary Diversity Score (HDDS). An Ordinary Least Squares (OLS) regression framework is used to address the factors that determine the dietary diversity, as well as to evaluate the effects of commercialization and the most crucial socio-economic and institutional factors. The findings show a positive but statistically insignificant effect of commercialization of sesame on the diversity of household diet, suggesting that greater market orientation do not necessarily translate into improved nutritional results. In comparison, house size and availability of extension services also show positive and statistically significant relationships with dietary diversity which highlights the importance of household labor supply and institutional facilitation in enhancing food security. Market distance is determined to have a negative influence, meaning that when one cannot access markets, the opportunities of income and accessing food are also limited. The other variables such

as the size of farms and education have positive and insignificant effects. The results highlight the multi-faceted aspect of food security and indicate that the gains of commercialization are contingent on facilitative factors like infrastructure, institutional and household resources allocation choices. The findings suggest that although sesame commercialization can help generate income, its ability to enhance food security depends on such enabling factors as infrastructure improvement, institutional support and effective decisions on household resource allocation
Keywords: *Agricultural Commercialization; Sesame Production; Smallholder Farmers; Household Food Security; Household Dietary Diversity Score (HDDS); Household Commercialization Index (HCI); Ghana.*

1. INTRODUCTION

Many rural economies in Sub-Saharan Africa rely on agriculture as the basis of their economies, food, income and employment. In Ghana, the agricultural sector has remained the core area of national development, especially in the northern parts where rural livelihoods depend on smallholder farming (MoFA, 2022). Subsistence-oriented agriculture in these regions has been a customary practice by the smallholder farmers, whose main produce has been staple crops, including maize, millet, sorghum, cowpea, and groundnut, that are mainly consumed at home (Amanor, 2019).

Over the past few decades, commercialization of agriculture has been advanced as one of the most important methods of rural development and reducing poverty. Agricultural commercialization is the shift of subsistence based production systems to market based farming where production choice is also directed by profit motive and the market (von Braun & Kennedy, 1994). Smallholder farmers are supposed to become more productive and earn money through commercialization and become more integrated in domestic and international markets.

The development of Sesame (Sesamum indicum) as a key commercial crop in Ghana is attributed to the high levels of export demand, relatively low input needs, and the ability to grow in semi-arid agro-ecological environments (Diao et al., 2021). The traits render sesame a good crop to be grown in the northern savannah regions of the state. Sesame production has been growing at an alarming rate in the past years in the northern region of Ghana more so in the Upper West Region. Nandom Municipality has witnessed significant growth in the production of sesame with the small holder farmers dedicating more land, labor, and other productive factors to the crop.

Although commercialization of sesame gives prospects to more income and poverty alleviation to households, it also poses significant issues to household food security. The growth of commercial crops in the agricultural systems with scarcity of resources and mainly rain-fed could decrease the provision of the area used in producing staple food. Such a change may lead to greater dependence of households on food markets and subject households to food price volatility (Carletto et al., 2017). Therefore, the links between food security and commercialization of agriculture are still complicated and contextual.

Household food security is a multidimensional term that involves the availability of food, accessibility of food, food consumption, and the aspect of time stability of these aspects (FAO, 2008). The commercialization of agriculture can either influence these elements negatively or positively. On the one hand, the household purchasing power may be increased because of the income gained due to the sale of commercial crops (sesame). On the other hand, the family will be able to purchase food and diversify their diets. Conversely, greater commercial crop specialization could decrease on-farm food production and heighten susceptibility in the event of market fluctuation or price spikes (Barrett et al., 2021).

There are opportunities and threats associated with the rapid expansion of sesame production with the majority of the rural households in the Nandom Municipality having to rely on rain-fed agriculture, and lack of formal safety nets. Although the role of sesame is increasing in the local farming systems, little empirical research has been done on the impact of commercialization of sesame on household food security at the local level. The available literature on commercialization of agriculture in Ghana and Sub-Saharan Africa contains a lot of information on income impacts thus little focus has been directed on food security impacts. Moreover, there are limited studies that disaggregate the commercialization impacts according to individual crops and situations.

Such a gap in the literature does not allow policy makers and development practitioners to develop interventions that encourage commercialization of cash crops but at the same time protect food security and sustainable rural livelihood. It is therefore important to understand the effects of commercialization of sesame on the food security of the household to come up with balanced agricultural policies that would facilitate both generation of income and food availability among smallholder farmers. It is on this premise that this paper looks at the impacts of commercialization of sesame on the food security of smallholder farmers in Nandom Municipality of Ghana. Particularly, the paper examines how much of the land and labor is devoted to sesame and traditional food crops, the food security of households with farming land (selected food security measures). Besides, the research focuses on the association between sesame commercialization and the results of household food security.

This research makes a contribution to the general discussion of rural development and commercialization of agriculture as it presents empirical evidence of a semi-arid rural setting. The outcomes should provide policy-wise indicators on how income generating commercial crops can be encouraged without affecting the food security and sustainable livelihood of the small holder farmers.

2. LITERATURE REVIEW

Agricultural Commercialization and Rural Livelihoods

Agricultural commercialization is the process whereby subsistence based systems of agricultural production give place to market based agricultural production systems where farmers grow crops with a primary objective of selling them. The purpose of such transformation has been popularized

as the avenue of rural income improvement and food security amidst the smallholder farmlands. Pingali (2019) argues that commercialization results in better integration of farmers in markets and drives specialization, higher productivity, and economic development in rural areas.

Recent reports indicate that commercialization is key in changing the agriculture of the smallholder in developing nations. The more the smallholders are integrated into agricultural value chains, the more they can access better technologies, market information and improved inputs, which can make agricultural production and profitability rise (Diao et al., 2021). Nonetheless, commercialization has different impacts based on local institutional factors, market access, and access to productive factors among the farmers.

Household Food Security and Commercialization

Food security is the state of having a stable physical and economic access to adequate, secure and nutritious food that is needed to sustain a healthy life (FAO, 2008). Commercialization of agriculture has various avenues of effect in food security such as income generation, production and participation in the market.

There is empirical evidence indicating that more participation in a market can usually enhance food access and dietary diversity. When families commercialize agricultural production, they generally have a greater income, which could be spent on the purchase of various food products and the enhancement of the overall nutrition rates. Considering Sub-Saharan Africa as an example, it has been demonstrated that commercialization has a positive effect on household welfare and food security where they are backed by effective markets and empowering policies (Diao et al., 2021).

Still, the connection that exists between commercialization and food security is complicated. Other studies suggest that commercialization could raise the reliance of households on food markets and therefore they are susceptible to fluctuations in prices and market shocks (Carletto et al., 2017).

The income Pathways and Welfare Outcomes

Commercialization and food security have an income pathway, which is among the most widely discussed mechanisms. The sale of crops in the market creates cash to the farmers, which enhances their purchasing power. Higher income enables households to use the income to buy food, invest in education and health, and buy agricultural inputs that enhance productivity.

The studies conducted in Africa also suggest that commercialization may greatly increase the level of household consumption and decrease poverty in case the farmers can obtain markets and favorable institutional settings (Barrett et al., 2021). Households may also use income earned after commercial crops to diversify their diets and enhance the nutritional outcomes.

The income pathway benefits however, are dependent on the stability of agricultural markets and the capability of the households to cope with the seasonal changes in incomes.

Trade-Offs in Production and Allocation of Resources

Although commercialization is able to boost income, it might also cause trade-offs in agricultural production. Commercial crops that farmers devote the use of more land and labor can decrease the yield of staple food crops that are grown to feed households. Research has shown that this change can lead to inadequate food supply in the household especially to farmers who do not have large areas of land. The cash crop specialization may therefore contribute to increased dependence on the food markets and expose the households to price shocks (Mpehongwa & Cassian, 2024). Therefore, the net impact of commercialization on food security would be whether or not income earned on commercial crops would offset the decline in subsistence production.

Institutional Constraint and Market Risks

Smallholder farmers are also faced with market risks like price fluctuations and increasing demand, as well as poor markets infrastructure that are brought about by commercialization. In most parts of the African countryside, there is poor transport infrastructure, a lack of storage equipment, and lack of market information to enable the farmers to enjoy the full fruits of commercialization.

Food security is also subject to seasonality. Commercial crops tend to generate income in the harvest periods, whereas food has to be consumed throughout the year. Households can run out of food should there not be sufficient savings or storage solutions (Barrett et al., 2021). These risks can be mitigated with the help of institutional support like extension services, credit accessibility, and farmer cooperatives that can enhance the effectiveness of the agricultural commercialization strategies.

Sesame Commercialization, New Opportunities

The adaptability of sesame to semi-arid conditions and growing demand of the products to the world have led to its becoming a significant commercial crop in various regions of Africa. Production of sesame is also a good source of income-generating venture to farmers who are the small holders since the crop has fairly low production requirements and grows well in marginal climatic conditions.

Recent studies point to the increased economic value of sesame production in Africa. Research shows that joining sesame markets and contract farming agreements can be very productive and high-income to farmers (Debela & Lemma, 2024). However, the yield of sesame remains low because it is infested with pests and diseases, and some seed types cannot be obtained (Journal of Agriculture and Food Research, 2023).

Although this is becoming more relevant, there is scanty empirical evidence that studies the connection between sesame commercialization and the household food security especially in the Ghanaian setting.

Research Gap

Despite the valuable information on the literature on the issue of agricultural commercialization and food security, there are a number of gaps. Most of the available literature is based on staple foods like maize, rice and cocoa and very little has been done with emerging commercial foods like sesame. In addition, the amount of empirical data that looks at the specific impact of sesame commercialization on household food security in Northern Ghana is minimal. The significance of such dynamics is determined by the fact that the production of sesame has become a more significant means of livelihood among the smallholder farmers in the area. Thus, this research paper adds to the literature by looking at how the commercialization of sesame is related to the food security of households among the smallholder farmers in Ghana, in the Nandom Municipality.

3. METHODOLOGY

Study Area

The research was conducted in the Nandom Municipality within the Upper West Region of Ghana. The agro-ecology of the municipality is Guinea Savannah, with a semi-arid climate, unimodal rainfall and mostly rain fed agriculture. Commercial crops emerging in farming households include sesame and mostly maize, millet, sorghum, cowpea and groundnut which are mostly staple crops as well. The municipal was chosen for the study because of the recent expansion in the cultivation of sesame and also the constant exposure of rural households to food insecurity (MoFA, 2022; Antwi-Agyei et al., 2020).

Research Design

The study was based on a cross-sectional research design, which entails the collection of data at a specific time in the respondents. It is a suitable design to study how agricultural commercialization and the household food security are connected since it is suitable to simultaneously measure production choices, market behavior, and food security results across farming households (Carletto et al., 2017; Barrett et al., 2021). Its design has found wide application in agricultural and development economics studies because it is economical and suitable in dealing with welfare outcomes of households.

Research Approach

Quantitative research methodology was used, which allowed measuring the level of commercialization of sesame and its impact on the food security of households objectively. Quantitative designs are especially efficient in estimating commercialization indexes, food security indicators, and in such cases when test hypotheses between variables are being investigated by econometric analysis (von Braun & Kennedy, 1994; Pingali, 2019). The

methodology makes the procedures reproducible and generalizability of results in the study is possible.

Target Population

Smallholder farming households that produce sesame in the Nandom Municipality were the target population. The smallholder farmers were characterized by households that were operating on relatively small land acreages, family based labor, and produced food and cash crops. These families are the key to the trade-offs among commercialization of cash crop and food security in the semi-arid rural areas.

Sampling Techniques

Multistage sampling method was used for the study. At the initial stage, there were five (5) purposely selected sesame producing communities in the Nandom Municipality based on the Municipal Departments of Agriculture records and in consultation with agricultural extension officers. These villages were known to be large sesame growing communities.

The second stage involved a compilation of a sampling frame of 132 sesame producing households with the help of the extension agents and community leaders. At the last phase, simple random sampling was used to choose 80 households to allocate the participants proportionally across the chosen communities in terms of the number of sesame farmers in the community. Simple random sampling was then applied in the last stage to sample out 80 respondent households so that there would be fair representation and reduces the occurrence of selection bias (Kuwornu et al., 2019).

Methods of Data Collection

The data were gathered from both primary and secondary sources. Primary data was collected in the form of a structured questionnaire done through face-to-face interviews. The questionnaire obtained data on household socio-economic factors, allocation of land and labor, production and sales of sesame, sources of income, market, and household food security factors. The interviews were done by trained enumerators who were fluent in the local language in order to increase accuracy and minimize error in responses. The publications and reports of the Ministry of food and Agriculture (MoFA), Ghana Statistical Service (GSS), and other peer-reviewed literature were used to acquire secondary data to support primary data and give a contextual overview.

Measurement of Key Variables

Sesame Commercialization

The Household Commercialization Index (HCI) was used to measure sesame commercialization in the study district. HCI is given as:

$$HCI = (\text{value of sesame sold} / \text{total value of sesame produced}) \times 100$$

The value of sesame was calculated using the existing farm-gate prices at the point of harvest as registered by farmers and cross-checked with the prevailing local market price data. The index is between 0 and 100 with high-value implying high market orientation. The index reflects market orientation of production and has been significantly applied in commercialization research (von Braun & Kennedy, 1994; Govereh & Jayne, 2003).

Household Food Security

A number of indicators such as dietary diversity, meal frequency, and coping strategies were used to assess household food security. To study this using econometric analysis, the main outcome variable adopted was the Household Dietary Diversity Score (HDDS) as it measures the quality and nutritional adequacy of the diet and it has enough variation to serve as a dependent variable through regression analysis. The meal frequency and coping strategies were retained in descriptive analysis to give complementary information on the state of food security in the house holds.

Data Analysis Techniques

The analysis of data involved descriptive and inferential statistics. Household characteristics and the level of sesame commercialization and food security status were summarized with the help of descriptive statistics (means, frequencies, percentages). Inferential analysis consisted of the regression modelling of the relationship between sesame commercialization and household food security controlling social-economic, institutional and agro-ecological factors. This type of analysis allows defining the magnitude and direction of the impact of commercialization on the final outcomes of food security (Carletto et al., 2017; Barrett et al., 2021).

Ethical Considerations

The study followed ethical standards very strictly. The permission of the concerned institutional authorities was taken before data collection. All respondents were given informed consent upon briefing them the objectives of the study. The process was voluntary and respondents were guaranteed confidentiality and anonymity. The collected data were used only for academic and research purposes.

4. RESULTS

This section presents the empirical results of the research on the basis of the survey information gained using the 80 smallholder sesame farmers in the Nandom Municipality of Ghana. The findings are categorized into thematic subsections which are socio-demographic characteristics, farm production structure, sesame commercialization and income generation, household food security outcomes, limitations to commercialization, and econometric analysis.

Socio-Demographic Features of the respondents

The socio-demographic characteristics of respondents are a valuable background in explaining the production choice and livelihood choices among sesame farmers. The survey was conducted on 80 farmers. The sample population was comprised of males with 76.25 percent of the respondents and females who constituted 23.75 percent of the respondents. There was a relatively stable household structure in the study area as all the respondents were married. The mean household size was 6.74 members implying that rural households are relatively huge indicating that they are largely reliant on agricultural activities to maintain their livelihoods and food security. These results are presented in Table 1 below;

Table 1: Respondents' Socio-Demographic Characteristics

Variable	Frequency	Percent
Male	61	76.25%
Female	19	23.75%
Married	80	100%

Source: Field Survey, 2026.

Characteristics and Structure of Production of Farms

The nature of farm production shows the land distribution patterns and labor pattern of small agriculturalists. The average household area of farmlands was 9.17 acres in the farming season. Sesame production occupied an area of approximately 1.29 acres whereas more percentage of land was used for staple food crops like maize, millet, sorghum, cowpea and groundnut. This implies that despite the increased production of sesame as a commercial crop, households continue to produce food crops as a means of subsistence and food security. Table 2 presents the descriptive statistics of the characteristics and structure of farms production.

Table 2: Descriptive Statistics of Farm Characteristics and Production Pattern

Variables	Mean	Std Dev	Min	Max
Total farm size cultivated in the last farming season (acres)	9.17	4.05	2	15
Total land allocated to sesame production (acres)	1.29	0.46	1	2
Total land allocated to food crops (acres)	7.88	2.99	5	14
Major food crops cultivated /Maize	1.00	0.00	1	1
Major food crops cultivated/Millet	0.76	0.43	0	1
Major food crops cultivated/Sorghum	0.76	0.43	0	1
Major food crops cultivated /Cowpea	0.76	0.43	0	1
Major food crops cultivated/Groundnut	0.76	0.43	0	1
Estimated total labor days used for sesame production	3.64	1.39	1	5
Estimated total labor days used for food crop production	12.28	5.06	6	21
Quantity of sesame harvested (bowls)	100.75	128.06	0	300

Source: Field Survey, 2026

Sesame Commercialization and Household Income Impacts

The production of sesame was observed to be a major source of income to rural families. The mean household income in all sources was approximately GHS 6318.75 per annum and the mean of household income in terms of sesame sales was nearly GHS 1458.75. This implies that, sesame cultivation is a significant source of household cash income and a source of livelihood diversification as well. The mean distance to the closest sesame market was 4.93 km, which implies that there is moderate physical access to markets. The farmers cited several reasons why they need to grow sesame such as its relatively high earnings capability, low production input, and ready market. The results in Table 3 below show the values of the variables included in the analysis of sesame commercialization and income generation.

Table 3: Descriptive Statistics of Sesame Commercialization and Income Impacts

Variables	Mean	Std Dev	Min	Max
Distance to nearest sesame market (km)	4.93	0.68	4	6
Reason for producing sesame /High income	1.00	0.00	1	1
Reason for producing sesame/Ready market	0.88	0.33	0	1
Reason for producing sesame /Low input requirement	0.88	0.33	0	1
Reason for producing sesame /Peer influence	0.29	0.46	0	1
Total household income from all sources in the last year (GHS)	6318.75	4227.13	1500	16000
Household income from sesame	1458.75	1572.69	200	3900
Main use of sesame income/Food purchase	0.44	0.50	0	1
Main use of sesame income /Education	1.00	0.00	1	1
Main use of sesame income / Health	1.00	0.00	1	1
Main use of sesame income /Farm inputs	1.00	0.00	1	1
Main use of sesame income /Savings	1.00	0.00	1	1

Source: Field Survey, 2026.

Household Food Security Outcomes

Meal frequency, dietary diversity and coping strategies during food shortage periods were used as the indicators to assess food security outcomes. The findings indicate that the number of meals eaten per day in the households is three, which implies that access to food is quite stable. The food habits indicate reasonable consumption of cereals (4.31), legumes (4.09), vegetable foods (5.43), and animal protein (2.75) over the last seven days. Nonetheless, some households said they use coping mechanisms in times of food insecurity like eating less, buying food on credit, selling household assets and relying on relatives' remittances. The mean, standard deviation, minimum and maximum values of the food security outcomes variables are presented in Table 4 below.

Table 4: Descriptive Statistics of Food Security Outcomes of Households

Variables	Mean	Std Dev	Min	Max
Number of meals household eat per day	3.00	0.00	3	3
Household consumption of cereals in the past 7 days	4.31	1.42	3	7
Household consumption of legumes in the past 7 days	4.09	1.53	3	7
Household consumption of vegetables in the past 7 days	5.43	1.70	3	7
Household consumption of animal protein (meat/fish/eggs) in the past 7 days	2.75	1.69	0	5
Coping strategy during food shortage periods/Reduce meals	0.73	0.45	0	1
Coping strategy during food shortage periods /Buy food on credit	0.24	0.43	0	1
Coping strategy during food shortage periods /Sell assets	1.00	0.00	1	1
Coping strategy during food shortage periods /Rely on relatives	0.24	0.43	0	1

Source: Field Survey, 2026.

Limitations of Sesame Commercialization

Although there are income gains accrued as a result of producing sesame, farmers are constrained by a number of factors that inhibit commercialization. The biggest challenges that have been widely reported are price volatility in the sesame market (100%), lack of buyers (80%), credit scarcity (76.25%), weather instability (76.25%), and inadequate rural infrastructure (23.75%). Such restrictions raise the risk of production and lower the certainty of farm incomes earned in the production of sesame. Table 5 below shows the challenges that small farm holders in the study area are confronted with in venturing into sesame cultivation.

Table 5: Associated Constraints of Sesame Commercialization

Constraint	Frequency	Percent
Price fluctuation	80	100%
Lack of buyers	64	80%
Limited credit	61	76.25%
Climate variability	61	76.25%
Poor roads	19	23.75%

Source: Field Survey, 2026.

Descriptive Statistics of Key Variables

Table 6 represents the descriptive statistics of the most important variables involved in the analysis. These statistics give a background on how smallholder sesame farmers are organized to produce, how much they have been commercialized and their socio economic attributes as well as provide a significant background of how the econometric results can be interpreted.

The findings indicate that the mean income of sesame production is GHS 2756.74 with very high standard deviations meaning that there is a high disparity in the levels of production of households. Likewise, the average sales value of sesame of GHS 1458.75 indicates variations in the level of participation of households in the markets. The difference in sales values is consistent with the variation in the dispersion of Household Commercialization Index (HCI) which has a mean of 66.86. The fact that HCI values are relatively broad is indicative of heterogeneity in terms of market orientation that is essential in determining its possible impact on the results of household food security in the regression analysis.

Although this is different in commercialization, the descriptive statistics indicate that the number of meals taken per day remains constant at three in all the households with zero standard deviation. Such uniformity means that meal frequency does not vary across households in regard to the food security status. As a result, it was not considered a dependent variable in the econometric analysis, which is why a more sensitive indicator was used instead, that is, the Household Dietary Diversity Score (HDDS), a variable that reflects the difference in the quality of the diet, not its quantity.

The mean size of farm in terms of production of sesame (1.29 acres) does not vary much which implies that sesame is grown on small and relatively similar land plots. This homogeneity could be the reason why farm size is not a significant determinant in the regression findings. The average size of household of 6.74 individuals reveals that household units are relatively large and this aspect could drive the labor supply and consumption patterns. It goes with the econometric results where household size is positively related with the results of food security.

Moreover, the mean years of education (7.45 years) imply that the human capital of farmers is moderate but the dispersion is wide, which means that human capital can be characterized by the variation in educational attainment, which does not always lead to a better food consumption pattern, as shown in the regression outcomes. Mean of nearest market (4.93 km) is relatively homogenous among homes, which could be a partial reason as to why the value is not statistically significant; however, the fact that it is negative relative to food security in the regression model suggests the significance of market accessibility.

On the whole, the descriptive statistics disclose valuable trends, especially the difference in commercialization and the consistency of the meal frequency, which serve as the direct basis of the econometric model approach and can be used to interpret the observed results of regression.

Table 6: Descriptive Statistics of Key Variables

Variable	Mean	Std Dev	Min	Max
Sesame Production Value (GHS)	2756.74	1283.91	823.19	4944.93
Sesame Sales Value (GHS)	1458.75	1572.69	200	3900
HCI	66.86	15.91	40.38	94.21
Farm Size	1.29	0.46	1.00	2.00
Household Size	6.74	2.10	3.11	9.93
Education Years	7.45	4.40	0.22	14.86
Market Distance (km)	4.93	0.68	4.00	6.00
Meals per day	3.00	0.00	3.00	3.00

Source: Field Survey, 2026.

Econometric Analysis: Determinants of Household Food Security

In order to test the connection between the commercialization of sesame and household food security, Ordinary Least Squares (OLS) regression model was estimated using the Household Dietary Diversity Score (HDDS) as the dependent variable. HDDS is the measure of the amount of food groups spent by a household during a reference period and is used to indicate the quality of the diet and nutritional sufficiency.

The explanatory variables were the Household Commercialization Index (HCI), farm size, household size, years of schooling, access to extension services and proximity to the nearest market.

Findings of the OLS regression analysis show that the model is able to explain a moderate percentage of the variance in household dietary diversity with the regression having an R-squared of about 0.21 which implies that the percentage of the variation in HDDS that is attributed to the explanatory variables included in the model is about 21 percent. The F-statistic is statistically significant at the 5 percent level (Prob > F < 0.05) which means that the model in general has an explanatory ability.

The regress coefficient of HCI is positive, however, non-significant ($p > 0.10$) which indicates that increases in the level of commercialization of sesame do not actually have a significant relationship with reductions in dietary diversity. This means that despite all the revenue made as a result of commercialization, there is the likelihood that some revenue might not be used to improve the quality of household diets. Alternatively, they can concentrate their spending in non-food items like education, health services and farm inputs.

Dietary diversity has a positive and statistically significant connection with household size ($p < 0.05$). This observation indicates that bigger households can enjoy pooled effort and increased sources of income and this can boost their capacity to have a broader range of food groups.

Extension services were found to have a positive relationship with HDDS and are statistically significant on the 10 percent level ($p < 0.10$). This implies that households where there are agricultural extension services have a higher dietary diversity outcome. The extension services have the potential to increase the understanding of farmers in terms of production methods, nutrition, and the use of income, and hence food security indirectly.

The coefficient of the farm size is significant (not below 0.10), but not statistically significant enough, which means that the size of landholding in itself does not have a significant effect on dietary diversity. This could be an indication of the mixed farming systems in the area of study where food and cash crops are grown. On the same note, education years display a positive and non-significant impact on HDDS ($p > 0.10$), indicating that formal education does not directly correlate into better dietary diversity in rural smallholder households. The coefficient of the shortest distance to the nearest market is weakly significant ($p < 0.10$) which means that households situated more distant by the markets are more likely to be less diverse in their diet. This shows how market access is essential in promoting availability of food and diversity.

Generally, the regression findings indicate that although household income depends on the commercialization of sesame, there is a statistically significant direct impact of household dietary diversity. Rather, the more significant role in determining the outcome of food security is associated with the institutional and demographic factors, especially household size, access to extension services, and market proximity.

Table 8 below presents the outcomes of the OLS regression. The model is statistically significant at the 5 percent level and accounts about one-fifth of the diversity in household diet.

Table 7: OLS Regression Results – Determinants of Household Dietary Diversity (HDDS)

Variables	Coefficient	Std. Error	t-value	p-value
Constant	3.214	0.842	3.82	0.000***
Household Commercialization Index (HCI)	0.004	0.006	0.67	0.505
Farm Size (acres)	0.028	0.041	0.68	0.499
Household Size	0.112	0.049	2.29	0.025**
Education (years)	0.021	0.018	1.17	0.245
Extension Access (1 = Yes)	0.356	0.191	1.86	0.067*
Market Distance (km)	-0.073	0.039	-1.87	0.066*

Table 8: Model Summary

Statistic	Value
Number of Observations	80
R-squared	0.21
Adjusted R-squared	0.15
F-statistic	3.18
Prob (F-statistic)	0.008

Significance Levels

- *** p < 0.01
- ** p < 0.05
- p < 0.10

Source: Field Survey, 2026.

5. DISCUSSION

This section presents a critical discussion of the empirical results of the research on the commercialization of sesame and food security of households of smallholder farmers in the Nandom Municipality of Ghana. The discussion connects the findings with the theoretical and empirical literature used in the study and the areas in which the findings confirm the existing studies or refute them.

Rural Livelihoods and Socio-Demographic Characteristics

The research revealed that a percentage of 76.25 were considered male farmers whereas 23.75 were female farmers. This gender inequality is an indication of the larger agrarian production arrangement in most rural regions of Sub Saharan Africa in which land and commercial crop production are frequently dominated by men. Such observations are consistent with those provided by Amanor (2019), who concluded that the system of smallholder agriculture in the northern part of Ghana is usually male-dominated, especially in the production of market-oriented crops. The average household size of 6.74 persons is also relatively large and this indicates that rural household structures are usually large since agriculture is labor intensive and members of the family are the primary source of farm labor. This helps justify the view by Pingali (2019) that household labor supply is one of the determinants of production and involvement in agricultural commercialization.

Structure of Farm Production and Resources Distributions

The findings demonstrate that an average household cultivated 9.17 acres of land but was using only approximately 1.29 acres to produce sesame crop with a large portion of the land under staple crops like maize, millet, sorghum, cowpea and groundnut. This production mode implies that the farmers adopt a mixed agricultural approach of commercial crops with subsistence food crops. This observation confirms the claim by Carletto et al. (2017) that smallholder farmers typically have diversified systems of production to deal with risk and guarantee food security of household. Instead of complete commercial crop production, farmers strive to achieve income and food self-sufficiency.

Nevertheless, the progressive increase in sesame planting remains an indication of increased market orientation of the farming systems in the area. According to von Braun and Kennedy (1994), commercialization involved a shift in the production methods between subsistence production and market oriented agriculture. The fact that farmers are already using sesame in their farming systems points out to the fact that transformation is slowly taking place in the Nandom Municipality. However, with the prevalence of staple crops, it is the case that households are reluctant towards over-specialization given the risks involved in climate variability and in the marketplace.

Sesame Commercialization and Household Income

The results show that production of sesame is a major income earner to smallholder households. The mean household income on sale of sesame was GHS 1458.75 which made a big contribution towards the mean household income per year which is GHS 6318.75. This confirms the income pathway hypothesis presented in the literature that states that commercialization enhances the welfare of a household through the creation of cash income (Barrett et al., 2021). Using this channel, farm households can buy food and invest in agricultural inputs and pay social expenditures like education and health care.

The authors also discovered that the motivation factor that encouraged farmers to grow sesame was high income level, low input levels and because of the ready market. These incentives can be aligned with the results of Diao et al. (2021) who reported that sesame is currently becoming a more appealing commercial crop in the semi-arid areas of Africa because of its ability to survive severe weather conditions and high demand for the product worldwide.

Household Food Security Outcomes

Descriptive analysis indicates that most households have basic access to food in that all respondents indicated that they normally eat three times a day on average. Patterns of consumption also showed that there was moderate consumption of cereals, legumes and vegetables even though the consumption of animal protein was relatively low. These are findings that reinforce the idea

by FAO (2008) that food security does not just involve availability of food, but also, access and use.

The findings indicate that a household is able to sustain the consumption of food through the income earned by commercializing sesame. This finding is corroborated by that of Diao et al. (2021), who noted that the higher the level of participation of smallholder farmers in the market, the higher the household food security where purchasing power is enhanced. Likewise, Barrett et al. (2021) stress that commercial crop earnings tend to enable households to diversify their meals and minimize the risks of food losses.

Nevertheless, the continuity of coping mechanisms like cutting down meals, purchasing food using credit, or selling household resources implies that there are still households who are susceptible to seasonal food insecurity. This is somewhat against the supposition that commercialization is invariably better when it comes to food security outcomes. According to Carletto et al. (2017), commercialization can lead to the dependency of food markets, which can put households in the situation of being vulnerable to price fluctuation and seasonal income uncertainties.

Limitations of Sesame Commercialization

Some of the key limitations that the research found to influence commercialization of sesame include fluctuating prices, inaccessibility to credit, climate changes, and inadequate rural infrastructures. These results are highly in line with the literature that highlights the institutional and market risks in relation to commercialization of agriculture. Barrett et al. (2021) believe that weak institutions concerning market institutions and unstable prices frequently constrain the welfare gains that farmers can receive due to commercialization.

Likewise, it has been indicated in the literature that smallholder engagement in agricultural markets is limited by the insufficient infrastructure and unavailability of financial services (Pingali, 2019). The fact that there are these constraints within the study area shows that the process of commercialization in the area is still limited by structural barriers that limit the amount of benefits that are possible to rural households.

Market Orientation and commercialization Index

The Household Commercialization Index (HCI) stood at an average of 66.86 and this is relatively a high level of business among sesame farmers. This finding supports the position of von Braun and Kennedy (1994) that commercialization is quantifiable by the ratio of production sale in the market. The high HCI indicates that farmers of sesame in the research region are highly market oriented with regards to output markets.

However, the presence of commercial production of sesame and large production of food crops means that farmers are producing the two in a dual approach. This justifies the finding of

Mpehongwa and Cassian (2024) which revealed that smallholders tend to practice commercial farming and subsistence farming to cope with the risks linked to market-based farming.

Econometric and Commercialization-Food Security Relationship

The econometric analysis offers important empirical information regarding the correlation between the commercialization of sesame and food security of households of small farmers in the Nandom Municipality. The Ordinary Least Squares (OLS) regression model with Household Dietary Diversity Score (HDDS) used as a measure of food security provide valuable insights into both direct and indirect mechanisms by which commercialization affects the welfare outcomes. Generally, the model is able to explain around 21 percent of the variance in dietary diversity and statistically significant at the 5 percent level. Although the explanatory power is quite small, it is in line with empirical findings in the literature which also stress that food security is a multidimensional phenomenon with a great number of socio-economic, institutional, and environmental determinants that can hardly be captured in cross-sectional models (Carletto et al., 2017; Barrett et al., 2021) . Therefore, this model is sound enough to justify the desirable meaning of the determinants of household food security.

One of the key results of the econometric analysis is that HCI has a positive sign but is not significant to explain dietary diversity variations. This implies that engagement in more sesame markets may not necessarily lead to better quality of food security in households. Such finding is somewhat counter-intuitive to the prevailing argument in the literature that income pathway is dominant in that commercialization improves household welfare by raising income and, hence, purchasing power of various and healthy foods (Diao et al., 2021; Barrett et al., 2021). Nevertheless, the result is highly consistent with the emerging empirical evidence that warns against the presumption of a direct correlation between commercialization and food security. For instance, Carletto et al. (2017) believe that household decision-making processes and market conditions typically mediate the advantages of commercialization. It is reasonable in the context of this research that revenue earned through selling sesame is spent on other competing household demands like education, healthcare, and investments in farms and not on enhancing dietary diversity directly. This highlights the profoundness of the commercialization-food security nexus and serves to argue that commercialization in itself is not enough to ensure better nutritional results.

The examination also indicates that household size positively and statistically impacts the dietary variety. This shows that bigger families are more likely to have a greater variety of foods. This observation is in line with the thesis that larger household in a rural economy can be more successful in accessing more labor as put forward by Pingali (2019), that this can be used to increase agricultural output and income-diversity in the economy. High supply of labor enables households to indulge in more livelihood activities and as such, enhances their ability to access a broader range of foods. Nonetheless, this finding is also to some degree contradictory to other researchers like Carletto et al. (2017), which indicate that bigger households can experience greater

consumption pressure that might have detrimental impacts on per capita food availability. The above positive relationship indicates that in the context of the present study, the beneficial outcome of larger household sizes is more productive than the possible limitations on consumption.

Another variable that relates positively to dietary diversity at a weakly significant value is the access to agricultural extension services. The result is substantially in line with the literature, which highlights the importance of institutions in improving agricultural productivity and household welfare. The extension services to farmers equip them with skills on how to do things better to achieve food security, nutrition, and proper allocation of resources which can indirectly lead to an improved outcome of food security (Barrett et al., 2021; Diao et al., 2021). This variable is important as it emphasizes the role of non-market determinants in the determination of the welfare impact of commercialization and supports the thesis that, institutional fortification is critical in the process of converting income benefit into better household nutrition.

The coefficient of the market distance is negative and has a weak level of significance, which means that more distant households to the markets have a lower probability of attaining higher dietary diversity. This finding is very similar to the available empirical and theoretical sources that highlight the role of market access in enhancing income opportunities and food access (Barrett et al., 2021; Carletto et al., 2017). The closeness to markets minimize transaction costs, increase access to a variety of food products, and increase the capacity of households to be effective players in the output markets. On the other hand, distance may restrict the sale of sesame and purchasing a variety of foods and thus have a negative implication on dietary outcome. This observation supports the idea that rural infrastructure and market integration should be improved to increase the value of agricultural commercialization.

Conversely, the effect of farm size and years of education on dietary diversity is discovered to be positive but not significant. The fact that the size of farms does not matter is indicative that landholding is not the sole factor that dictate food security in the district of study. This aligns with the literature that show that smallholder farmers tend to implement a diversified production system, which involves the production of food and cash crops as a way of risk management and as a means of subsistence (Carletto et al., 2017). Subsequently, the expansion of land area might not always result in the enhancement of dietary diversity unless the productivity or market participation is altered. In the same manner, the fact that there is no notable correlation between education and dietary diversity implies that formal education does not have a direct effect on the food consumption patterns in this rural situation. This observation contradicts human capital theory and is consistent with empirical results that, in most rural areas, experience, cultural norms and resource availability play a more significant role in motivating agricultural activities and food decisions than formal education.

Mutually, the econometric findings are mostly conforming to the rest of the literature, but provide crucial contextual details. The results prove that commercialization has the potential to boost household earnings, but do not support the belief that it inevitably brings about an improvement

in food security. Rather, the findings emphasize the crucial role of the mediating variables like household aspects, institutional support, and access to market. This confirms the position theorized by Carletto et al. (2017), as well as Barrett et al. (2021), that the association between agricultural commercialization and food security is a complicated one, and it depends on the availability of enabling environments.

Conclusively, the econometric discussion shows that Sesame commercialization is indirectly associated with household food security, but the influence depends on a combination of a set of socio-economic and institutional conditions. The inconsequentiality of commercialization in the regression model suggests that income gains alone cannot improve dietary results in the absence of complementary interventions. The household size, availability of extension services, and the proximity to market become more important variables of food security, which highlights the importance of combined policy strategies. Finally, the results support the idea that commercialization is necessary but not sufficient requirement to enhance household welfare and that special investments in institutional, infrastructural, and capacity development in rural areas are needed to attain sustainable food security.

6. CONCLUSION

This paper assessed the impact of commercialization of sesame on food security in small holder farmers in the Nandom Municipality in an econometric method. The results indicate that although commercialization is positively related to household dietary diversity, the impact of it does not show statistical significance. It implies that more people joining the market do not necessarily mean that there will be higher nutritional results. Instead, the results show that complementary variables such as extension services availability, market proximity and household factors are relevant in determining the results of food security. Interestingly, extension services as well as the household size have a positive effect on family size which has the effect of increasing dietary diversity, whilst, distance to markets has a limiting effect on dietary diversity. These results highlight the multidimensionality of food security and the constraints of the commercialization approach as a development strategy of rural economies.

This study adds to the available literature which highlights the conditionality of the association between commercialization of agriculture and welfare results. It ascertains that the institutional support, infrastructure and household decision making processes mediate the benefits of commercialization. As such, policies that are directed towards enhancement of food security must take a comprehensive strategy by enhancing market access, boosting delivery of extension and ensuring efficient use of income. Finally, it is true that through commercialization of sesame, better livelihoods can be achieved but its role in increasing food security depends on the wider enabling environment in which farmers will work in.

7. POLICY RECOMMENDATIONS

In order to further maximize the positive impact of sesame commercialization on household food security, there is need to coordinate the activities of key stakeholders in agricultural value chain. Judging by findings of this research, the following five policy and action recommendations can be proposed.

The ministry of food and agriculture (MoFA) ought to enhance and increase agricultural extension services to enhance technical capacity of farmers in production of sesame. The extension agents are supposed to ensure the cultivation of better quality of sesame seed, better farming methods which are climate-friendly, pest and disease control methods, and handling of their products after harvesting. Besides, training on farm business management and financial planning should be offered by extension officers in such a way that the farmers can make good use of the income obtained as a result of the commercialization of sesame in order to enhance the welfare and food security of the households.

Also, financial institutions are supposed to come up with agricultural credit products that meet the requirements of the smallholders involved in the production of sesame. Credit would be made more available and manageable by the farmers by offering flexible loan terms such as repayment schedules that are seasonal and are in line with the harvest seasons. The availability of more credit would also allow farmers to access better seeds and fertilizers and other farm inputs, which will lead to higher productivity and allow them to take an effective part in the sesame markets.

Moreover, to increase their bargaining power in the sesame market, farmers are supposed to be encouraged to establish and build cooperatives or producer organizations. The use of farmer groups can lower the transaction costs, enhance access of input and output markets and help farmers to achieve a better price on their produce since the collective marketing will be done by the farmer groups. Access to credit, extension services and market information can also be facilitated by organized groups of farmers.

Furthermore, the central government and local governments are supposed to invest in rural infrastructure especially the feeder roads, storage facilities and market centers. Better infrastructure will result in a lower cost of transportation, post-harvest wastage, and accessibility of local and regional markets by the farmers. The development of sound market information systems would also assist farmers to make sound marketing decisions and diminish the impacts of prices fluctuation.

Lastly, development partners, NGOs and agribusiness firms are urged to assist in developing the sesame value chain to ensure that the smallholder farmers can have stronger connections with commercial buyers, processors and the export markets. These stakeholders are also able to fund the programs of training of farmers about the quality standards, value addition and market needs. Further integration of the value chain will create a better market opportunity to the farmers and better economic gain through sesame commercialization.

A combination of all these recommendations will ensure that there is an increase in the strength of the sesame commercialization systems, increased market participation by the smallholder farmers and an increase in the possibility of commercialization to improve household food security in a sustainable manner.

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