



ANALYSIS OF LIVELIHOOD DIVERSIFICATION STRATEGIES AMONG GINGER (*ZINGIBER officinale rosc*) FARMING HOUSEHOLDS IN KADUNA STATE, NIGERIA

¹Danladi, E. B., ¹Ojeleye, O. A., ¹Egwuma, H. and ²Ntat, F. H.

¹Department of Agricultural Economics, Faculty of Agriculture/Institute for Agricultural Research, Ahmadu Bello University, Zaria-Nigeria

²Department of Agricultural Economics and Extension,
Faculty of Agriculture, University of Jos.

Corresponding Author's E-mail: danladiezrabako@gmail.com **Tel.:** 08034674451

ABSTRACT

The study focused on analysis of livelihood diversification strategies among ginger farming households in Kaduna State, Nigeria. Primary data were collected with the aid of structured questionnaire administered to 205 ginger farming households in the study area. The data were analyzed using descriptive statistics and Poisson regression count model (Negative binomial variant of the Poisson regression model). The results of the socio-economic characteristics of the ginger farming households showed the mean age of the farmers of 39 years and average years of farming experience of 16 years. The average household size of the ginger farming households was 7 persons per household. The result also showed that ginger farming households engaged in many livelihood activities with livestock keeping the most dominant livelihood activities with an average income of ₦69,744 and milk sale the least with an average income of ₦22,667. Results of the factors influencing the choice of livelihood diversification strategies showed that age, education status, farming experience, access to credit were negative and statistically significant at different levels of significant while household size was positive and significant at $P \leq 0.01$.

Keywords: Diversification, Farming households, Ginger, Livelihood, Poisson regression.

INTRODUCTION

Ginger (*Zingiber officinale*) is a flowering plant in the family of *Zingiberaceae*. It is a root crop and a typical herb extensively grown across the world for its pungent aromatic underground stem or rhizome which makes it an important export commodity in world trade (Ndanmadu and Marcus, 2013; Factfish, 2013; Mazza *et al.*, 2019). Ginger is an important commercial crop that is gaining popularity worldwide with Kaduna State Nigeria having abundant potential to produce for domestic consumption and for export purposes (Ihuoma, Dogara and Micah, 2018).

Kaduna State, Nigeria has contributed significantly to the global production of ginger since 2008 and subsequently became a major exporter of ginger to the United Kingdom, Germany, Spain, France, Saudi Arabia and United States of America among others (National Agricultural Extension Research and Liaison Services [NAERLS], 2014). The southern part of Kaduna State is the largest producers of ginger in Nigeria with concentrations in Kachia, Jaba, Jamma'a and Kagarko Local Government Areas (LGAs) (Kaduna State Agricultural Development Project [KSADP], 2011; KSADP, 2018). Generally, the varieties produced in Nigeria especially in the southern part of Kaduna State are "TaffinGiwa" and "YatsunBiri" which are higher in monoterpene and oil, giving a more pungent aroma. These species are usually preferred for the production of oils and oleoresins (KSADP, 2014; Mazza *et al.*, 2019).



Ellis (2000), Benard (2014) and Gebru (2018) defined livelihood diversification as a process by which rural family construct a diverse portfolio of activities and social support capabilities in order to survive and improve their standard of living. For ginger farming households, livelihood diversification incorporates both on-farm and off-farm ventures which are undertaken to bring additional income from the main households agricultural activities through the generation of agricultural and non-agricultural goods and services, the sale of waged labour, or self-employment in little firms and other strategies attempted to spread risk (Eshetu *et al.*, 2016; Udoh *et al.*, 2017). However, several studies (Nghiem, 2010; Adepoju and Oyewole, 2014; Kassie *et al.* 2017, Dilruba and Roy, 2012) has shown that livelihood diversification has positive impact to increase income when the resources needed for the main activities are too short to provide enough means of livelihood, to exploit strategic complementarities and positive interactions between different activities and to earn cash income and finance investment in the face of credit failures.

Southern Kaduna is one of the major producers of ginger in Nigeria, fewer studies have been carried out on livelihood diversification strategies among ginger farming households in Kaduna State and few of the studies on ginger farming concentrated on determinants of production without assessing the diversification situations of the ginger farming households and detailed empirical investigation into the livelihood diversification activities of farmers in the study area has been scanty. In view of the forgoing, this study was carried out to: identify the livelihood activities engaged in by the ginger farming households in the study area and determine the factors influencing livelihood diversification strategies among ginger farming households.

MATERIALS AND METHODS

The Study Area

The study was carried out in Kaduna State. Kaduna State lies in the north-western part of Nigeria's agro-ecological zones. Kaduna State is located between latitude 9° 00'N and 11° 30'S and longitudes 6° 00'E and 9° 10'W of the prime meridian (Kaduna State Agricultural Development Agency, KSADA, 2018). There are 23 LGAs and four (4) Agricultural zones in Kaduna State. The agricultural zones include Maigana zone, Lere zone, Samaru and BirniGwari zones. The State occupies an area of about 48,473.2 square kilometres (Federal Office of Statistics [FOS], 2006), with total population 6,066,526, as at 2006 population census. The population was projected to be 8,789,003 in 2019 at 3.2% annual growth rate (National population Commission [NPC], 2006; and National Bureau of Statistics [NBS], 2016). Majority of the farmers in Southern Kaduna produce ginger either as a sole crop or in mixed cropping. Other crops production in the region include Guinea corn cassava, sesame seed, and acha.

Sampling Procedure and Sample size

A multi-stage sampling procedure was employed in this study to select the appropriate sample size of the ginger farming household. The first stage was purposive selection of Samaru zone based on the high cultivation of ginger (KSADA, 2018). The second stage was random selection of 3 LGAs out of the seven (7) LGAs in Samaru zone. The chosen local governments are Kachia, Jema'a and Jaba. Thirdly, 4 villages each were randomly selected from each LGA given a total of 12 villages. Finally, a simple random sampling was employed in selecting ginger farming households from each of the villages to get the sample size. A sample size of 205 ginger farming households for the study was obtained from the sampling frame of 2,060 using 10% of the sample frame.



Method of Data Collection

Primary data were used in this study. The primary data were obtained through the administration of structured questionnaire to ginger farming households. The Data collected included Socio-economic characteristics of ginger farming households, reasons for diversification, number of livelihood diversification activities

Analytical Techniques

Analysis of data collected was done using descriptive statistics, and Poisson regression count model (Negative Binomial Poisson regression). Descriptive statistics involves the use of measures of central tendency such as mean, frequency distribution, coefficient of variation and percentages to describe the socio-economic and institutional characteristics of ginger farming households in the study area, describe the livelihood activities (farm, off farm and non-farm activities).

Poisson regression count model (PRM) was used in studies where the decision maker was faced with several alternatives taken in sets. For instance, Toyin and Abbyssiania (2016), in their work on income diversification and its determinants among household in Eastern Cape Province, South Africa used poison regression count model to analyze Factors Influencing Household Livelihood Diversification. Also, Challa *et al.* (2019) used negative binomial poisson regression model (NBPRM) to identify the determinants of non-farm activity Participation. Other similar works are Senadza, (2012); Greene (2008); and Njunguna, (2012).

The model of choice for analysis of count data which relaxes the assumption above is Poisson regression model (PRM) (Winkelmann and Zimmermann, 1995; and Greene, 2008). The PRM recognizes that a households/decision maker can adopt one or more livelihood strategies as a set. Therefore, it overcomes the assumption of Multinomial logit by counting all the livelihood strategies a households is involved. PRM has been used in studies where the decision maker was faced by several alternatives taken in sets.

Most studies on livelihood diversification using the parametric approach use the multinomial logit (MNL) mainly due to the presence of a polytonomous response variable (High, Medium and low). The main objective of using MNL in this regard is to explain the factors that determine the probability of a households engaging in alternative livelihood options. However, the assumption that is put by MNL through clustering livelihood strategies and assuming that households only adopts strategies in a given category, may not be true in practice. Hence, there was need to use a model that relaxes this assumption and observes a households given all the strategies it adopts. Therefore, this study adopted the PRM model since it overcomes the above assumption by treating all the livelihood strategies households is involved in as count data. The merits of PRM as outlined by Winkelmann and Zimmermann (1995) are: (i) it takes into account the non-negative and discrete nature of the data, (ii) the assumption of the equality of the variance and conditional mean accounts for the inherent heteroscedasticity and skewed distribution of non-negative data, and (iii) the log-linear model allows for the treatment of zeros.

This study used the Poisson regression model (PRM) because it relaxes the assumption that some households cannot participate in some livelihood strategies by treating the number of livelihood strategies households is involved in as a set. The idea was to assess the factors that influence households to choose the actual number of livelihood activities hence relaxing the assumption that households is restricted from participating in some activities which is not the case in practice. These choices constitute count data the analysis of which is better handled by the PRM.

The i^{th} households was assumed to engage in y_i livelihood strategies, where y_i is non-negative and Poisson distributed. The following model was fitted into the data:



$$y_i = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_{10} X_{10} + \ell_i \quad \dots(1)$$

where;

y_i is the number of (counted) livelihood strategies a ginger farming household was involved in (i.e., 1,2,3,4,5,6,7...n)

The independent variables were specified as follows:

X_1 = age of the respondents (years),

X_2 = Sex

X_3 = educational Level (no formal=0, Arabic=1, Adult=2, primary=3, secondary=4, tertiary=5), X_4 = household size (number of individuals in a given household),

X_5 = farming experience (years),

X_6 = marital status (Single = 0 Married =1) ,

X_7 = farm size (ha),

X_8 = access to credit (amount of credit obtained),

X_9 = membership of cooperative (years of membership of cooperative),

X_{10} = extension (number of extension contacts per farming season),

β = vector of poisson maximum likelihood estimates

RESULTS AND DISCUSSION

Socio-economic Characteristics of Ginger Farming Households

The result in Table 1 revealed the socio-economic characteristics of ginger farming household. 64.4% of the respondents were male, the mean age of the farmers was 39 years. Farmers within this age range are believed to be in their active and productive age, implying that there is likelihood of high productivity. This agrees with studies conducted by Ayana *et al.* (2021); Ezra *et al.* (2016). In addition, 95% of the farmers had one form of education and another. From the result, it can be said that majority of the ginger farming households have formal education which can influence their decision making concerning farming activities and income diversification. The mean household size of ginger farming households was 7 persons with the lowest 1 person and highest 25. This indicates that there is a good number of family labour supply to achieve different farming activities. This finding is in agreement with Ajayi *et al.* (2016) who posited that in Nigeria, larger household size has a better chance of livelihood diversification than small ones. The mean years of farming experience is 16 years. This indicated that majority of ginger farming households in the study area are experienced in ginger production. This finding agrees with the results of Nwaobiala *et al.* (2019) and Etuk *et al.* (2018), who found that farmers had many years of practical experience on farming ranging from 16-20 years. The mean ginger farm size was 1.19 hectares, an indication that majority of the ginger farming households are small scale farmers. Result on membership of cooperative revealed that majority (61.5 %) of ginger farmers do not participate in any cooperative society. About 84.0% of farmers had no access to credit to finance their production activities. 83.4% of ginger farmers had no extension visit or contact, and about 11.2% had access to extension visit.



Table 1: Distribution of sorghum farmers based on socio-economic characteristics

Variables	Frequency	Percentage	SD	Mean	Min.	Max.
Sex						
Male	132	64.4				
Female	73	35.6				
Age			11.3	39	18	75
<30	36	17.6				
31-40	81	39.0				
41-50	55	26.8				
51-60	26	12.7				
61-70	5	2.4				
>70	2	1.5				
Marital status						
Single	71	34.7				
Married	134	65.3				
Household size			3.7	7	1	25
1-7	121	59.0				
8-14	74	36.1				
15-21	9	4.4				
>22	1	0.5				
Level of education						
No formal education	10	5				
Adult	8	4				
Primary education	23	11				
Secondary education	85	42				
Tertiary education	78	38				
Farming experience			10.2	16	2	50
2-11	63	30.7				
12-21	88	42.9				
22-31	38	18.5				
32-41	13	6.3				
>42	3	1.5				
Cooperative membership						
Non membership	126	61.5				
Member	79	38.5				
Years of membership						
1-10	185	90.2				
11-20	14	6.8				
21-30	4	2.0				
>31	2	1.0				
Farm size			5.15	5.61		
0.3-3.0	97	47.3				
3.1-7.0	45	22.0				
7.1-9.0	23	11.2				
>9.0	40	19.5				
Extension contact per season						
No contact	171	83.2				
1-3 times	23	11.4				
4-6 times	11	5.4				
Access to Credit						
No access to credit	173	84.0				
Access to credit	32	16.0				



Livelihood Activities Engaged in by Ginger Farming Households

The result of the analysis on the livelihood activities engaged in by the ginger farming households in Table 2 shows that about 14.1% of the ginger farmers are engaged in livestock keeping as their most dominant activities with an average income of ₦69,744, crop farming accounted for 13.5% being second most dominant activities with an average income of ₦59,136, artisan 11.7% third most dominant activities with an average income of ₦57,452, wage from non-agricultural labour supply on other people's farm accounted for 7.0% being the fourth most dominant activities with an average income of ₦34,673, remittance 6.1% was the fifth most dominant livelihood activities with an average income of ₦7,576. Others are revenue from leasing out land and other resources/rent accounting for 6.0% six most dominant activities with an average income of ₦35,960, private employment 5.9% with an average income of ₦39,163, wage from agricultural labour supply on other people's farm accounted for 5.6% with an average income of ₦9,276, transportation 5.0% ninth most dominant activities with an income of ₦45,300 while firewood sale 4.9%, government employment was 4.0%, okada riding 3.0%, quarry 2.8%, hunting 2.4%, fishing 2.2%, Machinery services from other farm 2.1%, pension 1.5%, fruit sale 1.2%, milk sale, 0.9% with average income of ₦28,950, ₦76,027, ₦22,263, ₦21,630, ₦8,167, ₦28,706, ₦30,733, ₦55,583, ₦13,375, ₦22,667, respectively. This is an indication that farmers in the study area are still more inclined to farming activities and involved in more than two activities.

Table 2: Livelihood activities engaged in by the ginger farmers in the study area per season

Variables	*Frequency	Percentage	₦average income	ranked
Livestock keeping	145	70.7	69,744	1st
Crop farming	139	67.8	59,136	2nd
Artisans	121	59.0	57,452	3rd
Waged non-Agric. laboured	72	35.1	34,673	4th
Remittance	63	30.7	75,769	5th
Leasing of land	62	30.2	35,960	6th
Private employed	61	29.7	39,163	7th
Agricultural labour	58	28.2	9,276	8th
Transportation	52	25.3	45,300	9th
Firewood sale	51	24.8	28,950	10th
Government employed	41	20.0	76,027	11th
Okada riding	31	15.1	22,263	12th
Quarry	29	14.1	21,630	13th
Hunting	25	12.1	8,167	14th
Fishing	23	11.2	28,706	15th
Machinery service	22	10.7	30,733	16th
Pension	15	7.3	55,583	17th
Fruit sale	12	5.8	13,375	18th
Milk sale	9	4.3	22,667	19th

*Multiple entries are observed.

Factors Influencing Livelihood Diversification among Ginger Farming Households

Negative binomial variant of the poisson regression model was used to analyze the factors influencing livelihood diversification strategies among ginger farmers. The model was selected based on the theoretical background and review of literature on related studies and earlier justifications illustrated in the methodology. Before selection of the model for the data, it was checked for over dispersion and under-dispersion to see if the mean and the variance are



the same or not and the Poisson regression model failed because there was over dispersion that is the mean and the variance are not the same and in order to control for over- or under-dispersion the negative binomial variant of the Poisson regression model was used instead of Poisson regression model.

Table 3 shows the factors influencing livelihood strategies chosen by ginger farmers in the study area. A negative binomial regression model was fitted into the data, where five of the ten variables were statistically significant. The variables include age, education, household size, farming experience and credit.

The model result indicates that age had negative coefficient of (-0.172) and significantly affected the ginger farmer's livelihood diversification at 10% probability level of significance. That is as the age of the ginger farmers increases the probability of involving in many livelihood diversification activities decreases by 87 % This is because elderly people have less diversified livelihood strategies than younger ones which could be attributed to the fact that as one advances in age his farming strength, activities and productivity tends to decrease, and he acquire less resources endowments. Which is in line with the finding of (Gebru *et al.*, 2018; Doyo *et al.*, 2018; and Samuel and Sylvia, 2019).

The result of the negative binomial regression model analysis shows that education had negatively and significantly influenced the ginger farmers' livelihood diversification activities at 5% probability level of significance. The higher the level of education the less livelihood diversification strategies, this may be due to the fact that as the person acquires more educational knowledge he or she become more skilled, professional, more focused and specialize on a particular activity rather than diversifying into many. From the model result, the marginal effect reveals the likelihood of a ginger farmer diversifying into other livelihood activities decrease by 55%, as the ginger farmers become literate. This is similar with the finding of Ajayi *et al.* (2016) and Doyo *et al.* (2018).

From the result, household size was found statistically significant ($p < 0.01$), and positively influence the choice of livelihood diversification strategies. From the model result, it reveals that an increase in the number of households in the study area could increase the livelihood diversification strategies of the ginger farming households by 20.6%. Large household sizes tend to diversify and find other sources of livelihood strategies to sustain the family. This is similar to the finding of Gecho *et al.* (2014), Doyo *et al.* (2018), and Samuel and Sylvia (2019) who noted that relative large household size enhances the availability of labour for increased efficiency among farmers.

As the model result indicates, farming experience was found to negatively and significantly affect the ginger farmers' choice of livelihood activities at 5% level of significance which explained that farming experience decreases the choice of livelihood diversification strategies. This is probably because, with more experience they are better informed in their decision making, role sharing for effective and efficient utilization of resources in the farm to better their standard of living. The result is consistent with the findings of Osondu *et al.* (2014); Nwaobiala *et al.* (2019). Finally, the model result indicates that, credit negatively and significantly affected ginger farmer's livelihood diversification activities at 1% probability. That is, the more ginger farmers have access to credit, the lesser they engage into so many livelihood activities. This is because the utilization of credit may help them to invest in high return activities rather than various strategies. The likelihood of participating in so many livelihood activities decrease by 8.8% for ginger farmers using credit.



Table 3: Binomial regression results for the factors influencing the choice of livelihood strategies

Variables	Coefficient	Standard error	P > z	Marginal effect
Age	-0.172192	0.089756	0.055*	-0.8745927
Sex	0.0099991	0.0061363	0.103	0.0507873
Marital status	-0.0172158	0.0645073	0.790	-0.087442
Education status	-0.1099841	0.0449191	0.014**	-0.5586281
Household size	0.040625	0.0133996	0.002***	0.2063412
Extension contact	0.0045539	0.0074268	0.540	0.0231302
Year of cooperative	-0.0006352	0.0094994	0.947	-0.0032264
Farming experience	-0.3820273	0.182443	0.036**	1.940382
Ginger farm size	0.0115665	0.0149324	0.439	0.0587481
Access to Credit	-0.01748	0.0064343	0.007***	0.0887838
Member of coopt.	0.00212	0.1256527	0.987	0.0107677
Constant	2.379896	0.5546495	0.000***	
Observations	205			
Wald chi2 (01)	37.53			
Prob>chi ²	0.01			
Log likelihood	-487.4899			
Lnalpha	-2.051398			
Alpha	.1285551			

Note: ***, ** and * significant at 1%, 5% and 10% levels of probability

Constraint to Ginger Farming Households

The problems faced by ginger farming households in the study area were ranked according to their magnitude as stated by the ginger farming households. Table 4 shows farmers constraints in ginger farming. High cost of production (10.1%), lack of credit (9.7%), low price or price fluctuation (8.7%), problem of transportation (8.5%), poor storage facilities (8.3%), poor extension service (7.5%), inadequate improved technology (7.3%), inadequate access to input (7.2%), high cost of labour (6.5%), weed, pest and disease attack (5.3%), lack of training (5.2%), low market (5.0%) were ranked the highest constraints affecting ginger farming households in the study area. On the other hand, poor access to market (4.6%), high cost of business premises (2.8%) theft (1.8%) and inadequate rainfall (1.5%) accounted for the least constraints in the study area. This finding agrees with those of Samuel *et al.* (2019), Ndanmadu and Marcus (2013), Ezra *et al.* (2017), Ihuoma *et al.* (2018) and Chidiebere-Mark and Ibe (2018) who observed that, high cost of production, lack of credit, problem of transportation, lack of farm inputs, high cost of labour, pest, diseases, weed infestation, inadequate storage/processing facilities and inadequate extension visits were among the constraints faced by ginger farming households.



Table 4: Constraints to ginger farming

Variables	*Frequency	Percentage	Ranking
High cost of production	166	10.1	1st
Lack of credit	159	9.7	2nd
Low price/fluctuation	143	8.7	3rd
Problem of transportation	141	8.5	4th
Poor Storage facility	136	8.3	5th
Poor extension services	123	7.5	6th
Inadequate improved tech	119	7.3	7th
Inadequate access to input	118	7.2	8th
High cost of labour	107	6.5	9th
Pest, diseases, weed infest.	87	5.3	10th
Lack of training	85	5.2	11th
Low market	82	5.0	12th
Poor access to market	75	4.6	13th
High cost of business prem.	46	2.8	14th
Theft	29	1.8	15th
Inadequate rainfall	25	1.5	16th

*Multiple entries are observed

CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study, it can be concluded that livestock keeping is the most dominant (14.1%) activities with an average income ₦69,744 while milk sale is the least (0.9%) with an average income of ₦22,667. The major variable influencing livelihood diversification strategies were age, education, household size, farming experience, and credit. It was recommended that there is need to enlighten ginger farming households on the benefit of engaging into multiple stream of income generating activities to improve their standard of living. Furthermore, ginger farming households are encourage to join existing cooperative societies, this will ensure that farmers have better chances of overcoming financial constraints and have access to credit schemes which can make them self-reliant.

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