FOOD
RESEARCH

Intra-household food security among smallholder macadamia nuts and avocado farmers in Makhado and Thulamela municipalities, Limpopo Province, South Africa

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Abstract

South Africa, a middle-income country is believed to be self-sufficient in food production but there is still very large inequality and a high level of poverty experienced. Nationally, many households are food secure and yet there are a lot of compromises in an individual's food security within households. This study analysed intra-household food security amongst smallholder tree crop farmers (macadamia nuts and avocado farmers) in the Makhado and Thulamela Municipalities of Limpopo province, South Africa. A random sample of 150 smallholder tree crop farmers was purposively selected for the study. Data was collected using a self-administered questionnaire. Analytical methods employed include descriptive statistics, Household Food Insecurity Access Scale (HFIAS), logistic regression model and Coping Strategy Use Index (CSUI). Descriptive analysis of respondents' socioeconomic characteristics showed that most of the participants were males (54.7%) as compared to females (45.3%). About 73.3% of the farmers had formal education with an average age of 61 years. The result of HFIAS indicated that 54% were food secure, 24% were mildly food insecure, 15.3% were moderately food insecure and 6.7% were severely food insecure. The result of logistic regression on the determinants of food security revealed that educational level, off-farm work, and farming experience positively influenced intra-household food security. Coping strategies harnessed to minimize food insecurity include gathering wild fruits, relying on less expensive food, buying food on credit and a few indicating skipping meals. The study, therefore, recommends improvement in human capital development through education by relevant stakeholders and enhanced access to off-farm employment as this will economically improve respondents' purchasing power thus resulting in reduced intra-food insecurity.

1. Introduction

The issue of food security has been precarious in various parts of the world including South Africa and several African nations. The right to food is protected by international and national law. In South Africa, food security got much attention after 1994 when South Africa became a free democratic nation (du Toit, 2011). In the 2010/2011 monetary year, food security was reprioritised as one of the top main concerns for the Republic of South Africa government (RSA) (2014). This is in accordance with South Africa's Millennium Development Goals (MDGs) (2015) which was to half the number of individuals who go hungry between the period 1990 and 2015 and a half poverty and joblessness by 2014.

In undertaking to expand food security and meet the MDGs, South Africa's projects and mediation are unequivocally grounded in agribusiness (RSA, 2014), like anywhere around the world (FAO, IFAD, and WFP 2014). In South Africa, an expected 20.7% of households participate in horticulture, and 65% of these families utilize agribusiness simply as a subsistence methodology to take care of families and to meet food demand (du Toit, 2011). The link between impoverishment, income and household food security is not clear. While South Africa might be food secure as a nation, many households in the country are food insecure (Altman *et al.*, 2009; Oluwatayo, 2019; Oluwatayo *et al.,* 2021).

Food security and ensuring that food is available is a main challenge across the globe. Food security, according to FAO (2010), alludes to the circumstance "when all individuals, consistently, have physical, social

and financial access to enough, secure and nutritious food to meet their dietary needs and food preferences for a functioning and healthy life". Food security is considered a fundamental human right however more than one billion individuals on the planet, particularly in third world countries are still living under serious poverty and undernourishment (IEG, 2011). The greater part of these individuals lives in rural zones and relies upon subsistence farming for meeting their day to day needs and livelihood (Mozumdar, 2012).

In many rural areas, trees are planted alone or combined with annual crops because they play an important role in the food security of the households. Trees improve households' food security throughout the year, directly by producing food and indirectly by inputs into other food-producing facilities of the farm system and by providing fuel for cooking mostly in rural areas. Trees produce products that households can sell or eat during seasonal shortfall in food and income. Households in rural areas preferred tree farming because it requires low levels of labour as compared to other cash crops. Due to lack of access to land farmers increase farm tree and agroforestry activities to keep their families food secured at all times (FAO, 1989).

According to Olofsoon *et al*. (2016), while some groups of macadamia nuts and avocado farmers in Makhado and Thulamela municipalities in Limpopo province considered themselves full-time farmers, other groups considered themselves pensioners. On average, each household owned 1.7 hectares of land with only 2.8% having title deeds and the rest grow their trees on communal land. The farmers grow different varieties of trees which assist them to have a steady source of income. The main income source is from agriculture while only a few are dependent on remittances.

One of the South African agricultural policy's main objectives is to be self-sufficient when it comes to production. South Africa has achieved this goal by producing a surplus in most of the agricultural commodities (Khapayi and Celliers, 2016). Even though this objective is being achieved yet many South African households and individuals go to bed with an empty stomach. This is because of large inequities, resulting from poor food distribution networks and a high level of malnutrition experienced (van Zyl and Kirsten, 1992). There is a very strong and correlated relationship between agricultural productivity and food availability. Agricultural productivity growth can assist in decreasing poverty. It may also help in meeting food demands because it will ensure food availability for rural poor people. It can increase the incomes of farm labourers and many of the inhabitants. This can also improve food supplies which can reduce food prices, which in turn

increase the real income and help in declining poverty in rural areas (Mozumar, 2012).

The food security of individuals in households tends to differ because of the different preferences and eating habits (Omotesho *et al*., 2007). Intra-household inequality differs between different household groups. However, the overall food security status of households does not translate to individuals within households being food secure. This study, therefore, examined intra-household food security among smallholder macadamia and avocado farmers in Makhado and Thulamela municipalities of Limpopo province, South Africa.

2. Materials and methods

2.1 Study area

The study to analyse intra-household food security among smallholder macadamia nuts and avocado farmers was conducted at Makhado and Thulamela local municipalities in the Vhembe district of Limpopo province. The Vhembe district is in the northern part of Limpopo province with suitable land for agricultural production. Because a large part of the land in Limpopo province belongs to the tribal authorities, it is difficult for developers to take place due to the land tenure system which is not favourable to commercial business (IDP, 2016/17).

Thulamela municipality is an area covering a huge track of lands mainly tribal and it's located in the eastern part of the province with Thohoyandou being its political, administrative and business centre. Makhado local municipality is a category B (municipalities sharing municipal executive and legislative authority in its area) within the Vhembe area (IDP, 2016/17). Makhado is also a major producer of macadamia nuts and the second-biggest producer of avocado in the Limpopo area (LEDS, 2013). Thulamela produces enormous quantities of macadamia nuts and avocado (IDP, 2016/17).

2.2 Sampling method

Meanwhile, data for this study was collected through the administration of structured questionnaires to 150 smallholder macadamia nuts and avocado farmers selected from Thulamela and Makhado municipalities located within the Vhembe district. A multistage purposive sampling technique was employed in data collection. The first stage involves a purposive selection of two municipalities (Thulamela and Makhado) from the four municipalities in the Vhembe district of Limpopo province the two municipalities with the highest production of Avocado and Macadamia. The second stage is the selection of wards and the third stage entails the section of villages where the respondents

(farmers) are located. Respondents were selected based on probability proportionate to size.

2.3 Methods of data analysis

The analytical tools used to analyse data include descriptive statistics, Household Food Insecurity Access Scale (HFIAS), and Logistic Regression Model.

Descriptive statistics were used to analyse and describe the socio-economic characteristics of smallholder macadamia nuts and avocado farmers in Makhado and Thulamela municipalities. Household Food Insecurity Access Scale (HFIAS) was used to determine the food security status of individuals within the households of smallholder macadamia nuts and avocado farmers in Makhado and Thulamela municipalities. A binary logistic regression model was used to estimate the factors associated with food security in Makhado and Thulamela municipalities.

The general regression model used in this study is defined as follows:

$$Ln\ [Pi/\ (1 - Pi)] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_{11} X_{13} + e_i$$

The probability is represented by Pi is food secure, 1-Pi is food insecure, β_0 is the intercept, $\beta_1 X_1$ to $\beta_{11} X_{13}$ are the coefficients related to the independent variables and e_i is the disturbance term.

HFIAS was used to determine the food security status of individuals within the households of smallholder macadamia nuts and avocado farmers following Coates *et al*. (2007), asking nine questions with a review time of about fourteen days (2 weeks). The respondents were asked occurrence questions if the respondent answers "yes" to an occurrence question, a recurrence of occurrence question was asked to determine if the condition happened occasionally, some of the time or regularly in the previous two weeks with a scale from 1 to 3. The Household Food Insecurity Access Scale was sorted into 4 specifically; Food secured, Mildly Food Insecure, Moderately Food Insecure, and Severely Food Insecure (Chinnakali *et al*., 2014). The HFIAS score was calculated using the appropriate responses based on the nine recurrences of occurrence questions. In the study, the recurrence of occurrence scores was used to determine the food security of people in the household. Therefore, when adding the score for each sampled household, the least score was 0 and the highest was 27. The higher the score the higher the likelihood of a household/ individual being vulnerable to food insecurity (Coates *et al*., 2007).

Food security as dependent variable (Table 1) is regressed with various independent variables. Food security = β_0 + βAGE + βEDU + βGEN + βHHS + βMTS + βHHI + βWORKF + β EXTC + β ACSC + β MFA + β DSTN + β FRME + β MARK + e

3. Results and discussion

3.1 Socioeconomic characteristics of respondents

Figure 1 shows the distribution of respondents by gender with more males (54.7%) than females (45.3%). This may be because the agricultural sector is still dominated by males in communal areas of South Africa. Males have more rights to ownership of land than females (Doss *et al.,* 2013). The minimum age of macadamia nuts and avocado smallholder farmers was 29 years and 87 years was the maximum age of respondents. The results indicate that youth participation in the farming sector is still a startling issue considering the dominance of older people in the sector (Table 2).

Table 1. Description of variables

Variable	Description	Unit of measurement
Dependent variable		
Food security	1. Food secured 0. Not food secured	Dummy
Independent variables		
X1 Age	Age of respondent	Years
X2 Gender	1= if male respondent 0 = if female respondent	Dummy
X3 Education	School years	Number
X4 Household size	Actual number of household	Numbers
X5 Marital status	1 = if respondent is married and 0 otherwise	Dummy
X6 Household Income	Income of the respondent	Rand
X7 work off farm	1= if respondent receives income from farm 0 otherwise	Dummy
X8 Extension contact	1= if respondent have extension visitation 0 otherwise	Dummy
X9 Access to credit	1= if the respondent has access to credit 0 otherwise	Dummy
X10 Membership of the association	1= if the respondent has association membership 0 otherwise	Dummy
X11 Market access	1 if yes 0 otherwise	Dummy
X12 Distance from town	Actual kilometers	Kilometers
X13 Farming experience	Number of years	Years

Table 2. Summary statistics of socioeconomic variables

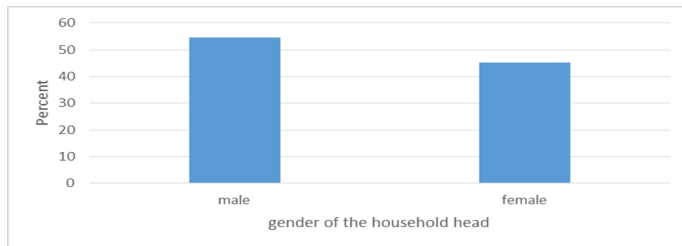| Variables	Mean	Std dev	Max	Min
Age in years	61.27	15.065	87	29
Household size	5.81	2.319	15	2
Farming years	12.39	7.007	31	1
Household income	5996.920	11647.74165	76596.98	390

Figure 1. Gender of respondents

In terms of educational qualification, the results revealed that 73.3% had formal education with about 40% of respondents not married. The marital status of respondents was considered important in this study because marital status has an influence on household income which also affect the decision making about food security. Respondents' distribution by farming experience also showed that while there were those with little or no farming experience there were others with about 31 years of experience in the study area. Farming experience is important in addressing the issues of intra-household food security.

3.2 Intra-household food security status of respondents

Several factors contribute to intra-household differences. For example, gender is the most extensively discussed characteristic of intra-household differences. This arises from the different roles played by both males and females within households (Oakley, 1972). The distribution of food within the household is influenced by gender differences. The study shows that in the order of allocating food, females are the ones sacrificing their meals to ensure that everyone in the household eats. The findings here are similar to Moser (2014) and Oluwatayo and Babalola (2020) indicating that gender differences influence the distribution of resources between males and females and are premised on economic, religious, ethnic, ideological and social determinants.

Age plays a vital role in intra-household food security. The age difference between the individuals within the household is a sensitive factor because it affects the distribution of food and other resources in the household. Household income determines the type of diet household members have, the time spent eating outside and their eating habits. The income that a household receives each month influences the number of times individuals eat in a day as also reported by Oluwatayo and Chauke (2018). The implication drawn from these results is that household income has a great impact on individuals' vulnerability to food insecurity.

Results indicate that out of 150 respondents interviewed, 98 (65.3%) disclosed that there is no order of preference in allocating food in their homes, whereas 52 (34.7%) indicate that there is an order of preference in allocating food. Respondents reported that preference is given to elderly people down to children while others indicated that children's food security is prioritized. In households headed by females, it was disclosed that in the severity of food shortages they sacrifice their meals and feed their children. The analysis indicates that there is inequality in food allocation among individuals in households; the inequality is mostly based on gender and the role an individual play within the household. This finding is corroborated by Botreau and Cohen (2020) in their study on gender inequality and food insecurity.

Food security is not only about accessibility but also about the availability of food (FAO, 2008). Results presented indicate that most respondents eat 3 times a day. It's also reported that 33.3% eat twice a day whilst 4.7% eat once a day. However, about 4.7% of the respondents explained that this is done when there is an intense lack of food in the household. The findings from data analysis show that 50% of the respondents never take time to go eat at restaurants with their family members, while about 33.3% and 16.7% go on family outings and eat at restaurants respectively.

3.3 Responses of smallholder tree crop farmers to the nine HFIAS questions

The respondents as depicted in Table 3 indicate their inability to eat preferred foods by eating the less preferred food when they are hungry. Few reported having gone to bed hungry or gone a whole day and night without eating. Few household heads also reported that they had to eat smaller meals and had to have fewer meals in a day. This incidence only happens when there is not enough food in the household. About 6.6% disclosed that there was no food to eat. Results show that 9.7% went to sleep hungry and 8.7% revealed that they went the whole day and night without eating.

3.4 Descriptive results on intra-household food security

Based on the HFIAS classification measure of food security (Figure 2), about 69 (46%) of the sampled households were found to be food insecure and 81 (54%) were found to be food secure. The results also indicate

Table 3. Distribution of responses to HFIAS questions

Questions	Options							
	No		Rarely		Sometimes		Often	
	N.	%	N.	%	N.	%	N.	%
Worry about not having food	89	59.3	36	24	18	12	7	4.7
Unable to eat preferred food	120	80	25	16.7	3	2	2	1.3
Eat few kinds of foods	69	46	41	27.3	32	21.3	8	5.5
Eat less preferred food	104	69.3	22	14.7	20	13.3	4	2.7
Eat small portions of food	106	70.7	33	22	19	12.7	2	1.3
Eat fewer meals in a day	92	61.3	42	28	13	8.7	3	2
No food in a household	140	93.3	5	3.3	3	2	2	1.3
Go to sleep hungry	135	90	11	7.3	3	2	1	0.7
Go whole day and night without eating	137	91.3	6	4	4	2.7	3	2

that from the sampled households, about 54% were classified as food secure, 24% as mildly food insecure, 15.3% as Moderate food insecure and 6.7% as severely food insecure.

Figure 2. Food security level

3.5 Household food security and demographic variables

The results (Table 4) indicate that the age of the household head and food security are interlinked. Food insecurity is more prevalent in households headed by younger people. Farming experience contributes to the increased likelihood of being food secure. Food security and the gender of the household head have direct linkage. From the results, food security differs significantly between male and female-headed households. The most severe food-insecure group were the females (14.49%) whereas 62.96% of male-headed households are food secure. This is because women do not have sufficient access to production resources, few job opportunities, low levels of education and have to stay home to take care of their households (Doss *et al.*, 2013).
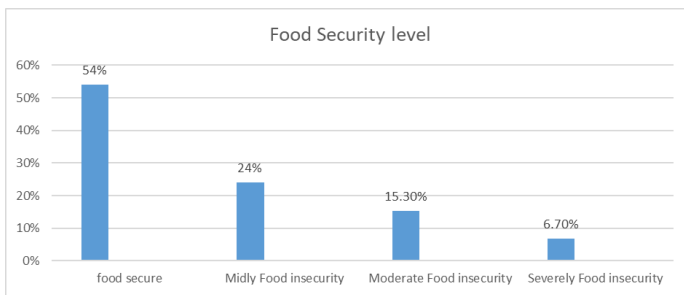
From the result of data analysis, married household heads were found to be more food secure than single,

Table 4. Respondents' food security status by demographic variables

Age	Food secure		Mildly food insecure		Moderate food insecure		Severe food insecure	
	N	%	n	%	N	%	N	%
<40	12	14.81	13	18.84	5	7.25	7	10.14
41-50	5	6.17	17	24.64	0	0.00	1	1.45
51-60	10	12.34	3	4.34	4	5.80	2	2.90
61+	54	66.70	9	13.04	8	11.59	0	0.00
Gender	Food secure		Mildly food insecure		Moderate food insecure		Severe food insecure	
	N	%	n	%	n	%	N	%
Female	30	37.04	23	33.30	10	14.49	10	14.49
Male	51	62.96	11	15.94	8	11.59	7	10.14
Marital status	Food secure		Mildly food insecure		Moderate food insecure		Severe food insecure	
	N	%	N	%	N	%	N	%
Married	54	66.70	15	21.74	3	4.35	3	4.35
Otherwise	27	33.30	17	24.64	25	36.23	5	7.25
Household size	Food secure		Mildly food insecure		Moderate food insecure		Severe food insecure	
	N	%	N	%	N	%	N	%
2	3	3.70	3	4.35	0	0.00	0	0.00
3-6	42	51.85	23	33.33	8	11.59	1	1.45
7-10	31	38.27	15	21.74	9	13.04	7	10.14
11+	5	6.17	2	2.91	1	1.45	0	0.00
Education	Food secure		Mildly food insecure		Moderate food insecure		Severe food insecure	
	N	%	N	%	N	%	N	%
Formal	60	74.07	13	18.84	9	13.04	6	8.70
Informal	21	25.93	20	28.99	11	15.94	10	14.49

divorced or widowed heads. Thus, unmarried heads are more prone to food insecurity as compared to married heads as 24.64% of the former were moderately food insecure and 7.25% were severely food insecure. A comparison between the two shows that married household heads has a higher likelihood of being food secure (66.7%) as compared to 33.3% of unmarried household heads.

It was further shown that households with 3-6 members are more food secured as compared to those with 2 members only. The analysis does not conclude that food security increases with increasing household size. Educational attainment is directly linked to food security. Households with heads having formal education are more likely to be food secured than households with heads having no formal education.

3.6 Determinants of food security of smallholder tree crop farmers

The logistic regression model was used to examine the determinants of intra-household food security. Out of the 13 variables included in the analysis as depicted in Table 5, only 3 variables were positive and significant. The variables that influenced intra-household food security of smallholder tree crop farmers include educational level, working off-farm and farming experience. The educational level of the household head was found to be significant at 1% and had a positive influence on food security. This indicates that having formal education by the household head increases the likelihood of a household being food secure. Farm experience had a positive influence on intra-household food security at a 1% level of significance. This is because farmers with more years of experience in farming have a better level of understanding,

management skills and skills about sustainable land practices and effective use of small farmlands available and will be able to increase production. Working off-farm had a positive influence on intra-household food security at a 1% level of significance. This means that farmers working off-farm have a higher likelihood of being food secure than those relying solely on the income from Avocado and Macadamia sales. This is further corroborated by the result of the marginal effect depicted in Table 5.

3.7 Coping strategies harnessed by tree crop farmers

Food insecure households utilize several strategies to cope with food insecurity. As indicated in Table 6, about 27% of the respondents were gathering wild food, 21% rely on non-expensive food and about 15% of them buy food on credit as their coping mechanism. Limiting portions consumed at dinner time was utilized by different households as a technique by 10.50% of respondents. Reducing the number of times eaten daily every day and borrowing food from neighbours were utilized by some households as a way of coping with food insecurity. Limiting consumption by grown-ups to allow little ones to eat was utilized by 7% of the households. Skipping the whole day without eating was employed by 3% of the households. These different strategies show that different people employ different strategies but the most harnessed of all is the gathering of wild fruits and other edible items available.

4. Conclusion

The analysed intra-household food security among smallholder macadamia nuts and avocado farmers in Makhado and Thulamela municipalities, Limpopo province, South Africa. The descriptive statistics results

Table 5. Logistic results on determinants of food security

Variables	Coefficient	Standard error	Marginal values (dy/dx)	t-values
Age	0.010	0.038	00.01	00.263
Gender	-0.999	0.844	-0.997	10.184
Hhsz	-0.139	0.166	-0.138	00.837
Marital status	-0.850	0.797	-0.853	10.066
Education	20.792	10.060	20.788	20.634***
Household income	00.163	10.129	00.166	00.144
Working off-farm	20.215	00.881	20.208	20.514***
Extension contact	-00.369	00.802	-00.370	00.460
Access to credit facility	-00.748	00.782	-00.755	00.957
Association membership	-00.391	00.783	-00.390	00.499
Market access	00.722	00.847	00.719	00.852
Distance	00.000	00.013	00.001	0
Farming experience	00.151	00.060	00.149	20.517***
CONSTANT	-20.805	19070.539	-20.807	00.147
Number	150			
-2log likelihood	54.911			
nagelkerke r square	0.851			
CHI-SQUARE	152.072			

***Significant at 1% **Significant at 5%* Significant at 10%

Table 6. Ranking of coping strategies based on their frequency of use

Coping strategies	Frequently (3)	Occasionally (2)	Rarely (1)	Not used	CSUI	%	Rank
Gather wild food	15	101	8	8	263	26.81	1
Borrow food	3	19	25	40	72	7.34	5
Buy on credit	16	37	29	13	151	15.39	3
Beg for food	0	0	5	115	5	0.51	8
Less expensive	64	3	5	1	204	20.8	2
Restrict consumption	8	11	20	37	66	6.73	6
Reduce the number of times eaten daily	16	7	27	13	89	9.07	4
Skip meal	0	4	18	49	26	2.65	7

showed that men (54.3) were more than women (45.7%) in the sampled smallholder farmers. Respondents' distribution by age and education indicate that more than 60% of them were old with about 73.3% having a formal education. The results of the HFIAS classification measure of food security revealed that about 46% were food insecure and 54% food secure. The results further show that about 54% classified as food secure, 24% were mildly food insecure, 15.3% were moderately food insecure and 6.7% were severely food insecure. The results of the logistic regression model indicated that educational level, work-of-farm, and farming experience were the main determinants of food security among smallholder macadamia nuts and avocado in Thulamela and Makhado municipalities.

Based on the findings of the study, it is, therefore, recommended that decent and well-paying jobs should be created as an alternative means of livelihood for the farmers to improve their food security status. Also, policies targeted at ensuring access to credit facilities at reduced interest rates should be instituted to enhance the productivity of the farmers. The coefficient of this variable is negative because only a few of the farmers reported having access to credit facilities. Agricultural education should be prioritized and made fashionable in the communities in order for farmers with more farming experience to assist in educating and empowering other farmers.

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