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Profitability analysis of small ruminant production among rural households in Ife-Ijesa agricultural zone, Osun state, Nigeria

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Abstract

The study examined profitability of small ruminant production in Ife/Ijesa Agricultural Zone, Osun State, Nigeria, using data of 120 respondents, selected through a multistage sampling procedure, and field surveys conducted using structured interviews. The study found that majority of respondents were middle-aged, married male, with a household size of five. Most had 1 to 13 years of formal education. Trading and small ruminant production were the most engaged livelihood activities. Most (90.00%) earned between ₦7,000 and ₦100,000 monthly from their primary occupation, with a mean monthly income of ₦58,908.33. The majority of respondents were male (52.50%), with a household size of five. The study found that the mean years of small ruminant production experience, total revenue, total production cost, and gross margin from the small ruminant production cycle were 12.23 years, ₦125,516.70, ₦199,662.49, and ₦99,000.03 respectively. Most respondents earned a medium gross margin, with the cost of feeding negatively influencing the level of gross margin. However, years of formal education, flock size, experience, and starting flock were positive determinants. The study found that the small-scale small ruminant farming is a profitable venture, increasing household income and reducing poverty. It suggests that policies and initiatives, especially in rural areas, should support small ruminant farmers through financial access, market development, and technology transfer.

Keywords: small ruminant, rural households, small ruminant farming, gross margin, cost-benefit analysis

INTRODUCTION

Smallholder rural farmers have identified livestock husbandry as a key means of subsistence. This is especially true in light of crop failures and diminishing productivity, which have significantly reduced the farm income of rural households. Small ruminants are crucial to the livelihood of small and marginal rural farmers, not only because they provide food and nutritional security but also an income during difficult times. Because they require more maintenance and a larger initial investment than their smaller counterparts, large ruminants are not so popular among landless and marginal farmers (Narmatha *et al*., 2015; Never, 2023).

Smallholder farmers in rural areas have developed a variety of risk management and poverty-coping strategies. The majority of food insecurity and poverty in rural households continue to exist as a result of decreasing farm productivity and income. Poverty and low income are the primary threats to rural households (Oyelami et al., 2017). If these households do not receive substantial attention it will be extremely difficult to achieve Sustainable Development targets (SDG) 1 and 2, which call for eradicating hunger and poverty.

The main source of income for rural residents in developing nations, like Nigeria, is subsistence agriculture, which is vulnerable to decreasing productivity, shifting climatic conditions, and shocks connected to production

(Akintunde *et al.*, 2023; Food and Agriculture Organisation (FAO), 2023). Limiting factors that affect subsistence farming in Nigeria include insufficient arable land, a lack of credit and capital, and the debilitating effects of climate change, which have caused agricultural crop productivity and output to decline, forcing rural households to diversify their sources of income (Akintunde *et a*l., 2023). Income diversification for rural households is necessary due to the unstable state of arable farms, poor profitability and the growing hazards that go along with it. These factors have slowed production, leading to crop and market failures (Idris-Adeniyi *et al*., 2021).

One of the important agricultural subsector is the livestock production. It includes all animals farmed domestically to provide labor, food, and fiber, among other agricultural goods. In addition to give rural households' access to food, it also generates cash. According to Enechi *et al*. (2012) and Offor, Ekweanya, and Oleka (2018), livestock can be raised for profit or for subsistence. From a sociocultural and nutritional standpoint, livestock production is extremely important to rural households (Adam *et al*., 2010; Offor *et al.*, 2018). Small ruminants are also very beneficial to the impoverished rural households, in addition to being a major source of food security for them. When faced with unforeseen circumstances like crop failure or family illness, small ruminants—goats and sheep in particular—can be turned into income to help pay for food or medical expenses. In developing nations, like Nigeria, dairy goats have the potential significantly to boost economic development due to their tremendous importance in battling poverty and food insecurity (Baruwa, 2013; Offor *et al*., 2018).

In tropical livestock systems, small ruminants are extremely valued and important. Small ruminants, which include sheep and goats, are the majority of farm animals in Nigeria that are raised by rural households under the pastoral system of the nation. Together, they make up the whole livestock population. According to Suleiman *et al.* (2015), there are 22.1 million sheep and 34.5 million goats in Nigeria. Offor *et al.* (2018) noted that the country is still unable to meet its population's need for animal protein per capita in terms of both quality and quantity, despite the livestock subsector's importance to the rural economy and the abundance of species. This is because of the production system and related factors.

About 60–70% of Africans live in rural areas, where extreme poverty and deprivation are more prevalent, according to Oyelami *et al*. (2017) and FAO (2019). Small ruminants provide a reliable source of income and valuable assets for both men and women in developing nations. Goats are more profitable than sheep because of their innate ability to withstand severe and difficult climatic conditions; this helps marginalized and landless families as well as rural households fight poverty (Valdivia, 2001; Alary, *et al.*, 2015; Ampaire, 2011; Wodajo *et al*., 2020).

However, housing, health issues along with a high frequency of pests and diseases, parasite infestation, and volatile market prices pose a danger to the profitability and sustainability of small ruminant rural enterprises (Doma *et al*., 1999; Alabi *et al*., 2019). Numerous research on the profitability of this business have been reported in the literature; however, the majority of these studies do not include pertinent socioeconomic variables in their models of profitability. Therefore, the study evaluated the profitability of smallholder small ruminant enterprise among rural households in Ife-Ijesa Agricultural Zone, Osun State, Nigeria. The major objective of the study is to examine the profitability of small ruminant enterprise among rural households in Ife-Ijesa Agricultural Zone, Osun State, Nigeria. Specifically, the objectives of the study are: (1) to describe the socioeconomic characteristics of the respondents in the study area; (2) to examine the costs and returns of small ruminant

production among rural households in the study area; (3) to determine the level of gross margin of small ruminant production among rural households in the study area; and (4) to determine significant factors influencing the gross margin of small ruminant production among the rural households in the study area.

MATERIALS AND METHODS

The study area

The study was carried out in Ife-Ijesa Agricultural Zone, Osun State, Nigeria. Situated in the north-eastern region of Osun State, Nigeria, the Ife/Ijesa Agricultural Zone spans an approximate area of 3,500 square kilometers (Ife/Ijesa Zone, 2022). There are thirteen local govern areas in the zone. The region is well-known for having rich soil, a pleasant temperature, and an abundance of water resources, which make it suitable for farming (Adeoluwa, 2017). Cocoa, coffee, kola nuts, and food crops like maize, yam, and cassava are among the main crops grown there (Osun State Government, 2022). The region is endowed with an abundance of grazing spaces, which encourages the production of small ruminants, particularly in the rural parts. The population of the study area are rural dwellers who are involved in small ruminant production.

Sampling procedure and sample size

A multistage sampling technique was adopted to select 120 respondents as the sample size for the study. In the first stage, five (5) local government areas (LGAs) with highest rural communities were purposively selected from the thirteen (13) LGAS in the agricultural zone. In the second stage, six (6) rural communities where small ruminant production is predominant were selected from each LGAs to make thirty (30) communities. Finally, using snowball technique, five (5) rural households' heads engaged in small ruminant production were selected from each community to make 120 respondents for the study.

Research instrument and data collection

Primary data for the study were collected through structured interview schedule to elicit responses from the respondents. The structured interview schedule was pretested to ensure its accuracy and validity for the study. Socio-economic characteristics of the respondents such as age, education level and small ruminant production experience were measured in years, household size measured as number of people eating from the same pot, flock size measured as number of animals kept, and labour was measured in man days. Costs of inputs, and revenue from animal sales were measured in Naira. The independent variables of the study are age, cost of feeding, years of formal education, cost of medication, household size, extension contact, flock size, small ruminant production experience, and costs of starting flock. The dependent variable of the study is the level of gross margin from small ruminant production per rural household.

Analytical Technique

The analytical techniques that were employed in this study include descriptive statistics such as frequency table, percentages and mean, gross margin analysis and multiple regression analysis. Budgetary analysis was employed to investigate the profitability of the small ruminant enterprise.

The gross margin was computed as the total revenue minus total variable cost of production. Gross margin was calculated by subtracting the total variable costs from the total revenue.

Mathematics:

Total Revenue = Output x Unit price

Gross margin = Total Revenue – Total Variable Cost

Benefit cost Ratio = Total Revenue/ Total Cost

Benefit cost ratio is a measure of profitability and investment criteria requires that benefit cost ratio (BCR) should be greater than one (i.e. BCR>1) before a business can be termed profitable.

The inferential analytical tool and the multiple regression analysis are used to establish the relationship between revenue generated from small ruminant production and the selected determinants. The equation is given as:

$Y = f(X_1, X_2, X_3, X_4, ----------, X_{10}, ei)$

Where, Y is the gross margin from small ruminant production; X_1 – the age of respondents (years), X_2 – the cost of feeding, X_3 – years of formal education, X_4 – cost of medication, X_5 – household size (number), X_6 – extension contact (yes = 1, no = 0), X_7 – flock size (number), X_8 – experience in small ruminant husbandry (years), X_9 – cost of starting flock, ei – random error term.

RESULTS AND DISCUSSION

Socio-economic characteristics of respondents

The distribution of socio-economic characteristics of respondents in the study area is presented in Table 1. Data in the Table shows that majority (52.50%) of the respondents were male, while few (47.50%) were female suggesting that small ruminant production is a male dominated venture in the study area. Age distribution of the respondents as shown in the Table indicates that most of the respondents (69.17%) are at age between 46-65 years, with a mean of 51.12 years, showing that they are still in their economic active age. Most of the respondents are married (76.67 %). The years of formal education of the respondents is shown in Table 1. Most (70.83%) of the respondents have between 1 to 13 years of formal education with a mean of 9.57 years, implying that the respondents were literate. Also, the household size of the respondents reveals that virtually all (99.57%) of the respondents had between 1 to 10 persons in their households, with a mean of 5 persons per household. The primary occupation distribution of the respondents as presented in the Table shows that most engaged livelihood activities among the respondents in the study area are trading (29.17%) and small ruminant's production (31.67%).

The income distribution among the respondents shows that a significant majority (89.17%) earn between ₦7,000 and ₦100,000 monthly from their primary occupation, with an average monthly income of ₦58,908.33, indicating a relatively low level of primary income. The experience of the respondents in small ruminant keeping, as shown in the table, indicates that they possess considerable experience in small ruminant rearing, averaging 13.23 years. Additionally, the distribution of small ruminant flock sizes reveals that nearly all (89.17%) of the respondents are smallholders, with flock sizes ranging from 2 to 20 animals, and an average flock size of 20 animals.

Table 1: Socio-economic characteristics of the respondents (n=120)

Variables		
Gender	**Frequency**	**Percentage**
Male	63	52.50
Female	57	47.50
Age (Years)		
26-35	12	10.00
36-45	18	15.00
46-55	53	44.17
56-65	30	25.00
66-75	7	5.83
Mean	**51.12 years**	

Marital status		
Single	0	0.00
Married	92	76.67
Separated	7	5.83
Divorced	5	4.17
Widowed	16	13.33
Years of formal education		
0	15	12.50
1-6	30	25.00
7-13	55	45.83
14-20	20	16.67
Mean	**9.57 years**	
Household size	**Frequency**	**Percentage**
1-5	83	69.17
6-10	36	30.00
11-15	1	0.83
Mean	**5 persons**	
Primary occupation		
Small ruminant	38	31.67
Crop production	13	10.83
Civil servant	12	10.00
Trading	35	29.17
Artisan	22	18.33
Primary income (₦)		
7000-100000	107	89.17
101000-200000	11	9.17
201000-300000	1	0.83
301000-500000	1	0.83
Mean	**₦58,908.33**	
Ruminant keeping experience		
2-10	64	52.50
11-20	44	36.67
21-30	7	5.83
31-40	8	5.00
Mean	**13.23 years**.	
Flock size		
1-10	40	33.33
11-20	33	27.50
21-30	22	18.33
31-40	14	11.67
41-50	7	5.83
51-60	4	3.33
Mean	**20 animals**	

Source: Field Survey, 2024

Budgetary analysis

The results of budgetary analysis to determine costs and returns to small ruminant production enterprise is presented in Table 2. Cost of pen construction, land purchase, and starting flock constituted 20.09%, 18.54%, and 55.66%, respectively, of the fixed cost (₦173,145.82). The initial capital investment required to start a small ruminant enterprise in the study area is ₦173,145.82. The major variable costs are cost of feeding and medication constituting 49.23% and 39.71% of the total variable cost of ₦23,030.46. The gross margin per small ruminant production cycle in the study area is ₦ 99,000. 03. The value of benefit cost ratio is 1.27, implying that ₦0.27 is returned for every Naira invested in the enterprise, indicating that the venture is profitable in the study area.

Gross margin levels of respondents in the study area

Table 3 presents the respondents' gross margin levels from small ruminant production in the study area. The gross margin was classified as low (difference between mean and standard deviation of the gross margin). Medium (mean of the gross margin), and high (sum of the mean and standard deviation of the gross margin). Results in the Table shows that most (76.67%) of the respondents earns medium gross margin, while few (11.67%) earn low or high gross margin. This results might be due to small ruminant flock size and production practices.

Multiple regression analysis

Regression analysis aimed to identify factors that influence the gross margin of small ruminant production in the study area (Table 4). The R^2 value is 0.565, which means that approximately 56.5% of the variance in the gross margin can be explained by the independent variables included in the model.

Table 2. Costs and Return Analysis per small ruminant production cycle

Costs and Return Analysis per small ruminant production cycle			
s/n	**Items**	**Amount (₦)**	**Scale**
A	Fixed costs		**% of TFC**
	Land purchase	34,783.33	20.09
	Land rent	4,083.33	2.36
	Pen construction	32,100.00	18.54
	Starting flock	96,370.83	55.66
	Production materials (bowls, plastic buckets)	5,808.83	
B	Cost of fixed assets (TFC)	173,145.82	
C	Total Revenue (TR)	125,516.70	
D	Variable costs		**% of TVC**
	Cost of feeding	15,754.17	59.41
	Cost of medication	8,464.17	31.92
	Cost of transport	1,477.08	5.57
	Cost of animal shed	620.83	2.34
	Market levies	200.42	0.76
E	Total variable cost (TVC)	26,516.67	
F	Gross margin (TR-TVC)	99,000.03	
G	Benefit/Cost ratio	1.27	

Field Survey, 2024

Table 3. Gross margin levels of respondents in the study area

Gross margin levels of respondents in the study area			
Levels of gross margin	**Mean (₦)**	**Frequency**	**Percentage**
Low	1,550.00	14	11.67
Medium	75,900.02	92	76.67
High	1,550.00	14	11.67
Total	**99,000.03**	**120**	**100**

Field Survey, 2024

The adjusted R^2 is 0.511, which accounts for the number of predictors, offers a more precise assessment of the model's fit. The F-value of 14.95 is significant at the 1% level, indicating that the model is statistically significant. The positive coefficient for age indicates that as age increases, there is a slight tendency for increase of gross margin. However, the high p-value of 0.723 suggests that this relationship is not statistically significant, meaning that age does not have a meaningful impact on the gross margin of small ruminant farmers in the study area.

The negative coefficient for feeding costs shows that for each unit increase in feeding expenses, the gross margin from small ruminant production drops by 0.770 units. This finding is statistically significant, highlighting the considerable negative effect of feeding costs on profitability. Increased feeding costs lead to lower profitability because of higher operational expenses. These results align with the studies of Mohammed & Josephine (2017), Owoshagba *et al*. (2021), and Oni *et al*. (2022).

The positive coefficient of formal education suggests that improved education is associated with an increase in gross margin, and the p-value of less than 0.01 confirms that this relationship is highly significant. Specifically, each additional year of formal education increases the gross margin from small ruminant production by 29.116 units. This highlights the important role education in enhancing the profitability of small ruminant production. Education provides farmers with knowledge and skills, which leads to improved management practices and decision-making. This finding aligns with the research of Fakoya & Oloruntoba (2009) and Anim-Jnr *et al.* (2023).

The coefficient for medication costs is positive, but the high p-value (0.723) indicates that these costs do not have a significant effect on the gross margin. In the same way, the positive coefficient and high p-value (0.734) for household size show that it does not significantly affect the profitability of small ruminant enterprise. Despite that there is a positive coefficient, the high p-value (0.486) suggests that extension contact does not significantly impact the profitability of the small ruminant enterprise.

There is strong and significant relationship ($p < 0.01$) between larger flock sizes and increased gross margin. For every additional unit added to the flock size, the gross margin for small ruminant production rises by 22.453 units. Larger flocks tend to result in greater profitability. Investing initially in high-quality animals or infrastructure can enhance growth rates and yield higher returns. Additionally, larger flocks can create economies of scale, which help lower per-unit costs and boost overall profitability. This aligns with the findings of Oluwatayo & Oluwatayo (2018) and Offor et al. (2018).

The coefficient of 23.456 for experience in small ruminant production is both positive and statistically significant ($p < 0.01$). This means that for every additional year of experience, the gross margin increases by 23.456 units. Experience plays a crucial role in

enhancing profitability. More experienced farmers effectively managed the health, nutrition, and reproduction of animals, which results in improved productivity and profitability. Mustapha *et al*. (2024) implied in their study that experience has a significant effect on small ruminant production.

The cost of starting a flock positively and significantly impacts the gross margin ($p < 0.05$), suggesting that higher initial investment costs correlate with increased gross margins. This could mean that investing in higher-quality animals or infrastructure results in greater returns. This conclusion is consistent with the findings of Oni *et al*. (2022). However, the intercept term is not significant, suggesting that it does not play a meaningful role in the model.

In conclusion, the regression analysis emphasizes how crucial education, experience, and initial investment are for enhancing the profitability of small ruminant production. These factors significantly affect the gross margin from small ruminant production in the study area.

CONCLUSIONS

The results indicated that small ruminant production is a viable and profitable venture for rural households in the study area. It highlights the crucial role of small ruminant production in increasing household income, which consequently contributes to poverty alleviation and addressing food insecurity. Despite the challenges faced by this important rural enterprise, the overall profitability suggests that with proper management and support the small ruminant production can be a sustainable livelihood for rural households in the study area. However, several recommendations can be made. There is necessity of policies and initiatives, especially in rural areas, that should assist small ruminant farmers by providing access to finance, markets, and technology to enhance their productivity. Strong policy support is needed to promote small-scale ruminant farming as a viable income source for rural residents. Small ruminant farmers should receive extension education, particularly focused on adopting improved management techniques to increase their gross margins from small ruminant farming.

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