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Effect of Food Security Status on Economic Efficiency Among Small Scale Broiler Producers in Southern Taraba State Nigeria

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ABSTRACT

This study examined the effect of food security status on economic efficiency among small-scale broiler producers in Southern Taraba State, Nigeria. Specifically, it described the socioeconomic characteristics of broiler farmers, assessed their food security status, analyzed the cost and returns of broiler production, and analyzed effect of food security on broiler production. Primary data were collected from 138 respondents using a structured questionnaire through a multi-stage sampling technique. Analytical tools employed included descriptive statistics such as mean and standard deviation, food security index, enterprise budgeting, and the stochastic frontier production function. Results showed that the average age of broiler farmers was 35 years, with most having formal education and moderate household sizes. About 76.8% of households were food secure, with a food security index of 2.7 and an average daily calorie intake significantly above the recommended threshold. Profitability indicators such as a net return on investment of 1.4 and a profitability index of 0.6 confirmed that broiler production is economically viable and the average economic efficiency was estimated at 66%. Key determinants of economic efficiency included cost of day-old chicks (0.7718191), feed (0.1091954), water (-0.0318129), and litter material (0.0118794), while age (-0.0043665), sex (0.0612589), household size (0.0099204), and food security status (0.1173318) significantly influenced inefficiency. The study concludes that food security enhances broiler producers' economic efficiency, with food-secure farmers performing better than food-insecure ones. It recommends policies enhancing farmers' welfare, stable input supply, feed management training, and credit access to improve both food security and production efficiency in the study area.

INTRODUCTION

Food security remains a pressing global concern, particularly in Sub-Saharan Africa, where poverty, conflicts, and climate variability persistently threaten the availability, accessibility, and affordability of food (Bappah and Adejoh, 2024). According to Nwanmuoh *et al.* (2024), over 33% of the population in Sub-Saharan Africa remains food insecure, with rural agricultural households most affected. In Nigeria, food insecurity has worsened due to inflation, insecurity, and inefficiencies in agricultural production (Sakanko *et al.,* 2025). Taraba State, despite its vast agricultural potential, is not exempted, as a significant proportion of its farming households still grapple with both food insecurity and low productivity (Dearsley and Enganya, 2024).

Poultry farming, especially broiler production, is a critical sub-sector of Nigeria's livestock industry. It serves as a significant source of animal protein, income, and employment for rural households (Ojo, 2023). Broiler farming is particularly attractive to smallholder farmers due to its short production cycle, high turnover rate, and relative ease of management (Awoyomi, 2021). However, many of these producers operate under constrained production environments characterized by high input costs, limited access to veterinary services, poor technical knowledge, and limited market access (Abadula *et al.,* 2022).

Food security refers to a condition where people consistently have both physical and economic access to adequate, safe, and nutritious food. This ensures they can meet their dietary needs and preferences to maintain an active and healthy life (World Health Organization 2021). For rural small-scale broiler producers, achieving food security depends not only on income earned from poultry but also on how efficiently resources are allocated and utilized in the production process (Saheed, 2023). Economic efficiency in broiler production implies the ability of producers to maximize output (broilers) with minimum cost while maintaining profitability (Ojo *et al.,* 2021). An economically efficient farmer is more likely to enjoy higher income and thus better food access and dietary quality (Ogunniyi *et al.,* 2021).

Despite the vital role of broiler farming in improving household welfare, there remains a limited understanding of the relationship between food security status and the economic efficiency of broiler producers, particularly in Nigeria. Several studies have analyzed food security or farm efficiency independently (Omodara *et al.,* 2023; Ikuemonisan, 2024), but few have empirically linked the two. Theoretically, food-secure households may be better positioned to allocate labor more productively, make informed decisions, and reinvest profits into improved production practices, all of which can enhance economic efficiency (Adeniyi, 2019). Conversely, food-insecure households might divert labor to off-farm jobs, sell inputs prematurely, or make suboptimal production decisions, thereby reducing efficiency (Collins-Sowah, 2021).

In Southern Taraba, smallholder poultry producers face multiple challenges that may hinder both their food security and productive efficiency. These include high feed costs, inadequate extension services, disease outbreaks, and fluctuating market prices (Attia *et al.,* 2022). As a result, even though poultry farming presents an opportunity for poverty alleviation and nutritional improvement, these opportunities are not fully harnessed due to production inefficiencies (Kumar *et al.,* 2021). A better understanding of the link between food security status and the economic efficiency of broiler farmers can offer new insights into how best to support farmers to achieve both improved welfare and productivity.

Furthermore, assessing the economic efficiency of broiler producers provides a basis for identifying key determinants of inefficiency, such as access to credit, education, training, and food security status (Ramukhithi *et al.,* 2023). Previous studies, such as that by Mivumbi *et al.* (2023), found that improving farmers' technical and allocative efficiency significantly enhances overall productivity. Similarly, Kapari *et al.* (2023) showed that food security is positively influenced by farm income and production efficiency, particularly in smallholder systems. This study, therefore, seeks to investigate the effect of food security status on the economic efficiency of small-scale broiler producers in Southern Taraba State. It is motivated by the need to fill the existing empirical gap and provide data-driven insights for policymakers, development partners, and extension practitioners. A better understanding of this nexus will help in designing policies that not only enhance poultry productivity but also improve household food security outcomes in a sustainable manner. Given the rising cost of poultry inputs and the growing threat of food insecurity in Nigeria, it is imperative to understand the dynamics at play between food access and production efficiency. The specific objectives for the studies were to; socioeconomic characteristics of small scale Broiler farmers; food security status of farmers; cost and return of broiler production and effects of broiler production on food security status of small scale broiler farmers in the study area

METHODOLOGY

Study Area

The research was carried out in Southern Taraba, located within Taraba State, Nigeria. The region comprises five Local Government Areas—Wukari, Takum, Donga, Ussa, and Ibbi—and one Special Development Area, Yangtu. Geographically, it lies between latitudes 8°30′N and 9°03′E and longitudes 8°30′N and 10°30′E (Danladi et al., 2024). Southern Taraba occupies a land area of approximately 14,099 km² and had a population of 687,077 people according to the 2006 National Population Census (NPC, 2006). Based on the National Population Commission's estimated annual growth rate of 3.5%, the population was projected to reach about 1,233,080 by 2023 (Danladi et al., 2024). The area is predominantly agrarian, with most residents engaged in small-scale farming of both food and cash crops such as yam, maize, sorghum, cassava, rice, and sesame. In addition, freshwater fishing and forestry are common livelihood activities, while livestock rearing plays a relatively minor economic role.

Sources of Data /Data Collection

Primary data was used for this research work. A well-structured questionnaire was used to collect the data from respondents in the study area.

Sampling procedures

A multistage sampling procedure was adopted to select respondents for the study. At the first stage, all five local government areas constituting Southern Taraba were included. In the second stage, three wards were randomly chosen from each of the selected local government areas. At the final stage, a total of 138 small-scale broiler farmers were identified and interviewed using the snowball sampling approach, which facilitated the selection of farmers within the chosen wards.

Analytical techniques

Data collected for the study were subjected to both descriptive and inferential statistical analyses. Descriptive statistics, including percentages, means, and standard deviations, were employed to examine the socioeconomic characteristics of small-scale broiler farmers in the study area (Objective i). The food security status of the farmers (Objective ii) was assessed using the Food Security Index (FSI), with the food security line derived from the daily recommended calorie intake of 2,260 kcal (Ojeleye, 2015). The cost and returns associated with broiler production (Objective iii) were determined through enterprise budgeting tools such as gross margin, net farm income, net return on investment, gross ratio, and profitability index. Finally, the influence of broiler production on the food security status of small-scale broiler farmers (Objective iv) was estimated using the Stochastic Frontier Analysis (SFA) model.

Model Specification:

The economic efficiency model was specified as follows:

$$\ln Yi = \beta o + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + \beta_8 \ln X_8 + e \quad \ldots\ldots\ldots(1)$$

Where:

Yi = Total production (₦), X_1 = Cost of day old chicks (₦), X_2= Cost of feeding (₦)
X_3= Cost of labour (₦), X_4 = Cost of water (₦), X_5 = Cost of medication / vaccine (₦), X_6 = Cost of warming and lighting (₦), X7 = Cost of liter material (₦), X8 = Cost of transportation (₦), Bi = Parameters to be estimated, Ln = Natural logarithms, e = Composite error term defined as $vi - ui$.

The economic inefficiency model is specified as:

$$Ui = \delta 0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 + \delta_8 Z_8 + \delta_8 Z_8 + \text{ei} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where:

Ui = Economic inefficiency of the Yam farmers, Z_1 = Age of farmers (years), Z_2 = Sex (1= Male, 0 =

Female), Z_3 = Farming experience (years), Z_4 = Level of education (Years), Z_5 = Household size (number of persons), Z_6 = Extension contact (1=Yes, 0 = No), Z_7 = Number of broiler reared (Number), Z_8 = Cooperative membership (1 =Yes, 0 = No), Z9 = Food security status (1 = food secure, 0 = food insecure), δi = Parameters to be estimated.

RESULTS AND DISCUSION

Socioeconomic Characteristics of Small-Scale Broiler Farmers

The findings revealed that the average age of small-scale broiler farmers was approximately 35 years, with 76.8% below 40, suggesting that broiler farming is dominated by young, economically active individuals capable of adopting innovations (Saheed, 2023). The average household size was five, which can support labor availability, though large sizes may strain food resources (Ayaz and Mughal, 2024; Giller *et al.,* 2021). Regarding education, 40.6% had secondary and 30.4% had tertiary education, which supports informed decision-making and technology adoption (Masere and Worth, 2022; Saheed, 2023).

The average farming experience was 9 years, with 73.9% having less than 10 years, indicating potential for further training and capacity building (Bello *et al.,* 2021). An average flock size of 37 birds, with 69.6% keeping 40 or fewer, confirms the small-scale nature of operations due to capital limitations and high input costs (Tahmasbi, 2024; Balana and Oyeyemi, 2022). Only 17.4% of farmers engaged in broiler farming full-time, while most combined it with other livelihoods like crop farming and trading, reflecting its role as a supplementary income source (Arowolo *et al.,* 2022).

Access to credit was limited, with an average borrowed amount of ₦101,666.67, pointing to undercapitalization and restricted investment in essential inputs (Karamchedu *et al.,* 2022). Extension contact was very low (13.0%), limiting farmers' access to updated knowledge and innovations (Saheed, 2023; Aromolaran *et al.,* 2024). Only 18.8% belonged to cooperatives, reflecting weak institutional support, which undermines service delivery and market access. Strengthening cooperatives could significantly enhance productivity and farmer welfare (Biswas, 2024).

Table 1: Socioeconomic characteristics of small-scale broiler farmers

Variables	Frequency	Percentage	Mean (Standard Deviation)
Age			
≤ 30	60	43.5	
31 – 40	46	33.3	
41 – 50	26	18.8	
> 50	6	4.3	34.7681(±8.78310)
Household Size			
≤ 5	102	73.9	
6 – 10	30	21.7	
> 10	6	4.3	4.6667 (±3.03106)
Educational Level			
No Formal Education	28	20.3	
Primary Education	12	8.7	
Secondary Education	56	40.6	
Tertiary Education	42	30.4	
Farming Experience			
≤ 5	58	42.0	
6-10	44	31.9	
11-15	18	13.0	
16-20	12	8.7	
> 20	6	4.3	9.0870 (±6.60179)

Number of Broilers			
≤ 20	56	40.6	
21-40	40	29.0	
41-60	10	7.2	
61-80	14	10.1	
> 80	18	13.0	36.6087 (±28.71568)
Major Occupation			
Crop Farming	50	36.2	
Broiler Production	24	17.4	
Students	22	15.9	
Civil Servant	18	13.0	
Trading	16	11.6	
Artisan	8	5.8	
Amount Borrowed			
≤ 50000	2	16.7	
50001-100000	8	66.6	
>100000	2	16.7	101666.67 (±50602.43)
Extension Contact			
Yes	18	13.0	
No	120	87.0	
Cooperative Membership			
Yes	26	18.8	
No	112	81.2	
Total	138	100	

Source: Field Survey, 2025

Food security status of small scale broiler farmers

Food security exists when individuals have consistent physical, social, and economic access to safe, nutritious food that meets dietary needs (World Health Organization, 2021). In this study, the calorie intake approach was used, with 2260 kcal per adult per day as the threshold for food security, as recommended by national guidelines (Ademola *et al.,* 2021). Results show that 76.8% (106 households) of broiler farming households were food secure, while 23.2% (32 households) were food insecure. This suggests that most small-scale broiler farmers in Southern Taraba can meet their dietary needs, likely due to income from poultry sales enhancing their food purchasing power. This finding supports previous studies by Omodara *et al.* (2023) and Edafe *et al.* (2023), who found that poultry farming significantly improves household food security. Food-secure households had an average daily calorie intake of 6108.40 kcal, exceeding the minimum by 3848.4 kcal, resulting in a food security index of 2.7 and a surplus index of 1.7. This indicates not only adequacy but possible overconsumption, raising concerns about dietary balance and food waste (Hussain *et al.,* 2025). In contrast, food-insecure households averaged 1664.51 kcal daily 595.50 kcal below the threshold with a food insecurity index of 0.7 and a shortage index of 0.3, reflecting a significant calorie deficit.

Cost and Return of Small-Scale Broiler Production

Profitability analysis provides key insights into the economic viability of small-scale broiler production in Southern Taraba. The average total revenue per cycle was ₦629,850.70, derived mainly from bird sales (₦578,937.70) and poultry droppings (₦50,913.04), underscoring the contribution of by-products to overall revenue (Kabugo *et al.,* 2023). Total variable cost stood at ₦249,668.10, with feeding (₦118,926.10; 47.6%) and stocking (₦111,647.80; 44.7%) as major expenses, highlighting the need for cost-effective feed and day-old chicks. Other costs included labor (₦9,672.46), water (₦2,088.41), and medication (₦1,807.25), with low labor costs reflecting family labor usage.

Total fixed cost was ₦8,544.35 (3.2% of total cost), mainly from depreciation of basic equipment, indicating low capital investment (Zaehringer *et al.,* 2021). The gross margin of ₦380,182.60 shows strong ability to cover variable costs, while a net farm income of ₦363,093.90 demonstrates high profitability. A return on investment (ROI) of 1.4 confirms the venture's profitability—comparable to studies by Aminu and Hermanns (2021) and Akoh and Jimoh (2024). A gross ratio of 0.4 reflects high cost efficiency, while a profitability index of 0.6 shows that 60% of total revenue is retained as profit (Al-Rikabi, 2021). Overall, despite small flock sizes (average 36 birds), the sector proves to be financially sustainable and economically efficient.

Table 2: Food security status of small scale broiler farmers

Variable in Average	
Food secured households	106
Food security index	2.7
Surplus index	1.7
Average household daily calorie consumption for food secured households	6108.40
Average calorie consumption in excess of recommended (2260Kcal)	3848.40
Percentage of food secured household	76.8%
Food insecure households	32
Food insecurity index	0.7
Shortage index	0.3
Average household daily calorie consumption (Kcal) for food insecure households	1664.51
Average calorie consumption in shortage of recommended (2260Kcal)	595.50
Percentage of food insecure household	23.2%

Source: Field Survey, 2025

Determinants of Economic Efficiency of Broiler Production

The stochastic frontier analysis (SFA) model was used to analyze economic efficiency and its determinants among small-scale broiler producers, incorporating both cost inputs and socioeconomic variables (Sultana *et al.,* 2023). Results showed that the Cost of Day-Old Chicks (X_1) had a positive and significant effect (1%), where a unit increase raised output by 0.77%, reflecting high elasticity with respect to chick quality and quantity (Mukailan et al., 2023). Cost of Feeding (X_2) was also positive and significant at 1%, reinforcing the importance of feed in productivity and aligning with Reis *et al.* (2021) who reported feed as a key cost driver and performance enhancer. In contrast, Cost of Water (X_4) was significant at 5% with a negative effect, indicating that higher water expenses reduce output, possibly due to poor access or quality, as noted by Sullivan *et al.* (2021). Cost of Litter Material (X_7) positively influenced output at 1% significance, emphasizing its role in improving hygiene and reducing disease (Abougabal and Taboosha, 2023).

In the inefficiency model, Age (Z_1) was negatively significant at 1%, suggesting that older farmers are more efficient, likely due to experience. Sex (Z_2) was significant at 1% and had a positive effect on inefficiency which showed that male farmers were more inefficient than females, perhaps due to women's stronger management practices (Anderson *et al.,* 2021). Household Size (Z_5) was significant at 5% and had a positive effect on inefficiency, indicating that larger households may dilute resources and reduce efficiency, consistent with Smith and Landry (2021). Interestingly, Food Security Status (Z_9) increased inefficiency at 1% significance suggesting that food-secure farmers may deprioritize cost minimization, aligning with Khumalo et al. (2024), who observed that well-nourished households sometimes underperform economically due to reduced urgency in profit optimization.

Table 3: Cost and return of small-scale broiler production

S/N	Description	Broilers Production Cost
1	Stocks	
	Average Opening Stocks (37 birds per production cycle of 3 months)	
	Average Closing Stocks (36 birds per production cycle of 3 months)	
2	Revenue	Value (₦)
a.	Sales of Birds	578937.7
b.	Sales of droppings	50913.04
	Total Revenue (TR)	629850.7
3	Variable Cost:	
	Stocking	111647.8
	Feeding	118926.1
	Labour	9672.464
	Water	2088.406
	Medication/Vaccination/Additives	1807.246
	Warming + lighting and fuel	1500.145
	Litter Material	783.1884
	Transportation	2762.319
	Other Utility expenses	480.4348
	Total Variable Cost (TVC)	249668.1
4	Fixed Cost:	
	Depreciation on:	
	Buildings / cages	2226.087
	Feeders	1345.652
	Drinkers	1300.725
	Stove	822.029
	Jerry-can, Bucket and Basins	1047.681
	Spades and Shovel	977.5362
	Wheel Barrows	824.6377
	Total Fixed Cost (TFC)	8544.348
	Total Cost (TC)	266756.8
	Gross Margin (GM)	380182.6
	Net Farm Income (NFI)	363093.9
	Net Return On Investment (NFI / TC)	1.4
	Gross Ratio	0.4
	Profitability Index (PI)	0.6

Source: Field Survey, 2025

Economic Efficiency of Broiler Production

The study found that the average economic efficiency of small-scale broiler producers in Southern Taraba State is 66%, indicating that farmers could reduce their production costs by 34% without lowering output. The majority of farmers (44.2%) operated within a moderate efficiency range (0.61–0.80), while only 20.3% approached full efficiency (0.81–1.0). A small portion (2.9%) exhibited very low efficiency levels. These variations suggest that while some farmers are performing relatively well, many still face challenges related to poor input management, limited technical knowledge, and access to resources. The results highlight the need for targeted interventions such as training, better access to credit, and extension services

to improve economic efficiency. The findings are consistent with the study by Nwaubani *et al.* (2023) who emphasize the importance of managerial ability and cost control in broiler production.

Table 4: Determinant of Economic Efficiency of broiler production

Variable	Coefficient	Standard error	z	P>/z/
Constant	3.651397	0.153395	23.80	0.000
Cost of Day old chicks (X_1)	0.7718191***	0.022555	34.22	0.000
Cost of feeding (X_2)	0.1091954***	0.016172	6.75	0.000
Cost of labour (X_3)	0.0076588	0.0112256	0.68	0.495
Cost of water (X_4)	-0.0318129**	0.0150148	-2.12	0.034
Cost of Medication / Vaccine (X_5)	-0.0083731	0.0064075	-1.31	0.191
Cost of Warming and lighting (X_6)	-0.0088899	0.01253	-0.71	0.478
Cost of liter material (X_7)	0.0118794***	0.0043424	2.74	0.006
Cost of Transportation (X_8)	-0.0140068	0.0192755	-0.73	0.467
Number of Observation	138			
Prob > F	0.0000			
sigma2	0.0432779	0.0071276		
Lambda	6.324288	0.0288873		
Inefficiency model				
Constant	0.1641926	0.0547768	3.00	0.003
Age (Z_1)	-0.0043665***	0.0014611	-2.99	0.003
Sex (Z_2)	0.0612589***	0.0190487	3.22	0.002
Farming experience (Z_3)	-0.0012832	0.001897	-0.68	0.500
Level of education (Z_4)	0.0013731	0.001594	0.86	0.391
Household size (Z_5)	0.0099204**	0.0048577	2.04	0.043
Extension contact (Z_6)	-0.0377158	0.0365131	-1.03	0.304
Number of broiler (Z_7)	-0.0005366	0.000435	-1.23	0.220
Cooperative membership (Z_8)	-0.001053	0.0341928	-0.03	0.975
Food security status (Z_9)	0.1173318***	0.0303989	3.86	0.000

Source: Field Survey, 2025 **** sign at 1%, ** sig at 5% and * sig at 10%*

Table 5: Economic efficiency estimate of broiler production

Efficiency Level	Economic Efficiency	
	Frequency	Percentage (%)
0.11 – 0.2	4	2.9
0.21 – 0.4	2	1.4
0.41 – 0.6	43	31.2
0.61 – 0.8	61	44.2
0.81 – 1.0	28	20.3
Total	138	100
Mean	0.66	
Std dev.	0.18	
Minimum	0.15	
Maximum	0.99	

Source: *Field Survey, 2025*

CONCLUSION

In conclusion Small-scale broiler production in Southern Taraba State is profitable and plays a significant role in enhancing household food security. However, food security status significantly enhances the economic efficiency of small-scale broiler producers, with food-secure farmers performing better than their food-insecure counterparts, underscoring the need for policies that jointly address household welfare and production constraints.

Based on the findings, it is recommended that policies promoting household food security among broiler producers be prioritized, as improving farmers' welfare can lead to better production efficiency and profitability. Support programs should focus on ensuring stable input supply, extension training on feed management, and credit access to strengthen both food security and economic efficiency in broiler production systems.

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