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Original Research Article

Cost Benefit Analysis of Egg Production and Comparative Evaluation of Various Breeds of Birds reared by Rural Dwellers in Imo State, Nigeria, From 2015 to 2022

Ahaotu E.O[1*], Okoro C.N[2], Onuruka A.C[3], Ikpe J.N[4], and Nwokeforo C.U[5]

[1]Department of Animal Science, University of Agriculture and Environmental Sciences Umuagwo, Imo State, Nigeria.

[2]Department of Cooperative Economics Technology, Imo State Polytechnic Omuma, Nigeria.

[3]Department of Agricultural Engineering, Imo State Polytechnic Orlu Campus, Nigeria.

[4]Department of Agricultural Technology, Akanu Ibiam Federal Polytechnic, Unwana – Afikpo, Ebonyi State, Nigeria.

[5]Department of Mathematics and Statistics, Imo State Polytechnic Omuma Campus, Nigeria.

***Corresponding Author's E-mail: emmaocy@gmail.com**

Abstract

Poultry is one of the fastest growing investments of the agricultural economy in Nigeria. This study estimated the cost benefit analysis of egg production and comparative evaluation of various breeds of birds reared by rural dwellers in Imo State, Nigeria, from 2015 to 2022.The objective was to examine the socio-economic status, estimate the costs and returns in production of egg. A stratified random sampling technique was used. Feed conversion ratio, egg-feed price ratio and benefit-cost ratio were analyzed statistically to estimate the production. Various social factors like age of farmers, family size and number of laying birds were significantly affecting the poultry business. Various investment patterns and values were analyzed. The analysis of net return differed significantly with farm size. This study concluded that large farm has higher mass of egg production and lower feed conversion rate indicating higher profit margin as farm size increased.

Keywords: Backyard Poultry Keepers, Costs, Egg Production, Net Farm Income, Returns

INTRODUCTION

Poultry is one of the most important enterprises of Nigeria which is growing rapidly in both government and private sectors in order to meet up the constant demand for meat, egg and income generation (Aganga et al., 2000). As an important sub-sector of livestock production, however, the poultry plays a crucial role in economic growth that creates numerous employment opportunities (Das *et al.* 2008). Billah (2008) reported that 4.5 to 5 metric tons of processed broiler chickens are needed as meat per day, where about 0.175-0.2 million chickens are consumed per day. Dutta (2010) studied the productivity and management practices of the poultry breeds. Poultry productivity is largely dependent on a number of non-genetic factors such as climate (Elijah and Adedapo 2006), management system and feed supply (Hassen et al., 2006; FSRS 2011), adequate funding (Berning *et al.,* 2008; Das et al. 2008) and seasonal disease outbreaks (Alam *et al.,* 2009; Natukunda *et al.,* 2011). On the other hand, studies designed to estimate overall return on investment revealed that incidence of diseases (Vaillancourt 2001), bio-security measures (Mengesha *et al.,* 2011), efficient management of resources (Nworgu and Egbunike 2000), feed and adoption of more innovation (Alabi and Aruna 2005), and growth rate and low productivity (Nworgu, 2007) affect the cost-benefit ratio of poultry farms. In this study, productivity of some selected government and private poultry farms along with their cost-benefit analysis, market prices of the available chicken breeds and constraints of poultry farming in Imo state, Nigeria have been presented.

MATERIALS AND METHODS

Study area

Seven local government councils in Imo State, Nigeria: Ikeduru, Owerri North, Oru East, Ngor Okpuala, Ahiazu

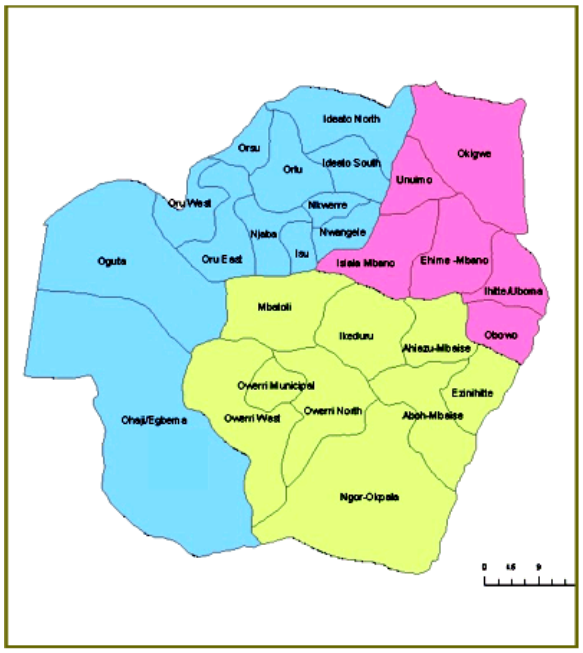

Figure 1. Map showing the twenty Seven Local Government Areas of Imo State, Nigeria

Mbaise, Mbaitolu and Okigwe, were randomly selected among rural dwellers for the study (Figure 1). The main considerations in selecting the study area were as follows: (a) a large number of poultry farms are raised in local government councils; (b) no study of this nature was conducted previously; (c) the study areas are well-communicated; (d) satisfactory co-operation received from the farm owners; and (e) occasional outbreaks of bird flu (avian influenza, AI) and other poultry diseases in the area.

Poultry farms

A total of ten poultry farms, consisting of four governments and six private ones, were selected for collecting data and information required for the experiment. The poultry farm owners were interviewed personally and data were collected using a specifically designed interview schedule. The main consideration for selecting the farms was the availability of both pure and crossbred chickens throughout the year.

Chicken breeds

Information on productivity, cost-benefit analysis, constraints on mass producing and market prices of five chicken breeds namely: Nera black, Hy-line Brown, ISA Brown, Rhode Island Red (RIR) and Shaver brown were collected from the selected poultry farms.

Parameters studied

The following parameters were studied. (a) Productivity: Farm- and breed-wise productivity of the chickens in all 10 poultry farms was recorded during the study.

Data were collected every two weeks from October 2015 to March 2022

(b) Cost-benefit analyses

For the cost-benefit analyses (in Naira) of the farms, the following parameters were computed (Alabi and Aruna 2005; Nworgu 2007): Total cost of production (TCP) = amount spent for rent of the land/houses, purchase of day-old chicks, feed, medicine and wages, electricity and water bills, caring and depreciation; Total revenue (TR) = amount received from sales of chicken, eggs and poultry waste products; Net profit (NP) = TR-TCP; Cost-benefit ratio (CBR) = TR÷TCP; Rate of return on investment (RRI)% = NP÷TCP×100; Gross ratio (GR) = TCP÷TR; and Profitability index (PI) = NP÷TR. In addition, the production costs and profits/losses per chick, along with the whole-sale and retail-sale prices for each breed were also calculated.

(c) Market prices of the chicken breeds

To get an overall picture of the poultry enterprise and its dynamics on the economy of the study area, the wholesale as well as the retail-sale prices of the chicken breeds were monitored recorded and analyzed for six months during the study period.

Table 1. Farm and breed wise productivity of chickens in the poultry farms randomly selected from seven local government councils in Imo State, Nigeria during October 2015 and March 2022.

Farms*	Nera black	Hy-line brown	ISA Brown	RIR	Shaver brown
G_1	0	3374	0	3371	3372
G_2	0	25960	0	25957	25957
G_3	0	14500	0	14497	14503
G_4	0	11552	0	11547	11551
P_1	243000	0	0	0	0
P_2	2000	0	20183	0	0
P_3	12300	0	0	0	0
P_4	0	45433	0	45433	45434
P_5	0	0	22980	0	0
P_6	19050	0	0	0	19050
Breed total	276350	100819	43163	100805	119867

*G_1-G_4 refer to government and P_1-P_6 refer to private farms

(d) Major constraints of the poultry productivity: In order to recognize the major problems frequently faced by the poultry farm owners, two persons, preferably the Manager and his assistant, or else the next responsible persons, from each farm were asked to pass their comments and/or suggestions on 10 questionnaires involving the capital invested for farming, availability and prices of day-old chick, feed and vaccines, housing systems, power (electricity) supplies, outbreak of poultry diseases including bird flu, marketing and selling systems, credit/loan facilities and training on poultry farming. The queries and their answers reflected the overall constraints and bottlenecks of the poultry enterprise in the study area.

Statistical analyses

Data and information on productive performance and cost-benefit of different breeds of chickens at the government and private farms were collected and were processed. Moreover, costs of rearing the chicken breeds and their corresponding losses or profits, and the current market prices of the chickens were analyzed. Data on constraints of the poultry productivity were expressed in percentages. One-way analysis of variance (ANOVA) for the productivity data among treatment means was performed. Microsoft Excel spread sheets and SPSS for Windows (version 11.0) were used for analyzing the experimental data.

RESULTS AND DISCUSSION

Productivity of 10 poultry farms in the study area (Table 1; Figure 1) revealed that significant differences existed among the poultry farms (F_9, 103 = 29.32; $P<0.001$), among the chicken breeds (F_4, 108= 3.03; $P <0.05$),as well as between the government and private farms (F_1, 111= 6.17; $P <0.05$). A total of 641,004 chickens were produced by the farms under study, of which Nera black grown in P_1 was the highest in number (243,000) while G_1 yielded the lowest, 10,117 heads comprising Hy-line brown, RIR and Shaver brown breeds. The most common chicken breed reared was Nera black (276,350) and the least common was ISA Brown (43,163).

Cost-benefit

A summarized account of the cost-benefit components of the poultry farms is presented in Table 2. Results clearly demonstrate that all the government farms in the study area were losing concerns in the order of $G_2 > G_3 = G_4 > G_1$, as indicated by their negative NP and RRI values, whereas all the private farms were making profits in the sequence of $P_1 > P_3 > P_2 > P_6 > P_4 = P_5$ at varying NP and RRI. This trend has been reflected in terms of the P_I values which in the government farms ranged between -0.09 and -0.13, and in the private farms between 0.18 and 0.52. Other components of the analyses such as CBR and GR also show similar nature of profitability against the farms under study.

Market prices

Depending on the availability of breeds, their supply and demand in the market, the prices of chickens fluctuated throughout the study period (Table 3). The average retail-sale price (per kg) of the most common breed Nera black was around N3,000, followed by the least common ISA Brown at N2000, Hy-line brown at N2,600 and the most popular Shaver brown at N2,400. In respect of the production cost, however, the maximum profit per chicken was recorded for Nera black (N3,000), followed by Hy-line Brown (N2,600), Shaver brown (N2,400) and

Table 2. Various components of the cost-benefit analysis derived from the total cost of production (TCP) and total revenue (TR) in randomly selected poultry farms during October 2015 and March 2022.

Farms	TCP	TR	NP	CBR	RRI	GR	P1
G_1	11109136	10217100	-892036	0.92	-8.03	1.09	-0.09
G_2	50136254	44531650	-5604604	0.89	-11.18	1.13	-0.13
G_3	22649848	20489875	-2159973	0.90	-9.54	1.11	-0.11
G_4	22775040	20506025	-2269015	0.90	-9.96	1.11	-0.11
P_1	182385840	379080888	196695048	2.08	107.85	0.48	0.52
P_2	14102096	20810925	6708829	1.48	47.57	0.68	0.32
P_3	263889	418500	154611	1.59	58.59	0.63	0.37
P_4	32411850	39619375	7207525	1.22	22.24	0.82	0.18
P_5	10293136	12577150	2284014	1.22	22.19	0.82	0.18
P_6	3740773	5269500	1528727	1.41	40.87	0.71	0.29

RP= total cost of production; TR-total revenue; NP = net profit; CBR = cost-benefit ratio; RRI = rate of return on investment; GR = gross ratio; PI = profitability index.

Table 3. Breed-wise production, production cost, whole-sale and retail-sale prices, and profit/loss of chickens in the study area during October 2015 and March 2022

Chicken breeds Produced per kg (Tk.)	*No. birds per kg (Tk.)	Production cost per kg (Tk.)	Whole-sale price per kg (Tk.)	Retail-sale price	Profit/loss
Nera black	276350	103.50±3.91	104.50±0.81	109.30±4.15	7.90±1.70
Hy-line brown	100819	131.50±1.12	164.90±0.83	169.50±3.50	34.40±1.80
Shaver Brown	43163	134.80±0.98	165.10±0.83	169.00±3.74	31.50±1.75
ISA brown	119867	72.60±0.66	84.80±0.75	89.50±3.50	14.40±1.69

*RIR was not available in the market during the study period.

ISA brown (N2,000). Therefore, ISA brown was the commonest but the least profitable, and Nera black was the most popular and the poultry growers achieved the maximum profit from Nera black.

Major constraints

Most of the respondents (85%) opined that high feed cost was the most serious concern for keeping the productivity at the demand levels. Further constraints to maintaining profitable poultry enterprise were recognized to be outbreak of diseases (80%), inadequate vaccine and medicine supply at the time of need (80%), lack of easy credit facilities (80%) and lack of sufficient capital for running the farms (80%). However, poor housing for the poultry birds (75%), dearth of quality day-old chicks (70%), lack of training facilities (50%), unpredictable marketing system (50%) and assurance for uninterrupted power supply (40%) were traced out to be the minor constraints to poultry growers in the study area. There is a dearth of information regarding the exact productivity in different poultry farms of the country. An early study showed that the location of poultry farms in different agro-ecological zones of the country affected productivity (Odoemelam *et al.,* 2020), who also demonstrated that shaver brown layers had the highest egg production, lowest mortality and high profit per hen. A trial was conducted with different exotic hens reared in semi-scavenging conditions where shaver brown layers was shown to be the best performer crossbred in terms of its higher egg production and better adaptability in rural conditions (Ahaotu *et al*., 2023). Experiments at the Osho Poultry Farm, Atta-Ikeduru, Imo State, Nigeria, during the period from 2015 to 2022 encompassed breeding of 22 genetic groups of five purebreds namely; Australorp, Barred Plymouth Rock, White Leghorn, RIR and Hy-line, while the remainders were crossbreds (F1) made up of the aforesaid purebreds (Uduji *et al.,* 2020). A later study by Sarkar (2007) showed that Shaver brown layers were suitable for the environment of Imo State, Nigeria.

In contrast, Islam and Nahar (2008) reported the productivity of RIR, WLH and indigenous chickens in terms of meat and egg morphometric where the RIR was assigned to be the superior breed. However, the commercial poultry production in Imo State, Nigeria grew tremendously in spite of some difficulties such as bird flu and shortage of day-old chicks, but it made a significant contribution to the economic development of the country (Das *et al*., 2008). A review made by Faruque *et al.,* (2009) emphasized further research on the genetics, breeding and productivity of poultry species in the country.

However, Lemlem and Tesfay (2010) studied productivity of Hy-line brown, RIR and WLH and concluded that RIR and WLH can be effectively managed for meat and egg production under scavenging condition by smallholder farmers.

Amidst such an alarming situation, the present investigation was undertaken to evaluate production performance of the selected poultry farms where G_2 was attacked by fowl pox, G_4 by E. coli infection and Salmonellosis, whereas P_1 and P_2 farms were struck by bird flu, P_3 by Gumboro and Omphalitis, P_5 by common cold and P_6 by Gumboro, Newcastle and Hyper-vitaminosis. Irregular incidences of these diseases therefore had obvious effects on the productivity of the poultry farms under study.

The cost-benefit assessment of a poultry enterprise is often determined by the level of risk to which the reared flocks are exposed to bio-security measures (Vaillancourt, 2001). Apart from these, the profit margin in poultry production depends mainly on feed utilization, cost of day-old chicks and efficient management of such resources as land, day labourers and appliances (Nworgu and Egbunike 2000). Studies on the financial dynamics of smallholder farms, poultry production and profits can be increased by the use of appropriate feed, capital, vaccines and adoption innovative approaches (Alabi and Aruna 2005; Nahamya *et al.,* 2006; Nworgu 2007).

The present losses incurred by the non-governmental farms lend support to the work of Kryger*et al*., (2005), where model-breeders and mini hatcheries were delivering economic losses to the farmers in smallholder poultry-production projects. In contrast, Berning *et al.,* (2008) estimated rate of return from poultry farms in the urban and semi-urban communities in Imo State, Nigeria to be 0.42 which is close to 0.32-0.52 P_I values for some private farms of our study, whereas the cost benefit ratios for Hy-line brown (5.74) and Shaver brown (5.92) reported by Zaman *et al.,* (2008) appeared to be much higher than those of the present results. However, finding by Oko *et al.,* (2021) seemed to be similar to the present work where the profit of the poultry farms was affected by total average costs, distance to the nearest market, access to extension services and education level and experiences of the farm owners. ISA brown was the cheapest breed, followed by Shaver brown while RIR was not being sold in the markets during the study period.

Feed stuff substitution (Rae and Hartel 1998), housing (Elijah and Adedapo 2006), government funding (Das *et al.,* 2008), mortality by infectious diseases (Permin and Madsen 2002; Sonaiya and Swan 2004; Natukunda *et al*., 2011; Mengesha *et al.,* 2011) and feed ingredient market (FSRS 2011) were recognized to be the usual constraints for poultry raising. In partial agreement with the present results, Sonaiya and Swan (2004) pointed out that small credit, supplying parent stocks and supplementary feeds, participatory training, delivery of vaccines, day-old chickens, training and follow-up are the major problems for poultry farmers. Elijah and Adedapo (2006) showed that in order to improve poultry productivity, the poultry farmers need to establish appropriate housing and sanitation practices to minimize the effect of heat and the occurrence and spread of diseases.

Seasonal disease outbreaks (mainly Newcastle disease), predation, low productive performance of certain breeds, theft, inadequate chicken management and lack of chicken marketing information were identified as the most important constraints affecting the chicken enterprise. Top five constraints recognized in this study were high feed cost, outbreak of diseases, inadequate vaccine/medicine supplies, insufficient credit facilities and lack of capital conform to the factors emphasized by Sonaiya and Swan (2004) and Das *et al.,* (2008), FSRS (2011) and Mengesha et al. (2011).

This study appeared to be the first one in connection with the estimation of productivity and cost-benefit analyses of some selected poultry farms in the study area. Significant differences were found among the farms, breeds and between the government and private farms. The most common breed was Nera black whereas the least common was ISA Brown. Interestingly all the government farms were running in loss compared to their private counterparts as indicated by the profitability indices. The commonest but the least profitable breed was Nera black, but the most popular and cheapest breed was ISA brown.

CONCLUSION

High feed cost, outbreak of diseases, inadequate supply of vaccines, lack of credit facilities and capital funding were recognized to be the major constraints. It finally appeared from the above findings that strict bio-safety oriented management practices coupled with the selection of fast growing and heavy laying breeds of chickens could ensure profitability of the poultry farms in the study area.

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