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Economic Assessment of Raising Different Broiler Strains

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ABSTRACT

Broiler chicken strains differ in genetic make-up and performance characteristics. The aim of this study was to evaluate and compare the cost of production and gross revenue of three strains of broiler chicken in order to determine their profitability. Also, the productivities of inputs and cost were determined. The three strains were Marshall, Hubbard and Arbor Acre. Data on costs of production and the live weights of 50 birds per strain; at 8 weeks were obtained. Results show that there were no significant ($p>0.05$) differences in the production costs to the three broiler strains. Feed cost took the highest percentage (48%) of the total cost of production, while cost of medication was the least (4%). Marshall strain had the highest mean hive weight (2.10 kg) at maturity and the least cost ($2.83 kg^{-1}) of producing 1 kg of meat. It also recorded the highest gross margin ($51.8). This is followed by Hubbard strain ($30.4), while Arbor Acre ($26.7) strain have the least gross margin. The highest benefit-cost ratio, profitability index and rate of return on investment were 1.17, 0.15 and 17.5%, respectively for the Marshall strain. The partial productivities were highest for the Marshall strain and particularly for labour (3.91). The results reveal that the level of profitability and productivity of broiler depends among other factors on the strain. The Marshall broiler strain is the most profitable and productive to raise for commercial purpose.

Key words: Gross margin, broiler, strain, production cost, productivity

INTRODUCTION

Broiler meat is considered a major source of high quality animal protein, required for growth and mental development. The negative impact of inadequate animal protein intake is visible among the rural dwellers whose inhabitants constitute over 70% of Nigerian population and over 85% of the extreme poor in the country (Chukwuji *et al*., 2006). Broiler production provides employment and regular income within the shortest time possible due to its fast growth and shorter production cycle. However, reasonable returns can be guaranteed only when produced at minimum cost of production because net profit is a function of gross return and cost of production. Though minimum cost of production is desirable to obtain higher returns, care must be taken so as not to be too rigid so that the goal of producing soft, tender and high quality meat is not compromised. According to Asghar *et al*. (2000) and Zahir-ud-Din *et al*. (2001), smaller cost of production and higher returns are key factors for higher profit in broilers.

In order to achieve higher returns therefore, necessary attention should be paid to regular vaccination, sound production practices, maximization of available resources and hygienic

environment since broiler birds are more sensitive to foul odour and contaminated environment. Khan *et al.* (2004) posited that net returns in broiler production depends on market age, delivered body weight, feed efficiency, mortality, flock size, optimal rearing environment, immunization program and cost of production. There was positive association between net profit and flock size (Farooq *et al.*, 2001) and negative association with mortality (Kitsopanidis and Manos, 1991; Zahir-ud-Din *et al.*, 2001). This implies that net profit increases with flock size but decreases as mortality increases. In effect, a larger sized farm is assured of larger profit in the absence of high mortality rate. The age at which broilers are marketed also plays an important role as to how much a farmer earns as his profit at the end of the season. According to Kitsopanidis and Manos (1991) and Farooq *et al.* (2001), profitability of broilers decreased as the birds advanced in age. This may be due to the fact that more of the feeds are converted to fat than meat, thereby eroding the profit margin of the product since fat constitutes a waste at the slaughter house.

Two other important determinants of profit are cost of feeds and day-old chicks. Kitsopanidis and Manos (1991), Asghar *et al.* (2000) and Khan *et al.* (2004) observed that feed accounted for 55-60% of the total cost of production. Efficiency of feed consumption could be enhanced by reducing feed wastage to the barest minimum. The feed cost is predicated upon the availability of raw materials and this, in turn is dictated by the fluctuated weather conditions. With very favourable planting season and good harvest, prices of raw materials are expected to be reasonably low leading to lower cost of production and higher returns for the farmers. But the reverse is the case when there are adverse weather conditions during the year. The price of day-old chicks also fluctuates depending on the demand which always reaches the peak during festive periods. For profit maximization therefore, it is advisable that the rearing period coincides with the time of either local or national festivals when there is high demand for poultry meat. Alternative to this arrangement is for the farmer to monitor the price of day-old chicks, purchase them when the price is low (Khan *et al.*, 2004).

There are different strains of broilers in the market. Some are fast growing, while others are slow growing and poor converters of feed to meat. This present investigation was carried out to compare the cost of production per kilogramme of meat, gross margin and net profit for three strains of broilers commonly reared in Nigeria. The main objective was to determine the strain of broiler with the least cost of production, higher profit and productivity. The live weight of the birds at maturity (8 weeks) were tested for significant differences among the strains.

MATERIALS AND METHODS

The study was carried out at the Animal Breeding Unit, Teaching and Research Farm, Ekiti State University, Ado-Ekiti, between September, 2010 and December, 2010. Ado-Ekiti is situated along latitude 7°31' and 7°49' North of the Equator and longitude 5°71' and 5°27' East of the Greenwich meridian. The city falls under the Derived Savannah zone. The city enjoys two separate seasonal periods namely, Rainy (May-October) and Dry (November-April) seasons. A total number of 150 broiler day-old chicks, that is, 50 chicks each of Arbor Acres, Marshall and Hubbard were purchased from local hatcheries and raised on deep litter in separate pens for 56 days (8 weeks). The chicks were brooded using coal pot to supply heat for the first three weeks of life. Antibiotics and vitamins were administered as and when due. Also, vaccines against infectious bursae and newcastle diseases were given at specified age intervals. Their beddings are made up of dry

shavens to prevent coccidiosis outbreak and high level of hygiene was maintained throughout the experimental period to ensure unhindered conducive conditions for growth and to lower death rate. The birds were fed *ad libitum* with starter mash (1-4 weeks) containing 22%CP, 3000 kcal kg^{-1} ME and finisher feed (5-8 weeks) containing 20%CP, 3100 kcal kg^{-1} ME.

At the maturity age of 56 days, the birds were numbered and weighed individually on strain basis to obtain their live body weight after starving them overnight. Data on input costs including veterinary services were recorded. These include the costs of day-old chicks, feed, drugs medication and labour.

ANALYTICAL TECHNIQUES

Profitability of broiler production: The profitability of broiler production was estimated using budget analysis and profitability ratios. The budget analysis involves the deduction of the total variable costs (in US Dollars) from the total revenue of live weight of broilers (in US Dollars) to obtain the gross margin for each broiler strain. The total variable costs of production are the cost of day old chicks, labor, feed, veterinary services, medication and other miscellaneous expenses.

$$\text{Gross margin} = \text{Gross revenue-Total variable cost} \tag{1}$$

It is given by formula:

$$GM_i = \sum_{i=1}^{n} P_i Y_i - C_i \tag{2}$$

Where:

GM_i = Gross margin of strain i
P_i = Farm gate price per kg of meat of strain i
Y_i = Total live weight in kg of meat of strain i
C_i = Total variable costs incurred on strain i
i....n = Total number of birds per strain i

The profitability ratios include the Benefit Cost Ratio(BCR), the Profitability Index (PI) and the Rate of Return on Investment (ROI). Due to equality in the fixed costs across strains, they were not included in the analysis and the gross margin was used as a proxy for net profit:

$$\text{Benefit cost ratio (BCR)} = \frac{TR}{TC} \tag{3}$$

$$\text{Profitability index (PI)} = \frac{NP}{TR} = \frac{GM}{TR} \tag{4}$$

$$\text{Rate of return on investment (ROI)} = \frac{NP}{TC} \times 100 = \frac{GM}{TC} \times 100 \tag{5}$$

Where:
TR = Total revenue (value of the total live weight of broiler)
TC = Total costs of production of broiler
NP = Net profit of broiler production

Productivity of broiler production: To determine the average productivity of the inputs used in production, four indicators were used to assess feed, veterinary services, labor and cost productivities. These productivities are estimated as.

- **Feed Productivity:**

$$P_F = \frac{\sum_{i=1}^{n} Y_i}{Q_F} \quad (6)$$

Where:
P_F = Feed productivity
Q_F = Quantity of feed in kg

- **Veterinary services productivity:**

$$P_{VS} = \frac{\sum_{i=1}^{n} Y_i}{C_{VS}} \quad (7)$$

Where:
P_{VS} = Veterinary services productivity
C_{VS} = Cost of veterinary services in US $

- **Labour productivity:**

$$P_L = \frac{\sum_{i=1}^{n} Y_i}{Q_L} \quad (8)$$

Where:
P_L = Labour productivity
Q_L = Quantity of labour in man-days

- **Cost productivity:**

$$P_C = \frac{\sum_{i=1}^{n} Y_i}{TC} \quad (9)$$

Where:
P_C = Cost productivity
TC = Total cost of production in US $

The Analysis of Variance (ANOVA) was employed to test the difference in mean weight of different strains of broiler.

RESULTS

Production cost of broiler strains: The total production cost of the three strains of broiler range between US$ 291.9 and US$296.8 (Table 1). There were no significant differences between the production costs of the strains ($p>0.05$). Across the strains, the percentage contribution of each cost item to the production cost was also not significantly different ($p>0.05$). Overall, the cost of feed contributed the largest amount to the total production cost, followed by cost of day-old chicks, while the cost of medication contributed the least.

Weight at maturity of broiler strains: The Marshall strain had the highest mean weight of 2.10 kg per bird (Table 2) with a standard deviation of 0.38. The mean weight at maturity differs significantly ($p<0.01$) between Marshall and the other two strains. This implies that despite no significant difference in the cost of production, there exist a significant difference between the mean weight of the Marshall strain and other strains at 1%. This shows that while the production cost did not differ significantly, the mean weight shows significant difference at 1% between Marshall and other strains.

However, there was no significant ($p>0.05$) difference between the mean weights of Arbor Acre and Hubbard. The Marshall strain recorded the lowest cost of producing 1 kg of live weight broiler (Table 3). The difference between Marshall and Arbor Acre was US$0.23, while it was US$0.19 between Marshall and Hubbard.

Table 1: Mean production cost in US dollars for different strains of broiler

	Arbor acre		Hubbard		Marshall	
Variable cost items	Cost	Percentage	Cost	Percentage	Cost	Percentage
Cost of day old chicks	73.30	24.70	73.3	25.10	73.30	24.7
Feed1	142.9	48.10	138.0	47.20	143.2	48.3
Medication	12.40	4.20	12.4	4.30	12.40	4.2
Veterinary services	13.30	4.50	13.3	4.60	13.30	4.5
Labor	26.70	9.00	26.7	9.12	26.70	9.0
Miscellaneous	28.20	9.50	28.2	9.70	27.50	9.3
Total	296.8	100.00	291.9	100.00	296.4	100.0

Table 2: Mean weight (kg) at maturity for different broiler strains

Strain	Mean weight	Std. deviation	Minimum	Maximum
Arbor acre	1.94	0.31	1.25	2.60
Hubbard	1.93	0.37	0.90	2.90
Marshall	2.10	0.38	1.10	2.80

Table 3: Cost of producing 1 kg of broiler strains in US dollars

Variable	Arbor acre	Hubbard	Marshall
Cost	3.06	3.02	2.83

Table 4: Costs and returns for the broiler strains in US dollars

	Arbor Acre		Hubbard		Marshall	
	Per farm (50 birds)	Per bird	Per farm (50 birds)	Per bird	Per Farm (50 birds)	Items Per bird
Gross revenne						
Sale of live weight of broiler ($3.3 kg^{-1})	323.5	6.5	322.3	6.4	348.2	7
Variable cost						
Cost of day old chick ($1.47 chick^{-1})	73.3	1.5	73.3	1.5	73.3	1.5
Cost of feed	142.9	2.9	138.0	2.8	143.2	2.9
Cost of medication	12.4	0.2	12.4	0.2	12.4	0.2
Cost of veterinary services	13.3	0.3	13.3	0.3	13.3	0.3
Labor cost	26.7	0.5	26.7	0.5	26.7	0.5
Miscellaneous	28.2	0.6	28.2	0.6	27.5	0.6
Total	296.8	6.0	91.9	5.9	296.4	6.0
Gross margin	26.7	0.5	30.4	0.6	51.8	1.0

$1: N150

Profitability of broiler strains: Table 4 contains the costs and returns of broiler production for the three strains. The Marshall strain had the highest gross revenue per farm and per bird. This is followed by Hubbard and lastly by Arbor Acre strain. The difference between Marshall and Hubbard was $0.40 per bird, while between Marshall and Arbor Acre it was $0.05. Due to similarity in their cost structure, the gross margin followed a similar pattern as that of the gross revenue. The differences were significant at the 5% level. At both the farm or bird level of analysis, the Marshall strain recorded the highest gross margin.

Table 5 presents the profitability ratios for the broiler strains. The Benefit Cost Ratio (BCR) for Marshall strain is 1.17 which implies that it is more profitable to invest in the marshall strain than other strains because for every $1cost incurred, the benefit acquired increases by $1.17 as compared to Hubbard (1.10) and Arbor Acre (1.08). The rate of return on investment for the three strains also follow similar pattern as in BCR. The ROI shows that for every $1 invested in producing the three broiler strains, the Marshall strain generated the highest return on investment by 17.5%. The profitability index indicates that for every Dollar earned as revenue on Marshall Strain, 15 cents is returned to the farmer as profit while it is 9 cents for Hubbard and 8 cents for Arbor Acre. The ROI was highest for Marshall Strains with 17.5%, followed by Hubbard 10.4% and Arbor Acre 9%.

The result of the profitability ratios revealed that there was no significant difference ($p>0.05$) between Hubbard and Arbor Acre in the estimated performance parameters, while there were significant differences ($p<0.05$) between Marshall and Hubbard and between Marshall and Arbor Acre.

Productivity of broiler strains: In Table 6, the partial productivities of production for the three broiler strains are presented. For all the productivities estimated namely feed, veterinary services, labor and cost; the Marshall strain ranked highest. For both Hubbard and Arbor Acre, the labor and cost productivities were equal but slightly different for feed productivity, as it was 0.01 higher

Table 5: Profitability ratios for the broiler strains

Profitability ratio	Arbor acre	Hubbard	Marshall
Benefit cost ratio	1.08	1.10	1.17
Profitability index	0.08	0.09	0.15
Rate of return on investment (%)	9.00	10.40	17.50

Table 6: Productivity of production for broiler strains

Items	Arbor acre	Hubbard	Marshall
Feed	0.37	0.38	0.39
Veterinary services	7.30	7.27	7.85
Labor	3.62	3.62	3.91
Cost	0.33	0.33	0.35

for Hubbard than Arbor Acre. It was also observed that although feed constituted the highest cost item in broiler production, the feed productivities were not significantly different ($p>0.05$).

DISCUSSION

The Marshall strain had the lowest cost of producing 1kg of meat and the highest gross margin per bird and thus the most profitable to raise for commercial purposes. This is followed by Hubbard, while the Arbor Acre strain has the least gross margin. The profitability of broiler production depends also on the cost of inputs which are cost of day-old chicks, feed, drugs, labour, veterinary services and the sale price of matured birds. The costs of feed and day-old chicks were the major items that significantly influenced the profitability of broilers. Feed contributed 47-48% to the total cost of production and this was lower than 56-60% obtained in previous studies (Mian, 1994; Asghar *et al*., 2000; Khan *et al*., 2004).

The reduction in the cost of production reported in this study was as a result of the drop in the prices of inputs especially maize used in feed formulation. The cost of day-old chicks constituted 24-25% of the total cost of production. Asghar *et al*. (2000) and Khan *et al*. (2004) observed similar contribution of cost of broiler chicks to total cost of production. The cost of medication was 4% of the total cost of production. This is consistent with the 4% reported by Asghar *et al*. (2000) but higher than 3% observed by Khan *et al*. (2004). The low medication cost was due to improved management practices, good quality feeds and improved hygiene. There was no incidence of disease outbreak throughout the period of the research and experimentation as reflected by zero mortality. This also lends credence to the fact that broiler production can be raised at with minimal cost provided necessary attention is given to feeding and hygiene.

The BCR is lower than that reported by Mohsin *et al*. (2008) for larger farm (1.34) while it is higher than that reported for medium farm (1.10) and small farm (0.95). Also, the profitability indices is lower than the findings of Ajala and Alli-Balogun (2004) which was 0.43; Nworgu (2007) which range between 0.48-0.52. In similar vein, the rate of return on investment is also lower than that reported by Nworgu (2007) which range between 76.2-106.04%. The profitability of broiler production depends on the strain of the birds, costs of production, revenue and farm hygiene. The partial productivities were highest for the Marshall strain and particularly for labor productivity.

CONCLUSION

There were no significant ($p>0.05$) differences in production costs among the three broiler strains. Feed cost took the highest percentage of the total cost of production, while medication was

the least. Marshall strain had the highest live weight at 8weeks and the least cost of producing 1kg meat. Marshall also recorded the highest gross margin per bird and per farm. The productivities are highest for the Marshall strain though not significantly different from those of other strains. The Marshall broiler strain should be recommended to farmers as the most cost efficient, productive and profitable strain.

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