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Comparative Cost Analysis of Broiler Chicken Fed with Concentrate and *Aspilia africana*

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Authors' contributions

This work was carried out in collaboration between both authors. Author AJA designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author DIA managed the analyses of the study and managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Poultry production is a unique business which offers one of the quickest returns to investment for rural farmers. It has the highest feed conversion rates and produces the cheapest and best sources of animal protein. However, consumption of animal protein by a human in developing countries like Nigeria is grossly below the average required for good health in line with Sustainable Development Goals (SDGs) and World Health Organization (WHO). This is because animal proteins (Broilers) are still expensive for the average Nigerian. This is accentuated with a high cost of feeds and drugs which accounts for about 85% of the total production of chicken. The outcomes of this high cost of production have deterred many families from accessing and consuming this animal protein for good health. The continuous rise in feed cost and the resultant shortage in animal protein supply have encouraged the exploration of locally available and cheap animal feed alternatives to forestall the threat to the future of poultry production. The paper assesses the comparative cost analysis of broiler chicken fed with concentrate and *Aspilia africana* leaf. The objectives were to: determine feed efficiency of *Aspilia africana* combined with concentrates at various levels and compare the performance and costs of the proposed feeds. This paper is a review of three past studies Adedeji et al., 2014[a], Adedeji et al., 2014[b] and Oko et al., 2014. The

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data and results from these studies were complemented with current price data of inputs used to get cost values for feed intake and output values to arrive at cost-effectiveness. The results show that such economic parts as the drumstick, back, breast, wings, weight gain as well as the feed consumption were influenced by the inclusion of *Aspilia africana* in a feed. The weight gain positively affected profitability in the Aspillia ration. Therefore, there should be specific government policy geared towards developing local poultry industry to meet the increasing local demand at a reduced cost for poultry products, especially meat. There is a need for the cultivation of more *Aspilia africana* plant for use in the poultry industry for improved cash flow, national economic development, food security and poverty reduction.

Keywords: comparative cost; broiler; feed; concentrates and Aspilia africana.

1. INTRODUCTION

The importance of poultry industry in man's civilization cannot be overemphasized as it has gone through swift development and commercialization stages. This is because it offers one of the quickest returns to investment for rural farmers [1] such as highest feed conversion rates, produces the cheapest and best sources of animal protein. However, consumption of animal protein in developing countries like Nigeria is grossly below the average required for good health in line with Sustainable Development Goals (SDGs) and World Health Organization (WHO). This is because animal proteins (Broilers) are still expensive for the average Nigerian despite the high demand and high production of broiler chicken. This is accentuated with the high cost of conventional feeds ration (concentrates) and drugs which accounts for about 85% of the total production of chicken since feed costs have a major impact on the profitability of poultry farm operations [2,3,4]. This drastically reduced the profit margin of poultry farmers thereby discouraging production among the poultry farmers as there is reduces returns from this choice of an enterprise. This condition has resulted in the dismal contribution of the sector to agricultural output [5]. On the other hand, Poultry farming is a sub-sector in the livestock industry constituting a significant component of the agricultural economy. This sector provides animal protein to the population as well as help to employ a considerable percentage of the population so that the primary malcondition of unemployment could be retrieved. According to [6], poultry stands at fourth position among general resources of animal proteins and most importantly it is easily consumable by human of Nigeria and contributes approximately 27% to the total quantity of national meat production [7,8,9].

The outcomes of this high cost of production have deterred many families from accessing and consuming this animal protein for good health. Most rural poultry farmers, therefore, seek for efficient ways of production to enhance better output, with minimal cost and profit maximization to be derived at the end of production as a measure to reduce poverty and increase income for their families. The continuous rise in feed cost and the resultant shortage in animal protein supply have encouraged the exploration of locally available and cheap animal feed alternatives to forestall the threat to the future of poultry production [10 and 11].This has created a need for research into a sustainable feed alternative ration which will be able to cope with the high demand for poultry meat (broilers). The quest for this alternative feed ration has propelled the need or desire for the use of *Aspilia africana* plant.

Aspilia africana is one of the many indigenous plants used by trado-medical practitioners in Nigeria to cure certain illness and possess the ability to stop bleeding, block infection and quick wound healing. The plant is popularly known as "haemorrhage plant" [12]. [13] reported that the plant is known as organgilia in Ibo, Tanzanian in Hausa, Yungun in Yoruba and Edemedong in Efik. It is a common weed of field crops in West Africa found in a fallow land almost everywhere especially in the forest zone. It is a scrambling perennial herb varying in height from 60 cm to about 1.5 m depending on the amount of rainfall [14]. The flowers are bright yellowish florets and the fruits are bristly and minutely hairy with four (4) angled schemes about 5 mm long. It has a somewhat aromatic carroty smell. It is widely gathered from the wild [15]. According to [16], *Africana africana* leaves has many other additional uses such as palliative properties because its chemical constituents are capable of arresting wound bleeding, inhibiting the growth of microbial wound contaminants and accelerating wound healing. In Kenya, they are used to kill intestinal worms, in Uganda, it is used to treat gonorrhoea [16]. The methanol extract of the

leaves is reported to cure malaria and respiratory problems [17]. A concussion of the leave are used to cure eye problem and as a lotion for the face to relieve a febrile headache. *Aspilia africana* is of its economic importance to the farmer. It has ability to enhance growth, promote a healthy and strong animal with a minimal cost. [18] States that *Aspilia africana* as a plant, boost animal antibodies with the presence of antibiotic found in them. This antibiotics reduce cost of buying synthesize drugs derived from similar plants. *Aspilia* is a genus of flowering plants in the daisy family. Historically, the effect of *Aspilia africana* leave on reproduction is not well documented, however unauthenticated information in some communities in Nigeria said it prevent conception when boiled, alleviate menstrual cramps and dysmenorrheal For example, *Aspilia africana* was used in Mbaise and most Igbo speaking parts of Nigeria to prevent conception, suggesting potential contraceptive and anti-fertility properties. Leaf extract and fractions of *Aspilia africana* effectively arrested bleeding from fresh wounds, inhibited microbial growth of known wound contaminants and accelerated wound healing process.

Based on the present economic situation in our country such as high cost of living, transportation instability in the price of commodity and high-cost production of broiler chicken, there is a necessity to promote alternative ways of conserving cost. Initial studies have been conducted on Marigold (*Aspilia africana*) leaf as antimicrobial agent which enhances animal health [19 and 20].High cost of feed ingredients and other costs associated with production had accounted for the failure of the plans and policies associated with effective production of broilers in the country. This problem can be solved by directing efforts at the exploitation of hitherto neglected novel plants that are indigenous, readily available, of high quality, cheaper and capable of reducing production cost of feeds. Analysis of cost-returns structure in poultry production would facilitate appropriate knowledge of costs implications in order to obtain optimum economic benefit from investment into the industry [21].However, limited published reports are available on the cost efficiency of feeding birds with *Aspilia africana.* Therefore, this study is aimed at finding suitable avenues of limiting high cost of production through supplementary yet available feed substances to enable farmers minimize cost while maximizing profit at the end of production. It is against this back drop that the study looks at the comparative cost analysis of broiler chicken fed with concentrate and *Aspilia africana* with the specific objectives of determining feed efficiency of *Aspilia africana* combined with concentrates at various levels and comparing the performances and costs of the proposed feeds.

2. METHODOLOGY

This paper is a review of three past studies [22, and 23]. The data from these studies was complemented with price data to get cost values for feed intake and output values to arrive at cost effectiveness. Broiler chicken in the studies were fed with various combinations of *Aspila africana* dried leaves with concentrates.

Fig. 1. *Aspila africana* plant in picture

The ratio of *Aspila africana* to concentrates in the review was that used by [24] as follows: 0g of *A. africana* was given as control diet to the Chicks which are treated as Control group. A was placed on 50g of dried grounded *Aspilia africana*/1kg of feed, treatment B on 60g of dried grounded *Aspilia africana*/1kg of feed while treatment C was placed on 70g of dried *Aspilia africana*/1kg of feed. The compositions of the diets are shown in Tables 1 and 2. Proximate composition of the experiment diets were analysed according to [25] method as shown in Table 3. All animals were housed under identical conditions of temperature and humidity. Clean water was readily available to the birds ad-libitum, vaccination and medication was done as at when necessary [24].

Table 1. Diet composition of birds at starter phase

Ingredient	Control	Group A	Group B	Group C
Maize	55.00	55.00	55.00	55.00
GNC	15.00	15.00	15.00	15.00
Soybean	10.00	10.00	10.00	10.00
Fishmeal	2.00	2.00	2.00	2.00
Wheatoffal	8.30	8.30	8.30	8.30
Oystershell	1.00	1.00	1.00	1.00
Bonemeal	2.00	2.00	2.00	2.00
PKC	5.00	5.00	5.00	5.00
Salt	0.25	0.25	0.25	0.25
Bloodmeal	3.00	3.00	3.00	3.00
Methionine	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10
Premix	0.25	0.25	0.25	0.25
Total (kg)	100	100	100	100
A.africana (g)	Nil	50.00	60.00	70.00
Crude protein (%)	22.65	22.65	22.65	22.65
ME (kcal/kg)	2960	2960	2960	2960

Source: Adedeji et al., 2014[a]

Table 2. Diet composition of birds at finisher phase

Ingredient	Control	Group A	Group B	Group C
Maize	50.00	50.00	50.00	50.00
GNC	13.00	13.00	13.00	13.00
Soybean	6.00	6.00	6.00	6.00
Fishmeal	3.00	3.00	3.00	3.00
Wheatoffal	13.30	13.30	13.30	13.30
Oystershell	1.50	1.50	1.50	1.50
Bonemeal	3.00	3.00	3.00	3.00
PKC	8.50	8.50	8.50	8.50
Salt	0.25	0.25	0.25	0.25
Bloodmeal	3.00	3.00	3.00	3.00
Methionine	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10
Premix	0.25	0.25	0.25	0.25
Total (kg)	100	100	100	100
A.africana (g)	Nil	50.00	60.00	70.00
Crude protein (%)	21.06	21.06	21.06	21.06
ME (kcal/kg)	2797	2797	2797	2797

Source: Adedeji et al., 2014[a]

Table 3. Proximate composition of diets and control

Parameters	Control	Group A	Group B	Group C
Crude protein	10.50	8.75	7.76	7.08
Crude fibre	9.80	6.02	4.11	8.23
Ether extracts	22.08	21.45	20.65	20.71
Ash	9.45	11.35	9.58	8.05

Source: Adedeji et al., 2014[a]

2.1 Analytical Techniques

Data were subjected to statistical analysis using descriptive and inferential statistics.

3. RESULTS AND DISCUSSION

The results of the experimental trials of substituting *Aspilia africana* in the ration of broiler feeds is discussed under the following headings after the review of our three papers: Total weight gain, Carcass characteristics, Economics of production and acceptability of the products.

3.1 Total Weight Gain

The results of the experiments show that the weight gain in the control treatment (fed with only concentrates) was the highest implying that that combination was better in all circumstances as far as weight gain per given period is concern. The literature has established that the substitution of items in the concentrates ingredients do not lead to higher weight gain. However when compared with the cost and availability, substitution may be justified as in the case of the present paper.

3.2 Carcass Characteristics

The characteristics of interest include the breast weight, thigh, drum stick, back, wing, neck, shank, head, etc, all form the parameters of interest in the experiments. These parameters are usually measured and compared during experiments. We also have measurements of internal organs like the heart, lungs, liver, Kidney, GIT, empty gizzard and whole gizzard. The results show satisfactory outcomes of performance of birds fed with ration in which *Aspilia africana* was included in the feed. However, the performance of the control diet was always better that the three experimental trials as presented in Table 5.

3.3 Economics of Production

The attachment of cost values to all the inputs in the production process was to analyse the comparative cost advantage of the inclusion of *Aspilia africana* in the ration of broiler chicken and compare the returns from these inclusions. Table 6 shows that the cost of feed reduced as the rate of substitution increased. The inclusion of *Aspilia africana* therefore was able to reduce the cost of feeding the birds as presented. The cost per unit weight gain was next calculated by dividing the weight gained by the cost and the results showed that the ration with 60g *Aspilia africana* in the ration had the lowest cost per unit weight gain followed by the ration with 50g *Aspilia africana* included in the ration. All the experimental rations were found to be cheaper in terms of weight gain per unit cost than the control.

Table 4. Total weight gain of broilers from the diets and control

Parameters	Control	Group A	Group B	Group C
Feed intake	6773.25	6421.50	6108.00	6647.50
Weight gain	2272.50	1355.00	1140.00	1455.00
Feed to weight gain	0.34	0.21	0.21	0.23

Source: Adedeji et al., 2014[a].

Table 5. Total weight gain of broilers from the diets and control

Parameters	Control	Group A	Group B	Group C
Live weight (g)	2.39	1.54	1.19	1.50
Defeathered weight (g)	89.73	89.11	89.71	88.75
Dressing percentage (%)	63.73	58.52	54.59	57.82

Source: Adedeji et al., 2014[a].

Table 6. Cost per unit of weight gain of broilers from the diets and control

Parameters	Control	Group A	Group B	Group C
Cost	3000	2499.88	2074.18	2022.76
Weight gain	2.39	1.54	1.19	1.50
Cost per unit weight	0.797	0.616	0.574	0.752

Source: Adedeji et al 2014.

3.4 Acceptability of the Products

The palatability tests that follow at the end of the experiments show that the quality of meat remains the same as the composition in the meat analysis do not differ. The products are therefore generally accepted as perfect poultry meat (broiler). The chemical composition of the meat showed a balance in all the chemical components of the meat, not significantly different from all the trial rations and the control.

4. CONCLUSION

The study has been able to show that the inclusion of *Aspilia africana* into the ration of poultry could reduce the cost of production but also compromise on the quality of the overall performance of the birds. However, given the high production cost and the deprivation that follow the fact that many Africans cannot afford to pay and consume poultry meat (broiler), it would be wise to develop the next best alternative or categories of poultry meat(broiler), to give consumers options to select from since the nutrient composition remains the same for all the alternatives. The paper concludes that the use of *Aspilia africana* as a substitute in poultry ration has revealed the possibility of reducing cost using locally available materials, this should lead to other studies that will use other locally available and cheap alternatives to explore feed composition for poultry that will give better results and lead to the attainment of the sustainable development goals in Africa.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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