

APR -33

Economic Characteristics and Sensory Properties of Broiler Chicken Administered Roselle (*Hibiscus sabdariffa*), Garlic (*Allium sativum*) and Ginger (*Zingiber officinale*) Extracts

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Abstract

The economic characteristics and sensory properties of broiler chicken administered roselle, garlic and ginger extracts from starter to finisher phase were evaluated. 200 day-old-chicks were randomly allotted to five treatments designated as T1, T2, T3, T4 and T5 with each treatment having four replicates, and each replicate contained 10 birds. T1 was designed as the control and birds on T1 were administered 100 % water and no plant extracts; T2, 4 g of roselle per litre of water; T3, 4 g of roselle and 4 g of ginger per litre of water; T4, 4 g of roselle and 2 g of garlic per litre of water and T5, 4 g of roselle, 4 g of ginger and 2 g of garlic per litre of water. Parameters measured for economic characteristic included cost per kg of feed, feed conversion ratio (FCR), cost of feed intake, cost per kg weight gain, cost savings, body weight gain and feed intake; while sensory properties determined included tenderness, juiciness, colour, aroma, flavour and overall acceptability. The results for economic characteristics showed significant ($p<0.05$) differences only for cost savings at starter phase, with T3 (16.45 %) having the best performance. At finisher phase, FCR, cost of feed per body weight gain and cost savings showed significant ($p<0.05$) differences with T5 having the best performance for the three parameters (2.82, ₦491.97 and 22.91% respectively). Sensory properties showed no significant difference across the treatments. It was concluded that roselle (4 g), garlic (2 g) and ginger (4 g) extracts per litre of water can be used to improve the economic characteristics of broiler chicken without affecting their sensory properties.

Keywords: Economic characteristics, sensory properties, plant extracts, broiler chicken.

Introduction

Broiler production is widely practiced around the world because of its quick returns and the increasing demand for chicken meat and eggs. In order to attain peak production, proper development of the gastrointestinal tract is necessary to make optimal use of feeds since the efficiency of chicken to convert feed into meat plays an important role in the economics of the broiler industry. In fact, 70 % of the total cost of production is contributed by feed (Willems *et al.*, 2013). Given the possible adverse effects in poultry caused by the use of antibiotic growth promoters (AGP) and the eventual bacteria resistance in man, careful selection and use of appropriate non antibiotic additives in poultry nutrition is very important. The alternative feed additives used in livestock and poultry nutrition include probiotics, prebiotics, synbiotics, organic acids and medicinal plants. Recently, medicinal herbs and their related essential oils or extracts are being considered as potential growth enhancers. They consist of a combination of compounds which have many effects such as antimicrobial, anti-coccidial and antioxidants, as well as stimulating animal digestive system, increasing production of digestive enzymes and improving utilization of digestive products by improving liver functions (Ziarlarimi *et al.*, 2011). Various researches have been carried out to determine separately the effects of roselle, garlic and ginger extracts on growth rate, carcass and meat quality, haematological and blood serum characteristics of broilers but there is paucity of information on their combined effects on the sensory properties and economic characteristics of broiler chicken.

Therefore, this research study was designed to determine the effect of roselle, garlic and ginger extracts on the sensory and economic characteristics of broiler chicken.

Materials and Methods

This research study was carried out at the Department of Animal Production Teaching and Research Farm, Federal University of Technology, Minna; which is the capital city of Niger State and lies within the Guinea Savannah zone of Nigeria. It is located within latitude 9°37' North and longitude 6°33' East (Niger State Agricultural Development Project, 2009). The plant parts used to obtain the plant extracts were purchased dried except garlic.

The cloves were carefully removed and oven dried in the laboratory using an electric oven at 100°C for 24 hours. The ginger and roselle were also oven dried at 80°C for 24 hours to ensure that they were properly dried. The materials were later on crushed using an attrition mill and administered to the birds as five treatments as follows: T1 was the Control and was made up of 100 % water and no plant extracts; T2 was 4 g of roselle per litre of water; T3 was 4 g of roselle and 4 g of ginger per litre of water, T4 was 4 g of roselle and 2 g of garlic per litre of water and T5 was 4 g of roselle, 4 g of ginger and 2 g of garlic per litre of water. The treatments were prepared daily by adding all the required ingredients in water, boiling for about 20 minutes and sieving after cooling. A total of two hundred (200) day-old chicks were purchased from Chi Farms Ibadan, Oyo State. The birds were acclimatized for a week before they were randomly allotted to the five treatments (T1- T5), with four replicates per treatment, and each replicate made up of 10 birds. The birds were fed standard formulated diets of 24 % crude protein and about 3000 kcal/kg ME at the starter phase and 20 % crude protein and about 3000 kcal/kg ME at the finisher phase. The birds were fed *ad libitum* and administered the treatments in their drinking water for seven weeks. Data were collected on feed intake and body weight gain. Prevailing market prices of feedstuff were used to calculate the cost of feed per kilogram of both starter and finisher diets. The method of Obun *et al.* (2010) was used to collate the economic characteristics as follows: total cost of feed consumed (total feed intake (kg) × cost per kg of feed); cost of feed per body weight gain (cost per kg of feed × feed conversion ratio); and cost savings (%) = $A-B/A \times 100$ where A = cost/kg weight gain of the control diet and B = cost/kg weight gain of the test diet. After slaughter, the breast of the meat of broilers from each treatment was cooked for 20 minutes with 400 ml of water and 2 g of salt. A 20-man panel was used to evaluate the sensory properties of samples using a 9--point Hedonic Scale which ranged from dislike extremely (1) to like extremely (9).

All data obtained from the experiment were subjected to statistical analysis using a one-way analysis of variance (ANOVA) as described by Steel and Torrie (1980). Treatment means when significant were separated using Duncan Multiple Range Test (DMRT).

Results and Discussion

The significant ($p < 0.05$) difference observed in percentage cost savings at starter phase (Table 1), with T3 having the best performance (16.45) may be as a result of lower feed intake since the cost of per kg of feed was the same for all the diets at both the starter and finisher phases. This, consequently, reduced the cost incurred on feeding. While for the finisher phase, FCR, cost per body weight gain and cost savings showed significant differences ($p < 0.05$) with T5 (birds given roselle, garlic and ginger extracts combined) showing the best performance for the three parameters (2.82, ₦491.97 and 22.91 % respectively). This may be as a result of the prebiotic effects of the extracts since prebiotics are known to enhance FCR and body weight gain (Alloui *et al.*, 2013). This is in agreement with the findings of Maiorano and Bednarczyk (2016). Improved FCR leads to a reduction in cost per body weight gain and increases in cost savings. There were no significant ($p > 0.05$) differences among the treatments in sensory properties although the meats were generally acceptable. This is in agreement with Loddi *et al.* (2000) who observed no difference in sensory properties of broiler meat treated with probiotics.

Table 1. Economics characteristics of broiler chicken fed roselle, garlic and ginger extracts at the starter phase (2-4 weeks)

Parameters	T1	T2	T3	T4	T5	SEM	LS
Cost of feed/kg (₦)	175.91	175.91	175.91	175.91	175.91	0.00	NS
Feed intake(g)	476.00	480.50	446.25	485.50	479.00	8.98	NS
Cost of feed intake (₦)	83.74	84.53	78.50	85.40	84.26	1.58	NS
FCR	3.52	3.11	2.95	3.28	3.52	0.10	NS
Body weight gain (g)	136.75	158.00	152.75	149.25	137.25	4.93	NS
Cost of feed per wt gain (₦)	620.09	547.52	518.06	577.87	618.77	17.63	NS
Cost savings (%)	-	11.70 ^b	16.45 ^a	6.81 ^c	0.25 ^d	1.47	*

^{a b c d e} Means along the same row with different superscripts were significantly different ($p < 0.05$)

Table 2. Economics characteristics of broiler chicken fed roselle, garlic and ginger extracts at the finisher phase (5-8 weeks)

Parameters	T1	T2	T3	T4	T5	SEM	LS
Cost of feed/kg (₦)	174.61	174.61	174.61	174.61	174.61	0.00	NS
Feed intake(g)	1964.25	1767.50	1610.00	1704.25	1608.25	57.75	NS
Cost of feed intake (₦)	342.98	308.63	281.12	297.58	280.52	9.21	NS
FCR	3.66 ^b	3.08 ^{ab}	3.01 ^{ab}	3.22 ^{ab}	2.82 ^a	0.12	*
Body weight gain(g)	591.00	574.25	536.25	535.00	566.50	14.40	NS
Cost of feed per wt gain (₦)	638.20 ^b	538.24 ^{ab}	525.58 ^{ab}	561.38 ^{ab}	491.97 ^a	20.03	*
Cost savings (%)		15.66 ^c	17.65 ^b	12.04 ^d	22.91 ^a	1.76	*

^{a b c d e} Means along the same row with different superscripts were significantly different (P<0.05)

Table 3 Sensory properties of broiler chicken fed roselle, garlic and ginger extracts from starter to finisher phase (2-8 weeks)

Parameters	T1	T2	T3	T4	T5	SEM	LS
Colour	6.05	5.75	6.30	5.95	6.20	0.17	NS
Juiciness	6.15	5.80	6.30	6.45	6.75	0.14	NS
Flavour	6.30	5.85	6.25	6.35	6.35	0.16	NS
Aroma	6.20	5.45	6.40	6.05	6.55	0.18	NS
Tenderness	6.80	6.55	6.55	6.30	6.80	0.15	NS
Overall Acceptability	6.90	6.25	6.95	6.55	6.95	0.14	NS

Conclusion and Recommendation

In conclusion, roselle (4 g), garlic (2 g) and ginger (4 g) extracts per litre of water can be used to improve the economic characteristics of broiler chicken without affecting their sensory properties.

References

- Alloui, M. N., Szczurek, W. and Świątkiewicz, S., (2013). The usefulness of prebiotics and probiotics in modern poultry nutrition: A Review. *Annals of Animal Science*, 13(1): 17-32.
- Steel, R.G.D. and Torrie, J.H. (1980). *Principles and procedures of statistics*, 2nd edition. McGraw, Hill New York, USA, 633.
- Maiorano, G. and Bednarczyk, M. (2016). Prebiotics and synbiotics in broiler chicken production: In vivoperformance and meat quality aspects: A Review. *The 4th International Scientific Conference "Animal Biotechnology."* Slovak *Journal of Animal Science*, 49(4): 151-156.
- Obun, C.O., Yahaya, S.M., Kibon, A.A., Olafadehan, O.A. and Alison, S.D. (2010). Evaluation of *Detarium microcarpum* pulp meal as feed ingredient in rabbits diets. *Electronic Journal of Environmental, Agricultural and Food Chemistry*. 9(2): 308-314.
- Loddi, M. M., Gonzalez, E., Takita, T. S., Mendes, A. A., Roca, R. O., Roca, R.(2000).Effect of the use of probiotic and antibiotic on the performance, yield and carcass quality of broilers. *Revista Brasileira Zootecnia*, 29, 1124-1131.
- Willems, O.W., Miller, S.P., Wood, B.J. (2013). Aspects of selection for feed efficiency in meat producing poultry. *World's Poultry Science Journal*, 69: 77-88.
- Ziarlarimi, A., Irani, M., Gharahveysi, S. and Rahmani, Z. (2011). Investigation of antibacterial effects of garlic (*Allium sativum*), Mint (*Menthe species*) and Onion (*Allium cepa*) herbal extracts on E. coli Isolated from broiler chickens. *African Journal of Biotechnology*, 10(50):10320-10322.