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Carcass Traits and Serum Mineral Profile of Finisher Broilers Fed a Phytogenic-Based Diet

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ABSTRACT

Background and Objective: Mitigating the gap between man and the poultry sector has been a great concern over the years; this is because there is a vast competition between the two groups. This research work is focused on determining the carcass characteristics and serum minerals of finisher broiler birds fed a phytogenic-based diet. **Materials and Methods:** A total of 96 broiler birds at their fourth week of age were used for the experiment. They were raised from day old and were randomly distributed at four weeks of age into different pens. Four experimental diets were formulated at 3% inclusion levels, with diet 1 containing 0% lemon grass and pawpaw leaf meal, which served as the control. Diets 2, 3 and 4 contained lemon grass and pawpaw leaf meal at the levels and ratios of 0.75:2.25, 1.50:1.50 and 2.25:0.75, respectively. Feed and water were given *ad libitum*. Proximate analysis of the test ingredients was also carried out accordingly. The research work lasted for twenty-one days. **Results:** Live weight had the highest value of 2270 g in treatment 4, which was similar to the value of 2150 g obtained in treatment 1. The lowest value of 2000 g was seen in treatment 3. A superior($p<0.05$) value for carcass weight (2010.35 g) was observed in treatment 4, which was higher than the lowest value of 1870.50 g in treatment 3. Serum mineral indices in calcium had similar ($p>0.05$) values with 0.46 mmol/L obtained in treatment 1, which did not differ from the values of 0.51, 0.48 and 0.53 mmol/L corresponding to treatments 2, 3 and 4. Values reported for phosphorus were similar, with 6.38 mg/dL (T1), 6.56 mg/dL (T2), 6.44 mg/dL (T3) and 6.59 mg/dL (T4). Data for sodium had for treatments 1, 2, 3 and 4 values of 138.83, 149.23, 142.23 and 144.03 mmol/L, respectively. **Conclusion:** The inclusion of lemon grass and pawpaw leaf meal in the diet of finisher broiler chicken is viable without any negative effect on the performance of the birds, with better results obtained in treatment 4.

KEYWORDS

Carcass characteristics, serum mineral, finisher broiler, lemon grass, black plum, leaf meal

INTRODUCTION

Currently, there is a continuous increase in prices and scarcity of conventional feed ingredients used in poultry feed production. This is as a result of the negative effects of climatic factors on crops and total human dependence on these feed ingredients for consumption[1]. Therefore, there is a need to search for nonconventional and less competitive plant sources that will serve as an alternative in poultry production. High-quality feeds together with a clean environment, clean water and subsequently good managerial qualities can ensure the production of nutritious animal products with desirable traits for human

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consumption[2]. Thus, the use of additives of natural origin as alternatives to antibiotics in animal and human nutrition has been encouraged recently. Feed additives like probiotics, prebiotics, organic acids and plant derivatives with their biochemical structures and physiological functions of various degrees have been reported. The subsequent consumption of medicinal herbs, aromatic plants and spices in man's nutrition for the improvement of taste, aroma and colour of feed as additives has been carefully substituted into animal nutrition for the growth and health of the animals[3]. With the recent ban of antibiotics used in animal nutrition due to the emergence of microbial resistance, alternative growth promoters must be evaluated. Thus, the removal of antibiotics as growth promoters has been reported[4]. A wide range of herbs, spices and their extracts exert beneficial effects within the digestive tract, such as laxative acid, spasmolytic effects and reduction of flatulence1. These active components' effects largely depend on the dosage administered. An increase in the number of doses can even be detrimental to animals and subsequent dose reduction in quantity poses no effect to the animal.

Carica papaya belongs to the family *Caricaceae*. It has the following common names; pawpaw tree, papaya, papayer, tinti, pepol, chich put, fan kua, wan shoukuo, kavunagaci, kepaya etc. The parts that are usually used include the leaves, fruit, seed, latex and root. The plant is described as a fast-growing, erect, usually unbranched tree or shrub, 7-8 m tall with copious latex, trunk of about 20 cm in diameter. The plant is also described in documented property forms and it acts as an analgesic, amebicide, antibacterial, cardiotonic, cholagogue, digestive, emenagogue, febrifuge, hypotensive, laxative, pectoral, stomachic and vermifuge. It is distributed throughout Asia, Nigeria. *Carica papaya* contains many biochemically active compounds. Two important compounds are chymopapain and papain, which are supposed to aid in digestion. Papain is used in the treatment of arthritis. The leaves of *Carica papaya* is used as soap substitute which are supposed to remove stains. The papain, the proteolytic enzyme, has a wealth of industrial uses. It has milk-clotting (rennet) and protein-digesting properties[5]. Active over a wide pH range, papain is used in medicine, combating dyspepsia and other digestive disorders. In liquid preparations, it has been used for reducing enlarged tonsils.

Lemon grass is a perennial monocotyledonous grass that can grow up to 6 feet tall and 4 feet wide[6], it grows in clumps. Lemongrass (*Cymbopogon citratus*) contains flavonoids, phenolic compounds, terpenoids and essential oils (such as citral α, citral β, nerol, geraniol, citronellal, terpinolene, geranyl acetate, myrcene and terpinol methylheptenone) which may be responsible for its different biological activities such as anti-bacterial, anti-diarrheal, anti-fungal, antioxidant and as a growth promoter. Chemical composition and anti-bacterial activity of aqueous extract of *Cymbopogon citratus* leaves were studied. Moisture, crude protein, crude fiber and carbohydrate contents were 12.36, 15.68, 27.72 and 29.58%, respectively. Phosphorus was found to be the most abundant (15.58 mg/100 g) followed by Potassium (8.60 mg/100 g)[7]. The objective of this study was to evaluate the effects of a phytogenic-based diet on the carcass characteristics and serum mineral profile of finisher broiler birds.

MATERIALS AND METHODS

Experimental site: The experiment was carried out at the poultry section of the Animal Production Technology Department, Federal College of Agriculture, Ishiagu, Ivo Local Government Area of Ebonyi State, from June to July, 2024.

Source and processing of leaves: The lemon grass leaf (7.5 kg) and pawpaw leaf (7.5 kg) that were used for the research work were sourced within Enugu and Ishiagu, in Ebonyi State. The lemon grass and pawpaw leaves were obtained fresh and washed. The leaves were then sun-dried and later ground into a meal using the hammer mill.

Experimental design and management of birds: Ninety-six broiler birds of the Ross 308 strain at four weeks of age were used for the experiment. The birds were randomly distributed to four groups. Each treatment was replicated three times in a Completely Randomized Design (CRD) with 8 birds per replicate.

The birds were obtained from the 'Cosin farm' in Enugu, Enugu State. The birds were raised on a cement floor covered with wood shavings as a source of litter. The pens were also divided into partitions such that each partition accommodated 8 birds. Feed and water were given *ad libitum* in the course of the experiment. Three birds from each treatment (birds closest in mean weight) were fasted overnight and weighed to obtain the live weight, thereafter bled by severing the jugular vein. They were then dipped in hot water and de-feathered. The head, neck and shank were removed to determine the dressed weight and percentage dressed weight and calculated as shown below. The wings were removed by cutting anteriorly, severing at the humeral scapular joint. The cut was made close to the body line. Lateral cuts were made through the rib heads to the shoulder girdle and the breast was removed intact by pulling anteriorly. The thighs, drumsticks and back were dissected from each carcass.

All parts were weighed and expressed as a percentage of dressed weight by Khattak *et al.*[8].

$$\text{Dressed weight (\%)} = \frac{\text{Dressed weight}}{\text{Live weight}} \times 100$$

Where:

Live weight = Weight of the bird after fasting

Dressed weight = Live weight-weight of the head+shank+feathers+blood

Also, blood samples were obtained from twelve birds (one bird per replicate). A 2 mL blood sample was collected from the jugular vein into a sample bottle without anti-coagulant and used for the serum electrolyte analysis.

Four experimental diets were formulated at 3% inclusion levels, with diet 1 containing 0% lemon grass and pawpaw leaf meal, which served as the control diet. While, diets 2, 3 and 4 contain lemon grass and pawpaw leaf meal at the levels and ratios of 0.75:2.25, 1.50:1.50 and 2.25:0.75, respectively (Table 1).

Statistical collection: Data obtained in the research work were subjected to Analysis of Variance (ANOVA) and significant means were compared using Duncan's Multiple Range Test at 5% significance level.

RESULTS AND DISCUSSION

The results of carcass characteristics of finisher broiler birds fed diets supplemented with lemon grass and pawpaw leaf meal are presented in Table 2. The dietary effect on live weight showed superiority in treatment 4 with 2270 g, which was similar to the value of 2150 g observed in treatment 1. The least value of 2000 g was reported in treatment 3, which did not differ from the value of 2060 g observed in treatment 2. Results obtained for carcass weight were significant across the treatment group, with treatment 4 having the highest value of 2010.35 g, which was significantly different from the lowest value of 1870.50 g obtained in treatment 3. Birds in treatment 1 had a value of 1930.45 g, which did not vary from the value of 1890.20 g obtained in treatment 2. Data obtained in the present study agree with the report of Ademola *et al.*[9] where they observed increased carcass weight in treatments fortified with ginger powder in broiler birds. Olabode *et al.*[10] disagree with the assertion in this study while working on broilers, where they observed no significant ($p>0.05$) difference in the results across the treatment groups. Percentage dressed weight had a value of 89.79% in treatment 1, which was not significantly different from the values of 91.76, 93.53 and 93.41% corresponding to treatments 2, 3 and 4, respectively. The results of dressing percentage in this study contradict the observation of Fallah[11], where he reported a significant ($p<0.05$) difference in treatments treated with Aloe vera gel and ginger powder. Also, Amaechi and Iheanetu[12] concluded that the antibiotics group showed better dressing weight than the Aloe vera powder and the control group. Agu *et al.*[4] reported better dressing percentage in treatments fortified with turmeric rhizome powder in broilers.

Table 1: Experimental diet for finisher broiler birds fed graded levels of lemon grass and pawpaw leaf meal

	Treatments			
Ingredients	T1	T2	T3	T4
Maize	58.00	58.00	58.00	58.00
Wheat offal	6.90	5.40	5.40	5.40
Soybean meal	6.00	6.00	6.00	6.00
Groundnut cake	12.00	12.00	12.00	12.00
Fish meal (72%)	1.50	1.50	1.50	1.50
Blood meal	3.50	3.50	3.50	3.50
Palm kernel cake	7.00	5.50	5.50	5.50
Lemon grass leaf meal	0.00	0.75	1.50	2.25
Pawpaw leaf meal	0.00	2.25	1.50	0.75
Limestone	1.50	1.50	1.50	1.50
Bonemeal	2.50	2.50	2.50	2.50
Methionine	0.30	0.30	0.30	0.30
Lysine	0.20	0.20	0.20	0.20
Finisher premix	0.35	0.35	0.35	0.35
Salt	0.25	0.25	0.25	0.25
Total	100	100	100	100
Calculated value				
Crude protein (%)	19.45	19.90	19.76	19.53
MEnergy (Kcal/kg)	3007.90	2979.20	2975.85	2971.44
Crude fiber (%)	3.78	3.91	3.89	3.89
Ether extract (%)	4.73	4.69	4.69	4.69
Calcium (%)	1.35	1.37	1.37	1.37
Phosphorus (%)	0.54	0.56	0.56	0.56
Methionine (%)	0.61	0.59	0.59	0.59
Lysine (%)	1.11	1.09	1.09	1.09

Table 2: Carcass characteristics of finisher broiler birds fed supplemental levels of lemon grass and pawpaw leaf meal

	Treatments				
Components	T1	T2	T3	T4	SEM
Live-weight (g)	2150.00^{a}	2060.00^{b}	2000.00^{b}	2270.00^{a}	39.06
Carcass weight (g)	1930.45^{b}	1890.20^{b}	1870.50^{bc}	2010.35^{a}	17.78
Dressed weight (%)	89.79	91.76	93.53	93.41	0.95
Thigh muscle (%)	17.65^{a}	16.71^{a}	15.20^{b}	18.34^{a}	0.47
Back muscle (%)	13.24	12.76	12.34	13.68	0.45
Breast muscle (%)	29.29	27.96	26.49	28.89	0.52
Neck (%)	6.76	6.79	6.69	7.10	0.16
Wing (%)	5.25^{a}	5.08^{a}	4.92^{b}	5.36^{a}	0.06
Head (%)	2.91	2.92	2.87	2.82	0.06
Shank (%)	1.98	1.93	1.91	1.98	0.03
Gizzard (%)	2.77	2.86	2.92	2.65	0.05

^{abc}Means on the same row with different superscripts are significantly ($p<0.05$) different and SEM: Standard error of mean

The effect of diet on thigh muscle revealed significant differences among the treatments studied. Birds in treatment 4 had a superior value of 18.34% for thigh muscle, which was closely followed by those in treatments 1 and 2 with 17.65% and 16.71%, respectively. The least value of 15.20% was observed in treatment 3. Agu *et al.*[4] reported a significant effect in the value of thigh muscle and back muscle obtained when turmeric rhizome powder was used in the diet of broiler birds. This was similar to the results obtained in the present study, where thigh muscles were significantly ($p<0.05$) affected across the group studied. Thus, they agreed that the improvement in carcass traits observed could be attributed to the influence of beneficial phytochemicals in turmeric, such as curcumin, methyl curcumin and other compounds. This theory was further validated by David *et al.*[10] where they used turmeric powder on broiler birds and observed significant ($p<0.05$) increases in carcass quality and quantity, respectively. Back muscle had had a value of 13.24% in treatment 1, which was similar to the values of 12.76%, 12.34% and 13.68% corresponding to treatments 2, 3 and 4, respectively.

Table 3: Serum mineral of finisher broiler birds fed supplemental levels of lemon grass and pawpaw leaf meal

	Treatments				
Component	T1	T2	T3	T4	SEM
Calcium (mmol/L)	0.46	0.51	0.48	0.53	0.02
Phosphorus (mg/dL)	6.38	6.56	6.44	6.59	0.19
Magnesium (mg/dL)	2.88	2.95	2.90	2.93	0.15
Potassium (mmol/L)	3.69	3.81	3.77	3.90	0.16
Sodium (mmol/L)	138.83	149.23	142.23	144.03	3.41

SEM: Standard error of mean

Values of 29.29, 27.96, 26.49 and 28.89% obtained for breast muscle were not significantly influenced across the treatments relating to treatments 1, 2, 3 and 4, respectively. The neck also had values that were similar among the groups. Birds in treatment 1 had a neck value of 6.76%, which did not differ from the values of 6.79, 6.69 and 7.10% observed in treatments 2, 3 and 4. Dietary effects on wing values were significantly affected across the group studied. Birds in treatment 4 had a value of 5.36%, which did not differ from those of 5.25% and 5.08% obtained in treatments 1 and 2. The lowest value of 4.92% was observed in treatment 3, respectively. Head, shank and gizzard had values which did not differ across the treatment group, with head showing a similar effect in treatments 1, 2, 3 and 4 with values of 2.91, 2.92, 2.87 and 2.82%, respectively. Shank had a value of 1.98% in treatment 1, which was not significantly different from the values of 1.93%, 1.91% and 1.98% in treatments 2, 3 and 4, respectively. Values obtained for gizzard in treatment 1 were similar to those obtained in treatments 2, 3 and 4 with 2.77, 2.86, 2.92 and 2.65%, respectively. The report of Durrani *et al.*[13] as different from the results obtained in this study. They observed a significant effect on gizzard, shank and head when black seed (*Nigella sativa*) powder was used in the diet of broilers.

The effect of treatments on serum minerals of finisher broiler birds was displayed on Table 3. Data obtained for serum minerals in the present study revealed that there was no significant difference in values obtained in the serum mineral parameters across all treatment groups. Calcium had a value of 0.46 mmol/L in treatment 1, which was not significantly different from the values of 0.51, 0.48 and 0.53 mmol/L observed for calcium in treatments 2, 3 and 4, respectively. Dietary effect on phosphorus showed that birds in treatments 1, 2, 3 and 4 had a similar value of 6.38 mg/dL, 6.56 mg/dL, 6.44 mg/dL and 6.59 mg respectively. Values obtained for magnesium were 2.88 mg/dL in treatment 1, which did not differ from the values of 2.95, 2.90 and 2.93 mg/dL obtained for magnesium in treatments 2, 3 and 4, respectively.

Potassium had values which did not vary across the treatment group, with 3.69 mmol/L in treatment 1, which was similar to the values 3.81, 3.77 and 3.90 mmol/L corresponding to treatments 2, 3 and 4. Values reported for sodium in this study were not significant, with treatment 1, 2, 3 and 4 showing similar values of 138.83, 149.23, 142.23 and 144.03 mmol/L, respectively.

CONCLUSION

It can be concluded that the inclusion of lemon grass and pawpaw leaf meal in the diet of finisher broiler chickens was possible up to a combination level of 3%, with best results obtained in treatment 4 (2.25:0.75 lemon grass to pawpaw leaf meal). Thus, the inclusion of these test ingredients significantly on the carcass weight, especially in treatment 4. Since a better result was obtained in treatment 4, I would suggest that in subsequent research, higher levels can be tried. Also, different seasons and processing techniques could be experimented with.

SIGNIFICANCE STATEMENT

Looking at the necessity to meet the growing population with safe and quality table meat, it has become highly important and necessary to focus on how to engage herbal plants which has little or no side effects when used in the production of livestock and poultry birds in particular. Medicinal plants, such as lemon

grass and pawpaw, have been used over the years and their significant impact in the area of antibacterial, antifungal and antioxidant effects cannot be overemphasized. Thus, this research work circles around the use of these medicinal plants as feed additives in the diet of finisher broiler chickens.

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