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Influence of Combination of Lemon Grass and Black Plum Leaf Meal on Haematological and Serum Biochemical Indices of Broiler Finisher Birds

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ABSTRACT

Background and Objective: Maximizing the nutrients and bioactive components of different plant materials in a combined form is now becoming increasingly popular in dealing with the adverse effects of synthetic feed promotant and additives in farm animals, especially poultry birds. The objective is to assess the effect of the combination of lemongrass and black plum leaf meal on haematological and serum biochemical indices of broiler finishers. **Materials and Methods:** A total number of 120, four weeks old broiler birds were used for the research work. The experiment was conducted at the poultry unit of Federal College of Agriculture, Ishiagu in Ebonyi State, Nigeria. Four experimental diets were compounded with treatment 1 containing 0% lemon grass leaf meal and black plum leaf meal, which served as the control. Treatments 2, 3 and 4 contained lemon grass leaf meal and black plum leaf meal at the levels and ratios of 1:3, 2:2 and 3:1, respectively. **Results:** Packed cell volume was superior in treatment 4 (34.66%) while the lowest value of 28.86% was observed in treatment 1. Haemoglobin had a higher value of 12.05 g/dL in treatment 2 which differs from the value of 9.82 g/dL obtained in treatment 1. Results for white blood cells in treatment 2 with 257.47×10^3/L were superior when compared to 235.34×10^3/L observed in treatment 1. Total protein had a superior value of 3.45 g/dL in treatment 2 which did not differ from those in treatments 3 and 4 with 3.41 and 3.44 g/dL, respectively. Data for cholesterol had a descending order with the highest in treatment 1 (169.37 mg/dL) which differs from the lowest value of 153.35 mg/dL in treatment 4. **Conclusion:** Thus, the combination of lemongrass and black plum leaf meal is viable in broiler finisher birds in the ratio of 1:3, 2:2 and 3:1 without any negative effect on the health of the birds.

KEYWORDS

Serum biochemistry, haematological, broiler finisher, lemon grass, black plum, packed cell volume, cholesterol level

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INTRODUCTION

One of the basic concerns in poultry production in Nigeria is disease outbreaks. Though antibiotic growth promoters have been used to promote growth, prevent infection and control disease in farm animals, especially in poultry birds, their usage has been under question due to the incidence of mutation and resistance over a long period of usage in poultry birds[1]. Most developing countries have adopted the use of leaves, seeds, fruits, bark and roots of plants to increase the performance of their animals, which has turned out to be very positive and advantageous over the years[2]. The interest in plant feed additives (which include, neem leaf, lemon grass and bitter leaf, etc.) grew over the last decade as the usage continues to increase across the nation. These plant feed additives have a high attention as feed supplements for various purposes in poultry production during recent years. Beneficial effects of bioactive plant materials such as flavonoids, tannins, etc., in farm animal feeding may result in the reduction of microbial threat and promotion of intestinal health in the animals, which is important and necessary for better performance and profitability[3].

Blood plays an important role in transporting nutrients, metabolic waste products and gases around the body. Moreover, blood represents a means of assessing the clinical and nutritional health status of animals. The hemato-biochemical profiles are most commonly used in nutritional studies for chickens and other birds like pigeons, guinea fowl, bronze and Japanese quail[4]. The full blood count examines mostly the cellular components of blood whereas biochemical testing focuses on its chemical constituents. It has been shown that data from blood profiles could be exploited for the improvement of chicken stocks[5]. In addition, blood parameters help diagnose specific poultry hen pathologies and might serve as basic knowledge for studies in immunology and comparative avian pathology[6].

The lemon grass is a perennial grass belonging to the family Graminaceae and grouped under genus *Cymbopogon*[7]. It is of indigenous origin and is a medicinal and aromatic plant. It is locally known by different names such as “Gawati Chah”, “Nibugrass”, “Puthiganda” etc. in different languages. The three species of lemon grass are found in India. *Cymbopogon flexuosus* is grown in East Indian states which is famous for its oil and has a good market. *Cymbopogon citrates* found in the West Indian states contain less *citral*. *Cymbopogon pendulus* in Jammu region contains higher high citral but its cultivation is limited[8]. Lemon grass (*Cymbopogon citrates*) has a rich composition of phytochemicals like tannins, flavonoids and phenols[9]. It is also an aromatic perennial tropical plant that can grow as high as 3.5 m with long thin leaves. The grass was originally found growing wild in India. It produces a network of roots and rootless that rapidly exhausts the soil. In human medicine, lemongrass has the following therapeutic properties; analgesic, anti-depressant, antimicrobial, bactericidal, fungicidal and insecticidal[10].

Black plum is an evergreen tropical tree in the flowering plant family Myrtaceae and is flavored for its fruit, timber and ornamental value[11]. It is among plant leaves with potential for improving performance in livestock and poultry nutrition. It is an indigenous tropical plant distributed across tropical Sub-Saharan, Africa’s coastal savannas and savanna woodland. The tree is not domesticated, but it is often found at the centre of West African villages. The leaves are used as food for livestock, as they have good nutritional value[11]. Vegetables like *Vitex doniana* are important sources of protective foods, which are highly beneficial for the maintenance of good health and the prevention of diseases in broilers. The inclusion of leaves in the diet of poultry is becoming adaptable due to their availability and phytochemical constituents responsible for the medicinal or organoleptic properties of the plant. They are found to contain much more potassium and phosphate than calcium, magnesium, zinc and iron[12].

In view of this, the present study was carried out to determine the hematological and serum biochemical indices of lemongrass and black plum leaf meal in finisher broiler birds.

MATERIALS AND METHODS

Experimental site: The experiment was conducted at the Poultry unit of Animal Production Department, Federal College of Agriculture, Ishiagu, Ebonyi state from July, 2023 to August, 2023.

Source and processing of black plum leaf: The lemongrass and black plum leaves (7.5 kg each) were sourced within the college environment. The leaflets were stripped from the petioles and sorted out to remove dirt. Then-after shade-dry until they became dry, after which they were sundried for 2 hrs to make them crispy and then ground to powder using a hammer mill machine. One hundred and twenty, four weeks old Agrited (Ross 308 strain) broiler birds were used for the experiment. The birds were randomly distributed into four treatments. Each treatment was replicated three times in a Completely Randomized Design (CRD) with ten birds per replicate. The birds were purchased from Cosin farm in Enugu, Enugu State. Feeders and drinkers for the research work were thoroughly washed and cleaned. The birds were raised on a deep litter system with wood shavings which served as a source of litter. The birds were randomly distributed to their different pens.

Four different diets (Table 1) were compounded for the birds at the finisher phase. Feed and water were given *ad libitum*. All due vaccinations and medication necessary for the bird's welfare during the entire growth cycle from five weeks old to the end of the experiment were strictly adhered to according to laid down standards.

Data collection and statistical analysis: Blood samples of 5 mL per bird from each replicate were collected. Two milliliters was placed in specimen bottles without Ethylenediaminetetraacetic Acid (EDTA) to determine the serum biochemistry parameters, while the remaining 3 mL was placed in a sample bottle with EDTA accordingly to determine the hematological parameters. A proximate analysis of the lemon grass and black plum leaf meals was carried out (Table 2). Data collected were subjected to Analysis of Variance (ANOVA) and significant difference mean were separated at 5% level.

Ethical consideration: The research possesses no risk to the birds and there was no incidence of disease transfer to the end user as it was considered safe and sound for consumption at the final stage.

Other feed ingredient had same value across treatment group: Maize-58.00, full fat soya-5.00, groundnut cake-14.00, fishmeal-1.50, blood meal-3.50, bonemeal-2.50, limestone-1.50, salt-0.25, finisher premix-0.35, lysine-0.20 and methionine-0.30.

Table 1: Composition of diet for finisher broilers fed graded levels and ratio of lemon grass and black plum leaf meal

	Treatments			
Ingredients	T1	T2	T3	T4
Wheat offal	6.90	3.90	3.90	3.90
Palm kernel cake	6.00	4.00	4.00	4.00
Lemon grass leaf meal	0.00	1.00	2.00	3.00
Black plum leaf meal	0.00	4.00	3.00	2.00
Total	100.00	100.00	100.00	100.00

Table 2: Proximate composition of lemongrass and black plum leaf meal

Component (%)	Lemon grass leaf meal	Black plum leaf meal
Dry matter	90.90	89.06
Moisture	9.10	10.94
Crude protein	11.45	11.27
Crude fiber	7.89	7.37
Ether extract	1.69	2.60
Ash	10.16	9.38
Nitrogen free extract	59.71	58.44

RESULTS AND DISCUSSION

Haematological and serum biochemistry indices of finisher broiler birds fed a combination of lemongrass and black plum leaf meal was displayed in Table 3. Dietary effect on packed cell volume was significantly ($p<0.05$) affected across the treatment group studied. Birds in treatment 4 had the highest value of 34.66% which was similar to the values of 34.50 and 33.34% observed in treatments 2 and 3, respectively. The lowest value of 28.86% was obtained for birds in treatment 1. The result showed that there was an increase in the values of packed cell volume in treatments fortified with lemongrass and black plum leaf meal.

This connotes that plant materials used in the present research had the ability to increase blood count of finisher birds leading to better activation of body antigens and antibodies. The values obtained were within the recommended normal range of 22 to 37.50% as given by Kahn and Line[6], which suggested that there was no toxic substance released from the plant source as a result of antinutritional factor to the birds by the addition of lemongrass and black plum leaf meal in their diet. Haemoglobin was superior ($p<0.05$) in treatment 2 with a value of 12.05 g/dL followed by 11.98 g/dL obtained for birds in treatment 4. The lowest value of 9.82 g/dL obtained in treatment 1 was also similar ($p>0.05$) to the value of 9.85 g/dL observed in treatment 3, respectively. The values of haemoglobin obtained in this study fall within the recommended range of 9.20 to 13.00 g/dL as reported by Simaraks *et al.*[13]. Which describes the quality of protein in the diet of the birds with the ability to contribute to a positive state of the birds' hemoglobin level. Birds in treatment 2 had a superior ($p<0.05$) value of 3.46×10^{12}/L for red blood cells, which differs from the least value of 2.79×10^{12}/L in treatment 1. Treatments 3 and 4 had values of 3.19×10^{12}/L and 3.30×10^{12}/L which are by themselves similar ($p>0.05$) to each other.

Results showed that treatment diets containing the test ingredients had higher red blood cell values when compared to the control. This implies that there are active substances in the lemongrass and black plum leaf meal which enable better and easy flow of blood to the birds throughout their productive period. Dietary treatment had a significant ($p<0.05$) effect on the values of white blood cells obtained across the treatment groups. Birds in treatment 2 had the highest value of 257.47×10^{3}/L for white blood cells, which did not differ ($p>0.05$) from the values of 252.44×10^{3}/L and 257.32×10^{3}/L the values for white blood cells obtained in treatment 3 and 4. The lowest value for white blood cells was obtained in treatment 1 with a level of 235.34×10^{3}/L. The values obtained for white blood cells in this study suggest that the immune status of the birds fed on the test ingredient was sufficient to keep them in good health and that the birds were able to maximize the bioactive substances in the plant materials which enhanced their ability to defend and resist any disease factor.

Table 3: Hematological and serum biochemical indices of finisher broiler birds fed supplemental levels of lemon grass and black plum leaf meal

	Treatments				
Parameter	T1	T2	T3	T4	SEM
Packed cell volume (%)	28.86^{b}	34.50^{a}	33.34^{a}	34.66^{a}	0.74
Haemoglobin (g/dl)	9.82^{b}	12.05^{a}	9.85^{b}	11.98^{a}	0.38
Red blood cell ($\times10^{12}$/L)	2.79^{c}	3.46^{a}	3.19^{b}	3.30^{b}	0.08
White blood cell ($\times10^{3}$/L)	235.34^{b}	257.47^{a}	252.44^{a}	257.32^{a}	2.92
Total protein (g/dL)	3.25^{b}	3.45^{a}	3.41^{a}	3.44^{a}	0.03
Albumin (g/dL)	2.65	2.73	2.63	2.70	0.03
Globulin (g/dL)	0.60^{b}	0.72^{a}	0.78^{a}	0.74^{a}	0.02
Urea (mg/dL)	7.85^{b}	8.75^{a}	7.78^{b}	8.90^{a}	0.16
Cholesterol (mg/dL)	169.37^{a}	156.87^{b}	156.63^{b}	153.35^{b}	1.93

^{abc}Means on the same row with different superscripts are significantly ($p<0.05$) different

Dietary treatments on total protein were superior ($p<0.05$) with a value of 3.45 g/dL, which did not differ ($p>0.05$) from the values obtained for total protein in treatments 3 and 4 with 3.41 and 3.44 g/dL, respectively. The lowest value of 3.25 g/dL was observed in treatment 1. The value obtained for total protein in this study falls within the recommended range of 3.3 to 5.5 g/dL for total protein as given by Kahn and Line[6], respectively, except for those in treatment 1. Kahn and Line[6] had earlier stated that the quality of protein in the diet of the birds usually determines the quality and quantity of protein made available to the birds, which usually reflects in the total protein in the blood factor. Albumin had a value of 2.65 g/dl in treatment 1, which did not differ ($p>0.05$) from the values of 2.73, 2.63 and 2.70 g/dL obtained for albumin in treatments 2, 3 and 4, respectively. Data obtained for urea revealed a significant ($p<0.05$) effect of diet on the values of urea obtained across the treatment group. The highest ($p<0.05$) value of 8.90 mg/dL was obtained for birds in treatment 4, which was closely followed by those in treatment 2 (8.75 mg/dL), while the lowest value of 7.78 mg/dL was obtained in treatment 3, which was similar ($p>0.05$) to those observed in treatment 1 with 7.85 mg/dL, respectively. The high level of urea in treatments fortified with the test ingredients above the control (except treatment 3) could suggest an increase in the release of serum urea which could be a result of the good quality and quantity of protein available to the birds from the diet given. Thus, the value obtained for urea in this study was within the recommended value range of 2.50 to 10.50 mg/dL as reported by Melesse *et al.*[14].

Results revealed that there was a progressive decrease in the serum cholesterol level from the control to the treatments fortified with the test ingredients. It shows that birds on the control diet had the highest ($p<0.05$) serum cholesterol value of 169.37 mg/dL. Birds in treatment 4 had the lowest value of serum cholesterol with 153.35 mg/dL, which did not differ ($p>0.05$) from those in treatments 2 and 3 with 156.87 and 156.63 mg/dL, respectively. The results for serum cholesterol showed that the value obtained for birds was within the recommended range of 86-211 mg/dL[6]. This finding agreed with the results obtained by Dey *et al.*[15], who worked with leaf meals in farm animals and observed a corresponding decrease in serum cholesterol values as the levels of leaf meals increased in the diets of the animals.

This shows that the combination of lemongrass and black plum leaf meal in broiler birds is feasible without any detrimental effect on the birds in terms of morbidity and mortality. Also, there is a possibility of the birds developing a better immune system with the inclusion of these leaf meals.

Based on the results obtained from this study, it is recommended that this combination be repeated at the starter phase. And that other levels of combination be adopted to try out the potency of the combination at other different levels in other poultry birds.

A major limitation of the study has to do with the drying of the black plum and lemon grass leaves. As rainy season poses a major problem.

CONCLUSION

This study concluded that lemon grass leaf meal and black plum leaf meal can be used as phytogenic plant materials in broiler finisher birds. The active substances embedded in the lemongrass and black plum leaf meal have the ability to enhance the immune system of the birds at finishing phase. Broiler birds can tolerate plant-based diets and by this take advantage of the natural factors in them to build stronger antibodies that can help the birds fight germs and diseases at this stage of growth.

SIGNIFICANCE STATEMENT

This study focuses on the combining of lemon grass and black plum leaf meal on the haematology and serum biochemistry of finisher broiler birds to fortify the immune system of the birds using natural feed additives. The study showed the possibility of combining two different plant materials and maximizing the nutrients and bioactive materials embedded in them to the advantage of the birds in terms of building a better immune system and reducing the rate of morbidity and mortality in the flock. It further showed the possibility of using these leaf meals in other poultry species, given that the digestive systems of the birds are similar in functions, there is thus the possibility of a close or still better performance in other species of poultry birds.

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