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Effect of Dried Lemongrass Leaves (*Cymbopogon citrates*) Powder on Haemato-biochemical Parameters in Broilers

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ABSTRACT

The experiment was conducted from July to September, 2024 at the poultry farm of the College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur, Rajasthan, India to evaluate the effect of dried lemongrass leaves (*Cymbopogon citratus*) powder on haemato-biochemical parameters in broilers. A feeding trial of six weeks followed by a metabolism trial was conducted using ninety-six-day-old chicks. The chicks were randomly distributed in a completely randomized block design in four treatment groups, viz., the T_1 group, i.e., the control group fed on a basal diet; the T_2 group, i.e., the basal diet+lemongrass leaves powder @ 5 g kg^{-1} feed; the T_3 group, i.e., the basal diet+lemongrass leaves powder @ 10 g kg^{-1} feed; and the T_4 group, i.e., the basal diet+lemongrass leaves powder @ 15 g kg^{-1} feed respectively in basal pre-starter, starter and finisher ration. There was a non-significant (p>0.05) difference in blood hemoglobin, PCV, TEC, TLC, serum globulin, A/G ratio, blood glucose, creatinine, ALT, and AST levels. Cholesterol level was significantly (p<0.05) high in the T_1 group, whereas serum albumin and total protein levels were significantly higher (p<0.01) in the T_4 group, and serum triglyceride level was significantly (p<0.01) higher in the T_1 group as compared to other groups. It was concluded that supplementing the broiler diet with lemongrass leaves powder @ 15 g kg^{-1} feed could be beneficial for improving broiler chick haemato-biochemical parameters.

KEYWORDS: Broiler, blood, serum, lemongrass leaves powder

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Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

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1. INTRODUCTION

Poultry was currently one of the fastest-growing agricultural sectors in India. According to the 20th livestock census, there were 851.81 million poultry in the country in 2019. Poultry meat was one of the most popular animal-source foods in the world, across a wide range of countries, customs, and religions. Poultry meat consumption had risen dramatically during the last several decades. According to Anonymous (2007), the Department of Animal Husbandry and Dairying reported that poultry meat output was 5.018 mt, accounting for approximately 48.96% of total meat production. Poultry meat production had increased by 0.46% over the previous year (2022-23).

Poultry meat was also suitable for human health due to its low fat and cholesterol content (Mustafa et al., 2019) and thus contributed significantly to people's health status, particularly in developing countries like India.

The poultry industry's growth and development coincided with the trend of employing a variety of strategies to boost output, including the use of antibiotics as growth promoters and the addition of organic acids, enzymes, herbs, prebiotics, probiotics, and their mixtures (synbiotics) as feed additives (Ebrahim et al., 2020). Antibiotics have been used extensively to boost the production of meat and eggs as well as to prevent infections and poultry diseases. Antibiotic resistance in bacteria, drug residue in carcasses, and changes to the natural gut microbiota, however, limit the use of antibiotics. In the edible tissues of hens treated with therapeutic or preventative antibiotics, (Kabir et al., 2004) and (Hind et al., 2014) discovered noticeably greater concentrations of various antibiotic residues. Animal nutritionists are working hard to find safe substitutes from natural sources to fill this gap (Abdel-Aziz et al., 2015). In the food and feed industries, phytogenic materials are typically thought to be safe (Elghalid et al., 2020; Kholif and Olafadehan 2021). According to (Dalle Zotte et al., 2016), phytogenic substances have a variety of modes of action and may have antimicrobial properties.

India had a long and illustrious history of traditional herbal knowledge. Phytogenic feed additives ensured the presence of spices, herbs, and essential oils (Abd El-Hack et al., 2022). Turmeric, lemongrass, aloe vera, amla, and other herbs were therefore used in traditional herbal knowledge heritage for both human and animal nutrition. Lemongrass was a herb that had been shown to have therapeutic and physiological advantages (Khattak et al., 2014). Lemongrass contained flavonoids, phenolic compounds, terpenoids (Lewis, 1986), and essential oils (such as citral α, citral β, nerol geraniol, and geranyl methylheptenone) that might have been responsible for its different biological activities, such as antibacterial, antidiarrheal, antifungal, antioxidants, and growth promoter (Shah et al., 2011).

Lemongrass had been found to reduce cholesterol levels (Safwat et al., 2021) in the bloodstream (Olorunnisola et al., 2014), likely due to the existence of active substances and crude fiber. Additionally, the citral and other bioactive components in lemongrass imparted a hypocholesterolemic effect by inhibiting hepatic 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase activity (Gopi et al., 2013). Lemongrass's ability to repair hepatic damage by inhibition of reactive oxygen species (ROS) production, lipid peroxidation, release of pro-inflammatory mediators, and restoration of cellular permeability induced by cytotoxic and mutagenic chemicals might have explained the low liver enzymes (ALT and AST) in lemongrass treated birds (Tiwari et al., 2010).

The objective of the study was to determine how adding dried lemongrass leaves (*Cymbopogon citratus*) powder to the diet as a substitute for antibiotic feed additives would impact the haemato-biochemical parameters of broilers.

2. MATERIALS AND METHODS

2.1. Experimental birds and design

The present experiment was conducted during July-September, 2024 at poultry unit of College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur Rajasthan, India on ninety-six (approved by CCSEA committee, IAEC/RES/04/07) unsexed, apparently healthy, day-old ('VENCOBB-400') broiler chicks of the same hatch purchased from Kewal Ramani Hatcheries Pvt. Ltd. Ajmer. The wing bands were placed, and the chicks were individually weighed before the start of the experiment. The completely randomized design was adopted for the present experimental trial. The 96 experimental broiler chicks were equally and randomly divided into four dietary treatment groups (T_1–T_4), and each dietary group was replicated into 3 subgroups (R_1–R_3) to make the initial body weight uniform. Thus, each dietary group comprised 24 chicks distributed into 3 replicated pens of 8 chicks each. The ISO-certified basal feed in the form of broiler pre-starter, broiler starter, and broiler finisher was procured from the feed distributor "Udaipur Kukkut Utpadak Sahkari Samiti Ltd.," Udaipur (Rajasthan), in sufficient quantity. Lemongrass leaves were procured in sufficient quantity from the "herbal garden" of the College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur. The lemongrass leaves were then sun-dried, chopped, and ground to pass through a 1mm sieve in the Department of Animal Nutrition and stored in airtight plastic containers for further use. Group T_1 served as a control-fed basal diet, while groups T_2, T_3 and T_4 were supplemented with lemongrass leaves powder at 5 g, 10 g, and 15 g kg^{-1} of feed, respectively. Fresh and clean water was

available at all times during the trial. Fresh and clean water was available at all times during the trial. The proximate composition of broiler pre-starter, starter, finisher, and lemongrass leaves powder wasyes shown in Table 1.

Table 1: Proximate composition of broiler pre-starter, starter, finisher feed, and lemongrass (*Cymbopogon citratus*) leaves powder (% DM basis)

S. No.	Chemical composition	Broiler pre-starter	Broiler starter	Broiler finisher	Lemongrass leaves powder
1.	Dry matter	90.24	91.09	91.28	90.60
2.	Crude protein	23.03	22.23	20.54	11.21
3.	Ether extract	4.36	4.53	4.87	3.52
4.	Crude fibre	4.25	4.30	4.45	28.10
5.	Total ash	5.57	5.93	6.26	8.06
6.	Nitrogen free extract	62.79	63.01	63.88	49.11
7.	Calcium	1.03	1.10	1.15	0.04
8.	Phosphorus	0.81	0.89	0.94	0.09

2.2. Estimation of haemato-biochemical parameters

Blood samples were taken from all of the sacrificed birds on day 42 of the experiment to evaluate different haemato-biochemical parameters. Ethylenediamine tetra-acetic acid (EDTA) containing vacutainer tubes were used to hold half of the blood in order to measure blood hemoglobin, PCV, TEC, and TLC. After blood collection, hematological investigations were performed immediately. In order to separate the serum, the remaining blood samples were transferred to non-EDTA tubes. The samples were centrifuged at 3000 rpm for 15 minutes to separate the serum, which was then stored at -20°C for additional analysis. The Sahli-Hellige Haemoglobinometer and the Micro-Haematocrit Method were used to measure hemoglobin and PCV, respectively. Using a hemocytometer, the total erythrocyte count (TEC) and total leukocyte count (TLC) were manually performed in accordance with Benjamin's standard procedure (1978). Using commercial test kits, serum samples were examined for albumin, globulin, total protein (TP), glucose, creatinine, cholesterol, alanine aminotransferase (ALT), and aspartate aminotransferase (AST) as per the manufacturer's protocol.

2.3. Statistical analysis

Data from the experiment related to the main effect of dried lemongrass leaves powder were statistically analyzed using a factorial design in accordance with Snedecor and Cochran (1994), and the significance of mean differences was assessed using Duncan's New Multiple Range Test (DNMRT), which was modified by Kramer (1957).

3. RESULTS AND DISCUSSION

3.1. Haematological parameters

The hemoglobin levels of different treatment groups T_1, T_2, T_3 and T_4 were 10.23, 10.37, 11.30, and 12.17 mg dl^{-1}, respectively. The packed cell volume of different treatment groups T_1, T_2, T_3, and T_4 was 31.33, 31.47, 33.67 and 34.53%, respectively. The total erythrocyte counts of varying treatment groups T_1, T_2, T_3 and T_4 were 2.30, 2.34, 2.48 and 2.72 (10^6 $cumm^{-1}$), respectively. The total leukocyte counts of different treatment groups T_1, T_2, T_3 and T_4 were 22.21, 23.87, 24.37 and 24.77 (10^3 $cumm^{-1}$), respectively.

Statistical analysis of data for hemoglobin (Hb), packed cell volume (PCV), total leukocyte count (TLC) and total erythrocyte count (TEC) was found to be non-significant (p>0.05) in different treatment groups.

The findings of the present research study are similar to the findings of Samant et al. (2021) who observed a non-significant (p>0.05) effect on hematological parameters of broilers fed lemongrass leaves powder-supplemented diets as compared to the control group.

The effect of Lemongrass leaves powder on haematological parameters in broiler chicks is shown in Table 2.

3.2. Biochemical parameters

The serum globulin levels in the T_1, T_2, T_3, and T_4 groups were 1.11, 1.14, 1.23 and 1.31 (g dl^{-1}), respectively. The albumin/globulin ratio in the T_1, T_2, T_3, and T_4 groups was 1.18, 1.17, 1.19 and 1.15, respectively. The overall mean value of glucose levels in the T_1, T_2, T_3 and T_4 groups was found to be 246.41, 240.65, 243.37 and 238.59 mg dl^{-1}, respectively. The overall mean value of creatinine levels in T_1, T_2, T_3 and T_4 groups was found to be 0.34, 0.35, 0.37

Table 2: Effect of Lemongrass leaves powder on hematological parameters in broiler chicks

Hematological parameters	Treatment groups				SEm±	Level of significance
	T_1	T_2	T_3	T_4		
Hb (g dl^{-1})	10.23	10.37	11.30	12.17	0.358	N.S.
PCV (%)	31.33	31.47	33.67	34.53	0.626	N.S.
TEC (106 $cumm^{-1}$)	2.30	2.34	2.48	2.72	0.085	N.S.
TLC (103 $cumm^{-1}$)	22.21	23.87	24.37	24.77	0.637	N.S.

Means with different superscripts in a row differ significantly; N.S.: Non-significant (p>0.05)

and 0.39 (mg dl^{-1}), respectively. The overall mean value of serum alanine transaminase (ALT) levels in T_1, T_2, T_3 and T_4 groups was found to be 22.74, 22.60, 22.34 and 21.41 IU l^{-1}, respectively. The overall mean value of serum aspartate transaminase (AST) in the T_1, T_2, T_3, and T_4 groups was found to be 176.21, 175.55, 174.59 and 173.18 IU l^{-1}, respectively.

The overall mean value of cholesterol in the T_1, T_2, T_3, and T_4 groups was found to be 142.41, 135.00, 127.70 and 116.35 mg dl^{-1}, respectively.

The total serum albumin levels of different treatments T_1, T_2, T_3, and T_4 were 1.31, 1.34, 1.42 and 1.51 (g dl^{-1}), respectively. The total serum protein levels of different treatments T_1, T_2, T_3 and T_4 were 2.42, 2.48, 2.65 and 2.82 (g dl^{-1}), respectively. The serum triglyceride levels in the T_1, T_2, T_3 and T_4 groups were 112.90, 108.35, 105.43 and 91.38 (mg dl^{-1}), respectively.

Statistical analysis of data for albumin, albumin/globulin ratio (A/G), glucose, creatinine, alanine transaminase (ALT), and aspartate transaminase (AST) was found to be non-significant (p>0.05) in different treatment groups.

The statistical analysis of variance revealed a significant (p<0.05) effect of feeding lemongrass leaves powder in different treatment groups on serum cholesterol. Alagawany et al. (2021); Ali and Yasir (2021); Rahman et al. (2022) also observed a significant (p<0.05) effect on reduction in cholesterol level while broilers fed lemongrass leaves powder-supplemented diets as compared to the control group.

The statistical analysis of variance revealed a highly significant (p<0.01) effect of the feeding of lemongrass leaves powder in different treatment groups on albumin, total protein, and triglyceride levels. Ali and Yasir (2021); Alagawany et al. (2021) also observed a significant (p<0.05) effect on reduction in triglyceride levels, improvement in albumin and total protein levels in serum, while broilers fed lemongrass leaves powder-supplemented diets as compared to the control group.

The Lemongrass powder enhanced serum total protein and albumin levels, probably due to the presence of phenolic compounds such as flavonoids, which interact with the key regions of serum proteins to enhance their biological activity Nardini (2022).

Lemongrass powder may help lower blood glucose levels in broilers by impacting their gut health and metabolism through antioxidant capabilities, which may assist control the absorption of sugar from the digestive system, potentially resulting to reduced blood glucose levels (El-Sahn et al., 2024).

Lemongrass contains phenolic and flavonoid components that help lower blood triglyceride and total cholesterol levels (Alagawany et al., 2021).

Lemongrass leaves powder was found to reduce cholesterol levels in the bloodstream (Olorunnisola et al., 2014), likely due to the existence of active substances and crude fiber. Additionally, the citral and other bioactive components in lemongrass impart a hypocholesterolemic effect by inhibiting hepatic 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase activity (Gopi et al., 2013).

Lemongrass's ability to repair hepatic damage by inhibition of reactive oxygen species (ROS) production, lipid peroxidation, release of pro-inflammatory mediators, and restoration of cellular permeability induced by cytotoxic and mutagenic chemicals may explain the low liver enzymes

Table 3: Effect of lemongrass leaves powder on biochemical parameters in broiler chicks

Hematological parameters	Treatment groups				SEm±	Level of significance
	T_1	T_2	T_3	T_4		
Albumin (g dl^{-1})	1.31^{c}	1.34^{c}	1.42^{b}	1.51^{a}	0.026	**
Globulin (g dl^{-1})	1.11	1.14	1.23	1.31	0.039	N.S.
Total protein (g dl^{-1})	2.42^{c}	2.48^{bc}	2.65^{ab}	2.82^{a}	0.053	**
A/G ratio	1.18	1.17	1.19	1.15	0.034	N.S.
Glucose (mg dl^{-1})	246.41	240.65	243.37	238.59	1.888	N.S.
Triglyceride (mg dl^{-1})	112.90^{a}	108.35^{a}	105.43^{a}	91.38^{b}	2.806	**
Cholesterol (mg dl^{-1})	142.41^{a}	135.00^{a}	127.70^{ab}	116.35^{b}	3.556	*
Creatinine (mg dl^{-1})	0.34	0.35	0.37	0.39	0.008	N.S.
ALT (IU l^{-1})	22.74	22.60	22.34	21.41	0.312	N.S.
AST (IU l^{-1})	176.21	175.55	174.59	173.18	0.541	N.S.

Means with different superscripts in a row differ significantly; NS: Non-significant (p>0.05); *: Significant at 5% probability (p<0.05); **: Significant at 1% probability (p<0.01)

(ALT and AST) in lemongrass-treated birds Tiwari et al. (2010). The effect of Lemongrass leaves powder on biochemical parameters in broiler chicks is shown in Table 3.

4. CONCLUSION

The feed additive lemongrass (*Cymbopogon citratus*) leaves powder had the ability to improve haemato-biochemical parameters like albumin, total protein, triglyceride and cholesterol level in blood.

5. ACKNOWLEDGEMENT

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