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Dracaena Mannii Leaf Meal Supplementation in Broiler Chicks: Effects on Growth Performance, Haematology and Serum Biochemical Indices

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A B S T R A C T

The study aimed to investigate the impact of Dracaena mannii leaf meal on the growth performance and haematological and biochemical indices of Hubbard broiler chicks. 200 chicks were divided into four groups, each with a different diet. The diets were based on corn-soya meal without Dracaena mannii leaf (DMF), with DMF added at different amounts. The study found that DMF contained flavonoids, phenols, tannins, alkaloids, steroids, and saponins. The average daily feed intake was similar in diets 3 and 4, but significantly higher than in diets 1 and 2, with no mortality recorded. The diets significantly influenced pack cell volume, red blood cell, haemoglobin, white blood cell, leucocytes, and monocyte counts, but within the optimal range for healthy birds. The study concluded that DMF supplementation up to 600 g can optimize broiler performance without negatively impacting their health status.

INTRODUCTION

As antibiotic growth promoters have been banned in the European Union since January 2006, experience has been gained in the use of alternative substances such as phytogenic feed additives (plants) (Ulrich and Arne, 2020; Lubricant and Taraswor, 2001). Medicinal plants have an almost infinite ability to synthesize chemical compounds (phytochemicals) that are safe, eco-friendly and are predicted to have a promising future in animal nutrition due to their broad range of efficacies and their effects on sustainability and safety (Jan, 2021; Alagbe *et al*., 2023). The use of phytogenics such as *Dracaena mannii* show a wide range of activities in animal nutrition than synthetic substances due to their pharmacological properties; antimicrobial, anti-helminthic, hepato-protective, immune-stimulators, antioxidant, antifungal, antiviral activities amongst others (Luis, 2021; Enright *et al*., 2002).

Dracaena mannii is an evergreen, hardy, multipurpose and medium sized tree belonging to the family Agavaceae with about 80 species with high medicinal value due to the presence of phytochemicals such as: phenols, alkaloids, terpenoids, oxalates, saponins, flavonoids, tannins, amongst others (Chinyere et al., 2015; Dutta, 2003). The trees are drought resistance and predominantly found in tropical Africa and some parts of Asia including India (Chineye et al., 2015; Judd et al., 1999). The leaves of *D. mannii* are oblong-elliptic with a flaring base clinging to the stem for half its circumference, up to 400 × 20 mm (Anigboro et al., 2022; Sharma, 1993). The leaves, stems and roots extracts have been believed to possess pharmacological or therapeutic properties and has been used in the treatment of dermatitis, bacterial infections, liver disorders such as hepatitis, jaundice, cirrhosis, the eradication of intestinal parasites (Mathu et al., 2006; Palombo, 2011). Lagnika et al. (2011); Venter and Venter (1995) demonstrated the antimicrobial activity of *D. mannii* leaf extract against *Staphylococcus aureus*. Anigboro et al. (2022); Yasunaka et al. (2005) demonstrated the antifungal properties of *D. mannii* against *Candida albicans*.

Previous studies have shown that the dietary supplementation of phytogenics in broilers yielded positive outcome on growth performance as well as blood parameters since there is a direct relationship between nutrition and blood of animals (). For instance, Zaminur et al. (2013) reported that supplementation of guava (Psidium guajava) and mango (Mangifera indica) leaf meal at 4.5 % and 7.5 % improved final daily weight, feed intake as well as reduction in mortality rate of broilers. Deka et al. (2020) recorded an improvement in pack cell volume, red blood cell, haemoglobin, white blood cells and some serum biochemical indices of broilers fed diet supplemented with Azadirachta indica leaf meal at 0.3 % without causing any deleterious effect. Recent literature reports have indicated that phytogenic feed additives may also improve gut integrity because of its antioxidants and immune-modulating properties (Alagbe, 2018). These results suggest that medicinal plants medicinal plants can be used to bridge the gap between food safety and poultry production. However, there is little or no report on the dietary supplementation of *D. mannii* leaf on broiler chicks

There is no reason to presume that because medicinal plants originate from nature, it must be safe. Therefore, this study was carried out to investigate the effect of dietary supplementation of *D. mannii* leaf on the growth performance and some heamatological and serum biochemical indices of broiler chicks.

METHODOLOGY

Experimental location, management of birds and experimental design

200 one-day old Hubbard broiler chicks (mixed sex) were used in a 28 days' experiment carried out at the Poultry unit of Sumitra Research Institute located between 23^{o} 13' N and 72^{o} 41' E, Gujarat India. The average initial weights of birds were taken before they were distributed over four groups of 50 birds with 5 replicates containing 10 birds each. A properly disinfected automated battery cage measuring 400 cm (length) × 200 cm (breath) × 100 cm (height) equipped with a stainless feeder and nipple drinkers as well as a suspended electric bulb (200 watts) for brooding was used. Birds were given glucose /vitamin mixture (2 g/5 g to 1 liter of water) on arrival and fed four experimental diet consisting of corn-soya meal formulated based on hubbard recommendations for broilers. Chicks were fed *ad libitum* for 4 weeks and also offered fresh clean water. Birds in group 1: corn-soya meal basal diet without *Dracaena mannii* leaf (DMF), group 2, 3 and 4 were given basal diet with DMF at 200 g, 400 g and 600 g respectively. A completely randomized design technique was adopted and efficient management practices were strictly adhered to.

Collection, Identification and Processing Of Dracaena Mannii Leaf

Freshly harvested leaves of *Dracaena mannii* were harvested from the Research farm of Sumitra Research Institute, Gujarat, India and sent to the biological science section for proper identification and issued a voucher number (HH/08/2021). Leaves were washed with a running tap water followed by a distilled water, air-dried in a shade for ten days and grinded to powder using an electric blender. Thereafter it was packed into a transparent labeled polythene bags and transferred into the laboratory for further examination.

Phytochemical Examination of Dracaena Mannii Leaf (DMF)

Quantification of steroids in *Dracaena mannii* leaf meal (DMF) was carried out according to procedures outlined by Alagbe et al. (2024). Analysis of other component were stated below:

Total Flavonoids Content

Using catechin as a reference, the total flavonoid content was calculated using the aluminium chloride technique. After adding 0.1 mL of aluminum chloride and 0.2 mL of 5 percent sodium nitrite, 2.0 grams of *Dracaena mannii* leaf meal (DMF) was added to 3 mL of 1 M sodium hydroxide. The mixture was thoroughly mixed and incubated for 10 minutes at room temperature. Immediately, 10 mL of distilled water were added to the final volume. Using a spectrophotometer, the reaction mixture's absorbance at 550 nm was evaluated in comparison to a blank.

Total Phenolic Concentration

The Folin-reagent Ciocalteu's was used to determine the total phenolic contents in DMF. 2.0 grams of DMF and 0.4 mL of 1:10 v/w were combined followed by the addition of 4 mL of sodium carbonate solution and kept at room temperature for 15 minutes. A spectrophotometer was used to test the sample's absorbance at 800 nm in comparison to the blank. The phenolic content in the sample was expressed as milligrams of catechol per dry gram of dry weight.

Total Saponin Concentration

Using a vanillin and concentrated sulfuric acid colorimetric technique, saponin was quantified. 0.4 milliliters of 77 percent sulfuric acid, 0.5 milliliters of freshly made vanillin solution, and 0.2 milliliters of DMF were combined. The mixture was allowed to cool to room temperature before being heated in a water bath for 30 minutes at 60 degrees centigrade. A spectrophotometer was used to detect the absorbance at 560 nm.

Total Alkaloid Content

Alkaloids were precipitated by mixing 20 mL of acetic acid solution in ethanol (10 percent w/v) with 2.0 grams of DMF and placing the mixture on a water bath for 10 minutes followed by the addition of ammonium hydroxide. After the precipitate reached a constant weight, it was transferred to desiccators and reweighed to estimate the total alkaloid content.

Total Tannins Estimation

The Folin-Ciocalteau technique was employed to determine the total tannin concentration. 2.0 mL of sodium bicarbonate and 1.0 mL Folin-Ciocalteau was added to 2.0 grams of DMF to dilute it (100 mL). The combination was thoroughly mixed and then let to cool for 15 minutes at room temperature. Then, using a spectrophotometer, the absorbance of the standard curve and DMF were compared to a blank at 800 nm.

Measurements:

Growth Performance Traits

The average initial weights of the birds were taken before the commencement of the experiment thereafter it was measured on a weekly basis and expressed in grams. Weight gain was estimated by subtracting the final body weight from the initial body weight (grams). Average daily weight gain was calculated by dividing the weight gain by the number of experimental days (28 days). Average daily feed intake (grams) = total feed intake divided by the number of experimental days (28 days).

Collection of Blood and Analysis

On the 28th day of the experiment, blood samples were collected from ten randomly selected birds per treatment and sent to Sumitra research laboratory for heamatological and serum biochemical examination. 4 ml of blood was collected from the wing vein of each birds out of which 2 ml was transferred

into a sterile bottle with anti-coagulant for haematological studies, the remaining 2 ml was collected into bottles free from anticoagulant for serum biochemical examination. All samples were kept in an ice pack to prevent deterioration. Analysis of red blood cell, pack cell volume, haemoglobin, white blood cell, leucocytes and monocytes were carried out using XN-1500 advanced diagnostic auto-analyzer (HD-066DC, Netherlands) equipped with closed and open tube volume at 100 µL each, work station (intel pentium dual core 2.00 GHz 200 W desktop/tower), (3Gb/s 7200 RPM 16 MB Cache hard drive; 2 GB memory module CD-RW) and (11-inch torch screen with LCD monitor).

Serum biochemical evaluation was carried out with 200T/H automatic chemistry analyzer composed of a sample and reagent volume 70 µL and 350 µL with post spectral spectrophotometry equipped with LAN port access, thirteen operational wave lengths (305, 340, 450, 480, 505, 546, 570, 600, 630, 686, 712, 705, 722 nm) and humidity of 40 to 85 % and can display results within 120 seconds.

Statistical Analysis

Data obtained were subjected to analysis of variance in a completely randomized design using statistical package for social sciences (SPSS version 25.0). Duncan multiple range test of the same software was used to test the difference among the means at $P \leq 0.05$ level of significance.

Using the model: $Yxy = \mu + \alpha x + \beta xy$, was used in this investigation, where Yxy = general response to variables; x = the overall mean; αx = effect of the xth treatment (1=4); and βxy = random error term for each estimate.

Table 1: Chemical composition of basal diet (percentage dry matter)

Feedstuffs/materials	Inclusion
Corn	52.00
Wheat bran	3.00
Soy bean meal	28.00
Fish meal (65 percent)	2.00
Groundnut cake	9.00
Limestone	2.00
Bone meal	3.50
Lysine	0.20
Methionine	0.25
*Mineral/vitamin premix	0.25
Salt	0.30
Total	100.0
Calculated analysis (g/kg)	
Crude protein (CP)	226.1
Crude fibre (CF)	44.8
Ether extract (EE)	48.0
Calcium (Ca)	16.3
Phosphorus (P)	61

Lysine	17.0
Methionine plus cysteine	88
Energy (kcal/kg)	3002.5
Determined analysis	
Crude protein (CP)	231.6
Crude fibre (CF)	42.0
Ether extract (EE)	46.7
Calcium (Ca)	18.6
Phosphorus (P)	85
Lysine	20.1
Methionine plus cysteine	10.2
Energy (kcal/kg)	2998.5

Each Kg of Mineral/vitamin premix contains; vitamin A, 10,000 I.U; vitamin E, 28.0 mg; vitamin D 4,000I.U, vitamin K, 5.00mg; vitamin B2, 5.0mg; Niacin, 80 mg; vitamin B12, 25 mg; choline chloride, 100 mg; Manganese, 10.0 mg; Zinc, 40.1mg; Copper, 8.0g; folic acid, 4.5mg; Iron, 5.1g; pantothenic acid, 30mg; biotin, 31.5g; antioxidant, 70mg

RESEARCH RESULT AND DISCUSSION

As indicated in Table 2, the growth performance of broiler starter chicks was examined based on the inclusion of Dracaena mannii leaf meal (DMF) in their diets. The average daily weight gain of birds receiving diet 3 (400 g DMF/100 kg diet) was comparable ($P>0.05$) to those on diet 4 (600 g DMF/100 kg diet) but significantly ($P<0.05$) higher than those on diet 1 (0g DMF) and diet 2 (200g DMF/100 kg diet). Conversely, the average daily feed intake of birds on diet 1 was similar ($P>0.05$) to those on diet 2 but significantly ($P<0.05$) greater than the other groups.

This study affirms that incorporating Dracaena mannii leaf meal at 600 g (diet 3) and 800 g (diet 4) significantly improved ($P<0.05$) the average daily weight gain compared to the other groups. Additionally, there was a numerical decrease in average daily feed intake across the groups, indicating the potential impact of phytochemicals such as flavonoids and phenols present in DMF (1000.51 mg/g and 842.9 mg/g). These compounds possess antioxidant and antimicrobial properties, potentially reducing microbial pressure in the gut and enhancing the birds' immune system (Singh et al., 2023; Teanpaisan et al., 2017; Tekwu et al., 2012; Rolando, 2020).

The increased weight gains in diet 3 and 4, coupled with reduced feed intake, suggest improved feed utilization by the birds. The feed conversion ratio was also better ($P<0.05$) for DMF-supplemented animals compared to the control (diet 1). No mortality was observed in any of the groups, indicating a high level of hygiene during the experimental period. The presence of tannins and alkaloids in DMF is noteworthy, as these compounds play an active role in traditional herbal remedies and are currently under investigation for antibacterial, antineoplastic, antifungal, and other pharmaceutical functions (Shaheen et al., 2015; Tenover, 2006).

The findings of this experiment align with previous reports, such as Alagbe (2018), who observed enhanced growth rates in broiler starter chicks fed Delonix regia extracts at 2 mL/liter. The extract was reported to stimulate bile and enzymatic production, as well as improve the rate of feed digestion in birds. Similarly, Velenzuela et al. (2017) reported that dietary supplementation of phytochemicals at 2g/kg significantly ($P<0.05$) increased growth rate and reduced mortality in broilers.

As depicted in Table 3, the hematological parameters of broiler starter chicks were examined concerning the inclusion of Dracaena mannii leaf meal (DMF) in their diets. The packed cell volume in birds fed diets supplemented with DMF at 200 g/100 kg (diet 2) and 400 g/100 kg (diet 3) were found to be comparable ($P>0.05$) to those on diet 4 (800 g/kg diet) but significantly higher ($P<0.05$) than those in the control group (diet 1). Similar trends were observed for red blood cell and monocyte values, with higher levels ($P<0.05$) recorded in diet 3 (400 g/100 kg diet) and diet 4 compared to the other groups.

These values for packed cell volume, red blood cells, and monocytes fell within the established ranges for healthy birds, as reported by Jain (1993), Kuttappan et al. (2013), and Abdi-Hachesoo et al. (2011). Hemoglobin, white blood cell count, leucocytes, mean corpuscular volume, mean corpuscular hemoglobin, and mean corpuscular hemoglobin concentration in diet 3 (400 g/100 kg diet) and diet 4 (600 g/kg diet) were statistically similar ($P>0.05$) but significantly greater than the other groups ($P<0.05$). These values also aligned with the normal ranges cited by Simaraks et al. (2004), Talebi et al. (2005), and Albokhadaim (2012).

Blood analysis serves as a diagnostic tool for various disorders in animals (Alagbe, 2019). For example, packed cell volume helps diagnose conditions like polycythemia, dehydration, anemia, lung disease, and kidney tumors (Alagbe, 2023). Hemoglobin, a protein in red blood cells that carries oxygen, is essential for maintaining the red color of blood (Ramalan et al., 2022; Omokore and Alagbe, 2019). Deviations below optimal ranges in hemoglobin, red blood cells, mean corpuscular volume, mean corpuscular hemoglobin, and mean corpuscular hemoglobin concentration indicate anemia (Alagbe et al., 2022). Elevated mean corpuscular hemoglobin suggests deficiencies in vitamin B12 and folic acid, as well as reticulocyte issues (Anuore et al., 2023). White blood cells play a crucial role in producing antibodies that protect birds from infections (Agubosi et al., 2022).

In Table 3, the serum biochemical indices of starter broiler chicks fed Dracaena mannii leaf meal are presented. Total protein, albumin, and globulin values in birds fed diet 3 (400 g/kg) were similar ($P>0.05$) to those in diet 4 (600 g/kg) but significantly higher ($P<0.05$) than in diet 1 and 2. These values fell within the normal ranges reported by Simaraks et al. (2004), suggesting the absence of immune disorders, severe inflammation in vital organs, or blood leakage into tissues (Alagbe, 2022). The albumin/globulin ratio, an indicator of nutritional and immune status, was higher in diets 3 and 4, intermediate in diet 2, and lower in diet 1. Albumin, crucial for maintaining oncotic pressure and transporting hormones, vitamins, and enzymes, offers insights into the birds'

overall health (Adewale et al., 2021). This ratio serves as a diagnostic tool for conditions like liver and kidney diseases, chronic infections, and pancreatitis (Alagbe, 2023). Globulins, responsible for immune defense and enzymatic activities, contribute to the overall health of the birds (Alagbe et al., 2023).

The values for creatinine, urea, alkaline phosphatase, aspartate transaminase, and alanine transaminase were not influenced ($P>0.05$) by the diets, falling within normal ranges for broilers (Albokhadaim, 2012). Results for creatinine and urea suggest the absence of kidney inflammation (Agubosi et al., 2022). Rapid increases in alkaline phosphatase and alanine transaminase may indicate liver and bone diseases or vitamin D deficiency (Singh et al., 2022).

CONCLUSIONS AND RECOMMENDATIONS

It was concluded that DMF show a wide range of potential benefits all targeting the enhancement of birds. It is loaded with several phytochemical with pharmacological properties, dietary supplementation of DMF especially at 400 g (diet 3) and 600 g (diet 4) had positive effects on final weight gain and feed conversion ratio as well as enhancing some of the blood parameters examined without causing any deleterious effect on the health status of broiler chicks.

ADVANCED RESEARCH

The research on the impact of DMF on the growth performance and health of Hubbard broiler chicks provides valuable insights for poultry farmers and industry professionals. The findings highlight the potential benefits of DMF supplementation in broiler diets, emphasizing the importance of further research and exploration in this area. By incorporating DMF into broiler diets, farmers can potentially enhance the growth and health of their flocks, leading to improved productivity and profitability.

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