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# Growth Response of Broiler Chickens to Diets Containing Graded Levels of *Datura stramonium* and *Curcuma longa* Blend

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**ABSTRACT**

**Background and Objective:** The use of medicinal plants in poultry diets is gaining attention as a natural alternative to synthetic additives. *Datura stramonium* (thorn apple) and *Curcuma longa* (turmeric) possess antimicrobial and growth-promoting properties. This study aimed to evaluate the effects of graded levels of a Datura-turmeric blend on the growth performance and health status of broiler chickens. **Materials and Methods:** A total of 200 Abor acres of day-old broiler chickens were used to evaluate the impact of thorn apple and turmeric blend on performance, haematology, and serum biochemistry of broiler chicken. They were divided into five dietary groups of $T_1$-0 g, $T_2$-2 g/kg, $T_3$-4 g/kg, $T_4$-6 g/kg, and $T_5$-8 g/kg inclusion of the blend at the ratio of 1:1 thorn apple and turmeric. Each group contained 40 birds, which were divided into 4 replicates of 10 birds per replicate in a completely randomized design. Data were collected on growth, carcass, haematology, and serum biochemistry, and they were analysed using ANOVA ($p<0.05$). **Results:** Highest ($p<0.05$) weight gain (2573.53 g) was recorded with broiler birds fed a diet containing (2 g/kg) of thorn apple and turmeric blend, while broiler birds fed a diet containing 6 g/kg had the least (2146.13 g). The highest ($p<0.05$) feed conversion ratio (2.20 g) was recorded with broiler birds fed a diet containing (6 g/kg) of thorn apple and turmeric blend, while broiler birds fed a diet containing 2 g/kg had the least (1.97 g). The highest ($p<0.05$) cost/kg meat (1951.83 g) was recorded with the broiler bird fed diet containing (6 g/kg) of thorn apple and turmeric blend, while the broiler fed diet containing 2 g/kg had the least (1762.63 g). The highest ($p<0.05$) carcass weight (2254.00 g) was recorded with broiler birds fed a diet containing (2 g/kg) of thorn apple and turmeric blend, while broiler birds fed the control diet had the least (1908.70 g). Highest ($p<0.05$) kidney (0.42 g) was recorded with broiler birds fed a diet containing (2 g/kg) of thorn apple and turmeric blend, while broiler birds fed the control diet had the least (0.34 g). The highest ($p<0.05$) lungs (0.63 g) were recorded with broiler birds fed a diet containing (8 g/kg) of thorn apple and turmeric blend, while broiler birds fed the control diet had the least (0.44 g). Highest ($p<0.05$) total protein (38.50 g/L) recorded on broiler fed diet containing 2 g/kg thorn apple and turmeric blend, while broiler fed diet containing 8 g/kg had the least value (27.50 g/L). **Conclusion:** The inclusion of thorn apple and turmeric blend at 2 g/kg helps improve growth performance, carcass, cost/kg meat, and health status of broiler chicken.

**KEYWORDS**

Broiler chicken, carcass, haematological, serum



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## INTRODUCTION

The enhancement of growth performance in broilers is not merely about increasing weight but also about improving feed conversion ratios, ensuring health and welfare, and optimizing overall productivity Choi *et al.*[1]. Global economic pressures have driven a tendency of the poultry production to produce more products per unit of feed intake with minimum stress to the poultry and environment. A variety of feed additives are being included in the poultry diet to derive maximum growth of broiler chickens. Use of in-feed antibiotics leads to residues in meat and develops antibiotic resistance in microbes. Therefore, the feed industry should search for alternatives to antibiotics[2]. Phytogenic feed additives have received considerable attention as alternatives to antibiotic growth promoters. Feed additives are integral to achieving these enhancements. Traditionally, synthetic additives have been employed to improve feed efficiency, growth rates, and the health of poultry. However, concerns over antibiotic resistance, residues in meat products, and consumer preferences for organic produce have shifted attention towards natural alternatives.

Thorn apple (*Datura stramonium*) and turmeric (*Curcuma longa*) are two medicinal plants that have shown considerable potential as natural feed additives. *Datura stramonium*, commonly known as thorn apple, has a history of use in traditional medicine for its antimicrobial and anti-inflammatory properties[3]. Its bioactive compounds, such as alkaloids, tannins, and phenol, which are known to influence microbial populations in the gut, potentially improving nutrient absorption and immune responses[4]. However, the presence of toxic alkaloids necessitates careful consideration of their dosage in animal feed to avoid adverse effects.

Turmeric, widely used as a spice and medicinal herb, contains curcumin, a compound renowned for its antioxidant, anti-inflammatory, and antimicrobial properties[5]. Curcumin has been extensively studied and is well-documented for its ability to enhance immune function, improve gut health, and protect against oxidative stress[6]. The inclusion of turmeric in poultry diets has been associated with improved weight gain, better feed conversion ratios, and overall enhanced health of the birds[7]. The combination of thorn apple and turmeric in broiler diets holds the potential for a synergistic effect, where the antimicrobial and anti-inflammatory properties of thorn apple complement the antioxidant and immune-boosting effects of turmeric. This synergistic approach could lead to improved growth performance and health in broiler chickens while minimizing the risks associated with the toxic compounds in thorn apple through the mitigating effects of turmeric[8]. Such an approach aligns with the growing consumer demand for natural and safe poultry products, contributing to a sustainable and economically viable poultry industry[9].

However, the optimal dosage of turmeric in broiler diets, especially in combination with other additives like thorn apple, remains under-explored. While studies have shown that turmeric can improve weight gain and feed conversion ratios in broilers[7], the interaction between turmeric and thorn apple and their combined effects on broiler growth performance require further investigation.

Moreover, the existing literature lacks sufficient data on the synergistic effects of combining these two plants. The potential for turmeric to mitigate the toxic effects of thorn apple's alkaloids has not been thoroughly examined. This gap in knowledge poses a significant problem, as understanding the interaction between these two additives is crucial for developing safe and effective feed formulations. Research is needed to establish the appropriate graded levels of thorn apple and turmeric that maximize their benefits while minimizing any adverse effects on broiler health and performance. Another problem relates to the economic feasibility and practical application of these feed additives in commercial poultry production. While natural additives may offer health and growth benefits, their cost-effectiveness compared to synthetic additives is a critical consideration for poultry farmers. This study aimed to evaluate the effects of graded levels of a Datura-turmeric blend on the growth performance and health status of broiler chickens.

## MATERIALS AND METHODS

**Study area:** The experiment was carried out at the Poultry Unit of Teaching and Research Farm, Ladoke Akintola University of Technology Ogbomoso, Oyo State, Nigeria (October-November, 2024). The area is in the derived Savannah Zone of Nigeria. It lies on Longitude 4.5° East of the Greenwich meridian and Latitude 8.50° North-East towards Ibadan, the capital of Oyo State, Nigeria. The mean annual rainfall is 1247 mm, while the relative humidity is between 75 and 95%. It is situated at about 300-600 m above sea level with a mean annual temperature of 27°C[10].

**Preparation of test ingredients:** Thorn apple was fetched within the Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria, while turmeric rhizome was purchased from a local market in Ogbomoso. They were clean and later sliced into flakes to increase the surface area to aid drying. Thereafter, each of the test ingredients was air dried until the weight remained constant. The test ingredients were reduced into lentil-size parts with the aid of a mortar and pestle and milled into a fine powdery form following the method described by Okanlawon *et al.*[11]. Thereafter, it was sieved and stored in an air-tight container until use.

**Experimental animals and management:** Two hundred unsexed day-old Abor acre chicks were purchased from a reputable hatchery and used for the experiment. The birds were randomly allotted into five dietary treatments of 40 birds per treatment and 4 replicates of 10 birds per replicate in a completely randomized design. Five experimental diets were formulated using a ratio 1:1 inclusion level of thorn apple and turmeric blend in which the treatment groups include $T_1$-0 g inclusion, $T_2$-2 g/kg, $T_3$-4 g/kg, $T_4$-6 g/kg, and $T_5$-8 g/kg inclusion of the blend shown in Table 1.

### Data collection

**Growth performance[12]:**

$$\text{Weight gain (g)} = \text{Final weight gain (g)-Initial weight (g)}$$

$$\text{Feed intake (g)} = (\text{Feed given-Leftover})$$

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Average feed intake (g)}}{\text{Average weight gain (g)}}$$

**Carcass characteristics and relative organ weights:** At the end of the 6 week experimental period, four birds were randomly selected were starved of feed for 12 hrs with the presence of abundant water and slaughtered by severing the jugular veins. The birds were bled; defeathered, after which the visceral organs such as liver, intestine, pancreas, spleen, kidney, proventriculus, and hearts were removed. The bled, defeathered, and eviscerated weights were evaluated accordingly. The head and shanks were removed to determine the carcass weight. The carcass was cut into various parts (thigh, breast, back, shank, drumstick, wings, and head), and their weights were expressed in percentage relative to the carcass weight. The weights of the organs were also expressed in relative values. The following calculations were evaluated; the formula used is as reported by Adewale *et al.*[12]:

$$\text{Relative cut parts weight} = \frac{\text{Weight of the cut}}{\text{Carcass weight}} \times 100$$

$$\text{Relative organ weight} = \frac{\text{Weight of organs}}{\text{Carcass weight}} \times 100$$

Table 1: Composition of experimental diets with the inclusion levels of the turmeric and datura at a ratio 1:1

| Ingredient | T1 | T2 (2 g/kg) | T3 (4 g/kg) | T4 (6 g/kg) | T5 (8 g/kg) |
|---|---|---|---|---|---|
| Maize | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 |
| Soya bean meal | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 |
| Groundnut cake | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 |
| Wheat offal | 8.80 | 8.80 | 8.80 | 8.80 | 8.80 |
| Fish meal | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Salt | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Premix | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Methionine | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Lysine | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Oyster shell | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 |
| Bone meal | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| ME (kcal/kg) | 3000 | 3000 | 3000 | 3000 | 3000 |
| Crude protein (%) | 18.00 | 22.00 | 22.00 | 22.00 | 22.00 |

**Blood analysis:** For each treatment, four birds were chosen at random. To ascertain the values of hemoglobin concentration, packed cell volume, red blood cell count, total white blood cell count, differential white blood cell count, platelets count, and red cell indices, approximately 2.5 mL of blood were drawn in tubes containing EDTA anticoagulant[13]. After taking the needles out of the syringes, the blood was gradually expressed into EDTA tubes to lower the possibility of hemolysis. Serum parameters include a total protein obtained by the biuret method in the assay as described by Kohn and Allen[14]. The globulin concentration was obtained by subtracting albumin from the total protein. Albumin was determined using the bromocresol green (BCG) method. Aspartate Transferase (AST) activities were determined using a spectrophotometric method. Alanine Transferase (ALT) activities were determined using a spectrophotometric method. Serum urea was determined using a kit (Quinica clinical spam) having a linear measurement of about 566.6 mL/L of urea concentration. The serum urea was determined calorimetrically. The serum cholesterol was determined using the enzymatic endpoint method by Kohn and Allen[14]. Cost per kilogram feed (N) and total feed intake per animal were calculated using the prevailing market price.

**Data analysis:** Data collected were analysed using ANOVA as contained in SAS (2002). Significant means were separated using Duncan Multiple Range Test as contained in (Duncan, 1955) as contained in SAS (2002) ($p<0.05$).

## RESULTS

Table 2 shows the effect of thorn apple and turmeric as feed additives on the growth performance of broiler chicken. There was a significant ($p<0.05$) difference in weight gain, total feed intake. Feed conversion ratio, cost/kg/meat. The broiler chick fed a meal containing 2 g/kg of thorn apple and turmeric blend had the highest ($p<0.05$) weight increase (2573.53 g), while the broiler fed a diet containing 6 g/kg had the lowest (2146.13 g). The highest ($p<0.05$) total feed intake (40477.50 g) was recorded with broiler birds fed the control diet, while broiler birds fed a diet containing 4 g/kg had the least (37961.50 g). The highest ($p<0.05$) feed conversion ratio (2.20 g) was recorded with broiler birds fed a diet containing (6 g/kg) of thorn apple and turmeric blend, while broiler birds fed a diet containing 2 g/kg had the least (1.97 g). The highest ($p<0.05$) feed/cost/kg (926.00 g) was recorded with broiler birds fed a diet containing (6 g/kg) of thorn apple and turmeric blend, while the broiler fed the control diet 0 g/kg had the least (881.00 g). The highest ($p<0.05$) cost/kg/meat (1951.83 g) was recorded with broiler bird fed diet containing (6 g/kg) of thorn apple and turmeric blend, while broiler fed diet containing 2 g/kg had the least (1762.63 g).

Table 2: Effect of thorn apple and turmeric as feed additives on growth performance of broiler chicken

| Parameter | T1 (0 g/kg) | T2 (2 g/kg) | T3 (4 g/kg) | T4 (6 g/kg) | T5 (8 g/kg) | SEM |
|---|---|---|---|---|---|---|
| Weight gain (g) | 2527.72$^{a}$ | 2573.53$^{a}$ | 2406.86$^{ab}$ | 2274.50$^{bc}$ | 2146.13$^{c}$ | 41.79 |
| Feed intake (g) | 40477.50$^{a}$ | 40299.00$^{a}$ | 37961.50$^{b}$ | 38553.50$^{b}$ | 38103.50$^{b}$ | 235.53 |
| FCR (g) | 2.00$^{b}$ | 1.97$^{b}$ | 1.98$^{b}$ | 2.11$^{ab}$ | 2.20$^{a}$ | 0.03 |
| Feed (cost/kg) | 881.00$^{e}$ | 896.00$^{d}$ | 911.00$^{c}$ | 926.00$^{a}$ | 941.00$^{a}$ | 3.98 |
| Cost (kg meat) | 1763.47$^{c}$ | 1762.63$^{c}$ | 1803.23$^{bc}$ | 1951.83$^{a}$ | 2075.53$^{a}$ | 32.46 |

$^{abc}$Means in the same row by factor with different superscripts differ significantly ($p<0.05$) and FCR: Feed conversion ratio

Table 3: Effect of thorn apple and turmeric as feed additives on carcass characteristics of broiler chicken

| Parameter (g) | T1 (0 g/kg) | T2 (2 g/kg) | T3 (4 g/kg) | T4 (6 g/kg) | T5 (8 g/kg) | SEM |
|---|---|---|---|---|---|---|
| Live weight | 2747.50 | 2825.50 | 2607.50 | 2845.50 | 2903.50 | 46.78 |
| Bled weight | 2665.50 | 2750.00 | 2549.00 | 2776.50 | 2808.00 | 47.75 |
| Carcass | 1908.70$^{c}$ | 2254.00$^{a}$ | 1993.50$^{bc}$ | 2212.50$^{b}$ | 2696.00 | 44.40 |
| Breast | 40.53$^{a}$ | 38.68$^{b}$ | 41.81$^{a}$ | 38.96$^{b}$ | 40.86$^{a}$ | 0.29 |
| Back | 15.53$^{b}$ | 15.19$^{b}$ | 14.65$^{c}$ | 17.02$^{a}$ | 14.82$^{bc}$ | 0.20 |
| Drum stick | 13.16$^{a}$ | 13.75$^{a}$ | 12.20$^{b}$ | 12.09$^{b}$ | 13.62$^{a}$ | 0.17 |
| Thigh | 14.03$^{b}$ | 14.78$^{a}$ | 14.00$^{b}$ | 13.83$^{b}$ | 14.14$^{b}$ | 0.10 |
| Wing | 10.28 | 10.31 | 10.58 | 10.10 | 10.20$^{ab}$ | 0.08 |
| Neck | 4.04$^{b}$ | 4.93$^{b}$ | 5.11$^{a}$ | 5.03$^{a}$ | 4.76$^{a}$ | 0.10 |

$^{abc}$Means in the same row by factor with different superscripts differ significantly ($p<0.05$)

Table 3 shows the effect of datura and turmeric as feed additives on the carcass characteristics of broiler chicken. There was a significant ($p<0.05$) difference in carcass, breast, back, drumstick, thigh, wing, and neck. The highest ($p<0.05$) carcass weight (2254.00 g or 79.73%) was recorded with broiler birds fed a diet containing (2 g/kg) of thorn apple and turmeric blend, while broiler birds fed the control diet had the least (1908.70 g or 75.19%). The highest ($p<0.05$) breast (41.81 g) was recorded with broiler birds fed a diet containing (3 g/kg) of thorn apple and turmeric blend, while broiler birds fed a diet containing 2 g/kg had the least (38.68 g). Highest ($p<0.05$) back (17.02 g) was recorded with the broiler bird fed diet containing (6 g/kg) of thorn apple and turmeric blend, while the broiler fed diet containing 2 g/kg had the least (15.19 g). The highest ($p<0.05$) drumstick (13.752 g) was recorded with the broiler bird fed diet containing 2 g/kg of thorn apple and turmeric blend, while the broiler fed diet containing 6 g/kg had the least (12.09 g). The highest ($p<0.05$) thigh (14.78 g) was recorded with broiler birds fed a diet containing (2 g/kg) of thorn apple and turmeric blend, while broiler birds fed a diet containing 6 g/kg had the least (13.83 g). The highest ($p<0.05$) neck (5.11 g) was recorded with broiler birds fed a diet containing (4 g/kg) of thorn apple and turmeric blend, while broiler birds fed a diet containing 0 g/kg had the least (10.10 g). No significant ($p>0.05$) difference was recorded on wings.

Table 4 shows the effect of thorn apple and turmeric as feed additives on the organs of broiler chicken. There was a significant ($p<0.05$) difference in kidneys, lungs, gizzard, proventriculus, and crop. Highest ($p<0.05$) kidney (0.42 g) was recorded with broiler birds fed a diet containing (2 g/kg) of thorn apple and turmeric blend, while broiler birds fed the control diet had the least (0.34 g). The highest ($p<0.05$) lungs (0.63 g) were recorded with broiler birds fed a diet containing (8 g/kg) of thorn apple and turmeric blend, while broiler birds fed the control diet had the least (0.44 g). Highest ($p<0.05$) gizzard (2.10 g) was recorded with broiler birds fed the control diet, while broiler birds fed a diet containing 2 g/kg had the least (1.12 g). Highest ($p<0.05$) proven triculus (0.48 g) was recorded with broiler bird fed diet containing 6 g/kg of thorn apple and turmeric blend, while broiler fed diet containing 2 g/kg had the least (0.39 g). The highest ($p<0.05$) crop (49 g) was recorded with the broiler bird fed diet containing 4 g/kg of thorn apple and turmeric blend, while the broiler fed diet containing 6 g/kg had the least (0.39 g). No significant ($p>0.05$) difference was recorded in the spleen, heart, and pancreas.

Table 4: Effect of thorn apple and turmeric as feed additives on organs of broiler chicken

| Parameter (g) | T1 (0 g/kg) | T2 (2 g/kg) | T3 (4 g/kg) | T4 (6 g/kg) | T5 (8 g/kg) | SEM |
|---|---|---|---|---|---|---|
| Liver | 2.01 | 1.91 | 2.03 | 1.95 | 1.73 | 0.05 |
| Kidney | 0.34$^{b}$ | 0.42$^{a}$ | 0.42$^{a}$ | 0.36$^{b}$ | 0.32$^{b}$ | 0.01 |
| Lungs | 0.44$^{b}$ | 0.45$^{b}$ | 0.54$^{ab}$ | 0.62$^{a}$ | 0.63$^{a}$ | 0.02 |
| Gizzard | 2.10$^{a}$ | 1.12$^{d}$ | 1.94$^{ab}$ | 1.80$^{b}$ | 1.52$^{c}$ | 0.07 |
| Proventriculus | 0.44$^{a}$ | 0.39$^{a}$ | 0.40$^{a}$ | 0.48$^{a}$ | 0.26$^{b}$ | 0.02 |
| Crop | 0.39$^{b}$ | 0.38$^{b}$ | 0.39$^{a}$ | 0.30$^{b}$ | 0.37$^{b}$ | 0.02 |
| Spleen | 0.13 | 0.12 | 0.14 | 0.13 | 0.14 | 0.00 |
| Heart | 0.38 | 0.42 | 0.38 | 0.40 | 0.38 | 0.01 |
| Pancreas | 0.18 | 0.19 | 0.17 | 0.17 | 0.18 | 0.01 |

$^{abc}$Means in the same row by factor with different superscripts differ significantly ($p<0.05$)

Table 5: Effect of thorn apple and turmeric as feed additives on haematological indices of broiler chicken

| Parameter | T1 (0 g/kg) | T2 (2 g/kg) | T3 (4 g/kg) | T4 (6 g/kg) | T5 (8 g/kg) | SEM |
|---|---|---|---|---|---|---|
| PCV (%) | 26.50 | 29.50 | 26.50 | 28.50 | 25.50 | 0.70 |
| HB (g/L) | 130.50 | 141.00 | 131.50 | 139.50 | 120.60 | 3.35 |
| RBC ($\times10^{12}$/L) | 2.22 | 2.56 | 2.35 | 2.48 | 2.14 | 0.50 |
| MVCfL | 115.50 | 115.00 | 116.00 | 115.50 | 113.50 | 0.93 |
| MCH (pg) | 56.50 | 55.50 | 56.00 | 56.00 | 54.50 | 0.44 |
| MCHC (g/L) | 481.00 | 479.00 | 489.50 | 485.00 | 481.00 | 1.85 |
| WBC ($\times10^{9}$/L) | 137.00 | 140.00 | 144.50 | 141.50 | 137.50 | 2.55 |
| Neutrophils | 21.50 | 14.50 | 21.50 | 21.00 | 19.50 | 1.92 |
| Lymphocyte | 65.50 | 79.50 | 66.50 | 68.50 | 69.50 | 3.32 |
| Eosinophils | 4.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.55 |
| Monocytes | 2.20 | 3.00 | 3.00 | 2.50 | 2.50 | 0.40 |
| Basophils | 7.50 | 8.00 | 8.50 | 8.00 | 8.50 | 0.95 |
| PLT ($\times10^{9}$/L) | 29.00 | 32.00 | 30.00 | 33.00 | 32.00 | 1.48 |

$^{abcd}$Means in the same row by factor with different superscripts differ significantly ($p<0.05$), PLT: Platelet, MCV: Mean corpuscular volume, MCH: Mean corpuscular haemoglobin, HB: Haemoglobin, MCHC: Mean corpuscular haemoglobin concentration, PCV: Pack cell volume, RBC: Red blood cell and WBC: White blood cell

Table 6: Effect of thorn apple and turmeric as feed additives on serum biochemistry of broiler chicken

| Parameter | T1 (0 g/kg) | T2 (2 g/kg) | T3 (4 g/kg) | T4 (6 g/kg) | T5 (8 g/kg) | SEM |
|---|---|---|---|---|---|---|
| TP (g/L) | 28.00$^{cd}$ | 38.50$^{a}$ | 31.00$^{b}$ | 28.50$^{c}$ | 27.50$^{d}$ | 0.77 |
| ALB (g/L) | 12.50$^{c}$ | 14.50$^{a}$ | 13.50$^{b}$ | 13.50$^{b}$ | 13.50$^{b}$ | 0.14 |
| GLB (g/L) | 16.00$^{c}$ | 24.50$^{b}$ | 15.50$^{c}$ | 15.50$^{c}$ | 35.50$^{a}$ | 0.15 |
| Urea (mmol/L) | 0.51$^{b}$ | 0.35$^{c}$ | 0.45$^{b}$ | 1.60$^{a}$ | 0.36$^{c}$ | 0.14 |
| Creat (mmol/L) | 51.50 | 46.50 | 43.50 | 46.50 | 42.50 | 1.24 |
| HDLC (mmol/L) | 1.80$^{d}$ | 2.15$^{c}$ | 2.30$^{b}$ | 2.35$^{ab}$ | 2.45$^{a}$ | 0.05 |
| CHOL (mmol/L) | 3.60$^{a}$ | 3.25$^{c}$ | 2.55$^{d}$ | 2.45$^{b}$ | 1.85$^{c}$ | 0.17 |
| TRIG (mmol/L) | 0.55$^{b}$ | 0.35$^{c}$ | 0.75$^{a}$ | 0.37$^{c}$ | 0.36$^{c}$ | 0.31 |
| AST ($\mu L^{-1}$) | 137.50$^{b}$ | 145.50$^{a}$ | 131.50$^{c}$ | 135.60$^{b}$ | 135.50$^{b}$ | 0.91 |
| ALT ($\mu L^{-1}$) | 11.00$^{a}$ | 9.00$^{b}$ | 5.50$^{c}$ | 7.50$^{b}$ | 8.00$^{b}$ | 0.40 |
| ALP ($\mu L^{-1}$) | 107.50 | 106.50 | 100.50 | 105.50 | 102.50 | 5.84 |

$^{abc}$Means in the same row by factor with different superscripts differ significantly ($p<0.05$), AST: Aspartate amino transferases, ALT: Alanine amino transferases, ALP: Alkaline phosphatase, TP: Total protein, ALB: Albumin, GLB: Globulin, CHOL: Cholesterol, TRIG: Triglycerides, HDL: High density lipoprotein-cholesterol and Creat: Creatinine

The effect of thorn apple and turmeric as feed additive on haematological indices of broiler chicken is shown in Table 5. No significant ($p>0.05$) difference was recorded on pack cell volume, red blood cell, haemoglobin, mean corpuscular volume, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, white blood cell, neutrophils, lymphocytes, monocytes, eosinophil basophils and platelet.

Table 6 shows the effect of thorn apple and turmeric as feed additives on the serum biochemistry of Broiler chicken. Highest ($p<0.05$) total protein (38.50) was recorded on broiler fed diet containing 2 g/kg thorn apple and turmeric blend, while broiler fed diet containing 8 g/kg had the least value (27.50 g/L).

The highest ($p<0.05$) albumin (14.50 g/L) was recorded on broiler fed diet containing 2 g/kg thorn apple and turmeric blend, while broiler fed control diets had the least value (12.50 g/L). The highest ($p<0.05$) globulin (35.50 g/L) was recorded on the broiler fed diet containing 8 g/kg thorn apple and turmeric blend, while the broiler fed diet containing 6 g/kg had the least value (15.50 g/L). Highest ($p<0.05$) urea (1.60 mmol/L) was recorded on broiler fed diet containing 6 g/kg thorn apple and turmeric blend, while broiler fed diet containing 2 g/kg had the least value (0.35 mmol/L). Highest ($p<0.05$) high density Lipoprotein (2.45 mmol/L) was recorded with broiler fed diet containing (8 g/kg) of thorn apple and turmeric blend, while the broiler fed control diet had the least (1.80 g). Highest ($p<0.05$) cholesterol (3.60 mmol/L) was recorded with broiler chicken fed the control diet, while broiler fed diet containing (8 g/kg) had the least (1.85 mmol/L). The highest ($p<0.05$) triglycerides (0.75 mmol/L) were recorded with broiler birds fed containing (4 g/kg) of thorn apple and turmeric blend, while broiler birds fed a diet containing (0.35 mmol/L) had the least (2 g/kg). Highest ($p<0.05$) aspartate aminotransferase (145.50 µL) was recorded in broiler birds fed containing (2 g/kg) of thorn apple and turmeric blend, while broiler birds fed a diet containing 4 g/kg (131.50 µ/L) had the least. Highest ($p<0.05$) alanine amino transferases (11.00 µL) were recorded with broiler birds fed containing (2 g/kg) of thorn apple and turmeric blend, while broiler birds fed a diet containing 4 g/kg (5.50 µL) had the least.

## DISCUSSION

The result of these experiment shows that there was a significant increase on weight gain of broilers chicken fed diet containing 2 g/kg of thorn apple and turmeric blend, and this result is in line with report of Ademola *et al.*[15], who reported the inclusion of turmeric in the diet of broiler chicken cause an increase in the body weight gain. Also Johannah *et al.*[16] reported that phytobiotics used in those studies contain tannin, who helps to improve growth performance of livestock. it was also reported that phytobiotics are natural growth promoters and these has been proven in these studies and also agrees with the report of Kafi *et al.*[17], who observed highest weight on birds supplemented with inclusion turmeric powder in feed than other groups. Inclusion of phytobiotics in this study helps to improve feed intake since it has been reported by Emadi and Kermanshahi[18], that phytobiotics in the diet of livestocks helps to increase the feed intake because it contains flavornoid which helps to increase a palatability of the diet. Feed conversion ratio; this also confirms the result of Emadi and Kermanshahi[18] also reported the inclusion of phytobiotics in the diet of broilers help to convert the diet taken into meat. Similar findings were reported by Mondal *et al.*[19] and Arslan *et al.*[20], who also observed that the addition of turmeric powder in the feed enhanced the overall performance of the broiler chicken. It was reported by Singh *et al.*[4] that, thorn apple contains some bioactive compounds, such as alkaloids, tannin and phenol which are known to influence microbial populations in the gut, potentially improving nutrient absorption, to promotes the performance of the intestinal flora thereby improving digestion and enhancing the utilization of energy, leading to improved growth. Similarly, observations were made El-Hack *et al.*[21], in their study on weaned rabbits; they noted that these herbs may have controlled and limited the growth and colonization of numerous pathogenic and non-pathogenic species of bacteria in the gut, leading to improved translation of feed to meat. The improvement in body weight gain in different levels of inclusion could be attributed to the fact that the herbal plant may provide some compounds that enhance the digestion and absorption of some nutrients in these diets, which leading to improved growth of birds in this study. The increase in the cost of feed/kg and cost/kg/meat is much expected because as the inclusion level increases, the price of the blend will also increase. Higher dressing percentage and carcass yield might be due to the positive influence of thorn apple and turmeric powder which led to more gain in body weight of the broilers. Similar findings had also been reported by Abd El-Hakim *et al.*[22]. This may be linked to the activities of the phytochemicals in the diet, which may exert a positive effect on the growth and carcass traits of the broiler chickens. The positive effects of thorn apple and turmeric supplementation on the carcass traits being recorded in this study agree with the report of Abd Al-Jaleel[23] that stated that supplementation of turmeric powder in broiler chicken significantly increased the dressing percentage as the level of inclusion

increased. The results of cut-off parts and organs obtained did not follow a definite pattern that can be attributed to thorn apple and turmeric powder inclusion, and it supports the report of El-Hack *et al*.[21], who stated that the addition of turmeric did not affect the development of certain body organs. Improvement to carcass weight and edible carcass weight in these experiments is attributed to the antioxidant activity of turmeric as it contains beneficial photochemicals (phenols, quinones, flavones, tannins, terpenoids, and alkaloids) found in thorn apple and turmeric used in this study would act as natural growth boosters, enhancing both growth and carcass yield as reported by Arutselvi *et al*.[24].

This variation on organ parameters may be because of the differences in the methods of thorn apple and turmeric processing and environmental factors. The stability of the relative weights of the heart, kidney, lungs and pancreas in this study may be because of level of supplementation of thorn apple and turmeric in the diet which did not affect or alter the normal anatomical and physiological functions of these organs and this as shown that turmeric and thorn apple help to prevent inflammation of the internal organ since they have been reported by Batool *et al*.[3] that they serve as anti-inflammation. Turmeric powder causes a decrease in the weight of some internal organs of broiler chicken as the level of inclusion increases, and this could be attributed to the high concentration of the test ingredient in the experimental diet. This result was in close agreement with the results of Al-Sultan[25], who also concluded that feeding of high level of turmeric will alter the size of some major organs that are involved in nutrient metabolism.

The result for haematology indicates an increase in the count of red blood cells, haemoglobin, and packed cell volume is suggestive of polycythaemia and positive erythropoiesis as reported by Okpuzor *et al*.[26]. This is an indication of sufficient iron in the blood. This suggests that the inclusion of the blend will improve oxygen carrying capacity of the cells, and it agrees with the report of Obianwuna *et al*.[27]. Values obtained for haemoglobin and red blood cell increased as turmeric and thorn apple blend are included. The bioactive compounds in turmeric, especially curcumin, are known to have antioxidant, anti-inflammatory, and erythropoietic properties, which contribute to improved blood health and oxygen transport in broilers. However, the observed white blood cell values among birds placed on control diet and feed additives in this study falls within the normal range as reported by Joshua *et al*.[28]. This result shows an increase in count of white blood cell indicating expression of leucocytes and their production from bone marrow which suggests that there was no infection or regenerative anaemia, it improved immune function through other mechanisms, such as enhancing the activity of macrophages and natural killer cells. The present study, showed no significant differences lymphocyte, eosinophil, monocyte, and basophil levels but showed some numerical increase with inclusion of the blend, which in line with the report of Emadi[18], that supplementation of turmeric in the diet of broiler chicken showed a consequential increase in lymphocyte, eosinophil, monocyte, and basophil since the thorn apple and turmeric use in this study contain alkaloid and phenol as reported by Arutselvi *et al*.[24] consistent with existing literature on the effects of phytogenic feed supplements, such as turmeric, on hematological parameters in broilers. Studies by Emadi[18] have all demonstrated that turmeric supplementation, particularly at moderate levels, can improve haematological indices. All these parameters fall within the normal range as reported by Joshua *et al*.[28] for healthy broilers.

Reduction in aspartate aminotransferase and alanine aminotransferase levels across the treatment groups suggests that thorn apple and turmeric might exert hepatoprotective effects. This aligns with studies that have reported the antioxidant properties of turmeric, particularly its active compound curcumin, which is known to protect liver cells from damage by neutralizing free radicals[29]. The significant increase in alkaline phosphatase levels, particularly in the T4 group, could indicate an adaptive response, possibly due to increased bone turnover or liver activity. This is consistent with findings by Choi *et al*.[1], where dietary supplements in poultry were found to stimulate bone growth and liver function, leading to elevated ALP levels. The observed increase in total protein and albumin levels, especially in the T2 group, may indicate improved protein synthesis or a positive nitrogen balance. Turmeric has been documented to improve protein metabolism by enhancing digestive enzyme activity and nutrient absorption El-Hack *et al*.[21]. The

higher globulin levels in the treatment groups could reflect an enhanced immune response, as globulins are crucial for immune function. Significant rise in urea levels in the T4 group suggests a possible rise in protein breakdown or increased amino acid catabolism, which could be a result of higher metabolic demands or stress induced by the high concentration of thorn apple and turmeric. However, the creatinine levels did not show significant stress on kidney function, indicating that while protein metabolism may be affected, renal health remains stable. The significant increase in cholesterol and the decrease in triglycerides suggest that datura and turmeric positively affect lipid metabolism. The reduction in triglycerides further supports the role of these additives in promoting a healthy bird. The result of serum biochemistry has also shown that this phytobiotics contains some phytochemicals like alkaloid, phenol that helps liver function in the body and this also agreed with the report of Ademola *et al.*[15], who reported that the inclusion of phytobiotics in the diet of broiler chicken will help to boost the immune system and liver function of broiler chicken and this has also been proven in the data collected from growth parameter.

## CONCLUSION

It can be concluded based on the result obtained in this experiment that inclusion of thorn apple and turmeric blend at 2 g/kg can be used to obtain optimum growth performance, carcass yield and to improve health status of broiler chicken. The 2 g/kg of thorn apple and turmeric blend in the diet is therefore recommended for improved overall performance of broiler chicken. It is therefore suggested that future research, such as exploring other combinations of feed additives.

## SIGNIFICANCE STATEMENT

This study identified the optimal inclusion level (2 g/kg) of thorn apple and turmeric blend in broiler diets, which could be beneficial for enhancing growth performance, carcass yield, cost efficiency, and overall health status in broiler chickens. This study will assist researchers in uncovering critical areas of phytogenic feed additive synergy that have remained unexplored by many. Consequently, a new theory on plant-based dietary optimization for poultry production may be developed.

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