



CARCASS YIELD, HAEMATOLOGICAL AND SERUM BIOCHEMICAL PARAMETERS OF BROILER CHICKENS FED DIETARY LEVELS OF PURPLE ORCHID (*Piliostigma reticulatum*) SEED MEAL

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ABSTRACT

The study was conducted to evaluate the carcass characteristics, haematology and serum biochemical indices of broiler chickens fed diets containing varying levels of purple orchid (*Piliostigma reticulatum*) seed meal as substitute to soya bean meal. Three hundred (300) day old chicks (*Ross 308*) were used for the study that lasted for six (6) weeks. The chicks were assigned to five dietary treatments in a Completely Randomized Design for six weeks. Feed and water were provided *ad libitum*. All necessary managerial practices were strictly adhered to during the study period. At the end of the trial, four birds per replicate were sampled for carcass and organ measurements, and blood was collected for analysis. The result for Carcass traits differed significantly ($P<0.05$), with the 20% inclusion level (T3) producing higher live weight, eviscerated, and carcass weights (1850.0, 1319.0 and 1197.67g) comparable to the control (1870.0, 1305.17 and 1243.33g). Dressing percentage and most organ weights were not affected, except gizzard weight (T5, 2.10 to T1, 1.80). Significant ($P<0.05$) differences occurred in some haematological and serum biochemical indices, but all the values obtained remained within normal physiological ranges of a healthy broiler birds. Incorporating *Piliostigma reticulatum* seed meal at 20% level improved carcass yield without adverse effects on haematology and serum biochemical parameters.

Keywords: Biochemistry, Broiler, Carcass characteristics, Haematology

INTRODUCTION

The increasing dependence and continual rise in the prices of, conventional plant protein supplements have become a major concern in the poultry industry. This challenge is particularly pronounced in developing nations, where the rapid expansion of poultry production depends heavily on the availability of high quality, locally sourced, and affordable feed ingredients (Mufwa *et al.*, 2021). The escalation in production costs has largely been attributed to the high demand for conventional plant protein sources, resulting in competition between humans and livestock for these limited resources (Wafar *et al.*, 2017). Consequently, this trend has led to a decline in animal protein production and a rise in the cost of animal products (Adesina, 2018).

Given these challenges, it is imperative to explore alternative plant protein sources that are cost-effective, less competitive between humans and livestock, and nutritionally comparable to conventional protein supplements. One such potential alternative is the purple orchid (*Piliostigma reticulatum*) seed. *Piliostigma reticulatum* is a leguminous browse species widely recognized for its medicinal, nutritional, and agroforestry applications (Soufianou and Issoufou, 2024). It is abundantly distributed across the northeastern region of Nigeria and throughout sub-Saharan Africa, and is locally referred to as *kargo* or *kalgo* in Hausa (Soufianou and Issoufou, 2024).

According to Bayala *et al.* (2015), *Piliostigma reticulatum* contributes significantly to agroforestry and traditional medicine owing to its role in enhancing soil fertility, controlling erosion, and promoting biodiversity conservation. The plant produces numerous pods containing seeds that are primarily consumed by ruminant animals, which generally prefer the pods to the seeds. Studies conducted by Akin-Osanaiye *et al.* (2009) revealed that raw (undefatted) *Piliostigma reticulatum* seeds contain approximately 30.30% crude protein (CP), while defatted seeds contain about 40.40%



CP. Similarly, Musa and Bichi (2015) reported a 34.20% CP content in *Piliostigma reticulatum* seeds subjected to heat processing. These findings suggest that *Piliostigma reticulatum* seeds possess substantial nutritional potential comparable to conventional plant protein sources such as soybean, which typically contains 38-44% CP (Aduku, 1992) and therefore can be utilized in poultry production. Despite its promising nutritional profile, *Piliostigma reticulatum* seeds are known to contain considerable quantities of anti-nutritional factors that may exert deleterious effects on animal health and nutrient utilization if not properly detoxified. Various processing techniques have been employed to mitigate these anti-nutritional compounds with varying degrees of success (Obadire *et al.*, 2022; Lamalang *et al.*, 2024). Blood parameters serve as critical indicators of the physiological and pathological state of animals (Etim *et al.*, 2014; Lamalang *et al.*, 2024). Haematological and serum biochemical indices provide valuable insights into the nutritional and health status of animals (Kokore *et al.*, 2021). Evaluating the blood profile of poultry offers an effective means of assessing the adequacy of diets in meeting metabolic and health requirements (Lamalang, *et al.*, 2024). Furthermore, established blood reference values constitute essential diagnostic tools for interpreting physiological conditions and guiding management decisions (Arzour-Lakehal and Boudebza, 2021). Deviations from these reference ranges often signify physiological disturbances that may not be readily detected through performance indices alone. Hence, haematological evaluation is particularly crucial when assessing non-conventional feed resources, as their utilization depends not only on nutritive value and availability but also on their safety for animal health (Igoche, 2015; Lamalang *et al.*, 2024). Therefore, the study was conducted to evaluate the effect of substituting soya bean (*Glycine max*) with purple orchid (*Piliostigma reticulatum*) seed meal on carcass characteristics and haematobiochemical indices of broiler chickens.

MATERIALS AND METHODS

Study Area

The study was conducted at the Poultry Production Unit of the Departmental Teaching and Research Farm, Abubakar Tafawa Balewa University (ATBU), Bauchi, Nigeria. Bauchi metropolis, the capital of Bauchi State, is located within the northeastern geopolitical zone of Nigeria on the northern fringe of the Jos Plateau. It lies between coordinates 10°29'N and 7.71°E, covering an estimated land area of 3,687 km² (BASG, 2025).

Source and Processing Experimental Materials

Purple orchid (*Piliostigma reticulatum*) seeds were collected from the outskirts of Potiskum town in Yobe State and neighboring villages with the assistance of local collectors. The seeds were separated from their pods, cleaned through winnowing to remove debris, and subjected to moist heat treatment for 60 minutes to deactivate anti-nutritional compounds. The treated seeds were air-dried for 3-4 days to reduce moisture content. Subsequently, the seeds were ground to a 2-3 mm particle size and stored in properly labeled polyethylene bags for use in diet formulation. Other feed ingredients were similarly sourced and processed according to standard procedures.

Experimental Design and Management

A total of 300 day-old Ross 308 broiler chicks were obtained from Agritech Hatchery, Ibadan, Nigeria. Before their arrival, pens, feeders, and drinkers were thoroughly cleaned, disinfected, and allowed to dry. During the brooding period, adequate heat, feed, and water were provided *ad libitum*. Routine vaccination and standard management practices were strictly observed throughout the study. After one week of brooding, the chicks were randomly distributed into five dietary treatments, each replicated four times, in a completely randomized design (CRD). The feeding trial lasted for six weeks.

Carcass Analysis

At the end of study, four birds were randomly selected per treatment one each from a replicate for carcass analysis. Prior to slaughtering live weight was measured and the birds were individually slaughtered to obtain eviscerated and carcass weight. Dressing percentage was also calculated for each treatment group while visceral components were weighed and expressed as percentage of the live weight.



Blood Collection and Analysis

At the conclusion of the trial, blood samples were collected from representative birds for haematological and serum biochemical analyses. Parameters determined included red blood cell count (RBC), white blood cell count (WBC), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentration (MCHC). Serum samples were analyzed for total protein, albumin, globulin, urea, glucose, creatine, total bilirubin, AST, ALT and cholesterol concentrations following procedures described by Bush (1991), Jain (1993), and Jelalu (2014).

Samples for haematological analysis were collected into EDTA-coated tubes to prevent coagulation, while samples for serum biochemical analysis were collected into plain tubes to allow clot formation and subsequent serum separation.

Proximate Analysis of Test Ingredient and Experimental Diets

Ground samples of *Piliostigma reticulatum* seeds and formulated experimental diets were analyzed for dry matter, crude protein, crude fiber, ether extract, and ash content. Metabolizable energy (ME) and nitrogen-free extract (NFE) were computed by difference. All analyses were performed according to standard procedures of the Association of Official Analytical Chemists (AOAC, 2016).

Data Analysis

All data collected were subjected to one-way analysis of variance (ANOVA) using the SPSS Statistical Package (Version 22, 2015). Significant differences among treatment means were separated using Duncan's Multiple Range Test (DMRT) as described by Duncan (1955).

Table 1: Proximate Composition (%) of Raw *Piliostigma reticulatum* Seed

Parameters	Values
Dry matter (%)	88.87
ME (Kcal/kg)	2008.93
Crude protein (%)	28.34
Crude fibre (%)	25.30
Ether extract (%)	3.38
Ash (%)	12.51
NFE (%)	19.34

ME = Metabolisable energy, NFE = Nitrogen Free Extract

Table 2: Ingredients and Composition (%) of Broiler Starter Diets Containing Boiled Purple Orchid (*Piliostigma reticulatum*) Seed Meal at Varying Replacement Levels for Soya Bean Meal in Broiler Starter Chicks

Ingredients	Diets				
	T ₁ (0 %)	T ₂ (10 %)	T ₃ (20 %)	T ₄ (30 %)	T ₅ (40 %)
Maize	45.92	45.92	45.92	45.92	45.92
Full fat Soya bean	35.53	31.98	28.42	24.87	21.32
<i>P. reticulatum</i>	0.00	3.55	7.11	10.66	14.21
Fish meal	4.00	4.00	4.00	4.00	4.00
Wheat offal	10.00	10.00	10.00	10.00	10.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Limestone	1.50	1.50	1.50	1.50	1.50
Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.30	0.30	0.30	0.30	0.30
Lysine	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis (%)					
Crude Protein	23.00	23.08	23.87	23.03	23.09
ME (kcal/kg)	2978.80	2988.42	2997.45	3007.39	3014.96
Crude Fibre	4.10	4.13	4.17	4.20	4.28
Ether Extract	6.21	6.10	5.86	5.76	5.58
Calcium	1.55	1.54	1.54	1.53	1.54
Phosphorous	0.80	0.79	0.77	0.76	0.76
Methionine	0.39	0.38	0.39	0.38	0.37
Lysine	1.24	1.21	1.18	1.13	1.08

*Vitamin-Mineral. Premix (Bio-mix) provided per Kg the following: Vitamin A 12,000,000in, Vitamin D₃, 3,000, 000iu, Vitamin E, 30,000mg, Vitamin K₃, 2,500mg, VitaminB₁,2,000mg, VitaminB₂, 5,000mg, VitaminB₆, 3500mg, VitaminB₁₂, 20mg Folic acid 1,000mg, Nacin, 40,000mg, Calpan, 10,000mg, Biotin, 80mg, Antioxidant, 25,000mg, Cobalt, 250mg, selenium, 250mg, Iodine, 1,200mg, Iron, 40,000mg, Manganese, 70,000mg, Copper, 8,000mg, Zinc, 60,000mg. Choline chloride, 2000, 000mg.

Table 3: Ingredients and Composition of Experimental Diets Containing Boiled Purple Orchid (*Piliostigma reticulatum*) Seed Meal at Varying Levels of Replacement for Soya Bean Meal in Broiler Finisher Chickens

Ingredients	Diets				
	T ₁ (0 %)	T ₂ (10 %)	T ₃ (20 %)	T ₄ (30 %)	T ₅ (40 %)
Maize	47.00	47.00	47.00	47.00	47.00
Full fat Soya bean	31.45	28.30	25.15	22.18	18.85
<i>P. reticulatum</i>	0.00	3.15	6.30	9.45	12.60
Fish meal	2.00	2.00	2.00	2.00	2.00
Wheat offal	15.00	15.00	15.00	15.00	15.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Limestone	1.50	1.50	1.50	1.50	1.50
Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.30	0.30	0.30	0.30	0.30
Lysine	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis (%)					
Crude Protein	21.09	21.07	21.05	21.08	21.06
ME (kcal/kg)	2927.24	2935.50	2953.07	2952.03	2960.29
Crude Fibre	4.39	4.42	4.45	4.48	4.52
Ether Extract	5.95	5.77	5.67	5.63	5.38
Calcium	1.36	1.35	1.34	1.33	1.33
Phosphorous	0.81	0.79	0.78	0.76	0.75
Methionine	0.34	0.33	0.33	0.32	0.42
Lysine	1.11	1.07	1.03	1.00	0.96

*Vitamin-Mineral. Premix (Bio-mix) provided per Kg the following: Vitamin A 12,000,000in, Vitamin D₃, 3,000, 000iu, Vitamin E, 30,000mg, Vitamin K₃, 2,500mg, VitaminB₁,2,000mg, VitaminB₂, 5,000mg, VitaminB₆, 3500mg, VitaminB₁₂, 20mg Folic acid 1,000mg, Nacin, 40,000mg, Calpan, 10,000mg, Biotin, 80mg, Antioxidant, 25,000mg, Cobalt, 250mg, selenium, 250mg, Iodine, 1,200mg, Iron, 40,000mg, Manganese, 70,000mg, Copper, 8,000mg, Zinc, 60,000mg. Choline chloride, 2000, 000mg.

RESULTS AND DISCUSSION

Carcass and Internal Organs Characteristics of Broiler Chickens Fed Diets Containing Varying Level of Purple Orchid (*Piliostigma reticulatum*) Seed Meal

Carcass Characteristics

The carcass characteristics of broiler chickens fed diets containing graded levels of *Piliostigma reticulatum* seed meal as a replacement for soybean meal were presented in Table 4. The results showed that live weight, eviscerated weight, and carcass weight were significantly (P<0.05) affected by dietary treatments, while dressing percentage was not significantly influenced.

Birds fed the control diet (T1, 0%) recorded the highest live weight (1870.0g), followed closely by T3 (20%) with 1850.0g. The lowest live weights were observed in T4 (30) and T5 (40%) with 1470.0g and 1475.0g respectively. A similar pattern was observed for eviscerated weight, where T1 (1305.17) and T3 (1319.0g) were significantly higher than T4 (986.0) and T5 (997.0g). The carcass weight followed the same trend, with the control (1243.33g) and 20% replacement level (1197.67g) showing significantly higher values than the 30 and 40% inclusion levels (886.83 and 901.17g) respectively.

The findings of the study is in line with the work of Nwosu *et al.*, (2020) who reported a significant increase in carcass characteristics in control diets and 25% inclusion levels when birds were fed diets containing Nigerian brown beni seed as a substitute to soya bean cake. The findings was also in agreement to the report of Antyev *et al.*, (2017) and Afolayan, *et al.*, (2020) who observed significant differences in carcass weight and prime cuts, where control diets recorded higher values when compared to other treatments. The present study was in contrast with the report of Ezewuso *et*

al., (2022) that recorded higher values in carcass characteristics in birds fed diets containing varying levels of *Telfairia occidentalis* leaf meal.

The relative increase in carcass characteristics in some treatments may be related to improve metabolism and tolerable limit of (*piliostigma reticulaum*) seed meal inclusion levels in broiler chickens diets while the reduction in live, eviscerated, and carcass weights observed at higher inclusion levels (30-40 %) could be attributed to reduced nutrient utilization efficiency or the presence of residual anti-nutritional factors in *Piliostigma reticulatum* seed meal, which may have influenced growth and muscle deposition as noted by Antyev *et al.* (2017).

The dressing percentage, however, was not significantly ($P>0.05$) affected across treatments, ranging from 60.33 on T4 to 66.49% on T1. This suggests that although increasing levels of *Piliostigma reticulatum* seed meal affected carcass yield in absolute terms, the relative proportion of carcass to live weight remained largely unchanged. Nonetheless, the 10% and 20% substitution levels produced carcass traits comparable to the control, indicating that *Piliostigma reticulatum* seed meal can effectively replace soybean meal up to 20% without adverse effects on carcass yield and composition.

This result agrees with the findings of Afolayan *et al.* (2020) and Lamalang *et al.* (2024), who reported that partial substitution of conventional protein sources with processed alternative seed maintained carcass yield within acceptable physiological limits. However, higher inclusion levels tend to reduce carcass yield, likely due to nutrient imbalance or reduced feed digestibility (Antyev *et al.*, 2017).

Table 4: Carcass Yield of Broiler Chickens Fed Diets Containing Purple Orchid (*Piliostigma reticulatum*) Seed Meal as a Substitute for Soya Bean Meal

Parameter	Diets					SEM
	T1 (0%)	T2 (10%)	T3 (20%)	T4 (30%)	T5 (40%)	
Live weight (g)	1870.00 ^a	1688.3 ^{ab}	1850.00 ^a	1470.00 ^b	1475.00 ^b	109.47 *
Eviscerated weight (g)	1305.17 ^a	1131.83 ^{ab}	1319.00 ^a	986.00 ^b	997.00 ^b	179.11 *
Carcass weight (g)	1243.33 ^a	1036.50 ^{ab}	1197.67 ^a	886.83 ^b	901.17 ^b	72.28 *
Dressing (%)	66.49	61.39	64.74	60.33	61.10	3.07 NS

a b c = Means bearing different superscripts within the same row differ ($P<0.05$), NS = Not significant, SEM = Standard Error of Means

Chicken Offal and Internal Organs Characteristics

The effects of dietary inclusion of *Piliostigma reticulatum* seed meal on the internal organ weights of broiler chickens are presented in Table 5. The results show that there were **no significant ($P>0.05$) differences** among treatment groups in the relative weights of the **head, legs, liver, lungs, kidney, heart, spleen, and abdominal fat**. However, a **significant ($P<0.05$) difference** was observed in **gizzard weight** across dietary treatments.

Broiler birds fed the 40% substitution level (T5) recorded the **highest gizzard weight (2.10)**, while the **lowest value (1.80%)** was obtained in the control group (T1). This trend indicates that increasing inclusion levels of *Piliostigma reticulatum* seed meal may stimulate gizzard development, possibly due to increased dietary fiber content of the seed as indicated in its composition (Table 3) or the presence of structural components requiring greater mechanical grinding activity. Similar observations were reported by Afolayan *et al.* (2020) and Ezenwosu *et al.* (2020) who noted that higher fibrous feed materials tend to enhance gizzard musculature in broiler chickens.

The **liver, kidney, and heart weights** were within normal physiological ranges for broiler chickens as reported by Ezenwosu *et al.* (2020) implying that *Piliostigma reticulatum* seed meal inclusion did not adversely affect hepatic or renal function. The **non-significant variation in liver and kidney weights** further suggests that the seed meal was well tolerated and did not impose toxic stress on the metabolic organs of the broiler chickens.

The **abdominal fat content** decreased numerically with increased dietary inclusion of *Piliostigma reticulatum* seed meal, with birds on 10% substitution (T2) recording the lowest value

(1.28%). Although the differences were not statistically significant, this trend may indicate reduced fat deposition as the seed meal level increased, a finding consistent with Angbulu *et al.* (2020).

Table 5: Chicken Offal and Internal organs weight (% of body weight) of Broiler Chickens Fed Diets Containing Purple Orchid (*Piliostigma reticulatum*) Seed Meal as a Replacement for Soya Bean Meal

Parameter	T1 (0%)	T2 (10%)	T3 (20%)	T4 (30%)	T5 (40%)	SEM
Head	2.43	2.32	2.35	2.33	2.37	0.11 ^{NS}
Legs	3.46	3.46	3.50	3.52	3.38	0.12 ^{NS}
Liver	2.18	2.28	2.22	2.15	2.46	0.17 ^{NS}
Lungs	0.47	0.44	0.42	0.45	0.46	0.08 ^{NS}
Gizzard	1.80 ^b	1.94 ^{ab}	1.86 ^{ab}	1.86 ^{ab}	2.10 ^a	0.12 [*]
Kidney	0.40	0.52	0.47	0.57	0.64	0.10 ^{NS}
Heart	0.41	0.41	0.39	0.43	0.44	0.7 ^{NS}
Spleen	0.11	0.13	0.12	0.13	0.12	0.02 ^{NS}
Abdominal fat	1.87	1.28	1.49	1.65	1.50	0.25 ^{NS}

a b c = Means bearing different superscripts within the same row differ ($P<0.05$), NS = Not significant, SEM = Standard Error of Means

Haematology and Serum Biochemical Indices of Broiler Chickens Fed Diets Containing Varying Level of *Piliostigma reticulatum* Seed Meal

Haematological Parameters

The haematological parameters of the experimental birds are presented in Table 6. Results indicated significant differences ($P<0.05$) among treatment groups in packed cell volume (PCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentration (MCHC). The highest PCV value was observed in T1 (20), whereas the lowest occurred in T3 (19.0%). For MCH, T4 recorded the highest value (35.24) and T1 the lowest (29.57%). Similarly, mean corpuscular volume (MCV) values were highest in T1 (113.0) and lowest in T2 (95.0%). The highest MCHC value was obtained in T3 (34.73) and the lowest in T1 (26.17%). All values fell within normal physiological ranges, suggesting that the birds were neither anaemic nor deprived of adequate blood supply during the study period.

These findings are consistent with those of Antyev *et al.* (2017), who reported non-significant differences in most haematological parameters except PCV, MCV, and white blood cell (WBC) count. The results also align with Afolayan *et al.* (2020), who observed similar non-significant variations in broiler chickens. However, the present study contrasts with Nwosu *et al.* (2020), who found no significant differences in any measured parameter when brown beni seed replaced soybean meal in broiler diets. Similarly, Lamalang *et al.* (2024) reported reduced PCV values in control diets compared to those fed boiled sorrel seed meal, which differs from the present findings.

Furthermore, Aliyu *et al.* (2020) and Igoche, (2015) each reported non-significant effects of sorrel seed and enzyme, and amino acids supplemented diets on haemoglobin (Hb) and red blood cell (RBC) counts in broilers, aligning with the current study. Almost all the haematological parameters in this study were within normal reference ranges for broiler chickens (Wikivet, 2012; Kokore *et al.*, 2021). The normal Hb levels observed indicate adequate protein and iron availability for haemoglobin synthesis and oxygen transport (Esiegwu and Obih, 2019).

The normal values recorded for RBC, MCV, and Hb suggest that dietary inclusion of *Piliostigma reticulatum* seed meal at graded levels did not compromise the birds' health or cause haematological abnormalities associated with anti-nutritional factors. The slightly elevated WBC and MCH values may indicate an adaptive immune response to potential pathogenic exposure. As noted by Antyev (2017), moderate increases in WBC count within the normal range are not detrimental, provided PCV values remain stable. Reduced PCV values, on the other hand, may indicate underlying toxic effects or conditions such as hepatic or renal dysfunction or vitamin B12 deficiency (Demoranville and Best, 2013, as cited in Esiegwu and Obih, 2019).

Therefore, the higher WBC counts observed may reflect enhanced disease resistance and adaptability to environmental stressors, consistent with the report of Afolayan *et al.* (2020). The normal haematological values recorded across treatments indicate that the inclusion of *Piliostigma reticulatum* seed meal maintained the physiological and health status of the broiler chickens, as indicated in the reported of Bobbo *et al.* (2017).

Table 6: Haematological Indices of Broiler Chickens Fed Diets Containing Purple Orchid (*Piliostigma reticulatum*) Seed Meal Substituted with Soya Bean Meal

Parameters	Diets					SEM	Ref. values
	T1	T2	T3	T4	T5		
PCV (%)	26.00	25.00	19.00	22.00	25.00	0.38*	22.00 – 35.00(K)
Hb (g/dL)	6.80	7.80	6.60	7.10	7.70	7.00 ^{NS}	7.00 – 13.00(K)
RBC count $\times 10^{12}/l$	2.30	2.60	2.00	2.10	2.60	0.21 ^{NS}	2.20 – 3.30(K)
WBC count $\times 10^9/l$	10.40	9.40	9.30	10.10	11.10	0.11 ^{NS}	4.07 – 4.32(K)
MCH (pg)	29.57	30.00	33.00	35.24	29.62	1.22*	27.20 – 29.90(W)
MCV (fl)	113.0	96.15	95.00	104.76	96.15	2.11*	90.00 – 140.00(W)
MCHC (g/l)	26.17	31.20	34.73	33.64	30.81	1.21*	26.00 – 35.00(W)

MCV = Mean Corpuscular Volume, MCH = Means Corpuscular Heamoglobin, MCHC = Means Corpuscular Heamoglobin Concentration, (K) = Kokore (2021), (W) = Wikivet (2012)

Serum Biochemical Parameters

The effects of *Piliostigma reticulatum* seed meal on serum biochemical indices of broilers were presented in Table 7. Significant differences were observed among treatments for most biochemical parameters, except total protein, total bilirubin, cholesterol, aspartate aminotransferase (AST), and alanine aminotransferase (ALT), which remained statistically non-significant across treatments. All measured values were within normal physiological ranges for healthy broiler chickens (Esiegwu and Obih, 2019; Arzour and Boudebza, 2021; and Lamalang *et al.*, 2024).

Although total protein did not differ significantly, its fractions (albumin and globulin) were significantly affected by the dietary treatments. The highest albumin value was recorded in T5 (2.85) and the lowest in T1 (1.90%), whereas globulin levels were highest in T1 (2.45) and lowest in T2 (1.69%). Urea concentration ranged from the highest in T5 (3.23) to the lowest in T3 (1.83%). The reduction of urea in some treatment may indicate that the diets have no deleterious effect on the protein quality as high urea levels may indicate poor quality of protein Esiegwu and Obih (2019). Creatinine values showed no clear trend, with the highest observed in T1 (40.1) and the lowest in T3 (33.16%) indicating normal status of the kidneys as the values were within the normal ranges. Serum glucose exhibited a linear increase with increasing inclusion levels of *Piliostigma reticulatum*, reaching the highest value in T5 (12.30%).

The findings for total protein, glucose, cholesterol, urea, ALT, and AST were consistent with those of Lamalang *et al.* (2024), who reported non-significant effects of boiled sorrel seed meal on broiler serum biochemistry. In contrast, Angbulu *et al.* (2020) as cited in Lamalang *et al.* (2024) and Acar *et al.* (2024) observed significant alterations in birds fed alternative protein sources in place of soybean meal.

The non-significant variation in liver enzyme activity (AST and ALT) suggests that *Piliostigma reticulatum* seed meal was well tolerated by the birds and did not induce hepatic or renal damage. The modest increase in serum cholesterol across treatments likely reflects normal lipid metabolism and energy utilization, indicating that dietary inclusion of *Piliostigma reticulatum* seed meal did not adversely affect fat metabolism or overall metabolic health in broiler chickens.

Table 7: Serum Biocemical Indices of Broiler Chickens Fed Diets Containing Purple Orchid (*Piliostigma reticulatum*) Seed Meal as Replacement for Soya Bean Meal

Parameters	Diets					SEM	Ref. values
	T1	T2	T3	T4	T5		
Total protein (g/dl)	4.35	4.31	4.30	4.01	4.53	0.23 ^{NS}	3.0- 4.90(A)
Albumin (g/dl)	1.90 ^c	2.62 ^{ab}	2.48 ^b	2.25 ^b	2.85 ^a	0.81*	2.5 – 3.0(E)
Globulin (g/dl)	2.45 ^a	1.69 ^b	1.82 ^b	1.76 ^{ab}	1.68 ^b	0.52*	1.15 – 1.53(E)
Glucose (Mmol/l)	12.30 ^a	11.20 ^{ab}	9.70 ^c	11.40 ^b	12.40 ^a	1.20*	4.10 – 12.50(E)
Urea (Mmol/l)	2.42 ^b	2.55 ^b	1.83 ^c	2.48 ^b	3.23 ^a	0.62*	4.46 – 6.00(L)
Creatinine (μmol/l)	40.01 ^a	38.00 ^a	33.16 ^c	34.25 ^b	35.86 ^b	0.21*	44.4-47.50(F)
T. bilirubin (μmol/l)	26.10	24.42	21.97	26.15	28.75	0.23 ^{NS}	NA
T.cholesterol (mg/dl)	102	109	107	111	113	0.11 ^{NS}	82.07-114.8(AK)
AST (iu/l)	240	240	240	250	250	0.10 ^{NS}	150.9-288.5(A)
ALT (iu/l)	18	19	18	21	19	0.11 ^{NS}	16.87-23.0(M)

AST= aspartate aminotransferase, ALT= alanine aminotransferase A = Arzour and Boudebza (2021), (E) = Esiegwu and Obih (2019), (L) = Lamalang *et al.*, 2024), (M) = Marcos *et al.* (2012), (AK) = Akinduro *et al.* (2021), (F) = Faniyi, (2013), NA = Not available

CONCLUSION AND RECOMMENDATIONS

The results indicate that, replacement of soybean meal with *Piliostigma reticulatum* seed meal up to 40% did not have deleterious effects on the carcass characteristics and internal organ development of broiler chickens. However, 20% inclusion gave better carcass yield. It is therefore, suggested that the dietary treatments maintained normal physiological integrity, health, and metabolic balance in broiler chickens.

- Incorporation of 20% boiled *Piliostigma reticulatum* seed meal is therefore recommended for broiler chicken production.
- Further research should be carryout to ascertain other methods of processing *Piliostigma reticulatum* seed especially fermentation to enhance its utilisation.

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