



Effect of Dietary Supplementation of Bamboo (*Bambusa tulda*) Leaf Powder on Growth, Haemato-biochemical, Carcass Traits, Relative Organ Weights and Organoleptic Qualities of Meat in Broiler Chicken

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ABSTRACT

The present study was conducted during August, 2024–September, 2024 at Instructional Poultry Farm, College of Veterinary Science, AVFU, Khanapara, Guwahati (781 022) India, to investigate the effects of dietary bamboo (*Bambusa tulda*) leaf powder (BLP) supplementation on growth performance, carcass traits, relative organ weights, organoleptic quality of meat, and haemato-biochemical properties of broiler chicken. In total, 144 straight run Vencobb 430Y broiler chicks were randomly assigned to four treatments with three replications of 12 birds. A control group received basal diet without BLP, while treatment groups received basal diets supplemented with 0.25%, 0.5%, and 0.75% of BLP of basal diets. Up to 42 days of age, the final body weights and body weight gain were significantly ($p<0.05$) higher with supplementation of BLP at 0.75% followed by 0.50% 0.25% and 0.00% of the basal diet, while feed conversion ratio was improved with increased doses of BLP. The dressing weight, dressing percentage, breast yield and thigh yields were also significantly ($p<0.05$) higher in treatment groups than control group, while other cut-up parts and relative organ weights were not influenced by dietary BLP. The dietary BLP significantly ($p<0.05$) improved the overall acceptance of meat. Further, BLP supplemented diet in broiler did not alter any haemato-biochemical parameters indicating no adverse effect on broiler chickens. In conclusion, supplementing broiler diets up to 0.75% BLP of basal diets positively influenced growth performance by improving feed conversion ratio without any adverse effect on haemato-biochemical parameters.

KEYWORDS: Broiler chicken, bamboo leaf powder, body weight, carcass traits

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1. INTRODUCTION

With the ban on antibiotics in poultry production by the European Union in 2006, increased awareness of food safety and human health, and rising poultry feed costs, there has been a shift towards alternatives that can effectively and economically replace antibiotics in poultry production. In the present day, there have been growing trends of using phytogetic and herbal products, which are eco-friendly and have a long history of being utilized for treating various diseases in both animals and humans (Kuralkar and Kuralkar, 2021). Now-a-days these natural elements are incorporated in poultry and livestock feeds extensively due to their potential beneficial effects in animal body. The herbs, spices, essential oils or oleoresins are referred to as phytogetic feed additives consisting of many bioactive molecules with antioxidant and antimicrobial properties, and stimulating effects on the digestive system (Attia, et al., 2017a; Attia, et al., 2017b). Bamboo is widely used in architecture, furniture, handicrafts, food, and even medicine (Nirmala et al., 2018). Recently, bamboo has gained attention in the field owing to its nutritive and therapeutic potential and its important effects on food production, the pharmaceutical industry, and livestock production (Nirmala et al., 2015). The bamboo leaf has been known to possess multifarious biologically active compounds including flavonoids, polysaccharides, phenolic acid, and volatile oils (Cheng et al., 2023). Flavonoids have the effect of inhibiting intestinal inflammation and regulating intestinal immune function (Pei et al., 2020). Polysaccharides in bamboo have anti-bacterial, and anti-oxidation functions (Xiao et al., 2020). Phenolic bamboo has the effect of reducing the occurrence of fatty liver and anti-oxidation, and anti-bacterial effects (Kwon et al., 2017; Hoy-weghen et al., 2012). The main volatile compounds in bamboo exhibit antimicrobial, antioxidant, and antiparasitic activities (Jin et al., 2011; Wang et al., 2021). Bamboo powder and bamboo byproducts could also be added to pig and chicken feed to replace the use of antibiotics (Dai et al., 2022; Wang et al., 2021). Flavonoids present in bamboo has been proved to be enhanced both livestock growth performance and product quality when included in their diet (North et al., 2019). Bamboo leaf extract has potential as an immunity booster or immunomodulator (Zheng et al., 2023). The flavonoids in bamboo leaf extract can enhance the immune response by stimulating lymphocyte cell proliferation (Wiranata et al., 2013). Bamboo leaf extract also exhibits antioxidant properties and can scavenge free radicals. Hence, bamboo and its byproducts have been widely used in food, medicine and cosmetics industries. However, there is limited information of using bamboo leaf powder in poultry production. Further, no such works have been reported in poultry production using bamboo in India,

except Sakhare et al. (2022). Based on this evidence, it is suggested that bamboo leaf may have significant phytogetic activity and may be effectively used in broiler chicken as feed additive to enhance their performance. Based on these benefits, this study was conducted to evaluate the effects of bamboo leaf powder as a feed additive in broiler chickens, focusing on growth performance, blood parameters, carcass traits, organ weights, and meat quality. We hypothesize that dietary supplementation of BLP will improve growth performance, carcass traits, and meat quality without adverse effects on haematological parameters. Hence, the present study investigated the effects of bamboo (*Bambusa tulda*) leaf powder (BLP) supplementation on growth performance, carcass traits, relative organ weights, organoleptic quality of meat, and haemato-biochemical properties of broiler chicken.

2. MATERIALS AND METHODS

The present study was conducted during August, 2024–September, 2024 at Instructional Poultry Farm, College of Veterinary Science, AVFU, Khanapara, Guwahati (781 022)

2.1. Collection, preparation, proximate and qualitative analysis of bamboo (*Bambusa tulda*) leaf powder

The fresh, green, and mature bamboo leaves were collected from Sonapur, Kamrup (M). The leaves were thoroughly cleaned and washed with plain water to remove any foreign particles. After draining excess water, they were sun-dried. Following preliminary sun drying, the leaves were further dried in a hot air oven at 60°C for 10 hrs until they became crisp. The dried leaves were then finely powdered using a kitchen-grade mixer grinder and stored in an airtight container for future use. Prior to incorporating the bamboo leaf powder (BLP) in the diet, a proximate analysis was conducted (Anonymous, 2012).

2.2. Preparation of hydroethanolic extract for qualitative analysis of bamboo leaves

The hydroethanolic extract of BLP was prepared by the method described by Mallmann et al. (2018). The extract of bamboo leaves was then subjected to qualitative analysis for presence of various active principles viz. steroids (Salkowski test), alkaloids (Hager's test), phenolic compounds, tannins (Ferric chloride test), flavonoids (Ferric chloride test), glycosides (Benedict's test) and saponins (Foam test) as per the procedure described by Harborne (1991).

2.3. Experimental birds, housing, diets, experimental designs and treatments

A total of 144 unsexed day-old commercial broiler (Vencobb 430Y) chicks were procured from a reputed local hatchery. After recording initial body weights, the chicks were wing-banded and were then randomly assigned to four groups

viz. T₀, T₁, T₂, and T₃ containing 36 chicks in each group. Each group was further subdivided into three replicates of 12 chicks each. The chicks were reared under a deep litter system following uniform and standard management practices. The experimental diets were designed as T₀, T₁, T₂, and T₃ and were prepared as follows (Table 1).

Table 1: Composition of experimental diets

Groups	Composition of experimental diet
T ₀	Basal diet with no BLP(Control)
T ₁	Basal diet with BLP at 0.25%of basal diet
T ₂	Basal diet with BLP at 0.50%of basal diet
T ₃	Basal diet with BLP at 0.75%of basal diet

The birds were fed with a basal diet of broiler pre-starter (0–14 days), starter 15–21 days), and finisher (22–42 days) diets as per Anonymous (2013) throughout the experimental period of 42 days during August to September, 2024 (Table 2).

Table 2: Ingredients and nutrient composition of basal diets as per Anonymous, 2013

Ingredients (kg)	Pre-starter (0–14 days)	Starter (15–21 days)	Finisher (22–42 days)
Yellow maize	52.0	52.0	53.0
Rice polish	7.5	8.0	9.5
Groundnut cake	15.0	13.2	10.2
Soybean meal	22.0	22.0	23.0
Vegetable oil	1.0	2.5	2.0
Mineral mixture	2.0	2.0	2.0
Salt	0.5	0.3	0.3
Nutrient composition			
Dry matter (%)	88.92	87.52	86.64
Crude protein (%)	22.0	21.50	19.50
Ether extract (%)	3.20	3.92	3.98
Crude fibre (%)	3.98	4.0	4.02
Nitrogen free extract (%)	64.31	63.43	63.22
Total ash (%)	6.70	6.78	6.50
Metabolizable energy (K cal kg ⁻¹)	3000	3050	3100

Vitamin premix was added at 20g q⁻¹ in all categories of rations with the following compositions (per g): Vitamin K, 10 mg; Vitamin B₂, 50 mg; Vitamin D₃, 12,000 I.U. and

Vitamin A, 28,500 I.U.

2.4. Growth, carcass traits and relative organ weights

2.4.1. Feed intake and total feed consumption

The daily average feed intake of the various experimental groups was monitored up to the sixth week of age. The average collective feed intake per bird was calculated on the basis of weekly feed intake by the birds.

Feed consumption (g bird⁻¹)=(Feed offered-Feed residue left)/Number of birds

2.4.2. Body weight (BW) and body weight gain (BWG)

The body weights of all the birds were recorded at day-old age and then weekly intervals up to 6th week of age, in the morning hours before providing any feed or water, using a standard weighing balance. These weight records were used to calculate the average weekly and final body weight gain of individual birds across the various treatment groups.

Total body weight gain (TBWG) (g)=Final body weight (g) at end of period–Initial body weight (g) at start

2.4.3. Feed conversion ratio (FCR)

The weekly feed conversion ratios of various experimental groups were computed using the relevant data from the weekly feed intake and body weight gain using the following formula:

FCR=Feed consumed during experimental period (g)/Body weight gain during the period (g)

2.5. Carcass traits

At the end of the experiment (42 days), 5 birds from each treatment group were randomly selected and were slaughtered in humane manner following standard procedure to determine carcass quality traits viz. pre- slaughter live weight, dressed yield, dressing percentage, cut-up parts and giblet yield. Processing (slaughtering, bleeding, scalding, defeathering and evisceration) of birds were done following standard procedures. The dressed weight of the carcass was recorded after bleeding, defeathering, evisceration and giblet removal based on pre- slaughter live weight.

Dressing percentage (DP) (%)=
$$\frac{\text{Dressed weight (weight after bleeding, defeathering, evisceration and giblet removal)}}{\text{Pre-slaughter live weight (PSW)}} \times 100$$

2.6. Giblet yield

On the basis of the pre- slaughter live weight of the bird, the weight of the heart, liver, and gizzard was recorded as giblet weight and expressed as percentage.

Giblet yield (GY) (%) = (Weight of the giblet/Pre-slaughter live weight)×100

Cut-up part yield (%)=(Weight of individual part/Pre-slaughter live weight)×100

2.7. Relative organ weights

The heart was freed from the pericardium and internal clots; gizzard was cleaned by removing internal linings and undigested feed. On the basis of the live weight of the bird before slaughter, the heart, liver, gizzard, head, shank and intestine were individually weighed (g) and expressed as a percentage.

Relative organ weight (%) = {Weight of the individual organ (g)/Pre-slaughter live weight (g)}×100

2.8. Organoleptic qualities of meat

For the organoleptic evaluation, chicken breast meat samples were collected as small cubes from T₀, T₁, T₂ and T₃ groups. Then the meat cubes were pressure cooked at 15lb pressure for 5 min. Arrangement of the cooked meat was done before the taste panel evaluation. Then the codified samples were presented and tested by a semi-trained panellist of 20 members. The panellists were provided with a 7-point hedonic score card to evaluate the colour, flavour, juiciness, tenderness and overall acceptance of the meat samples as described by Bratzler (1971).

2.9. Haemato-biochemical parameters

At the end of the trial (on 42nd day), six birds from each group were randomly selected, and approximately 2 ml of blood was aseptically collected in EDTA vials and then estimated haemoglobin (Hb), packed cell volume (PCV), red blood cell (RBC) count, and white blood cell (WBC) count by using an “Automated Hematology Analyzer” (MELET SCHLOESING Laboratoires, FLS257).

Similarly, 2 ml of blood was aseptically collected from each bird into clot activator vials. The blood samples were then shifted to the laboratory without disturbing the clots and were centrifuged at 2000 rpm for 15 min to separate the serum. The collected serum was then stored at -20°C in 2 ml Eppendorf tubes until further analysis. The serum samples were analyzed for total protein, uric acid, ALT, AST, and creatinine using commercial assay kits (Coral Clinical Systems, A division of tulip diagnostic (P) Ltd.).

2.10. Statistical analysis

The experiment was designed as Completely Randomized Design (CRD) with four treatment groups and 3 replications. The statistical model used for the analysis was represented as follows:

$$Y_{ij} = \mu + T_i + \epsilon_{ij}$$

Where, Y_{ij}=Response variable

μ=overall mean

T_i=Effects due to treatment groups

ε_{ijk}=Random error

The level of significance was $p < 0.05$

The analysis was aimed to evaluate the impact of Bamboo Leaf Powder (BLP) on growth indices, carcass traits, relative organ weights, hematological and serum biochemical profile as well as organoleptic characters of broiler chicken meat. To confirm the homogeneity of variance of the data obtained for various parameters, first the normality of data distribution was checked using the Shapiro-Wilk and Kolmogorov-Smirnov tests, while Levene's test was used for variance homogeneity. The measured parameters were then analyzed following Analysis of Variance (ANOVA) in a Completely Randomized Design (CRD) with equal replication. Post-Hoc Analysis for examining differences between pairs of experimental treatment groups were made using Fisher's Least Square Difference (Fisher's LSD). Also, Dunnett's test was applied for examining differences between control group mean and other experimental treatment group means.

For statistical analysis of ordinal or ranked parameters like sensory attributes or organoleptic attribute data of broiler chicken meat, Kruskal-Wallis ANOVA is followed. The Kruskal-Wallis ANOVA test was a non-parametric statistical test used to compare two or more independent groups when the data is not normally distributed or when the data was ordinal (ranked). It is a non-parametric alternative to the one-way ANOVA. The test determines if there was a statistically significant difference between the medians of the groups being compared. If the Kruskal-Wallis test indicated a significant difference, Dunn's test could be used to perform pairwise comparisons between the treatment groups to pinpoint which specific groups differ significantly. Dunn's test is the appropriate nonparametric pairwise multiple- comparison procedure when a Kruskal-Wallis test was rejected. For statistical analysis of the data software primarily used was JMP Pro, subsidiary of SAS and IBM SPSS Statistics 20 version.

3. RESULTS AND DISCUSSION

The results of proximate analysis of bamboo leaf powder (BLP) indicated that it contained higher crude protein (18.39%) and crude fiber (25.88%) (Table 3).

Table 3: Proximate composition of bamboo leaf powder (on dry matter basis)

Nutrients	Nutrient composition (%)
Moisture	10.34
Crude protein	18.39
Ether extract	1.49
Crude fibre	25.88
Nitrogen free extract	31.38
Total ash	12.53

Anonymous, 2012

The analysis of BLP confirmed presence of flavonoids, alkaloids, steroids, phenols, glycosides, tannins, and saponins in the extract (Table 4).

Table 4: Qualitative analysis of phytochemicals in BLP

Sl. No.	Phytoconstituents	Present (+ve) / Absent (-ve)
1.	Flavonoid	+ ve
2.	Alkaloid	+ ve
3.	Steroid	+ ve
4.	Phenols	+ ve
5.	Glycoside	+ ve
6.	Tannin	+ ve
7.	Saponin	+ ve

Phytochemical analysis of BLP extract revealed the presence of phytochemicals namely flavonoids, alkaloids, steroids, phenols, glycosides, tannins, and saponins. Similar findings were observed by several researchers (Dey et al., 2015; Dey et al., 2018; Gauchan et al., 2020) who reported the presence of various phenolic and flavonoid compounds (*p*-hydroxybenzoic acid, salicylic acid, ferulic acid, vanillic acid, *p*-coumaric acid, and β -resorcylic acid), saponins, steroids, alkaloids, tannins, carbohydrates, anthraquinones,

triterpenes and glycosides in BLP. Phytochemical screening confirmed the presence of carbohydrates, reducing sugars, triterpenoids and cardiac glycosides in *Bambusa tulda* (Narzary et al., 2025). The presence of bioactive compounds such as saponins, alkaloids and phyto steroids in both species suggests that they may offer various health benefits to livestock (Sasu et al., 2025).

The mean weekly feed intake (FI), total feed consumption per broiler, body weight (BW), body weight gain (BWG) and FCR during the trial period of 42 days have been presented in Table 5. During the first 21 days, feed intake (FI) was significantly ($p < 0.05$) higher in T_2 than T_0 , but comparable to both T_1 and T_3 . From 22 to 42 days, T_0 had the highest FI, while among treatments, T_3 had higher ($p < 0.05$) FI than T_1 and T_2 . At 3 weeks, body weight (BW) was significantly ($p < 0.05$) higher in treatment groups than control, though T_1 was comparable to T_0 . By day 42, all treatment groups had significantly ($p < 0.05$) higher BW than control, with T_3 highest, followed by T_2 and T_1 . Body weight gain (BWG) at 3 weeks was higher in treatments than control, with no major differences among treatment groups. By day 42, T_3 showed the highest BWG, while T_1 and T_2 were similar and higher than T_0 . Feed conversion ratio (FCR) was significantly ($p < 0.05$) better (lower) in T_3 compared to control at both 21 and 42 days and was

Table 5: Growth parameters of broiler chicken fed diets supplemented with different doses of BLP

Particulars	Basal diet supplemented with BLP				SEM	<i>p</i> -value
	T_0 (no BLP)	T_1 (BLP at 0.25%)	T_2 (BLP at 0.50%)	T_3 (BLP at 0.75%)		
BW at day 1	47.45	47.70	47.94	47.59	0.14	1.00
BW at day 21	680.65 ^c	697.86 ^b	725.39 ^{ab}	735.02 ^a	0.81	0.01
BW at day 42	2001.22 ^d	2177.98 ^c	2252.34 ^b	2332.05 ^a	3.96	0.00
1 to 21 days						
BW(g)	680.65 ^c	697.86 ^b	725.39 ^{ab}	735.02 ^a	0.84	0.01
BWG (g)	633.20 ^c	650.16 ^b	677.45 ^{ab}	687.43 ^a	0.79	< 0.01
FI (g)	1007.36 ^c	1025.85 ^b	1051.82 ^{ab}	1036.38 ^a	9.51	< 0.01
FCR	1.48 ^b	1.47 ^b	1.45 ^{ab}	1.41 ^a	0.01	< 0.01
22 to 42 days						
BW(g)	2001.22 ^d	2177.98 ^c	2252.34 ^b	2332.05 ^a	12.26	< 0.01
BWG (g)	1320.57 ^c	1527.82 ^b	1526.95 ^b	1597.03 ^a	2.76	< 0.01
FI (g)	3902.38 ^c	3855.02 ^b	3851.50 ^b	3871.20 ^a	15.24	< 0.01
FCR	1.95 ^c	1.77 ^b	1.71 ^{ab}	1.66 ^a	0.02	< 0.01
BPEI	120.03 ^c	120.79 ^c	128.97 ^b	137.92 ^a	0.57	< 0.01

BLP: Bamboo leaf powder; T_0 : BLP-free basal diet; T_1 : basal diet supplemented with 0.25% BLP of diet; T_2 : Basal diet supplemented with 0.05% BLP of diet; T_3 : Basal diet supplemented with 0.75% BLP of diet; BW: Body weight (g); BWG: Body weight gain bird⁻¹ (g); FI: Feed intake bird⁻¹ (g); FCR: Feed conversion ratio; BPEI: Broiler performance efficiency index; SEM $\pm$: Standard error of mean; Means in the same row not sharing a common superscript differ for $p < 0.05$

comparable to T_2 . Overall, T_3 showed the best performance among all groups.

Dietary polyphenols, especially bamboo leaf powder (BLP), have beneficial effects on broiler performance (Cao et al., 2022). In this study, BLP improved feed intake (FI), body weight gain (BWG), and reduced feed conversion ratio (FCR). The increase in FI might be due to better feed palatability (Zhang, 2002), antioxidant properties, and improved gut health and nutrient absorption. Similar improvements in FI have been reported by several studies (Shen et al., 2019; Okeniyi et al., 2023; Cao et al., 2023; Williams et al., 2024), though some researchers found no effect (Kim et al., 2011; Yang et al., 2019; Dai et al., 2022; Malyar et al., 2024). The higher total FI in the BLP-supplemented groups, particularly at 0.75%, suggests that bamboo leaf powder might have contributed to improved gut health, feed digestibility, or metabolism, leading to higher total FI. The present findings indicated that dietary supplementation with BLP, particularly at 0.75%, had a positive impact on FI, especially during the later stages of life of broiler chicken.

The increase in body weight and BWG might be due to flavonoids in BLP, which acted as growth hormone in animals due to their hydroxyl groups of aglycone being positioned in the same manner just like estrogen (Havsteen, 2002) and could enhance growth, nutrient utilization, and metabolism. Fiber in BLP may also support gut health and digestion. Many studies (Li et al., 2017; Shen et al., 2019; Ayeni et al., 2022; Dai et al., 2022; Williams et al., 2024; Shoura et al., 2024) support these findings, although a few reported (Yang et al., 2019; Dai et al., 2023) no significant effect on BWG.

The best FCR was observed in the T_3 group (0.75% BLP). This improvement might be due to enhanced intestinal development (Teng et al., 2023), better enzyme activity, improved nutrient absorption, and reduced stress effects (Dhama et al., 2015; Kimura et al., 2022). Most previous studies (Kim et al., 2011; Shen et al., 2019; Oladayo et al., 2019; Ayeni et al., 2022; Okeniyi et al., 2023; Cao et al., 2023; Williams et al., 2025; Shoura et al., 2024) agree with these results, though some reported (Dai et al., 2023) no significant change in FCR. Top of Form

The highest BPEI value in the T_3 group could be attributed to improved body weight gain and better FCR in bamboo leaf supplemented broiler diets (Cao et al., 2023; Shoura et al., 2024) throughout the entire experimental period. The efficiency index of broiler chickens increased progressively as the dietary inclusion level of bamboo leaf powder increased from 0.25% to 0.75%, compared to the control group.

The mean values of different carcass quality traits of broiler chicken under different treatment groups are

presented in Table 6. Significant ($p < 0.05$) differences were observed in pre-slaughter weight (PSW) among groups, with T_3 showing the highest values, followed by T_2 , T_1 , and T_0 . Dressed weight followed the same pattern, with T_3 significantly ($p < 0.05$) higher than all other groups. Dressing percentage was significantly ($p < 0.05$) higher in all treatment groups than control, with T_3 highest, though comparable to T_1 and T_2 . Giblet yield showed no significant ($p > 0.05$) differences among groups. For cut-up parts, neck and back yields were similar across all groups. Breast yield was significantly ($p < 0.05$) higher in T_3 compared to T_0 and T_1 , but comparable to T_2 . Thigh yield was highest in T_3 , comparable to T_1 , but significantly ($p < 0.05$) higher than T_2 and T_0 . Drumstick and wing yields did not differ significantly ($p > 0.05$). There were no significant ($p > 0.05$) differences among groups in the relative weights of organs such as liver, heart, gizzard, spleen, bursa, kidneys, pancreas, intestine, shank, head, and abdominal fat.

Carcass characteristics play a pivotal role in both producers' profitability and consumers' purchasing decisions (Ungkumongkol and Wattanachant, 2024). The improved carcass quality traits (pre-slaughter live weight, dressed weight, and dressing percentage) observed in BLP supplemented groups might be due to higher contents of bioactive compounds in bamboo leaves, including flavonoids, which could enhance protein metabolism and muscle development, contributing to improved carcass traits (Kamboh et al., 2019). Also, the antioxidant properties of bamboo leaf flavonoids could improve meat quality and stability, potentially leading to better overall carcass characteristics (Cao et al., 2023). These findings corroborated well with the observation of Imonikebe, (2024) who reported that the live weight, dressed weight and dressing percentage of finisher broilers were significantly ($p < 0.05$) influenced by the inclusion of *bambusa vulgaris* leaf meal (BVLM) in their diet and were remarkably increased at 5% and 7.5% dietary level of BVLM. The per cent yields of all cut-up parts viz. breast, and thighs were significantly ($p < 0.05$) higher in treatment groups than control group, while dietary BLP could not influenced the yields of neck, back, drumsticks, and wings. The higher breast and thigh yields might be due to the bioactive compounds in bamboo leaf powder, including flavonoids and polyphenols, which could enhance protein metabolism, promote muscle development, and improved nutrient absorption and utilization, resulting in increased muscle growth. The present findings were in accordance with Malyar et al., (2024) and Shoura et al., (2024) who reported that supplementing broiler chicken diets with fermented bamboo powder significantly ($p < 0.05$) increased breast and thigh weights compared to the control group. In contrast to the present findings, Shen et al., (2019) observed

Table 6: Carcass quality traits of broiler chicken under different treatment groups

Particulars	Basal diet supplemented with BLP				SEM	<i>p</i> -value
	T ₀ (no BLP)	T ₁ (BLP at 0.25%)	T ₂ (BLP at 0.50%)	T ₃ (BLP at 0.75%)		
PSW (g)	2094.62 ^d	2124.96 ^c	2166.08 ^b	2212.68 ^a	9.30	< 0.01
DW (g)	1468.96 ^d	1510.32 ^c	1561.88 ^b	1599.42 ^a	10.76	< 0.01
DP (%)	70.13 ^c	71.08 ^b	72.11 ^{ab}	72.28 ^a	0.62	0.01
GW (g)	88.23	88.86	90.74	93.42	0.87	0.14
GY (%)	4.43	4.33	4.32	4.41	0.03	0.63
<u>Cut-up parts (%)</u>						
Neck	3.52	3.53	3.60	3.62	0.04	0.11
Back	12.67	12.78	12.54	12.71	1.24	0.93
Breast	21.73 ^b	22.19 ^b	22.98 ^a	23.40 ^a	1.31	< 0.01
Thigh	11.11 ^b	11.44 ^{ab}	10.90 ^b	11.76 ^a	0.97	0.03
Drumstick	9.18	9.15	9.36	9.89	0.94	0.49
Wings	8.02	8.28	8.11	8.25	0.74	0.38
<u>Relative organ weights (%)</u>						
Liver	2.37	2.23	2.24	2.24	0.01	0.32
Heart	0.45	0.44	0.45	0.45	0.00	0.87
Gizzard	1.75	1.73	1.77	1.77	0.01	0.17
Head	2.41	2.40	2.38	2.40	0.03	0.96
Shank	3.81	3.79	3.75	3.84	0.02	0.63
Intestine	4.81	4.69	4.72	4.70	0.02	0.81
Kidney	0.55	0.54	0.58	0.56	0.01	0.62
Pancreas	0.24	0.27	0.27	0.26	0.01	0.50
Abdominal fat	1.60	1.60	1.59	1.57	0.01	0.53
Spleen	0.12	0.12	0.12	0.11	0.01	0.57
Bursa of Fabricius	0.06	0.06	0.05	0.06	0.00	0.61

BLP: Bamboo leaf powder; T₀: BLP-free basal diet; T₁: basal diet supplemented with 0.25% BLP of diet; T₂: Basal diet supplemented with 0.50% BLP of diet; T₃: Basal diet supplemented with 0.75% BLP of diet; BW: Body weight (g); BWG: Body weight gain bird⁻¹ (g); FI: Feed intake bird⁻¹ (g); FCR: Feed conversion ratio; BPEI: Broiler performance efficiency index; SEM±: Standard error of mean; Means in the same row not sharing a common superscript differ for *p*<0.05

no significant (*p*>0.05) difference in breast and thigh meat percentage of broiler chicken among bamboo leaf extract (BLE) supplemented groups.

The present study indicated that BLP supplemented diets could not influence per cent yields of liver, heart, gizzard, head, shank, intestine, kidney, pancreas, and abdominal fat. The present findings agreed with the observation of Dai et al., (2023) who found no significant (*p*>0.05) difference in relative organs weights of broiler chicken supplemented with micronized bamboo leaf powder (MBP) at the level of 1.00% in their basal diet for 24–25 days. Similarly, the lymphoid organs like spleen and bursa of Fabricius also showed non-

significant (*p*>0.05) differences in per cent weights among the different treatment groups. These findings were in accordance with the observation of Dai et al., (2022), who reported no significant (*p*>0.05) differences in the organ indexes of spleen and bursa of Fabricius of broiler chicken supplemented with 1.00% micronized bamboo leaf powder (MBP) in their basal diet for over 22 days.

Colour scores were significantly (*p*<0.05) higher in T₂ and T₃ than T₀ and T₁. Flavour was significantly (*p*<0.05) best in T₃, showing improvement over T₀ and T₁ (Table 7). Texture improved significantly (*p*<0.05) in T₂ and T₃ compared to T₀. Juiciness was significantly (*p*<0.05) higher in T₂ than

Table 7: Organoleptic qualities of broiler chicken meat fed with BPL

Particulars	Basal diet supplemented with BLP				SEM	p-value
	T ₀ (no BLP)	T ₁ (BLP at 0.25%)	T ₂ (BLP at 0.50%)	T ₃ (BLP at 0.75%)		
Colour	5.11 ^b	5.39 ^{ab}	5.78 ^a	5.72 ^a	0.57	0.04
Flavour	5.22 ^b	5.22 ^b	5.61 ^{ab}	5.72 ^a	0.46	0.49
Texture	5.17 ^b	5.39 ^{ab}	5.72 ^a	5.72 ^a	0.38	0.45
Juiciness	5.28 ^b	5.39 ^b	5.89 ^a	5.72 ^{ab}	0.48	0.03
Overall acceptance	5.06 ^b	5.33 ^b	5.72 ^a	5.78 ^a	0.41	0.01

BLP: Bamboo leaf powder; T₀: BLP-free basal diet; T₁: basal diet supplemented with 0.25% BLP of diet; T₂: Basal diet supplemented with 0.05% BLP of diet; T₃: Basal diet supplemented with 0.75%BLP of diet; BW: Body weight (g); BWG: Body weight gain bird⁻¹ (g); FI: Feed intake bird⁻¹ (g); FCR: Feed conversion ratio; BPEI: Broiler performance efficiency index; SEM±: Standard error of mean; Means in the same row not sharing a common superscript differ for $p < 0.05$

T₀ and T₁. Overall acceptability was significantly ($p < 0.05$) higher in T₂ and T₃ compared to T₀ and T₁.

Dietary supplementation of BLP containing flavonoids has a great potential in improving the nutritional, sensorial, and microbiological qualities of poultry meat (Kamboh et al., 2018). The mean scores for organoleptic evaluation of broiler meat samples revealed significant differences ($p < 0.05$) among the treatment groups in terms of colour, flavour, texture, juiciness, and overall acceptance. The BLP supplemented birds exhibited an improved appearance of meat (colour) than control group. Similarly, the flavour scores were significantly ($p < 0.05$) higher in the treatment group compared to control group, reflecting enhanced sensory attributes. The texture scores also improved significantly ($p < 0.05$) in BLP fed birds, while juiciness was recorded highest in the T₂ group. The overall acceptance scores were also significantly ($p < 0.05$) higher in treatment groups compared to T₀ and T₁, indicating better consumer preference for meat from these groups. The significant improvements in sensory attributes such as color, flavor, texture, juiciness, and overall acceptance observed in broiler meat from groups supplemented with bamboo leaf powder (BLP) could be attributed to several factors. BLP is rich in flavonoids and other bioactive compounds that possess potent antioxidant properties. These antioxidants could help to reduce lipid oxidation in meat, leading to better preservation of color and flavour (Kamboh et al., 2018). The presence of bioactive molecules, particularly flavonoids, in bamboo leaves could contribute to extending the shelf-life of broiler meat by reducing lipid oxidation (Islam et al., 2024). Additionally, the antioxidative effects contributed to improved meat texture and juiciness by maintaining cellular integrity and reducing protein degradation. The present finding was in accordance with Cao et al., (2023), who noted that supplementing broiler diets with bamboo leaf flavonoids (BLFs) at the level of 50 or 250 mg kg⁻¹,

significantly enhanced meat texture profile and improved sensory attributes such as tenderness and juiciness.

At day 42, haemato-biochemical parameters showed no significant ($p > 0.05$) differences among groups (Table 8). Haemoglobin, RBC, WBC, and PCV levels were similar across all groups. Total protein, uric acid, ALT, AST, and creatinine levels also did not differ significantly ($p > 0.05$) between treatment and control groups.

The mean values of haematological parameters comprising of haemoglobin levels, red blood cell (RBC) count, white blood cell (WBC) count, and packed cell volume (PCV) estimated on 42nd days of age, showed no significant ($p > 0.05$) differences among the different treatment groups. These findings suggested that bamboo leaf powder (BLP) supplementation did not negatively impact the blood profile of broilers, indicating BLP supplementation is safe and does not alter physiological homeostasis. A comparable finding was reported by Ayeni et al., (2022), who observed that incorporating avocado-bamboo composite leaf meal into broiler chicken diet did not show any changes to the haematological parameters, indicating no negative impact on the blood components of the broilers. Similar conclusions were also drawn by Okeniyi et al., (2023) who reported that the haematological values of broiler chickens fed bamboo leaf meal (BLM) remained within the normal range for healthy birds, indicating no adverse effects on their health. Contradicting the present findings, Fathurrahman et al., (2022) reported that supplementation of bamboo leaf extract at the rate of 500 ppm in diet of broiler chicken effectively lowered the heterophil to lymphocyte (H/L) ratio.

The mean values of biochemical parameters comprising of serum total protein, uric acid, alanine transaminase (ALT), aspartate transaminase (AST) and creatinine studied on 42nd days of age, did not differed significantly ($p > 0.05$) among the different treatment groups. The present findings suggested that dietary BLP supplementation did not negatively impact

liver and kidney function. The stable levels of ALT and AST indicated that hepatic integrity was not compromised, while consistent uric acid and creatinine levels suggested that renal function remained unaffected. The enzymes viz. ALT and AST are secreted by the liver and their levels in serum act as indicators of liver health in birds. Further, the serum urea, creatinine and uric acid levels indicate the function and health of the kidneys in birds (Lierz 2003). Additionally, the steady serum total protein levels across all groups indicated that protein metabolism and overall nutritional status were well maintained. The results of the present study aligned with Kim et al., (2011) who found no significant differences in the blood biochemical parameters among the various treatment groups of broiler chickens supplemented with 0.5% bamboo charcoal (BC) and bamboo leaf (BL) in their diet for 30 days. Contrary to the present findings, Shoura et al., (2024) observed that incorporation of fermented bamboo powder increased total protein (TP) levels and improved liver function by reducing the AST/ALT ratio ($p < 0.05$). It also significantly ($p < 0.05$) decreased urea concentration, while creatinine levels remained unaffected.

4. CONCLUSION

Adding bamboo leaf powder (BLP) to broiler feed could improve the growth better by improving how they digest and use their food. This might be due to flavonoids present in the bamboo leaves. Broilers fed with BLP also had better meat yield and overall meat quality. It did not harm their blood health, so BLP could safely be used in broiler diets up to 0.75%.

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