




Effect of Dietary Supplementation of Amla (*Phyllanthus emblica*, Syn. *Emblica officinalis*) on Growth and Health of Commercial Broiler Chicken (*CARIBRO Dhanraja*)

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ABSTRACT

The present research work was performed at Rathindra Krishi Vigyan Kendra, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, Birbhum, West Bengal, during February–April 2022. The objective of the present study was to explore the effect of dietary supplementation of amla (*Emblica officinalis*) on the health and growth of broiler chicks (*CARIBRO Dhanraja*). A total of thirty-six (36) one-day old chicks were randomly distributed into three dietary treatment groups with three replicates for each treatment group and four birds in each replicate to conduct the proposed study. The three experimental dietary treatments were, Control group, fed with standard diet, i.e., without amla (*E. officinalis*) supplementation (T₁), Test groups, fed with 1.5% amla (*E. officinalis*) supplemented diet (T₂) and 2.5% amla (*E. officinalis*) supplemented diet (T₃). From the results, the highest average body weight, highest weekly average body weight gain and better Feed Conversion Ratio were observed in T₂ followed by T₃. It was found that serum SGPT/ALT, SGOT/AST and ALP levels were found to be highest in the control group (T₁), and were significantly reduced in amla-supplemented groups, least levels were observed in the T₃ group. There was no significant difference observed in dressing yield among the treatments. However, in some carcass parameters, a significant difference was observed among the groups with different treatments. From the above study, it could be concluded that feed supplemented with amla (*E. officinalis*) improved the health and growth of the broiler chicken, which is economically profitable to the poultry farmers.

KEYWORDS: Broiler chicken, *CARIBRO Dhanraja*, dietary supplementation, *Emblica officinalis*

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1. INTRODUCTION

Broilers are major source of poultry meat which is the best source of high-quality protein with least fat as they are the most efficient converters of feedstuffs to protein. Broilers are raised solely for meat purpose, up to six weeks of age. The producer's major goal is to improve feed efficiency, growth rate, and disease resistance. Performance of broilers varies according to agroclimatic zones in different regions. Improvement in broiler production would not have been possible without major improvements in nutrition. Several studies have been conducted by various researchers to determine the effect of different feed additives on FCR, growth performance, and disease resistance. Antibiotics, enzymes, hormones, prebiotics, probiotics, herbal items, and other feed additives are used as growth stimulants in chicken production (Samarth et al., 2002). Antibiotics, the most regularly used feed additives, cannot be used indefinitely due to the risk of drug resistance and health problems in humans as a result of residual effects across the food chain (Botsoglou and Fletouris, 2001). To address customer concerns about safety and toxicity, natural ingredients such as herbs, herbal preparations, and other botanicals are favored over artificial chemicals (Makkar et al., 2007). The range of phyto-based feed additives utilized in the poultry is extensive, with disease-prevention capabilities that contribute to immune-boosting and growth-promoting effects. Supplementing these agents in poultry nutrition is primarily intended to promote absorption and assimilation of various nutrients, hence increasing commercial profit margins by lowering feed and production costs (Pandey et al., 2013). Natural Growth Promoters (NGPs) come into play as herbal feed additives in the poultry to stimulate growth and maximize production levels while also protecting the health of customers. Broiler performance is improved by using a dietary herbal growth enhancer, which boosts live weight gain and FCR (Prasad and Sen, 1993, Samarth et al., 2002).

Amla (*Phyllanthus emblica*, syn. *Emblica officinalis*) is a well-known herb in the Indian traditional medicine system of Ayurveda, which is found in tropical and sub-tropical places such as Southeast Asia. Amla has traditionally been used to treat anorexia, indigestion, diarrhea, anemia, and jaundice, as well as a laxative, eyewash, appetite stimulant, and restorative tonic. Amla has immunomodulating, anti-fungal, anti-bacterial, anabolic, anti-hepatotoxic, anti-inflammatory, and hypolipemic effects (Kiritkar and Basu, 1935). Amla fruit is useful in conjunctivitis, inflammation, dyspepsia, ulcerative stomatitis, gastro helicases, cough, diarrhea, dysentery, diabetes, asthma, bronchitis, cephalgia, ophthalmopathy, colic, jaundice, emaciation, cardiac disorder, intermittent fever hepatopathy, hemorrhage, menorrhagia and skin diseases (Anjaria et al., 2002). Polyphenols, flavonoids, alkaloids, gallic acid, Phyllembin,

and hydrolysable tannins are abundant in Amla fruit, which is also a rich source of ascorbic acid (Baby et al., 2017). Significance of amla as a feed ingredient is defined by a slew of medicinally useful chemicals such as flavonoids, phyllembin, vitamin C, gallic acid alkaloids, and tannins. Flavonoids, tannin, and antiscorbutic vitamin, which are found in the highest amounts, boost the antioxidant effect (Kaur and Kapoor, 2002). Phenols, tannins, and saponin have antibacterial effect against both gramme positive and negative microorganisms. Tannins are thought to be more effective at limiting bacterial populations (Saradha and Rao, 2011), it is also regarded as a rich source of amino acids, minerals, and vitamin C (Yokozawa et al., 2007). Amla's curative properties aid in the control of poultry health through immunomodulation growth promotion and antioxidant effect (Priya et al., 2010, Elizabeth et al., 2011).

Due to its wide variety of medicinal qualities documented in traditional Ayurvedic Unani textures, *E. officinalis* was chosen as a feed additive. The current study was designed to determine the effect of dietary supplementation of *E. officinalis* (amla) on health and growth in *CARIBRO Dhanraj* birds.

2. MATERIALS AND METHODS

2.1. Experimental location and weather conditions during the experimental period

The present research work was conducted during February–April 2022 at Rathindra Krishi Vigyan Kendra, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, Birbhum, West Bengal, India. During the experimental period, the maximum temperature was ranged between 28–37°C (average=34°), and the minimum temperature was ranged between 17–27°C (average=23°C). Relative humidity was ranged between 38–85%.

Permission was obtained from the Departmental ethical review board to carry out this experiment. The study protocol was conducted in line with the rules and regulations of the ethical committee.

2.2. Preparation of the amla (*E. officinalis*) powder

Fresh amla fruits were purchased from local market in Sriniketan, Birbhum, West Bengal, India. The amla fruits were first properly cleaned with tap water and wiped with a clean cloth, and were cut into small thin slices in a cleaned tray and dried under the sun for 72 hours. After drying, the dried crunchy pieces are taken from the trays and pulverized in an electric grinder to obtain powder form. To prevent oxidation, it is then stored in an airtight brown-colored bottle until use.

2.3. Selections of birds and dietary treatments

One-day old *CARIBRO Dhanraja* broiler were brought from the Central Poultry Development Organization,



Hyderabad and randomly distributed into three dietary treatment groups (T_1 , T_2 and T_3) with three replicates for each treatment group and four birds in each replicate. From day one to 42 days of age (marketable age), the chicks were reared in a deep litter system with optimal brooding conditions.

The broiler diets, i.e., pre-starter diet, starter diet, and finisher diet (Epic Poultry Feed, West Bengal Livestock Development Corporation Ltd.) were purchased from Loknath Feed Centre, Kirnahar, Birbhum, West Bengal. Birds were fed with the diet according to their age, i.e., pre-starter diet during 1–14 days, starter diet during 15–28 days, and finisher diet during 29–42 days. T_1 group was fed with the standard diet without any amla supplementation, which served as a control, T_2 and T_3 groups were fed with the standard diet supplemented with 1.5% and 2.5% amla powder, respectively.

2.4. Experimental birds' management

Before the experiment started, the poultry house was properly cleaned and disinfected with potassium permanganate and commercial formaldehyde solution (1:10), and dried. Following a proper cleaning with detergent and potassium permanganate ($KMnO_4$) solution at 2:1 ratio, all circular and linear feeders, spout waterers, and chick guards were sterilized.

Rice husk was used to prepare a deep litter system, the house's floor was covered up to 5–6 cm with fully dry and cleaned rice husk. Six different brooder guards were provided for 9 replications of the 3 treatments of chicks. The birds were labeled with distinct colored wool on their leg loosely before putting them into the separated brooder for easy and quick identification. During the brooding stage, adequate light and ventilation were made available. Artificial light was used throughout the brooding period and ensured appropriate photoperiod. The chicks' behaviors were always monitored to see if the given temperature was correct or if it needed to be increased or decreased. To relieve the broiler birds of the heat, an electric fan was utilized inside the house. Fresh, clean drinking water was provided ad-libitum on a daily basis. All experimental birds were immunized against various diseases as per the standard schedule as mentioned in Table 1.

2.5. Body weight and body weight gain measurement

Weight of birds up to the age of 42 days was done on weekly intervals, i.e., up to 6 weeks, using a digital weighing machine. The weekly body weight gain was calculated by subtracting the previous week's body weight from the following week's body weight.

2.6. Feed consumption and calculation of feed conversion ratio (FCR)

The amount of daily feed consumed by each group of

Table 1: Vaccination schedule of experimental birds

Name of Disease	Name of Vaccine	Age of vaccination (day)	Route of administration
Mareks's disease	HVT strain	0-1 st	S/C at neck (at hatchery)
Ranikhet disease	RDV F_1 strain	5-7 th	I/N or I/O
Gumboro disease	IBD vaccine	14 th	I/N or I/O
Gumboro disease	IBD vaccine (booster)	18-21 th	D/W
Ranikhet disease	RDV lasota strain	28 th	D/W

HVT: Herpes virus turkey; RDV: Ranikhet disease virus; IBD: Infectious bursal disease; S/C: Sub cutaneous; I/N: Intra nasal; I/O: Intra ocular; D/W: Drinking water

birds was recorded on a daily basis. For each treatment, the average weekly feed consumption was calculated by deducting the leftover feed during the week from the total feed given during the week. FCR of each treatment was calculated using records on body weight gain and feed consumption during the entire experimental period.

2.7. Blood collection and serum separation

On day-42, blood sample was collected from 6 birds from each treatment (2 birds from each replicate) from the wing vein using a sterile 21-gauge needle. 2 ml of blood was drawn aseptically (without anticoagulant) to a sterilized vial, and allowed to clot at room temperature for 1 h, and centrifuged at 10,000 g for 10 m at 4°C. The serum was collected and kept in a refrigerator for biochemical analysis.

2.8. Biochemical analysis of serum

SGPT (serum glutamate pyruvate transaminase)/ALT (alanine transaminase), SGOT (serum glutamate oxaloacetate transaminase)/AST (aspartate transaminase), and ALP (alkaline phosphatase) were determined using commercial diagnostic kits (Arkray Healthcare Pvt. Ltd., India) by UV-Vis-Spectrophotometer.

2.9. Carcass characteristics

At the end of the 42 days of experiment, 3 birds from each treatment (one bird from each replicate) were picked at randomly and processed for measuring carcass traits viz. live weight, dressed yield, the weight of different cut-up parts such as breast, wings, thighs, drumsticks, and the weight of internal organs including whole giblet, liver, heart, gizzard, gallbladder, and spleen was measured using digital weighing balance. The birds were just given plenty of water and not fed for 12 hours before processing. The live weight

of the birds was measured prior to processing. The dressing percentage was calculated.

2.10. Statistical analysis

The results were expressed as mean \pm S.E. To demonstrate significant differences between the mean values of different treatments, a one-way analysis of variance (ANOVA) was done, followed by a *post-hoc* Tukey test using SPSS software 25.0 version.

3. RESULTS AND DISCUSSION

3.1. Average weekly body weight

Effect of the dietary supplementation of amla (*E. officinalis*) on the growth of birds (*C. Dhanraja*) was determined. The body weight of birds was recorded in weekly intervals in all three treatments, from week 1 to 6. The body weight of birds in all treatment groups (T_1 , T_2 and T_3) was ranged between 39.45–42.70 g bird⁻¹, on day-1. By the end of the experiment, i.e., on week-6, the final body weights of birds among all groups were ranged between 1625.81–1682.50 g bird⁻¹. From the results, it was found that the birds treated with 1.5% amla (*E. officinalis*) powder through diet (T_2) had the highest average body weight (1682.50 g) followed by T_3 group birds treated with 2.5% amla powder (1644.30 g), and the lowest average body weight was found in the control group (T_1) birds receiving normal diet (1625.81 g). The treatment T_2 was significantly higher than others ($p \leq 0.05$). The growth pattern reveals that the most positive effect of amla could be observed at a concentration of 1.5%. No difference was observed between the treatments up to 2 weeks of the experiment. However, from the 3rd week onwards, the difference in the average body weight was clearly seen among the treatments, and as the birds were growing older, the average body weight was found to be significantly different ($p \leq 0.05$) among all the treatments in the 6th week (Figure 1).

A rise in body weight was reported with supplementation of

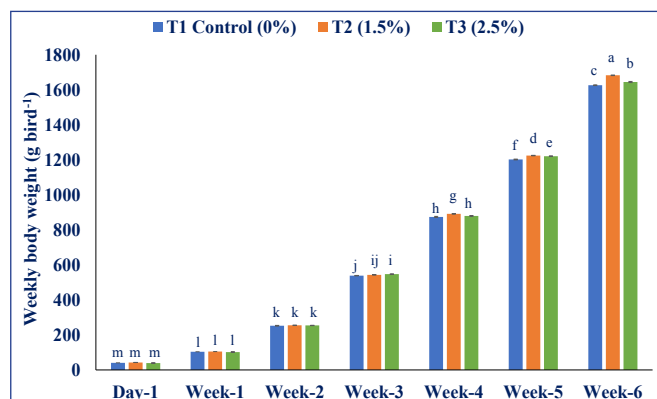


Figure 1: Effect of dietary supplementation of amla on the weekly average body weight of *C. Dhanraja* birds

amla (*E. officinalis*) powder either alone or in combination as an herbal growth promoter at the level of 0.25% (Daisy et al., 2007, Mode et al., 2009, Reddy et al., 2012a, Patel et al., 2016). It was found that supplementing amla powder as an herbal growth promoter increased the body weight significantly (Patil et al., 2012, Chaudhary et al., 2015). These earlier findings were in agreement with our current findings. In contrast to our studies, some research findings mentioned that supplementation with vitamin-C @ 250 mg kg⁻¹ of food and supplementation with *E. officinalis* (amla) up to 20 g kg⁻¹ of diet had no effect on body weight (Nakajothi et al., 2009). Birds treated with amla alone or in combination with probiotics had no significant effect on body weight (Untoo, 2010). The studies above revealed that consuming (*E. officinalis*) amla supplements alone or in combination with other herbal sources did not show any substantial effect on body weight. However, in our study, we found that there was a significant increase in the body weight upon treatment with amla.

3.2. Average weekly body weight gain

The effect of dietary supplementation of amla on the average weekly body weight gain of *C. Dhanraja* was shown in Figure 2. The mean body weight gain for T_1 , T_2 and T_3 treatments were 63.35 g, 62.46 g and 62.88 g, respectively on the 1st week, and 384.28 g, 458.40 g and 423.74 g, respectively on the 6th week. The maximum body weight gain was shown in T_2 group that received 1.5% amla-supplemented diet (458.40 g), followed by T_3 and T_1 groups that received 2.5% amla-supplemented diet and normal diet, respectively. The treatment T_2 was significantly better than both T_3 and T_1 ($p \leq 0.05$). On the other hand, T_3 also has shown better weight gain than the T_1 control group. There was no difference observed between the treatments up to 2 weeks. However, from the 3rd week onwards, the difference in the average body weight gain was clearly seen among the treatments, and as the birds were growing older. The average

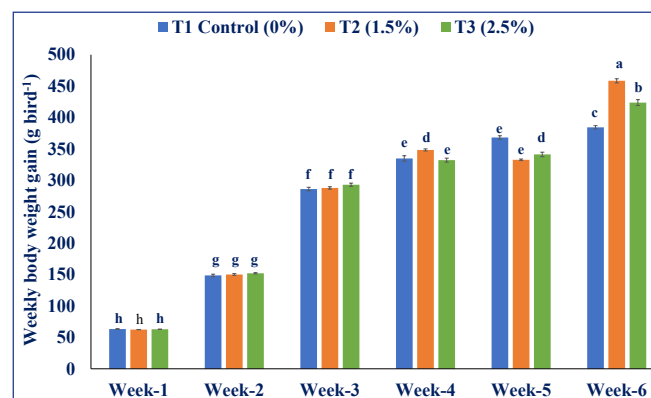


Figure 2: Effect of dietary supplementation of amla on average weekly cumulative body weight gain (g bird⁻¹) of *C. Dhanraja* birds

body weight gain was found to be significantly different ($p \leq 0.05$) among all the treatments in the 6th week (Figure 2).

Reddy et al. (2012a) reported that, addition of 0.25% herbal combination in broiler feed has significantly increased the average body weight gain than control groups. Patel et al. (2016) reported that, average body weight gain at the end of the 6th week in the 0.4% amla-treated group was significantly higher than the other groups. Tangade (2007) reported that the inclusion of herbal (amla powder) and vitamin-C (amla) @ 200 mg kg⁻¹ of feed in broiler ration significantly improved the mean body weight gain than other groups. These research studies showed a significant increase in average body weight gain in commercial broilers fed with *E. officinalis*, and are in agreement with our current findings.

3.3. Weekly cumulative feed intake

Throughout the experiment, feed intake of experimental broiler chicks was measured daily and summed up and represented as weekly cumulative feed intake. Figure 3, shows the average weekly feed consumption of broiler chicks. From the analysis, it was noticed that the feed consumption has significantly and gradually enhanced from the 1st week to the 6th week. On the 1st week, the average weekly feed consumption group⁻¹ was ranged between 88.45–83.50 g, and on the 6th week, the average feed intake group⁻¹ was ranged between 1019.65–1032.22 g. Though there was little difference between the treatments in the feed consumption throughout the 6 weeks, these differences were not at all significant.

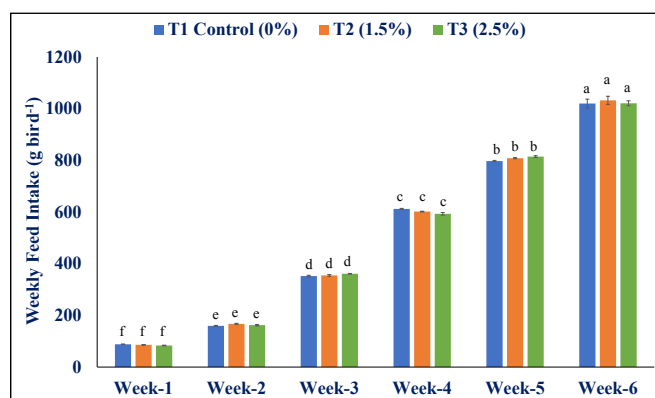


Figure 3: Effect of dietary supplementation of amla on the average weekly feed intake of *C. Dhanraja* birds

It was reported that, amla (*E. officinalis*) supplemented dietary treatments showed a decrease in feed consumption than control (Wadhwa et al., 2007, Chaudhary et al., 2015, Kumari et al., 2012, Kumar et al., 2013, Gaikwad et al., 2016]. It was also reported that, adding *E. officinalis* to the diet considerably increased feed consumption compared to the control group (Tangade, 2007, Ghavate et al., 2009, Reddy et al., 2012b). However, in our study, we found no significant difference in the weekly feed consumption

among the control and treatments. Similar results in feed consumption were reported by other researchers. It was reported that supplementation of amla did not influence feed consumption considerably up to the sixth week (Patel et al., 2016, Patil et al., 2014, Lohakare et al., 2005). No significant differences were found in weekly feed consumption between groups treated with synthetic and natural vitamin C sources (Ghule, 2010). These small insignificant differences could be attributed to varying amla powder doses in the ration.

3.4. Feed conversion ratio (FCR)

The FCR for the entire 42 days of the experiment was 1.89, 1.81 and 1.846 for T₁, T₂ and T₃ treatments, respectively. The FCR was found to be least in T₂ and highest in T₁. It was found that dietary supplementation of amla has reduced the FCR, which is a positive sign for the poultry farmers. From the results, it was found that the birds fed with amla-supplemented diets (T₂ and T₃) showed superior FCR compared to the birds that were fed with a normal diet without amla supplementation (T₁). The improved performance and FCR found in *E. officinalis* supplemented groups might be explained due to antioxidant characteristics of bioactive ingredients such as ascorbic acid, polyphenols, flavonoids, tannic acid and gallic acid (McDowell, 1989). The benefits of phyto-based additives on growth performance can be explained by their antioxidant properties, immune-stimulating activity, stimulation of gastric juice, protection and maintenance of gut congenial microflora, and suppression of harmful microbes (Hashemi and Davoodi, 2011).

Several other researchers have reported that, amla (*E. officinalis*) powder-supplemented groups, whether alone or in combination with other herbal mixtures, showed lower FCR than the control group (Nakajothi et al., 2009, Kumari et al., 2012, Kumar et al., 2013, Reddy et al., 2012b, Mandal et al., 2017, Dhore et al., 2014, Maini et al., 2007). These reports were in agreement with our present findings. However, in contrast to our present results, it was reported that FCR remains same or approximately equal in amla (*E. officinalis*) fed groups and control group, and no significant difference was found (Patel et al., 2016, Patil et al., 2014].

3.5. Serum biochemical parameters

From the results, it was shown that the dietary supplements of amla (*E. officinalis*) had a substantial impact on blood SGPT/ALT, SGOT/AST, and ALP levels (Figures 4a–c). Dietary supplementation of amla has significantly reduced these levels than in the control. This indicates the healthiness of the birds in the amla-treated group. This also indicate that supplementation of amla has reduced the stress of the birds. SGPT/ALT, SGOT/AST, and ALP levels in amla-treated groups (T₂ and T₃) were always lower than the control group (T₁), which was not treated with amla. SGPT/

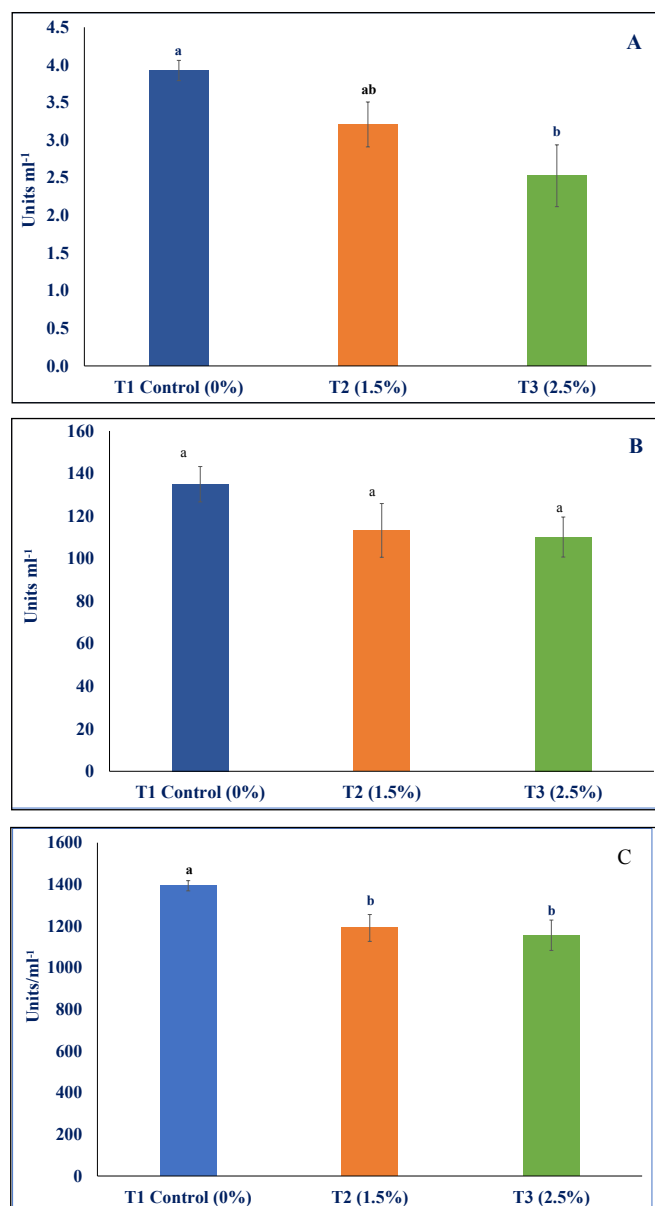


Figure 4: Effect of dietary supplementation of amla on serum (A) SGPT/ALT level, (B) SGOT/AST level, (C) ALP level in *C. Dhanraja* birds

ALT, SGOT/AST, and ALP levels were always highest in the T₁ control group, and found to be least in the T₃ group, whereas T₂ lies in between. These differences were found to be significant ($p \leq 0.05$) in most of the cases, but in few cases it was shown not significant (though there was a great difference), this may be due to the smaller sampling size.

Relevant to our observations, it was reported that supplementation of herbal feed additives with prominent ingredient like amla (*E. officinalis*) led to improvements in serum ALP and SGPT levels, and unaltered levels of serum protein and SGOT in all treatment groups (Vidhyarthi et al., 2008). Supplementation of amla powder

in broiler chicks had shown significant impact on the serum biochemical parameters such as total serum protein, SGPT/ALT and SGOT/AST levels (Begum et al., 2019). It was reported that supplementation of herbal feed containing *E. officinalis* (amla) showed better impact on SGOT and ALP parameters than the control group (Patankar et al., 2011). It was observed that alkaline phosphatase (ALP) levels in broiler chicks significantly differed upon dietary supplementation of vitamin-C (Kumar et al., 2014). All these research findings are in agreement with our current results. However, in contrast to our results, it was reported that supplementation with herbals such as amla (*E. officinalis*), either individually or in combination, had no significant effect on the blood SGPT/ALT, SGOT/AST and serum cholesterol levels (Reddy et al., 2012b).

3.6. Carcass characteristics and organ parameters

The dressing yield of T₁, T₂ and T₃ were 70.68%, 71.05% and 70.60%, respectively. There was no significant difference found between the treatments. However, dietary incorporation of amla showed a significant impact on wing yield, breast yield, thigh yield and drumstick yield.

The wing yield of the birds ranged from 127.15 g to 134.93 g in different groups. The highest wing weight was found in T₁ (134.93 g), followed by T₃ (131.95 g) and T₂ (127.15 g) groups (Figure 5). The breast yield ranged from 336.83 to 375.81 g. The highest breast weight was found in the T₂ group that was supplemented with 1.5% of amla (375.81 g), followed by T₃ (360.21 g) and T₁ (336.83 g) groups (Figure 5). The thigh yield of birds varied from 196.86 g to 210.26 g among all the groups. The maximum thigh weight was observed in T₂ (210.26 g), followed by T₃ (203.07 g) and T₁ (196.86 g) treatments (Figure 5). The drumstick yield varied from 155.67 g to 166.24 g. The highest thigh weight (g) was reported in T₂ (166.55 g), followed by T₃ (160.55 g) and T₁ (155.67 g) treatments (Figure 5).

On day-42, the weight of various essential organs such as the heart, liver, gizzard, gallbladder, and spleen of the

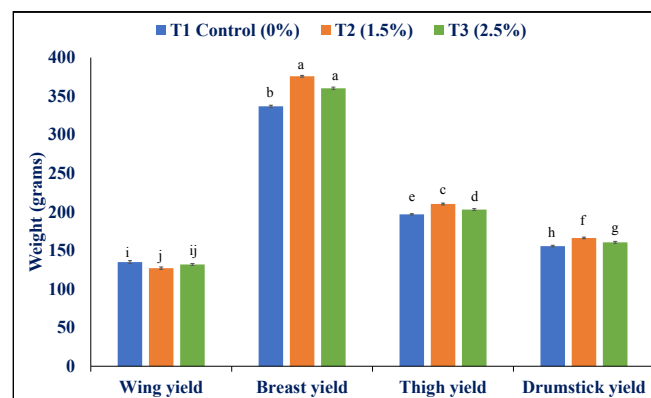


Figure 5: Effect of dietary supplementation of amla on carcass characteristics in *C. Dhanraja* bird

birds were measured, and represented in Figure 6. The heart weight of T₁, T₂ and T₃ were 9.71 g, 10.39 g and 10.19 g, respectively. The heart weight was observed to be highest in T₂ (10.39 g) group, followed by T₃ (10.19 g) and T₁ (9.71 g) groups (Figure 6). However, these differences do not seem significant. The liver weight varied from 36.82 to 41.09 g among all the treatments. The highest liver weight was found in T₂ (41.09 g) group followed by T₃ (39.70 g) and T₁ (36.82 g) groups. From the analysis, there was significant difference ($p \leq 0.05$) between T₁ and T₂ groups, whereas there was no significant difference between T₁ and T₃, and T₂ and T₃ groups (Figure 6). The gizzard weight of T₁, T₂ and T₃ were 67.12 g, 68.96 g and 67.97 g, respectively. The maximum gizzard weight was noticed in the T₂ group (68.96 g), followed T₃ (67.97 g) and T₁ (67.12 g) groups. There was no significant difference found between the groups (Figure 6). The gallbladder weight of T₁, T₂ and T₃ were 1.46 g, 1.27 g and 1.52 g in all the treatments. There was a significant difference found among all the groups (Figure 6). The spleen weight of T₁, T₂ and T₃ were 1.64 g, 1.98 g and 1.83 g, respectively. Among all the groups, spleen weight was significantly different (Figure 6).

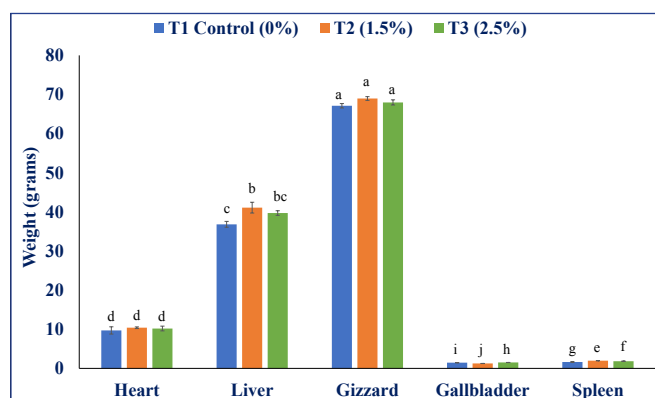


Figure 6: Effect of dietary supplementation of amla on organ parameters in *C. Dhanaraja* birds

Similar results were observed by other research findings, the dressing percentage was highly significant in birds supplied with Ayucee herbal product and Vit-C (amla powder) supplemented group in compared to control (Kumar et al., 2014). The usage of herbal combinations, including amla (*E. officinalis*) as an essential component, reduces abdomen fat and improves dressing percentage, spleen weight, liver weight, and whole giblet weight (Eevuri and Putturu, 2013). Broilers' giblet and dressing production is increased when amla and turmeric powder are added to their basic diet (Singh et al., 2007). It was found that groups treated with phyto-active feed additives that included amla (*E. officinalis*) as the primary ingredient had higher dressing and liver percentages on a pre-slaughter weight basis (Kurkure et al., 2002).

However, in contrary to our result, it was found that neither amla (*E. officinalis*) alone nor a blend with multiple herbal additives did not significantly change the carcass features or abdominal obesity in birds (Chaudhary et al., 2015, Kumari et al., 2012, Reddy et al., 2012b). Except for a noticeable decrease in abdomen fat percentage based on the addition of herbal Vitamin-C, values of carcass parameters showed no significant changes in birds (Dhore et al., 2014). Ascorbic acid supplementation had no appreciable impact on the features of avian carcasses (Pardue et al., 1985).

4. CONCLUSION

Dietary supplementation of amla powder (*E. officinalis*) has improved the growth of the birds by reducing the FCR, and also improved the health of the birds by reducing the serum SGPT/ALT, SGOT/AST and ALP levels. As the dietary supplementation of amla (*E. officinalis*) has improved the growth and health of the broiler chicks, farmers may adopt this to get better quality and profitable production in the poultry industry.

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