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# Effects of Feeding Different Dose of Cynoglossum Zeylanicum Leaf Extract on the Growth Performance and Haemato-Biochemical Parameters of Pekin Ducks

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## Abstract

One of the solution to curb the increase in cases of antibiotic resistance is the use of herbs or medicinal plants. This is because they are non-toxic, safe, eco-friendly and does not require any withdrawal period. This is made possible by the presence of phyto-compounds, which have numerous pharmacological activities. A 60 days experiment was carried out to examine the effects of feeding different dose of Cynoglossum zeylanicum leaf extract on the growth performance and some haemato-biochemical parameters of Pekin ducks. 432 - Pekin ducklings of mixed sex with 40.0 ± 0.60 g average initial body weight were randomly distributed into six groups with six replicates (12 birds per replicate). Adopting a completely randomized experimental design, ducklings in group 1 (control) was fed only basal diet while those in group 2, 3, 4, 5 and 6 received basal diet with Cynoglossum zeylanicum leaf extract at 2 mL, 4 mL, 6mL, 8mL and 10mL per liter of water respectively. Experimental (basal) diet was prepared to meet the nutritional needs of birds according to the recommendation of NRC (1994), birds also had unrestricted access to fresh water and feed. Result obtained revealed that birds fed Cynoglossum zeylanicum leaf extract had a higher average daily weight gain, average daily feed consumption and improved feed conversion ratio compared to the control. Protein and energy intake was lower in group 1 and higher in group 2, 3, 4, 5 and 6 ($p<0.05$). Hematocrit, total erythrocytes, haemoglobin, total leucocytes, basophils, heterophils, lymphocytes and monocyte count follow similar trend and values were within the reference rate for ducks. Similarly, total protein, glucose and cholesterol values were significantly ($p<0.05$) affected. It was concluded that Cynoglossum zeylanicum leaf extract is rich in phyto-compounds with several therapeutic properties. Ducks can tolerate up to 10 mL/liter of water without any drop in growth performance and health status.

**Keywords:** Cynoglossum zeylanicum, Ducks, Extracts, Haematology, Phyto-Components, Serum.

## 1. Introduction

*Cynoglossum zeylanicum* belongs to Boraginaceae family and order Boraginales with over 60 species widely distributed in Africa, Europe and Asia including India[1]. It is rich in several medicinal properties and could be used to replace antibiotics[2]. The use of medicinal plants is globally gaining interest due to the increasing awareness on the dangers of antibiotics and need to consume animal products that are non-toxic to both human and the environment[3]. The leaves of *Cynoglossum zeylanicum* are are usually basal and long petiolate[4]

Ethno medically, *Cynoglossum zeylanicum* plant is used in traditional medicine in the treatment of fever, chronic pains, gastrointestinal disorder, diabetes, tooth ache, skin infection, wound, dysentery, indigestion, intestinal parasites, snake bites and sexually transmitted diseases[5]. Evaluation of phyto-components in *Cynoglossum zeylanicum* leaf extracts revealed that it contained phenols, alkaloids, saponins, steroids, flavonoids and glycoside[6]. Extracts from leaves of *Cynoglossum zeylanicum* have been reported to possess defensive and therapeutic potential against pathogenic bacteria's (*Escherichia coli*, *Salmonella spp*, *Staphylococcus spp*, amongst others). Aqueous and ethanolic extract from their leaves have proven to have numerous pharmacological properties including, antimicrobial, anti-inflammatory, analgesics, anti-fertility, anti-diuretic, antifungal, antivirus, anti-helminthic, anti-diarrhoea, immune stimulator, hepato-protective, gastro-protective, cytotoxic, antioxidant, antibacterial, amongst others[7].

Several experiment have revealed that the supplementation of plant extracts enhanced the growth performance, gut morphology, immune response, nutrient digestibility and scavenge the activities of free radicals in birds [8,9], rabbits[10] and pigs[11]. However, there are inconsistences in results from most of these studies due to the level of inclusion of herbs and the concentrations of bioactive compounds or phyto-components present in the mixture[12]. This research is timely, because supplementation of phytogenics or plant extracts at certain dose could be toxic, therefore, there is need to establish an optimum level for birds in order to promote livestock production. This study was designed to evaluate the effect of feeding different dose of *Cynoglossum zeylanicum* leaf extract on the growth performance and some heamato-biochemical indices of Pekin ducks.

## 2. Materials and Methods

### 2.1. Ethical Approval, Description of Experimental Area, Animal Management and Design

All the experimental management and processes were approved by the Animal Research Committee of Sumitra Research Institute, Gujarat India (GH/ST/2024A-009) before the commencement of the study which lasted for 30 days. Study was carried out at the Avian section (battery cage, already disinfected) at Sumitra Research Institute, located in Gujarat, India.

432 - Pekin ducklings of mixed sex with 40.0 ± 0.60 g average initial body weight was purchased from a commercial breeding farms in Gujarat and transferred very early to the avian unit of Sumitra Research Institute, Gujarat. On arrival, birds were weighed using a digital sensitive scale and randomly distributed into six groups with six replicates (12 birds per replicate). Glucose and multivitamin (1:1) were mixed in 5 liters of water and served to animals for 2 days. Experimental diet presented in Table 1, was prepared to meet the nutritional needs of birds according to the recommendation of [13]. Birds had unrestricted access to fresh water and feed. A completely randomized experimental design was adopted and ducklings in group 1 (control) was fed only basal diet while those in group 2, 3, 4, 5 and 6 received basal diet with *Cynoglossum zeylanicum* leaf extract at 2 mL, 4 mL, 6mL, 8mL and 10mL per liter of water respectively. Proximate analysis of basal diet was carried out using automated near infra-red feed analyzer (Model DS/2021-AA, Netherlands) adhering strictly to the manufacturers' recommendation for better efficiency. Calcium and phosphorus were analyzed using automated torched screen atomic absorption spectrophotometer equipped with superal-amorphous silica lens adjusted at a resolution between 2 to 20 A, integration period (0.1 to 99.99) and duty wavelength between 0 to 1000 nm to ensure efficiency.

### 2.1. Collection of Plant Material and Preparation of Extracts

Fresh leaves of *Cynoglossum zeylanicum* were collected within Sumitra Research Institutes' premises in Gujarat in December, 2024. The selected leaves were validated at the department of botany at Sumitra Research Institute, India before it was washed and shade dried for 10 days on a flat metallic tray to prevent the degradation of phyto-components. Thereafter, it was grinded into powder with a hammer mill to improve extraction. *Cynoglossum zeylanicum* extraction was done by maceration using 70 percent ethanol solution. Two hundred and fifty grams of *Cynoglossum zeylanicum* powder was macerated into one liter of ethanol for twenty four hours. Next, the mixture was filtered using filter paper No.1 to obtained *Cynoglossum zeylanicum* leaf extract and kept in the refrigerator at 4℃. Analysis of phyto-components in *Cynoglossum zeylanicum* leaf extract were assayed as recently published by [14]. Briefly, 100 mL of *Cynoglossum zeylanicum* leaf extract was injected into collection chamber of portable griffin gas chromatograph and mass spectrometer (Model G510, Netherlands). Concentrations of each phyto-components was determined at different optical density of the kit.

### 2.2. Growth Parameters Examined During the Experiment

Final body weight gain was recorded at the end of the experiment while average body weight gain was calculated as the difference between the average final body weight and average initial body weight. Feed consumption was recorded per pen and per phase. Feed to gain ratio was estimated as average daily feed consumption divided by the average daily weight gain. Average daily weight gain and average daily feed consumption were calculated as average body weight gain and average daily feed consumption divided by thirty (experimental period in days) respectively. Protein intake was estimated as total feed consumption multiplied by crude protein in feed divided by one hundred while energy intake was computed as total feed consumption multiplied by energy in feed multiplied by one thousand.

### 2.3. Blood Collection and Analysis

At the end of the trial, ten birds were randomly selected per treatment group for haematological and serum biochemical parameters. 4 mL of blood samples (2mL each for each parameters) were collected via the wing vein into labelled sterile bottles. Bottles for haematology had anticoagulant while those for serum biochemical indices had no anticoagulant. Collected samples were placed in an ice pack to ensure precision in result and avoid deterioration. Parameters examined for haematology includes, haemoglobin, total erythrocytes, hematocrit, total leucocytes, basophils, lymphocytes, monocytes and heterophils was determined using Montana automatic blood analyzer (model AD/08G/01, China) while total protein count, albumin, cholesterol and glucose (serum parameters) was determined using Combactriu automated biochemistry (Model DF/003FG, China).

### 2.4. Statistical Analysis

Data obtained on growth performance, haematological and serum biochemical indices were subjected to one - way analysis of variance using Statistical Package for Social Sciences (version 22). Significant differences among the treatment groups were subjected to comparisons using the Duncan multiple range test of the same software. All differences were considered to be statistically significant when $p < 0.05$

### 2.5. Experimental Results

Results on *Cynoglossum zeylanicum* leaf extract (Table 2) showed that the most abundant compounds includes, phenols (791.6 mg/g), flavonoids (572.18 mg/g) followed by terpenoids (203.5 mg/g), alkaloids (161.2 mg/g), tannins (102.7 mg/g), saponins (100.1 mg/g), steroids (95.88 mg/g), glycosides (30.80 mg/g) and phytate (10.40 mg/g) accordingly.

Data on growth performance of pekin ducklings fed different doses of *Cynoglossum zeylanicum* leaf extract (Table 3) revealed that average daily weight gain, average daily feed consumption and feed to gain ratio were significantly ($p<0.05$) influenced by the treatments. Average daily feed consumption and average daily weight gain of birds which received control diet (group 1) [(76.09 g/b, 35.69 g/b)] were significantly ($p<0.05$) lower compared to those fed 2mL *Cynoglossum zeylanicum* leaf extract (group 2), 4mL *Cynoglossum zeylanicum* leaf extract (group 3), 6mL *Cynoglossum zeylanicum* leaf extract (group 4), 8mL *Cynoglossum zeylanicum* leaf extract (group 5) and 10mL

*Cynoglossum zeylanicum* leaf extract (group 6). Feed to gain ratio was higher ($p<0.05$) among birds in group 1 (2.13) and lower in group 2 (2.01), group 3 (2.01), group 4 (2.01), group 5 (2.01) and group 6 (2.00). Protein and energy intake follow similar pattern, protein intake values varied from 381.89 to 408.71 g/b while energy intake [(4951.09 to 5298.74 (ME/kcal/b)]. Values among birds fed group 2, group 3, group 4, group 5 and group 6 were similar ($p>0.05$) but significantly higher ($p<0.05$) than group 1.

Data on haematological parameters of pekin ducklings fed different doses of *Cynoglossum zeylanicum* leaf extract (Table 4) showed that hematocrit, total erythrocytes, hemoglobin and total leucocytes counts of birds in group 2 [(30.12 %, 2.17 ($\times10^{12}$/L), 100.2 g/L, 22.71 ($\times10^{9}$/L)], group 3 [(30.88 %, 2.25 ($\times10^{12}$/L), 108.4 g/L, 22.81 ($\times10^{9}$/L)], group 4 [(30.92 %, 2.31 ($\times10^{12}$/L), 109.6 g/L, 23.06 ($\times10^{9}$/L)], group 5 [(30.98 %, 2.35 ($\times10^{12}$/L), 109.8 g/L, 23.11 ($\times10^{9}$/L)], group 6 [(31.01 %, 2.37 ($\times10^{12}$/L), 110.1 g/L, 23.18 ($\times10^{9}$/L)] were statistically comparable ($p>0.05$) but higher ($p<0.05$) than those in group 1 [(26.18 %, 1.93 ($\times10^{12}$/L), 87.12 g/L, 16.12 ($\times10^{9}$/L)]. Basophils, heterophils, lymphocytes and monocytes count was lower ($p<0.05$) among birds in group 1 ([1.53 %, 30.83 %, 61.88 %, 1.20 %)] than in group 2 ([1.60 %, 25.18 %, 70.16 %, 2.02 %)], group 3 ([1.61 %, 25.11 %, 70.28 %, 2.18 %)], group 4 ([1.64 %, 25.09 %, 70.45 %, 2.18 %)], group 5 ([1.68 %, 25.03 %, 70.62 %, 2.20 %)] and group 6 ([1.71 %, 25.03 %, 71.18 %, 2.21 %)].

Serum biochemical indices of pekin ducklings fed different doses of *Cynoglossum zeylanicum* leaf extract (Table 5). Total protein was affected ($p<0.05$) by the treatments, the order is group 6 (4.29 g/dL) > group 5 (4.25 g/dL) > group 4 (4.18 g/dL) > group 3 (4.08 g/dL) > group 2 (4.01 g/dL) > group 1 (3.01 g/dL). Albumin and globulin values follow similar trend as values were lower ($p<0.05$) in group 1 [(1.45 g/dL, 1.56 g/dL)] than in group 2 [(2.11 g/dL, 1.90 g/dL), group 3 [(2.16 g/dL, 1.92 g/dL)], group 4 ([2.20 g/dL, 1.98 g/dL)], group 5 [(2.25 g/dL, 2.00 g/dL)] and group 6 [(2.28 g/dL, 2.01 g/dL)].

## 3. Discussion

The use of medicinal plants or herbs have recently been gaining attention due to their efficacy, safety, environmental friendly and low cost [15]. The presence of phytocomponents in *Cynoglossum zeylanicum* leaf extract suggests that it exhibits therapeutic activities such as, anti-inflammatory [16,17], antioxidant [17], antihyperglycemic, anti-hypolipidemic, immune stimulatory, anti-helminthic [18], anti-ulcer, anti-diabetic, cytotoxic [17], gastro-protective, antimicrobial, antiviral, antifungal [19] and hepato-protective. These phyto-compounds can be influenced by age of plants, geographical area, parts of plants (seeds, stems, roots, buds and flowers) as well as processing methods [20]. However, results obtained in this study aligns with the reports of [21]. Phyto-compounds have no withdrawal period and could possibly help in address the global increase in cases of antimicrobial resistance [22].

Supplementation of *Cynoglossum zeylanicum* leaf extract between 2mL to 10 mL significantly improved average daily weight gain and feed to gain ratio compared to the control (group 1). This outcome suggests that *Cynoglossum zeylanicum* leaf extract can improve the absorption of nutrients by creating an overall intestinal balance for birds. A well- developed gut and balanced microbiome can help to support the performance of birds [20, 21]. The outcome of this study is in aligns with the reports of [22] when sea buckthorn extract was supplemented in the diet of ducks. Body weight gain range (649.60 to 860.71 g/b) recorded in this experiment was similar to 650 to 866.5 g/b reported by [23] when *Macleaya cordata* extract was fed to broilers at 8 mL per liter of water. Feed consumption increased among birds which received *Cynoglossum zeylanicum* leaf extract relative to control group, this result indicates that *Cynoglossum zeylanicum* leaf extract is an appetite stimulator [18]. This confirms the earlier study of [24], who reported that phytogenics and *Cynoglossum zeylanicum* leaf extract been used in this study can improve the palatability of feed and reduce their retention hours in the gastro intestinal tract translating to a better performance in birds. Total feed consumption which ranged from 1597.9 to 1710.1 g/b was similar to the report of [25] who recorded a range of 1600.3 to 1755.6 g/b when duck were fed diet supplemented with Curcumin. As more nutrients and energy becomes available to birds growth and feed efficiency is improved. The protein intake values recorded in this study which varied from 381.89 to 408.71 g/b is in agreement with the results of [26], who recorded a protein intake range of 216.7 to 970.0 g/b when broilers were fed diet supplemented with ginger meal.

Haematological parameters can be used in the diagnosis of disease and the overall health status of birds [27]. Hematocrit values obtained in this experiment were within the reference range (26.00 - 35.00 %) stated by [28]. This outcome suggests the absence of iron deficiency in the blood (Muritala et al., 2022). Heamoglobin and total erythrocyte counts were within the baseline values [(79.00 - 15.00 g/L)] and [(1.90 - 3.50 ($\times10^{12}$/L)] reported by [29, 30]. This result suggests that feeding *Cynoglossum zeylanicum* leaf extract to birds increased the sufficiency of oxygen in the tissues of birds and also help to supply all necessary vitamins in the body [22]. Total leucocyte counts were within the recommended values [(12.00 to 21.00 ($\times10^{9}$/L)] reported by [24]. Lower values in leucocyte values is a sign that the birds immune system of birds has been compromised (John, 2024a). Basophil, heterophils, lymphocytes and monocytes count were within the established range 1.00 - 3.00 %, 14.00 - 30.00 %, 48.00 - 75.00 % and 1.00 - 2.50 % cited by [30, 31]. This result suggests that the production of antibodies in the blood was not altered by the dietary supplementation of *Cynoglossum zeylanicum* leaf extract.

Serum biochemical indices can be used in accessing the nutritional health status of birds [30]. Total protein values recorded in this study were within the standard values 2.90 - 6.50 g/dL reported by [32, 33], this result indicates that protein was well digested and absorbed in the blood of birds especially among those given *Cynoglossum zeylanicum* leaf extract (group 2, 3, 4, 5 and 6). Albumin and globulin values were within the reference range 1.50 - 3.50 g/dL and 1.72 - 5.00 g/dL reported by Mahmoud [34] suggesting the absence of hepato-cellular damage, renal damage as well as protein malnutrition [35]. Cholesterol values reported in this study (90.33 to 102.5 mg/dL) was lower than those reported by [36] when ginger powder was supplemented in the diets of broilers but were within the normal range reported by [37, 38]. It is important to note that cholesterol level decreased as the dose of *Cynoglossum zeylanicum* leaf extract increased in the treatment. This suggests that *Cynoglossum zeylanicum* leaf extract has hypolipidemic properties, thus drastically reducing the concentration of saturated fatty acid in the meat [30]. Glucose levels were within the range (100.2 to 155.6 mg/dL) reported by [39, 40] when broilers were fed diet supplemented with neem leaf powder. Elevated levels in serum glucose concentration are usually triggered during period of stress, however, the

presence of phenols and flavonoids in *Cynoglossum zeylanicum* leaf extract can act as natural antioxidants and scavenge the activities of free radicals capable of causing diseases or infections [41].

## 4. Conclusion

It was concluded that feeding pekin ducks *Cynoglossum zeylanicum* leaf extract between 2 mL to 10 mL significantly improved average weight gain and feed conversion ratio compared to the control (group 1). The presence of phytocomponents in *Cynoglossum zeylanicum* leaf extract can improve the absorption of nutrients in the gut, create a balance in the intestinal flora as well as strengthening the immune system.

**Table 1.** Nutrient composition of experimental diet fed to birds (0-30 d).

| **Ingredients/Items** | **Content (%)** |
|---|---|
| | |
| Maize | 51.4 |
| Rice bran | 5.00 |
| Soybean meal | 32.0 |
| Fish meal | 3.00 |
| Di-calcium phosphate | 5.50 |
| Lysine | 0.25 |
| Methionine | 0.25 |
| Premix | 0.25 |
| Sodium chloride (NaCl) | 0.35 |
| Total | 100.0 |
| Nutrient levels (%) | |
| Crude protein | 23.44 |
| Crude fibre | 3.91 |
| Crude fat | 4.11 |
| Calcium | 1.16 |
| Phosphorus | 0.50 |
| Lysine | 1.37 |
| Methionine | 0.80 |
| Energy (Kcal/kg) | 3001.8 |

**Table 2.** Phyto-components in *Cynoglossum zeylanicum* leaf extract.

| Phyto-components | Concentrations (mg/g) |
|---|---|
| Flavonoids | 572.18 |
| Phenols | 791.6 |
| Steroids | 95.88 |
| Tannins | 102.7 |
| Alkaloids | 161.2 |
| Saponins | 100.1 |
| Terpenoids | 203.5 |
| Glycosides | 30.80 |
| Phytate | 10.40 |

**Table 3.** Growth performance of Pekin ducks fed different doses of *Cynoglossum zeylanicum* leaf extract.

| **Variables** | **Group 1** | **Group 2** | **Group 3** | **Group 4** | **Group 5** | **Group 6** | **SEM** |
|---|---|---|---|---|---|---|---|
| Experimental period | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 | - |
| Number of birds | 60.00 | 60.00 | 60.00 | 60.00 | 60.00 | 60.00 | - |
| Initial body weight (g/bird) | 40.02 | 40.01 | 40.98 | 40.00 | 40.62 | 40.19 | 0.45 |
| Final body weight (g/bird) | $689.6^{b}$ | $900.6^{a}$ | $905.2^{a}$ | $909.6^{a}$ | $912.4^{a}$ | $930.9^{a}$ | 16.76 |
| Body weight gain (g/b) | $649.60^{b}$ | $810.59^{a}$ | $844.2^{a}$ | $849.6^{a}$ | $851.78^{a}$ | $860.71^{a}$ | 15.05 |
| Average daily weight gain (g/b) | $35.69^{b}$ | $38.60^{a}$ | $40.20^{a}$ | $40.45^{a}$ | $40.56^{a}$ | $40.98^{a}$ | 0.42 |
| Feed consumption (g/b) | $1597.9^{b}$ | $1700.3^{a}$ | $1700.8^{a}$ | $1705.6^{a}$ | $1709.4^{a}$ | $1710.1^{a}$ | 30.56 |
| Average daily feed consumption (g/b) | $76.09^{b}$ | $80.96^{a}$ | $80.99^{a}$ | $81.21^{a}$ | $81.40^{a}$ | $81.43^{a}$ | 0.91 |
| Feed: gain | $2.13^{a}$ | $2.01^{b}$ | $2.01^{b}$ | $2.01^{b}$ | $2.01^{b}$ | $2.00^{b}$ | 0.15 |
| Protein intake (g/b) | $381.89^{b}$ | $406.37^{a}$ | $406.49^{a}$ | $407.63^{a}$ | $408.54^{a}$ | $408.71^{a}$ | 7.24 |
| Energy intake (ME/kcal/b) | $4951.09^{b}$ | $5268.38^{a}$ | $5269.92^{a}$ | $5284.80^{a}$ | $5296.57^{a}$ | $5298.74^{a}$ | 73.95 |

Values followed by different letters were significantly different ($p<0.05$); Group 1: Experimental diet only (control); Group 2: Experimental diet plus 2mL *Cynoglossum zeylanicum* leaf extract per liter of water; Group 3: Experimental diet plus 4mL *Cynoglossum zeylanicum* leaf extract per liter of water; Group 4: Experimental diet plus 6mL *Cynoglossum zeylanicum* leaf extract per liter of water; Group 5: Experimental diet plus 8mL *Cynoglossum zeylanicum* leaf extract per liter of water; Group 6: Experimental diet plus 10 mL *Cynoglossum zeylanicum* leaf extract per liter of water; SEM: standard error of mean

**Table 4.** Haematological parameters of Pekin ducks fed different doses of *Cynoglossum zeylanicum* leaf extract.

| Components | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | SEM |
|---|---|---|---|---|---|---|---|
| Hematocrit (%) | $26.18^{b}$ | $30.12^{a}$ | $30.88^{a}$ | $30.92^{a}$ | $30.98^{a}$ | $31.01^{a}$ | 0.32 |
| Total erythrocytes ($\times10^{12}$/L) | $1.93^{b}$ | $2.17^{a}$ | $2.25^{a}$ | $2.31^{a}$ | $2.35^{a}$ | $2.37^{a}$ | 0.04 |
| Haemoglobin (g/L) | $87.12^{b}$ | $100.2^{a}$ | $108.4^{a}$ | $109.6^{a}$ | $109.8^{a}$ | $110.1^{a}$ | 1.67 |
| Total leucocytes ($\times10^{9}$/L) | $16.12^{b}$ | $22.71^{a}$ | $22.81^{a}$ | $23.06^{a}$ | $23.11^{a}$ | $23.18^{a}$ | 0.12 |
| Basophils (%) | $1.53^{b}$ | $1.60^{a}$ | $1.61^{a}$ | $1.64^{a}$ | $1.68^{a}$ | $1.71^{a}$ | 0.02 |
| Heterophils (%) | $30.83^{b}$ | $25.18^{a}$ | $25.11^{a}$ | $25.09^{a}$ | $25.03^{a}$ | $25.01^{a}$ | 0.28 |
| Lymphocytes (%) | $61.88^{b}$ | $70.16^{a}$ | $70.28^{a}$ | $70.45^{a}$ | $70.62^{a}$ | $71.18^{a}$ | 0.75 |
| Monocytes (%) | $1.20^{b}$ | $2.02^{a}$ | $2.15^{a}$ | $2.18^{a}$ | $2.20^{a}$ | $2.21^{a}$ | 0.04 |

Values followed by different letters were significantly different ($p<0.05$); Group 1: Experimental diet only (control); Group 2: Experimental diet plus 2mL *Cynoglossum zeylanicum* leaf extract per liter of water; Group 3: Experimental diet plus 4mL *Cynoglossum zeylanicum* leaf extract per liter of water; Group 4: Experimental diet plus 6mL *Cynoglossum zeylanicum* leaf extract per liter of water; Group 5: Experimental diet plus 8mL *Cynoglossum zeylanicum* leaf extract per liter of water; Group 6: Experimental diet plus 10 mL *Cynoglossum zeylanicum* leaf extract per liter of water; SEM: standard error of mean

**Table 5.** Serum biochemical indices of pekin ducks fed different doses of *Cynoglossum zeylanicum* leaf extract

| Components | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | SEM |
|---|---|---|---|---|---|---|---|
| Total protein (g/dL) | $3.01^{b}$ | $4.01^{a}$ | $4.08^{a}$ | $4.18^{a}$ | $4.25^{a}$ | $4.29^{a}$ | 0.03 |
| Albumin (g/dL) | $1.45^{b}$ | $2.11^{a}$ | $2.16^{a}$ | $2.20^{a}$ | $2.25^{a}$ | $2.28^{a}$ | 0.02 |
| Globulin (g/dL) | $1.56^{b}$ | $1.90^{a}$ | $1.92^{a}$ | $1.98^{a}$ | $2.00^{a}$ | $2.01^{a}$ | 0.02 |
| Glucose (mg/dL) | $121.6^{b}$ | $115.3^{a}$ | $110.2^{a}$ | $105.6^{a}$ | $102.3^{a}$ | $101.4^{a}$ | 2.05 |
| Cholesterol (mg/dL) | $102.5^{a}$ | $93.57^{b}$ | $91.46^{b}$ | $90.52^{b}$ | $90.41^{b}$ | $90.33^{b}$ | 1.87 |

Values followed by different letters were significantly different ($p<0.05$); Group 1: Experimental diet only (control); Group 2: Experimental diet plus 2mL *Cynoglossum zeylanicum* leaf extract per liter of water; Group 3: Experimental diet plus 4mL *Cynoglossum zeylanicum* leaf extract per liter of water; Group 4: Experimental diet plus 6mL *Cynoglossum zeylanicum* leaf extract per liter of water; Group 5: Experimental diet plus 8mL *Cynoglossum zeylanicum* leaf extract per liter of water; Group 6: Experimental diet plus 10 mL *Cynoglossum zeylanicum* leaf extract per liter of water; SEM: standard error of mean

## Declaration:

Author declare that he has no competing interests.

## Contribution:

Dr. Alagbe Olujimi John designed the experiment, statistical analysis and writing of manuscript

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