Study the Effect of Ceylon Cinnamon (Cinnamomum Zeylanicum) Powder on Some Physiological Parameters in Broiler Chicks

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Abstract

The current study aimed to investigate the effects that could be caused by ceylon cinnamon (Cinnamomum zeylanicum) powder addition to diet of broileron some physiological parameters. A total of 150 one-day-old mixed-sex broiler chicks were distributed into 3 treatments, comprising 5 replicates per treatment, with 10 chicks for each replicate. 1st group (control) fed on the standard diet during the experimental period (42 days), 2nd group (T1) and 3rd group (T2) fed on standard diet mixed with 500&1000 mg/kg of CNP, respectively. On 1st and 42nd day of experiment, body weight was recorded. As well as, blood samples were collected at the end of experiment, for assessment of RBC and WBC counts, PVC, Hemoglobin concentration (Hb) and heterophils/lymphocytes ratio (H/L). Total protein, Albumin, globulin, Triiodothyronine (T3) and Tetraiodothyronine (T4) concentrations in blood serum were determined. The statistical analysis registered the significant (P<0.05) elevation in the body weight on 42nd day of experiment in T1 and T2 groups comparing with the control. The results revealed that the second and third groups recorded significant (P<0.05) increase in RBC and WBC counts, as well as, PVC and HB concentration. While H/L significant (P<0.05) decline in T1 and T2 groups comparing with the control. At the same time, the result of total protein, globulin, T3 and T4 concentrations revealed a significant increment (P<0.05) in two treated groups when compared with control. Therefore, it was concluded that the use of cinnamon powder can affected positively on some physiological traits and broiler performance.

Key words: Cinnamon powder, Physiological parameters, Broiler chicks.

Introduction

In the past, using the additives as growth promoters in livestock like antibiotics have been banned due to their deposits in animal tissues and subsequent promotion of bacterial resistance. Because this concern, some researchers have estimated alternative growth promoters such as prebiotics and probiotics, which usefully to the health of the digestive system (1).

Currently, manufacturing and development of these alternatives are time-consuming, costly and their side effects have not been clearly proven, many researchers have estimated herbs and their essential oils due to their advantages in using medicinal plants such as easy usage, some of it didn't have side effects, no waste particulars in the target body (2, 3 and 4). Cinnamon, belonging to the Lauracea family. The genus Cinnamomum comprises approximately 250 species that are widely distributed in China, India and Australia (5). It has major two kinds, Chinese Cassia (Cinnamomum aromaticum) and Ceylon cinnamon (Cinnamomum zeylanicum) or ‘true cinnamon’ (6).

One main difference between the ‘cassia’ cinnamon and ‘true’ cinnamon is their contents of coumarin (7). Coumarins are naturally compounds of plants, have a strong anticoagulant features. Ceylon cinnamon have very little quantities of coumarin, whereas its level is high in C. aromaticum causing health risks if large quantity consumed on a regular basis (7). Besides, coumarins have the toxic effects on the liver (8). Phytochemicals analysis of Cinnamomum zeylanicum according to the Ministry of Agriculture American food on the following information: Calories: 247%, fat: 1.24%,
saturated fat: 0.34%, carbohydrates: 80.59%, Fiber: 53.1%, proteins: 3.99%, cholesterol: 0% (7). In native medicine, cinnamon has high levels of cinnamaldehyde (the active polyphenol component), followed by eugenol and carvacrol (9 and 10).

It used for treatment the respiratory, digestive, and gynecological disorders, many researches exposed many health effects of cinnamon such as reducing risk of colonic cancer, reducing cardiovascular disease, blood glucose control, anti-inflammatory properties and boosting cognitive function (10 and 11), cinnamon and its components (eugenol and cinnamaldehyde) have antimicrobial and antioxidant action against Staphylococcus aureus, Pseudomonas aeruginosa, Enterococcus faecalis, Salmonella sp., Staphylococcus epidermis, as well as, it appear inhibitory action against some aspergillus species like Aspergillus flavus (2; 12, 13,14) demonstrated that 200 ppm extract of essential oil from cinnamon, pepper and oregano enhanced nutrient digestibility in broilers. Furthermore, the antibacterial action of the essential oil and cinnamaldehyde obtained from cinnamon was improved by (15). In this study, we investigated the effects of cinnamon on performance, blood and biochemical of broiler chicks.

Materials and Methods

Cinnamon sticks-ceylon cinnamon (Cinnamomumzeylanicum) obtained from local market of medicinal plants and herbs and grinded by electrical blender into a fine cinnamon powder (CNP) which was packed in air-tight bags plastic till use for basal diet supplementation. In this study 150, 1 day old mixed sex broiler chicks of Hubbard were distributed into 3 treatments with 50 chicks each, comprising 5 replicates per treatment. Starter diets containing crude protein (CP) 22.4% and 2850 Kcal/Kg ME and were given from 1st to 28th days of age. And a finisher diet contains crude protein 20.2% and 2900 Kcal/Kg ME were given from 29th to 42nd days of age. Ingredients and the composition of the experimental diets are shown in Table 1. All diets were formulated to cover the nutrient requirements of chicken (16), all routine management procedures used in intensive broiler production were followed to ensure disease control and comfort of the experimental birds. 1st group (control) given the standard diet during the experimental period (42 days), 2nd group (T1) given the standard diet supplemented with 500 mg/kg of CNP in the diet, third group (T2) given standard diet supplemented with 1000 mg/kg of CNP in the diet. All laboratories analysis of this study was carried out in College of Agriculture/ university of Kerbala during the period 26/4/2016 to 22/2/2017.

At 1st and 42nd days old the body weight of each group will be estimated. At the end of experimental period, blood sample were taken from wing vein, and divided into two parts, 1st part 1.5 ml put into Ethylene Diamine Tetracetic Acid (EDTA) tubs for estimation of red and white blood cells counts according to (17), Packed Cell Volume (PVC) according to (17), Hemoglobin concentration (Hb) according to (18). 2nd part 3.5 ml put in tubes without anticoagulant, isolation of serum was done by centrifugation of blood samples at 5000 rpm for 10 min.

The serum was transported carefully to dry vials and kept in -20 until using for assessment of total serum protein according to (19). After albumin concentration was determined, then globulin concentration (g/100ml) was calculated by Globulin concentration= total protein concentration-Albumin concentration. Serum level of T3 and T4 hormones was determined according to (20) by using radioimmunoassay, all kit procedures were followed according to the manufacturer's protocol. Data of the experiment were analyzed by using Complete Random Design (C.R.D). Differences were considered to be significant at the level of P<0.05, Statistical analysis was carried out by using procedure of (21).

Table 1: Composition of experimental diets in different periods of the experiment

<table>
<thead>
<tr>
<th>Ingredient (%)</th>
<th>Starter (1-28 day)</th>
<th>Finisher (29-42 day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow corn</td>
<td>58.0</td>
<td>64.0</td>
</tr>
<tr>
<td>Soybean meal (45% Protein)</td>
<td>38.0</td>
<td>32.0</td>
</tr>
<tr>
<td>*Premix</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Oil</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>
### Table 1: Composition of the basal diet

<table>
<thead>
<tr>
<th>Salt</th>
<th>0.3</th>
<th>0.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methionine</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Lysine</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

### Results and Discussion

The result of the effect of cinnamon powder (CNP) on body weight at the beginning 1st and the end 42nd of experiment of broiler chicks were illustrated in table 2. The result indicated that there is a significant increased (P<0.05) in the body weight in two treated groups when compared with the control group at the end of experiment. The results of the current study showed that cinnamon powder (CNP) supplementation to broiler chicks in a dose 500 & 1000 mg/kg of CNP for 42 days produced beneficial effects on birds healthy and improvement performance. These effects may be mediated through several mechanisms since (CNP) itself is a complex mixture of many biologically active compounds.

In the present results, the cinnamon causing significance (P<0.05) increment in body weight may be due to the present of phenolic, antioxidants and antimicrobial substances in cinnamon could cause reducing the harmful intestinal bacteria growth causing elevation of feed consumption and improvement in weight gain that agreement with (22), who found the usage cinnamon extract with other herbs consider safely herbs as a growth promoters in broiler performance without detrimental effects on chicken health. At the same time *Cinnamomum zeylanicum* contained multiple compounds that improved the body weight as recorded by (23) who concluded that the supplementation the birds with poly herbal compounds specially cinnamon caused higher feed consumption, weight gain, as well as, body weight, and, because its anti protozoal and antimicrobial properties including *Staphylococcus aureus*, *Mycobacterium sp.*, *Salmonella paratyphi* and *Klebsiella pneumonia* (22; 23 and 24), which help to reduce the microbial load in the gut of birds and improve the feed consumption of the birds (25). The current results are in line with those documented by (26) who fed diets containing cinnamon and turmeric, which caused increment in weight gain. This improvement the inhibitory action of cinnamon extract for growing of intestinal bacteria such as *Saureus* and *E. coli*, when the load of these bacteria in the intestine is low, birds may absorb more nutrients due to enhancement the functions of digestion system in poultry through the improvement liver function, enhancement the pancreatic digestive enzymes and increment metabolism of the proteins, carbohydrates and oil in the body as reported by (27).

As well as , the increment in body weight may be due to the elevation in Triiodothyronine (T₃) and Tetraiodothyronine (T₄) hormones that recorded in present results that enhancement the basal metabolic rates, as well as, the important components of cinnamon like cinnamaldehyde that play basic role for increment the metabolic rate of phenyl alanine and tyrosine that considered the basic structure of Triiodothyronine (T₃) and Tetraiodothyronine (T₄) hormones that influence on growth hormone as a result the normal growth and performance of birds (9 and 28).

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Premix (1%) provided the following (per kg of complete diets): 1400 IU Vit. A, 3000 IU Vit. D₃, 50 mg Vit. E, 4 mg Vit. K, 3 mg Vit. B₆, 6 mg Vit. B₁₂, 60 mg niacin, 0.2 mg folic acid, 150 mg choline, 4.8 mg Ca, 3.18 mg P, 100 mg Mn, 50 mg Fe, 80 mg Zn, 10 mg Cu, 0.25 mg Co and 1.5 mg iodine.

<table>
<thead>
<tr>
<th>Composition</th>
<th>ME (Kcal/kg)</th>
<th>Crude protein (%)</th>
<th>Calcium (%)</th>
<th>Avail. Phosphorus (%)</th>
<th>Methionine + cysteine</th>
<th>Lysine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal diet</td>
<td>2850</td>
<td>22.4</td>
<td>0.13</td>
<td>0.17</td>
<td>0.80</td>
<td>1.22</td>
</tr>
<tr>
<td>CNP 500</td>
<td>2900</td>
<td>20.2</td>
<td>0.23</td>
<td>0.16</td>
<td>0.75</td>
<td>1.15</td>
</tr>
<tr>
<td>CNP 1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Thus, CNP regarded as a growth promoter for poultry due to its antimicrobial effects and digestive improvements (3 and 29).

Table 2: Effect of cinnamon powder (CNP) on body weight of broiler chicks at the beginning (1st day) and at the end (42nd day) of experiment

<table>
<thead>
<tr>
<th>Groups</th>
<th>Parameters</th>
<th>C</th>
<th>T₁</th>
<th>T₂</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial body weight (g) on 1st day</td>
<td>126.2 ±0.583 a</td>
<td>126.8 ±1.157 a</td>
<td>127.2±0.86 a</td>
</tr>
<tr>
<td></td>
<td>Final body weight (g) on 42nd day</td>
<td>1852±0.1.22 c</td>
<td>2255.8 ±1.77 b</td>
<td>2554.8 ±2.13 a</td>
</tr>
</tbody>
</table>

C: Control group given standard diets during the experimental period (42 days). T₁: Treatment group given standard diets mixed with 500 mg/kg of CNP in the diet. T₂: Treatment group given standard diets mixed with 1000 mg/kg of CNP in the diet. Means with different superscripts in the same row differ significantly (P<0.05).

The result of the effect of cinnamon powder (CNP) on red blood cell (RBC) count, Packed Cell Volume (PCV), hemoglobin concentration (Hb), white blood cell (WBC) count and heterophils/lymphocytes ratio (H/L) of broiler chicks were illustrated in Table 3. The result indicated that there is a significant increased (P<0.05) in the RBC, WBC, PVC and Hb in T₁ and T₂ compared with the control group, while the statistical analysis showed significant decreased (P<0.05) in H/L ratio in T₁ and T₂ comparing with control group. The nature of this increment was in sync with the increase in the concentration of cinnamon powder, this increment was attributed of red blood cells count as a result of the body’s need to meet the new requirements for the transfer of nutrients and oxygen to cells because of the increased metabolic rate of birds that dealt with CNP added to the diet, may be the reason for the high red blood cells count in CNP treatments being an antioxidant effective where it helps protect blood cells from damage that may occur as a result of oxidation (26). At the same time, the elevation of the levels of thyroid hormones in present results, which play direct role on metabolic rate of body, as well as it had indirect role for controlling on blood cells production in bone marrow, thymus and other organs (11). All this lead to induced erythropoiesis causing increment of red blood cells production that was associated with PCV measure of the number of red blood cells, where the greater the number of red blood cells lead to an increased in the PCV scale and Hb (30). On the other hand, cinnamaldehyde(3-phenyl-2-propenal), effect on efficacy of intestinal absorption of some electrolytes, that enhancement iron absorption in turn entering in erythropoiesis leading to increase the red blood cells, PVC and Hb. This results agreement with (31) found elevation in WBC, RBC, PCV and Hb values when fed the broilers with diets containing oil extract of cinnamon and thyme. As well as, the reason for increment the total counts of WBC, due to the action of the active components in cinnamon (cinnamaldehyde) that stimulated synthesis and increment the production all types of WBC especially lymphocytes with both types B-lymphocytes and T- lymphocytes that leading to reduce the ratio H/L that considered as physiological indicator for different form of stress response in chickens (32), because exposure to stressors causes that ratio to increase progressively (33, 34), as in present results the decrement in the ratio H/L in the treatments groups accompanied with high level of white blood cells was indicator for increased synthesis and production lymphocytes (B- &T-lymphocytes) that will be reflected the positive effects of CNP on the general healthy and immunity - humeral and cellular- in birds and reflected the physiological responsiveness of the animals to its internal and external environment including the type of feed the animal consumed and feeding practices (32 and 35), the present results agreement with (26), who concluded that dietary supplementation of cinnamon and turmeric either alone or together improve the performance of broiler chickens under heat stress by reducing lipid peroxidation.

Table 3: Effect of cinnamon powder (CNP) on hematological parameters of broiler chicks

<table>
<thead>
<tr>
<th>Groups</th>
<th>Parameters</th>
<th>C</th>
<th>T₁</th>
<th>T₂</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RBC(10⁵/L)</td>
<td>3.476 ±0.063 c</td>
<td>4.3 ±0.084 b</td>
<td>4.96±0.234 a</td>
</tr>
<tr>
<td></td>
<td>PVC %</td>
<td>33.1±0.509 c</td>
<td>38.14±0.308 b</td>
<td>41.16±0.382 a</td>
</tr>
</tbody>
</table>
Table 4 showed the effect of cinnamon powder (CNP) on total serum protein, albumin and globulin of broiler chicks. The result indicated that there is a significant increased (P<0.05) in the total protein and globulin in two treated groups compared with the control group, while non-significant (P>0.05) differences in albumin concentration in compared each other. As well as, the statistical analysis recorded significant increment (P<0.05) in the level of T3 and T4 hormones in two treated groups when compared with the control group. This changes may be due to the role of cinnamaldehyde (3-phenyl-2-propenal), the active polyphenol component, influenced on metabolic of tyrosine and phenylalanine that considered the basic components of T3 and T4, on the other hand, the present results showed significance elevation in total protein, that will increased binding site with T3 and T4 hormones particularly thyroid binding globulin and prealbumen (36) that may be due to antimicrobial activity and phenolic substance in cinnamon causing decline in quantity of intestine microbial colony led to prevent degradation of protein and amino acids of nutrients, reduce their absorption improve the levels of absorbed amino acids and proteins(9 and 37). So that due to increment of amino acids absorbed causing to elevation of serum total proteins, albumin and globulin as in presents results.

Table 4: Effect of cinnamon powder (CNP) on some biochemical parameters of broiler chicks

<table>
<thead>
<tr>
<th>Groups</th>
<th>Parameters</th>
<th>C</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total protein (g/100ml)</td>
<td>4.4 ±0.17 b</td>
<td>5.772 ±0.212a</td>
<td>6.268 ±0.163 a</td>
</tr>
<tr>
<td></td>
<td>Albumin (g/100ml)</td>
<td>2.634±0.138a</td>
<td>2.98±0.132a</td>
<td>3.124±0.125 a</td>
</tr>
<tr>
<td></td>
<td>Globulin (g/100ml)</td>
<td>2.138±0.104c</td>
<td>3.32±0.075 b</td>
<td>3.904±0.038a</td>
</tr>
<tr>
<td></td>
<td>T3 (mg/dl)</td>
<td>1.224±0.061 b</td>
<td>1.678±0.021 a</td>
<td>1.772±0.005 a</td>
</tr>
<tr>
<td></td>
<td>T4 (mg/dl)</td>
<td>10.294±0.092 c</td>
<td>11.132±0.03 b</td>
<td>11.545±0.047 a</td>
</tr>
</tbody>
</table>

C: Control group given standard diets during the experimental period (42 days). T1: Treatment group given standard diets mixed with 500 mg/kg of CNP in the diet. T2: Treatment group given standard diets mixed with 1000 mg/kg of CNP in the diet. Means with different superscripts in the same row differ significantly (P<0.05).

Conclusion

The results presented in current study demonstrated that incorporation of ceylon cinnamon (Cinnamomum zeylanicum) powder as 500 & 1000 mg/kg feed is able to enhance the cell protection from oxidative stress leading to improve the bird healthy, production and immune response of broilers. In Future, more studies are required for determined the direct effect of CNP on reproductive efficiency.

References

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