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Evaluation of hematological and biochemical parameters of Kadaknath birds supplemented with different essential oils

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Abstract
The present study was carried out to determine the hematological and biochemical parameters of Kadaknath birds supplemented with thyme oil, cinnamon oil and clove oil at dosage rate of 150 ppm basal diet. A total of 120 day old Kadaknath chicks were divided into 4 groups (T, T_2, T_3 and T_4) with 6 replicates of 5 chicks in each for a 98-day feeding trial (from 1 to 98 day of age). The haematological parameters like Hb, TEC, TLC and PCV were analysed by automatic blood analyser. The biochemical parameters like glucose, cholesterol, total protein, albumin, globulin, SGPT and SGOT were analyzed on chemistry analyzer diagnostic kits. The haematological parameters like Hb was significantly higher in T_4 group, PCV was significantly (p<0.05) higher in T_2 and T_3 group, TLC was significantly (p<0.05) higher in T_3 group while no significant change observed in TEC. The biochemical parameter like glucose, cholesterol and SGOT were found significantly (p<0.05) higher T_4 group whereas total protein, albumin and globulin were significantly higher in all treatment T_2, T_3 and T_4 groups. Based on the results of this study, it could be concluded that essential oils at a level 150 ppm of basal diet no detrimental impact on hematological and biochemical parameters of Kadaknath birds.

Keywords: Kadaknath, thyme oil, cinnamon oil, clove oil haematological and biochemical parameters

Introduction
Antibiotics are commonly used in chicken nutrition as a preventative measure to increase growth, feed consumption, feed utilization, and reduce clinical illness mortality (Miles *et al.*, 2006) [1]. However, there are now major issues with livestock and public health due to the growing concern about the spread and growth of resistant bacteria across the food chain (Muaz *et al.*, 2018) [2]. These phytogenic additives may have multiple modes of action, such as enhancing feed intake and flavor, promoting the release of digestive enzymes, boosting intestinal and gastric motility, immune stimulation, endocrine stimulation, antiviral, antimicrobial, coccidiostat and anthelmintic activities, as well as anti-inflammatory and anti-oxidative activity (Botsoglou *et al.*, 2004) [3]. Additionally, it has been proven that the antimicrobial activity of the phytochemical components of herbs and the essential oils they contain may improve the health and performance of poultry as well as improve the digestive systems of birds by lowering the number of bacteria that cause disease (Jamroz *et al.*, 2005) [4]. Cinnamon oil is extracted from cinnamon (*Cinnamomum zeylanicum*) and is commonly utilized in the animal and poultry feed industries due to its distinct aroma. The main effects of cinnamon oil are attributable to its presence of cinnamaldehyde, followed by eugenol, which has the strongest antibacterial, antifungal, and antioxidant activities (Abd El-Hack *et al.*, 2020) [5]. Clove (*Syzygium arimaticum*) and its essential oil are plant extracts that have been found effective in poultry to improve growth performance, control some intestinal pathogens, act as an antiseptic and digestion stimulant, and exhibit strong antimicrobial and antifungal, anti-inflammatory, anesthetic, anti-carcinogenic, antiparasitic, and antioxidant effects.

(Najafi and Torki, 2010) [6]. Thymol is the primary component of thyme's volatile oils. The principal derived components of the thyme (*Thymus vulgaris*) plant are thymol and carvacrol, phenolic compounds with antioxidant, antifungal and anticoccidial properties. It had been demonstrated that food supplementation with thyme oil improved broiler chicken performance (Al-Kassie *et al.*, 2009) [7].

Because Kadaknath birds are slow developing, efforts should be made to increase their body weight in a short period of time or to improve their production performance in the current scenario. Keeping this in mind, we are investigating the effects of three herbal essential oils (thyme oil, cinnamon oil, and clove oil) as feed supplements, with the aim of comparing the hematological and biochemical profiles of Kadaknath birds.

Materials and Methods

Place of the experiment

The present work was carried out on Kadaknath chicken in the Department of Livestock production Management, College of Veterinary Science & Animal Husbandry, Rewa (M.P.). Kadaknath birds were reared for a period of 98 days. The place is situated at the latitude 24ºN, longitude 81ºE and at 450 above mean sea level. It falls under Eastern Platueand Hills Agro-climatic Zone of the India. Climate of the place is tropical with average annual rainfall of 1128mm. During summer months, temperature goes upto 45ºC and in winter it remains as low as 4ºC. The soil is mixed red and black soil with uniform topography.

Management of birds

All birds were maintained in deep litter system under isomanagerial conditions. Readymade broiler feed purchased from market was offered to birds during research period. The birds were routinely vaccinated against Marek's Disease (MD), Gumboro (IBD), and Newcastle Disease (ND) etc.

Ethical approval

The birds were handled humanely throughout the study, and the experimental design and protocol for using the birds in research were approved by the Institutional Ethical Committee.

Ration

The birds were fed on formulated broiler rations until the end of the experiment. The diet was formulated to meet the nutritional requirements as recommended by the NRC. Thyme oil, cinnamon oil, and clove oil were purchased locally in Jabalpur, Madhya Pradesh, India.

Experimental birds

A total of 120 day old Kadaknath chicks were divided into 4 experimental groups (control and treatments) with 6 replicates of 5 chicks in each for a 98-day feeding trial (from 1 to 98 day of age).

Experimental design

T_1 Group (Control group): The birds in this group were fed on the basal diet only without any additives all over the entire experimental period.

T_2 Group (Thyme Oil treated group): The birds in this group were fed on the basal diet provided with Thyme Oil at dosage rate of 150 ppm basal diet

T_3 Group (Cinnamon Oil treated group): The birds in this group were fed on the basal diet provided with Cinnamon Oil at dosage rate of 150 ppm basal diet

T_4 Group (Clove Oil treated group): The birds in this group were fed on the basal diet provided with Clove Oil at dosage rate of 150 ppm basal diet.

Blood sampling

Blood samples (2.0 ml/bird) were collected at the end of experiment to estimate haematological parameters: Haemoglobin, Total Erythrocyte Count (TEC), packed cell volume (PCV), Total Leukocyte count (TLC). Serum was separated at 2000 rpm for 15 minutes to estimate the biochemical parameters (Glucose, Total Serum protein, Serum albumin, Serum globulin, Cholesterol, SGPT and SGOT) using standard kit.

Haematological and biochemical studies

Estimations of hematological parameters were done by standard procedures described by Jain (1986) [8]. The serum biochemical parameters like Serum glucose, total sprotein, albumin, Cholesterol, Alanine aminotransferase or Serum glutamic pyruvic transaminase (SGPT) and Aspartate aminotransferase or Serum glutamic oxaloacetic transaminase (SGOT) were analysed on autoanalyzer using commercially available standard kits (Erba).

Statistical analysis

All data pertain to various haematological and biochemical parameters were analyzed statistically by running ANOVAs using SPSS 20 software (SPSS, 2012). Significant mean differences between the treatments were determined at a 5% significance level ($p<0.05$) using Duncan's Multiple Range Test (Duncan, 1955) [9]. All data have been presented as mean ± SE.

Results and Discussion

Haematology parameters of Kadaknath birds

The data representing the haematological parameters in terms of haemoglobin, total erythrocyte counts, packed cell volume and total leucocyte counts of Kadaknath birds fed diets supplemented with 150 ppm of Thyme oil, Cinnamon oil and Clove oil on 98th day of feeding trial are shown in Table 1.

Table 1: Haematogical parameters (Mean ± SE) of Kadaknath birds supplemented with different essential oils

Parameter	T_1	T_2	T_3	T_4
Hb (g/dl)	8.14±0.05^a	8.65±0.03^a	8.40±0.0^a	9.40±0.37^b
TEC (million/µl)	3.12±0.02^a	3.55±0.02^a	3.01±0.15^a	3.14±0.08^a
PCV (%)	31.25±0.27^a	32.50±0.35^b	32.70±0.42^b	32.08±0.35^{ab}
TLC (10^3/µl)	21.30±0.15^a	22.88±0.78^a	26.41±0.78^b	21.44±2.34^a

Means bearing different superscript (a and b) differ significantly ($p<0.05$) within a row.

Haemoglobin

Haemoglobin is the RBC's oxygen-carrying protein. Hb values directly indicate the amount of oxygen in the blood. Increased Hb is detected in chronic obstructive pulmonary disease, dehydration, and so on, whereas a decrease causes anemia, liver disease and blood loss. The hemoglobin levels are the most critical elements in defining anemia and erythrocyte distribution.

The number of red blood cells in a bird's blood influences its overall health (Imaseun and Ijen, 2017) [10]. The average haemoglobin concentrations in this study were 8.14±0.05, 8.65±0.03, 8.40±0.0 and 9.40±0.37 g/dl in T_1, T_2, T_3 and T_4 groups respectively in Kadaknath birds. There was significantly higher haemoglobin concentration observed in the T_4 group compared to other groups.

Total erythrocyte counts

Erythrocyte/RBC carries oxygen to animal tissues for oxidation, which releases energy, moves carbon dioxide (CO_2) out of the tissues. Iron is necessary for the production of haemoglobin and myoglobin (El-Bashier *et al.,* 2012) [11]. The average values of total erythrocyte counts (TEC) in this study were 3.12±0.02, 3.55±0.02, 3.01±0.15 and 3.14±0.08 million/µl in T_1, T_2, T_3 and T_4 groups respectively in Kadaknath birds. There was no significant difference in TEC values observed among different groups.

Packed cell volume

A packed cell volume/PCV is a measure of the percentage of red blood cells in your blood. PCV is involved in the transfer of oxygen and nutrients taken in throughout the body, delivering them to specific cells or tissues. Low PCV levels suggest anemia, which can result in fatigue, weakness, and organ malfunction. High PCV levels suggest dehydration, requiring immediate treatment to restore fluid balance. High PCV levels may indicate polycythemia, which raises the risk of blood clots and stroke (Goodwin *et al.,* 1992) [12]. The average values of PCV in this study were 31.25±0.27, 32.50±0.35, 32.70±0.42 and 32.08±0.35% in T_1, T_2, T_3 and T_4 group respectively in Kadaknath birds. There was significant difference in PCV values observed among the T_2 and T_3 groups as compared to the other groups.

Total leucocyte counts

Leucocyte or White blood cells (WBCs), provide antibodies for the immune system and protect the body from invasion by foreign substances. High WBCs animals are capable of producing antibodies and exhibiting a high level of disease resistance (Soetan and Oyewol, 2009) [13]. While birds with low WBC are more likely to contract an illness, those with higher WBC can produce antibodies during phagocytosis and exhibit greater disease resistance (Soetan and Oyewol, 2009) [13]. The average values of total leucocyte counts (TLC) in this study were 21.30±0.15, 22.88±0.78, 26.41±0.78 and 21.44±2.3410^3/µl in T_1, T_2, T_3 and T_4 groups respectively in Kadaknath birds. There was significant difference in TEC values observed among the T_3 group as compared to the other groups. The mean values of haematological parameters had been barely accelerated in the treatment groups. Still, the values were within the normal ranges. The some of the haematological parameters among the groups varied significantly. However, the improvement in haemoglobin RBC, PCV, TEC and TLC level was noticed in the experimental groups.

Tabari *et al.* (2018) [14] found significant improvements in Hb, WBC, and PCV levels in broiler chickens fed clove aqueous extract. The impact could be attributed to improved meal intake and digestion. The active component of clove oil (Ugeonol) is regarded a digestion stimulant factor (Cabuk *et al.,* 2003) [15], in addition to its antimicrobial qualities, which may have resulted in higher feed utilization efficiency. Tariq *et al.* (2014) [16] found that the combination of 0.5% Aloe Vera (*Aloe barbadensis*), 0.5% clove (*Syzigium aromaticum*), and 0.25% Aloe vera and 0.25% clove had no effect on haemoglobin concentration, total erythrocyte count, packed cell volume, and total leucocyte count.

Haque *et al.* (2010) [17] demonstrated that organic acid supplementation in broiler chicken diets had no significant influence on haemoglobin concentration, PCV, TEC, or TLC. Hernandez *et al.* (2006) [18] also found that adding organic acids to broiler chicken diets had no effect on haemoglobin or blood metabolites levels. Rathore (2013) [19] reported no significant difference in hemoglobin (%) or PCV (%) between treatment groups after feeding *Mentha arvensis*. Also, all of the readings were within the normal physiological range. Toghyani *et al.* (2010) [20] found no negative effects of thyme on WBC and RBC counts, hemoglobin content, or hematocrit, %. Reports on the effect of thyme supplementation on blood hematological markers are quite rare.

Al-Kassie (2009) [21] shown that supplementing broiler diets with oil extract produced from thyme and cinnamon resulted in considerably higher RBC, WBC, Hb and HCT values than the control group. Shunthwal and Sheoran (2017) [22] who noted a significant (p<0.05) increase in WBC counts in the 10% flaxseed group. Mushtaque *et al.* (2012) [23] also observed similar results by supplementing broilers with a combination of phytogenic feed additives. Tiago *et al.* (2019) [24] who supplemented eucalyptus oil through water and found no significant (p>0.05) difference in haematological values like total erythrocytes, haemoglobin, mean corpuscular volume. Islam *et al.* (2020) [25] also reported that hematological parameters (RBC, WBC, Hb and HCT) did not show any significant (p>0.05) difference among the treatments by supplementing aloe vera, amla and antibiotic through water. On contrary Eler *et al.* (2019) [26] observed increased TEC by supplementing oregano essential oil and 10% flaxseed, respectively in broilers.

Table 2: Biochemical parameters (Mean ± SE) of Kadaknath birds supplemented with different essential oils

Parameter	T_1	T_2	T_3	T_4
Glucose (mg/dl)	160.79±0.92^a	182.72±1.64^b	163.90±0.91^a	183.8±1.87^b
Cholesterol (mg/dl)	140.49±2.17^a	141.88±2.08^a	140.20±2.03^a	157.08±9.69^b
Total Protein (g/dl)	4.11±0.03^a	4.83±0.08^c	4.44±0.03^b	4.88±0.07^c
Albumin (g/dl)	2.46±0.02^a	2.89±0.05^c	2.66±0.02^b	2.88±0.04^c
Globulin (g/dl)	1.51±0.01^a	1.83±0.03^c	1.73±0.01^b	1.95±0.02^d
SGPT (IU/L)	6.13±0.12^a	6.97±0.42^a	6.74±0.23^a	7.13±0.37^a
SGOT (IU/L)	188.21±2.05^a	171.51±3.63^a	181.44±1.49^a	248.6±14.1^b

Means bearing different superscript (a, b, c and d) differ significantly (p<0.05) within a row.

Biochemical parameters of Kadaknath birds

Serum glucose

Glucose is a primary source of energy for most off the cells in the body, including brain and other cells. Carbohydrates are made up of glucose. Glucose levels in the blood are essential because they can suggest health issues (Lehninger *et al.*, 2017) [27]. The average glucose concentrations (mg/dl) in this study were 160.79±0.92, 182.72±1.64, 163.90±0.91 and 183.8±1.87 mg/dl in T_1, T_2, T_3 and T_4 groups respectively in Kadaknath birds. There was significantly higher serum glucose concentrations observed in the T_2 and T_4 group compared to other groups.

Hernandez *et al*. (2006) [28] who reported that dietary supplementation of organic acid showed no significant effect on serum glucose concentration in broiler chickens. Kalafova *et al.* (2014) [29] also reported that dietary supplementation of 0.25 percent citric acid had no significant (p>0.05) effect on serum glucose concentration in broiler chickens. Rathore (2013) [19] also reported no significant change in blood glucose concentration by feeding of *Mentha arvensis* in goats. Tariq *et al*. (2014) [16] also reported that serum glucose level was not affected by aloe vera and clove supplementation. The increased blood glucose in the control group can be correlated to increased cortisol levels in the blood due to stress which affects glucose metabolism and increases glucose concentration in broilers.

Tabari *et al.* (2018) [14] observed that broiler chickens fed with clove aqueous extract had significantly reduced serum glucose levels (p<0.05) compared to the control group. Sabu and Kuttan (2002) [30] found that an aqueous extract of clove (*Eugenia caryophyllus*) has antihyperglycemic action in rats without changing basal plasma glucose levels. This impact could be attributed to polyphenol-rich clove extract, which boosts glucose intake by muscle cells. Mohammadi *et al.* (2014) [31] found that dietary supplementation with clove essential oil reduced glucose levels compared to the control.

Serum cholesterol

Serum cholesterol levels are essential because they predict the plausibility of heart disease and stroke. High blood cholesterol levels provide a significant risk for heart disease. The entire quantity of cholesterol in blood is LDL and HDL cholesterol (Charlton-Menys and Durrington, 2008) [32]. The average cholesterol concentrations (mg/dl) in this study were 140.49±2.17, 141.88±2.08, 140.20±2.03 and 157.08±9.69 mg/dl in T_1, T_2, T_3 and T_4 groups respectively in Kadaknath birds. There was significantly higher cholesterol concentrations observed in the T_4 group compared to other groups.

The present results are contrary to the finding of Tollba (2010) [33], who noted that plasma cholesterol and plasma lipids were reduced with addition of organic acid and essential oil and Mehr *et al*. (2014) [34], who found clove oil supplementation significantly reduced serum cholesterol level. Lee *et al.* (2004) [35] observed that the major components of essential oils suppress hepatic 3-hydroxy-3 methylglutaryl coenzyme A (HMG-COA) reductase activity, which is a critical regulating enzyme in cholesterol formation. As a result, essential oils are likely to have a hypocholesterolemic impact. Mint is a calm and soothing herb used to aid with upset stomach and digestion. It increases bile secretion and encourage bile flow, which helps to speed and ease digestion and support healthy cholesterol levels.

Tabari *et al.* (2018) [14] found a substantial decrease in cholesterol concentration in broiler chickens fed clove aqueous extract. The major component of clove (*Eugenia caryophyllus*) essential oils that block hepatic 3-hydroxy-3-methylglutaryl co-enzyme (HMG-COA) reductase activity, which is a crucial regulatory enzyme in cholesterol production and causes hypocholesterolemia (Shimaa, 2015) [36].

Clegg and Mbada (1980) [37] concluded that a 5% inhibition of HMG-COA reductase reduces serum cholesterol levels in chicken by 2%. Jin and Cho (2011) [38] discovered that cold-pressed clove oil (CCPO) lowered blood cholesterol and triacylglycerol levels in a hyperlipidemic zebra fish model by 68% and 80%, respectively. Khaksar *et al.* (2012) [39] found that supplementing thyme essential oil reduced serum total cholesterol, triglycerides, and glucose in Japanese quails.

Serum total protein, albumin and globulin

Serum protein

Serum proteins are produced in the liver to maintain blood volume by the colloidal osmotic effect, buffer blood pH, transport hormones and pharmaceuticals, cell coagulation, catalyze enzymatic reactions, regulate hormones, and protect the body from outside contaminants. (Mmereole, 2008) [40]. The average total protein concentrations (g/dl) in this study were 4.11±0.03, 4.83±0.08, 4.44±0.03 and 4.88±0.07 g/dl in T_1, T_2, T_3 and T_4 groups respectively in Kadaknath birds. There were significantly higher total protein concentrations observed in the all treatment T_2, T_3 and T_4 groups compared to control T_1 group.

Serum albumin

Serum albumin is an important protein in the blood, essential for maintaining plasma oncotic pressure and carrying compounds such as hormones, vitamins, fatty acids, and medicines throughout the body. Its significance stems from its ability to serve as a major biomarker for assessing liver function, nutritional health, and probable disease states, especially in situations such as kidney disease, where low blood albumin levels might suggest a bad prognosis and increased mortality risk (Finlayson, 1975) [41]. The average albumin concentrations (g/dl) in this study were 2.46±0.02, 2.89±0.05, 2.66±0.02 and 2.88±0.04 g/dl in T_1, T_2, T_3 and T_4 groups respectively in Kadaknath birds. There were significantly higher albumin concentrations observed in the all treatment T_2, T_3 and T_4 groups compared to control T_1 group.

Serum globulin

Serum globulin is an essential blood protein marker that predominantly indicates the presence of inflammation in the body; elevated levels are frequently associated with disorders such as autoimmune diseases, persistent infections, liver disease, and some malignancies (Finlayson JS, 1975) [41]. The average globulin concentrations (g/dl) in this study were 1.51±0.01, 1.83±0.03, 1.73±0.01 and 1.95±0.02 g/dl in T_1, T_2, T_3 and T_4 groups respectively in Kadaknath birds. There were significantly higher globulin concentrations observed in the all treatment T_2, T_3 and T_4 groups compared to control T_1 group.

The results obtained are in agreement with the findings of Hariharan and Gangadevi (2015) [44] reported that dietary supplementation of MOS and organic acid in broiler chickens significantly increased serum total protein and albumin concentration. Tollba (2010) [33] also reported that essential oil and organic acid supplementation increased plasma total protein as well as albumin and globulin concentration in broiler chicken.

In contrary, Nourmohammadi and Khosravinia (2015) [42] who indicated that dietary supplementation of citric acid in broiler chickens showed no significant effect on serum total protein concentration. Similarly, Hassan *et al.* (2016) [43] observed that dietary supplementation of citric acid in broiler ducks showed no significant difference in serum total protein. Rathore (2013) [19] also reported that there was no significant change in serum total protein by feeding of *Mentha arvensis* between the treatment groups in goats.

Serum enzymes

SGPT

SGPT (Serum glutamic pyruvic transaminase), also called alanine aminotransferase (ALT), is an enzyme that assesses liver function. High SGPT levels in the blood may suggest liver injury or illness. SGPT levels in the normal range suggest proper liver function. Elevated SGPT levels may indicate liver stress or injury, but significantly high SGPT levels may indicate liver illness, such as hepatitis, cirrhosis, or inflammation (Cohen and Kaplan, 1979) [45]. The average SGPT concentrations (IU/L) in this study were 6.13±0.12, 6.97±0.42, 6.74±0.23 and 7.13±0.37 IU/L in T_1, T_2, T_3 and T_4 groups respectively in Kadaknath birds. There was no significant difference in SGPT values observed among different groups.

SGOT

Serum glutamic-oxaloacetic transaminase (SGOT) is a liver enzyme that helps to determine liver health. SGOT levels in the blood can detect liver damage or disease before symptoms develop. Elevated SGOT values could indicate liver damage or injury. This could be caused to hepatitis, alcoholism, certain drugs, or other liver conditions. Low SGOT values are less common, but they can signal serious liver malfunction or injury (Cohen and Kaplan, 1979) [45]. The average SGPT concentrations (IU/L) in this study were 188.21±2.05, 171.51±3.63, 181.44±1.49 and 248.6±14.1 IU/L in T_1, T_2, T_3 and T_4 groups respectively in Kadaknath birds. There was significantly higher SGPT concentrations observed in the T_4 group compared to other groups.

The results of present experiment corroborate with the findings of Salgado-Transito *et al.* (2011) [46] who reported that dietary supplementation of organic acid in broiler chickens diet showed no significant effect on AST, ALT and ALP levels. In contrary, Nourmohammadi and Khosravinia (2015) [42] reported that dietary supplementation of citric acid in the diet of broiler chickens reduced alkaline phosphatase activity and increased aspartate transaminase activity. Saleh *et al.* (2014) [47] observed that thyme oil dramatically reduced ALT levels but had no effect on AST activity. Our findings were consistent with those of Toghyani *et al.* (2010) [48], who found that adding black seed and peppermint to the basal diet had no statistically significant effect on AST and ALT enzyme concentrations. Shewita and Taha (2011) [49] showed that there were no significant variations in AST levels between groups that received different levels of *Nigella sativa*.

Conclusion

The results of this study showed that inclusion essential oils diet significantly change the blood and serum parameters such as Hb, PCV, TEC, TLC, albumin, globulin total protein, glucose, cholesterol, SGOT and SGPT. All the values were found to be in the normal physiological range, therefore it could be concluded that essential oils at a level 150 ppm of basal diet no detrimental impact on hematological and biochemical parameters of Kadaknath birds.

Conflict of Interest

Not available

Financial Support

Not available

Reference

1. Miles L, Newton AC, DeFries RS, Ravilious C, May I, Blyth S, Gordon JE. A global overview of the conservation status of tropical dry forests. Journal of Biogeography. 2006;33(3):491-505.
2. Muaz K, Riaz M, Akhtar S, Park S, Ismail A. Antibiotic residues in chicken meat: global prevalence, threats, and resistance. In: Kumar Y, editor. Antimicrobial Resistance - A Global Threat. London, UK: Intech Open, 2018.
3. Botsoglou NA, Christaki E, Paneri FP, Giannenas I, Papageorgiou G, Spais AB. The effect of a mixture of herbal essential oils or α-tocopheryl acetate on performance parameters and oxidation of body lipid in broilers. South African Journal of Animal Science. 2004;34(1):52-61.
4. Jamroz D, Wiliczkiewicz A, Wertelecki T, Orda J, Skorupińska J. Use of active substances of plant origin in chicken diets based on maize and locally grown cereals. British Poultry Science. 2005;46(4):485-493.
5. Hack AELME, Alagawany M, Moneim AAME, Mohammed NG, Khafaga AF, Jumah BM, *et al*. Cinnamon (*Cinnamomum zeylanicum*) oil as a potential alternative to antibiotics in poultry. Antibiotics. 2020;9(5):210.
6. Najafi P, Torki M. Performance, blood metabolites and immune-competence of broiler chicks fed diets included essential oils of medicinal herbs. Journal of Animal Veterinary Advances. 2010;9:1164-1168.
7. Al-Kassie GAM. Influence of two plant extracts derived from thyme and cinnamon on broiler performance. Pakistan Veterinary Journal. 2009;29(4):169-173.
8. Jain NC. Schalm's veterinary hematology. 4th Ed. 1986, p. 1221.
9. Duncan DB. Multiple range and multiple F tests. Biometrics. 1955;11:1-42.
10. Imaseun JA, Ijeh OA. Hematological parameters, serum biochemistry and antioxidant capacity of broiler chickens fed diet supplemented with two sources of antioxidants as feed additives. Journal of Agriculture and Veterinary Science. 2017;10(9):5-9.
11. El-Bashier OM, Hashish SM, Ali RA, Arafa SA, Samee ELLDA, Olemy AA. Effects of feeding organic zinc, manganese and copper on broiler growth, carcass characteristics, bone quality and mineral content in bone, liver and excreta. International Journal of Poultry Science. 2012;11(6):368-377.
12. Goodwin MA, Davis JF, Brown J. Packed cell volume reference intervals to aid in the diagnosis of anemia and polycythemia in young broiler chickens. Avian Disease. 1992;36(2):440-443.
13. Soetan KO, Oyewole OE. The need for adequate processing to reduce the anti-nutritional factors in plants used as human foods and animal feeds: A review. African Journal of Food Science. 2009;3(9):223-232.
14. Tabari ASAL, Zuhairi ZAAL, Abdulrazzaq M. Study the effect of adding aqueous extract of clove (*Eugenia*

caryophyllus) to drinking water in productivity and physiological efficiency of broiler chicken. Basrah Journal of Veterinary Research. 2018;17:1.
15. Cabuk M, Alcicek A, Bozkurt M, Imre N. Antimicrobial properties of the essential oils isolated from aromatic plants and using possibility as alternative feed additives. In: National Animal Nutrition Congress. 2003;18(20):184-187.
16. Tariq H, Rao PV, Mondal BC, Malla BA. Effect of Aloe vera (*Aloe barbadensis*) and Clove (Syzygium aromaticum) supplementation on immune status, haematological and serum biochemical parameters in Japanese quails. Indian Journal of Animal Nutrition. 2014;31(3):293-6.
17. Haque MN, Islam KM, Akbar MA, Chowdhury R, Khatun M, Karim MR, Kemppainen BW. Effect of dietary citric acid, flavomycin and their combination on the performance, tibia ash and immune status of broiler. Canadian Journal of Animal Science. 2010;90(1):57-63.
18. Hernandez F, Garcia V, Madrid J, Orengo J, Catalá P, Megias MD. Effect of formic acid on performance, digestibility, intestinal histomorphology and plasma metabolite levels of broiler chickens. British Poultry Science. 2006;47(1):50-56.
19. Rathore VS. Effect of feeding pudina (*Mentha arvensis*) herb as feed additive on nutrient utilization efficiency in goats, Doctoral dissertation, Rajasthan University of Veterinary and Animal Sciences, Bikaner-334001, 2013.
20. Toghyani M, Toghyani M, Gheisari A, Ghalamkari G, Mohammadrezaei M. Growth performance, serum biochemistry and blood hematology of broiler chicks fed different levels of black seed (*Nigella sativa*) and peppermint (*Mentha piperita*). Livestock Science. 2010;129(1-3):173-8.
21. Al-Kassie GA. Influence of two plant extracts derived from thyme and cinnamon on broiler performance. Pakistan Veterinary Journal. 2009;29:169-173.
22. Shunthwal J, Sihag S, Sheoran N. Effect of feeding linseed oil on growth performance and nutrients utilization efficiency in broiler chicks. The Pharma Innovation. 2017;6(11):120.
23. Mustaque KM, Jayakumar S, Shabeer TK. Phase transfer catalysis: kinetics of acrylonitrile polymerization initiated by potassium peroxomonosulfate-cetylpyridinium chloride system. Journal of Chemical, Biological and Physical Sciences (JCBPS). 2012;2(2):601.
24. Tiago GP, Sutille MA, Petrolli OJ, Stefani LM, Simionatto AT, Tavernari FC, *et al*. Eucalyptus oil to mitigate heat stress in broilers. Revista Brasileira de Zootecnia. 2019;48:e20160306.
25. Islam SM, Rohani MF, Zabed SA, Islam MT, Jannat R, Akter Y, *et al*. Acute effects of chromium on hemato-biochemical parameters and morphology of erythrocytes in striped catfish (*Pangasianodon hypophthalmus*). Toxicology Reports. 2020;7:664-70.
26. Eler G, Gomes AVC, Trindade BS, Almeida LSL, Dilelis F, Cardoso VS, *et al*. Oregano essential oil in the diet of broilers: performance, carcass characteristics, and blood parameters. South African Journal of Animal Science. 2019;49(4):753-62.
27. Lehninger A, Nelson D, Cox M. Lehninger Principles of Biochemistry. 7th Ed. New York: W.H. Freeman, 2017, 930 p.
28. Hernandez PA, Graham CH, Master LL, Albert DL. The effect of sample size and species characteristics on performance of different species distribution modeling methods. Ecography. 2006;29(5):773-785.
29. Kalafova A, Capcarova M, Hrncar C, Petruska P, Tusimova E, Kopecky J, *et al*. Metabolic effect of citric acid in broiler chickens. Journal of Microbiology, Biotechnology and Food Sciences. 2014;3(2):110-112.
30. Sabu MC, Kuttan R. Anti-diabetic activity of medicinal plants and its relationship with their antioxidant property. Journal of Ethnopharmacology. 2002;81(2):155-160.
31. Mohammadi Z, Ghazanfari S, Moradi MA. Effect of supplementing clove essential oil to the diet on microflora population, intestinal morphology, blood parameters and performance of broilers. European Poultry Science. 2014;78:1-11.
32. Charlton-Menys V, Durrington PN. Human cholesterol metabolism and therapeutic molecules. Experimental Physiology. 2008;93(1):27-42.
33. Tollba AAH, Shabaan SAM, Abdel-Mageed MAA. Effects of using aromatic herbal extract blended with organic acids on productive and physiological performance of poultry during cold winter stress. Egyptian Poultry Science Journal. 2010;30:489-510.
34. Mehr MA, Hassanabadi A, Nassiri Moghadam H, Kermanshahi H. Supplementation of clove essential oils and probiotic on blood components, lymphoid organs, and immune response in broiler chickens. Research Opinions in Animal and Veterinary Sciences. 2014;4(4):218-223.
35. Lee KW, Everts H, Beynen AC. Essential oils in broiler nutrition. International Journal of Poultry Science. 2004;3(12):738-752.
36. Shimaa MH. Effect of some levels of cardamom, clove and anise on hepatotoxicity in rats caused by CCL4. World Applied Sciences Journal. 2015;33(6):854-865.
37. Clegg RJ, Mbada W. Inhibition of hepatic cholesterol synthesis and 3-hydroxy-3-methylglutaryl-coA reductase. Biochemical Pharmacology. 1980;29:2125-2127.
38. Jin S, Cho KH. Water extracts of cinnamon and clove exhibit potent inhibition of protein glycation and anti-atherosclerotic activity in vitro and in vivo hypolipidemic activity in zebrafish. Food and Chemical Toxicology. 2011;49(7):1521-1529.
39. Khaksar V, Krimpen VM, Hashemipour H, Pilevar M. Effects of thyme essential oil on performance, some blood parameters and ileal microflora of Japanese quail. The Journal of Poultry Science. 2012;49(2):106-110.
40. Mmereole FU. The effects of replacement of groundnut cake with rubber seed meal on the haematological and serological indices of broiler. International Journal of Poultry Science. 2008;7(6):622-624.
41. Finlayson JS. Physical and biochemical properties of human albumin. In: Sgouris JT, Rene A, editors. Proceedings of the workshop on albumin, 1975, p. 31-56.
42. Nourmohammadi R, Khosravinia H. Acidic stress caused by dietary administration of citric acid in broiler chickens. Archives Animal Breeding. 2015;58(2):309-315.
43. Hassan I, Mosaad GM, Elstar AM. Effect of feeding citric acid on performance of broiler ducks fed different protein levels. Journal of Advanced Veterinary Research. 2016;6(1):18-26.
44. Hariharan T, Gangadevi P. Synergistic effect of folic acid on corrosion inhibition of carbon steel in presence of a phosphonate and zinc ions. International Journal of Recent Scientific Research. 2015;6(6):4461-4464.

45. Cohen JA, Kaplan MM. The SGOT/SGPT ratio-an indicator of alcoholic liver disease. Digestive Diseases and Sciences. 1979;24(11):835-838.
46. Transito SL, García DRJC, Roman AJL, Martinez ME, Albores MA. Effect of citric acid supplemented diets on aflatoxin degradation, growth performance and serum parameters in broiler chickens. Archivos de Medicina Veterinaria. 2011;43(3):215-22.
47. Saleh N, Allam T, Latif ELAA, Ghazy E. Effects of dietary supplementation of different levels of thyme (*Thymus vulgaris*) and ginger (*Zingiber officinale*) essential oils on performance, hematological, biochemical and immunological parameters of broiler chickens. Global Veterinaria. 2014;12(6):736-44.
48. Toghyani M, Toghyani M, Gheisari A, Ghalamkari G, Mohammadrezaei M. Growth performance, serum biochemistry and blood hematology of broiler chicks fed different levels of black seed (*Nigella sativa*) and peppermint (*Mentha piperita*). Livestock Science. 2010;129(1-3):173-8.
49. Shewita RS, Taha AE. Effect of dietary supplementation of different levels of black seed (*Nigella sativa* L.) on growth performance, immunological, hematological and carcass parameters of broiler chicks. World Academy of Science, Engineering and Technology. 2011;77:788-94.

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