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# The Effect of Dietary Inclusion of *Sesame indicum* Leaves on Haematology and Serum Parameters of Broiler Chickens

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**Introduction:** Various types of feed additives have been evaluated under commercial conditions and in experimental trials with the aim to achieve improvements on growth performance and the best economic return. Herbs, including *Sesamu indicum* leaves, spices and various plant extracts/essential oils can be used as alternatives to replace antibiotic growth promoters as they are rich in phytochemicals (active compounds) that can be used to stimulate growth and health of the animals. The uses of all these herbs should be studied in relation to the blood and serum indices of the animals in order to determine their harmful level of consuming them by the animals. Therefore, the aim of the study is to determine the effect of different dietary inclusion levels of *Sesame indicum* leaves on haematology and serum parameters of broiler chickens at both starter and finisher phases.

**Methods:** A total of one hundred and fifty 1-day old, unsexed (Marshal) broiler chicks were randomly divided into five experimental groups at rate of 30 birds per group. Each group was further subdivided into three replicates at the rate of ten chicks per replicate in a Complete Randomized Design. A maize-soybean basal diet served as control while the *Sesame indicum* leaves was added to the basal diets at level (0g, 10g, 20g, 30g and 40g/kg) resulting in five formulae, respectively. At the end of the 4th and 8th weeks respectively, six birds were randomly selected from each of the replicate and blood samples were collected from the jugular vein of birds for haematology and serum.

**Results:** The results indicated that all the haematology and serum parameters were significantly ($p < 0.05$) affected by the different inclusion levels of *S. indicum* leaves but the value obtained were within the recommended range while birds fed with the diet containing 40g/kg of *S. indicum* leaves had the highest values.

**Conclusion:** Inclusion of *S. indicum* leaves in the diets appear not to have detrimental effect on the haematology and serum parameters of the experimental birds. The study recommended that 40g/kg inclusion level be adopted as it improved growth performance and general well-being of broiler chickens.

**Keywords:** *Sesamum indicum* leaves, broiler chickens, Haematology, serum

## 1.0 INTRODUCTION

Poultry keeping is one of the major practical business or enterprise in Nigeria today which serve as a good source livelihood for family subsistence because it requires less capital investment compared to other domesticated animals [1]. Poultry health and good management practices are the core components of the operational dynamic of developing profitable production industry [2]. However, the continuous rise in the cost of production and most especially cost of medication is affecting local broiler producer. Despite the observed improvements in broiler performance, the use of antibiotic growth promoters has been criticized due to its possible role in the occurrence of antimicrobial resistance in humans [3]. This has led a lot of poultry and plant experts to think of alternative sources to solve the constraint of rising cost of production and procurement of the animal drugs.

In recent years, interest has shifted in many countries in the collection and extended use of medicinal plant extract for an alternative production purposes [4]. Plant active principles are chemical compounds present in the entire plant or in specific parts of the plant that confers therapeutic activity or beneficial effects. These substances have low molecular weight and are derived from the plant secondary metabolism, including glucosides, alkaloids (alcohols, aldehydes, ketones, ethers, esthers, and lactones), phenolic and polyphenolic compounds (quinones, flavones, tannins, and coumarins), terpenoids (mono- and sesquiterpenoids, and steroids), saponins, mucilages, flavonoids, and essential oils [5]. These compounds are produced by the plants for defense against external factors, such as physiological stress, environmental factors, and protection against predators and pathogens [5]. These plant extract are use as feed additives and are added to broiler diets to improve its productive performance by increasing growth rate, improve feed conversion efficiency and greater livability in poultry birds.

Several researchers have advocated for the use of alternative sources of synthetic methionine that is readily available and cheaper [6, 7, 8]. One of the vegetable plant sources that can supplement synthetic methionine is sesame seed. Sesame (*S. indicum* L.) otherwise known as *sesamum* or benniseed, member of the family *Pedaliaceae*, is one of the most ancient oil seed crop known to mankind. The protein content has been reported by many researchers; 18-25% [9], 20% [10], 22.3% [11] and 22-25% [12]. The protein is rich in essential amino-acids including leucine, arginine and methionine but is low in lysine [13]. Sesame seeds are also good sources of minerals and vitamins such as manganese, copper, calcium, vitamin B1 and vitamin E [14].

According to Animashahun *et al*. [15] the ingestion of dietary components has measurable effects on blood constituents. Although nutrient levels in the blood and body fluids are not really indications of nutrient function at cellular level, they are considered to be proximate measures of long term nutritional status [16]. Awosanya *et al*. [17] has reported the dependence of blood protein and creatinine on the quality of dietary protein while feeding swine with cassava leaf supplement led to a significant reduction in ALT and AST with a significant increase in serum total protein [18]. Haematological values are widely used to determine systemic relationship and physiological or pathological adaptations including the evaluation of general health condition, diagnosis and prognosis of various types of animals' diseases [19]. Amao [20] claimed that haematological and serum biochemical indices provide valuable information for breeding purpose and immune status of animals. This study aimed to investigate the effect of a non-synthetic growth promoter, *S. indicum* leaves as a feed additive alternative to the use of the synthetic antibiotics on haematology and serum parameters of broiler chickens.

## 2.0 METHODOLOGY

### 2.1 Site of the Experiment

The study was carried out at the Poultry Unit of Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso, Oyo State. Nigeria

### 2.2 Preparation and Collection of Test Ingredient

The *Sesame indicum* plants used for this experiment were planted at the Arable Unit of Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso. It was air dried and ground into powdery form.

### 2.3 Experimental Animal and Management

A total number of 150 (Marshall) 1-day old broiler chicks were sourced from Zartech Farms, Ibadan. Prior to the arrival of the chicks, the pens were clean and disinfected. The birds were randomly divided into five (5) treatments, each treatment consist of three (3) replicates of 10 birds each. The birds had free access to clean water and feed for the entire fifty six (56) days of the experiment.

### 2.4 Experimental Diets

Broiler starter feed containing 22.87 % Crude Protein and 2987kcal/kg Metabolizable Energy and broiler finisher feed of 20.94 % Crude Protein and 2813kcal/kg Metabolizable Energy with the processed *Sesamum indicum* leaves were added to broiler diets at both broiler starter and finisher phases. A maize-soybean basal diet served as the control Treatment I (T1) while

Sesamum indicum leaves was added at 10, 20, 30 and 40 grams per kg of diet, in treatments II (T2), III (T3), IV (T4) and V (T5) respectively. All animals were housed under identical conditions of temperature and humidity. Necessary vaccinations and medications were administered to the birds whenever the needs arise. The gross compositions of the experimental diets are presented in tables 1 and 2.

**Table 1:** Gross composition of experimental diets at starter phase

| Ingredients (kg) | T1 0g/kg | T2 10g/kg | T3 20g/kg | T4 30g/kg | T5 40g/kg |
|---|---|---|---|---|---|
| Maize | 53 | 53 | 53 | 53 | 53 |
| Soyabean meal | 34 | 34 | 34 | 34 | 34 |
| Groundnut cake | 2 | 2 | 2 | 2 | 2 |
| Fish meal | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| Corn bran | 5 | 5 | 5 | 5 | 5 |
| Sesamum indicum | 0 | 0.1 | 0.2 | 0.3 | 0.4 |
| Limestone | 1 | 1 | 1 | 1 | 1 |
| Bone meal | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Lysine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Methionine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Premix | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Total | 100 | 100 | 100 | 100 | 100 |
| Calculated analysis | | | | | |
| Metabolizable Energy kcal/kg | 2987 | 2987 | 2987 | 2987 | 2987 |
| Crude Protein (%) | 22.87 | 22.87 | 22.87 | 22.87 | 22.87 |
| Crude Fiber (%) | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 |
| Lysine | 1.48 | 1.48 | 1.48 | 1.48 | 1.48 |
| Methionine | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 |

T1 0 (g/kg) = diet without *S. indicum,* T2 10 (g/kg) = diet with 10g of *S. indicum,* T3 20 (g/kg) = diet with 20g of *S. indicum,* T4 30 (g/kg) = diet with 30g of *S. indicum,* T5 40 (g/kg) = diet with 40g of *S. indicum.*

## 2.5 Data Collection

On the 28 and 56 days, blood samples were collected from six randomly selected birds from each replicate through the vein puncture of wing vein and blood samples were collected into two different sets of bijou bottles. The first set of bottles contained Ethylene-diaminetetra- acetic acid (EDTA anti-coagulant) while the other set was without EDTA. Blood samples were labeled according to treatment and date of sampling.

**Table 2:** Gross composition of experimental diets at finisher phase

| Ingredients (kg) | T1 0g/kg | T2 10g/kg | T3 20g/kg | T4 30g/kg | T5 40g/kg |
|---|---|---|---|---|---|
| Maize | 45 | 45 | 45 | 45 | 45 |
| Wheat offal | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 |
| Soyabean meal | 23 | 23 | 23 | 23 | 23 |
| Groundnut cake | 5 | 5 | 5 | 5 | 5 |
| Fish meal | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| Corn bran | 11.2 | 11.2 | 11.2 | 11.2 | 11.2 |
| Palm kernel cake | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| Sesamum indicum | 0 | 0.1 | 0.2 | 0.3 | 0.4 |
| Limestone | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| Bone meal | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Lysine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Methionine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Premix | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Total | 100 | 100 | 100 | 100 | 100 |
| Calculated analysis | | | | | |
| Metabolizable Energy (kcal/kg) | 2813.13 | 2813.13 | 2813.13 | 2813.13 | 2813.13 |
| Crude Protein (%) | 20.94 | 20.94 | 20.94 | 20.94 | 20.94 |
| Crude Fiber (%) | 4.85 | 4.85 | 4.85 | 4.85 | 4.85 |
| Lysine | 1.15 | 1.15 | 1.15 | 1.15 | 1.15 |
| Methionine | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |

T1 0 (g/kg) = diet without *S. indicum,* T2 10 (g/kg) = diet with 10g of *S. indicum,* T3 20 (g/kg) = diet with 20g of *S. indicum,* T4 30 (g/kg) = diet with 30g of *S. indicum,* T5 40 (g/kg) = diet with 40g of *S. indicum.*

The set of blood samples with EDTA was used to determine Red Blood Cell (RBC), White blood Cell (WBC) using the improved Neubaucer haemocytometer, as described by [21]. Packed Cell Volume (PCV) was determined using the microhaematocrit method and haemoglobin (HB) using cyanomethaemoglobin method according to Coles [22]. Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin Concentration (MCHC) were determined as previously described [20].

The set of samples bottles without EDTA were centrifuged in a micro centrifuge to generate serum for biochemical analysis. Total protein was determined using the Biuret method [23], albumin using dye-binding technique with bromocresol green [24] while total cholesterol by enzymatic method [25].

### 2.6 Statistical Analysis

The data obtained on the blood samples were subjected to statistical analysis using the General linear model (GLM) procedure of SAS [26] while means with differences were separated using Duncan multiple range test [27].

## 3.0 Results and Discussion

The haematological indices of broiler birds in responses to Sesamun indicum leaves fed are presented in Table 3. There were significant ($p < 0.05$) higher variations in the values of Packed Cell Volume (PCV), haemoglobin (Hb) White Blood Cell (WBC), Red Blood Cell (RBC) and platelets among dietary treatments.

**Table 3:** *Sesamum indicum* leaves responses on haematological parameters of broiler chickens at starter and finisher phases

| Parameters | T1 0g | T2 10g | T3 20g | T4 30g | T5 40g | SEM |
|---|---|---|---|---|---|---|
| Starter Phase | | | | | | |
| PCV (%) | 31.50$^{c}$ | 33.00$^{bc}$ | 35.00$^{ab}$ | 33.50$^{bc}$ | 36.00$^{a}$ | 0.38 |
| Hb (g/dl) | 8.65$^{c}$ | 9.25$^{ab}$ | 9.25$^{ab}$ | 8.95$^{bc}$ | 9.60$^{a}$ | 0.90 |
| RBC (x10$^{6}$µl) | 1.19$^{c}$ | 2.29$^{b}$ | 2.35$^{b}$ | 2.32$^{b}$ | 2.60$^{a}$ | 0.38 |
| WBC (x10$^{6}$µl) | 271.45$^{b}$ | 278.50$^{ab}$ | 286.35$^{a}$ | 281.50$^{a}$ | 282.35$^{a}$ | 1.27 |
| MCV (fl) | 166.00$^{a}$ | 142.50$^{c}$ | 149.10$^{b}$ | 143.50$^{c}$ | 139.00$^{c}$ | 1.49 |
| MCH (pg) | 46.00$^{a}$ | 40.50$^{b}$ | 39.50$^{b}$ | 38.50$^{b}$ | 38.50$^{b}$ | 0.55 |
| MCHC (g/dl) | 27.50$^{ab}$ | 28.50$^{a}$ | 28.00$^{ab}$ | 27.00$^{b}$ | 28.00$^{b}$ | 0.17 |
| Platelet (x10$^{3}$µl) | 117.00$^{a}$ | 46.00$^{b}$ | 75.00$^{ab}$ | 121.00$^{a}$ | 54.00$^{b}$ | 8.32 |
| Finisher Phase | | | | | | |
| PCV (%) | 32.50$^{bc}$ | 32.00$^{c}$ | 33.50$^{b}$ | 35.30$^{a}$ | 30.00$^{d}$ | 0.29 |
| Hb (g/dl) | 9.95$^{b}$ | 9.65$^{c}$ | 10.20$^{b}$ | 10.85$^{a}$ | 9.20$^{d}$ | 0.84 |
| RBC (x10$^{6}$µl) | 2.30$^{ab}$ | 2.28$^{b}$ | 2.35$^{ab}$ | 2.39$^{a}$ | 2.10$^{d}$ | 0.19 |
| WBC (x10$^{6}$µl) | | | | | | |
| MCV (fl) | 142.50$^{b}$ | 139.50$^{c}$ | 142.50$^{bc}$ | 148.50$^{a}$ | 147.50$^{a}$ | 0.53 |
| MCH (pg) | 43.00$^{cd}$ | 42.50$^{d}$ | 43.50$^{c}$ | 45.4$^{a}$ | 44.00$^{b}$ | 0.17 |
| MCHC (g/dl) | 30.00 | 30.50 | 30.50 | 3.00 | 30.50 | 0.83 |
| Platelet (x10$^{3}$µl) | 18.50$^{c}$ | 63.00$^{a}$ | 34.00$^{b}$ | 19.00$^{c}$ | 20.50$^{c}$ | 2.53 |

$^{abc}$ Means with different superscripts along the same row are significantly($p<0.05$) different

RBC = Red Blood Cell, PCV = Packed Cell Volume, Hb = Haemoglobin, MCV = Mean Corpuscular Volume, MCH = Mean Corpuscular Haemoglobin, MCHC = Mean Corpuscular Haemoglobin Concentration, T1 0 (g) = diet without *S. indicum,* T2 10 (g/kg) = diet with 10g of *S. indicum,* T3 20 (g/kg) = diet with 20g of *S. indicum,* T4 30 (g/kg) = diet with 30g of *S. indicum,* T5 40 (g/kg) = diet with 40g of *S. indicum,* SEM = Standard error of means

The difference in the haematological parameters observed in response to the dietary treatments was in accordance with the findings of [28] who reported significant variations in the haematological indices for broiler chickens fed toasted Sesamum indicum seeds meal based diets. The PCV level is one of the indicators that is suggestive of the presence of toxic factor that adversely affects blood formation [29]. The PCV values obtained in this study were within the standard range of 22-35% [30] for healthy chickens. This may therefore be indicative of the effect of anti-nutritional factors in the seed. Haematological indices especially PCV and Hb have been earlier documented to be correlated with nutritional status of the animals [31, 32]. The red pigment of the erythrocyte functions in the transport of oxygen and carbon (IV) oxide in animal body. Results for Hb was therefore indicative of variations in oxygen and carbon (IV) oxide carrying capacity of birds fed graded levels of Sesamum indicum based diets. The values were within the standard range of 7-13g/dl [28]. There was a general progressive increase in the value with the increasing level of Sesamum indicum. However, value recorded for birds on T5 (9.20g/dl) at week 8 could be as a result of high dietary energy as earlier reported by Idowu et al., [33]. Birds on T4 had higher values for both PCV (35.50%) and Hb (10.85g/dl) at week 8 which implied that the diet contained relatively higher quality protein that met both the birds' protein requirement as well as favored the health status. The RBC values obtained in this study did vary significantly. This showed that graded dietary Sesamum indicum leaves had influence on RBC of birds and it revealed that the birds were not anaemic.

Serum biochemical indices of broiler chickens fed graded dietary Sesamum indicum are presented in table 4. There were significant ($P < 0.05$) higher in the values of total protein, (TP), Alanine Transaminase (ALT), Alkaline phosphate (ALP), Aspartate Transaminase (AST), cholesterol, albumin and creatine among dietary treatments. The variations in the serum biochemical indices of broiler chickens fed graded levels of Sesamum indicum were in line with the earlier findings of [28, 34]. The recorded variations in serum total protein stemmed from the different rate of protein metabolism and utilization by the birds. The values obtained were in line with earlier observation for broiler chickens using same test diets [28]. Birds on T5 had higher serum total protein value (64.00 g/l) at week 8 which indicated that the diet was relatively of good quality and that birds on T5 were more efficient in protein metabolism and utilization. Birds on diets T4 (62.00 g/l) and T5 (62.00 g/l) at week 4 showed similar variations. This revealed that the rate of protein metabolism and utilization were similar. Values of

**Table 4:** *Sesamum indicum* leaves responses on serum parameters of broiler chicken at starter and finisher phases

| Parameter | T1 0g/kg | T2 10g/kg | T3 20g/kg | T4 30g/kg | T5 40g/kg | SEM |
|---|---|---|---|---|---|---|
| Starter Phase | | | | | | |
| T.Protein (g/l) | 59.50$^{b}$ | 54.00$^{c}$ | 60.50$^{b}$ | 62.00$^{a}$ | 62.00$^{a}$ | 0.47 |
| Albumin (g/l) | 36.00$^{c}$ | 33.00$^{d}$ | 39.00$^{ab}$ | 40.50$^{a}$ | 38.50$^{b}$ | 0.41 |
| T.Chol (mm/L) | 3.50$^{c}$ | 2.95$^{d}$ | 3.90$^{b}$ | 3.85$^{b}$ | 4.05$^{a}$ | 0.47 |
| Creat (µmol/L) | 57.50$^{b}$ | 57.00$^{b}$ | 63.00$^{a}$ | 65.50$^{a}$ | 66.50$^{a}$ | 0.88 |
| ALT (Iµ/L) | 24.50$^{a}$ | 15.50$^{b}$ | 24.00$^{a}$ | 24.50$^{a}$ | 22.50$^{a}$ | 0.70 |
| AST (Iµ/L) | 26.50$^{a}$ | 19.50$^{b}$ | 28.50$^{a}$ | 27.00$^{a}$ | 26.50$^{a}$ | 0.55 |
| ALP (Iµ/L) | 71.50$^{d}$ | 57.50$^{e}$ | 76.50$^{c}$ | 88.50$^{a}$ | 84.50$^{b}$ | 1.53 |
| Finisher Phase | | | | | | |
| T.Protein (g/l) | 59.00$^{c}$ | 53.50$^{d}$ | 61.00$^{b}$ | 57.50$^{c}$ | 64.00$^{a}$ | 0.47 |
| Albumin (g/l) | 34.50$^{c}$ | 34.00$^{c}$ | 37.50$^{b}$ | 41.00$^{a}$ | 39.00$^{b}$ | 0.41 |
| T.Chol (mm/L) | 3.35$^{b}$ | 3.05$^{c}$ | 3.95$^{a}$ | 3.90$^{b}$ | 4.05$^{a}$ | 0.57 |
| Creat. (µmol/L) | 56.50$^{c}$ | 56.50$^{c}$ | 62.00$^{b}$ | 65.00$^{b}$ | 67.00$^{a}$ | 0.78 |
| ALT (Iµ/L) | 24.50$^{a}$ | 17.00$^{b}$ | 24.00$^{a}$ | 24.00$^{a}$ | 22.50$^{a}$ | 0.58 |
| AST (Iµ/L) | 26.50$^{a}$ | 19.00$^{b}$ | 29.50$^{a}$ | 27.00$^{a}$ | 26.50$^{a}$ | 0.56 |
| ALP (Iµ/L) | 69.00$^{c}$ | 58.50$^{d}$ | 75.50$^{b}$ | 85.50$^{a}$ | 82.50$^{a}$ | 1.35 |

$^{abcd}$ means with different superscript along the same row are significantly (P<0.05) different

T. Protein = Total protein, T. Chol. =Total Cholesterol, Creat = Creatinine, ALT = Alanine Transaminase, AST = Aspartate Transaminase, ALP = Alkaline phosphate.
T1 0 (g/kg) = diet without *S. indicum,* T2 10 (g/kg) = diet with 10g of *S. indicum,* T3 20 (g/kg) = diet with 20g of *S. indicum,* T4 30 (g/kg) = diet with 30g of *S. indicum,* T5 40 (g/kg) = diet with 40g of *S. indicum,* SEM = Standard error of means.

ALT obtained for birds on T1, T3 and T4 at both week 4 and 8 were similar which implied that livers of birds' on these diets were functioning properly. The values of ALP are indicative of liver function and also the rate of bone mineralization of broiler chickens. The significantly different values recorded for ALP values could be attributed to varying dietary phosphorus in the feed or its utilization as affected by phytate content of Sesamum indicum as earlier reported by Philips et al., [35]. Cholesterol (mg/dl) increased significantly from 2.95 in birds T2 to 4.05 in birds on T5 at week 4 also from 3.05 in birds T2 to 4.05 in birds on T5 at week 8 which conformed with the report on the capability of dietary sesame to increase serum cholesterol [36]. Sesame seed is reported to contain lignans that lowers total blood cholesterol [37]. Also, the presence of saponins in Sesamum indicum might interfere with the absorption of dietary lipids and cholesterol resulting in overall cholesterol-lowering effect.

## 4.0 CONCLUSION

Results of this study indicated that feeding *S. indicum* leave meal at 40g/kg supplementation favoured blood and its components. However blood profile function of broiler chickens were affected at all level of inclusions of *S. indicum* leaf meal as characterized by varying but normal haematological and serum biochemical indices values, but were not hepatotoxic. Based on this study, 40g/kg inclusion level should be adopted as it improved growth performance and general well-being of broiler chicken.

### Authors' Contributions

**OSA**, Conceived, planned and designed the work, wrote the paper, **SRA** Performed analysis and edited the paper; **KSO** Collected data. All authors approved the final version of the manuscript

### Declaration of conflict of interest

The Authors declare that there is no conflict of interest

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