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Original Research

Haematological parameters of broiler birds fed low levels of turmeric (*Curcuma longa)* powder as feed supplement

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ABSTRACT

With the gradual rise in human population, an increasing demand for poultry meat/egg as a source of protein is expected in the nearest future. This and increasing cost of antibiotics and other drugs in addition to their residual effects when used as feed additives have necessitated need to research into natural herbal plants that could serve as cheap and good alternative to commercial (synthetic) antibiotics. The study aimed to determine if there is any beneficial effect in hematological profile of broilers fed low levels of turmeric (*Curcuma longa*). One hundred and twenty (120) one-day-old broiler birds (Cobb 500) were raised for seven (7) weeks at the Aliyu Jodi Veterinary Clinic farm in Sokoto metropolis, Sokoto State, Nigeria. The birds were randomly assigned to four (4) treatments groups (T_C, T_1, T_2, and T_3) of thirty (30) birds each and were fed turmeric powder at levels of 0g per 25 kg of feed, 50g per 25 kg of feed, 100 g per 25 kg of feed, and 150 g per 25kg feed respectively. Each of the four (4) treatment-groups was further sub-grouped into three (3) replicas of ten (10) birds each. At seven (7) weeks old, one (1) bird was randomly selected from each of the replicas for hematological profile. The results indicated that, turmeric powder had no significant (P> 0.05) effect on hematological profile (RBC, PVC, and WBC) of the broilers. Feeding broiler birds with low levels of turmeric powder had no statistical significance on hematology parameters evaluated in this study.

Keywords: Broilers, *Curcuma longa*, hematological parameters, Nigeria, Sokoto, Turmeric.

INTRODUCTION

Poultry industry is the most dynamic and fastest growing aspect of the animal husbandry subsector. It represents an important source of high quality proteins, minerals, and vitamins to balance the human diet (Heise *et al.*, 2015). The Nigerian poultry industry is one of the most commercialized subsectors of Nigerian agriculture (Adene & Oguntade, 2006).

The increase rate of poultry production can be explained by the fact that poultry has many advantages over other livestock. Poultry birds are able to convert feeds into useable protein in form of meat and eggs. The production cost per unit is relatively low, and the return on investment is high. Therefore, farmers don't usually need large amount of capital to start a poultry farm. Furthermore, poultry meat is very tender and accepted by consumers, regardless of their religious or traditional beliefs. Also, the production cycle is quite short. So, capital and profit are recovered over a short period. Finally, eggs, one of the main products of poultry production, are inexpensive and can be more easily affordable compared to other sources of animal protein (Ojo, 2003; Aboki *et al.*, 2013).

In the past, antibiotics were used in broiler feeds as growth enhancers through improved gut health to reduced cost of production, and increase feed utilization efficiency. However, these antibiotics had indirect cumulative side effects on human health because of their residual effects in meat, egg and other products (Yang *et al.*, 2009), leading to resistance of certain microbes (Denli *et al.*, 2003). Therefore, researchers have tended to use different kinds of plants of medicinal importance as alternatives to antibiotics in diets of broilers (Zhang *et al.*, 2009).

With the continuous rise in human population, an increase in demand for poultry meat/egg is expected in the nearest future. For this reason, poultry health has become a significant issue (Guil-Guerrero *et al.*, 2017). The increasing cost of antibiotics and other drugs coupled with their residual effects has brought about the need to research into natural herbal plants that could serve as cheap and good alternative to commercial (synthetic) antibiotics. The use of plants with natural growth promoting properties as additives in livestock

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nutrition is becoming popular due to its resultant effect on animals such as improved productivity, reproduction, and quality of animal products (Olayemi *et al.,* 2016).

However, with increasing emergence of antibiotic resistant microbes, the widespread use of antibiotics as prophylactic tool for disease prevention and growth promotion was questioned (Patterson & Burkholder, 2003). Although antibiotics achieve good performance, their potential adverse effects have become a real public health concern worldwide and eventually led to banning their use in foods especially in the western world (Ukoha & Onunkwo, 2016). This initiated interests in the use of herbs and spices and their products as supplements in animal feeds (Owen, 2011).

In poultry industry, antibiotics are used as antimicrobial growth promoters to increase production (Gobiraju *et al.,* 2017). In 2006, European Union banned the use of antibiotics as feed additives because of their residual effects in animal tissues and eventually leading to antimicrobial resistance in humans (Gobiraju *et al.,* 2017).

Turmeric is a very significant medicinal plant that is used as a dietary additive in poultry feeds. Its benefits in poultry nutrition include improving broiler performance parameters and endogenous digestive enzyme secretion, activating immune responses, antimicrobial effects, and antioxidant activities (Dorman & Deans, 2000; Burt, 2004; Khan *et al.,* 2012). It is traditionally accepted that turmeric has high efficacy as an antioxidant and anti-inflammatory agent (Sugiharto *et al.,* 2011).

Introduction of turmeric to broiler birds is usually carried out by including this substance in their feed (Al-Sultan & Gameel, 2004; Sugiharto *et al.,* 2011) and, many authors have reported different results with different levels of turmeric powder in poultry feeds. Thus, this study aimed to elucidate if there is any effect associated with turmeric on hematological profile of broiler birds fed on feed incorporated with low levels of turmeric.

MATERIALS AND METHODS

EXPERIMENTAL LOCATION

The research was conducted at the poultry unit of Aliyu Jodi Veterinary Clinic, Sokoto South Local Government Area Sokoto State. Sokoto is located northwest of the country on the border with The Republic of Niger. It is located near the confluence of Sokoto River and Rima River between latitude 13^0 01^1 North and longitude 05^0 15^1 East of about 350m above sea level (Sokoto & Muhammad, 2014).

The climate has distinct wet and dry seasons. The dry season is characteristically long with cold dry air during harmattan from November to February and hot dry air during the hot season from March to May (Sokoto & Muhammad, 2014). The annual average temperature is up to 28.3^o C with highest temperatures of up to 45^{o}C during the hot dry months. The rainy season begins in May till September with an average annual rainfall of about 640mm (Jiya *et al.,* 2021).

EXPERIMENTAL DIET

Fresh turmeric rhizomes were obtained from Sokoto central market. The rhizomes were washed, sliced and oven-dried at 50^{o}C for 24 hours (Paul *et al*., 2020). The rhizomes were later air dried for one (1) week and then ground into powder.

The composition of the experimental diets is shown in Table (I). Turmeric powder was incorporated at different levels of 0g, 50g, 100g, and 150g per 25kg of feed (0 %, 0.2 %, 0.4 % and 0.6 %) for T_C, T_1, T_2, and T_3 respectively. The prepared diets (25kg) were packed into a labeled bag according to the treatment and kept within the pen.

Table I. Composition of experimental broiler starter and finisher diet for 25kg

Ingredients	Starter (kg)	Finisher (kg)
Maize	12.50	12.25
Soya bean	4.50	5.50
Groundnut cake	5.00	3.00
Wheat offal	2.00	3.25
Limestone	0.38	0.13
Bone meal	0.38	0.63
Premix	0.06	0.06
Lysine	0.06	0.06
Methionine	0.06	0.06
Salt	0.06	0.06

EXPERIMENTAL ANIMAL AND THEIR MANAGEMENT

The protocols for this experiment and care of broilers were carried out in accordance with the guidelines of the Department of Veterinary Medicine, Usmanu Danfodiyo University Sokoto and ethical approval code for the study is UDUS/IACUC/2014/AUP-R0-11

The experimental birds were purchased commercially from Olam Nigeria Limited, Kaduna, Nigeria at one-day-old. One hundred and twenty (120) one-day-old mixed-sex broiler chicks (Cobb 500) were used for the experiment. Before the arrival of the experimental chicks, the brooding pen was cleaned, washed, disinfected, and left to dry for five (5) days. The birds were reared on deep litter system.

Four demarcated spaces in the brooding pen (T_C, T_1, T_2, and T_3) were selected for the experiment. Thirty (30) birds were randomly selected into each pen with two (2) feeders and drinkers each. The experimental basal diet (broiler starter) was fed to the birds for two (2) weeks. Each treatment was

replicated into three (3) replicas with ten (10) birds each, two drinkers and two feeders were allowed to each replica. The experimental broiler finisher diet was fed to the birds for five (5) weeks. Standard management procedures for raising broilers birds were strictly followed. Feed and water were supplied ad-libitum, and the drinkers in each pen were cleaned daily and refilled with fresh water.

EXPERIMENTAL DIETARY TREATMENT

The chicks were brooded for two (2) weeks in four (4) treatments (T_C, T_1, T_2, and T_3) of thirty (30) birds each fed basal diet. The birds were divided randomly into three (3) replicates per treatment. Birds in T_C representing the control group were fed basal diet, while T_1, T_2, and T_3 were fed basal diets containing 0.2%, 0.4% and 0.6% turmeric powder as supplement respectively. The birds were fed for five (5) weeks before the experiment was terminated.

BLOOD SAMPLE COLLECTION

At the end of the feeding trial seven (7) weeks, the birds were sampled from each replicate and blood was collected through the wing vein, one bird was selected per replicate making a total number of three (3) per treatment.

Blood was collected using a sterile needle and syringe into a well labeled sterile Bijou bottle containing ethylene diamine tetra-acetic acid (EDTA) to prevent clotting. All blood sample collected were subjected to hematological analysis immediately at the Physiology Laboratory, Faculty of Veterinary Medicine, Usmanu Danfodiyo University Sokoto.

SAMPLE ANALYSIS

Hematological indices such as Red Blood Cell Count (RBC), Packed Cell Volume (PCV), White Blood Cell Count (WBC), Hemoglobin concentration, and WBC differentials were determined. Hemoglobin concentration was determined photometrically using cyanohemoglobin method (Elarabany, 2018), and PCV using Hacksley hematocrit centrifuge (UK) according to the procedure by Morris *et al.,* (2001), PCV results were determined using a micro hematocrit reader. The WBC counts and its differentials were determined using the Neubaer count chamber following procedure described in previous studies (Fudge, 2000; Cray & Zaias, 2004).

STATISTICAL ANALYSIS

The laboratory results obtained were assessed statistically using two-way analysis of variance (ANOVA) using GraphPad Prism 8.0.2 (263) software for windows. The resultant data were express in Mean ± Standard Deviation, a P-value of less than 0.05 was considered statistically significant.

Table II. The Effect of turmeric powder (*Curcuma longa*) on hematological profile of broiler birds raised in Sokoto

Parameters	T_1	T_2	T_3	T_C
PCV (%)	25.67±4.51	28.33±3.51	25.67±4.73	24.00±1.00
Hb (dl)	7.59±1.50	9.16±0.72	7.54±1.56	7.03±0.34
RBC ($\times10^6 mm^3$)	1.42±0.50	2.22±0.82	2.20±1.34	1.32±0.24
WBC ($\times10^6 mm^3$)	7.55±2.86	9.15±0.48	7.85±1.00	7.13±1.12
L (%)	81.33±2.52	79.33±3.06	80.33±1.53	83.33±0.58
N (%)	18.00± 2.00	20.33±3.51	18.33±1.15	16.33±0.58
M (%)	0.67±0.58	0.33±0.58	1.33±0.58	0.33±0.58
E (%)	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
B (%)	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00

Key: PVC – Packed Cell Volume, Hb – Determination of Hemoglobin, RBC – Red Blood Cell, WBC – White Blood Cell, L – Lymphocytes, N – Neutrophils, M – Monocytes, E – Eosinophil, B – Basophil.

RESULT

The haematological parameters of broiler birds fed low dietary levels of turmeric powder for 49 days on deep litter house is as shown in Table (II) below. There was no significant ($P>0.05$) effect of turmeric powder on all the hematology profile measured.

DISCUSSION

Turmeric did not affect significantly ($P>0.05$) the concentration of red blood cells (RBCs) of broilers in our study. This is in agreement with the study conducted by Basavaraj *et al.,* (2011) and Sugiharto *et al.,* (2011) but is in contrast with the study by Daramola (*et al.,* 2020), who reported significant ($P\leq0.05$) increase in birds on diet 2 (0.5%) and 3 (1%) than in birds on control diet (0%) and the study by Ayodele *et al.,* (2021), who also reported that the values of RBC were significantly ($P\leq0.05$) higher in birds fed 2% dietary turmeric level, this can be attributed to the low dietary level of turmeric supplement in this study. The major component of RBCs is hemoglobin (Reece 2009). Hemoglobin concentration (Hb) is not statistically affected ($P>0.05$) by turmeric in this study and this is in agreement with the study by (Kafi *et al.,* 2017 and Daramola *et al.,* 2020), and in contrast with the study by Oyebanji *et al.,* (2018), who reported that the hemoglobin concentration of birds fed 10g of turmeric per kg (1%) of feed was significantly different when compared with other groups.

Increase hemoglobin concentration due to dietary turmeric inclusion should be followed by increase RBCs

concentration. However, the findings above did not follow this pattern. This inconsistency can be due to the fact that production of RBCs is not entirely correlated with the synthesis of hemoglobin (Sugiharto *et al.*, 2011).

Packed cell volume (PCV) measures the volume of entire blood in percentage (%) and it is strongly affected by RBCs concentration in the blood (Reece, 2009). In this study PCV was not affected significantly ($p>0.05$) by dietary turmeric inclusion in feed. This finding is in agreement with that of Daramola *et al.,* (2020), who reported that turmeric had no effect on broiler birds feed at the rate of 0%, 0.5% and 1.0% for eight (8) weeks and Emadi *et al.,* (2007), who also reported that addition of turmeric had no effect on PCV level of broiler birds measured at day-21 and day-42.

The WBC count, granulocyte and lymphocyte count in this study were not affected statistically ($P>0.05$) by turmeric and this finding strongly agrees with the study by Daramola *et al.,* (2020) and Paul *et al.,* (2020), who reported that the WBC values of broilers fed diets with turmeric level of 1.5%, 3.0% and 4.5% were statistically not significant ($P>0.05$) but the values were higher than what was obtained for those on control group. Although monocyte was not affected statistically ($P>0.05$) in this study, this finding is in contrast with the study by (Daramola *et al.,* 2020), who reported that value of monocyte increased with increase in the dietary inclusion of turmeric and there was significant ($P<0.05$) increase in birds on diets 2 (0.5%) and 3 (1.0%) than birds on control diet (0%). These inconsistencies may be attributed to the different turmeric inclusion levels, different bioactive substances of turmeric plant used in these studies which depend on the plant species, type of soil, harvest season and process of preparation (Lal, 2012), experimental period and location, breed of bird, immune stimulatory effect of turmeric and endogenous corticosteroid which may be due to stress.

CONCLUSION

From the result of this study, it was concluded that feeding broiler birds with diet that contain turmeric (*Curcuma longa*) powder of up to 0.6% as feed supplement had no significant effect on all the hematological parameters analyzed. Based on this finding, it was suggested that further research is needed with more emphasis on large sample size and/or different turmeric inclusion level to better understand the effect of turmeric on hematological profile of broiler birds.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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