EFFECT OF DIETARY SUPPLEMENTATION TURMERIC RHIZOME POWDER (*CURCUMA LONGA*) AND CAYENNE PEPPER ON SERUM BIOCHEMICAL AND HEMATOLOGICAL PARAMETERS IN BROILER CHICKENS

***[1]Mbakwe, C. C., Ojo S. T. and Saifullah Idris**
*[1]Department of Animal Science, Faculty of Agriculture, Federal University Dutsin-ma, Kastina State.
Corresponding author: frimbia75@gmail.com Phone No. +2349035827553

ABSTRACT
Indiscriminate use of antibiotics in livestock and poultry farming has caused the emergence of new pathogenic strains and resistance to other strains. This situation warranted the development of safe and alternative growth promoters and immunity enhancers in livestock production. Phytogenic additives in animal and bird feeds are century-old practices. Thus, this study was aimed at investigating the efficacy of turmeric rhizome powder (TRP) (Curcuma longa), cayenne pepper and their combinations as a natural growth promoter (poultry feed additive).One hundred and twelve (112) one-day old chicks were assigned into four groups. Control group (T1) kept on basal diet only and groups T2, T3 and T4 fed with 1% turmeric powder, 0.5% cayenne pepper and 1% Turmeric powder combined with 0.5% cayenne pepper, respectively on top of the basal diet and then fed ad libitum for 42 days. Each dietary group consisted of four replicates of seven birds. Blood biochemical analysis status of serum were investigated. In summary, we conclude that Turmeric and cayenne pepper can be used as a natural feed additive to improve growth performance in poultry, probably due to the better antioxidant activity and antimicrobial effects contributed by the better bioavailability of curcuminoids and turmerones. Besides, curcuminoids and turmerones were also known to be gastroprotective and anti-inflammatory agents.
Keywords: Turmeric, Antioxidant activity, Phytogenic, Hematology, serum biochemistry.

INTRODUCTION

The poultry industry is one of the most commercialized sub-sectors of Nigeria agriculture. Poultry production is an aspect that has been receiving and still receiving emphasis from experts in animal science and agricultural development globally. The practice of using antibiotics in poultry is being questioned, due to reported cases of development of resistant populations of bacteria, alteration of natural gut microbiota and association of health risks in human (Pandey *et al.,* 2019). The need to improve performance in poultry production creates demand for natural and safe alternative sources. Phytogenic feed additives (PFA) are plant derived natural bioactive compounds that have been reported to enhance performance, feed conversion ratio, carcass meat safety and quality in animals (Dhama *et al.,* 2014, Dhama *et al.,* 2015). Turmeric is one of the numerous phytogenic additives of importance in poultry feed production. It is a rhizome of the herbaceous perennial plant of the ginger family, *Zingiberaceae.* Though it is known to be native to the tropical south Asia, it is also grown in other tropical and sub-tropical Africa including Nigeria. *Curcumin* is the active compound in turmeric powder which is reported to have a lot of molecular targets in the cell (Zhou *et al.,* 2012) that could affect cell functions in the body. Compared with synthetic antibiotics or inorganic chemicals, plant-derived products are natural, less toxic than antibiotics, and typically residue free.

MATERIALS AND METHODS

Study Area

The experiment was conducted at Late Professor Lawal Abdu Saulawa Livestock Farm, Department of Animal Science, Federal University Dutsin-Ma, Katsina State. The farm is located within latitude 12° 27'18' North 7°29' 29' East and 605 meters above sea level (Google Map). The Northern Guinea Savanna zone with an average annual rainfall of about 700mm/annum. The mean annual temperature ranges between 29-31^{o}C

Experimental materials

Experimental birds

One hundred and twelve (112) day old broilers chicks (Cobb 500 chicks) were obtained from a reputable hatchery in Katsina State. The birds were divided into four (4) treatments with 28 chicks per treatment (T1,T2,T3 and T4, respectively). Each treatment contained four replicates with 7 birds per replicate.

Experimental diets and treatments

The diets were as follows: broiler starter- 22.4%CP 3010Kcal/kg ME and broiler finisher- 20.8% CP 2897Kcal/kg ME). Turmeric rhizomes and cayenne pepper were purchased from Central Market Katsina. The turmeric and cayenne pepper were shade dried at room temperature, ground and added to the diets at varying inclusion levels as the treatments. (0, 1, 0.5 and 1% turmeric mixed with 0.5% cayenne pepper to T1, T2, T3 and T4, respectively.

Table 1: Starter and finisher Experimental diets (%) fed to broilers

Ingredients	Starter	Finisher
Maize	54	57
Full fat soya bean	35	32
Fish meal	2.65	2.30
Soya oil	4.0	2.50
Dicalcium phosphate	1.50	1.50
Premix	0.25	0.25
Limestone	2.0	2.0
Methionine	0.20	2.0
Lysine	0.20	0.20
Common salt	0.20	0.25
TOTAL	**100**	**100**
Crude fat (%)	3.52	3.5.0
Crude fibre (%)	3.66	3.10
Crude protein (%)	22.40	20.80
Metabolizable Energy (kcal/kg)	3010	2897

Data collection

Average initial weight was measured and recorded at week one after which weekly weight gain and feed intake were measured and recorded to evaluate the feed intake and weight gain. Mortality was also recorded as it occurs.

At day 42 of the experiment, blood samples (2.0 mL each) were collected with needle and syringe through the brachial wing vein of two growing chicks (weighing averagely 680.80g) per replicate into EDTA bottles and plain bottles (2 mL per bottle) directly for the determination of hematological and serum biochemical indices using standard procedures, as described by Weiss and Wardrop (2011). Blood samples were collected in the morning. Hematological indices determined were Packed cell volume (PCV), Hemoglobin (Hb), Red blood cells (RBC), White blood cells (WBC), Lymphocyte. The serum metabolites determined were Total protein, blood glucose, uric acid and cholesterol.

Data Analysis

The data collected in the experiment was subjected to statistical analysis using SPSS, statistical package to compare the effects of the treatments, which was then followed by Duncan Multiple Range Test for test of significance.

Laboratory Tests

The blood samples collected were taken to laboratory for hematology test and serum biochemistry, in which the following parameters were investigated.

RESULTS AND DISCUSSION

The results obtained from the hematological parameters showed that there was no significant difference ($p<0.05$) in PCV and RBC levels across treatments however, there was significant

difference observed for hemoglobin (HB) and white blood cells (WBC). T3 had the highest HB and WBC values while T1 and T4 had the lowest values for HB and WBC, respectively.
The result for serum biochemistry showed that T2 and T3 had the least value for cholesterol and was significantly ($p<0.05$) different from T4 and T1. The treatment with the least Hdl value was T4 which was significantly ($p<0.05$) different from all other treatments. Glucose was lowest in treatment 1 and highest in treatment 3. Triglycerides was highest in treatment 2 and lowest in treatment 4. Total protein and uric acid were higher in treatment 1 and significantly ($p<0.05$) different from treatment 2,3 and 4.

Table 2: **Hematological parameters of broiler chicken fed turmeric and cayenne pepper powder supplementation**

Parameters/Treatment	T1	T2	T3	T4	SEM
PCV (%)	30.50	29.50	26.50	27.50	0.94
HB (g/dL)	7.83^{b}	8.70^{a}	8.23^{a}	8.40^{ab}	0.21
RBC (x 10^{12}/L)	2.55	2.64	2.51	2.47	0.13
WBC (x 10^{9}/L))	25.05^{c}	25.80^{bc}	28.15^{a}	26.45^{b}	0.66
Neutrophils (%)	57.75	53.25	58.75	57.75	3.06
Lymphocytes (%)	38.00	42.5	37.25	38.00	3.30
Monocytes (%)	3.75	3.70	3.50	2.50	1.55
Eosinophils (%)	0.50	0.75	0.50	0.00	0.47
Basophils (%)	0.00	0.00	0.00	0.00	0.00

PCV**:** packed-cell volume, HB: haemoglobin concentration, RBC: red blood cell count WBC: white blood cell count. SEM – Standard Error of Means. ^{a,b,c,d} means with different superscript on the row are significantly different ($p>0.05$)

TABLE 3: Serum Biochemistry Indices of Broilers Chickens Fed Cayenne Pepper and Turmeric Supplementation

Parameters	T1	T2	T3	T4	SEM
Cholesterol (mg/dL)	115.00^{b}	104.50^{c}	102.80^{c}	154.00^{a}	2.06
HDL (mg/L)	87.00^{b}	97.00^{a}	80.00^{bc}	77.50^{c}	3.02
LDL (mg/L)	71.4^{c}	88.80^{a}	75.55^{c}	81.50^{b}	1.51
Glucose (mg/dL)	257.50^{c}	293.00^{b}	361.50^{a}	262.50^{bc}	9.19
Triglycerides mg/dL)	96.50^{ab}	103.50^{a}	101.50^{a}	92.50^{b}	2.55
Total Protein(g/dL)	107.50^{a}	96.00^{b}	98.50^{b}	98.50^{b}	1.97
Uric acid (mg/dL)	244.00^{a}	205.50^{b}	203.50^{b}	210.00^{b}	8.56

HDL= High density lipoprotein, LDL= Low density lipoprotein. SEM – Standard Error of Means . ^{a,b,c,d} means with different superscript on the row are significantly different ($p>0.05$)

It has been established that serum biochemical and hematological components show cases the state of health, nutrition and management conditions to which the animals were subjected (RAR,2009).
All the observed parameters were found to be within their normal range in chicken. The results in this study are supported by the work of Guil-Guerrero *et al.* (2017) stated that in chicken difference in addition of Turmeric rhizome powder in a similar study although not clearly stated as to what extent who. This was contrary to the work of Park *et al.* (2012) and Gumus *et al.* (2018) who also recorded no significant differences among treatments. No result was found to where addition of turmeric rhizome powder decreased or affected hematological parameters.

CONCLUSION

The results obtained from this research indicated that turmeric rhizome powder supplementation in broiler feed can enhance production by maintaining the desired levels of the observed parameters with no harmful effects on the birds. In most of the parameters observed, lower inclusion rates yield better results than higher inclusion rates. Supplementation of turmeric could effectively control the hematological parameters in broiler chickens. The variation of results obtained in studies with turmeric in broiler performance can be explained by the variability in the number of phytochemicals

in the plant since many factors may influence the relative proportions of these compounds in the plant. The scientific action of turmeric may be attributed with the overall health status, metabolic system, immunomodulation and antimicrobial action.

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