



RESEARCH ARTICLE

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**EFFECT OF VARYING LEVELS OF TURMERIC RHIZOME POWDER (*Curcuma longa*)
SUPPLEMENTATION ON HAEMATOLOGICAL PARAMETERS OF BROILER CHICKEN**

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Abstract

Indiscriminate use of antibiotics in livestock and poultry farming has caused 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. Phytopreventive additives in animal and bird feed is a centuries-old practice. Thus, this study investigated the efficacy of turmeric rhizome powder (*Curcuma longa*) as a natural growth promoter poultry feed additive. The study was designed on 112 one-day old chicks, assigned into four groups. Control group (T1) kept on basal diet only and groups T2, T3 and T4 fed with 0.5%, 0.75 and 1% TRP respectively on top of the basal diet for 45 days. Each dietary group consisted of four replicates of seven birds. Body weight, feed intake, blood biochemical analysis status of serum was investigated. In summary, we concluded that TRP 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. Beside these curcuminoids and turmerones act as gastroprotective and anti-inflammatory agents. The results obtained from this work show that lower inclusion rates of turmeric (0.5%) have a better potential on most of the observed parameters.

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Introduction: -

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 importance of this sector cannot be over emphasized because of the two probable reasons as; it is a fast economic route, and it is also a fast means of protein supply. Broiler production serves as a source of income for many families all over the world (Akinbobola, 2020). In poultry nutrition is a significant part of poultry feeding because the performances of chickens and other poultry birds mostly depend on their diet. Different types of birds have own specific nutritional requirement, which is considered during formulation of feed for that animal. The

value lower or higher from required amount would affect the performance of the chickens. That is why it is important to know the nutritional requirements of broilers. (Akinbobola, 2020). Livestock and poultry industry in Nigeria is highly hindered by the limited supply and high cost of conventional feed resources. Therefore, there is a need to explore alternative feed resources with appreciable energy and protein contents that are inexpensive, readily available, and capable of substituting costly conventional feed ingredients, particularly maize (Christopher et al., 2021). According to Dhama et al., 2015, 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. Among the numerous phytogenic additives, turmeric is one of the important ingredients in poultry feed production. Turmeric is derived from rhizome of the herbaceous perennial plant of the ginger family, "Zingiberaceae". Turmeric is known to be native to the tropical south Asia, it is also grown in other tropical and sub-tropical Africa including Nigeria. It requires temperature between 20 and 30°C and a considerable amount of annual rainfall for growth (Khan et al., 2012). 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 Method:-

Study area

This experiment was conducted at the "Late. Prof. Lawal Abdu Saulawa Livestock farm" Department of Animal Science, Federal University Dutsin-ma, Katsina state. Farm location is within latitude 12°27'18" North 7°29'29" East and 605 meters above sea level, in the Northern guinea Savanna zone. The average annual rainfall of the research location is about 700mm/annum. The mean annual temperature ranges between 29-31°C.

Experimental materials

Experimental birds

A total of One hundred and twelve (112) day old broilers chicks of Olam strain were obtained from Dan Hassan Agro ventures Katsina. The birds were divided into four (4) treatments with 28 chicks per treatment (T1, T2, T3 and T4 respectively). Each treatment contains four replicates with 7 birds per replicate.

Experimental diet and treatment

Broiler feed was formulated to feed the birds (broiler starter- 22.4%CP 3010Kcal/kg ME and broiler finisher- 20.8% CP 2897Kcal/kg ME). Maize grains, soya bean, soya oil, fish meal were purchased from Wednesday market Dutsin-ma, while the micronutrients (lysine, methionine, salt and premix) were obtained from the school livestock farm. Turmeric Rhizomes were purchased from central market Katsina. The rhizomes were shade dried at room temperature, grounded and added to the feed at varying inclusion levels as the treatments. (0%, 0.5%, 0.75% and 1%) to T1, T2, T3 and T4 respectively.

Table 1:- Experimental diet.

Ingredients	Starter	Finisher
Maize	54	57
SBFF	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
Salt	0.20	0.25
	100	100
Fat content in g/kg	35.20	35.04
Crude fibre in g/kg	36.59	35.10
Crude protein	22.40	20.80
Metabolizable Energy	3010	2897

Data Collection

Blood samples were collected through the brachial vein of the sampled birds at week 8 using a 2ml syringe after fasting the birds for two hours. Two birds per replicate from all the four treatments were randomly chosen. The blood sample was sent to the laboratory for hematological analysis and serum biochemistry. Below are the parameters accounted for;

- Hemoglobin concentration
- PCV
- WBC
- Glucose level
- Total cholesterol
- Uric acid
- Total protein
- Triglyceride
- Total protein
- HDL
- LDL

Data Analysis

The laboratory results obtained was subjected to statistical analysis using SPSS, statistical package to compare the effects of the treatments, which was then followed by LSD for test of significance.

Results and Discussion:-**Results:-**

The results of the hematological characteristics and serum biochemistry of the experimental birds fed turmeric supplementation are presented below in tables 2 and 3.

Table 2:- Hematological parameters of broiler chicken fed turmeric powder supplementation.

Parameters	Treatments			
	T1 (0%)	T2 (0.5%)	T3 (0.75%)	T4 (1%)
PCV	22.00±2.46	20.50±2.46	17.00±2.46	21.00±2.46
Hb	7.50±0.65	6.85±0.65	6.05±0.65	7.45±0.65
WBC	17.80±0.79	17.10±0.79	17.95±0.79	18.25±0.79
NEUTROPHILS	36.50±2.09	36.00±2.09	29.50±2.09	39.50±2.09
LYMPHOCYTES	61.00±3.62	61.50±3.62	69.50±3.62	58.50±3.62
MONOCYTES	2.00±0.35	1.50±0.35	1.00±0.35	2.00±0.35
EOSINOPHILS	0.50±0.50	1.00±0.50	0.50±0.50	0.50±0.50

PCV: packed-cell volume, HB: hemoglobin concentration, WBC: white blood cell count

Turmeric supplementation and hematological characteristics

The values obtained from the hematological test conducted on the samples collected from the different groups of broilers fed with varying inclusion levels of turmeric varies between the treatments. The highest packed-cells volume (PCV) was observed in the T1 control group and the lowest in T3 (0.75%) inclusion level. Hemoglobin concentration (HB) was observed to be highest in T1 and lowest in T3. The white blood cells count (WBC) was highest in T4 and lowest in T2. Neutrophils (%) were recorded highest in T4 and lowest in T3, while Lymphocytes (%) was recorded highest in T3 and lowest in T4. The Monocytes (%) was highest in T4 and T1 and it is lowest in T3. Eosinophils (%) was highest in T2 and entirely the same all-round the treatments.

Table 3:- Mean ± SE of Lipid profile obtained from the blood sample collected from various inclusion levels of turmeric rhizome powder supplementation.

Parameters	Treatments			
	T1 (0%)	T2 (0.5%)	T3 (0.75%)	T4 (1%)
Glucose (MMOL/L)	10.55±0.29	10.46±0.29	8.55±0.29	9.35±0.29
Total protein	6.25±0.19	6.25±0.19	5.65±0.19	6.45±0.19
Uric acid	3.40±0.47	4.20±0.47	4.15±0.47	3.55±0.47

LDL	1.97±0.06	2.20±0.06	2.10±0.06	1.93±0.06
HDL	0.76±0.48	0.80±0.48	0.70±0.48	0.66±0.48
Triglyceride	1.40±0.17	1.10±0.17	1.45±0.17	1.24±0.17
Total cholesterol	3.37±0.17	3.53±0.17	3.47±0.17	3.16±0.17

LDL: low density lipoprotein, **HDL:** High density lipoprotein

Turmeric and serum biochemistry

From the table above, the results show that glucose was highest in T1 and lowest in T3, total protein was highest in T4 and lowest in T3, uric acid was highest in T2 and lowest in T1, low density lipoprotein and high density lipoprotein were both observed to be highest in T2 and lowest in T4, triglyceride was highest in T3 and lowest in T2, and total cholesterol was highest in T2 and lowest in T4.

Discussion:-

The results obtained from this research shows that there is no significant difference ($p<0.05$) between the treatments in relation to the observed parameters. Although, there are slight differences in the means of the observed parameters.

Hematological Characteristics

All the observed hematological characteristics were found to be within their normal range in chicken, with no significant effect because of turmeric inclusion in the diet. The result of this research aligns with the work of Park et al. (2012), and Gumusel et al., (2018), who also recorded no significant effect in addition of TRP in a similar study. Contrary to the work of Guil-Guerrero et al. (2017) who stated that in chicken, TRP could increase some hematological parameters, although not clearly stated as to what extent.

Lipid Profiles

Total protein was recorded to be similar all through the treatments, with slight increase in T4(1% inclusion level). This is in line with the findings of Kumari et al. (2007) who recorded no difference in similar study. According to Rajput et al., (2013), in a study to evaluate the effect of turmeric (rhizome powder) in broilers supplemented with 0.00%, 0.25%, 0.50% and 0.75% turmeric, no difference was observed in the levels of total protein at 35 and 42 days of age. Total cholesterol level was recorded to be the same statistically, with slight increase in T2 (0.5%) which also corresponds with the results of Ekineet al., (2020). According to Rajput et al., (2013) concerning plasma lipids, the use of pure curcumin at low doses in feed reduces cholesterol level in broilers, while the same effect of TRP is possible when it is used at high amounts, up to 1 g/kg of feed. In this research, no significant effect was recorded on Triglyceride concentration and High-Density Lipoprotein throughout the treatments, although both highest in (0.5% inclusion levels). This is in line with the study of Ekineet al. (2020) who got the same results; this might be due to the reduction of synthetic enzymes activities as they mentioned. Similarly, Ahmadi, (2010) reported that curcuma longa had lowering effect on triglyceride level in broiler serum which shows that turmeric has hypolipidemic action in broilers birds, but contrasted with the findings of Emadi and Kermanshahi, (2007) who reported that turmeric supplement in high amount into basal diet of broilers significantly increased High Density Lipoprotein. Guil-Guerrero et al. (2017) in similar research recorded no effect on LDL, all the values obtained are within the normal range, with the lowest value in T4(1% inclusion level). Kumari et al. (2007) found that TRP induced a decrease in concentration of uric acid in serum (from 6.31 to 4.21 mg/dl).

Conclusion and Recommendation:-

Conclusion:-

The results obtained from this research indicated that turmeric rhizome powder supplementation in broiler feed is safe and can as well enhance production by maintaining the desired levels of hematological and serum characteristics. In most of the parameters observed, lower inclusion rates yield better results than higher inclusion rates. 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.

Recommendation:-

Phytonic feed additives such as turmeric can be seen as promising antioxidants that can be included in broiler diets to prevent deposition of toxic substances in poultry meat instead of using synthetic antibiotics, as they show promising results. Also, further research should be conducted to ensure that turmeric does not have any harmful effect on the consumers when used in large quantities. Meanwhile, lower inclusion rates are recommended until further evidence of using higher amounts with no negative effects are available. There are few literatures available that suggested the mode of action of turmeric in poultry, more researches should be carried out to focus on mechanism of action of curcumin as well as proper combination with other phytonic additives to provide strong support to the use turmeric in poultry industry.

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