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EFFECTS OF DIETARY TURMERIC (CURCUMA LONGA) RHIZOME POWDER ON GROWTH PERFORMANCE AND FEED EFFICIENCY IN BROILER CHICKENS

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Abstract

Antibiotic resistance has become an alarming issue in recent years, and the poultry industry is seeking alternatives in broiler feed to enhance growth and produce safe meat to meet consumer demand. Turmeric is one of the natural feed additives with the potential to improve broiler health and productivity. The present study was conducted to evaluate feed intake, weight gain, and feed conversion efficiency under different dietary treatment levels. A total of one hundred twelve (112) day-old chicks were used and divided into four treatment groups: T1, T2, T3, and T4, containing 0%, 0.5%, 0.75%, and 1% turmeric powder, respectively. Each treatment was replicated three times with seven birds per replicate in a completely randomized experimental design. A significant effect of turmeric powder on feed intake was observed ($P < 0.05$), whereas non-significant effects were observed on weight gain, body weight, feed conversion ratio, and feed efficiency at different levels of *Curcuma longa* powder supplementation. The experimental flocks were uniform and showed low variability in five parameters; however, the coefficient of variation (CV) for feed efficiency ratio was slightly higher at approximately 2.94%. The results of this experiment suggest that supplementation with 0.75% turmeric powder enhances feed intake in broiler chickens.

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Introduction: -

Poultry production has become a profitable business for rural farmers and commercially operated business stakeholders because of higher demand of poultry meat. Specially broiler meat is the major source of animal protein and high demand in cuisine and restaurant for processing fast food and meat products for human consumption. Broiler production increased remarkably due to its faster growth rate, low production cost and high demand for meat and achieved popularity as an alternative of beef and pork with approximately 70 billion broilers slaughtered annually in the world (Mace and Knight, 2022). Effective broiler production highly relies upon scientific management and economic feeding, optimal growth, lower morbidity and mortality. Poultry feed cost characterizes

approximately 65-70% of overall production cost of poultry revealing the necessity of feed improvisation (Al-Jaleel et al., 2012).

A wide range of feed additives were utilized in poultry ration for the maximization of growth rate in broiler chickens. Utilization of antibiotics and hormones in feeds not only increases the production cost but also inclusion of antibiotic residue in meat and develops antibiotic resistance in microbes (Raghdad and Al-Jaleel, 2012). Based on health consciousness people are likely to use natural herbs as an alternative of antibiotic growth promoters. In recent years, Phyto-biotics have gained priority as a feed additive in poultry production. These have potential medicinal properties and without containing any harmful residue act as best alternative of antibiotic growth promoters (Rahman et al., 2014).

Turmeric (*Curcuma longa*) is derived from such perennial herbs comprising with an active component named curcumin (Mashhadani, 2015 and WuthiUdomler et al., 2000) and the range of 2 to 5% of the turmeric contained by curcumin (Bagchi, 2012). Curcumin is well-known for its antibacterial, anti-inflammatory, and antioxidant activities, which is considered as a supplementary diet for a wide range animal species, incorporating broiler chickens (Hossain et al. 2022). Moreover, it had been documented for the for-metabolism enhancement, digestibility of nutrients and helps in the inhibition of anorexia and biliary disorders in human being and domestic animals (Al Sultan and Gameel, 2004; Chattopadhyay et al., 2004).

Although, the Turmeric has known to have different features which has a beneficiary impact to animals and poultry but there is a significance to conduct experiment on inclusion of dietary turmeric in poultry ration to gain optimum productivity, feed conversion efficiency and growth performance, therefore the present study aimed to evaluate how dietary turmeric rhizome powder affects growth performance, feed utilization, and overall efficiency in broiler chickens.

Materials and Methods: -

Study area

The study was carried at Late. Prof. Lawal Abdu Saulawa Livestock farm of the Department of Animal Science, Federal University Dutsinma, Katsina state. The farm is located within latitude 12°27'18' North 7°29'29' East and 605 meters above sea level, in the Northern guinea Savanna zone with an average annual rainfall of about 700mm/annum. The mean annual temperature ranges between 29-31°C.

Experimental Birds

For this present experiment, a total of one hundred and twelve (112) day old broilers chicks (Olam chicks) were procured from Danhassan Agro ventures Katsina. The birds were divided into four 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

Two types of broiler diet were formulated to feed the birds 1. broiler starter CP-22.4%, ME-3010 Kcal/kg and 2. broiler finisher CP-20.8% and ME-2897 Kcal/kg. Feed ingredients, maize, soya bean meal, soyabean oil, fish meal was purchased from Wednesday market Dutsinma, whereas the micro-nutrients molecule (lysine, methionine, salt and premix) were procured from the school livestock farm. Turmeric Rhizomes were purchased from central market Katsina. The rhizomes were shaded 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: - Feed Ingredients of Experimental diet.

Feed Ingredients	Starter Diet	Finisher Diet
Maize	54	57
SBFF	35	32
Fish meal	2.65	2.30
Soya oil	4.0	2.50
Dicalcium phosphate (DCP)	1.50	1.50
Premix	0.25	0.25
Limestone	2.0	2.0
Methionine (ME)	0.20	2.0
Lysine(L)	0.20	0.20

Salt	0.20	0.25
Total	100	100
Fat content in g/kg	35.20	35.04
Crude fiber in g/kg (CF)	36.59	35.10
Crude protein (CP)	22.40	20.80
Metabolizable Energy (ME)	3010	2897

Data collection

The data collected for these experiments were initial weight, final weight, feed intake, daily weight gain, and FCR. Average initial weight was measured and recorded at week one after another by 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. Feed conversion ratio is the measure of the ratio of the total feed intake that was used by the chicken to gain weight. It was calculated by dividing the total feed intake by the total weight gained by the chicken.

$$\text{FCR} = \frac{\text{Total feed intake}}{\text{Total weight gain}}$$

The feed conversion efficiency (FCE) of different treatment groups was calculated by procuring the following formula:

$$\text{Feed conversion efficiency (FCE)} = \frac{\text{Total body weight gain (g)}}{\text{Quantity of feed consumed (g)}}$$

Data Analysis

The data collected in the experiment was subjected to statistical analysis using R, analyzed with a software program R 4.5.1. The least significant Difference (LSD) test was applied to compare the difference means.

Statistical Model

A typical statistical model used:

$$Y_{ij} = \mu + T_i + \varepsilon_{ij}$$

Where:

Y_{ij} = observed value

μ = overall mean

T_i = effect of the i^{th} turmeric level

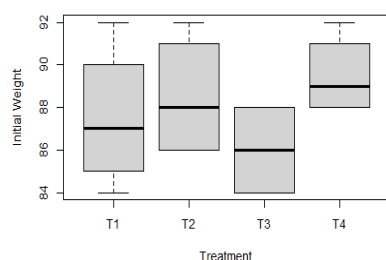
ε_{ij} = random error

Results and Discussion: -

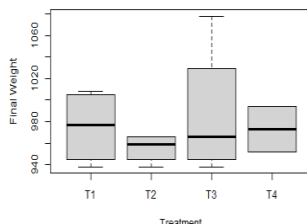
Table 2: - Performance of Broiler chicken with different levels of Turmeric Treatment.

Variable	T1(0%)	T2(0.5%)	T3(0.75%)	T4(1%)	Mean	CV (%)	P value
Initial Weight	87.5a	88.5a	86.0a	89.5a	87.8	0.03	0.351
Final Weight	975.0a	955.5a	987.0a	973.0a	972.62	0.04	0.722
Weight gain	887.5a	867.0a	901.0a	883.5a	884.75	0.04	0.684
Feed intake	9260b	8500d	9500a	8760c	9005	0.05	0.000
FCR	1.492ab	1.401b	1.512a	1.417ab	1.46	0.05	0.074
FCE	0.171a	0.014a	0.013a	0.014a	0.05	2.94	0.428

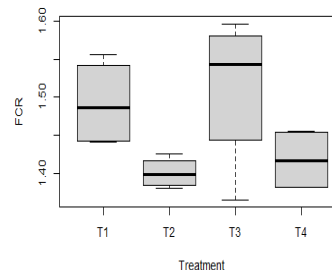
Initial Weight of Broiler in different Treatment level

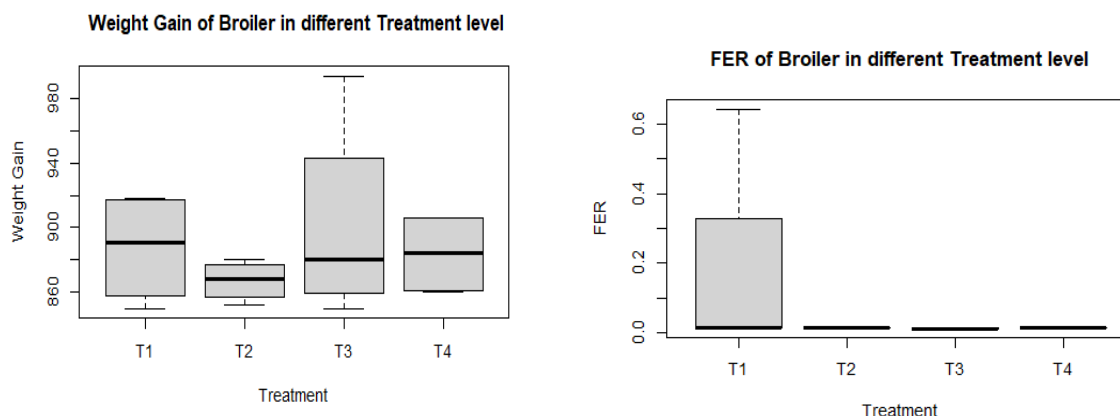


Final Weight of Broiler in different Treatment level



FCR of Broiler in different Treatment level





Graph 1:- Performance of Broiler chicken with different levels of Turmeric Treatment graphically.

Body Weight

The average initial and final body weight of broiler chicken under various treatment groups has been demonstrated in Table 2. Initial average body weight of the control group (T1) and the three treatment groups (T2, T3 and T4) were 87.5g, 88.5g, 86.0g and 89.5g per bird recorded respectively in Table 2. The table demonstrating the final weight of broiler for four different treatment groups were 975.0g, 955.5g, 987.0g and 973.0g per bird after 4 weeks of age. It is observed in table 2 that T3 indicates highest average final weight compared to others while T2 detected least final weight numerically. However, statistically $p > 0.05$, depicts that there are no significant differences in body weight among the treatments with supplementation of turmeric rhizome powder. Many studies provided with non-significant result where they were agreed with the present study result (Kichu et al., 2023; Wang et al., 2015; Mehala and Moorthy, 2008; Nouzarian et al., 2011). On the contrary, Mondal et al. (2015), reported that increased body weight in broiler with supplementation of 0.5% turmeric within four weeks of age. The significant impact depends on antioxidant activity which enhance the protein synthesis through bird enzymatic system with utilization of 0.5% turmeric. Similar statement provided by other researchers that use of turmeric increased the body weight of broiler (Jahan 2014; Mashhadani, 2015).

Weight gain

Estimated weight gain in various treatment groups 887.5g, 867.0g, 901.0g and 883.5g for T1, T2, T3 and T4 respectively depicted in Table 2. Numerically the highest increased weight observed in T3 with inclusion of 0.75% turmeric powder whereas less weight gain in T2. In view of statistically non-significant due to p value greater than 0.05. Related studies by Rangasaz and Ahangaran, (2011) demonstrated the non-significant impact of turmeric supplements. On contrast, previous researchers found the significant effect of turmeric on weight gain of broiler (Vashan et al., 2012; Elkhair et al., 2014; Mondal et al., 2015). The improvement of body weight gain influenced by the supplementation of turmeric powder which is because of increased intestinal villi length and reduction of intestinal PH (Siao et al., 2005). In addition, turmeric stimulates the digestive enzyme secretion and efficiently enhanced absorption of nutrient and impact on growth performance (Arslan et al., 2017).

Feed Intake

Table 2 develops the average feed intake during the whole period for different treatment groups 9260g, 8500g, 9500g, 8760g and 9005g per bird for T1, T2, T3 and T4 separately. In numerical illustration highest feed intake was observed in T3 followed by T1, T4 and T2 respectively. Higher feed intake occurred during the supplementation of turmeric. Statistically, $P < 0.05$, so there is a significant impact on feed intake in various levels of treatments. The result of the present study agreed with the previous experiment where significant differences observed (Vashan et al., 2012; Rajput et al., 2013). However, earlier researchers depicted non-significant effect of feed intake in broiler (Mondal et al., 2015; Nouzarian et al., 2011).

Feed Conversion Ratio

Regarding FCR, the average feed conversion efficiency in varying levels of treatment groups up to 4 weeks of age demonstrated 1.492, 1.401, 1.512, 1.417, 1.46 for T1, T2, T3 and T4 respectively in Table 2. Feed conversion ratio in different dietary treatments was not statistically significant $p > 0.05$. The best FCR (1.401) observed in T2. FCR

was lowest in 0.5% followed by 1%, 0% and 0.75% of turmeric supplementation indicating best feed conversion due to peak antioxidant activity of turmeric on 0.5% treatment. Similar studies Yaghobfar et al. (2011) reported that feeding turmeric powder to broiler, there is no significant effect on FCR at feeding 0.4 and 0.8% range. Moreover, other researchers indicated that addition of turmeric on broiler feed didn't show significant difference on FCR (Vashan et al., 2012 and Fallah and Mirzaei, 2016). Contrast, there is a significant difference on FCR depending on turmeric supplementation (Raghdad and Al-Jaleel, 2012). In this research feed efficiency ratio is higher in 0% turmeric treatment. Conversely, few experiments suggested that utilization of turmeric in broiler feed enhance the feed conversion efficiency of bird (Mondal et al., 2015; Rajput et al., 2013; Kassie et al., 2011).

Conclusion: -

Turmeric contains natural medicinal attributes which help to enhance the growth productivity and health status of broiler. The present study depicted that there was a significant impact on feed intake during the use of turmeric in broiler diet. Highest feed intake observed in T3 and lowest in T2. Average mean of feed intake in different groups was 9005g. The flocks were uniform and showed the low variability in five different parameters while in FER the CV is little bit higher than at 2.94. Inclusion of turmeric in dietary supplementation of broiler chicken has a non-significant effect on body weight. It is also revealed that utilization of turmeric in broiler diet there is no significant impact on body weight gain. Feed conversion efficiency highest in T2. It is suggested that inclusion of 0.75% turmeric powder effect on feed intake and feed conversion efficiency in broiler chicken.

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