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## Effect of dietary supplementation of turmeric (*Curcuma longa*) powder on the haematological and biochemical constituents of Vana raja birds

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### Abstract

An experiment was carried out to study the haematological and biochemical constituents of Vana raja bird provided with turmeric powder supplemented diet following scientific and standard management practices. The experiment was carried out as per Completely Randomized Block Design (CRD). One hundred and twenty (120) numbers of female Vana raja birds of 8 weeks of age were randomly divided into four (4) different groups designated as T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> with thirty (30) chicks in each group having five replicates of six (6) birds each and were raised under cage system. The trial was conducted for 365 days. The haematological and biochemical parameters were found to have positive effect in the treatment groups than control. On the basis of the findings, it can be concluded that using turmeric as herbal feed additives could help in improvement of health condition of the birds.

**Keywords:** Growth, FCE, WBC, RBC, HDL, LDL, cholesterol, triglycerides

### Introduction

A significant economic sector in many nations is now the poultry sector. The most affordable sources of animal proteins are eggs and poultry meat. Furthermore, one of the best fertiliser substitutes is poultry manure. The latest trends in poultry rearing practices and innovations for processed chicken meat, medications, feed additives, health goods, equipment, management, marketing and other technical support have made it feasible to increase the production of poultry meat and eggs. Feed cost continues to be the major expense item which accounts for 60-70 per cent of the total cost of production (Wilson and Beyer, 2002) [23]. In order to avoid the possible risk of developing resistant pathogen and also to produce antibiotics free animal products as per public demand, the use of turmeric in poultry diet is completely banned in European Countries. Various herbal products are being used as growth promoters in the poultry rations; one of which is Turmeric powder. The use of turmeric and its extracts as a substitute for antibiotic growth promoters in the production of poultry has been reported to be highly effective (Basak, 2015) [2]. Use of turmeric in poultry birds resulted in enhancement of haematological and biochemical markers (Guil-Guerrero *et al.*, 2017) [9]. The hepatoma protector activities of curcumin could prevent the damage of liver cells (Aggarwal *et al.*, 2007 and Kohli *et al.*, 2005) [1, 14]. Curcuminoids present in turmeric have antioxidative, anticarcinogenic and anti-inflammatory properties (Nishiyama *et al.*, 2005) [15].

The bioactive ingredients of turmeric promote healthy skin, eyes, and brain functioning in addition to aiding digestion. Its potent antiviral and antioxidant properties support the immune system's growth. Since the last decade, turmeric has increasingly been used in chicken feed due to its therapeutic properties (Khan *et al.*, 2012) [13].

There are limited studies on the effects of turmeric powder supplementation in birds, especially laying hens (Radwan *et al.*, 2008) [17] and also the literature available on use of turmeric powder as feed additive in the ration of laying hens is scanty (Dalal and Kosti, 2018) [5]. Considering the beneficial effects of turmeric, the present study entitled "Effect of dietary supplementation of turmeric (*Curcuma longa*) powder on the performance of Vana raja birds" as postulated to see the effect of turmeric on the blood profile of Vana raja birds.

### Materials and Methods

An experiment was conducted using 120 numbers of Vana raja pullets of uniform age (8 weeks) which were raised in the poultry unit of the Instructional Livestock Farm of the

Department of Livestock Production and Management, School of Agricultural Sciences and Rural Development, Nagaland University, Medziphema Campus, Nagaland. The farm is located at 93.20°E to 95.15°E longitude and latitude between 25.6°N at an elevation of 310 meter above mean sea level (MSL). The average annual rainfall was between 175 to 250 cm. The pullets were randomly divided into four groups with thirty pullets in each group having five replicates of six birds each. The birds were offered standard grower ration up to 18<sup>th</sup> weeks followed by layer ration which was supplemented with different levels of turmeric powder from eight weeks to 52 weeks of age. Group T<sub>1</sub> served as control and was provided with just the basal diet while groups T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were provided the same basal diet as in T<sub>1</sub> but supplemented with turmeric powder @ 0.5 (T<sub>2</sub>), 0.75 (T<sub>3</sub>) and 1.5 (T<sub>4</sub>) per cent of ration, respectively. Strict sanitation and hygiene were maintained during the rearing period. For blood profile, 2.0 ml blood samples were collected via wing vein from three birds from each treatment at four months intervals. Plasma was separated and stored at -20 °C. However, for

estimation of red blood cells (RBC) and White blood cells (WBC) fresh whole blood was used. RBC or erythrocytes and WBC were counted by using an improved Neubauer Haemocytometer as per the method described by Sastry (1985) [20]. Total serum cholesterol (TC), high density lipoprotein (HDL) and low-density lipoprotein (LDL) were determined by using biochemical analysis kits from Diatec Health care Pvt. Ltd. Total cholesterol concentration was estimated as per the method described by Richmond (1973) [19]. HDL was estimated as per the method described by Izawa *et al.* (1997) [11] and LDL concentration was estimated as per the method described by Weiland and Seidel (1983) [22]. The experimental data collected was subjected to statistical analysis in order to draw a valid interpretation using ANOVA in a completely randomized design as described by Gomez and Gomez (1984) [7].

## Results and Discussion

### Blood profile

#### Haematological parameters

**Table 1:** Haematological and biochemical parameters of blood of Vana raja birds in different treatment groups

Parameters	Treatments				
	Age	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
WBC (10 <sup>3</sup> /mm <sup>3</sup> )	180 days	18.02±0.09	18.78±0.43	19.02±0.33	19.06±0.31
RBC (10 <sup>6</sup> /mm <sup>3</sup> )		2.92±0.12	2.92±0.14	3.10±0.05	3.06±0.17
LDL (mg/dl)		80.2 <sup>a</sup> ±1.88	75.4 <sup>ab</sup> ±1.63	73.2 <sup>ab</sup> ±4.09	68.2 <sup>b</sup> ±1.15
HDL (mg/dl)		47±1.61	49±2.91	52.2±2.08	51.8±2.13
Cholesterol (mg/dl)		142.00 <sup>a</sup> ±2.30	136.80 <sup>ab</sup> ±3.30	134.40 <sup>b</sup> ±2.80	130.00 <sup>b</sup> ±0.83
Triglycerides (mg/dl)		67.80 <sup>a</sup> ±2.65	60.80 <sup>b</sup> ±2.90	59.20 <sup>b</sup> ±2.12	57.20 <sup>b</sup> ±1.88
WBC (10 <sup>3</sup> /mm <sup>3</sup> )	242 days	18.16±0.14	19.08±0.30	18.96±0.40	19.26±0.30
RBC (10 <sup>6</sup> /mm <sup>3</sup> )		2.92±0.07	2.96±0.14	3.08±0.20	3.00±0.13
LDL (mg/dl)		78.4 <sup>a</sup> ±1.02	73.4 <sup>a</sup> ±1.88	73.0 <sup>ab</sup> ±3.14	67.4 <sup>b</sup> ±1.07
HDL (mg/dl)		47.2±2.10	50.2±3.07	50.2±3.07	53.4±1.96
Cholesterol (mg/dl)		143.0 <sup>a</sup> ±1.22	138.4 <sup>a</sup> ±1.43	138.2 <sup>a</sup> ±2.22	133.0 <sup>b</sup> ±1.54
Triglycerides (mg/dl)		68.00 <sup>a</sup> ±2.16	62.00 <sup>b</sup> ±2.40	58.00 <sup>b</sup> ±1.64	57.60 <sup>b</sup> ±1.56
WBC (10 <sup>3</sup> /mm <sup>3</sup> )	365 days	18.16 <sup>b</sup> ±0.12	19.14 <sup>a</sup> ±0.43	19.14 <sup>a</sup> ±0.43	19.40 <sup>a</sup> ±0.29
RBC (10 <sup>6</sup> /mm <sup>3</sup> )		2.90±0.12	2.94±0.43	3.00±0.29	3.12±0.25
LDL (mg/dl)		76.20 <sup>a</sup> ±1.74	75.20 <sup>a</sup> ±0.80	73.80 <sup>a</sup> ±1.85	69.60 <sup>b</sup> ±0.87
HDL (mg/dl)		48.2±1.65	50.6±2.95	53.6±1.91	53.0±1.84
Cholesterol (mg/dl)		142 <sup>a</sup> ±0.89	140 <sup>a</sup> ±1.58	138 <sup>ab</sup> ±1.22	134.8 <sup>b</sup> ±1.59
Triglycerides (mg/dl)		68.40 <sup>a</sup> ±2.58	60.40 <sup>a</sup> ±2.33	57.80 <sup>b</sup> ±1.49	58.00 <sup>b</sup> ±1.78

As per the Table 1, the mean values for Total White blood cells (10<sup>3</sup>/mm<sup>3</sup>) at different ages (180, 242 and 365 days) for different groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> was 18.02±10.09, 18.78±0.43, 19.02±0.33, 19.06±0.31, 18.16±0.14, 19.08±0.30, 18.96±0.40, 19.26±0.30 and 18.16±0.12, 19.14±0.43, 19.14±0.25 and 19.40±0.29, respectively. Analysis of variance showed that there was significant ( $p<0.05$ ) difference in total WBC due to turmeric supplementation at 365 days. The turmeric treated group had higher total WBC as compared to the control. Higher values for WBC are indicative of positive effect of the active ingredient of turmeric. The present results are in line with the findings of Guil-Guerrero *et al.* (2017) [9] and Oluwafemi *et al.* (2021) [16] who had observed improvement in several hematological indicator when turmeric was supplemented in layer diet.

As per the Table 1, the mean values for Total Red blood cells (10<sup>6</sup>/mm<sup>3</sup>) at different ages (180, 242 and 365 days) for different groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> was 2.92±0.12, 2.92±0.14, 3.10±0.05, 3.06±0.17; 2.92±0.07, 2.96±0.14, 3.08±0.20, 3.00±0.13, 2.90±0.12, 2.94±0.43, 3.00±0.29 and 3.12±0.25, respectively. Analysis of variance showed that there was no

significant ( $p<0.05$ ) difference in total RBC due to turmeric supplementation. These findings were in agreement with the earlier findings of Shende *et al.* (2021) [24] who observed the non-significant influence of turmeric on haematological parameters. On the contrary, Oluwafemi *et al.* (2021) [21] had reported that turmeric added diet positively influenced the hematological and biochemical parameters of birds.

#### Biochemical constituents

As per the Table 1, the mean values for LDL (mg/dl) at different ages (180, 242 and 365 days) for different groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> was 80.20±1.88, 75.40±1.63, 73.20±4.09, 68.20±1.15, 78.4±1.02, 73.4±1.88, 73.00±3.14, 67.40±1.07, 76.20±1.74, 75.20±0.80, 73.80±1.85 and 69.60±1.07, respectively. Analysis of variance showed that there was significant ( $p<0.05$ ) difference in LDL due to turmeric supplementation irrespective of different ages and the values for LDL decreased significantly in T<sub>4</sub> as compared to the control group T<sub>1</sub>. Decrease in LDL could be attributed to the curcumin content which helps to use the serum cholesterol from the body to synthesize bile acids for lipid metabolism as

reported by Emadi *et al.* (2007) <sup>[6]</sup>. Similar to the present findings, Riasi *et al.* (2012) <sup>[18]</sup> and Chauhan *et al.* (2014) <sup>[4]</sup> had also reported that turmeric in layer diet significantly reduced the LDL level.

As per the Table 1, the mean values for HDL (mg/dl) at different ages (180, 242 and 365 days) for different treatment groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> was 47±1.61, 49.00±2.91, 52.20±2.08, 51.80±2.13; 47.20±2.10, 50.20±3.07, 53.6±1.96, 53.4±1.96, 48.20±1.65, 50.6±2.95, 53.60±1.91 and 53.00±1.84, respectively. Though numerically HDL values were observed to be in increasing trend in turmeric supplemented groups, statistically it was found to be non-significant. Radwan *et al.* (2008) <sup>[17]</sup> had also observed non-significant difference in HDL in layer birds subjected to diet supplemented with different levels of turmeric.

As per the Table 1, the mean values for Triglycerides (mg/dl) at different ages (180, 242 and 365 days) for different groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> was 67.80±2.80, 60.80±2.90, 59.20±1.06, 57.20±1.88; 68.00±2.16, 62.00±2.40, 58.00±1.64, 57.60±1.56, 68.40±2.58, 60.40±1.80, 57.80±1.49 and 58.00±1.78, respectively. Analysis of variance showed that there was significant ( $p<0.05$ ) difference in serum triglycerides and the values were found to be significantly lower in turmeric supplemented groups with the lowest level in T<sub>4</sub> as compared to T<sub>1</sub>. Several researchers including Kermanshahi and Riasi (2006) <sup>[12]</sup>; Riasi *et al.* (2012) <sup>[18]</sup> and Chauhan *et al.* (2014) <sup>[4]</sup> had also reported that turmeric in layer diet lowered triglycerides significantly. Decrease in serum triglycerides may be attributed to the inhibitory action of turmeric for secretion of liver triglyceride (Chattopadhyal *et al.*, 2004) and increased activity of lipoprotein lipase as reported by Graham (2009) <sup>[8]</sup>.

As per the Table 1, the mean values for cholesterol (mg/dl) at different ages (180, 242 and 365 days) for different groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> was 142.00±2.30, 136.80±3.30, 134.40±2.80, 130.00±0.83, 143.00±1.22, 138.40±1.43, 138.20±2.22, 133.00±1.54, 142.00±0.89, 140±1.58, 138.00±1.22 and 134.80±1.59, respectively. Statistical analysis had revealed that turmeric supplementation had significant ( $p<0.05$ ) effect on the serum cholesterol at all the given ages *i.e.*, 180, 242 and 365 days. Lower level of cholesterol was observed in all the groups fed with turmeric powder as compared to the control. These observations were in agreement with the findings of Kermanshahi and Riasi (2006) <sup>[12]</sup>; Radwan *et al.* (2008) <sup>[17]</sup> and Riasi *et al.* (2012) <sup>[18]</sup> who had also reported that turmeric in layer diet markedly decreased the cholesterol. The conversion of cholesterol to bile acid by the action of curcumin, a path to eliminate cholesterol from the body as reported by Srinivasan and Sambaiah (1991) <sup>[21]</sup> could be the reason for lower cholesterol level in the turmeric supplemented group. Contrary to the above findings, Gumus *et al.* (2018) <sup>[10]</sup> had reported non-significant effect of turmeric on the above parameters. Variations in the findings could be attributed to factors such as species/strain differences, duration of trial, system of rearing, argon-climatic differences, differences in the level of turmeric powder and season.

## Conclusion

Based on the above findings, it can be concluded that, overall, the turmeric powder supplementation at the rate of 1.5 per cent (T<sub>4</sub>) resulted in better performance in terms of haematological and biochemical values as compared to the control group. Therefore, on the basis of the findings, it can

be concluded that using turmeric as herbal feed additives could help in improvement of health condition of the birds.

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