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Effect of turmeric powder (*Curcuma longa*) as natural feed additive on growth performance of broilers

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Abstract
The research entitled "Effect of Turmeric Powder (*Curcuma longa*) as natural feed additive on Growth Performance of Broilers" was studied to assess the effect of different levels of Turmeric powder in broiler diet on growth performance, feed, feed conversion ratio and economics in broiler. One Hundred Sixty broiler chicks were purchased and divided into four groups (control) T_0 and treatment group T_1, T_2 and T_3 with 0.1, 0.2 and 0.3% Turmeric powder in broiler diet. Addition of Turmeric powder 0.3% and 0.2% showed significantly highest cumulative body weight than T_1 and T_0. At the end of 6th week total feed intake in T_3 (4292.86 g) was significantly (p<0.05) less than T_0 (4431.95 g) as well as treatments T_1 (4387.45 g) and T_2 (4345.78 g). Overall FCR of experiment, treatment T_3 (1.71) showed significantly (p<0.05) higher performance with respect to FCR from T_0 (1.85) and T_1 (1.80), However values of FCR of T_3 (1.71) and T_2 (1.76) differ non significantly from each other. Net profit per bird in T_3, T_2, and T_1 treatment was higher by (Rs.12.94), (Rs.8.35) and (Rs.4.19) than T_0. According to the results of present research it was concluded that 0.3% turmeric powder can be added safely in broiler diet thereby improving growth performance, FCR and reducing the cost of production over control as well as broiler feed with 0.2 and 0.1% turmeric powder.

Keywords: Turmeric powder, broilers and feed additives

Introduction
India ranks 3rd in egg production and 7th in chicken meat production in the world. About 3.4 million tons (74 billion) of eggs are produced from 260 million layers and 3.8 million tons of poultry meat is produced from 3000 million broilers per annum in India. The Poultry meat and eggs provides high quality food for humans, which also act as a protective food in human nutrition. Chicken meat is most acceptable and is easily digestible meat as compared to mutton and chevon. Indian Poultry Industry is facing prominent problems of immunosuppression due to various reasons *viz*., management conditions, nutritional status, intensive production system, high density rearing and infectious diseases etc. Hence, the priority to find ways and techniques for enhancement of immune response by nutritional manipulation. Qualitative and Quantitative information is available in literature to administrate vitamins, minerals, amino acids and their different combinations for chicken to improve their performance. Since the use of antibiotics has been limited, better use of supplementary immuno-stimulatory nutrients has to be made available in poultry feeding. (Mode *et al*, 2009) [5].

Majority of people in India use herbs as medicine and nutrition, which firstly herb originated from great science of Ayurveda. Nowadays there is increase in consumer criticism on synthetic medicines and demands for more natural products increased. Therefore, rising interest in use of plant based ingredients in both medicine and medical treatments are in great popularity in western world. In the Indian Ayurveda system of herbal medicine, turmeric is known as strengthening and warming to the whole body. Traditional uses in India include to improve digestion, to improve intestinal flora, to eliminate worms, to relieve gas, to cleanse and strengthen the liver and gallbladder, to normalize menstruation, for relief of arthritis and swelling, as a blood purifier, to warm and promote proper metabolism correcting both excesses and deficiencies, for local application on sprains, burns, cuts, bruises, insect bites and itches, for soothing action in cough and asthma, as antibacterial and anti-fungus, and in any condition of weakness or debility. Turmeric is eaten as a food both raw and cooked throughout Asia. (Bhowmik *et al*., 2009) [2]. Hence, this study was designed to evaluate the effects of turmeric powder (curcuma longa) as natural feed additive on growth performance of broilers.

Materials and Methods

This study was investigated for a period of 42 days carried out in the Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur, VNMKV, Parbhani, Maharashtra. One hundred and sixty day-olds straight run Vencobb-430 broiler chicks were randomly distributed to four treatment groups. Each treatment further divided into four replicates 10 birds in each treatment groups. Four treatments were T0: Standard Broiler Ration without turmeric powder (Control), T1: Standard Broiler Ration with 0.1 percent turmeric powder, T2: Standard Broiler Ration with 0.2 percent turmeric powder and T3: Standard Broiler Ration with 0.3 percent turmeric powder

All the broiler chicks were fed with ground maize for first two days of age. During experiment chicks feed standard feed purchased from market for a pre-starter (2-10 days), Starter (11-21 days) and finisher (22-42 days) feed were used. Feeding and watering was done in identical feeders and waterers specified for the deep litter. The birds under all treatment groups had ad libitum access to feed by adding required amount of Aloe vera powder as per treatment. The experimental feed *viz*. broiler starter and finisher which were supplemented with turmeric powder as per treatment details. All the experimental chicks were vaccinated against prevailing diseases adopting a standard protocol and subsequent vaccination schedule was carried out.

Body weight (growth performance), Feed and water intake and Economics of broiler production were recorded during course of investigation. The chemical analysis of the experimental broiler ration was carried out as per A.O.A.C. (1995) [1] for dry matter (DM), total ash, crude fiber, nitrogen and crude protein, ether extract and metabolizable energy (ME).

Result

1. Chemical composition of experimental broiler ration

Pre-starter, starter and finisher ration was 2975.4, 3059.9 and 3189.8 kcal/kg respectively. Whereas, energy protein ratio (E: P ratio) content in pre-starter, starter and finisher ration was 126.64:1, 143.12:1 and 159.04:1, respectively. Chemical composition of pre-starter, starter, and finisher for crude protein, crude fiber, ether extract, total ash, acid insoluble ash and nitrogen free extract was 23.30, 3.87, 4.89, 6.4, 1.46 and 62.25 percent., 21.560, 3.80, 4.95, 6.1, 1.52 and 64.38 percent., and 20.30, 3.95, 5.06, 5.90, 1.57 and 65.19 percent., respectively. Experimental broiler ration are adequate for growth of broilers as per BIS (1992) with an appropriate energy: protein ratio (E:P ratio) which was similar to those reported by Shinde (2015) [11] and Gaikwad (2018) [4].

2. Average weekly gain in body weight (g) per bird

The results on weekly gain in body weight during first five weeks showed that values of weight gain in control and treatment group as well as among the treatment group did not differ significantly from each other. In the 6th week gain in body weight was significantly ($p<0.05$) lowest in T_0 (625.47g) as compared to treatment group T_2 (660.02 g) and T_3 (694.81 g). Among the treatment groups significantly (<0.05) highest gain in body weight was observed in T_3 (694.81 g) than T_1 (647.17 g) and T_2 (660.02 g) however, T_2 (660.02 g) and T_1 (647.17 g) does not differ significantly from each other.

The results indicated that highest gain in body weight was the effect of feeding of turmeric powder at higher level (0.3%) resulted in T_3 (2504.62g) treatment followed by T_2 (2464.23 g) with 0.2 percent, and T_1 (2424.51g) with 0.1 per cent at the end of 6th week. The results are in agreement with Sethy *et al*. (2016) [9] that the addition of turmeric powder at the level of 0.50 and 1.00% caused significant ($p<0.05$) increase in body weight gain compared to without turmeric powder group (0.00%). Similar trends were also observed by Sharma *et al*. (2015) that significant ($p<0.05$) increase in the body weight gain in turmeric fed group (2289.27g) than the control group (1791.30 g) during the period of 42 days.

3. Average weekly feed intake (g) per bird

From table 4.4 it was observed that during first five weeks, weekly feed intake of treatment groups was lower than control. However, feed intake of control (T_0) and treatment group (T_1, T_2 and T_3) does not differ significantly from each other. In 6th week feed intake of control T_0 was (1101.65 g) was significantly higher when compere to T_1 (1099.62 g), T_2 (1098.75 g) and T_3 (1080.97 g). Significantly lowest feed intake was noted in T_3 (4292.86 g) group with 0.3 per cent Turmeric powder followed by T_2 (4345.78 g) with 0.2 per cent Turmeric powder, T_1 (4387.45 g) with 0.1 per cent Turmeric powder and highest feed consumption in T_0 (4431.95 g) without turmeric powder, at the end of 6th week. From the results it was noticed that higher level addition of Turmeric powder in broiler feed reduced feed intake in treatment group. Reduction in feed intake in treatment groups fed with Turmeric powder could be due to peppery, warm, bitter taste of Turmeric powder.

Present study in agreement with Qasem *et al*. (2015) [8] the dietary supplementation of turmeric powder at the rate of 1.00, 1.20, 1.40, 1.60, 1.80 and 2.00% significantly decreased feed intake in broiler chicken as compared to control group. Durrani *et al*. (2006) [3] addition of turmeric powder @ 0.25, 0.50 and 1.00 percent resulted in significant decrease in feed intake as compared to control without turmeric powder.

4. Average weekly feed conversion ratio of experimental birds

Average feed conversion ratio of control and experimental birds during first five weeks was almost same and does not differ significantly from each other. However in treatment groups T_1, T_2 and T_3 FCR improved over control towards higher level of addition of Turmeric powder in broiler diet. Addition of 0.3 percent (T_3) Turmeric powder in broiler diet significantly improved FCR with respect to control and T_1, but values in treatment group compared T_1(1.80) with T_2(1.76) and T_2(1.76) with T_3(1.71) showed non-significant difference towards higher level addition of Turmeric powder in diet of broiler. Mondal *et al*. (2015) [6] reported best FCR in 0.5% turmeric powder in poultry diet as compere to 1% and 1.5%. The best feed efficiency was due to optimum antioxidant activity of turmeric powder at 0.5% level.

5. Economics of broiler production per bird

The net profit per bird was highest in T_3 (Rs. 60.58) supplemented with 0.3 percent Turmeric powder, followed by T_2 (Rs. 55.99) supplemented with 0.2 percent Turmeric powder, T_1 (Rs. 51.83) with 0.1 percent and lowest for T_0 (Rs.

47.64). The performance of broilers in T_3 group was superior over control and other treatments. Broiler fed with 0.3 percent of Turmeric powder was economical due to its improved weight gain in less feed consumption, efficient feed conversion ratio and higher water intake than other treatment as well as control.

Namagirilakshmi (2005) [7] and Durrani *et al*. (2006) [3] reputed that supplementation of turmeric powder in broiler diet at 0.5 per cent level had lowered the cost (Rs. 23.10 and Rs. 30.00) of production par live weight compared to control (Rs. 24.62 and Rs. 34.00).

Table 1: Percent chemical composition of experimental broiler ration on dry matter basis

Sr. No.	Nutrients	Percent in ration		
		Pre-starter	Starter	Finisher
1	Crude protein	23.3	21.6	20.3
2	Crude fiber	3.87	3.8	3.95
3	Ether extract	4.89	4.95	5.06
4	Total ash	6.4	6.1	5.9
5	Acid insoluble ash	1.46	1.52	1.57
6	Nitrogen free extract	62.25	64.38	65.19
7	Metabolizable energy (kcal/kg)	2975.4	3059.9	3189.8
8	E/P ratio	126.64:1	143.12:1	159.04:1

Table 2: Average weekly gain in body weight (g) per bird

Treatments	Weeks						
	1st	2nd	3rd	4th	5th	6th	Total
T_0	118.61^a	195.48^a	391.05^a	510.03a	544.65^a	625.47^c	2385.28^d
T_1	119.12^a	197.30^a	402.08^a	512.90^a	545.95^a	647.17^{bc}	2424.51^c
T_2	122.48^a	199.50^a	403.15^a	514.48^a	564.60^a	660.02^b	2464.23^b
T_3	123.10^a	201.25^a	404.88^a	514.80^a	565.80^a	694.81^a	2504.62^a
SE±	2.42	10.61	18.89	27.89	21.82	17.36	16.93
CD at 5%	8.26	13.50	19.02	16.74	31.31	22.68	21.35
GM	120.64	198.57	400.91	513.02	554.66	656.87	2444.66

(Values (Means) with different superscripts in column differ significantly (p<0.05))

Table 3: Average weekly feed intake (g) per bird

Treatments	Weeks						
	1st	2nd	3rd	4th	5th	6th	Total
T_0	282.86^a	386.68^a	763.88^a	926.83^a	970.13^a	1101.65^a	4431.95^a
T_1	269.61^a	383.48^a	756.25^a	915.25^a	963.25^a	1099.62^a	4387.45^a
T_2	258.86^a	381.50^a	750.13^a	896.15^a	960.40^a	1098.75^a	4345.78^a
T_3	258.07^a	380.73^a	742.63^a	877.38^a	953.10^a	1080.97^b	4292.86^b
SE±	28.96	15.63	15.11	21.39	25.73a	4.76	29.40
CD at 5%	29.23	18.16	26.56	55.92	39.29	14.67	67.58
GM	267.35	383.09	753.22	903.90	961.72	1095.24	4364.52

(Values (Means) with different superscripts in column differ significantly (p<0.05))

Table 4: Average weekly feed conversion ratio of experimental birds

Treatments	Weeks						
	1st	2nd	3rd	4th	5th	6th	Total
T_0	2.38^a	1.98^a	1.95^a	1.82^a	1.78^a	1.76^a	1.85^a
T_1	2.26^a	1.94^a	1.88^a	1.78^a	1.76^a	1.69^{ab}	1.80^a
T_2	2.11^a	1.91^a	1.86^a	1.74^a	1.70^a	1.66^b	1.76^{ab}
T_3	2.10^a	1.89^a	1.83^a	1.70^a	1.68^a	1.55^c	1.71^b
SE±	0.41	0.46	0.52	0.46	0.47	0.02	0.03
CD at 5%	1.26	1.41	1.61	1.41	1.43	0.07	0.09
GM	2.22	1.93	1.88	1.76	1.73	1.67	1.79

(Values (Means) with different superscripts in column differ significantly (p<0.05))

Table 5: Economics of broiler production per bird

Sr. No.	Particular	Treatments			
		T_0	T_1	T_2	T_3
1	Cost of Day old chicks (Rs)	38.00	38.00	38.00	38.00
2	Turmeric Powder consumed per bird (g)	0.00	4.39	8.69	12.88
3	Cost of Turmeric Powder (Rs/g)	-	0.20	0.20	0.20
4	Cost of Consumed Turmeric Powder (Rs)	0.00	0.88	1.74	2.58
5	Avg. Total feed consumed per bird (g)	4431.96	4387.46	4345.78	4292.87
6	Cost of feed (Rs/Kg)	30.00	30.00	30.00	30.00
7	Cost of feed consumed per bird (Rs)	132.96	131.62	130.37	128.79
8	Total cost of feed with + turmeric powder per bird Rs (4+7)	132.96	132.50	132.11	131.36
9	Avg. Body weight gain at the end of 6th week (g)	2385.29	2424.52	2464.23	2504.62
10	Cost of medicine, vaccine and litter material per bird (Rs)	8.00	8.00	8.00	8.00
11	Cost of Production (1+8+12) Per bird (Rs)	178.96	178.50	178.11	177.36
12	Avg. Price realized @ Rs 95 Per kg live weight (Rs)	226.60	230.33	234.10	237.94
13	Net profit per bird (14-13) Rs.	47.64	51.83	55.99	60.58

Conclusions

Addition of 0.3% turmeric powder in broiler diet resulted in significantly higher values for gain in body weight, feed intake, feed conversion ratio and improved net profit progressively than control, as well as treatment 0.1%, and 0.2% turmeric powder.

From the results it could be concluded that 0.3% turmeric powder could be incorporated safely in broiler diet to achieve better growth performance, feed conversion ratio weekly gain in body weight and more profit.

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