Full Length Article

EFFECT OF TURMERIC (*Curcuma longa*) POWDER ON PRODUCTION PERFORMANCE AND EGG QUALITY CHARACTERISTICS OF LAYING HEN

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ABSTRACT

An experiment was conducted to study the effect of turmeric powder on production performance and egg quality characteristics of Rhodo White (RW) layers. Seventy two RW layers were weighed individually and distributed randomly into four turmeric powder supplemented reated experimental diets with three replicates of six layers each and the experimental diet was given for a period of 20 weeks from 26 to 45 weeks age of the birds. There was no significant difference in total egg production, hen day egg production (HDEP) and hen housed egg production (HHEP) among the treatment groups. The feed intake in all treatment groups was almost similar during 26 to 45 weeks of birds. Turmeric powder did not influence the feed intake and feed efficiency in all treatment groups. A non-significant difference was observed in egg quality characteristics. The egg yolk cholesterol was significantly (P<0.01) reduced by 18.59 %, 24.91 % and 33.24 % in 0.05, 0.10 and 0.15 % turmeric powder supplemented groups respectively than control. It was concluded that the inclusion of turmeric powder did not influence the production performance & egg quality characteristics and however the egg cholesterol level was significantly reduced at 0.15 % in RW layers..

Key words : Egg quality, Laying hens, Production performance, Turmeric powder

INTRODUCTION

Natural dietary agent like turmeric powder (*Curcuma longa*) is a traditional herb and it has been shown to have a wide spectrum of biological activities like anti-inflammatory, antioxidant, anti-carcinogenic, antimutagenic, anticoagulant, antifertility, antidiabetic, antibacterial, antifungal, antiprotozoal, antiviral, antifibrotic, anti-venom, antiulcer, hypotensive, hypocholesteremic and hepatoprotective characters (Krup *et al.*, 2013). Poultry egg is considered to be a good source of high quality protein and needs to be enriched with various phytochemical compounds for transferring the beneficial effects to human beings.

Many studies also reported that feed additives improved the performance of birds and digestibility of nutrients in poultry

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(Bharathidhasan, 2018; Liu *et al*., 2020) and addition of turmeric powder was reported to reduce cholesterol content substantially (Bharathidhasan *et al*., 2016). However, there are limited numbers of studies on the effect of turmeric powder supplementation on production performance and egg quality characteristics in laying hens (Malekizadeh *et al.,* 2012; Chauhan *et al.*, 2014). Hence the present experiment was carried out with an objective to investigate the effect of supplementation of turmeric powder (*Curcuma longa*) on the production performance and egg quality characteristics of Rhodo White (RW) layers.

MATERIALS AND METHODS

Four experimental layer diets were formulated (BIS, 2007) by addition of turmeric powder at 0, 0.05, 0.10 and 0.15 % with *iso-nitrogenous* and *iso- calori*e diet. Seventy two RW layers were weighed individually and distributed randomly into four experimental diets with three replicates of six layers each. The birds were housed in cage system of rearing and the experimental diet was given for a period of 20 weeks from 26 to 45 weeks age of the birds. The ingredients and chemical composition (AOAC, 1990) of the formulated diets are presented in Table 1. Production performance in terms of total egg production, HDEP, HHEP, daily feed intake and feed efficiency per dozen of eggs or per kg of egg mass in RW layers were studied with standard management practices. The egg quality characteristics, viz. average egg weight, shape index, shell thickness (mm), shell weight (g), shell percentage, yolk percentage, yolk weight (g), yolk index, yolk colour, albumin index and Haugh unit of RW layer eggs were evaluated in six eggs per treatment as per the standard procedure for four times (at 30, 35, 40 and 45th week age). Cholesterol in eggs was measured using laboratory kits (Gordon and Amer, 1977) at 45th week in six eggs in each treatment. Data collected were statistically analyzed as per the Snedecor and Cochran (1989).

Table 1. Ingredient and chemical composition of experimental layer diets

S.No.	Feed ingredients (kg)	Turmeric powder (%)			
		0	0.05	0.10	0.15
1	Maize	58.50	58.50	58.50	58.50
2	Soy bean meal	22.50	22.50	22.50	22.50
3	De-oiled rice bran	05.00	05.00	05.00	05.00
4	Fish meal	05.00	05.00	05.00	05.00
5	Shell grit	06.50	06.50	06.50	06.50
6	Mineral mixture	02.00	02.00	02.00	02.00
7	Salt	00.50	00.50	00.50	00.50
	Total	**100.00**	**100.00**	**100.00**	**100.00**

	Supplements (g/100 kg)				
1.	Vitamin AB_2D_3K[1]	10.00	10.00	10.00	10.00
2.	B-complex vitamins[2]	25.00	25.00	25.00	25.00
3.	Trace minerals[3]	50.00	50.00	50.00	50.00
	Chemical composition				
1.	Dry matter (%)	91.66	91.66	91.66	91.66
2.	Crude protein (%)	18.06	18.06	18.06	18.06
3.	Crude fibre (%)	7.91	7.91	7.91	7.91
4.	Ether extract (%)	3.33	3.33	3.33	3.33
5.	Total ash (%)	9.05	9.05	9.05	9.05
7.	Acid insoluble ash (%)	1.96	1.96	1.96	1.96
8.	Calcium (%)	3.29	3.29	3.29	3.29
9.	Phosphorus (%)	0.71	0.71	0.71	0.71
10.	Available Phosphorus (%)*	0.41	0.41	0.41	0.41
11.	Metabolizable Energy (kcal/kg)*	2613.00	2613.00	2613.00	2613.00

*Calculated value

[1] One gram of Vitamin AB_2D_3K supplement contained 82500 IU of Vitamin-A, 50 mg of Vitamin-B_2, 12000 IU of Vitamin-D_3 and 10 mg of Vitamin-K.

[2] One gram of B-Complex supplement contained 8 mg of Vitamin-B_1, 16 mg of Vitamin-B_6, 80 mcg of Vitamin B_{12}, 80 mg of Vitamin-E, 120 mg of Niacin, 8 mg of Folic acid, 80 mg of Calcium pantothenate, 120 mg of Calcium and 300 mg of Phosphate.

[3] One gram of Trace Minerals contained 54 mg of manganese, 52 mg of zinc, 20 mg of iron, 2 mg of iodine and 1 mg of cobalt.

RESULTS AND DISCUSSION

Total egg production in numbers for the period between 26 and 45 weeks ranged from 1187 to 1210 and the HHEP was 48.87 to 49.92 nos. in the treatment groups of RW layers. There was no significant difference in the total egg production and HDEP/ HHEP among the treatment groups (Table 2). Similar to the present study, Radwan *et al*. (2008) reported that the turmeric powder at 0.5 and 1 % did not influence the egg production in laying hens. Malekizadeh *et al.* (2012) also observed that the supplementation of 1 and 3 % turmeric powder had no effect on the egg production in laying hens. The average feed intake in the treatment groups in our study ranged from 217.15 kg to 218.82 kg for 26-45 weeks. The feed efficiency per dozen of eggs and feed efficiency per kg of eggs ranged from 2.15 to 2.21 and 3.47 to 3.61 respectively in the treatment groups. It was observed that the feed intake and feed efficiency did not differ among the treatment groups. As the work on the supplementation of turmeric powder in layers was limited, its effect on broiler chicken in terms of feed intake and feed efficiency was taken for comparison. While Gowda *et al.* (2008) reported that the feed intake and feed efficiency were not affected by the supplementation of turmeric powder at 0.50 % in broiler chicken, Emadi *et al.* (2007) also observed that the supplementation of turmeric powder at 0.25, 0.50 and 0.75 % did not influence the

Table 2. Effect of supplementation of turmeric powder (*Curcuma longa*) on production performance of RW layers and their egg cholesterol (Mean[#] ± S.E.) (26 weeks to 45 weeks)

Parameters	Turmeric level (%)			
	0 (T1)	0.05 (T2)	0.10 (T3)	0.15 (T4)
Total egg production (nos.) [NS]	1187 ± 2.33	1210 ± 1.45	1188 ± 2.08	1187 ± 1.76
HDEP/HHEP (%) [NS]	48.97 ± 0.29	49.92 ± 0.18	49.01 ± 0.26	48.97 ± 0.22
Feed intake (kg) [NS]	218.06 ± 1.27	217.15 ±1.54	218.82 ± 1.80	217.70 ± 1.31
Feed efficiency per dozen of eggs [NS]	2.20 ± 0.05	2.15 ± 0.04	2.21 ± 0.07	2.20 ± 0.05
Feed efficiency per kg of eggs [NS]	3.59 ± 0.06	3.47 ± 0. 23	3.57 ± 0.16	3.61 ± 0.12
Egg cholesterol (mg/g of yolk) at 40th week	13.93 ± 0.08 [c]	11.34 ± 0. 13 [b]	10.46 ± 0.05 [b]	9.30 ± 0.03 [a]

[#]Mean of six observations, [NS] Not significant, Means with at least one common superscript in the same row did not differ significantly (P<0.01)

feed intake and feed efficiency in broiler chicken. Egg yolk cholesterol was found to be significantly (P<0.01) decreased by, 18.59, 24.91 and 33.24 % in 0.05, 0.10 and 0.15 % of turmeric powder supplemented groups respectively than control. The maximum decrease in egg yolk cholesterol was observed in 0.15 % turmeric powder supplemented group among the treatment groups. Similarly, Kermanshahi and Riasi (2006) found that the turmeric powder supplementation from 0.05 to 0.15 % in laying hens decreased the egg cholesterol. Turmeric powder supplementation at 0.45 % reduced the egg cholesterol by 35.15 % (Chauhan *et al*., 2014) and the turmeric powder at 0.50 – 1.0 % significantly (P<0.05) decreased the egg yolk cholesterol by 4.99 and 4.59 % respectively over the control group in laying hens (Kanagaraju *et al*., 2017). The decrease of egg cholesterol in the present study could have been mainly due to the enhanced cholesterol catabolism by hepatic cholesterol-7α-hydroxylase activity (Riasi *et al*., 2012) and the effect of essential oil compounds present in the turmeric on lipid metabolism as suggested by Radwan *et al*. (2008).

Egg quality characteristics (Table 3) in terms of average egg weight, shape index, shell thickness (mm), shell weight (g), shell percentage, yolk percentage, yolk weight (g), yolk index, yolk colour, albumin index and Haugh unit were not found to differ in all treatment groups during the entire period of experimentation of 20 weeks. Similar to findings of the present study, Park *et al*. (2012) also observed that turmeric powder supplementation did not influence the eggs and egg shell qualities in Lohmann brown layers. Hassan *et al*. (2016) studied that the egg specific gravity and Haugh unit in layers and found that there was no difference due to turmeric supplementation up to 2 %. An earlier experiment on egg quality characteristics due to supplementation of turmeric powder in laying hens also reported no significant difference (Riasi *et a*l. 2012). However, on contrary to the present study, Liu *et al*. (2020) reported that the turmeric powder supplementation increased the egg shell thickness, egg shell strength and albumin height. This was reported to be mainly due to increased feed intake by laying hens, which frees calcium in the serum combined

with plasma proteins or other components so that there is enough calcium in the blood to participate in the formation of eggshells. In the present experiment, such increases in egg shell thickness, egg shell strength and albumen height were not seen and the feed intake was similar in turmeric supplemented groups to the control.

Table 3. Effect of supplementation of turmeric powder (*Curcuma longa*) on egg quality characteristics in RW layer eggs (Mean# ± S.E.)

Parameters	Turmeric level (%)			
	0 (T1) NS	0.05 (T2) NS	0.10 (T3) NS	0.15 (T4) NS
30th week				
Average egg wt (g)	49.67 ± 1.09	51.50 ± 2.41	52.17 ± 3.12	49.00 ± 1.92
Shape index	75.07 ± 0.61	75..36 ± 1.67	75.90 ± 1.20	74.24 ± 1.52
Shell thickness (mm)	0.35 ± 0.01	0.33 ± 0.01	0.32 ± 0.01	0.32 ± 0.01
Shell weight (g)	4.50 ± 0.34	5.33 ± 0.21	4.83 ± 0.48	4.67 ± 0.21
Shell percentage	9.02 ± 0.57	10.44 ± 1.2	9.19 ± 0.57	9.56 ± 0.43
Yolk weight (g)	14.00 ± 1.09	14.50 ± 0.67	14.83 ± 0.65	14.33 ± 0.43
Yolk percentage	28.18 ± 0.65	28.18 ± 0.38	28.89 ± 1.97	29.40 ± 1.08
Yolk index	0.49 ± 0.02	0.49 ± 0.02	0.47 ± 0.01	0.51 ± 0.03
Yolk color	7.67 ± 0.56	7.83 ± 0.60	8.17 ± 0.17	8.17 ± 0.17
Albumin index	0.16 ± 0.01	0.15 ± 0.01	0.14 ± 0.01	0.14 ± 0.02
Haugh unit	84.15 ± 7.31	84.35 ± 6.95	85.52 ± 7.65	84.65 ± 7.21
35th week				
Average egg wt (g)	52.00 ± 1.71	48..50 ± 0.76	51.00 ± 2.38	52.67 ± 2.33
Shape index	78.37 ± 1.15	74.65 ± 1.93	77.22 ± 1.53	74.94 ± 0.58
Shell thickness (mm)	0.33 ± 0.01	0.35 ± 0.00	0.33 ± 0.01	0.35 ± 0.00
Shell weight (g)	4.83 ± 0.31	4.33 ± 0.21	4.50 ± 0.43	4.83 ± 0.31
Shell percentage	9.29 ± 0.46	8.92 ± 0.32	8.76 ± 0.58	9.14 ± 0.22
Yolk weight (g)	14.50 ± 0.76	14.00 ± 0.37	14.67 ± 0.80	14.50 ± 0.62
Yolk percentage	27.88 ± 1.13	28.89± 0.81	28.78 ± 1.01	27.58 ± 0.59
Yolk index	0.46 ± 0.03	0.44 ± 0.02	0.41 ± 0.01	0.45 ± 0.01
Yolk color	8.17 ± 0.17	7.83 ± 0.17	7.50 ± 0.22	7.83 ± 0.17
Albumin index	0.11 ± 0.01	0.11 ± 0.00	0.10 ± 0.01	0.10 ± 0.01
Haugh unit	86.12 ± 6.85	85.25 ± 7.21	85.72 ± 6.99	84.29 ± 7.01
40th week				
Average egg wt (g)	53.50 ± 2.63	51.83 ± 1.68	53.17 ± 1.74	56.17 ± 2.57
Shape index	75.57 ± 2.07	71.24 ± 1.83	72.73 ± 1.25	75.27 ± 2.08

Shell thickness (mm)	0.30 ± 0.001	0.30 ± 0.001	0.28 ± 0.001	0.29 ± 0.003
Shell weight (g)	4.67 ± 0.42	4.75± 0.38	4.67 ± 0.31	5.18 ± 0.33
Shell percentage	8.68 ± 0.57	9.11 ± 0.5	8.74 ± 0.35	9.19 ± 0.19
Yolk weight (g)	15.17 ± 0.60	15.33 ± 0.80	15.33 ± 0.33	16.17 ± 0.79
Yolk percentage	28.48 ± 0.89	29.59 ± 1.23	28.90 ± 0.48	28.90 ± 1.2
Yolk index	0.45 ± 0.01	0.49 ± 0.03	0.47 ± 0.01	0.49 ± 0.01
Yolk color	8.00 ± 0.00	7.83 ± 0.31	8.00 ± 0.26	8.00 ± 0.00
Albumin index	0.12 ± 0.01	0.17 ± 0.01	0.14 ± 0.01	0.14 ± 0.01
Haugh unit	84.21 ± 7.12	85.12 ± 6.89	84.95 ± 7.45	85.65 ± 7.52
45th week				
Average egg wt (g)	54.17 ± 0.31	49.92 ± 1.78	52.58 ± 1.66	53.17 ± 2.20
Shape index	79.78 ± 1.29	75.62 ± 0.31	79.38 ± 0.91	72.90 ± 0.71
Shell thickness (mm)	0.28 ± 0.002	0.28 ± 0.001	0.28 ± 0.001	0.28 ± 0.001
Shell weight (g)	5.01 ± 0.03	4.73 ± 0.14	4.93 ± 0.20	5.05 ± 0.24
Shell percentage	9.25 ± 0.08	9.50 ± 0.15	9.37 ± 0.15	9.49 ± 0.08
Yolk weight (g)	16.17 ± 0.17	14.50 ± 0.44	14.80 ± 0.54	14.80 ± 0.93
Yolk percentage	29.84 ± 0.18	29.25 ± 1	28.22 ± 1.09	27.72 ± 0.64
Yolk index	0.46 ± 0.01	0.45 ± 0.01	0.46 ± 0.01	0.46 ± 0.01
Yolk color	8.17 ± 0.17	8.17 ± 0.17	8.17 ± 0.17	8.17 ± 0.17
Albumin index	0.16 ± 0.008	0.17 ± 0.004	0.16 ± 0.002	0.15 ± 0.007
Haugh unit	85.22 ± 6.98	84.55 ± 7.13	85.75 ± 7.59	85.72 ± 7.32

[#]Mean of six observations, [NS] Not significant

It is concluded that the supplementation of turmeric (*Curcuma longa*) powder in the feed from 0.05 to 0.15 % did not alter the production performance and egg quality characteristics in RW layers from 26 to 45 weeks of their production; however, the egg yolk cholesterol was significantly reduced by 33 % at 0.15 % turmeric supplementation in RW layers studied. Curcumin, the main principle in turmeric that was supplemented in layer diets that reduced the egg cholesterol content may have acted as an antioxidant and anti-atherogenic agent. Routine supplementation of turmeric powder at 0.15 % in the layer diets might be able to involve in prevention of coronary artery diseases by reducing the plasma cholesterol levels or by inhibiting LDL oxidation in human beings.

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