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Effect Of Turmeric (Curcuma longa) Powder and Whey Protein Inclusion in Broiler Diet on Growth Performances of Broiler Chickens

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Abstract
An experiment was conducted at Directorate of Agricultural Research, Province N 2, Parwanipur, Bara for 42 days to evaluate the effect of Turmeric (Curcuma longa) powder and whey protein inclusion in broiler feed and its effect on growth of broiler production. Altogether 150 day old Cobb-500 broiler birds were divided into 5 treatments with 3 replications (10 birds in each replication) by using completely randomized design. Experimental birds were provided adlib grower feed (B1) for 21 days and that after finisher feed (B3) for 21 days and had easily access to drinking water. Feed intake was recorded daily and body weight gain was measured in 7 days interval. Control group (T1) was provided concentrate mixture only, whereas in T2 and T4 groups concentrate mixture was mixed with 1gm, 2gm turmeric powder per kg feed respectively. Where as in T3 and T5 groups concentrate mixture was mixed with 10ml whey protein per liter of drinking water. Body weight gain was found 178.13±0.2, 370.07±0.9, 834.04±0.2, 1225±0.2, 1800±0.5 and 2553±02 in T1, T2, T3 T4 and T5 respectively. There was significant difference ($p<0.05$) found only at 28, 35 and 42 days in (T4) group. Whereas non- significant difference was found in total weight gain. Result showed non-significant difference ($p>0.05$) in feed intake during experimental period at 42 days between treatment groups ($p>0.05$).Similarly, mean FCR was observed similar among the treatment group ($p>0.05$). So, turmeric powder and whey protein could be added in broilers diet but further study should be carried out to precise its inclusion in broilers diet.

Key Words*: Turmeric powder, Growth performance, Whey protein, Broiler chicken*

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I. Introduction

Livestock farming is an important component of the Agricultural system of Nepal. The primary livestock species raised in Nepal includes cattle, buffaloes, sheep, goat, poultry, Himalayan goat (Chyangra), and yak depending upon the local agro climatic conditions. Livestock farming offers cash income to the farmers which are crucial to run their day-to-day financial activities (Karki and Bauer, 2004; Bhatta *et al.,* 2015). Among these several livestock species raised poultry especially chicken is one of the common species raised in the hills and terai areas of Nepal (Bhurtel and Shah, 2000). While poultry farming is one of the rapidly commercializing livestock subsectors in the peri-urban areas of Nepal (Sharma, 2010).

There is growing interest in developing natural alternatives to antibiotics as growth promoters in order to maintain both bird performance and health (Khan et al., 2012). In 2006, European Union banned the use of antibiotics as feed additives because of its residual effects in animal tissues and subsequently leading to antimicrobial resistance in human beings (Griggs and Jacob, 2005). Considering this harmful effect in many developed countries have made it legally not to be used in feed antibiotics (Amalraj *et al.,* 2017).

Turmeric (*Curcuma longa* Linn. Or *C. domestica* Val.) is the domesticated species of turmeric, while the wild one is called *C. aromatic*. It is rhizomatous herbaceous perennial herb belonging to Zingiberaceae family that is widely used and cultivated in the tropical and sub-tropical regions of the world, such as in Pakistan, China, Indonesia, India, Malaysia, Jamaica and Peru (Govindarajan and Stahl, 1980). Turmeric is a popular medicinal herb which shows a wide range of pharmacological properties like antioxidant, anti-protozoal, antimicrobial, anti-inflammatory, antitumor (Fallah and Mirzaei *et al.,* 2017).

Curcumin is the major component in turmeric having a potent antioxidant activity (Holt *et al.,* 2005; Mondal *et al.,* 2015). Turmeric falls in such a class of medicinal plant that provides an alternative method of natural antibiotic to feed poultry farm. Turmeric supplementation could effectively acts on growth, egg production and health status of chickens (Khan *et al.,* 2012). This medicinal plant possesses rhizomes and underground root-like stems (Araujo and Leon, 2001) that had been originally used as a food additives in curries

to improve the storage condition, appearance, flavor, palatability and preservation of food (Sultan, 2003). Supplementation of turmeric powder and its extract has beneficial effects on the performance of birds and animals (Anantkawlas, 2014).

Whey is the main co-product of the cheese industry, although it is usually disposed as a waste product. It is rich source of protein. Whey protein concentrate is a co-product of cheese or rennet casein industries with relevant protein (30% CP of dry matter) and lactose 52% of dry matter) contents. Whey is considered as an excellent amino acid source in bird nutrition and is composed of biologically active proteins such as *β*-lactoglobulin, *α*-lactoalbumin and immunoglobulin (Szezurek *et al.,* 2017). These proteins have a higher biological value compare with soyabean meal (Akbarian *et al.,* 2012) the main protein source in poultry feed. The lactose of whey protein might promote broiler performance by stimulating the growth of beneficial cecal bacteria. The benefits of the inclusion of whey protein on the performance and protein ileal digestibility of broiler diets (Szezurek *et al*., 2017).

In Nepal commercial poultry farmers are using antibiotics in poultry fed for fast growth which is resulting negative effect in human health. In another hand, there is high mortality of poultry bird due to various reasons. In this context, inclusion of turmeric powder and rich source of protein i.e.; whey in broiler feed is most promising option to reduce the bird mortality and fast growing instead of antibiotics. Therefore, this study was carried out to evaluate the effect of addition of various levels of turmeric powder and different combination of whey as a natural growth promoter on the performance of broiler birds.

II. Materials And Methods

Experimental Birds

The experiment was carried out on Cobb 500 broiler chickens at Poultry Research Unit of Directorate of Agricultural Research, Province N 2, Parwanipur Bara from 23rd March to 2nd May 2020 (2076/12/10 to 2077/01/20 BS) for 42 days. Hundred fifty experimental day old birds were procured from Shivam Hatchery, Birjung, Parsa and were allocated into five treatments with three replications having 10 birds in each replication by using Complete Randomized Design (CRD). All experimental, birds were vaccinated with F1 vaccine @ one drop/bird against Ranikhet at the first week.

Diet composition

Compound feed was procured from Shakti Feed Industry of Birjung, Parsa and treated with turmeric powder @1gm per kg of feed with and without whey @10ml per liter of drinking water. Likewise compound feed was treated with turmeric powder @2gm per kg of feed with and without whey @10ml per liter of drinking water. The sample of these feed was brought to the National Animal Nutrition Research Center, Khumaltar, Lalitpur for chemical analysis.

Chemical analysis

Representative samples were analyzed for Dry Matter (DM), Crude Protein (CP), Crude Fiber (CF), Organic Matter (OM) and Total Ash (TA) content. The DM was determined by oven drying at 100^0 C for 24 hours. Crude protein of the samples were determined by using the Kjeldahl method. Ash content was determined by ashing at 550^0 C in a Muffle furnace for 4 hrs (AOAC, 1980). Crude Ether of the samples were determined by using the Van Soest method (Goering, H.K and Van Soest, 1970).

Experimental diet

The following experimental diet was provided to the birds (Table 1).

Table 1: Experimental diet

Treatments	Diet
1	Adlib concentrate mixture (without inclusion of turmeric and whey)
2	Adlib concentrate mixture + Turmeric powder (1gm/kg feed)
3	Adlib concentrate mixture + Turmeric powder (1gm/kg feed) + 10ml whey/lit water
4	Adlib concentrate mixture + Turmeric powder (2gm/kg feed)
5	Adlib concentrate mixture + Turmeric powder (2gm/kg feed) + 10ml whey/lit water

Feeding regime

Concentrate mixture was given on group basis and was provided to the experimental birds once a day (morning) in adlib amount for both periods (starter-21 days and finisher-21 days) of the experiment. Drinking water was provided in adequate amount.

Data measurement

This trial period consisted for 42 days (21 days starter and 21 days finisher). Quantity of concentrate mixture was given daily to the birds in groups weighted daily and refusal was weighted in the next morning. The body

weight gain was measured in group basis (replication-wise) in seven days interval in the morning before feeding.

Data analysis

Data of feed intake and body weight gain were analyzed by "One way Anova" test for every measurement using statistical package Minitab 2003, version 13.20.

III. Result And Discussion

Chemical composition of concentrate mixture

The chemical composition of treated and non treated concentrate mixture is given in Table 2.

Table 2: Chemical composition of the compound feed (DM basis)

Concentrate mixture	DM	TA	OM	CP	CF
Feed (Starter)	**90.47**	**6.15**	**93.85**	**22.16**	**3.69**
Feed (Finisher)	**88.60**	**4.58**	**95.42**	**19.37**	**4.28**

Table 3: Body weight gain trend of experimental birds/day, gm (Mean±SD)

Treatment	0	7	14	21	28	35	42	Total weight gain(g)	Daily weight gain(g)	FCR kg
1	40.56±0.6	175.37±0.3	375.45±0.6	804.37±0.7	1230±0.2	1735±0.3	2534±0.3	2488±0.9	60.93±0.3	1.49
2	40.22±0.8	178.37±0.4	368.25±0.9	824.06±0.6	1231±0.3	1830±0.7	2541±0.7	2500±0.9	61.42±0.3	1.53
3	40.02±0.6	179.12±0.2	378.09±0.7	805.08±0.2	1178±0.5	1822±0.5	2553±0.3	2451±0.2	60.24±0.1	1.52
4	40.13±0.4	178.54±0.5	362.08±0.5	812.16±0.3	1265±0.7	1852±0.2	2555±0.3	2511±0.1	63.80±0.2	1.55
5	40.48±0.7	179.20±0.8	368.47±0.2	803.90±0.3	1235±0.3	1788±0.6	2540±0.5	2431±0.6	59.30±0.1	1.49
Mean	40.21±0.1	178.13±0.2	370.07±0.9	834.04±0.2	1225±0.2	1800±0.5	2553±0.2	2498±0.5	60.94±0.2	1.53
P-value	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	P<0.05	P<0.05	p>0.05	p>0.05	p>0.05

Average mean body weight of the experimental birds was found 40.21 g at the beginning which reached 2553 g at the end of the experiment. At the 7 days of experiment, the highest body weight gain was found 179.20 g in T3 and T5 which was followed by T2 and T4 178.54 g. At 14 days experiment the highest weight gain was found highest in T3 378.09 g which was followed by 375.45 g in T1. At 21 days of the experiment the highest weight gain was found in T2 824.06 g which was followed by T4 812.16 g. At 28, 35 and 42 days the highest weight gain was found in T4 1265, 1852 and 2555 g respectively. The total body weight gain was found highest in T4 2511 g, likewise the daily weight gain was found highest in T4 63.80g. In the body weight gain trend of the experimental birds the significant difference was found at 35 and 42 days of the experimental period. There was no significant ($p>0.05$) effect of different level of turmeric powder and whey protein inclusion on body weight gain and FCR.

Table 4: Feed intake of the experimental birds/day , g (Mean±SD)

Treatment	7	14	21	28	35	42	Cumulative feed intake
1	29.65±0.2	65.27±0.8	101.02±0.4	102.02±0.4	189.73±0.4	185.55±0.2	3835.33
2	28.64±0.9	62.50±0.2	99.04±0.2	98.03±0.1	172.11±0.4	178.89±0.4	3868.11
3	28.09±0.1	62.27±0.4	98.03±0.4	98.04±0.1	172.54±0.1	185.02±0.5	3911.51
4	27.13±0.4	62.50±0.1	101±0.2	102.08±0.2	178.48±0.2	184.44±0.1	3828.06
5	29.07±0.1	64.04±0.3	101±0.5	102.04±0.2	178.22±0.7	185.02±0.1	3801.04
Mean	28.48±0.3	63.31±0.5	99.71±0.1	99.07±0.4	179.49±0.3	182.08±0.2	3851.87
P-value	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05

Mean feed intake of experimental birds was recorded 28.48 g in 7 days which reached 182.80 g at the end of experiment i.e., 42 days which is non-significant among the diet groups. At the 7 days of experiment, feed intake of T1 and T5 (29 g) is similar where as T2 and T3 is also similar (28 g) followed by T4 (27 g). At 14 days of experiment the feed intake was found highest in T1 (65 g) followed by T5 (64 g) where as in T2, T3 and in T4 was found similar (62 g). At 21 days of experiment the feed intake was found similar in T1, T4 and T5 (101 g) where as T2 (99 g) which was followed by T3 (98 g). At 28 days of experiment the feed intake was found similar in T1, T4 and T5 (102 g) where was followed by T2and T3 also was similar (98 g). At 35 days of experiment the feed intake was found highest in T1 (189 g) where as in T4 and T5 similar i.e., (178 g) followed by T2and T3 (172 g). At 42 days of experiment the feed intake was found similar at T1, T3 and T5 (185 g)

where as inT4 it was found (184 g) which was followed by T2 (178 g). Even though there was no significant difference found among the treatments.

IV. Discussion

This study was initiated to evaluate the effect of different level of turmeric powder and whey inclusion in broiler diet and its effect on production performance. Experiment revealed that feed consumption was almost similar (3800 g) in T1, T2, T4 and T5 where as diet with 1gm turmeric powder with 10ml whey protein per liter of drinking (T3) water was found (3900 g). Increased level of inclusion did not reduce the consumption rate, however the total body weight gain was higher in T4 (2511 g) and FCR was similar in T1 and T5 (1.49) where as almost similar in T2 (1.53), T3 (1.52) and T4 (1.55) respectively. There was no any mortality of birds during the whole experiment.

Nouzarian *et al.,* (2011) also says that there was no significant effect on daily feed intake and body weight gain of chickens. Kumari *et al.,* (2007) observed that supplementation with 7.5g/kg turmeric powder in feed increases highest weight on birds. The variations in the values of body weight might be due to differences in agro climatic conditions (Mehala and Moorthy, 2008). Supplementation of 3.3, 6.6 and 10 g/kg turmeric powder in broiler chicken improves feed efficiency (Ahlawat *et al.,* 2018). These findings were also supported by Kafi *et al.,* 2017.

Arslan *et al.,* (2017) reported that turmeric supplementation at 0, 0.5, 1.0 and 1.5 percent improved feed conversion efficiency but supplementation at the rate of 1.5 percent showed the best result in comparison to other groups. Shohe *et al.,* (2019) observed that feed conversion efficiency was significantly ($p<0.05$) the lowest in the T4 group (7.5 g turmeric powder /kg feed) followed by T3 (5 g turmeric powder /kg feed), T2 (2.5 g turmeric powder /kg feed) and the highest in T1 (1.5 g turmeric powder /kg feed) group.

Malik *et al.,* (2015), reported that the supplementation of whey protein in broiler diets improved their feed conversion ratio. Ibrahim *et al.,* (2017), theorized that whey proteins support muscle building with its essential amino-acid content. The results of this study are in agreement with those reported by Bahari *et al*., (2015), who showed that the supplementation of 4% whey protein in broiler diets increases the relative weights of carcass, breast, drum sticks and wings. Moreover, Kermanshahi and Rostami (2006), reported that the carcass relative weight in broiler chickens fed 2% and 4% of dried whey reached its maximum ($p<0.05$) at 49 days of age.

The dietary supplementation of curcumin is limited because of its low solubility in alkaline pH and being subject to hydrolysis when exposed to sunlight, which result in poor absorption in animals (Kochhar, 2008). Studies on broiler chickens have shown increased weight gain and improved FCR (Hussein, 2013) with dietary supplementation of turmeric.

V. Conclusion

Inclusion of turmeric powder can be used as a growth promoter and whey as a protein source in broiler production. It has resulted better growth performance and reduction in bird mortality. However, further study should be conducted to validate this finding in farmer's field for wider dissemination of this study.

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