



## Effect of Turmeric (*Curcuma longa*) Powder and Synbiotic as Alternative to Antibiotic Growth Promoter on the Growth Performance and Mortality of Broiler Chicks

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### ABSTRACT

The objective of the study was to investigate the effect of turmeric (*Curcuma longa*) powder and synbiotic as alternative to antibiotic growth promoter on growth performance of broiler chicks. Total 150 day-old chicks were purchased and randomly divided into 5 treatments having 30 chicks in each group with three replicates of 10 chicks in each. The five dietary treatments were designated as T<sub>1</sub> control group (basal diet), T<sub>2</sub> supplemented with antibiotic @ 0.02% level, T<sub>3</sub> supplemented with turmeric @ 0.5% level, T<sub>4</sub> supplemented with synbiotic @ 0.05% level and T<sub>5</sub> supplemented with turmeric @ 0.25% + synbiotic @ 0.025% in the diet. Highly significant (P<0.01) effect of dietary treatment was observed on growth performance and mortality percent as compared to control and antibiotic supplemented group. Highest body weight was observed in T<sub>5</sub> group and lowest in control group. Body weight gain, daily weight gain, feed consumption and performance index was found significantly (P<0.01) higher in T<sub>5</sub> group which was comparable with T<sub>4</sub> group and lowest was recorded in control group which showed non-significant difference with T<sub>2</sub> group *i.e.* antibiotic supplemented group. Significantly (P<0.01) lowest feed conversion ratio and highest protein efficiency ratio was observed in T<sub>5</sub> group as compared to control group. Mortality was reduced in all treatment groups as compared to control group. It can be concluded that as an alternative to antibiotics, turmeric plus synbiotic supplementation can be used to increase the growth performance and livability of broiler chicken in the post-antibiotic period.

### HIGHLIGHTS

- Turmeric powder and synbiotic as alternative to antibiotic growth promoter significantly improved growth performance of broilers.
- Turmeric powder and synbiotic as alternative to antibiotic growth promoter significantly reduced mortality percent of broilers.

**Keywords:** Turmeric, synbiotic, antibiotic growth promoter, broiler

Today, poultry farming goes about as salary stabilizer as well as gives ordinary and convenient pay compared to the cultivation of crops and other domesticated animals. In poultry nutrition, feeding costs are considered the most-costly element in the entire cycle of production. Feed is a

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significant segment that influences the net income of the poultry business in the light of the fact that 70% of absolute consumption is in terms of money spent on feed purchase (Willems *et al.*, 2013). At the same time as making gains in production and efficiency, the industry needed to enhance the well-being and prosperity of birds and minimize the impact of the industry on the environment. The use of feed additives has been an important part of making progress in promoting growth, protecting well-being and optimizing the genetic potential of modern broiler and layer hybrid growth promoter feed additives used in poultry diets (Dhama *et al.*, 2011; Youssef *et al.*, 2013). There are different types of growth promoters used in the broiler industry such as antibiotics, probiotics, prebiotics, exogenous enzymes, antioxidants, coccidiostats, etc. (Dhama *et al.*, 2011; Angelakis *et al.*, 2013) and other novel growth promoters include herbs, panchgavya, elements and certain other nutritional substances (Mahima *et al.*, 2012, 2013; Dhama *et al.*, 2013).

The indiscriminate use of antibiotics as feed additives in poultry farms has increased public health wariness about the development of resistant strains of pathogenic bacteria (Abd El-Moneim *et al.*, 2020; Abd El-Moneim and Sabic, 2019) and residual contamination of poultry products (Shewita and Taha, 2018; Alagawany *et al.*, 2019a; Soomro *et al.*, 2019). Banning antibiotic growth promoters from the markets of the European Union and many other countries has challenged poultry producers to find appropriate alternative option to AGP (Abdelnour *et al.*, 2019; Alagawany *et al.*, 2019b).

Turmeric rhizome (*Curcuma longa*) is a perpetual rhizomatous plant of the ginger family, Zingiberaceae is a widely used spice, food preservative and coloring material that has biological actions and medicinal uses (Akbarian *et al.*, 2012) has a positive effect on the performance of broilers and a lowering effect on blood serum cholesterol, triglycerides (Hussein, 2013). Beneficial effects of bioactive plant substances in animal nutrition may include appetite stimulation and feed intake, improvement of endogenous digestive enzyme secretion, activation of immune responses, and antibacterial, antiviral and antioxidant action (Hosseini-Vashan *et al.*, 2012). Curcumin is the main important bioactive ingredient responsible for biological activity of curcuma longa (Nouzarian *et al.*, 2011) when compared to commercially

available antibiotics, turmeric is a safe, non-toxic and ideal food additive widely used in daily diet.

Animals need to maintain specific numbers of beneficial microbiota in the gastrointestinal tract to ensure that the animal has the proper microbial balance at all times (Abd El-Hack *et al.*, 2018; Alagawany *et al.*, 2018; Arif *et al.*, 2019). Therefore, adding the probiotics to the bird's diet improves their utilization (Alagawany *et al.*, 2016; Farghly *et al.*, 2018; Taha *et al.*, 2019) because probiotics can neutralize and stabilize the gut ecosystem, compete for the enteric pathogens for nutrients and intestinal attachment sites, inhibit pathogenic adhesion, inhibit epithelial invasion, prevent common intestinal clinical signs, promote the metabolic processes of digestion and absorption of nutrients and supply the birds with several substrates that enhance their immune response. Numerous *bifidobacteria* and *Bacillus* strains have been used as alternatives for chemotherapeutic agents in poultry, animals, and humans (Dankowiakowska *et al.*, 2013; Kantas *et al.*, 2015). On the other hand, prebiotics are indigestible food additives which help the host by selectively promoting the production and activity of live microbials in the host's gut and thus improving their health and longevity. The combination of prebiotics and probiotics in poultry nutrition giving energy and net health benefits to the host is referred to as synbiotic. This combined effect could enhance the survival and persistence of the health-promoting organism in the intestine of birds and could be used as an option for AGP due to its availability as a specific fermentation substrate and the synergistic action of both probiotics and prebiotics (Adil and Magray 2012; Aziz Mousavi *et al.*, 2015). Consequently, the required combination of the two components in a single product would ensure a superior impact compared to the probiotic or prebiotic action alone. Keeping the aforementioned realities in view, the present study was planned to describe the effect of turmeric powder and synbiotic as alternative to antibiotic growth promoter on the growth performance and mortality broiler chicks.

## MATERIALS AND METHODS

One hundred and fifty day-old, unsexed, apparently healthy broiler chicks procured from commercial hatchery were divided into 5 treatments and each treatment of 30 chicks was subdivided into three replicates having 10 chicks each.

The broiler chicks were vaccinated for Ranikhet Disease (F1 strain) on 7<sup>th</sup> day and Infectious Bursal Disease (IBD) on 14<sup>th</sup> day. Broilers were maintained under standard management practices regarding brooding, feeding and watering throughout the trial period. The fresh and dry wheat straw was used as bedding material. *Ad lib.*, access to water and feed was arranged for all the treatments. Commercially available ready-made broiler starter and broiler finisher feed were procured and feed additives such as antibiotic, turmeric (*Curcuma longa*) and synbiotic were supplemented. The experimental feed will be analyzed for proximate principles by procedure of AOAC (2016). The five dietary treatments were designated as T<sub>1</sub> control group (basal diet), T<sub>2</sub> supplemented with antibiotic @ 0.02% level, T<sub>3</sub> supplemented with turmeric @ 0.5% level, T<sub>4</sub> supplemented with synbiotic @ 0.05% level and T<sub>5</sub> supplemented with turmeric @ 0.25% + synbiotic @ 0.025% in the diet. The experimental birds were randomly assigned to diets and fed ad-libitum. During the experimental period the growth parameters such as body weight, body weight gain, average daily weight gain, feed consumption, feed conversion ratio, performance index and protein efficiency ratio of birds were evaluated. The chicks were weighed separately at the beginning of the experiment and then at weekly intervals for 6 weeks in the morning before feeding. Live weight gain at weekly interval was calculated from difference in body weight attained between the two consecutive weeks and average daily body weight gain was estimated by dividing the total body weight gain by number of days. Feed conversion ratio (FCR) was calculated as the total feed consumption

divided by weight gain in each replication. Performance index was constructed for each treatment by dividing the average weight gain by respective feed conversion ratio and the weight gain of chicks divided by protein consumed on the basis of dry matter was calculated as the protein efficiency ratio. Percent mortality is a measure of the number of deaths in a particular population. The birds in the experiment were routinely monitored for any death or illness to calculate the mortality rate.

### Statistical analysis

The Data belonging to all parameters were subjected statistical analysis by implementing standard methods of variance analysis as defined by statistical package for social science (SPSS), version 20. The significance of the mean difference was checked by Duncan's New Multiple Range Test (DNMRT) as modified by Kramer (1956).

## RESULTS AND DISCUSSION

### Growth performance

The results of growth parameters of six week old broiler chicks are presented in Table (1). The statistical analysis of data showed highly significant ( $P < 0.01$ ) effect on growth performance with incorporation of turmeric and synbiotic as alternative to antibiotic growth promoter.

Highest body weight was observed in T<sub>5</sub> group and lowest body weight was observed in T<sub>1</sub> group *i.e.* control group.

**Table 1:** Effect of turmeric and synbiotic as alternative to antibiotic growth promoter on growth performance of broilers

Parameters	Treatment groups*					SEM
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	
Body weight (g)	2004.37 <sup>a</sup>	2098.85 <sup>b</sup>	2185.10 <sup>c</sup>	2349.14 <sup>d</sup>	2392.94 <sup>e</sup>	3.53
Body weight gain (g)	1965.58 <sup>a</sup>	1926.90 <sup>a</sup>	2146.27 <sup>b</sup>	2309.41 <sup>bc</sup>	2353.41 <sup>c</sup>	59.84
Average daily body weight gain (g)	46.80 <sup>a</sup>	46.18 <sup>a</sup>	51.11 <sup>b</sup>	54.99 <sup>bc</sup>	56.04 <sup>c</sup>	1.29
Feed consumption (g)	3742.44 <sup>a</sup>	3750.07 <sup>a</sup>	3820.74 <sup>b</sup>	3916.90 <sup>c</sup>	3911.87 <sup>c</sup>	10.48
Feed conversion ratio	1.80 <sup>d</sup>	1.71 <sup>c</sup>	1.68 <sup>b</sup>	1.60 <sup>a</sup>	1.58 <sup>a</sup>	0.01
Performance index	1098.01 <sup>a</sup>	1135.15 <sup>a</sup>	1277.86 <sup>b</sup>	1450.95 <sup>c</sup>	1493.66 <sup>c</sup>	34.66
Protein efficiency ratio	2.64 <sup>a</sup>	2.76 <sup>b</sup>	2.80 <sup>b</sup>	3.01 <sup>c</sup>	3.05 <sup>c</sup>	0.02

**Note:** a, b, c, d, e- means superscripted with different letters within a column differ significantly from each other; T<sub>1</sub>: Control; T<sub>2</sub>: Antibiotic @ 0.02%; T<sub>3</sub>: Turmeric powder @ 0.5%; T<sub>4</sub>: Synbiotic @ 0.05%; T<sub>5</sub>: Turmeric @ 0.25% + Synbiotic @ 0.025%.

The body weight gain and daily body weight gain were significantly highest in T<sub>5</sub> group which was comparable with T<sub>4</sub> group and the lowest was found in T<sub>2</sub> group *i.e.* antibiotic supplemented group which was comparable with T<sub>1</sub> group. Highest feed consumption was observed in T<sub>4</sub> group which showed non-significant difference with the T<sub>5</sub> group and lowest feed consumption was observed in T<sub>1</sub> group and showed non-significant difference with T<sub>2</sub> group. Lowest feed conversion ratio was observed in T<sub>5</sub> group supplemented with 0.25% turmeric + 0.025% synbiotic powder and showed non-significant difference with T<sub>4</sub> group and highest feed conversion ratio was observed in T<sub>1</sub> group fed with basal feed without addition of turmeric and synbiotic powder. Highest performance index was recorded in T<sub>5</sub> group which was comparable with T<sub>4</sub> group and lowest performance index was observed in T<sub>1</sub> group which showed non-significant difference with T<sub>2</sub> group. Highest protein efficiency ratio was observed in T<sub>5</sub> group which was comparable with T<sub>4</sub> group and lowest was observed in T<sub>1</sub> group. The findings of present study are in accordance with Shohe *et al.* (2019) who reported significant (P<0.05) improvement in body weight, weight gain, feed intake, feed conversion ratio and performance index in the treatment group supplemented with turmeric powder. Arslan *et al.* (2017) also reported significant (P<0.05) improvement in body weight, weight gain, feed conversion ratio in the treatment group supplemented with turmeric powder. Similarly, Awad *et al.* (2009), reported significant (P<0.05) improvement in body weight, daily weight gain and feed conversion ratio due to synbiotic supplementation. Ashayerizadeh *et al.* (2011) also observed significant effect on daily weight gain of broiler with supplementation of synbiotic. Popovic *et al.* (2015) observed significant (P<0.05) effect body weight, feed intake and feed conversion ratio due synbiotic supplementation. The results obtained in study corroborate well with the findings of Kohri (2020) who observed highly significant (P<0.01) effect on performance index and protein efficiency ratio due to supplementation of synbiotic powder in broilers.

### Mortality

The mortality of chicks among various treatment groups are presented in Table (2). Lowest mortality percent was observed in T<sub>3</sub> and T<sub>5</sub> group while highest mortality was observed in T<sub>1</sub> group fed with basal diet.

**Table 2:** Mortality rate of broilers at the whole experimental period (Percentage)

Parameter	Treatment groups				
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>
Mortality (%)	16.67	6.67	3.33	6.67	3.33

T<sub>1</sub>: Control; T<sub>2</sub>: Antibiotic @ 0.02%; T<sub>3</sub>: Turmeric powder @ 0.5%; T<sub>4</sub>: Synbiotic @ 0.05%; T<sub>5</sub>: Turmeric @ 0.25% + Synbiotic @ 0.025%.

Results of the present study regarding per cent mortality well corroborate with the findings of Al-Jaleel (2012), Umaram (2018) also reported reduced mortality percent with supplementation of turmeric powder. Similarly, Abdel-Raheem and Abd-Allah (2011), Popovic *et al.* (2015) who observed reduced mortality due to synbiotic supplementation.

### CONCLUSION

It can be concluded that as an alternative to antibiotics supplementation Turmeric @ 0.25% + Synbiotic @ 0.025% can be used to increase the growth performance and to reduce mortality of broiler chicken in the post-antibiotic period.

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