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Effect of Turmeric (*Curcuma longa*) Powder and Synbiotic as Alternative to Antibiotic Growth Promoter on Carcass Characteristics and Nutrient Utilization in Broiler Chicks

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ABSTRACT

The study was conducted during August, 2021–September, 2021 at College of Veterinary and Animal Science, Udaipur, Rajasthan, India to investigate the effect of turmeric (*Curcuma longa*) powder and synbiotic as alternative to antibiotic growth promoter on carcass characteristics and nutrient utilization in 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_1 control group supplemented with basal diet, T_2 group supplemented with antibiotic at 0.02% level, T_3 group supplemented with turmeric at 0.5% level, T_4 group supplemented with synbiotic at 0.05% level and T_5 group supplemented with turmeric at 0.25%+synbiotic at 0.025% in the diet. Highly significant (p<0.01) effect was observed on dressing percentage and non-significant effect was observed on eviscerated weight percentage. Significant effect (p<0.05) was observed for liver weight per cent and non-significant effect was observed for heart, gizzard, giblet weight per cent, dry matter metabolizability and nitrogen balance among the treatment groups as compared to control group. However, numerically highest dry matter metabolizability was observed in T_5 followed by T_4, T_3, T_2 and T_1. Numerically highest nitrogen balance was found in T_5 and lowest was observed in T_1 group i.e. control group. It can be concluded that as an alternative to antibiotics, turmeric plus synbiotic supplementation could be used to positively influence the carcass traits and nutrient utilization in broiler chicks.

KEYWORDS: Turmeric, synbiotic, antibiotic growth promoter, broiler, organ weight

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1. INTRODUCTION

Poultry has influenced man's civilization in many ways such as source of income, source of food, industrial uses, and use in research work. Poultry meat is the quickest developing segment of worldwide meat production, utilization and trade with developing economy assuming a significant job in its development because of its huge potential to carry fast financial development with low investment (Najeeb et al., 2014). The benefit in broiler production relies upon how rapidly broilers can be grown to accomplish greatest put on in body weight in least period. Therefore, there is a need to produce good quality meat in minimum time and less efforts. Feed is a significant segment, influencing net income from the poultry business, in light of the fact that 80% of the absolute consumption is in term of money spent on feed buy (Asghar et al., 2000). The optimum performance of birds depends mainly on the genetic potential of birds, feed quality, environmental factors and disease outbreaks.

The poultry production systems have led to marked increase in the production of poultry meat and eggs worldwide (Baker and Armstrong, 1986). It has triggered the discovery and widespread use of a number of "feed additives". In poultry diets these additives are primarily included to improve the efficiency of the bird's growth, laying capacity, prevent disease, improve feed utilization and carcass characteristics.

Antibiotics are incorporated into diets for the aversion and control of coccidiosis, and to improve development, proficiency of feed usage and livability. For growth performance, the elimination of antibiotic growth promoters (AGPs) was problematic and led to an increase in the incidence of disease outbreaks. This led to the discovery of alternatives to AGPs. To limit the loss in growth, there is a need to discover option to AGP. There are various non-therapeutic options, for example, inorganic acids, probiotics, prebiotics and herbs (Banerjee, 1998). Consumers nowadays have become mindful about the quality and wellbeing of the nourishment products. Phytogenic growth promoters are ideal for poultry because they are natural, free of residues, eco-friendly and have no adverse effects.

Due to its medicinal properties, the use of turmeric in poultry feed has become widespread over the last decade. Turmeric rhizome is a rich source of bioactive compounds utilized non-medicinally as a spice and medicinally as medical remedies. When compared to commercially available antibiotics, turmeric is a safe, non-toxic and ideal food additive widely used in daily diet. Curcumin is the fundamental significant bioactive component responsible for biological activity of Turmeric (Nouzarian et al., 2011).

The combination of prebiotics and probiotics in poultry nutrition giving energy and net health advantages 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 to AGP due to its availability as a specific substrate for fermentation and to the synergistic action of both probiotics and prebiotics (Yang et al., 2009; Adil and Magray, 2012; Aziz Mousavi et al., 2015). Probiotics are characterized as live microbial feed supplements intended to colonize the gastrointestinal tract and to provide physiological well-being and performance benefits to the host (Fuller, 1989; Gibson and Fuller, 2000) while 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 (Gibson and Roberfroid, 1995).

Keeping the aforesaid facts in view, the present investigation was planned to study the effect of turmeric powder and synbiotic as alternative to antibiotic growth promoter on carcass characteristics and nutrient utilization in broiler chicks.

2. MATERIALS AND METHODS

The study was conducted during August, 2021–September, 2021 at College of Veterinary and Animal Science, Udaipur.

2.1 Birds and housing management

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 (F_1 strain) on 7th day and Infectious Bursal Disease (IBD) on 14th 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, *Curcuma longa* (turmeric) and synbiotic were supplemented. The experimental feed would be analysed for proximate principles by procedure of Anonymous (2016) were presented in Table 1 and ingredients compositions of synbiotic were presented in Table 2.

2.2. Dietary treatments

The five dietary treatments were designated as T_1 control group (basal diet), T_2 supplemented with antibiotic at 0.02% level, T_3 supplemented with turmeric at 0.5% level, T_4 supplemented with synbiotic at 0.05% level and T_5

Table 1: Proximate composition of broiler starter, finisher ration and turmeric

Proximate Principle	Starter	Finisher	Turmeric (*Curcuma longa*)
1. Dry Matter (%)	92.23	93.89	90.48
2. Crude Protein (%)	22.30	21.15	9.63
3. Ether Extract (%)	4.55	5.39	7.03
4. Crude Fibre (%)	4.30	4.70	4.54
5. Total Ash (%)	10.89	9.50	3.15
6. Nitrogen Free Extract	57.96	59.26	75.65

supplemented with turmeric at 0.25%+synbiotic at 0.025% in the diet. The experimental birds were randomly assigned to diets and fed ad-libitum.

2.3. Carcass traits

The birds were weighed shortly before they were slaughtered. The slaughter was achieved by severing the jugular vein and a bleeding time of 5–6 min was required for each bird. The weight of the organs, including the entire giblet, liver, heart and gizzard, was taken separately by means of an automated weighing scale. Dressed birds were eviscerated by cutting the median in the abdomen and extracting the crop, gullet, trachea and viscera. The lungs were scratched off. Heart, liver, pancreas, spleen and gizzard were isolated from the GI tract. Eviscerated weight was determined by subtracting the weight of the viscera except for the giblet from the yield of the carcass. The weight of giblets such as heart, liver and gizzard were taken and expressed as a percentage of the pre-slaughter weight.

Table 2: Ingredient composition of synbiotic used in the experimental trial

Ingredients	Active constituents	Concentration
Prebiotic	Mannon-oligosachharide	14–16%
Probiotics	Lactobacillus acidophilus Lactobacillus bulgaricus Lactobacillus plantarum Streptococcus faecium Bifidobacterium bifidus	10^9 CFU g^{-1}

2.4. Dry matter metabolizability and nitrogen balance

Standard traditional procedures were followed for the calculation of dry matter metabolizability. The effect on the metabolizability of dry matter is an important parameter for determining the nutritional value of the herb or feed additive, such as turmeric and synbiotics, used in the study to improve the use of feed in living systems in addition to the physiological form, quantitative and qualitative characteristics of feed. The total nitrogen content of feed, residues and excreta was calculated using the KelPlus Semi-Automatic Nitrogen Analyzer (Pelican Equipment) standard Kjeldahl process.

2.5. Statistical analysis

The Data belonging to all parameters were subjected to statistical analysis by applying a completely randomized design as per Snedecor and Cochran (1994). The significance of the mean difference was checked by Duncan's New Multiple Range Test (DNMRT) as modified by Kramer (1957).

3. RESULTS AND DISCUSSION

3.1. Carcass study

The results of carcass parameters were presented in Table 3. The statistical analysis of data revealed (p<0.01) highly significant effect of supplementation of turmeric and synbiotic alone and in combination as alternative to antibiotic growth promoter on dressed weight but non-significant on eviscerated weight. Statistical analysis of data showed significant effect (p<0.05) among the treatment groups on liver weight. However, non-significant effect was observed on heart, gizzard and giblet weight. On observing the data highest dressed weight was recorded in T_5 group which showed non-significant difference with T_4 group and lowest was observed in T_3 group which was non-

Table 3: Effect of turmeric and synbiotic as alternative to antibiotic growth promoter on carcass traits of broilers

Parameters	Treatment groups					
	T_1	T_2	T_3	T_4	T_5	SEm±
Dressing %	68.65^{a}	70.08^{ab}	69.19^{a}	72.00^{bc}	72.33^{c}	0.64
Eviscerated weight %	63.36	64.60	65.18	65.44	65.60	0.57
Heart wt. %	0.43	0.42	0.41	0.41	0.43	0.01
Liver wt. %	1.74^{ac}	1.78^{bd}	1.78^{bcd}	1.82^{d}	1.79^{d}	0.01
Gizzard wt. %	2.17	2.22	2.24	2.23	2.24	0.02
Giblet wt. %	4.33	4.41	4.42	4.45	4.45	0.03

a,b,c,d: means superscripted with different letters within a row differ significantly from each other

significantly differed with T_1 and T_2 groups. Numerically, highest eviscerated weight per cent was observed in T_5 group and lowest was observed in T_1 group. The per cent means of liver for various treatment groups were recorded to be 1.74, 1.78, 1.78, 1.82 and 1.79% in T_1, T_2, T_3, T_4 and T_5 respectively. The per cent means of heart weight per cent for various treatment groups were recorded to be 0.43, 0.42, 0.41, 0.41 and 0.43% in T_1, T_2, T_3, T_4 and T_5 respectively. The per cent means of gizzard for various treatment groups were recorded to be 2.17, 2.22, 2.24, 2.23 and 2.24% in T_1, T_2, T_3, T_4 and T_5 respectively. The per cent means of giblet for various treatment groups were recorded to be 4.33, 4.41, 4.42, 4.45 and 4.45% in T_1, T_2, T_3, T_4 and T_5 respectively.

Results of the present study regarding significant effect on carcass yield due to turmeric powder well corroborated with the findings of Al-Jaleel (2012), Arslan et al. (2017), Umaram (2018) who reported significant effect of turmeric on dressing percentage of broiler with addition of turmeric powder in broiler feed as compared to control birds. Significant effect on carcass yield due to synbiotic powder were in accordance with the findings of Awad et al. (2009), Mokhtari et al. (2015), Kohri (2022) who observed significant effect on carcass yield due to synbiotic supplementation. Results of the present study regarding eviscerated weight percentage (%) well corroborated with findings of Mehla and Moorthy (2008), Wang et al. (2015), Umaram (2018) who reported non-significant effect of incorporation of turmeric powder on eviscerated weight percentage (%) of broiler than those of control chicks. Similarly, Sarangi et al. (2016), Kohri (2022) who reported non-significant effect of incorporation of synbiotic powder on eviscerated weight percentage (%) of broiler.

Results of the present study regarding significant effect of turmeric on liver weight percent well corroborate with the findings of Hussein (2013), who observed significant effect (p<0.05) due to supplementation of 7 g kg^{-1} turmeric powder. Similarly, Abou-Elkhair et al. (2014) who reported significant effect of turmeric on liver weight due to supplementation of combination of 0.5% black pepper, 0.5% turmeric, and 2% coriander seeds. Significant improvement in liver weight percent due to synbiotic supplementation well corroborate with the findings of Abdel-Hafeez et al. (2017) who observed significant effect on liver weight due to synbiotic supplementation. Results of the present study regarding non-significant effect of turmeric and synbiotic powder on heart, gizzard and giblet weight percent well corroborated with the findings of Yaghobfar et al. (2011), Al-Jaleel (2012) who reported non-significant effect of turmeric powder on heart, gizzard and giblet weight of broiler chicks than those of control ones. Durrani et al. (2006), also observed non-significant effect on heart and gizzard weight due to supplementation of turmeric powder. Likewise, Abdel-Raheem and Abd Allah (2011), Saiyed et al. (2015), Sarangi et al. (2016), also observed non-significant effect on heart, gizzard and giblet weight due to synbiotic supplementation. Dizaji et al. (2012), also observed non-significant effect on gizzard weight due to synbiotic supplementation.

Table 4: Effect of turmeric and synbiotic as alternative to antibiotic growth promoter on dry matter metabolizability of broilers

Parameters	Treatment groups					
	T_1	T_2	T_3	T_4	T_5	SEm±
Dry matter intake	121.00^{b}	116.00^{b}	110.00^{a}	108.00^{a}	105.00^{a}	1.66
Dry matter voided	38.00^{c}	33.00^{bc}	31.2^{0b}	28.40^{ab}	24.68^{a}	1.63
Dry matter metabolizability	69.34	70.67	71.00	73.00	76.00	1.78

a,b,c: means superscripted with different letters within a row differ significantly from each other

3.2. Dry matter metabolizability

The results of dry matter metabolizability, presented in Table 4. The numerically highest dry matter metabolizability was observed in T_5 followed by T_4, T_3, T_2 and T_1 and lowest digestibility was recorded in T_1 group.

Results of the present study regarding dry matter metabolizability well corroborated with the findings of Narsimha et al. (2013), Kohri (2022) also reported non-significant effect of synbiotic on dry matter metabolizability of broilers. Thorat et al. (2015), also reported non-significant on dry matter metabolizability due to supplementation of prebiotic.

3.3. Balance study

The results of nitrogen balance, presented in Table 5. The numerically highest nitrogen balance was found in T_5

Table 5: Effect of turmeric and synbiotic as alternative to antibiotic growth promoter on N balance (g d^{-1}) of broilers

Parameters	Treatment groups					
	T_1	T_2	T_3	T_4	T_5	SEm±
N intake	4.08	3.55	3.75	3.62	3.90	0.12
N voided	1.20^{d}	0.54^{a}	0.78^{c}	0.65^{b}	0.86^{c}	0.02
N balance	2.89	3.02	2.97	2.97	3.04	0.09

a,b,c,d: means superscripted with different letters within a row differ significantly from each other

followed by T_2, T_3, T_4 and T_1 group. Results of nitrogen balance in the present study well corroborated with the findings of Kohri (2022) noticed non-significant effect on nitrogen balance with supplementation of synbiotic in the diet of broilers.

4. CONCLUSION

Supplementation of combination of turmeric powder at 0.25% with synbiotic at 0.025% as alternative to antibiotic growth promoter was quite effective for profitable broiler production.

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