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Research Article

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Effect of Turmeric (*Curcuma longa*) Powder and Synbiotic as Alternative to Antibiotic Growth Promoter on Haemato-biochemical Parameters, Comparative Economics and Mortality of Broiler Chicks

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Abstract

A study was conducted to investigate the effect of turmeric powder and synbiotic as alternative to antibiotic growth promoter on haemato-biochemical parameters, comparative economics and mortality of broiler chicks. Total 150 day-old chicks were randomly divided into 5 treatments having 30 chicks in each group with three replicates of 10 chicks in each. Control group was fed basal diet, second group supplemented with antibiotic @ 0.02%, third supplemented with turmeric @ 0.5%, fourth supplemented with synbiotic @ 0.05% and fifth supplemented with turmeric @ 0.25%+synbiotic @ 0.025% in the diet. Haemato-biological parameters, comparative economics and mortality were recorded. Non-significant (p>0.05) effect was observed for haemato-biochemical parameters. However, numerically highest level of haemoglobin, packed cell volume, total protein, albumin and globulin was found in group supplemented with turmeric and synbiotic powder in combination. Highest reduction in serum triglyceride and cholesterol level was observed in group supplemented with turmeric and synbiotic powder in combination and lowest reduction was observed in control group. Highest net return per bird was observed in group supplemented with turmeric and synbiotic powder in combination and lowest was observed in control group. Lowest mortality was observed in a group supplemented with turmeric and combination group, while highest mortality was observed in control group. It can be concluded that as an alternative to antibiotics, addition of turmeric and synbiotic combination in the diets positively influenced haemato-biochemical parameters and comparative economics with reduced mortality of broiler.

Keywords: Turmeric, synbiotic, antibiotic growth promoter, broilers, economics

1. Introduction

Poultry is one of the most competitive agribusiness sectors in the world, and the importance of feed supplementation has increased in the development of poultry in recent years with a view to improving the economic situation of poultry projects (Zeweil et al., 2006). Today, the productivity of poultry by converting feed into meat plays a key role in the economy of the broiler industry. It is therefore very important to increase the feed efficiency of poultry for the production of meat economically and food safety is now more seriously considered than before. The optimum

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performance of broiler birds depends mainly on the genetic potential of birds, feed quality, environmental conditions and outbreaks of disease (Sugiharto, 2016). Egg and meat of birds are being consumed since pre-historic times and poultry meat is also used extensively as a delicious food. On the other hand, the food production economy is also a factor that cannot be neglected.

The main objective of adding feed additives is to boost animal performance by increasing their growth rate, better feed conversion efficiency, greater livability and lowered mortality in poultry birds. These feed additives are termed as "growth promoters" and often called as non-nutrient feed additives (Singh and Panda, 1992). Feed additives are the non-nutrient substances which increase proficiency of feed utilization and rapid growth. Feed additives are beneficial for health and nutrient metabolism in the animals (Church and Pond, 1988). An immense amount of antibiotics has been used to control diseases and boost efficiency in livestock and poultry. The use of antibiotics to encourage growth and control diseases in farm animals has been common practice among farmers for many decades. However, because of the biosecurity threats to human and animal health that arise from the increasing resistance of pathogens to antibiotics and the accumulation of antibiotic residues in animal products and the environment, there is a global need to eliminate antibiotic from animal diets (Bampidis et al., 2005; Stanacev et al., 2011).

In order to reduce the loss of growth, it is necessary to discover the possibility for AGP to have various non-therapeutic options, such as chemicals, inorganic acids, probiotics, prebiotics and herbs (Banerjee, 1998). Numerous plants have gainful multifunctional properties which are derived from their particular bio-active components. For better increase several herbal feed additives have been utilized successfully in poultry production (Reddy et al., 2012). *Curcuma longa* is a rhizomatous perpetual plant of the ginger family, Zingiberaceae. 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. The active ingredients are tetrahydrocurcuminoids (Osawa et al., 1995), curcumin, demethoxycurcumin and bisdemethoxycurcumin. Turmeric has good pharmacological properties and can be a useful natural growth promoter and safe alternative to antibiotics. Turmeric (*Curcuma longa*) is a widely utilized spice, food preservatives and shading material which has biological activities and restorative applications.

A combination of probiotics and prebiotics as synbiotics may be a means of enhancing the efficacy of probiotic preparations, which has a beneficial effect on the host by enhancing the survival and implantation of live microbial dietary supplements in the gastrointestinal tract. These effects are due to the activation of the metabolism of one or a limited number of health-promoting bacteria, or to selective stimulation of their growth, which has improved the well-being of the host, or both (Gibson and Roberfroid, 1995). The required combination of the two components in a single product would therefore ensure a superior impact compared to the probiotic or prebiotic action alone. Probiotics are characterized as live microbial feed supplements while, prebiotics are non-digestible substances mostly oligo and polysaccharide that causes lowering pH in the gut. Keeping the aforementioned realities in view, the present study was planned to describe the effect of turmeric (*Curcuma longa*) powder and synbiotic as alternative to antibiotic growth promoter on haemato-biochemical parameters, comparative economics and mortality percent of broiler chicks.

2. Materials and Methods

One hundred and fifty day-old, unsexed, apparently healthy broiler chicks from commercial hatchery were divided into five treatments and each treatment of 30 chicks was subdivided into three replicates each containing 10 chicks. Broiler chicks were vaccinated on the 7th day for Ranikhet Disease (F1 strain) and on the 14th day for Infectious Bursal Disease (IBD). 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 will be analyzed for proximate principles by procedure of AOAC (2016). Ingredient composition of synbiotic used in the experimental trial has been given in Table 1. The five dietary treatments were designated as T_1 control group (basal diet), T_2 supplemented with antibiotic @ 0.02% level, T_3 supplemented with turmeric @ 0.5% level, T_4 supplemented with synbiotic @ 0.05% level and T_5 supplemented with turmeric @ 0.25% + synbiotic @ 0.025% in the diet. The experimental birds were randomly assigned to diets and fed ad-libitium. Blood samples of approximately 3 ml of wing vein from 2 representative birds of each replication were collected on the 42nd day of the experiment for haematological and serum biochemical parameters. Using an automated haematology analyzer,

Table 1: Ingredient composition of synbiotic used in the experimental trial

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

half of the blood was transferred to sterilize EDTA containing vacutainer tubes for the measurement of haemoglobin (Hb), packed cell volume (PCV). The residual blood sample was transferred to non-EDTA tubes for serum restoration. The serum was collected and processed for examination under deep freezing temperature, as per the normal protocol. Such samples were analyzed using an electronic biochemistry analyzer for total protein, serum albumin, serum cholesterol and triglyceride. The content of serum globulin was calculated by subtracting the concentration of serum albumin from total protein levels.

The cost of rearing the chicks for the entire experiment was determined by taking into account the cost of the chick, the cost of the overall feed consumed by the bird, the cost of the litter, the cost of vaccination, the cost of medication. The cost of feeding was determined on the basis of prices of feed and herbal feed additives. The average body weight of the birds was determined by the results at the end of the 6th week. The selling price per kg of live weight was estimated to be 80 per kg of live weight. Net profit per kg of body weight was measured on the basis of final body weight records and real market prices for ready-made feed and the price of turmeric powder, antibiotic and synbiotic powder mixed in feed.

During daily routine poultry farm activities, the birds in the experiment were routinely monitored for any death or illness to calculate the mortality rate and to evaluate the net amount of feed consumed. The dead birds were then subjected to routine post-mortem examinations

2.1. 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), 2018, version 20. 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. Haemato-biochemical parameters

The results of haemato-biochemical parameters of six week old broiler chicks are presented in Table 2. Statistical analysis of data revealed non-significant effect on haemato-biochemical parameters such as haemoglobin, PCV, serum total protein, albumin, globulin, triglyceride and cholesterol. Numerically highest haemoglobin was found in T_5 group supplemented with combination of turmeric @ 0.25 and synbiotic @ 0.025% and lowest was observed in T_2 *i.e*. antibiotic supplemented group. Numerically highest value of PCV was found in T_5 group supplemented with combination of turmeric @ 0.25 and synbiotic @ 0.025% and lowest was found in T_1 group *i.e.* control group. Numerically highest value of total protein and globulin was found in T_5 group and lowest in T_4 *i.e.* synbiotic supplemented group. Numerically highest value of albumin was found in T_2 group and lowest in T_3 group. Numerically highest reduction in serum triglyceride and cholesterol level was observed in T_5 group and lowest reduction was observed in T_1 group.

The results obtained from study are in line with the findings of Al-Jaleel (2012), Khwairakpam et al. (2016), Shohe et al. (2019) who reported non-significant effect on haemoglobin and PCV level due to turmeric powder supplementation in broiler ration. Similarly, Kohri (2020) also observed non-significant effect on haemoglobin and PCV value due to supplementation of synbiotic powder. Sethy et al. (2016) recorded non-significant effect on serum total protein, albumin, globulin and cholesterol due to supplementation of turmeric. Abdel-Hafeez et al. (2017) reported non-significant effect on haemoglobin, packed cell volume serum total protein, albumin globulin and serum cholesterol due to supplementation of synbiotic. Hosseini-Vashan et al. (2012) also reported non-significant effect on serum total protein due to supplementation of turmeric among the treatment groups. Mehala and Moorthy (2008), reported non-significant effect

Table 2: Effect of turmeric and synbiotic as alternative to antibiotic growth promoter on haemato-biochemical parameters of broilers

Parameters	Treatment groups					
	T_1	T_2	T_3	T_4	T_5	SEm±
Hb gm%	11.80	11.50	11.54	11.74	12.80	0.85
PCV %	30.00	32.34	31.00	31.00	33.00	0.67
Total Protein (g dl^{-1})	3.37	3.80	3.35	3.28	3.94	0.19
Albumin (g dl^{-1})	2.15	2.47	2.10	2.12	2.23	0.09
Globulin (g dl^{-1})	1.22	1.33	1.25	1.16	1.72	0.12
Triglyceride (mg dl^{-1})	103.67	100.67	103.00	102.34	98.67	2.66
Cholesterol (mg dl^{-1})	196.34	192.34	190	190.67	188.34	2.63

T_1: Control; T_1: Antibiotic @ 0.02%; T_3: Turmeric powder @ 0.5%; T_4: Synbiotic @ 0.05%; T_5: Turmeric @ 0.25%+Synbiotic @ 0.025%

on serum triglyceride and cholesterol level due to turmeric powder supplementation in broiler ration. Arslan et al. (2017) reported non-significant effect on triglyceride level due to turmeric supplementation. Park et al. (2012) recorded non-significant effect on cholesterol due to supplementation of turmeric powder. Similarly, Sahin et al., (2008), recorded non-significant effect on triglyceride and serum cholesterol due to supplementation of synbiotic powder. Beski et al. (2015) recorded non-significant effect on triglyceride and serum total protein due to supplementation of synbiotic powder. Likewise, Sharifi et al. (2011) also reported non-significant effect on serum cholesterol and serum total protein level due to synbiotic powder.

3.2. Comparative economics

The results of comparative economics of six week old broiler chicks are presented in Table 3. Net return per bird in T_1, T_2, T_3, T_4 and T_5 were found to 1.96, 8.68, 10.58, 21.26 and 24.60, respectively. Highest net return per bird was observed in T_5 group supplemented with combination of turmeric @ 0.25 and synbiotic @ 0.025% and lowest was observed in T_1 group *i.e.* control group.

The present findings are in line with Durrani et al. (2006), Shohe et al. (2019), who observed higher net profit due to turmeric powder supplementation as compared to control group likewise Narasimha et al. (2013), Saiyed et al. (2015), Kumar (2018), Kohri (2020) observed return over feed cost significantly higher in synbiotic supplemented group than those of control group. Similarly, Salah et al. (2018) observed higher net profit due to supplementation of synbiotic.

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

Components	T_1	T_2	T_3	T_4	T_5
Starter cost	31.00	31.00	31.00	31.00	31.00
Feed additive cost kg^{-1} feed	0.00	0.16	0.90	0.75	0.83
Starter cost with additive kg^{-1}	31.00	31.16	31.90	31.75	31.83
Finisher cost	30.40	30.40	30.40	30.40	30.40
Finisher cost with additive kg^{-1}	30.40	30.56	31.30	31.15	31.23
Starter consume in kg chick^{-1}	1.03	1.03	1.06	1.09	1.11
Finisher consume in kg chick^{-1}	2.70	2.72	2.76	2.82	2.80
Starter cost with additive	32.06	32.09	33.77	34.68	35.40
Finisher cost with additive	82.33	83.13	86.46	87.99	87.43
Total feed cost chick^{-1} ₹	114.40	115.22	120.22	122.67	122.83
Chick cost ₹	41.00	41.00	41.00	41.00	41.00
Miscellaneous cost ₹	3.00	3.00	3.00	3.00	3.00
Total expenditure ₹	158.39	159.22	164.22	166.67	166.84
Final weight in kg chick^{-1}	2.00	2.09	2.19	2.35	2.39
Sell cost 80 ₹ chick^{-1}	160.00	167.20	175.20	188.00	191.20
Net profit (return chick^{-1})	1.61e	7.98d	10.98c	21.33b	24.36a

3.3. Per cent mortality

An overall image of the weekly mortality in the broiler chicks of various treatment groups have been presented in Table 4. Out of total of 150 chicks reared in the present study, 11 chicks died during entire experimental period. During overall period, highest mortality was observed in T_1 group which was recorded to be 5 in numbers out of total 30 broilers lowest was observed in T_3 and T_5 group which was recorded to be 1 in number out of total 30 broilers.

Results of the present study well corroborate with the findings of Durrani et al. (2006), Al-Jaleel (2012), Umaram (2018), also reported reduced mortality percent with supplementation

Table 4: Effect of turmeric and synbiotic as alternative to antibiotic growth promoter on mortality at different weeks

Treatment	No. Initial	Mortality in different weeks						
		I	II	III	IV	V	VI	0-VI
T_1	30	0	2	1	1	1	0	5
T_2	30	0	1	1	0	0	0	2
T_3	30	0	0	0	0	1	0	1
T_4	30	0	1	1	0	0	0	2
T_5	30	0	0	0	1	0	0	1
Total	150	0	4	3	2	2	0	11

T_1: Control; T_2: Antibiotic @ 0.02%; T_3: Turmeric powder @ 0.5%; T_4: Synbiotic @ 0.05%; T_5: Turmeric @ 0.25%+Synbiotic @ 0.025%

of turmeric powder. Similarly, Abdel-Raheem and Abd Allah (2011), Abdel-Raheem et al. (2012), Popovic et al. (2015), Kohri (2020) who observed reduced mortality due to synbiotic supplementation.

4. Conclusion

An alternative to antibiotics, addition of turmeric and synbiotic combination in the diets positively influenced the haematological as well as biochemical parameters, comparative economics and reduced mortality of broiler chicken in the post-antibiotic period.

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