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Effect of Garlic (*Allium sativum*) and Turmeric (*Cucurma longa*) Powder Supplementation on Blood Parameters of Starter and Finisher Growth Phase of Broilers

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ABSTRACT

A study was conducted to investigate the effect of dietary supplementation of garlic (Allium sativum) and turmeric (Cucurma longa) powder and their combinations on blood parameters of broilers at different growth phases (starter and finisher phase). One hundred twenty day- old broiler chicks were randomly distributed into four treatment groups with three replicates of 10 chicks in each group i.e. 30 chicks in each group. The treatment groups were T1: basal diet no supplementation (control); T2: basal diet supplemented with 3% garlic powder; T3: basal diet supplemented with 0.5% turmeric powder and T4: basal diet supplemented with combinations of 1.5% garlic powder and 0.25% turmeric powder. Standard starter and finisher feed was provided from 0 to 3 weeks and 3-6 weeks, respectively. The results revealed that there was no significant effects of garlic and turmeric powder on both haematological and serum biochemical parameters on 21st day (starter phase). But on 42nd day (finisher phase) there was significant reduction in level of serum cholesterol and triglycerides in 3% garlic supplemented group (T2) and 1.5% garlic + 0.25 turmeric powder supplemented group (T4) as compared to T1 and T3. Supplementation of garlic and turmeric powder could not alter other haemato-biochemical parameters at the end of finisher phase (42nd day) of the feeding trial.

Key words: *Garlic, Turmeric, Broilers, Haemato-biochemical parameters*

INTRODUCTION

Garlic (*Allium sativum),* a member of allium family (liliaceace) is a well known spice which is widely used and distributed in most parts of the world. Garlic is rich in organosulfur substances such as allin, allicin, ajoene, S-allyl cysteine, diallyl sulfide, and diallyl trisulfide. Its characteristic odour and flavour as well as most of its biological properties are due allicin. Allicin do not exist in the garlic bulb until it is crushed or cut, however, injury to the garlic bulbs activates the enzyme allinase which metabolizes allin to allicin. Garlic contains higher concentration of sulphur compounds than any other allium species.

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The allium species has shown immune enhancing activities that include promotion of lymphocytes synthesis, cytokine release, phagocytosis and natural killer activity. Garlic and its preparations have been widely recognized as agents for prevention of various metabolic disorders such as atherosclerosis, hyperlipedemia, thrombosis, hypertension and diabetes. Several phytochemicals of garlic, mainly polyphenols such as flavonoids and sulfur-containing substances, have been revealed to have antioxidative properties in meat-type of poultry[1]. Garlic powder as a natural growth promoter can be a potential alternative for common artificial growth promoters like antibiotics and in this respect, it can improve performance and carcass characteristics in broiler chickens[2]. Garlic is widely consumed and gained the trust in the scientific media as hypolipidemic and hypocholesterolemic among wide range of species. Turmeric (*Curcuma longa),* a medicinal plant is a rhizomatous herbaceous perennial plant of ginger family, Zingiberaceae. It is widely used and cultivated in the tropical and sub tropical regions of the world, such as in China, Indonesia, India, Malaysia, Jamaica, and Peru[3]. Curcumin (diferuloylmethane) is the main yellow bioactive component that has a wide spectrum of biological actions, including antioxidant, antibacterial, antifungal, antiprotozoal, antiviral, antiinflammatory, antihypertensive, and hypocholesteremic activities[4]. Turmeric is well known to have a property as a safe, natural, and residue free phytobiotics[5]. Keeping the important properties of garlic and turmeric in view, it was supplemented in broiler starter and finisher feed to study its effect on haemato- biochemical parameters of broiler birds.

MATERIAL AND METHODS

The study was carried out to discern the effect of dietary incorporation of garlic (*Allium sativum*) and turmeric (*Curcuma longa*) powder on blood parameters of broilers at the end of starter and finisher phase. One hundred and twenty day- old broiler chicks were divided into four groups (T_1, T_2, T_3, and T_4) each with three replicates having ten birds in each replicate. Garlic powder and turmeric powder and their combination were supplemented in the broilers basal diets (starter and finisher diet) for a period of 6 weeks as follows:

Treatment T_1 : Basal diet (no supplementation)
Treatment T_2 : Basal diet + 3% garlic powder
Treatment T_3 : Basal diet + 0.5% turmeric powder
Treatment T_4 : Basal diet + 1.5 % garlic powder + 0.25% turmeric powder

Standard broiler diets for starter (0-3 weeks) and finisher (4-6 weeks) phases of growth were prepared by mixing the different ingredients as shown in Table.1 and provided to all the broiler chicks so as to meet the nutrient requirements as per BIS (1997). The starter diet was provided during 0-3 weeks while finisher diet was provided during 4-6 weeks of age in clean feederer. Garlic and turmeric powder were mixed with starter and finisher feed and fed to broilers. The broiler chicks were housed in a deep litter system and provided *ad libitum* feed and water throughout the trial period. To study the blood parameters, blood samples were collected from six experimental birds of each group i.e. two broiler chicks from each replicate at the end of starter phase (21st day) and finisher phase (42nd day) of experimental feeding. Blood samples (about 3.0 ml) were collected aseptically from their wing vein, using sterilized syringes and needles. Collected blood samples were divided into two parts. One part (1.5ml) was transferred to the vials containing anticoagulant (EDTA) for analysis of haematological parameters. The second part (1.5ml) of blood was used for separation of serum. For separation of serum, remaining 1.5

ml blood sample was allowed to stand at room temperature in slanting position for clot formation for three to four hours. After clotting of blood, serum was separated and stored at -20^{0}C with date and sample number for further analysis. The experimental data obtained during the study were analysed statistically using completely randomised design with the simple Analysis of Variance (ANOVA) technique[7].

RESULTS AND DISCUSSION

Haemato-biochemical parameters (21st day)

All the haematological parameters (Hb, PCV, TEC, TLC, MCV, MCH, MCHC) and serum biochemical parameters (Glucose, cholesterol, triglycerides, total protein, albumin, globulin ALP, SGOT and SGPT) showed no significant difference among the broilers of different treatment groups due to dietary incorporation of garlic and turmeric powder on 21st day (end of starter phase) of feeding trial (table. 2&3)

Haemato-biochemical Parameters (42nd day)

The different haematological parameters on 42nd day (table 4) were not influenced by feeding garlic and turmeric powder as feed additives to broilers. However, haemoglobin content in T_2 group of broilers showed numerically lower value as compared to other treatment groups. Decrease in haemoglobin content in broilers of treatment group T_2 might be due to the presence of some hemolytic bioactive constituents and/or their metabolites in garlic[8]. Ademola *et al*.[9], Fadlalla *et al*.[10] , Onyimonyi *et al*.[11] and Jawad[12] reported that value of haemaoglobin content of broilers was found to be insignificantly lowered in garlic treated group**.**And all serum biochemical parameters at the end of finisher phase (42nd day) showed no significant difference among the different treatments except serum cholesterol and triglycerides level. The mean serum cholesterol concentration (mg/dl) in broilers of group T_2 and T_4 was significantly ((P<0.05) less as compared to the broilers of control group (T_1). The mean cholesterol level of T_3 group of broilers was statistically similar with those of T_1 group. This reduction of serum cholesterol concentration due to dietary garlic powder supplementation may probably be due to the possible mechanism of hypocholesterolaemic and hypolipidemic action of active principles present in garlic products which depresses the hepatic activities of lipogenic and cholesterogenic enzymes such as malic enzyme, fatty acid synthase, glucose-6-phosphatase dehy-drogenase[13,14] and 3-hydroxyl-3-methyl-glutaryl-CoA (HMG-CoA) reductase[15]. Horton *et al*.[16], Jawad[12] and Ologhobo *et al*.[15] reported that dietary garlic supplementation in broiler chicks reduced serum cholesterol. Whereas Akbarian *et al*.[17] reported that addition of 0.5 g turmeric rhizome powder in diet of broilers did not affect serum cholesterol concentration. The serum triglycerides concentration (mg/dl) in broiler chicks of treatment groups T_2 and T_4 supplemented with garlic powder and garlic plus turmeric powder, respectively reduced significantly (P<0.05) as compared to control group. The serum triglycerides concentration of T_3 (86.21 mg/ dl) supplemented with turmeric powder had no significant difference from T_1 (87.10 mg/ dl). T_3 (78.80 mg/ dl) and T_4 (79.09 mg/dl) groups of broilers also had no significant (P<0.05) difference between them. The serum triglycerides lowering effect of garlic can be explained by the possible inhibition of the Acetyl CoA synthetase enzyme that is necessary for the biosynthesis of fatty acids[13,14] . Ologhobo *et al*.[15] and Ashayerizadeh *et al*.[18] also reported that dietary garlic supplementation to broilers significantly reduced serum triglycerides level. Whereas, Akbarian *et al*.[17] observed no significant change in serum triglycerides when turmeric rhizome powder was supplemented in the diet of broilers. Namagirilakshmi[19] stated that supplementation of turmeric to broilers had no significant effect on serum triglycerides. Glucose, total protein, Albumin, Globlulin, Alkaline phosphatase, SGOT and SGPT of broilers at the end of finisher phase of growth did not differ significantly among the different treatment groups.

Table 1: Ingredient and chemical composition (%) of the basal diets

Feed ingredients	Broiler starter diet (0-3 wks)	Broiler finisher diet (4-6 wks)
Maize	55.00	60.00
Deoiled soyabean meal	36.00	32.00
Rice polish	4.60	3.10
Soyabean oil	0.50	1.00
Marble stone	1.00	1.00
Dicalcium phosphate	2.00	2.00
DL- Methionine	0.10	0.10
Coccidiostat (Meduramycin)	0.05	0.05
Copper sulphate	0.01	0.01
Common salt	0.30	0.30
Merivite -100 (Vitamin B12)	0.02	0.02
Phosphoric acid	0.10	0.10
Lipocare (choline chloride)	0.05	0.05
Hepatocare	0.10	0.10
Vitamin mixture	0.03	0.03
Trace minerals	0.14	0.14

Table 2: Haematological values of broilers fed diets supplemented with garlic and turmeric powder (21st day)

Parameters	Treatments/ Groups			
	T_1	T_2	T_3	T_4
	Control	Garlic (3%)	Turmeric (0.5%)	Garlic (1.5%) + turmeric (0.25%)
Haemoglobin (%)	9.19 ± 0.12	9.18 ± 0.04	9.21 ± 0.01	9.18 ± 0.02
Packed cell volume (%)	25.01 ± 0.57	25.32 ± 1.12	25.17 ± 0.51	25.36 ± 0.26
Total erythrocyte count (10^6/µl)	2.40 ± 0.04	2.42 ± 0.03	2.41 ± 0.02	2.42 ± 0.02
Total leukocyte count (10^3/µl)	24.20 ± 0.52	23.93 ± 0.60	23.82 ± 0.40	24.41 ± 0.17
Mean corpuscular volume (fl)	104.18 ± 3.98	104.89± 5.50	104.60 ± 2.62	104.67 ± 1.96
Mean corpuscular haemoglobin (pg)	38.26 ± 1.14	37.98 ± 0.46	38.21 ± 0.33	37.89± 0.29
Mean corpuscular haemoglobin concentration (g/dl)	36.75 ± 0.41	36.40 ± 1.83	35.62 ± 0.68	36.21 ± 0.425

Value with different superscripts between columns differ significantly (P< 0.05).

Table 3: Average values of serum biochemical constituents of broilers fed diets supplemented with garlic and turmeric powder (21st day)

Parameters	Treatments/ Groups			
	T_1	T_2	T_3	T_4
	Control	Garlic (3%)	Turmeric (0.5%)	Garlic (1.5%) + turmeric (0.25%)
Cholesterol (mg/dl)	148.57 ± 6.62	146.55 ± 2.14	148.57± 3.03	145.50 ± 2.67
Triglyceride (mg/dl)	88.06 ± 1.36	85.20 ± 1.44	88.91 ± 1.26	84.61 ± 0.99
Glucose (mg/dl)	213.55 ± 2.09	210.46 ± 2.56	215.52 ± 1.64	212.56 ± 3.92
Total protein (g/dl)	4.10 ± 0.04	4.19 ± 0.05	4.19 ± 0.04	4.22 ± 0.03
Albumin (g/ dl)	1.38 ± 0.02	1.42 ± 0.02	1.41 ± 0.03	1.44 ± 0.03
Globulin (g/dl)	2.72 ± 0.05	2.77 ± 0.06	2.78 ± 0.06	2.78 ± 0.01
Albumin- globulin ratio	0.509 ± 0.019	0.514 ± 0.020	0.501 ± 0.036	0.517 ± 0.016
Serum alkaline phosphatase (U/l)	85.02 ± 1.11	83.27 ± 1.47	83.90 ± 2.67	81.47 ± 2.61
Serum glutamate pyruvate transaminase (U/l)	26.64 ± 0.85	26.32 ± 0.67	27.45 ± 0.99	25.81 ± 1.41
Serum glutamate oxaloacetate transaminase (U/l)	168.36 ± 0.58	171.28 ± 0.63	169.69 ± 1.45	171.01 ± 0.95

Value with different superscripts between columns differ significantly (P< 0.05).

Table 4 Haematological values of broilers fed diets supplemented with garlic and turmeric powder (42nd day)

Parameters	Treatments/ Groups			
	T_1	T_2	T_3	T_4
	Control	Garlic (3%)	Turmeric (0.5%)	Garlic (1.5%) + turmeric (0.25%)
Haemoglobin (%)	9.23 ± 0.08	9.09 ± 0.22	9.29 ± 0.20	9.14 ± 0.13
Packed cell volume (%)	25.09 ± 0.64	25.36 ± 0.59	25.34 ± 0.48	25.59 ± 0.32
Total erythrocyte count (10^6/µl)	2.46 ± 0.06	2.45 ± 0.03	2.49 ± 0.04	2.48 ± 0.04
Total leukocyte count (10^3/µl)	24.02 ± 0.50	24.33 ± 0.37	23.39 ± 0.12	24.46 ± 0.38
Mean corpuscular volume (fl)	102.15 ± 3.70	103.52 ± 2.08	101.83 ± 1.96	103.29 ± 1.79
Mean corpuscular haemoglobin (pg)	37.59 ± 0.98	37.15 ± 1.05	37.35 ± 0.91	36.88 ± 0.42
Mean corpuscular haemoglobin concentration (g/dl)	36.92 ± 0.97	36.01 ± 1.56	36.73 ± 1.05	35.74 ± 0.56

Value with different superscripts between columns differ significantly (P< 0.05).

Table 5: Average values of serum biochemical constituents of broilers fed diets supplemented with garlic and turmeric powder (42nd day)

Parameters	Treatments/ Groups			
	T_1	T_2	T_3	T_4
	Control	Garlic (3%)	Turmeric (0.5%)	Garlic (1.5%) + Turmeric (0.25%)
Cholesterol (mg/dl)*	149.79^{a} ± 3.27	131.27^{b} ± 1.47	146.81^{a} ± 2.56	137.97^{b} ± 1.95
Triglyceride (mg/dl)*	87.10^{a} ± 1.64	78.80^{c} ± 2.54	86.21^{ba} ± 2.50	79.09^{bc} ± 3.07
Glucose (mg/dl)	217.86 ± 2.31	211.30 ± 1.91	215.57 ± 2.35	210.99 ± 1.10
Total protein (g/dl)	4.26 ± 0.09	4.35 ± 0.05	4.28 ± 0.08	4.30 ± 0.04
Albumin (g/dl)	1.41 ± 0.06	1.46 ± 0.05	1.40 ± 0.01	1.49 ± 0.06
Globulin (g/dl)	2.85 ± 0.14	2.89 ± 0.07	2.88 ± 0.06	2.82 ± 0.06
Albumin- globulin ratio	0.49 ± 0.05	0.50 ± 0.03	0.48 ± 0.01	0.52 ± 0.03
Serum alkaline phosphatase(U/l)	85.37 ± 1.18	82.04 ± 1.45	84.40 ± 1.56	82.26 ± 1.76
Serum glutamate pyruvate transaminase (U/l)	28.10 ± 0.86	26.35 ± 0.64	26.84 ± 1.01	26.31 ± 0.79
Serum glutamate oxaloacetate transaminase (U/l)	171.05 ± 1.18	170.62 ± 1.08	170.50 ± 0.46	171.20 ± 0.95

Value with different superscripts between columns differ significantly (P< 0.05).

CONCLUSIONS

Garlic and turmeric are herbal feed additives which can be added in the diet of broilers without any harmful effect. In addition, 3% garlic powder can reduced the level of cholesterol and triglycerides in the serum of broilers thus help in improving the lipid profile of broiler.

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