

Effect of dietary garlic (*Allium sativum*) and turmeric (*Curcuma longa*) powder incorporation on growth performance and nutrients utilization in Broiler Chickens

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ABSTRACT: A feeding trial was conducted to discern the effect of dietary incorporation of garlic and turmeric powder as feed additive on growth performance and nutrient utilization in broiler chicks. A total of 120, day-old broiler chicks were divided randomly into 4 treatment groups with 3 replicates each and 10 broiler chicks per replicate. Chicks of treatment T₁ (control) were fed basal diet without any supplementation. In the treatments T₂, T₃ and T₄, basal diet was incorporated with 3% garlic powder, 0.5% turmeric powder and 1.5% garlic powder plus 0.25% turmeric powder, respectively. The feeding trial lasted for 42 days viz., 0-21 days (starter phase) and 21-42 days (finisher phase). A metabolism trial was conducted during the 6th week of feeding trial. During the starter phase, the body weight gain of broiler chicks of treatment group T₂ (540.50g) was significantly (P<0.05) higher than other treatment groups T₁ (533.49g) T₃ (534.67g) and T₄ (536.41g). During 21- 42 days (finisher phase), the body weight gain of broiler chicks fed garlic T₂ (1183.91 g) and garlic plus turmeric powder T₄ (1173.71g) incorporated diet was significantly higher than broiler chicks fed diet incorporated with turmeric powder alone T₃ (1163.87 g) and control group T₁ (1160.62 g). FCR and performance index were also improved in broiler chicks of treatment groups T₂ and T₄. The overall body weight gain was recorded highest in T₂ fed garlic incorporated diet. Nutrient utilization in terms of dry matter, crude protein and crude fat was significantly (P<0.05) improved in broilers fed diet (T₂) incorporated with garlic powder. It was concluded that incorporation of garlic powder as feed additive @3% in broiler diet improved weight gain and feed efficiency as well as nutrient utilization.

Key words: Broiler chicks, garlic, turmeric, growth performance, nutrient utilization

Over the years, the fast growing nature of broilers and their short generation interval has been associated with the use of antibiotic growth promoters in animal feeds. However, use of antibiotics not only increases the cost of production but also leads to residues in meat and eggs and develops antibiotic resistance in human being consuming the poultry meat. To overcome the poor performance and the increased susceptibility to diseases due to removal of antibiotics from poultry diets, several herbal sources as feed additives have been used effectively in poultry production for better gains and healthy chicken production (Guo *et al.*, 2004). Garlic (*Allium sativum*), a well known spice is rich in organosulfur substances such as allin, allicin, ajoene, S-allyl cysteine, diallyl sulfide and diallyl trisulfide. The sulphur compounds are responsible for many of its medicinal effects like lowering blood cholesterol level (Chowdhury *et al.*, 2002). Garlic can be used as a feed additive in broiler diets as it improves weight gain and feed conversion ratio (Mahmood *et al.*, 2009). Turmeric (*Curcuma longa*), contains a yellow bioactive component, curcumin (diferuloylmethane) that has a wide spectrum of biological actions such as antioxidant, antibacterial, antifungal, antiprotozoal, antiviral, anti-inflammatory, antihypertensive, and hypocholesteremic

activities (Chattopadhyay *et al.*, 2004). The present study was, therefore, planned to know the effect of garlic and turmeric incorporation as feed additive in broiler chicken diet on growth performance and nutrients utilization.

MATERIALS AND METHODS

A total of 120, day - old Top 400 strain broiler chicks were procured from A.G.M. Hatcheries Pvt. Ltd., Haldwani (Uttarakhand) and randomly allocated into 4 groups with 3 replicates per group and 10 chicks per replicate following completely randomized design. The broiler chicks in group T₁, were fed basal diet (control) whereas chicks of groups T₂, T₃ and T₄ were fed basal diet and incorporated with 3% garlic powder, 0.5% turmeric powder and 1.5% garlic plus 0.25% turmeric powder, respectively. Standard broiler diets for starter (0-3 weeks) and finisher (3-6 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 feeds were analyzed for proximate principles as per standard methods (AOAC, 1995), calcium and total phosphorus (Talapatra *et al.*, 1940) and gross energy by bomb calorimeter (Anon, 1994). The broiler chicks were raised

in a deep litter system under standard managerial conditions and provided *ad libitum* feed and clean drinking water throughout the trial period.

Body weight of the chicks and feed intake were recorded weekly during the feeding trial and feed conversion ratio (FCR), performance index and protein efficiency were calculated. During the 6th week of the experiment, a metabolism trial following standard procedure was conducted for three days using 2 chicks from each replicate in each treatment to know the nutrients utilization. The experimental data obtained during the study were analysed statistically (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSION

The chemical composition, calcium, phosphorus and gross energy contents of broiler's starter and finisher diets are presented in Table 1. The growth performance of broiler chicks fed experimental diet is presented in Table 2. During the starter phase (0-21 days) no significant differences were observed in feed consumption, FCR and protein efficiency ratio in the chicks of various treatment groups. However, weight gain improved significantly

($P < 0.05$) in broilers fed garlic powder incorporated diet (T_2). Performance index was also improved in broilers of garlic (T_2) and garlic plus turmeric powder incorporated groups (T_4). The results of present study corroborated with the findings of Prasad *et al.* (2009) who reported higher body weight gain in garlic supplemented group than control group of broilers but with a similar feed intake in both the groups. Similar to the present findings, Rahmatnejad *et al.* (2009) also showed that addition of turmeric powder as feed additives in diet of broilers did not affect growth performance. During finisher stage (21-42 days), there was no significant improvement in growth performance of broilers of turmeric powder incorporated groups, whereas growth performance in terms of weight gain, FCR and performance index of broilers of garlic powder (T_2) incorporated group improved significantly ($P < 0.05$) while feed intake and protein efficiency ratio were not influenced by dietary incorporation of garlic powder. In case of garlic and turmeric powder incorporated group (T_4), weight gain and performance index improved significantly, whereas feed intake, FCR and protein efficiency ratio were not affected (Table 2). No significant difference was observed in efficiency of utilization of metabolizable

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

Feed ingredients (%)	Broiler starter (0-21 days)	Broiler finisher (21-42 days)
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
Chemical Composition		
Moisture	9.20	10.90
Crude protein	22.16	20.81
Crude fibre	4.00	4.00
Ether extract	4.50	4.25
Nitrogen- free extract	62.54	64.44
Total Ash	6.80	6.50
Acid insoluble ash	1.35	1.30
Calcium	1.24	1.21
Phosphorus	0.79	0.77
Metabolizable energy (kcal/kg)*	2877.00	2946.00

*Calculated Value

energy in the chicks of different treatment groups due to garlic and turmeric powder incorporation in the diet.

The overall (0-42 days) cumulative performance of broilers (Table 2) in terms of weight gain, feed intake and FCR and performance index significantly improved in garlic powder incorporated group (T₂) as compared to control (T₁) group while protein efficiency ratio was not affected. The increase in growth performance in broilers due to feeding of garlic powder incorporated diet might be attributed to allicin, component of garlic which promotes the performance of intestinal flora, thereby improving digestion and utilization of nutrients by increasing villi length and width of intestine leading to improved growth performance (Lewis *et al.*, 2003). Weight gain and performance index of T₄ group (garlic plus turmeric) of broilers significantly increased as compared to control group of broilers which might be due to growth promoting effect of garlic. The present results indicated that dietary garlic powder supplementation significantly improved growth performance and are in agreement with the findings of Pourali *et al.* (2010), Onyimonyi *et al.* (2011) and Oladele *et al.* (2012) who reported that garlic powder has positive effects on growth performance. The present results clearly indicated that dietary turmeric powder supplementation in broilers had no significant effect on growth performance which were similar with the findings of Abou-Elkhair *et al.* (2014)

and Akbarian *et al.* (2012) who reported that growth performance of broilers was not influenced by inclusion of turmeric in the diet.

Data pertaining to the average nutrient utilization in broiler chicks are presented in Table 3. The nutrient utilization such as dry matter, crude protein and ether extract in broilers during the metabolism trial revealed significant (P<0.05) improvement in broilers of treatment T₂ group as compared to other treatment groups. Gross energy utilization in broilers of treatment groups T₁, T₂, T₃ and T₄ was 74.25, 77.24, 74.20 and 75.74 per cent, respectively. There was no significant difference in energy utilization among the broilers of different treatment groups fed diet incorporated with garlic and turmeric powder. The improvement of total tract digestibility in broilers fed different levels of garlic powder has been attributed to herbal effects in increasing the microbial population especially the number of bacteria such as *E. coli*, *Clostridium* spp. and *Enterococci* (Issa and Omar, 2012). The present findings are in agreement to that of Issa and Omar (2012) who reported improved digestibility of dry matter (DM), crude protein (CP) and ether extract (EE) by feeding garlic powder in broilers diet.

CONCLUSIONS

From the present investigation it can be concluded that incorporation of garlic powder at the rate of 3% in the

Table 2: Average cumulative growth performance of broiler chicks fed diets incorporated with garlic and turmeric powder

Parameter	Treatments/ Groups			
	T ₁	T ₂	T ₃	T ₄
0-21 days				
Weight gain (g/chick)*	492.29 ^b ± 0.84	499.27 ^a ± 0.80	492.47 ^b ± 1.06	495.21 ^b ± 1.49
Feed intake (g/chick)	804.07 ± 0.48	805.39 ± 0.55	799.77 ± 1.37	801.23 ± 2.15
Feed ratio conversion	1.633 ± 0.001	1.613 ± 0.001	1.624 ± 0.005	1.618 ± 0.002
Performance index*	301.40 ^c ± 0.87	309.50 ^a ± 0.82	303.25 ^b ± 1.60	306.07 ^{ab} ± 1.02
Protein efficiency ratio	3.058 ± 0.003	3.076 ± 0.003	3.076 ± 0.010	3.083 ± 0.001
21-42 days				
Weight gain (g/chick)*	1160.62 ^c ± 0.70	1183.91 ^a ± 4.02	1163.87 ^c ± 2.60	1173.71 ^b ± 2.06
Feed intake (g/chick)	2046.00 ± 0.75	2058.13 ± 4.13	2048.93 ± 2.07	2052.63 ± 1.97
Feed conversion ratio*	1.763 ^c ± 0.002	1.738 ^a ± 0.002	1.760 ^c ± 0.002	1.749 ^b ± 0.002
Performance index*	658.38 ^c ± 0.62	681.03 ^a ± 3.33	661.12 ^c ± 2.31	671.13 ^b ± 2.13
Protein efficiency ratio	3.096 ± 0.001	3.083 ± 0.006	3.097 ± 0.006	3.091 ± 0.004
Metabolizable energy efficiency	0.0203 ± 0.00	0.0204 ± 0.00	0.215 ± 0.00	0.0209 ± 0.00
0-42 days				
Weight gain (g/chick)*	1652.91 ^c ± 0.81	1683.18 ^a ± 3.35	1656.34 ^c ± 1.54	1668.92 ^b ± 1.15
Feed intake * (g/chick)	2850.07 ^b ± 1.11	2863.52 ^a ± 2.00	2848.70 ^b ± 3.17	2853.87 ^b ± 3.01
Feed conversion ratio*	1.721 ^a ± 0.003	1.701 ^b ± 0.001	1.720 ^a ± 0.001	1.710 ^a ± 0.001
Performance index*	958.61 ^c ± 0.58	989.37 ^a ± 2.63	963.06 ^c ± 1.05	975.97 ^b ± 1.25
Protein efficiency ratio	3.077 ± 0.001	3.075 ± 0.001	3.087 ± 0.006	3.083 ± 0.002

^{a,b,c} values bearing different superscripts in a row differ significantly, * P<0.05

Table 3: Nutrient utilization (%) in broiler chicks during finisher phase fed diets incorporated with garlic and turmeric powder

Parameter	Treatments/ Groups			
	T ₁	T ₂	T ₃	T ₄
Crude protein *	68.16 ^b ± 0.43	72.08 ^a ± 1.12	69.89 ^{ab} ± 0.12	68.38 ^b ± 1.01
Ether extract	77.71 ^b ± 0.66	81.71 ^a ± 0.57	78.76 ^{ab} ± 0.44	81.51 ^a ± 1.65
Gross energy	74.25 ± 1.45	77.24 ± 0.98	74.20 ± 0.33	75.74 ± 1.07
Metabolizable energy (kcal/ kg)	2864.50	2887.09	2790.25	2793.65

^{a,b} values bearing different superscripts in a row differ significantly, * P<0.05

diet of broiler chicks improved growth performance and nutrients utilization.

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