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Growth Performance and Carcass Charactristics of Broilers Fed Garlic (*Allium sativum*) Supplemented Diets

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ABSTRACT

This study was undertaken to investigate the effects of incorporating garlic (Allium sativum) powder, as a growth promoter in broiler feed on growth performance and carcass characteristics profile. One hundred and eighty (n=180) one day-old white commercial broiler chicks (Cobb-400) were randomly divided into 60 birds/dietary treatment and each treatment contained 4 replicates (15 birds/replicate). The dietary treatments were assigned to three diets containing (0, 0.1 and 0.5%) garlic powder. Feed and water were offered ad libitum till the termination of the trial after 42 days. Daily feed intake, weekly body weight and residue left any were recorded to calculate the feed conversion ratio. At the end of experiment six birds from each group were sacrificed to determine the carcass characteristics. Results revealed that dietary supplementation of 0.1% garlic powder (T2) significantly (P<0.01) improved body weight, body weight gain, feed intake and FCR as compared to birds supplemented with 0.5 % garlic powder (T3) and control (T1). Dietary supplementation of 0.1% garlic (T2) resulted in significant (P<0.05) improvement in dressed yield as compared to T3 and T1. On the other hand, comparable (P>0.05) effect was observed on shrinkage loss, blood loss, feather loss, eviscerated yield and relative weight of giblet. Mortality (%) in T1, T2 and T3 was 3.33, 0.00 and 1.67, respectively. Total feed cost, total cost/kg live weight and total cost/kg meat was reduced (P<0.05) in 0.1% garlic (T2) as compared to 0.5 % garlic (T3) supplemented birds or control (T1). Thus, dietary supplementation of 0.1 % garlic had beneficial effect on growth performance, dressed yield and cost of production.

Key words: *Broilers, Garlic, Growth, FI, Carcass characteristics.*

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INTRODUCTION

Feed is the major component of total costs of poultry venture as 80% of the total expenditure is on procurement of feed[4]. In the past, antibiotics were the most routinely used feed additives. However, nowadays use of antibiotics is not only limited but their use in livestock and poultry industry also have been banned in many countries due to the reasons like, alteration of natural gut microbiota and drug resistance in bacteria and humans. As a result, to replace them without adversely affecting the performance of birds, natural growth promoters such as prebiotics, probiotics, synbiotics, enzymes, plant extracts, etc., can be used to feed the broilers[6].

Garlic (*Allium sativum*) is bulbous vegetable, well known spice and medicinal plant, which contains organic sulphurous compounds such as, aliin, allicin, ajoene, allylpropyl disulphide, diallyl trisulphide and sallilcisteine[15]. It has possessed antibacterial, antifungal, antiparasitic, antiviral, antioxidant, anti cholesteremic, anti-cancerous and vasodilator characteristics[9]. Garlic supplements in broiler chicken diets have been recognized for their strong stimulating effect on the immune and digestive systems in birds[2]. Recent research works on garlic formulations as feed additives have shown encouraging results in regards to weight gain, feed efficiency, lowered mortality and increased livability in poultry birds[12,15]. Thus, the present study was designed to observe the potential of incorporating different levels of garlic as a phytogenic growth promoter in commercial broilers.

MATERIAL AND METHODS

The research work was conducted for six weeks at private poultry farm of Dangia village, Dantiwada taluka, Banaskantha district of Gujarat, India. One hundred and eighty (n=180) day old white commercial broiler chicks (Cobb-400) were randomly distributed into three groups with 4 replicates of 15 birds in each group. Dietary treatments were T_1: Basal diet without garlic powder supplementation (Control), T_2: Basal diet with garlic powder supplementation 1 g/kg of feed and T_3: Basal diet with garlic powder supplementation 5 g/kg of feed. Garlic bulb was procured from local market then powdered in an electrical grinder and stored in air tight container at room temperature for use. The basal diets were formulated as per the standards of NRC[14] from available feed ingredients with compositions given in Table-I. The proximate analysis of experimental diets was carried out at as per AOAC[3].

Table I: Composition of basal diet used during starting (0-3 wk) and finishing (4-6 wk) phase

Ingredients	Starter (%)	Finisher (%)
Yellow maize	56.6	60.4
Soybean meal	36.5	34
Rapeseed meal	3. 5	2.5
Limestone powder	0. 9	0.9
Dicalcium phosphate	1. 7	1.45
Common salt	0. 3	0.3
DL-Methionine	0. 11	0.07
Constant*	0.415	0.415
Total	**100.03**	**100.04**
Nutrient Composition (As Fed Basis)		
ME, kcal/kg***	2867.8	2905.7
Crude Protein, %**	22.13	20.89
Lysine,%***	1.27	1. 15
Methionine,%***	0.52	0. 46
Calcium,%***	0.92	0. 86
Phosphorus, %***	0.45	0. 40
Ether extract,%**	4.76	4. 64
Crude fiber,%**	3.5	3.4
Total ash,%**	3.38	3. 22

** Analyzed values as fed basis

***calculated values as fed basis

Constant includes trace mineral premix 0.1, vitamin premixes 0.215, toxin binder 0.05 and coccidiostat 0.05 %. Trace mineral premix supplied Mg-300, Mn-55, I-0.4, Fe-56, Zn-30 and Cu- 4 mg/kg diet. The vitamin premixes supplied vitamin A 8250 IU, vitamin D_3 1200 ICU; vitamin K 1 mg; vitamin E 40 IU, vitamin B_1 2 mg, vitamin B_2 4 mg, vitamin B_{12} 10 mcg; niacin 60 mg; pantothenic acid 10 mg and choline chloride 500 mg/kg diet.

Body weight of the individual experimental chicks were recorded in the morning before feeding with the help of digital weighing balance at day old and thereafter at weekly interval till six weeks of age. Feed consumption was measured by weighed quantity of feed offered to each group and at the end of week feed left over was weighed and recorded. On the basis of that average weekly feed intake and FCR was calculated. Mortality rate (%) was calculated from the records of dead birds. At the end of experiment, six birds from each treatment were randomly selected and slaughtered. The dressed weight of each bird was obtained separately by complete bleeding and removal of feathers, head, neck, shanks and viscera. Heart, liver, gizzard and spleen were also weighed individually and their percentages in relation to body weight were calculated. Relative economics was calculated by subtracting the cost of feeding from the output of bird sold at Rs. 70 per kg live weight. Garlic used for experimental feeding was purchased at Rs. 60 per kg. All the recorded and calculated data were subjected to statistical analysis by applying "factorial and completely randomized design" (FCRD) employing one-way analysis of variance as per Snedecor and Cochran (1994). A p-value of <0.05 was considered a significant difference among groups and the comparison of means was made using Duncan multiple range test (DMRT).

RESULTS AND DISCUSSION

Average initial body weight (IBW) and corresponding final body weight (FBW) of broiler chicks are presented in Table- II. Body weight of birds was significantly ($P<0.001$) higher in T_2 as compared to T_3 and T_1. Aji *et al.*[1], Saeid *et al.*[21] and Singh *et al.*[20] supported that garlic supplementation significantly improved body weight. While, Rahimi *et al.*[17] and Issa and Omar[10] reported that garlic supplementation had no significant effect on body weight.

Total body weight gain was significantly ($P<0.001$) higher in birds supplemented with 0.1% garlic as compared to 0.5% garlic supplementation and control (Table- II). Earlier studies have reported mixed responses in body weight gain to garlic supplementation. Mansoub[13] and Suriya *et al.*[22] opined that garlic supplementation significantly improved body weight gain. In present study, better weight gain in garlic fed birds might be due to the action of allicin (an antibiotic substance found in garlic) which inhibits the growth of pathogenic bacteria by interfering with bacterial cell metabolism[8]. Resultantly, when the load of these bacteria in the intestine is low birds may absorb more nutrients leading to improved in weight gain. Apart from this, garlic also enhances pancreatic enzymes activity[18] and activates the digestive process which improves absorption of nutrients and ultimately the growth.

Total feed intake was significantly ($P<0.05$) better in birds receiving 0.1% garlic (T_2) as compared to birds that are receiving either 0.5% garlic (T_3) or control (Table- II). Slight reduction in feed intake at higher doses might be due to increasing repulsive odour and taste of garlic[16]. Javandel *et al.*[11] reported that feed consumption was significantly higher in birds fed diets with lower concentration of garlic 0.125 and 0.25% as compared to higher level 0.5, 1 and 2%. In contrast, Rahimi *et al.*[17] reported non-significant effect of garlic supplementation on feed intake in broilers.

The better feed conversion ratio ($P<0.01$) was observed in birds receiving 0.1% garlic (T_2) as compared to those birds receiving either 0.5% garlic (T_3) or control (Table- II). Results of the present study were in line with previous findings of Fadlalla *et al.*[7] and Suriya *et al.*[22]. On the other hand, Aji *et*

al.[1] reported non-significant effect of garlic on feed conversion ratio. In present study, better FCR in garlic supplemented group might be due to control of growth and colonization of various pathogenic microorganisms in the gut resulting into enhanced efficiency of utilization of feed. Thus, better FCR in garlic fed birds may be due to nutrient sparing effect of garlic.

Table II. Growth performance of broilers fed at different levels of garlic

Parameters	Treatments			P Value
	T_1	T_2	T_3	
IBW (g)	42.28± 0.31	42.27± 0.32	42.18± 0.33	NS
FBW (g)	2013.69±6.89^{a}	2097.02± 5.86^{c}	2039.95± 3.77^{b}	0.001***
BWG (g)	1971.50±6.92^{a}	2054.70±5.77^{c}	1997.70±3.68^{b}	0.001***
FI (g)	3461.10±36.69^{a}	3615.70±8.82^{b}	3514.70±50.46^{ab}	0.041*
FCR	1.82±0.01^{b}	1.76±0.01^{a}	1.79±0.01^{ab}	0.017*

Means with different superscripts in a row differ significantly.
*(P < 0.05) ** (P < 0.01) *** (P < 0.001) NS- non-significant.

IBW: Initial body weight, FBW: Final body weight, BWG: Body weight gain, FI: Feed intake, FCR: Feed conversion ratio.Various carcass parameters are presented in Table- III. Significantly (P<0.05) higher dressing percentage was observed in T_2 as compared T_3 and T_1. However, shrinkage loss, blood loss, feather loss, eviscerated yield, relative weight of heart, liver, gizzard and giblet remained comparable (P>0.05) among different dietary treatment groups. Ashayerizadeh *et al.*[5] also reported significant (P<0.05) increase in dressing percentage on garlic supplementation. In contrast to present findings, Aji *et al.*[1] reported non-significant effect of garlic supplementation on dressing percentage in broilers.

Table- III. Carcass parameters (%) of broilers fed different levels of garlic.

Parameters	Treatments			P Value
	T_1	T_2	T_3	
Shrinkage loss	4.61±0.05	4.65±0.10	4.59±0.08	NS
Blood loss	2.91±0.07	3.05±0.05	2.95±0.04	NS
Feather loss	4.83±0.07	4.75±0.06	4.88±0.07	NS
Eviscerated yield	69.55±0.12	69.96±0.09	69.60±0.16	NS
Dressed yield	74.71±0.12^{a}	75.17±0.10^{b}	74.78±0.16^{ab}	0.05*
Heart	0.50±0.01	0.52±0.00	0.51±0.00	NS
Liver	2.50±0.01	2.52±0.01	2.50±0.01	NS
Gizzard	2.16±0.03	2.18±0.02	2.17±0.01	NS
Giblet	5.16±0.03	5.21±0.02	5.17±0.02	NS
Mortality	3.33	0.00	1.67	NS

Means with different superscripts in a row differ significantly.
*(P < 0.05) ** (P < 0.01) *** (P < 0.001) NS- non-significant

Out of 180 chicks reared only 3 chicks were died during entire experiment period indicating that the mortality (%) was well within the normal limit. Total mortality (%) was 1.67 in all the treatment groups with 3.33, 0.00 and 1.67 in T_1, T_2 and T_3 experimental groups, respectively. The results of the present study were supported by the earlier findings of Fadlalla *et al*[7].

Economics of garlic supplementation at various levels is presented Table- IV. The cost of feeding, total cost of production for 1 kg live weight and cost of production for 1 kg meat was significantly (P<0.05) lower in T_2 to T_3 and T_1. Lowered cost of production in garlic supplemented group is mainly because

of better feed conversion ratio due to garlic's growth promoting effect. In contrary to present findings, Aji *et al.*[1] reported increased feed cost when birds were supplemented with garlic as compared to control.

Table IV: Economics of feeding of different levels of garlic

Parameters	Treatments			P Value
	T_1	T_2	T_3	
Feed cost (Rs.)/kg live broiler	48.03 ± 0.40^b	46.74 ± 0.20^a	47.92 ± 0.24^b	0.022*
Total cost (Rs.)/kg live broiler	67.34 ± 0.45^b	65.90 ± 0.22^a	67.22 ± 0.27^b	0.023*
Total cost (Rs.)/kg meat	90.51 ± 0.60^b	87.67 ± 0.29^a	89.90 ± 0.36^b	0.003**
Total cost (Rs.) of production/broiler	134.20±0.97	135.65±0.27	135.35±0.49	NS

Means with different superscripts in a row differ significantly.
*(P < 0.05) ** (P < 0.01) *** (P < 0.001) NS- non-significant

CONCLUSION

It could be concluded that 0.1 % garlic supplemented group had significantly higher growth rate and better economic benefit than 0.5 % garlic supplemented group and control. Garlic at 0.1 % is an economical alternative to antibiotic growth promoters and can be easily made and adopted by the poultry farmers.

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