RESEARCH ARTICLE

Effects of Dietary Supplementation of Garlic (*Allium sativum*) powder on Growth Performance and Carcass Characteristics of Broilers

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Abstract

The present study was carried out for six weeks to investigate the effects of adding graded levels (0, 0.1 and 0.5%) of garlic (*Allium sativum*) powder to the basal experimental diet on the growth performance and carcass characteristics of broiler chicks. One hundred and eighty (n = 180) day old unsexed white commercial broiler chicks (Cobb-400) were randomly distributed into three dietary treatments of 60 birds/treatment and each treatment contained 4 replicates (15 birds/replicate). The dietary treatments were controlled basal diet (T1), and a diet supplemented with garlic powder at 0.1% (T2) and 0.5% (T3). Daily feed intake, weekly body weight, and residue leftover were recorded to calculate the feed conversion ratio (FCR). At the end of the 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 diet (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. Thus, dietary supplementation of 0.1% garlic powder had beneficial effects on growth performance and dressed yield of broiler chicks.

Keywords: Broilers, Cobb-400, Dressed yield, Garlic, Growth performance.

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Introduction

Antimicrobial compounds are commonly included in poultry ration for promotion of growth and control of diseases. The European Union has banned feed grade antibiotic growth promoters because of the risk of possible drug resistance in human pathogenic bacteria and only two antimicrobial growth promoters are planned to remain in use (Shane, 2001). Feeds containing no chemical additives are increasingly used in poultry nutrition. For this reason, herbs and natural feed additives, *i.e.*, garlic, fenugreek, thyme, etc. are being investigated as natural biologically important substances (Demir *et al.,* 2003). Garlic (*Allium sativum*) is a bulbous vegetable, well-known spice, and medicinal plant. It contains organic sulfurous compounds such as allin, allicin, ajoene, allyl propyl disulfide, diallyl trisulphide and sallilcisteine (Mansoub, 2011). Garlic supplements in broiler chicken diets have been recognized for their strong stimulating effect on the immune and digestive systems in birds (Al- Shuwaili *et al.,* 2015). Recent research works on garlic formulations as feed additives have shown encouraging results with regards to weight gain, feed efficiency, lowered mortality and increased livability in poultry birds (Karangiya *et al.,* 2016). Hence, the present study was designed to investigate the potential of incorporating different levels of garlic powder as a phytogenic growth promoter in commercial broilers.

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Materials and Methods

The research work was conducted for six weeks at private poultry farm of Dangia village (Dantiwada) of Banaskantha district in Gujarat. One hundred and eighty (n=180) day-old commercial broiler chicks (strain 'Cobb-400') were randomly distributed into three groups (n = 60 each) with 4 replicates of 15 birds in each group. Dietary treatments were T1: Basal diet without garlic powder supplementation (control), T2: Basal diet with garlic powder supplementation @ 1 g/kg of

feed and T3: Basal diet with garlic powder supplementation @5 g/kg of feed. Garlic bulbs were procured from the local market dried in hot air oven and then, powdered in an electric grinder and powder was stored in airtight container at room temperature for use. The basal diets were formulated as per the standards of NRC (1994) from available feed ingredients with compositions given in Table 1. The proximate analysis of experimental diets was carried out as per AOAC (1995).

Body weights of the individual experimental chicks were recorded in the morning before feeding with the help of digital weighing balance at day-old age and thereafter at weekly interval till six weeks of age. Feed consumption was measured by the weighed quantity of feed offered to each group and at the end of the week, feed leftover was weighed and recorded. Based on that average weekly feed intake and FCR was calculated.

Table 1: Composition of basal diet used during starting (0-3 wk) and finishing (4–6 weeks) phase

Ingredients	*Starter mesh (%)*	*Finisher mesh (%)*
Yellow maize	56.60	60.40
Soybean meal	36.50	34.00
Rapeseed meal	3.50	2.50
Limestone powder	0.90	0.90
Dicalcium phosphate	1.70	1.45
Common salt	0.30	0.30
DL-Methionine	0.11	0.07
Constant*	0.415	0.415
Total	100.025	100.035
Nutrient composition (as fed basis)		
ME, kcal/kg***	2867.80	2905.70
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, %**	3.50	3.40
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 D3 1200 ICU; vitamin K 1 mg; vitamin E 40 IU, vitamin B1 2 mg, vitamin B2 4 mg, vitamin B12 10 mcg; niacin 60 mg; pantothenic acid 10 mg and choline chloride 500 mg/kg diet

At the end of the 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. All the recorded and calculated data were subjected to statistical analysis by "factorial completely randomized design" (FCRD) employing one-way analysis of variance. A p value of <0.05 was considered as the significant difference among the treatments groups and the comparison of means was made using Duncan's multiple range test (Snedecor and Cochran, 1994).

Results and discussion

Average initial body weight (IBW) and corresponding final body weight (FBW) of broiler chicks are presented in Table 2. The final body weight of birds was significantly (p <0.01) higher in T2 as compared to T3 and T1. Mahmood *et al.* (2009) and Aji *et al.* (2011) also reported that garlic supplementation significantly improved body weight, while Rahimi *et al.* (2011) reported that garlic supplementation had no significant effect on body weight. Total body weight gain was significantly (p <0.01) higher in T2 as compared to T3 and T1 (Table 2). Earlier studies (Aji *et al.,* 2011; Rahimi *et al.*, 2011) have reported mixed responses in body weight gain to garlic supplementation. Stanacev *et al.* (2011) and Suriya *et al.* (2012) reported significantly improved body weight gain in broilers with garlic supplementation. In the present study, better weight gain in T2 might be due to the action of allicin which inhibits the growth of pathogenic bacteria by interfering with bacterial cell metabolism (Ghosh *et al.,* 2010). Apart from this, garlic also enhances pancreatic enzymes activity (Ramakrishna *et al.,* 2003) 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 received 0.1% garlic (T2) as compared to birds that received either 0.5% garlic (T3) or control diet (Table 2). A slight reduction in feed intake at higher dose might be due to increasing repulsive odor and taste of garlic (Pourali *et al.,* 2010). Javandel *et al.* (2008) reported that feed consumption was significantly higher in birds fed diets with a lower concentration of garlic 0.125 and 0.25% as compared to higher-level 0.5, 1 and 2%. Similar findings were also reported by Mansoub and Myandoab (2011). In contrast, Rahimi *et al.* (2011) reported a non-significant effect of garlic supplementation on feed intake in broilers.

The better feed conversion ratio (p <0.01) was observed in T2 as compared to T3 and T1 (Table 2). These results were in

Table 2: Growth performance of broilers fed different levels of garlic powder

Parameters	*Treatments*			*p value*
	T1	*T2*	*T3*	
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 ± 0.01b	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 <0.001; NS, non-significant.
IBW, initial body weight; FBW, final body weight; BWG, bodyweight gain; FI, feed intake, FCR, feed conversion ratio

Table 3: Carcass parameters (%) of broilers fed different levels of garlic powder

Parameters (%)	*Treatments*			*p value*
	T1	*T2*	*T3*	
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, NS, non-significant

agreement with previous findings of Fadlalla *et al.* (2010) and Suriya *et al.* (2012). On the other hand, Aji *et al.* (2011) reported a non-significant effect of garlic on feed conversion ratio. In the present study better FCR in garlic supplemented group might be due to control of the growth and colonization of various pathogenic microorganisms in the gut leading to enhanced efficiency of utilization of feed. Thus, better FCR in T2 may be due to nutrient sparing effect of garlic.

Out of 180 chicks reared, only 3 chicks died during the entire experiment period indicating that the mortality (%) was well within the normal limit. The mortality in T1, T2, and T3 were 3.33, 0.00 and 1.67%, respectively. These results were in line with the earlier findings of Fadlalla *et al.* (2010).

Various carcass parameters are presented in Table 3. Significantly (p<0.05) higher dressing percentage was observed in T2 as compared T3 and T1. However, shrinkage loss, blood loss, feather loss, eviscerated yield, the relative weight of heart, liver, gizzard, and giblet remained comparable (p >0.05) among different dietary treatment groups. Ashayerizadeh *et al.* (2009) also reported significant (p <0.05) increase in dressing percentage on garlic supplementation. In contrast to present findings, Aji *et al.* (2011) reported a non-significant effect of garlic supplementation on dressing percentage in broilers.

From the study, it could be concluded that 0.1% garlic powder supplemented group had a significantly higher growth rate and better economic benefit than 0.5% garlic supplemented group and control diet. Thus, garlic powder 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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