



Effect of Inclusion of Garlic (*Allium sativum*) as Feed Additive on Growth and Carcass Characteristics of Japanese Quail

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ABSTRACT

One hundred and fifty, day-old quail chicks randomly distributed to five dietary treatments each with three replicates of ten quails, were offered broiler quail diets (starter and finisher) to meet the nutrient requirements (ICAR, 2013). During the experiment, dried garlic powder (GP) was included at 0.0% (T_1 ; Control), 0.50% (T_2), 1.0% (T_3), 1.5% (T_4) and 2.0% (T_5) level. Results indicated that body weight gain increased significantly ($P<0.05$) and feed consumed/g gain decreased significantly ($P<0.01$) due to inclusion of dried GP in the diet. Further, there was no effect ($P>0.05$) on carcass yield (g), dressing percent, ready to cook yield (g), meat to bone ratio and percent weight of internal organs. The feed cost / kg gain decreased by ₹ 2.88 in T_2 and 5.71 in T_3 while it was increased by 1.20 in T_4 and 7.25 in T_5 groups as compared to the control (T_1). It is concluded that dried GP can be included up to 1.0% level in the diet of quails without any adverse effect.

Key words: Carcass characters, Cost economics, Garlic, Growth, Japanese Quail

INTRODUCTION

Addition of antibiotics in feed as antibiotic growth promoters (AGP) is very common in poultry production. However, irrational use of AGP in feed can cause transfer of drug residues and drug resistant bacteria to humans and thus it is a serious public concern. To overcome these problems, the use of feed grade antibiotic growth promoters in poultry was banned in many countries. The gradual withdrawal of AGP in feed will affect the poultry industry in coming days and hence, there is a need to find suitable alternatives. On the other hand, organic poultry, a term common in western countries is becoming popular now-a-days in India. In this, farmers tried using alternatives like probiotics, prebiotics, organic acids and phytogenic / herbal feed additives in place of AGP's. In the present-day market, these products are gaining importance from consumers point of view. Phytogenic feed additives are natural, non-toxic, residue free and easily available, thus making them first choice as alternate to AGP in poultry production.

Garlic (*Allium sativum*), is widely distributed and used in all parts of world as a spice and herbal medicine for prevention and treatment of a variety of diseases ranging from infections to heart diseases (Javandel *et*

al., 2008). Garlic contains 33 sulfur compounds (alliin, diallyl sulphides and allicin), several enzymes, 17 amino acids and minerals such as selenium (Newall *et al.*, 1996) which are responsible for antibacterial, antifungal, antiviral, antioxidant, anti-parasitic, anti-thrombotic, anti-cancer, immuno-modulator and anti-inflammatory characteristics (Canogullari *et al.*, 2010). It also contains vitamins especially thiamin with high bioavailability owing to some specific sulfur containing components (Kik *et al.*, 2001). Inconsistent results and inadequate data exist regarding the potential use of garlic powder as phytobiotic growth promoter in poultry rations. Positive effects of garlic on growth rate (Makwana *et al.*, 2015), feed conversion ratio (Singh *et al.*, 2015) and carcass characteristics (Raeesi *et al.*, 2010) were reported in broilers whereas, studies on the feeding value of garlic in Japanese quails (Mahdizadeh *et al.*, 2017) are very limited. Hence, the present investigation was conducted to evaluate the potential of incorporating dried garlic powder at varying levels in the diet on growth performance and carcass characteristics of Japanese quail.

MATERIALS AND METHODS

The present investigation is carried out at Poultry Experimental Station attached to Livestock Farm

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One hundred and fifty, day old Japanese quail chicks obtained from a local hatchery were utilized in the experiment. Quail chicks were wing banded and weighed individually. Chicks were divided into five treatment groups. Each treatment contained three replicates with ten chicks per replicate allotted at random. The experiment was conducted for 5 weeks duration. Broiler quail starter and finisher diets (Table 1) were prepared to meet the nutrient requirements (ICAR, 2013). During different phases of the trial, experimental diets were prepared by including dried garlic powder (GP) at 0% (T₁; Control), 0.5% (T₂), 1.0% (T₃), 1.5% (T₄) and 2.0% (T₅) levels. All the diets were made iso-caloric and iso-nitrogenous.

All the chicks were housed in battery brooders throughout the experiment. All the cages were provided with uniform brooding facilities, feeders and waterers. Irrespective of the treatments, all the chicks were fed ad-libitum 2 times a day with respective broiler quail starter diet from 0-3 weeks and finisher diet from 4-5 weeks of age. Fresh and clean drinking water was made

available at all the time. B-complex vitamins were offered in water for 3 days during first week. Except for feeding experimental diets, other managerial practices were uniform throughout the experimental period. The individual body weight of the quails was recorded at weekly interval up to 5 weeks of age. The feed offered and feed leftover was weighed daily to quantify the feed consumption. Weekly feed consumption was recorded replicate wise and feed efficiency was calculated accordingly. At the end of study period (5th week), two birds per replicate and thus a total 6 birds per treatment were randomly selected, weighed and slaughtered. The data on dressing percentage, carcass yield, ready-to-cook yield, meat to bone ratio and percent weight of heart, liver, gizzard and giblet were recorded. All the data were analyzed statistically (SPSS, 17th Version) as per Snedecor and Cochran (1994) and comparison of means was done using Duncan's multiple range tests (Duncan, 1955).

RESULTS AND DISCUSSION

The dried garlic powder (GP) used in the present study contained 86.91% dry matter (DM), and 97.12, 16.50, 3.10, 2.10, 75.42, 2.88, 0.46, 13.29 and 5.54 per

Table 1. Ingredient (%) and Chemical composition (% DM basis) of quail diets

Constituent	Starter Diet					Finisher Diet				
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₁	T ₂	T ₃	T ₄	T ₅
Maize	49.0	48.9	48.7	48.5	48.4	57.50	57.40	57.20	57.10	56.90
De oiled rice bran	7.30	6.90	6.70	6.40	6.10	7.50	7.10	6.90	6.50	6.30
Soybean meal	36.30	36.30	36.20	36.20	36.10	27.40	27.40	27.30	27.30	27.20
Fish meal	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Dried garlic powder	0.00	0.50	1.00	1.50	2.00	0.00	0.50	1.00	1.50	2.00
Di-calcium phosphate	0.30	0.30	0.30	0.30	0.30	0.50	0.50	0.50	0.50	0.50
Shell grit	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Trace min mix	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Feed additives	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Total	100	100	100	100	100	100	100	100	100	100
ME* kcal/kg	2900	2903	2904	2905	2907	2949	2952	2953	2955	2956
Crude protein (%)	24.99	25.01	25.00	25.02	25.00	21.49	21.50	21.49	21.50	21.49
Feed cost/1000 kg (₹)	25958	26288	26591	26918	27224	24015	24345	24648	24978	25281

*Calculated value

cent organic matter, crude protein, ether extract, crude fibre, nitrogen-free extract, total ash, acid insoluble ash, Ca and P on DM basis. The chemical composition of quail (starter and finisher) diets containing dried GP at varying levels is presented in Table 1.

Data pertaining to body weight gain, feed intake and feed conversion ratio (FCR) are presented in Table 2. Body weight gain was significantly higher ($P<0.05$) in quails fed diets containing 1.0% dried garlic powder as compared to those fed diets containing 0%, 1.5% and 2.0% dried garlic powder (Table 2). Similarly, Karangiya *et al.* (2016) reported that dried garlic powder supplementation at 1% level in the diet had resulted in improved body weight gain in commercial broilers. The increased body weight gains observed in quails upon feeding dried GP in the diet might be attributed to the action of compounds like allicin and organo-sulphur compounds present in garlic which promotes the performance of the intestinal flora thereby enhancing digestion and growth (Pourali *et al.*, 2010). Similarly, increased body weight gains upon feeding diets containing dried GP were reported in broiler chicken (Onyimonyi *et al.*, 2012; Makwana *et al.*, 2015; Singh *et al.*, 2015) and Japanese quail (Ahamad *et al.*, 2013). However, several researchers (Javandel *et al.*, 2008; Onibi *et al.*, 2009; Fadlalla *et al.*, 2010) reported no effect ($P>0.05$) on body weight gain in broilers upon feeding dried GP in the diet.

Feed intake (g) during the experimental period increased in quails fed diets containing 0.5 and 1.0% dried GP and decreased in quails fed diets containing

1.5 and 2.0% dried GP as compared to those fed control diet (Table 2). However, the differences between treatments were not statistically significant ($P>0.05$). This slight reduction in feed intake at higher doses might be due to increasing repulsive odour and taste of garlic (Pourali *et al.*, 2010). Ahmad *et al.* (2013) reported that supplementation of garlic powder up to 0.4% level in the diet had no effect ($P>0.05$) on feed intake in Japanese quails. Similarly, no effect ($P>0.05$) on feed intakes upon feeding diets containing dried GP were also reported earlier in broiler (Javandel *et al.*, 2008; Ademola *et al.*, 2009; Onibi *et al.*, 2009; Issa and Omar, 2012; Onyimonyi *et al.*, 2012; Singh *et al.*, 2015) and layer (Canogullari *et al.*, 2010) chicken. In contradiction, Makwana *et al.* (2015) reported significantly increased ($P<0.05$) feed intake in broilers fed garlic at 0.1% in the diet as compared to those receiving either 0.5% garlic or control diet.

Feed consumed / kg gain was lower ($P<0.01$) in quails fed diets containing dried garlic powder at 1.0% level as compared to the other treatments (Table 2). The improved feed utilization observed upon feeding dried GP at 1.0% level might be due to control of growth and colonization of various pathogenic micro-organisms in the gut resulting into enhanced efficiency and utilization of feed (Bedford, 2000). Thus, better FCR in garlic fed birds may be due to nutrient sparing effect of garlic. Similarly, improved FCR upon feeding diets containing dried GP were also reported earlier (Fadlalla *et al.*, 2010; Suriya *et al.*, 2012; Elagib *et al.*, 2013; Makwana *et al.*, 2015; Singh *et al.*, 2015) in broiler

Table 2. Effect of inclusion of dried Garlic powder in diet on body weight gain, feed intake, FCR and feed cost/kg gain of quails

Parameter	T ₁	T ₂	T ₃	T ₄	T ₅	SEM	P value
Body weight gain (g)	164.40 ^{ab±} 4.20	173.20 ^{bc±} 5.90	182.10 ^{c±} 2.10	167.80 ^{ab±} 5.10	157.50 ^{a±} 1.00	2.71	$P<0.05$
Overall feed intake (g)	613.10 [±] 9.70	617.90 [±] 12.40	627.10 [±] 8.90	609.70 [±] 14.40	601.50 [±] 9.50	4.80	$P>0.05$
Feed conversion ratio	3.73 ^{bc±} 0.08	3.57 ^{ab±} 0.06	3.44 ^{a±} 0.06	3.63 ^{bc±} 0.04	3.82 ^{c±} 0.07	0.05	$P<0.01$
Feed cost / kg (₹)	89.83 ^{b±} 2.03	86.95 ^{ab±} 1.48	84.12 ^{a±} 1.38	91.03 ^{b±} 1.07	97.08 ^{c±} 1.86	1.31	$P<0.01$

Table 3. Effect of inclusion of dried garlic powder in diet on carcass characteristics of quails

Parameter	T ₁	T ₂	T ₃	T ₄	T ₅	SEM	P value
Carcass yield (g)	130.24±5.48	135.17±1.76	140.76±6.23	131.66±1.90	129.35±4.62	2.00	P>0.05
Dressing (%)	64.03±2.36	65.82±1.63	66.15±2.60	64.43±2.49	63.58±0.75	0.83	P>0.05
Ready to cook yield (g)	139.33±5.24	140.83±5.19	151.05±6.05	146.45±2.14	143.49±2.39	2.04	P>0.05
Meat: bone ratio	4.33±0.42	4.84±0.37	5.22±0.65	4.30±0.09	3.91±0.58	0.21	P>0.05
Heart (%)	0.91±0.03	0.94±0.06	1.01±0.06	0.94±0.11	0.92±0.04	0.03	P>0.05
Liver (%)	1.98±0.11	2.30±0.18	2.39±0.11	2.26±0.09	2.20±0.10	0.06	P>0.05
Gizzard (%)	1.87±0.16	1.89±0.04	1.96±0.27	1.80±0.10	1.77±0.10	0.06	P>0.05
Giblet (%)	4.86±0.32	5.08±0.08	5.20±0.27	5.06±0.16	4.94±0.13	0.09	P>0.05

chicken. On the other hand, some researchers (Yalcin *et al.*, 2007; Ademola *et al.*, 2009; Onibi *et al.*, 2009; Issa and Omar, 2012) reported that feeding dried GP in the diet had no effect (P>0.05) on FCR in broiler chicken.

Inclusion of dried GP powder up to 2.0% level in the diet had no effect on carcass yield (g), dressing percent, ready to cook yield (g) and meat to bone ratio of quails as compared to those in control (Table 3). Similarly, several authors reported no effect (P>0.05) on carcass yield (Javandel *et al.*, 2008; Dehkordi *et al.*, 2009; Stanacev *et al.*, 2011; Amouzmehr *et al.*, 2012; Issa and Omar, 2012) and dressing percent (Onibi *et al.*, 2009; Fadlalla *et al.*, 2010; Issa and Omar, 2012; Elagib *et al.*, 2013; Singh *et al.*, 2015) in broilers fed garlic in the diet. The per cent weight of heart, liver, gizzard and giblet were not affected (P>0.05) by incorporation of dried GP in the diet (Table 5). Similar findings were also reported earlier (Onibi *et al.*, 2009; Onu, 2010; Issa and Omar, 2012; Makwana *et al.*, 2015).

The feed cost / kg gain was significantly (P<0.01) lower in quails fed diets containing 1.0% dried GP as compared to those fed diets containing 0, 1.5 and 2.0% dried garlic powder (Table 2). The feed cost / kg gain decreased by ₹ 2.88 in T₂ and 5.71 in T₃ while it increased by 1.20 in T₄ and 7.25 in T₅ groups of quails fed diets containing dried GP at varying levels as compared to the control. The decreased feed cost / kg gain in T₃ group of quails observed in the present study might be attributed to the better efficiency of feed utilization and increased weight gains of quails obtained due to incorporation of dried GP at 1.0% in the diet. Similarly, it is reported that feeding garlic powder at 0.1

(Makwana *et al.*, 2015), 0.75 (Onyimanyi *et al.*, 2012) and 1.5 (Singh *et al.*, 2015) per cent in the diet resulted in decreased (P<0.05) feed cost/kg gain in broilers as compared to the control.

CONCLUSION

It is concluded that dried garlic powder can be included at 1.0% level in the diet of quails without affecting feed intake for improving growth and decreasing cost of production.

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