



Effect of Dietary Supplementation of Garlic (*Allium sativum*) and Fenugreek (*Trigonella foenum-graecum* L.) Seed Powder on Growth Performance, Carcass Characteristics and Economics of Feeding in Broilers

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ABSTRACT

An experiment was conducted to assess the effect of dietary supplementation of garlic (*Allium sativum*) and fenugreek (*Trigonella foenum-graecum* L.) seed powder as herbal feed additives on growth performance, carcass characteristics and economics of feeding in broilers. A total of 320 day old broiler chicks of Cobb-400 strain were divided into four treatment groups with 4 replicates of 20 chicks in each treatment using completely randomized design. Dietary treatments were basal diet without any supplementation (CON), basal diet supplemented with 0.5% garlic bulb powder (GAR), 0.5% fenugreek seed powder (FEN) and 0.5% of each garlic bulb powder and fenugreek seed powder (GAR-FEN). Average daily gain (ADG) and feed conversion ratio (FCR) were significantly ($P < 0.05$) higher in the garlic supplemented group (GAR and GAR-FEN) as compared to CON and FEN group. Carcass characteristics showed non-significant ($P > 0.05$) effect of garlic, fenugreek and either combination on dressing percent, weights of liver, gizzard, heart, spleen and length of intestine, caecum and carcass. Return over feed cost and profit per bird was highest in garlic supplemented group followed by combination of garlic and fenugreek, fenugreek and lowest in control group. Whereas, benefit: cost ratio was observed maximum in garlic group followed by control, fenugreek and lowest in combination of garlic and fenugreek. The present study reveals that supplementation of garlic bulb alone or in combination with fenugreek seed improves the growth performance and feed utilization efficiency and return over feed cost and profit per bird.

Keywords: Broiler, carcass characteristics, FCR, fenugreek, garlic

Feed additives are indispensable element of poultry feed formulation that accelerate growth, feed efficiency and metabolism or health. Antibiotics as feed supplement are under serious criticism due to global concern of their ill effects like development of microbial resistance to the pathogens and their potential harmful effects on human health (Rahmatnejad *et al.*, 2009). These shortcomings have led to the search for alternative substances like probiotics, prebiotics and herbs as natural feed additives which can be used in poultry diets to enhance the performance of birds. In this regard, plant products seem to be best option due to their easy availability, no side-effects, historic faith of population and simple processing

techniques for manufacture. Garlic (*Allium sativum*) has been used as a spice and a native medicine since long ago (Rivlin, 2001). 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 growth rate, feed conversion ratio (FCR) and carcass characteristics (Makwana *et al.*, 2015; Demir *et al.*, 2003; Lewis *et al.*, 2003; Tollba and Hassan, 2003). Similarly, fenugreek (*Trigonella foenum-graecum* L.) benefits the digestive system as a laxative, intestinal lubricant, carminative, anti-emetic, digestive and tonic, helps dissolve fat and cholesterol deposits, prevents fat accumulation and water retention and helps

lower blood sugar levels. Fenugreek also exhibited growth promoting action (Awadein *et al.*, 2010). Based on the above information, an experiment was planned to assess the effect of dietary supplementation of garlic and fenugreek seed powder as herbal feed additives on growth performance, carcass characteristics and economics of feeding in broiler chicken.

MATERIALS AND METHODS

Birds and experimental diets

Three hundred and twenty (n=320) day old broiler chicks of Cobb-400 strain were divided into four treatment groups with 4 replicates of 20 chicks in each replication using completely randomized design (CRD). All experimental chicks were randomly assigned to 16 pens and identified with wing bands.

Table 1: Ingredient composition and Chemical Composition of starter and finisher feeds

Ingredients	Starter feed	Finisher feed
Maize	50.00	50.00
Maize Gluten	7.50	5.20
Deoiled Rice Bran	9.00	10.00
Rice Polish	5.00	9.50
De-Oiled Soya Cake	8.70	5.00
Ground Nut Cake	9.00	7.50
Protolive	7.90	9.90
Constant	2.90	2.90
Total (%)	100	100
	Nutrient	
Cal. ME (Kcal/kg)	2913.00	2931.00
DM	93.34	92.31
CP	23.24	20.22
EE	3.56	3.37
CF	4.20	4.53
NFE	60.87	62.90
TA	8.13	8.96
Ca	1.20	1.25
P	0.79	0.85

Constant includes trace mineral premix* - 0.1, DCP-2.50, Salt-0.15, Biomrth-0.03, lysine-0.03, Toxin binder-0.05, Choline-0.03 and meriplex-0.01

*Tracemin CB: Each 1 kg contains - Manganese - 90 g, Zinc - 80 g, Iron - 90 g, Copper - 15 g, Iodine - 2 g and Selenium - 300 mg

Dietary treatments were basal diet without any supplementation (CON), basal diet supplemented with 0.5% garlic bulb powder (GAR), 0.5% fenugreek seed powder (FEN) and 0.5% of each garlic bulb powder and fenugreek seed powder (GAR-FEN). The birds were fed as per recommendation of BIS (1992) feeding standards to meet the energy and protein requirements during starter phase (0-28 days) and finisher phase (29-42 days). The ingredient and chemical composition of mash feed for starter and finisher phase of experimental birds is presented in Table 1.

Housing and management

Birds were reared in deep litter system under uniform and standard managemental conditions. All the experimental chicks were properly vaccinated against various diseases like new castle disease, infectious bursal disease etc.

Sampling and analytical methods

The experimental feed was analysed by method of AOAC (1995). 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. 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. Mortality was recorded as and when occurred. Mortality rate (%) was calculated from the records of dead birds up to end of the study against total number of birds.

Relative economics was calculated by subtracting the cost of feeding from the output of bird sold at ₹ 58 per kg live weight. While calculating the economy, the cost of chicks, brooding, labour etc. was taken identical for all the groups and therefore ignored.

Statistical analysis

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). 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) described by Duncan (1955).

RESULTS AND DISCUSSION

Feed intake and growth performance

Supplementation groups GAR and GAR-FEN showed significant ($P<0.05$) improvement in body weight, body weight gain and average daily gain (ADG) compared to CON and FEN groups. The differences of growth performance between CON and FEN were non-significant ($P>0.05$). The improvement in weight gain in garlic supplemented group (GAR and GAR-FEN) may be due to the action of *allicin*, an organosulfur compound which inhibits the growth of pathogenic bacteria and aflatoxin producing fungi leading to improved gut environment (Reeds *et al.*, 1993 and Cullen *et al.*, 2005). Lewis *et al.* (2003) also mentioned that *allicin* promotes the performance of the intestinal flora, thereby improving digestion and enhancing the utilization of energy, leading to improved growth. Average feed intake by birds during

the whole experimental period was comparable ($P>0.05$) among different treatments (Table 2) indicating no adverse effect of herbal feed additives on palatability and feed intake. Similar non-significant ($P>0.05$) effects of garlic supplementation on feed intake in broilers were also reported by Choi *et al.* (2010), Mansoub (2011) and Rahimi *et al.* (2011). In contrast to present result, Makwana *et al.* (2015) recorded higher feed intake ($P<0.05$) in broiler birds supplemented with garlic supplemented seed.

Feed Conversion efficiency

Higher body weight gain with comparable feed intake resulted into significant ($P<0.05$) improvement in feed conversion ratio (FCR) in GAR and GAR-FEN groups pointing toward the potential of herbal feed additives in improving feed utilization efficiency. However, fenugreek alone failed to exert any significant improvement in FCR showing its idle role in feed utilization efficiency. The better FCR was observed in GAR group as compared to other supplemented groups. This may be due to control of growth and colonization of various pathogenic microorganisms in the gut of broiler resulting into enhanced efficiency of utilization of feed (Ankri and Mirelman, 1999; Bedford, 2000). Thus, better FCR in garlic fed birds might be due to nutrient sparing effect of garlic. Performance index of GAR and GAR-FEN experimental groups showed significantly higher values as compared to CON and FEN experimental groups (Table 2).

Table 2: Growth performance of broilers fed different levels of garlic and fenugreek

Parameter	CON	GAR	FEN	GAR-FEN	SEM	Sig
Initial body weight (g)	41.64	41.88	41.83	42.02	0.25	NS
Final body weight (g)	1245.76 ^b	1352.26 ^a	1261.42 ^b	1336.51 ^a	24.35	S
Body weight gain (g)	1204.12 ^b	1310.38 ^a	1219.60 ^b	1294.48 ^a	24.28	S
ADG (g/d)	28.67 ^b	31.20 ^a	29.04 ^b	30.82 ^a	0.58	S
Feed intake (g)	2789.85	2819.76	2829.38	2815.27	41.64	NS
FCR	2.42 ^a	2.21 ^b	2.40 ^a	2.25 ^b	0.05	S
Performance index(PI)	44.68 ^b	47.93 ^a	44.62 ^b	47.48 ^a	0.76	S

Means with different superscripts in a row differ significantly ($P<0.05$), ADG= Average daily gain, FCR=Feed conversion ratio,

PI= (Body weight/Feed intake) * 100

Table 3: Carcass characteristics of broilers fed different levels of garlic and fenugreek

Parameter	CON	GAR	FEN	GAR-FEN	SEM	Sig
Live weight (g)	1634.75	1574.75	1641.50	1562.75	60.88	NS
Dressed weight (g)	1044.50	1003.50	1056.50	992.25	28.28	NS
Dressing Per cent (%)	64.06	63.79	64.53	63.55	1.49	NS
Liver (%)	3.02	2.71	2.60	2.86	0.21	NS
Gizzard (%)	1.82	1.85	1.96	2.06	0.16	NS
Heart (%)	0.47	0.50	0.46	0.59	0.05	NS
Spleen (%)	0.08	0.10	0.11	0.12	0.02	NS
Intestine length (cm)	191.50	179.25	188.00	190.25	11.61	NS
Caecum length (cm)	16.75	16.25	17.25	17.00	1.19	NS
Carcass length (cm)	28.50	28.25	28.50	27.50	0.54	NS

Table 4: Comparative economics of broilers fed different levels of garlic and fenugreek

Parameter	C	G	F	GF
Mortality (%)	8.75	5.00	2.5	5.00
Average Live wt. per bird (kg)	1.25	1.35	1.26	1.34
Total live wt. Kg.	90.94	102.77	98.39	101.58
Amount Sale @ ₹ 58 per kg	5274.53	5960.75	5706.68	5891.36
Total feed consumed (kg)	Starter	99.78	100.65	102.68
	Finisher	109.35	117.42	118.24
Cost of ration (₹./kg)	Starter	18.28	19.28	18.88
	Finisher	17.51	18.51	18.11
Total cost of feeding (₹)	3738.72	4113.94	4079.81	4228.09
Total return over feed cost (₹)	1535.81	1846.81	1626.87	1663.27
Profit over control/chick (₹)	—	4.09	1.17	1.68
Benefit : cost ratio (over feed cost)	0.41	0.45	0.40	0.39

Carcass characteristics

Various carcass parameters are presented in Table 3. Non-significant effect of garlic and fenugreek and either combination was observed on carcass characteristics. Similar findings observed by findings of Fadlalla *et al.* (2010), Onu (2010), Pourali *et al.* (2010), Aji *et al.* (2011) and Stanacev *et al.* (2011) showed non-significant effect of garlic supplementation on dressing percentage in broilers. Similarly, Abbas (2010) and Awadein *et al.* (2010) reported non-significant effect of fenugreek supplementation on dressing percentage in broilers, layers and Japanese quails, respectively. Weights of liver, gizzard, heart and spleen were also showed non-significant ($P>0.05$) effect of garlic

and fenugreek. The results are in line with the findings of Sarica *et al.* (2005), Javandel *et al.* (2008), Mahmood *et al.* (2009), Onibi *et al.* (2009) and Onu (2010) in broilers in their experiment with garlic supplementation. Likewise, Abbas (2010) and Khan *et al.* (2011) also reported non-significant effect of fenugreek supplementation on liver weight. The average values of length of intestine, caecum and carcass revealed non-significant ($P>0.05$) effect of garlic and fenugreek alone and in combination. Javandel *et al.* (2008) reported non-significant effect of garlic on intestine length of broilers, likewise Abbas (2010) reported non-significant effect of fenugreek on intestine, caecum and carcass length in broilers.

Mortality

Out of 320 chicks reared only 17 chicks were died during entire experiment period indicating that the mortality (%) was well within the normal limit. Total mortality (%) was 5.31 in all the treatment groups with 8.75, 5.00 and 2.50 and 5.00 in CON, GAR, FEN and GAR-FEN experimental groups, respectively. In present study, lower mortality in garlic fed birds might be due to antimicrobial action of garlic (Ankri and Mirelman, 1999).

Comparative economics of feeding

Evaluation of comparative economy of feeding (Table 4) for different treatments revealed that highest return over feed cost was observed in GAR group followed by GAR-FEN, FEN and CON. Similarly, profit per bird over control was higher in GAR group followed by combination of garlic and fenugreek and lowest in fenugreek supplemented group. Maximum benefit: cost ratio was observed in GAR group followed by CON, FEN and GAR-FEN group. Thus, maximum benefit was obtained in garlic supplemented group.

CONCLUSION

Garlic alone or in combination with fenugreek seed powder supplementation @ 0.5% each for intensive broiler production improves the growth performance, return over feed cost and profit per bird. However, supplementation of garlic bulb, fenugreek and either combination has no effect carcass characteristics.

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