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Effect of Garlic, Black Seed and Turmeric on the Growth of Broiler Chicken

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Abstract: Group A (control) chicks were placed on commercial feed, group B, C and D were offered feed supplemented with garlic, kalongi and turmeric @0.5 g/ Kg of feed, respectively. Overall weight gain during six weeks was highest (1476.60 g) in chicks of group C followed by those of group D (1340 g), B (1338.97 g) and A (1333.60 g), respectively. Overall feed consumption was apparently highest in chicks of group B (3110 g) followed by group C (3065 g), D (3053 g) and A (2708.33 g), respectively. Overall FCR during six weeks period was apparently best in group C (2.0) followed by group A (2.0), D (2.2) and B (2.3), respectively. Maximum value for antibody titer against ND was recorded in group C (1032), followed by group B (873.33), D (783.33) and group A (558.33), respectively. The maximum antibody titer against IBD was recorded in group C which was 1030 followed by group B (873.33), D (770) and group A (470), respectively. ANOVA on data of both diseases showed significant differences between groups with respect to antibody titre at 6 weeks. Maximum value for serum cholesterol was recorded in group A (134 mg/dL). Followed by group D (115.70 mg/dL), C (105 mg/dL) and group B (94.67 mg/dL), respectively. ANOVA on data showed significant differences between groups with respect to serum cholesterol at 6 weeks. Statistical analysis of data on various treatments revealed non-significant effect on weight gain but significant effect on feed consumption and FCR. Statistical analysis also revealed non-significant effect of treatments on the average value of dressing percentage, liver, heart, gizzard, spleen and pancreas weight but significant effect on intestinal weight, abdominal fat pad weight, antibody titre against ND and IBD and serum cholesterol level. Maximum profit was found in treatment C (Rs.30.57) followed by treatment D, B and A i.e., 23.02, 22.11 and 28.16 rupees, respectively.

Key words: Garlic, turmeric, black seed, broilers, high quality protein, herbal products, antibody titre

INTRODUCTION

Poultry is one of the short duration and efficient avenue to convert the agro-industrial by-products and wastes into a high quality protein for human consumption. Poultry feed constitutes about 70-75 % of the production cost of meat and eggs (John, 1976). Success on rearing broilers for maximum weight gain is not only depends upon the strain of the birds and management but also on high quality feed (Nazeer *et al*., 2002). Feed additives are assuming a position of prime importance in poultry nutrition. In general, feed additives can be described as the substances which are non-nutritive in nature but under certain circumstances stimulate or promote the effective use of feed nutrients and thus enable an animal to grow rapidly, improve production and efficiency (Cullison and Lowery, 1987). Feed additives include binders, flavoring agents, enzymes, antibiotics and growth promoters, antifungal, toxin binders, anticoccidials, carotenoids and probiotics. Antibiotics; improve the production results of meat producing chicks, however the use of growth promoting antibiotics is being placed under more and more pressure as consumers increasingly fear that their resistance against bacteria which are pathogenic to humans (Langhout, 2000).

The use of herbal products as growth promoters and feed intake enhancers have been established with respect to Weight gain, feed conversion ratio and reduced mortality (Briminkmeryer, 1996). The herbal growth promoters could serve as better substitute for antibiotic growth promoters. Our country is abounds in herbal wealth and innumerable plants possessing interesting pharmacological properties. Therefore, these

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medicinal plants/herbs should be considered in order to exploit their properties as growth promoters. At 0.5% level of kalongi in broilers, maximum weight gain (1485.25 g) was observed (Ihsan, 2003).Similarly the use of turmeric as feed additive at level of 0.5% enhanced overall performance of broiler chickens (Al-Sultan, 2003).

Kalongi or black seed (*Nigella sativa*) has been used as a food or therapeutic agent for over 2000 years. It is a member of the Ranunculus family and mostly present in regions stretching from Middle East, North Africa and Southern Eurasia to Pakistan and India. Its seeds are black in color and mainly used in confectionaries, breads, cakes and other baking products (Stern, 2000). The plant of *Nigella sativa* is an annual herb in India and Pakistan. The seeds of *Nigella sativa* contain a yellowish volatile oil (0.5-1.6%), a fixed oil (35.6-41.6%), different types of proteins, reducing sugars, tannins, resins, glucosides, bitter principles, ash, moisture and Arabic acid (Nadkarni, 1976).

In Kalongi, the major pharmacological active ingredient is thymoquinone, which serves as anti cancer agent. It acts an immune booster in the HIV disease. It has and immune enhancing effect on the human T-cell production (Stern, 2000).

Garlic has been used medicinally for centuries and is still included in the traditional medicine of many cultures. Numerous investigations proved that garlic can brings about the normalization of plasma lipids, enhancements of fibrinolytic activity and reduction of blood pressure. Historically there has been a great interest in the role of garlic in reducing serum cholesterol level (Rahman, 2001).

Turmeric (*Curcuma longa*), is a perennial herb and its active ingredients are tetrahydrocucuminoids (Osawa *et al*., 1995), *curcumin*, demethoxycurcumin and bisdemethoxycurcumin (Wuthi-Udomler *et al*., 2000), immune modulator (Anthony *et al*., 1999), antioxidative (Osawa *et al*., 1995) and antimutagenic activities (Soni *et al*., 1997). Keeping in view the use of kalongi, garlic and turmeric as herbal growth promoters in birds, a project was planned to compare the efficacy of these herbs in broilers to evaluate the promoting ability of kaolngi, turmeric and garlic.

MATERIALS AND METHODS

Experimental details and treatments

Experimental material: One hundred and twenty day-old broiler chicks of mixed sexes purchased from a local hatchery of Faisalabad were randomly divided into 12 experimental units or replicates having 10 birds in each replicate.

Treatments: These units were randomly allotted to four treatment groups (A, B, C and D) with 3 replicates per treatment. At day, these birds were individually weighed and then divided randomly into 12 pens each measuring 3ft X 4ft and raised under similar standard management and housing conditions. Birds of all groups were primed with Newcastle disease+infectious Bronchitis vaccine (Bioteke, Italy) live vaccines at the age of 5 days using I/o route and for IBD vaccines was administered through I/n route at the age of 10 day. At the age of 17 days birds were vaccinated against Hydropericardium Syndrome vaccine (Sanna Labs, Faisalabad). The birds were boosted with ND at 18th days of age and with IBD vaccines at the age of 24 days in drinking water.

Ration: Commercial broiler starter and finisher rations were fed ad labium to all experimental units. Garlic kalongi and turmeric were purchased from local market. Garlic and kalongi were put in oven at 30-60 C for complete drying and were crushed/ground in a mill to bring them into powder form. After that garlic, kalongi and turmeric were mixed separately at rate of 0.5 g/kg of diet and then offered to chicks of the respective treatment groups. Fresh and clean water was made available at all times. The experimental units were allotted to each four treatments, i.e., A, B, C and D from 2nd week of age. The treatment group A was kept as control providing un supplemented Commercial Feed. The rations of the group B, C and D were supplemented with 0.5% garlic powder, 0.5% kolongi powder and 0.5% turmeric powder, respectively

Body weights: The birds were weighed to have their initial body weight on the first day of their arrival from the hatchery to the experimental room. Then five birds from each group were weighed randomly at the end of each experimental week to have their weekly body weight gain record.

Feed consumption ratio: A weighed quantity of feed was offered to each experimental group twice a day throughout the experimental week and the left over feed was weighed back to determine weekly feed consumption by each group. At the end of experiment i.e. 8 weeks, feed conversion ratio (FCR) of each group was calculated by the following formula mentioned by Singh and Panda (1992).

FCR = Feed consumption/Body weight gain

Killing data: At the end of experiment, two birds from each replicate were picked up randomly, weighed and slaughtered in order to record the following data.

Dressing percentage: After slaughtering, the birds were scalded by immersing in hot water at temperature ranging from 180-190-F (Jull, 1976).Thus they were plucked by hanging on shackles by feet. After defeathering, the birds were eviscerated to record the

dressed weight. Dressing Percentage was calculated with the help of following formula.

DP= Individual dressed weight / Individual live weight X 100

Where DP = Dressing percentage

Organ weights: After evisceration, the weight of various internal organs such as liver, heart, gizzard, spleen and pancreas of the slaughtered birds were recorded. Weights of the intestine and abdominal fat pad were also recorded. The relative weights (g the respective absolute weight/100 g body weight) of all these components were, however, subsequently calculated for statistical analysis and interpretation.

Immune responses against newcastle disease and infectious bursal disease: The effects of Garlic, kalongi and turmeric on immune response against Newcastle Disease and Infectious Bursal Disease was observed at the end of experiment i.e., at 6 week of age. For this purpose, the blood samples of two birds from each replicate were collected in sterile test tubes and the serum was harvested. Antibody titres against Newcastle Disease were measured through Hemagglutination Inhibition Assay technique as described by Thayer and Beard (1998). Similarly Indirect Hemagglutination Assay was used for the determination of antibodies against Infectious Bursal Disease as described by Saeed (1990).

Serum cholesterol: At the end of 6th week two birds from each replicate were randomly selected for serum sampling and biochemical analysis. Blood samples were collected at 9.00 a.m. after fasting for a period of 2 h. All blood samples were centrifuged at 4,000 rpm for 10 min to get the serum separation. Serum samples were analyzed for total cholesterol, using Bio-chemical analyzer (Micro Lab 200 Merck) and Elitech kit as described by Allain *et al.* (1974).

Statistical analysis: The data was subjected to statistical analysis for the interpretation of results using analysis of variance technique with Completely Randomized Design. Treatment means were compared by Duncan Multiple Range (DMR) test (Steel *et al*., 1996).

RESULTS

The results regarding various parameters studied in experimental chicks under different treatments (Kalongi, garlic and turmeric) are given below. The average body weight gain, feed consumption and feed conversion ratio values are presented in Table 1.

Weight gain: The average values for weight gain of the birds under treatments A, B, C and D were 1333.60, 1338.97, 1476.60 and 1340.00, respectively. The results showed that the birds of treatment C (Kalongi) apparently gained the maximum weight followed by those of treatment group D (turmeric), B (garlic) and A (control), respectively.

Feed conversion ratio: Feed conversion ratio was significantly ($p<0.05$) influenced due to the addition of garlic, kalongi and turmeric in the treatment rations (Table 1).

Dressing percentage: Supplementation of garlic, kalongi and turmeric did not exhibit any effect on the dressing percentage values of the broilers in this study (Table 2).

Immune response against newcastle and gumboro diseases: The maximum value for ND antibody titer was recorded in group C which was 1032, followed by group B (873.33), D (783.33) and A (558.33), respectively. Analysis of variance of the data showed significant differences between groups with respect to ND antibody titer at 6 weeks. The maximum value for IBD antibody titer was recorded in group C which was 1030, followed by variance on group B (873.33), D (770.33) and A (470.00), respectively (Table 3). Analysis of variance of the data showed significant differences between groups with respect to IBD antibody titer at 6 weeks.

Serum cholesterol: The maximum value for serum cholesterol was recorded in group A which was 134.0, followed by group D (115.7), C (105.0) and B (94.67) mg/dL, respectively (Table 3). Analysis of variance of the data showed significant differences between groups with respect to serum cholesterol at 6 weeks.

Economics of production: Use of various herbal growth promoters in the rations exhibited an increase in the profit margin of the broilers. However, dietary inclusion of kalongi @ 0.5% fetched the maximum profit as compared to garlic, turmeric and control treatment groups (Table 4).

The results of the present study are in line with the findings of Ihsan (2003) who reported that the dietary inclusion of kalongi in ration fetched more profit than those rations without supplementation of these herbal growth promoters.

DISCUSSION

Thus, supplementation of Kalongi was found to be more effective resulting in more beneficial effect of Kalongi supplementation in the rations as compared to garlic and turmeric in terms of weight gain of the broilers. However, statistical analysis of the data revealed that the supplementation of Kalongi, garlic and turmeric in broiler ration had non-significant effect on the weight gain of the birds of various treatment groups (Table 1).

Table: 1: Weight gain (g), feed consumption (g) and feed conversion ratio of broilers fed Different herbal growth promoters

	Treatments			
Parameters	A	B	C	D
Initial body weight	123.6	125.09	122.06	124.70
Final body weight	1457.23	1464.06	1598.66	1464.70
Weight gain	1333.60	1338.97	1476.60	1340.00
Feed consumption	2708.33^{b}	3110.00	3065.00^{a}	3053.00^{a}
Feed conversion ratio	2.0^{b}	2.3^{a}	2.0^{b}	2.2^{a}

Table 2: Average values of dressing percentage and relative weights (gm Absolute Weight) of liver, heart gizzard, spleen, pancreas, intestine and abdominal fat pad

	Treatments			
Parameters	A	B	C	D
Dressing percentage	62.78	63.71	65.52	64.26
Liver weight	2.70	2.97	3.16	3.10
Heart weight	0.51	0.52	0.55	0.55
Gizzard weight	1.82	1.73	1.82	1.75
Spleen weight	0.15	0.16	0.17	0.16
Pancreas weight	0.25	0.28	0.30	0.33
Intestinal weight	6.71^{ab}	6.29^{b}	6.00^{a}	7.49^{a}
Abdominal fat pad weight	1.26^{b}	0.90^{c}	1.17^{c}	1.73^{a}

Supplementation of garlic, Kalongi and turmeric did not exert any effect on the weight gain of the broilers. The results of the study are in line with the findings of Soliman *et al.* (1999) who reported a non-significant effect on weight gain due to the dietary inclusion of garlic and Kalongi in broiler ration. Similar results have been observed by Konjufea *et al.* (1995) and Choi *et al.* (2010) when garlic was supplemented in the ration of broilers. The results of the study are also in agreement with those observed by Pesti and Bakalli (1998) and Shafey *et al.* (1999) when feed additives were used in layer rations.

Contrary to findings of present study Siddig and Abelati (2001) observed that inclusion of Kalongi in ration significantly improved the weight gain of the broilers. Abd Rehman and Abu Bakar (1997) found that dietary inclusion of Kalongi exhibited a marked increase in weight gain of Turkey pouts. Similarly Meraj (1998) and Samanta and Dey (1991) found that dietary supplementation of garlic improved the weight gain of broilers and Japanese quails, respectively. Improvement in weight gain due to the addition of turmeric in broiler ration has also observed by Al-Sultan (2003).

Based upon the findings of present study it may be inferred that none of the treatments (garlic. Kalongi and turmeric) exerted any effect on the weight gain of broilers.

Samanta and Dey (1991) observed that difference in feed intake was found to be statistically non-significant due to the dietary inclusion of garlic in the ration of Japanese quails.

The results regarding feed conversion ratio are in line with the findings of Siddig and Abelati (2001) and Ihsan (2003) who reported a significant effect on feed conversion ratio due to the dietary inclusion of kalongi in ration. The results of compatible with those reported by Osman and Barody (1999) who found better FCR in broilers fed ration containing kalongi than those maintained on ration without it. Similar findings have been observed in layers (Nasir, 2001; Haq *et al.*, 2003; Rahman, 2001) which used their feed more efficiently due to the dietary inclusion of kalongi.

The improvement in FCR of the birds using kalongi in their rations may probably be due to the fact that ethyl ether extracts of *Nigella sativa* inhibits growth intestinal bacteria such as *S. aureus* and *E. coli* (Hanafy and Hatam, 1991). Resultantly, when the load of these bacteria in the intestine is low, birds may absorb more nutrients thus leading to improvement in weight gain of the birds using rations supplemented with *Nigella sativa* and hence resulting into better feed gain ratio.

These results are also in agreement with the findings of (Meraj, 1998; Haq *et al.*, 2003) who reported a significant effect on feed conversion ratio when garlic was supplemented in the ration of broilers and layers, respectively. The improvement in FCR may be due the action of allicin (an antibiotic substance found in garlic) which inhibits the growth of pathogenic bacteria and aflatoxin fungi (Striggs, 1998), thus improving the absorption of available nutrients in the gut.

The results of the study are also in line with the findings of Al-Sultan (2003) who reported a significant effect on FCR when turmeric was supplemented in the ration o f broilers The plant extracts of *Curcuma longa* (turmeric) have antifungal (Wuthi-udomler *et al.*, 2000) and antioxidative properties (Osawa *et al.*, 1995) which may contribute towards the better feed conversion ratio of the birds.

The results regarding dressing percentage are in line with those observed by Onibi *et al.* (2009) who reported no significant effects on dressing percentage due to the inclusion of garlic in the ration. Similar findings have been observed by Siddig and Abdelati (2001) in broilers fed kalongi in their rations. Similarly Al-Beitawi and El-Ghousein (2008) and Ismail (2011) observed the dressing percentage did not differ due to the addition of different levels of kalongi in broilers.

Table 3: Mean values of antibody titer against ND and IBD and serum cholesterol

	Treatments			
Parameters	A	B	C	D
ND antibody titer	558.33^{d}	873.33^{b}	1032.00^{a}	783.33^{c}
IBD antibody titer	470.00^{d}	873.33^{b}	1030.00^{a}	770.00^{c}
Serum cholesterol	134.00^{a}	94.66^{c}	105.00^{bc}	115.30^{b}

Means having different superscripts had significant effect

Table 4: Data showing economics of various treatments

Parameters	A	B	C	D
Cost/chick (Rs)	20	20	20	20
Total feed consumed/bird (Kg)	2.708	3.11	3.065	3.053
Feed cost/Kg (Rs)	13.5	13.5	13.5	13.5
Feed cost/bird (Rs)	36.55	41.98	41.37	41.21
Cost of treatments (Rs)	0	1	1	1
Miscellaneous charges/birds (Rs)	10	10	10	10
Total cost/bird (Rs)	66.55	72.98	73.37	72.21
Average Live weight(Kg)	1.457	1.464	1.599	1.465
Sale price/Kg (Rs)	65	65	65	65
Sale price/Bird (Rs)	94.70	95.16	103.94	95.23
Net profit (Rs)	28.16	22.11	30.57	23.02

Supplementation of garlic, kolongi and turmeric did not influence any significant effect on the relative weights of heart weight, liver, gizzard, spleen, pancreas weights in broilers. The results are similar to those of reported by Soliman *et al.* (1999) who reported that neither supplementation of garlic nor kalongi in broiler rations had any effect on their relative liver weights. The dressing percentage were not significantly affected ($p>0.05$) by dietary garlic supplementation but abdominal fat contents were numerically lowered (Onibi *et al.*, 2009). Same results have been observed when garlic was added as growth promoter in the rations of Japanese quails (Samanta and Dey, 1991). The findings of Meraj (1998) partially agreed with those observed in the present study who reported that various levels of garlic did not show any difference in the relative liver weight of broilers. The effect on relative liver weight was also non-significant at statistical level (Siddig and Abdelati, 2001) and (Ihsan, 2003) when various levels of kalongi were used in broiler rations. Supplementation of herbal growth promoters (garlic, kolongi and turmeric) exhibited a significant effect on the relative intestinal weight of the broilers. This improvement may be due to the pharmacological properties of these herbs, such as antifungal and anti-inflammatory effects, which modifies the intestinal environment and aids in increased weight gain and proper functioning of the intestine. Dietary inclusion of herbal growth promoters (garlic, kolongi and turmeric) exerted a significant effect on the relative abdominal fat pad weight of the broilers. The results of the present study are in line with findings of (Al-Sultan, 2003) who reported significant effect of turmeric on the abdominal fat pad weight in broilers. Based upon the findings of the study it may be inferred that the significant reduction in fat pad weight may be due to the antioxidant property of the garlic, which stimulants protein synthesis and brings about the normalization of plasma lipids and reduction of blood pressure (Rehman, 2002). Dietary inclusion of garlic, kalongi and turmeric as growth promoters in the broiler ration exhibited a significant effect on the immune response of birds against Newcastle and Gumboro diseases. The findings of the present study are in line with the findings of Soliman *et al.* (1999) who reported a significant effect of kalongi on the immune response of broilers. Similarly, Toghyani *et al.* (2010) and Sohail H. Khan *et al.* (2012) reported that adding black seed (kolongi) in the diet improved the immune response of chicks and marked ($p<0.05$) an increase in the weight of lymphoid organs. Studies evidenced that some constituent of black cumin exert stimulator roles toward T cell-mediated immune responses, whereas other constituents suppress B cell-mediated immune responses (Swamy and Tan, 2000; Islam *et al.*, 2004).

The results of the study are also in agreement with the findings of Meraj (1998) who reported a significant improvement in titers against Newcastle and Gumboro diseases by using garlic in the ration of broilers. Garlic has also shown immune booster effect and causes increased immunity level against these diseases. Similar results have been observed by Al-Sultan (2003) when turmeric was used as growth promoters in the ration of broilers. This improvement in immune response may be attributed to the active ingredient *Curcumin* extracted from *curcuma longa*, which has immunostimulatory activity and is responsible for the improvement in immunity against diseases (Anthony *et al.*, 1999).

Supplementation of herbal growth promoters (garlic, kolongi and turmeric) exhibited a significant effect on the serum cholesterol level of the broilers. The results of this study are in line with the findings of Siddig and Abdelati, (2001); Al-Beitawi *et al.* (2009), who found a significant decrease in serum cholesterol by the use of kalongi in broilers. Similar results are found in layer by Nasir (2001) and Suhail H. Khan *et al.* (2012) also

reported that serum and tissue cholesterol concentration decreased ($p<0.05$) as the level of Black cumin seed (kolongi) increased. The reduction in serum cholesterol may be due to the choleretic activity of *Nigella sativa* (kolongi) and presence of high percentage of mono-unsaturated fatty acids in it, as reported by El-Dakhakhny *et al*. (2000). The results of the study are also in line with the findings of Meraj (1998) who reported a significant decrease in cholesterol in broilers by using garlic and neem leaves. Similarly Konjufea *et al*. (1995) also reported a significant decrease in cholesterol in broilers by using garlic. The results of the study are also in agreement with the findings of Haq *et al*. (2003) and Rehman *et al*. (2002) who reported significant reduction in cholesterol by use of garlic in layers. The reduction in serum cholesterol due to the dietary inclusion of garlic may be due to the hypocholesterolemic action of tellurium compounds present in fresh garlic. These compounds inhibits theSqualene epoxidase, the penultimate enzyme in the synthetic pathway o f cholesterol and results in decreased cholesterol (Haq *et al*., 1999.)

Contrary to the findings of present study Reddy *et al*. (1991) reported a non-significant effect of garlic on plasma cholesterol level in White Leghorn pullets. The difference in the results may be due to the difference in Experimental conditions used in these studies.

Increase in the profit margin of the birds fed rations containing herbal growth promoters may be attributed to the better efficiency of feed utilization, which resulted in more growth and better feed to gain ratio, ultimately leading to higher profit margin in the broilers reared on kalongi supplemented rations.

Conclusion: It may be concluded that these findings will help the poultry producers to save expenditures from pocket snatching prices of antibiotics which they have to utilize for better health and growth of their birds. Above all, the use of herbal growth promoters will help in the production of organic broilers and save the health of mankind from ill effects of residual antibiotics present in the meat. In making final assessment of the study, addition of herbal growth promoters has shown to improve overall performance of the birds, being specifically related to efficient and economical broiler production. However, further studies are recommended before making it a regular ingredient of poultry feed.

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