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Research Article

EFFECT OF GINGER AND GARLIC SUPPLEMENT ON GROWTH AND HAEMATO-BIOCHEMICAL PROFILE OF JAPANESE QUAIL (*COTURNIX COTURNIX JAPONICA*)

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ABSTRACT: Ginger and Garlic supplement is one of the important natural growth promoters can be used as alternatives to the commercial antibiotics. Japa nese quails are hardy birds which can withstand poor managemental conditions. The objective of this study was to determine the effect of ginger and garlic supplement on growth and haemato-biochemical profile of quail. A total number of 300 Japanese quails (*Coturnix coturnix japonica*) of one week old were taken randomly, divided into 4 groups (T_0, T_1, T_2 and T_4) having 75 birds each. The trail was lasted for 5 weeks, during which weekly body weight changes were recorded. On 4th week, T_2 showed the highest body weight (111.67±2.40 gm) significantly (P<0.05) higher than T_0, T_1 and T_3 Blood samples were collected at the end of the experiment and haemato-biochemical parameters like glucose, protein, albumin, cholesterol, triglycerides were measured. It was observed that addition of ginger and garlic powder caused significant (P<0.05) decrease in cholesterol and triglyceride level of the birds. The lowest level of serum cholesterol and triglyceride was observed in group T_1 (99.57±10.11mg/dl and T_2 (88.49±8.31 mg/dl)) respectively. So, it can be concluded that the dietary ginger and garlic supplement not only improves the body weight but also lowers the cholesterol and triglyceride level of Japanese quail.

Key words: Ginger and garlic supplement, Japanese quail, Growth, Haemato-biochemical profile.

INTRODUCTION

Quail farming is now gaining wide popularity in poultry industry because of the possibility to achieve yields in very limited spaces, within short span of time without substantial investments and moreover, they are much more resistant to environmental factors (Nagarajan *et al*. 1991). Japanese quail (*Coturnix coturnix japonica*) are hardy birds, more tolerant to poor managemental condition and also to common poultry diseases like Marek's disease and New Castle disease etc (Faitarone *et al*. 2005). Pronutrients are as micro ingredients which enhance the physiology and microbiology of the animals, must be included in the formulation of animal feeds to enhance the growth of many domestic animals including cows, neonatal calves and piglets, broilers, and humans (Rautray *et al*. 2011). Some of these pro-nutrients in the poultry diet contribute the raising of plasma total cholesterol and low-density lipoprotein (LDL) cholesterol level which leads to the occurrence of atherosclerosis. So, there should be an alternative means of correcting and preventing these diseases. More recently, the applications of herbs and spices products, alternatives to antibiotic, have increased in poultry diets, which resulted in improved production and health (Khalaji *et al.* 2011). Moreover, Medicinal herbs such as garlic and ginger have been reported to possess lipid lowering effects (Sharma *et al.* 1996). Ginger is a rhizomatous herbaceous plant which contains several compounds and enzymes including gingerdiol, gingerol, gingerdione and shogaols (Zhao *et al.* 2011) having antimicrobial, antioxidative and pharmacological effects (Ali *et al*. 2008). Garlic containing important chemical called allicin, is best known as a spice and herbal medicine for treatment and prevention of an array of diseases (Adibmoradi *et al.* 2006). Ginger and garlic can stimulate the digestive

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systems by controlling the digestive pH, activity of digestive enzyme and the microbial activity (Herawati 2010). It has been reported that this combined supplementation also enhances the body weight gain and feed conversion ratio in broiler birds (Oleforuh-Okoleh *et al.* 2014). It has been found that Ginger and garlic supplement can lower the serum and tissue cholesterol levels by inhibiting the bacterial growth and oxidative stress in birds (Stanacev *et al.* 2012). Although lots of works have been done to know the efficiency of ginger and garlic supplement in broilers, but there is availability of less reports in Japanese quails till today. In this study, an experiment was conducted to explore the effect of ginger and garlic supplementation on the growth and haemato-biochemical parameters in the Japanese quails.

MATERIALS AND METHODS

An experiment was carried down by taking a total number of 300 Japanese quail (*Coturnix coturnix japonica*) birds of one week old which were divided into four groups with three replicates, having 25 birds in a complete randomized design. The quails were reared in deep litter system and supplied with feed and water ad labium. Basal diets were prepared to meet the nutrient requirements of quail birds (Table 1) as per specification of Bureau of Indian Standards (BIS 1992) and the ginger and garlic used in this experiment was purchased from local market of Bhubaneswar and was supplemented along with the basal diet from 0 to 5th weeks to the birds. The combinations were birds with basal diet (T_0), Birds with basal diet +1% ginger (T_1), birds with basal diet + 1% garlic (T_2) and birds with basal diet + 0.5% of each ginger and garlic powder (T_3). The basal diets were analysed for proximate composition as per A.O.A.C (1995). Body weights of birds were recorded at weekly intervals up to the 5th week by electronic weighing balance. 3ml of blood was collected from birds after slaughter at end of the experiment. The serum was collected by centrifugation of coagulated blood at 3000xg for 10 min and stored at - 40^{0}C till biochemical analysis. The biochemical parameters like glucose, protein, albumin, cholesterol and A:G ratio were estimated through fully automatic analyzer (Turbochem-100, CPC diagnostics) by using i-chem (Jeev diagnostics, Chennai, India) kit. Hematological parameters Hemoglobin (Hb), Packed Cell Volume (PCV). Total erythrocyte count (TEC), Mean cell volume and Mean corpuscular hemoglobin are estimated by standard manual method. The data were analyzed by Statistical Package for Social Science (SPSS) software version 16.

RESULTS AND DISCUSSION

The proximate analysis of the experimental diet and ginger and garlic used in this experiment was shown in Table 2 and Table 3 respectively.

Effect on Body weight

The weekly average body weight of quail birds under different dietary treatments up to sixth week of age has been presented in Table 4. The body weight (g) of one week old quail birds ranged from 17.00±0.45g to 19.00±0.08g with no significant ($P \geq 0.05$) difference between the groups. The 2nd week bodyweight (g) of the birds ranged from 34.00±1.60g to 39.00±1.15g with no significant ($P \geq 0.05$) difference between the groups. On 3rd week, body weight (g) of quail birds ranged from 64.00±2.04 to 70.67±2.18 having no significant difference between the groups. On 4th week T_2 showed the highest body weight (111.67^b±2.40) which was found to be significantly ($P<0.05$) higher than T_0, T_1 and T_3 groups while group T_0 recorded lowest value (99.00±3.15) g and it was significantly lower than groups (T_1, T_2 and T_3). Similar trend was observed in the 6th week, supplemented groups (T_1, T_2 and T_3) were found to have significantly ($P<0.05$) higher body weight than un-supplemented control group (T_0).

Effect on biochemical parameters

Serum biochemical parameters *viz*. glucose, cholesterol, triglyceride, total protein, albumin, globulin and albumin: globulin of Japanese quail at six weeks of age under different dietary treatments is presented in the Table 5. The average levels of serum glucose, ranged from 187.22 ±14.85 to 215.84±16.21mg/dl, serum cholesterol ranged from 99.57±10.11 to 150.66 ± 12.96mg/dl, triglyceride ranged from 88.49 ± 8.31 to 119.71± 11.76mg/dl, total protein ranged from 4.02±0.84 to 4.24± 0.93g/dl, serum albumin ranged from 2.14±0.39 to 2.27±0.38g/dl, serum globulin ranged from 1.87±0.20 to 2.01±0.31g/dl. The mean serum glucose, total protein, albumin and globulin levels did not show any significant ($P>0.05$) difference between the treatments. The serum cholesterol and triglyceride levels of the birds varied significantly ($P<0.05$) among the treatments. The highest level of serum cholesterol was observed in group T_0 (150.66±12.96 mg/dl) and it was found to be differed significantly ($P<0.05$) from T_1, T_2 and T_3. The lowest serum cholesterol was observed in group T_1 (99.57±10.11mg/dl) followed by T_3 and T_2. The highest level of serum triglyceride was observed in group T_0 (119.71±11.76mg/dl) and it was found to be differed

Table 1. Composition of the experimental feed.

Ingredients	Parts per quintal
Crushed yellow maize	51
De oiled Soya meal	40
DORB	5.6
Choline Chloride 50 %	0.12
Salt	0.2
Sodium Bicarbonate	0.2
Dicalcium Phosphate	1.28
ABDK vitamin	0.025
DL-Methionine	0.12
Calcite powder (Ca = 34%)	1.34
Mineral mixture	0.12

Table 2. Proximate composition of the feed offered.

Parameters	(% DM basis)
Dry matter	90.10
Crude protein	23.10
Ether extract	4.75
Crude fibre	4.20
Total ash	9.41
Acid insoluble ash	2.40
Nitrogen free extract*	58.54
Calcium	2.50
Available phosphorus	0.35
Metabolizable energy*	2810 (Kcal/kg)

significantly (P<0.05) from T_1, T_2 and T_3. The lowest serum triglyceride was observed in group T_2 (88.49±8.31 mg/dl) followed by T_1 and T_3.

Effect on haematological parameters

The average hematological values of Japanese quail under different dietary treatments at six weeks of age are presented in Table 6. The hemoglobin (g/dl), RBC (X 10^6/ mm^3), packed cell volume (%) of all the treated groups ranged from 10.03±0.22 to 11.87±0.13, 2.83 ±0.06 to 3.19±0.11 and 39.44 ±0.44 to 42.48±0.52 with significant (P<0.05) difference between them. Highest hemoglobin level was observed in T_1 (11.87±0.13) and lowest hemoglobin level was found in T_0 (10.03±0.22) showing significant higher hemoglobin concentration in ginger and garlic supplemented birds than control. The MCV (fl) and MCH (pg/dl) of all the groups ranged from 129.67 ±2.99 to 139.62±3.13 and 35.45 ±2.68 to 37.61 ±3.99 respectively without any significant difference between the treated groups (Table 6).

Table 3. Composition of ginger and garlic (% DM basis).

Composition	Ginger	Garlic
Moisture	74.32	69.80
Dry Matter	25.68	30.20
Crude Fat	5.09	2.61
Crude Protein	8.10	7.48
Total Ash	2.82	2.03
Crude Fiber	2.97	1.88
Nitrogen free extract*	81.02	86.00

It was seen that there was significantly (P<0.05) increase in body weight in supplemented group than control after 4th week (Table 4) which was coinciding with the findings of Karangiya *et al*. (2016) who disclosed that a body weight gain was significantly higher in garlic and ginger mixture supplementation in commercial broilers. Contrary to this, Zhang *et al.* (2009) mentioned that there was no significant weight gain, when ginger powder was supplemented in feed @ 5g/kg. Similar findings also reported by Nasiroleslami and Torki (2010) and they found no increase in feed intake when ginger oil was added to the layer diet. Experimental findings of Moorthy *et al*. (2009) narrated ginger supplementation had no gain effect on body weight in broiler. It has been shown that addition of turmeric powder caused significant increase in body weight gain and blood Hb concentration in broiler (Sethy *et al*. (2016). Present research showed that there was no significant body weight gain up to 3rd weeks of age in all the treated groups which was similar to the findings of Fadalla *et al.* (2010) but there was sudden increase in body weight after three weeks among all groups. Weight gain in particular T_2 group might be attributed from the beneficial effects of the pharmacological ingredients *i.e.* allicin, alliin, ajoene, diallyl sulphide, dithin, S-allylcysteine in *Allium sativum* through the anti-bacterial, anti-inflammatory, antiseptic, anti-parasitic as well as immune-modulatoy effect (Rehman and Munir 2015). Our result is in accordance with the research findings of Mahmood *et al*. (2009) who stressed upon the positive effect and herbal antibiotic present in the garlic, might be the reason behind improvised weight gain. T_0 support our finding which might be due to induced increase in intestinal villus height, villus area, cell area and cell mitosis of poultry chicks for better feed efficacy (Incharoen *et al*. 2010).

It was found that there was no such significant difference in different biochemical parameters between treatment and control group. But the serum cholesterol and triglycerides level was significantly decreased in T_1

Table 4. Average weekly body weight (g) of Japanese quail under different dietary treatments.

Week	Treatments				P value
	T_0	T_1	T_2	T_3	
1	17.67±0.45	17.00±0.73	19.00±0.58	19.00±0.08	0.751
2	39.00±1.15	34.00±1.60	38.33±1.33	38.33±1.37	0.666
3	69.00±2.58	64.00±2.04	70.67±2.18	66.33±2.81	0.699
4	99.00^{a}±3.15	107.33^{b}±2.76	111.67^{b}±2.40	108.67^{b}±2.45	0.005
5	142.33^{a}±3.91	156.33^{ab}±4.78	166.67^{b}±5.36	157.33^{ab}±3.86	0.040
6	181.00^{a}±5.69	206.67^{b}±5.45	217.67^{b}±5.96	203.67^{b}±6.33	0.003

^{ab}Values bearing different superscripts in a row differ significantly (P<0.05).

Table 5. Serum biochemical profile of Japanese quail under different dietary treatments at 6th week of age.

Parameters	Treatments				P value
	T_0	T_1	T_2	T_3	
Glucose (mg/dl)	215.84±16.21	195.26±15.84	191.00±16.06	187.22±14.85	0.116
Cholesterol (mg/dl)	150.66^{b}±12.96	99.57^{a}±10.11	102.83^{a}±12.07	100.98^{a}±8.87	0.000
Triglyceride (mg/dl)	119.71^{b}±11.76	89.71^{a}±9.13	88.49^{a}±8.31	93.65^{a}±8.88	0.000
Total Protein (g/dl)	4.02±0.84	4.21±0.91	4.12±0.62	4.24±0.93	0.261
Albumin (g/dl)	2.14±0.39	2.27±0.38	2.26±0.21	2.23±0.28	0.753
Globulin (g/dl)	1.87±0.20	1.94±0.26	1.94±0.35	2.01±0.31	0.846
A/G ratio*	1.15±0.08	1.17±0.15	1.19±0.12	1.13±0.10	0.967

^{ab}Values bearing different superscripts in a row differ significantly (P<0.05).

and T_2 groups. This result was in accordance with the finding of Bhandari *et al.* (2005). He found that ethanolic extract of ginger not only significantly reduced the serum total cholesterol and triglycerides but also shoot up the high-density lipid (HDL) cholesterol with dynamic protective effect on lipid peroxidation of the tissues in diabetic rats. Furthermore, Fuhrman *et al.* (2000) stated that the ginger decreases the low-density lipid (LDL) cholesterol, very low-density lipid cholesterol (VLDL-cholesterol) and triglycerides level in apoprotein-E deficient mice. Similarly, significant lowering down trend of cholesterol and triglyceride were studied in serum of broilers (Ademola *et al.* 2009). Zhang *et al.* (2009) pointed out that ginger powder added feed, increased ($P < 0.001$) the activities of superoxide dismutase and glutathione peroxidase with reduction in malondialdehyde and cholesterol ($P < 0.01$) in serum of broilers at 21 and 42 days old. The effect of squeezing down the cholesterol level in serum could be threaded to the presence of two important constituents in ginger viz., gingerols and shagols with inhibition upon lipid peroxidation (Ashani and Verma 2009). Recently, in an extensive research it had been confirmed that ginger essential oil supplementation to broilers, lowered the serum cholesterol as well as LDL significantly ($P < 0.05$) (Ghasemi and Taherpour 2015). Canogullari *et al.* (2010) also reported that the garlic addition to laying quail feed significantly decreased the total plasma cholesterol and triglyceride concentration. The result is in close proximity with our experimental finding. Oleforuh-Okoleh *et al.* (2015) reconciled that ginger and garlic aqueous filtrate inclusion in ration alone of broiler significantly ($P < 0.05$) decreased the plasma cholesterol, but the mixture of both ginger and garlic had no such tremendous impact. The

Table 6. Hematological values of Japanese quail under different dietary treatments.

Parameters	Treatments				P value
	T_0	T_1	T_2	T_3	
Hemoglobin (g/dl)	10.03^{a}±0.22	11.87^{b}±0.13	11.30^{b}±0.26	11.57^{b}±0.23	0.000
RBC (X 10^6/ mm^3)	2.83^{a}±0.06	3.16^{b}±0.07	3.08^{b}±0.05	3.19^{b}±0.11	0.015
Packed cell volume (%)	39.44^{a}±0.44	40.93^{b}±0.33	40.26^{ab}±0.18	42.48^{c}±0.52	0.000
MCV (fl)	139.62±3.13	129.67±2.99	130.98±3.72	134.17±5.24	0.668
MCH(pg/dl)	35.45±2.68	37.61±3.99	36.79±5.18	36.60±4.78	0.668

mechanism which is responsible for the lowering of cholesterol and triglycerides in quail serum at 6 weeks of age is the reduction of the activities of hepatic lipogenic and cholesterogenic enzymes *viz*., fatty acid synthase, malic enzyme, 3-hydroxy-3-methyl-glutaryl- CoA (HMG CoA) reductase and glucose-6-phosphate dehydrogenase (Yeh and Liu 2001). In *in vitro* studies, it was found that the organosulphur compound like diallyl-di-sulfide in oily and S-allyl cysteine in water soluble part of ginger extract are potent inhibitors of cholesterol synthesis (Gebhardt and Beck 1996). In our present research, the hypo-cholesteromic effect of garlic might be due to this oleic and aqueous extracted content when supplied as wholesome powder form. Component allicin might reduce the serum cholesterol, triglyceride and LDL (Alder and Holub 1997). Jimoh *et al.* (2012) reported that the garlic extract had significant cholesterol metabolism minimizing effect in the quail. There is a dose dependant significance of cholesterol, triglyceride and hypo-lipidaemic property of garlic addition to the quail feed (Omonona and Jarikre 2014). But other biochemical parameters like serum total protein, albumin, globulin and glucose concentration showed no significant variation in concentration as compared to the control in 42 days old birds supplemented with ginger powder in the present study which is in correlation with the findings of Ebrahimnezhad *et al.* (2014). Simultaneously, Jamel *et al*. (2010) stated that there was non-significant variation in serum total protein, globulin, and albumin in broilers. Our data supports that the ginger and garlic supplementation has significant effect on cholesterol and triglyceride backbone breaking with minimal surge effect on total protein, glucose, albumin and globulin.

It has been shown that among hematological parameters, hemoglobin (Hb) per cent, red blood corpuscle (RBC) and packed cell volume (PCV) significantly affected by ginger, garlic and duo mixture addition in the quail feed up to 6^{th} week of age but, mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH) showed no significant variation either to positive or negative side as compared to the control which is in accordance with results found by (Onu 2010). Ginger and garlic addition effect might be more adaptable for quail such which results in increase RBC count. Over all, there is a positive effect of ginger and garlic feeding on the basic hematological parameters with other physiological value in quail species at 6^{th} week of age.

CONCLUSION

This study can be concluded that Japanese quail farming is one of the important income sources to the poor farmers as these birds are very much tolerable to adverse condition. Ginger and garlic supplement can be used as alternative to the commercial used antibiotics for better growth and performance of the quail birds. This organic supplement not only lowers the cholesterol and triglyceride level but also enhances the growth and hematological parameters in quail birds. So, it would provide a better alternative to the commercial feed additive for better performances of the quail birds.

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