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RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

Effect of ginger (*Zingiber officinale*) and black pepper (*Piper nigrum L.*) powder on performance, haematological parameters and antibody titre in broiler chicks

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Abstract

This study was designed to investigate the effect of ginger and black pepper on performance of broiler chicks. A total 240 one day broiler chicks with an average weight of 39±2.1 g were randomly divided into four treatments. Each treatment was further divided into four replicates. Chicks were fed a basal diet as control group (T1), basal diet with 0.02% ginger powder (T2), basal diet with 0.02% black pepper powder (T3) and basal diet with 0.01% ginger + 0.01% black pepper powder (T4). At the end of trial (42 days), four birds form each treatment were weighted and slaughtered. Some haematological parameters such as calcium, phosphorus, cholesterol and triglyceride levels were also investigated. In addition, antibody titre against Newcastle vaccine was evaluated at 28, 35 and 42 day of the experiment. Data showed that FI increased significantly in T3 and T4 in comparison to control diets ($P<0.05$). Body weight gain and total body weight at the end of the experiment were also significantly higher in treated groups compared to the control. Percentage weight of liver and abdominal fat decreased significantly in all treated groups, while percentage weight of drumstick and gizzard increased significantly in the treated groups compared to the control. Weight of Bursa of fabricius percentage weight also decreased significantly in T2 and T3. Triglyceride level decreased significantly in the treated groups while cholesterol level decreased in T2 and T4 group. Ca concentration decreased significantly in all the treated groups and P concentration increased in T3 and T4. Antibody titre increased significantly in treated groups compared to the control group. We concluded that the use of ginger and black pepper or their mixture at the present level enhanced body performance, cholesterol profile and antibody titre.

Keywords: Ginger; black pepper; performance; broilers; hematological parameters

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Introduction

Ginger (*Zingiber officinale Roscoe*) is one of the most widely used spices and it is a common additive in large number of compounded foods and beverages due to its flavour and pungency. The rhizome of this plant is one of the most commonly used medicinal herbs as well as one of the most well known used condiments in Chinese cuisine. Folk people have long used the soup of ginger root to warm the human body in winter. Though spicy and hot in nature, the rhizome of ginger has been used to treat symptoms and signs including pale feature and cold extremities (Al-Harthi, 2002). Several pharmacological effects of the ginger have been reported such as antiulcer, antioxidant, potent antibacterial, antifungal and anthelmintic have also been reported (Greathead, 1999; Akoachere et al., 2002).

Black pepper (*Piper nigrum*) is well known spice due to its pungent quality (Hassan et al., 2007). Black pepper is a member of family Piperaceae (Herati and Marjuki, 2011; Hosseini, 2011). Efficient compounds of pepper are cupsaeesin, cupsisin and cupsantine.

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Piperine is one of compound of black pepper which has antiache effect (Mahady et al., 2008). In addition, the bioactive molecule like piperine, present in pepper, has major pharmacological impacts on the nervous and neuromuscular systems, exercises (Sarica et al., 1995). Many researchers that proved an increase in body weight and decrease in feed efficiency when used this herbal plants in broilers diet (Greenhead, 1999; Iqbal et al., 2011). Undoubtedly ginger and black pepper which are considered as herbal plants have a wide range of potential uses. The objective of this study was to explore the uses of ginger and black pepper on performance and health parameters in broilers.

Materials and Methods

The experiment was carried out at the Poultry Farm of Veterinary College, Islamic Azad University, Shahrekord branch, Iran. A total of 240 days old broiler (Ross 308) chicks were divided into four treatment groups and were further subdivided into four replicates. The ginger and black pepper were purchased from local market and grounded separately to a fine powder and then mixed with the basal diet. The treatments were divided as basal diet with no herbal plants kept as control (T1), basal diet plus 0.02% of ginger powder (T2), basal diet plus 0.02% black pepper powder (T3), basal diet plus 0.02% mixed ginger and black pepper powders (T4) in equal quantity. All diets of each period were prepared with the same composition. Diets were formulated to meet or exceed the requirements of National Research Council (NRC, 1994). The chemical composition of the experimental basal diets is shown in Table 1. Feed and fresh water were provided *ad libitum* during this experiment. The live body weight gains of birds were measured individually and feed consumption and feed conversion efficiency were calculated weekly. At the end of experimental period, four birds form each replicates (total 64 birds) were slaughtered. Body parts were separated and weighed as percentage weight. Dressing percentage was calculated free from giblets and the organs were weighed separately as percentage of carcass weight.

Blood samples were taken from the brachial vein from two birds per replicate and stored at refrigerator at +4°C. Blood samples were subjected to biochemical analysis for cholesterol and triglycerides (Ellefson and Garaway, 1967; Zlatkis and Boyle, 1993). Some blood samples were collected and antibody titre against Newcastle vaccine was measured by haemagglutination inhibition test (Hirst, 1942).

Data were collected and analyzed using the General Linear Model Procedure of (SAS, 2001). Differences between means were analyzed by Duncan's multiple ranges test. P value less than 0.05 was considered as significant.

Table 1: Composition of the experimental diets for broiler chicks

Ingredients %	0-14 (days old)	15-29 (days old)	30-42 (days old)
Corn grain	51.64	56.61	60.37
Soybean meal	37.74	32.30	27.81
Wheat grain	5.00	5.00	5.00
Vegetable oil	1.40	2.03	2.84
Dicalcium phosphate	1.56	1.47	1.39
Oyster shells	1.17	1.13	1.08
Methionine DL	0.30	0.29	0.27
Lysine L	0.13	0.13	0.30
NaCl	0.26	0.24	0.14
Vitamin Premix*	0.30	0.30	0.30
Mineral Premix**	0.30	0.30	0.30
Ginger/ Black pepper / Mixed	0.02	0.02	0.02
Calculated nutrient content			
ME (kcal/kg)	2.850	2.950	3.050
CP (%)	22	20	18.5
Ca (%)	0.90	0.85	0.80
Available Phosphorus (%)	0.45	0.42	0.40
Lysine (%)	1.35	1.20	1.16
Na (%)	0.16	0.15	0.15
Methionine+Cystine (%)	0.97	0.87	0.85

*Supplied Per Kilogram Of Feed: 7.500 IU of vitamin A, 2000IU vitamin D3, 30 mg vitamin E,1.5 µg vitamin B1 2, 2 mg B6,5 mg Vitamin K,5 mg vitamin B2,1 mg vitamin B1,40 mg nicotinic acide, 160µg vitamin Biothine, 12 mg Calcium pantothenate, 1 mg Folic acid 20 mg Fe, 71 mg Mn, 100µg Se, 37mg, Zn,6 mg Cu, 1.14 mg I,400 µg Cu.

Results

Data showed that use of T3 and T4 increased FI significantly in comparison to control diets ($P<0.05$). Body weight gain and total body weight at the end of the experiment were also significantly higher in treated groups compared to the control. Percentage weight of liver and abdominal fat decreased significantly in all treated groups, while percentage weight of drumstick and gizzard increased significantly in the treated groups compared to the control. Triglyceride level decreased significantly in the treated groups while cholesterol level decreased significantly in T2 and T3 groups. Ca concentration decreased significantly in all the treated groups and P concentration increased in T3 and T4.

Discussion

Piper nigrum has medicinal uses and is a common remedy for various disorders of humans in traditional Indian families (Ficker et al., 2003; Mahady et al., 2008). Herati and Marjuki (2011) showed that increase ginger in the ration up to 2% showed lower feed intake and total weigh gain. Herbal plants may provide some compounds that enhance digestion and absorption of some nutrients in the diet. Other researchers proved that there is an increase in body and feed conversion ratio with decreasing

Table 2: The effect of added experimental diets on broilers performance

Treatments	FI (g/d)	BWG (g/d)	FCR	FI (gm)	Pre-slaughter weigh (g)
T1	89.23[b]	40.92[d]	2.17[a]	3767.33[b]	1720.96[c]
T2	90.19[b]	40.93[c]	2.12[b]	3785.67[b]	1774.84[b]
T3	91.20[a]	42.64[a]	2.10[b]	3824.00[a]	1813.62[a]
T4	91.32[a]	41.98[b]	2.09[b]	3831.64[a]	1919.21[a]
SE	0.011	0.04	0.14	171.5	13.12

Means within row with no common on letter are significantly different (p<0.05); T1: control, T2: basal diet plus 0.02% of ginger powder, T3: basal diet plus 0.02% of black pepper powder, T4: basal diet plus 0.02% mixed ginger and black pepper powders
FI: Feed intake, BWG: Body weight gain, FCR: Feed conversion ratio, SE: Standard error

Table 3: The effect of added experimental diets on percentage some part of chicks' bodies

Treatments	Liver (%)	Abdominal Fat (%)	Drumstick (%)	Breast Meat (%)	Gizzard (%)	Heart (%)	Bursa of Fabricius (%)
T1	2.92[a]	3.16[a]	21.24[b]	25.21[a]	2.62[c]	0.20[a]	0.110[a]
T2	2.75[b]	2.93[b]	23.6[a]	25.13[a]	2.76[b]	0.18[a]	0.117[b]
T3	2.67[c]	2.70[c]	23.14[a]	26.16[a]	2.86[a]	0.17[a]	0.115[b]
T4	2.64[c]	2.55[d]	23.05[a]	25.90[a]	2.78[b]	0.17[a]	0.121[a]
MSE	0.05	0.015	0.451	1.67	0.005	0.194	0.018

Means within column with no common letter are significantly different (P<0.05); T1: control, T2: basal diet plus 0.02% of ginger powder, T3: basal diet plus 0.02% of black pepper powder, T4: basal diet plus 0.02% mixed ginger and black pepper powder

Table 4: The effect of added experimental diets on some blood parameters

Treatments	Triglyceride (mg/dl)	Cholesterol (mg/dl)	Ca (mg/dl)	P (mg/dl)
T1	72.13[a]	129.56[a]	8.20[a]	9.79[c]
T2	66.42[c]	120.45[b]	7.51[b]	9.89[bc]
T3	69.44[b]	131.52[a]	7.08[c]	10.42[a]
T4	65.42[d]	123.92[b]	7.15[c]	10.20[b]
SE	0.159	6.48	0.060	0.061

Means within column with no common letter are significantly different (P<0.05); T1: control, T2: basal diet plus 0.02% of ginger powder, T3: basal diet plus 0.02% of black pepper powder, T4: basal diet plus 0.02% mixed ginger and black pepper powder, SE: Standard error

Table 5: The effect of experimental diets on antibody titers against new castle vaccine

Treatments	28 days $_{(log2)}$	35 days $_{(log2)}$	42 days $_{(log2)}$
Control	2.63[c]	2.90[c]	4.01[c]
T1	2.74[b]	3.01[b]	4.16[b]
T_2	2.71[b]	3.05[ab]	4.14[b]
T_3	2.80[a]	3.10[a]	4.21[a]
SE	0.010	0.13	.012

Means within column with no common letter are significantly different (P<0.05); T1: control, T2: basal diet plus 0.02% of ginger powder, T3: basal diet plus 0.02% of black pepper powder, T4: basal diet plus 0.02% mixed ginger and black pepper powder

haematological values of some important blood parameters using ginger or black pepper in broiler diets (Demir et al., 2003; Iqbal et al., 2011).

Al-Harthi (2002) found that broiler chicks fed diets supplemented with hot pepper showed improved feed conversion ratio and concluded that the effect may be due to its stimulative, carminative, digestive and anti microbial properties (Hassanet al., 2007; Herati and Marjuki, 2011; AL-kassie et al., 2011).

Hosseini (2011) showed that black pepper increases digestion through arousing digestive liquids of stomach and eradicates infectious bacteria. Black pepper affects the absorption power, decreases material transit velocity and increases digestive enzymes. AL-kassie et al. (2011) suggested that the better effect of black pepper may be due to the presence of piperazine citrate which probably enhances the secretion of digestive juices in the stomach.

Zingiber has been extensively studied for a broad range of biological activities including antibacterial, anticonvulsant, analgesic, antiulcer, antitumor, antifungal, antispasmodic, antiallergenic and other activities (Akoachere et al., 2002). Ginger contains volatile oils like borneol, camphene, citral, eucalyptol, linalool, phenll andrene, zingibaine, zingiberol, gingerol, zingironeand, shogaol and resin. Ginger has medicinal properties responsible for the taste, the most noteworthy being gingerol and shogaol. Ginger speeds up digestion and enhances protein digesting enzymes. Ginger has antibacterial, antinflammatory action and is known to lower blood cholesterol level in man (Ferreira et al., 1999; Zomrawii et al., 2013). Decrease in cholesterol levels in broilers may be attributed to the ginger possesses antihypercholeste- rolemic activity. The deconjugation of gallbladder acids in small intestine can affects control of serum cholesterol, while deconjugated acids are not capable to absorb fatty acids as conjugated acids. As a consequence, they prevent absorption of cholesterol. The pungent compound of *piper nigrum* especially piperine increases the production of saliva and gastric secretions (Herati and Marjuki, 2011). Also free gallbladder acids attach to bacteria and fibres and this can increase their excretion. This is consistent with the well-observed effect of ginger on lowering blood cholesterol level (Ferreira et al., 1999; Ravindran, 2000; Soumyanath et al., 2006; Zomrawii et al., 2012).

Furthermore, the ingestion of peppercorn increases the production and activation of salivary amylase. The digestive enzymes production by the ingestion of *piper nigrum* probably stimulates liver to secrete bile, which digests food substances (Yoshikawa et al., 1994; Sarica et al., 1995; Zomrawii et al., 2012).

Babu and Srinivasan (1997) suggested that such a cholesterol-lowering effect could be mediated by the stimulation of hepatic cholesterol-7-hydroxylase which converts cholesterol into bile acids, facilitating the biliary cholesterol excretion. Conversion of cholesterol to bile acids is a multiple-step process in which the initial step, 7α-hydroxylation, is the rate limiting reaction. It is possible that in spice fed animals whose liver microsomal aryl hydroxlase activity is stimulated, cholesterol-7-α-hydroxlase is also similarly activated (Akbarian et al., 2012).

Piperine has an excellent bacteriocidal activity against all the Gram positive and negative bacteria. The alkaloids like piperine, piperidine, volatile oil and resins might be responsible for the antibacterial activity. The mechanism of antibacterial action appears to be loss of control over cell membrane permeability (Khalaf et al., 2008; Hosseini, 2011). In addition, several pharmacological effects of the zingiber plant have been reported such as antiulcer effect, antioxidant effect and potent antibacterial activity (Akoachere et al., 2002).

Calcium and phosphorus absorption and metabolism are influenced by many factors, such as the levels and ratio of inclusion in the diet, vitamin D3 and its derivatives, phytase and organic acids. Calcium is also necessary for bone formation; blood clotting and functioning of certain enzymes while phosphorus helps to control acid-alkaline reaction of the blood (Zomrawi et al., 2013). Black pepper and ginger are good source of vitamin B, C, E and D and they have essentials oils that they can help increase absorption of vitamin D3 and may be affective in Ca absorption (Ferreira al., 1999; Greathead., 1999). Zingiber has magnesium, calcium and phosphorus which function together in bone formation, muscle contraction and nerve transmission. The high content of these minerals in ginger makes it a useful candidate for muscle spasms, depression, hypertension, muscle weakness, convulsions, confusion, personality changes, nausea, lack of coordination and gastrointestinal disorders (Yoshikawa et al., 1994). Black pepper contains a good amount of minerals like potassium, calcium, zinc, manganese, iron, and magnesium. Also active principles in the black pepper may increase the gut motility as well as the digestion power by increasing gastro-intestinal enzyme secretions. It has also been found that piperine can increase absorption of calcium, selenium, B-complex vitamins, beta-carotene, as well as other nutrients from the food (Ravindran et al., 2000; Hosseini, 2011).

Conclusion

It was concluded that the use of black pepper and ginger and their mixture as feed additive at the rate of 0.02% enhanced the overall performance of broiler chicks.

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