

Impact of Dietary Ginger and Ginseng Powder in Broiler Diet on the Physiological Traits and Immune Response of Avian Influenza

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Abstract

The study aimed to investigate the synergistic effect of dietary ginger (Gn) and ginseng (Gs) powder on performance and evaluate the immune response to Avian Influenza (AI) vaccine in broilers. A total of 160 unsexed broiler chicks (Ross 308) at one day-old were randomly divided to four equal groups with two replicates. The chicks of the 1st group (control) were fed on a basal diet. The 2nd group fed on a basal diet with adding Gn at (5gm/ kg feed). The 3rd group was fed on a basal diet with adding Gs (5gm / kg feed). While the chicks of the 4th group were fed on a basal diet with adding Gn and Gs at (2.5 gm/kg feed) of each. Immune response against AI was measured at aged (5, 15, 25 and 35) days, while hematological and biochemical tests were measured at the end of the experiment. The results showed significant differences ($P \leq 0.05$) in 2nd group in the total protein and globulin concentrations as compared to other groups and control at 35 days old. No significant difference in albumin concentration, liver enzymes (ALT, AST). Also, the 2nd and 4th groups recorded a significant increase in WBC, RBC, Hb and PCV%, as well as, the superiority in the Ab against the AI at 35 days of age as compared to the other groups. Finding of the current study indicated that groups which receiving dietary Gn and Gs powder showed better health and higher Ab against AI disease vaccine.

Keywords: *Ginger, Ginseng, Avian Influenza.*

Introduction

The poultry industry in many regions of the world faces great challenges represented in finding new ways to confront epidemic diseases. There is no doubt that avian influenza is the biggest and most important of these challenges, and this disease does not only because heavy economic losses to the poultry sector, but also harms human health⁽¹⁾. Therefore, it is necessary to search for new means to curb this deadly

disease. The use of feed additives and nutritional herbs to enhance the health status and immune response of birds that are susceptible to infection may be one of those means, including the use of ginger⁽²⁾, ginseng⁽³⁾, vitamins⁽⁴⁾ and minerals⁽⁵⁾.

Ginger (*Zingiber officinale*) is a major crop, grown primarily in Central Asia. Ginger is a well-known plant that is widely used as a spice and in traditional medicine to cure a variety of ailments⁽⁶⁾. The main important compounds in ginger are gingerol, gingerdiol and gingerdione which have the ability to stimulate digestive enzymes, affect the microbial activity, and having antioxidant activity

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(7).Ginseng (*Ginseng panax*) also known as Asian ginseng, is one of the most well-known medicinal plants in the world, especially in Asian countries, and has been used for thousands of years to maintain bodily homeostasis and increase vital energy (8). Ginseng extract contains a number of important bioactive constituents, namely ginsenosides and flavonoids. It is regarded as an adaptogenic element that aids in the promotion of vitality, improved production performance, and metabolic mission (9). In this study, we investigated the synergistic effect of Ginger and Ginseng powder on some productive performance and some physiological characteristics of broiler chickens, as well as, evaluate the immune response to influenza disease vaccine.

Materials and Method

A total of 160 1-day-old broiler chicks (Ross 308) were randomly assigned to four experimental groups (40 chicks)each having tworeplicate. The experimental diets were prepared by adding certain dietary ginger(Gn),ginsengpowder (Gs) and both together that provided 0 (control), 5 gm, 5gm and (2.5gm+2.5gm) /kg feed in the basal ration. Starter and grower diets were formulated according to the recommendations (NRC, 1994). Water and feed were supplied *ad libitum* throughout the experiment. Immune response against AI was measured at ages (5, 15, 25, and 35) days, while hematological and biochemical tests were measured on the last day of the trial at (35 days) after randomly selected five broilers from each replicate to get the blood for tests.Data

was analyzed with SAS software (10) using LSD and ANOVA to compare between groups.

Results and Discussion

The results showed significant ($P \leq 0.05$) increased in WBCs, Hb and PCV% of the 2nd and 4thgroups as compared with the 3rd and control, while the count of RBCs recorded highest values in 2nd group than other groups (table 1).This increase in WBC count might be dietary ginger (Gn) and ginseng (Gs) powder were affected on the immune response of the vaccinated chicks with AI vaccine, also, the increase in RBC count, PCV and Hb concentration of birds fed the Gnare indication of improved oxygen carrying capacity of the cells which translated to a better availability of nutrient to the birds consequently affecting their well-being. Hematological constituents reflect the physiological responsiveness of animal to its internal and external environment, which includes feed and feeding.

Esonu et al., (11) who referred that hematological profile index a clear picture of the activity of the blood-forming organs, which are used as tools to assess the health and physiological status of farm animals. The blood profile in the body was influenced by nutrition, environment, breed, and the clinical conditions of the animal (12). Olafedehan et al.,(13) said the blood serves as a pathological reflector of the condition of an animal exposed to toxicants and other environmental stressors it is a means of assessing clinical and nutritional health of animals in feeding trials.

Table (1) Synergistic effect of dietary ginger and ginseng powder on blood picture of different groups at 35 days (mean \pm SE).

Groups Parameters	G1 (Control) Basal diet	G2 Ginger	G3 Ginseng	G4 Ginger with Ginseng
WBC(cell \times 103/ μ l)	28.00 \pm 1.90B	36.20 \pm 1.84A	32.80 \pm 0.69A	34.70 \pm 1.27A

Cont... Table (1) Synergistic effect of dietary ginger and ginseng powder on blood picture of different groups at 35 days (mean ± SE).

RBC(cell×106 /µl)	1.38±0.02B	1.61±0.03A	1.40±0.02B	1.43±0.04B
PCV%	33.00±1.34B	39.73±0.46A	34.41±0.55B	37.65±1.00A
Hb(gm/dl)	11.55±0.19B	13.38±0.16A	11.53±0.40B	13.08±0.34A

Means with a different letter in the same row are significantly different (P≤0.05).

Ginger is highly rich in protein and other nutrients like vitamin B and C, minerals in particular iron, and the sulphur containing amino acids, methionine and cysteine⁽¹⁴⁾. The current results agreed with results observed by Kehinde et al.,⁽¹⁵⁾ who reported that Gn supplementation on broiler diet had significantly (P < 0.05) higher PCV and HB concentration. In addition, our results confirmed that there is no toxicity associated with the consumption of Gn and Gs combination. Habibi et al.,⁽¹⁶⁾ found that Gs was not toxic, and hence had no negative effect on the health and physiological condition of the birds. Ginseng had positive significant effect on hematological profile due to the specific effects of saponins which is the main bioactive ingredient in ginseng⁽¹⁷⁾. Amaefule et al.,⁽¹⁸⁾ who observed that ginseng had a positive effect on packed cell volume of broilers fed ginseng and may have accelerated red blood cell formation from the bone marrow.

The results recorded significant (P ≤ 0.05) increase in the 2nd and 4th group in Total protein (TP) and Globulin concentrations as compared with 3rd and control at 35 days of age as shown in table (2). Also, the data revealed that no significant (P > 0.05) difference among the groups in the Albumin and liver enzymes (AST and ALT) concentrations. The increased TP concentration in the serum of broilers supplemented with ginger is consistent with the enhanced antioxidant enzyme activity. Ginger has been shown to contain a high level of plant proteolytic enzyme⁽¹⁹⁾. Ginger could help birds in digest dietary protein upon ingestion^(20,21).

These results were confirmed by Zhang *et al.*,⁽⁶⁾ that referred that supplementation of Gn powder at the level of 5 gm/kg feed tended to increase growth rate and enhanced oxidative stability, increased TP in the serum of broilers. This positive effect is due to Gn powder being rich in bioactive compounds that improve the antioxidant status of the bird and improve protein metabolism.

Table (2) Synergistic effect of dietary ginger and ginseng powder on Total Protein, Albumin, Globulin and Liver enzymes concentrations for different groups (Mean ± SE)

Groups Parameters	G1 (Control) Basal diet	G2 Ginger	G3 Ginseng	G4 Ginger with Ginseng
Total protein(gm/dl)	3.51±0.09C	3.92±0.06A	3.62±0.05BC	3.72±0.04B
Albumin(gm/dl)	2.30±0.07	2.39±0.06	2.32±0.04	2.35±0.05
Glubulin(gm/dl)	1.19±0.03D	1.65±0.03A	1.34±0.05C	1.46±0.03B
ALT(U/L)	26.06±1.17	27.40±1.30	27.40±0.40	28.60±1.71
AST(U/L)	47.77±1.10	46.67±0.41	49.14±1.94	48.02±1.19

Means with a different letter in the same row are significantly different (P≤0.05).

Generally, the increase in TP and globulin concentrations could be due to the role of ginger constitutes (Polyphenolic and flavonoids) the major sources of the antioxidant compounds. These constitutes prevent lipid hydro peroxide formation through their ability to quench free radicals (22), thus Gn will protect hepatic cells from any oxidative damage. Khan et al. (23) indicated that adding Gn to bird diets contributed to protecting the body cell membranes from damage caused by free radicals as a good antioxidant, and since the liver is an important organ in regulating body proteins and thus protecting liver cells from any damage, they contributed in not change protein concentration in the body. Also, table (3) showed that no significant (P>0.05) difference in the liver enzymes concentration (AST and ALT) among the groups at 35 days age. Ginger has active biomolecules such as phenols and flavonoids that fight oxidative stress and subsequently protect the liver cells (24). These results confirmed with Dias et al., (25) and Emadi, and Kermanshahi, (26) who demonstrate profound antioxidant, and hepatoprotective actions of ginger. There had no adverse effects of ginseng on the liver enzymes and health status of the chicks at (2.5% and 0.5%).

Antibody titers (Ab) against Avian Influenza disease (AI) vaccine measured by ELISA test, data of table (3) showed a significant (P ≤ 0.05) higher Ab of the 2nd group than the 3rd, 4th and control. In addition, the 4th group increases antibody titer as compared with the 3rd and control at age 35 day. Increasing the immunoglobulin attribute to role of ginger in rising immunity response in the body by stimulates lymphocyte production, these results confirmed with results of (27). Additionally, Ginseng inclusion in poultry diets enhances the immune function by increasing lymphocyte levels (28). Ginger is associated with properties like antioxidant, antimicrobial, hepatoprotective, immunomodulatory, these positive results indicated that the effect of ginger in the preservation of the immune cells by inhibiting free radicals formation as a product due to cellular immune response during the phagocytosis process against microorganisms when the body attacks (29). Rasha et al., (30) concluded in a study that addition ginger in broiler diets at the level of 0.4%/ kg had increased the serum concentration of total protein, albumin and globulin which is responsible of the humoral immunity. Supplementation of any antioxidants boosted endogenous antioxidants against oxidative stress and prevent lipid and protein oxidation (31).

Table (3) Synergistic effect dietary ginger and ginseng powder on antibody titers for Avian Influenza Vaccine measured by ELISA for different groups (Mean ±SE).

Groups Age	G1 (Control) Basal diet	G2 Ginger	G3 Ginseng	G4 Ginger with Ginseng
5 days	5255.10±160.07 Aa	5205.40±110.07 Aa	5235.10±119.99 Aa	5267.10±133.75 Aa
15 days	1104.00±21.93 Ad	1050.00±7.38 Ad	730.00±44.95 Bd	728.00±21.60 Bd
25 days	1979.40±47.23 Bb	2685.00±66.08 Ac	1128.90±9.76 Cc	1322.60±40.75 Cc
35 days	1633.80±45.87 Dc	3410.80±144.45 Ab	1907.20±91.98 Cb	2198.00±104.73 Bb

Means with a different capital letters in the same row are significantly ($P \leq 0.05$) different. Means with a different small letters in the same column are significantly ($P \leq 0.05$) different.

Nawal et al.,⁽³²⁾ concluded that Gn powder have positively effect on the immune system by increase the antibody titers against viral diseases. Ginger enhances the serological response and had an antioxidant activity (both in vivo and in vitro) mainly due to pungent active principles such as gingerols and shogaols⁽²³⁾. Carrasco et al.,⁽³³⁾ revealed that Gn showed improvement in humoral and cell mediated immune response in immune suppressed mice. The adding of Gn and Gs may have helped in maintaining the cells of the immune system as good antioxidants, as well as enhancing the auto-antioxidants against vaccines and immune stress that occur due to them, as well as preventing the oxidation of fats and proteins in the body.

Ginseng is one of the most valuable medicinal herbs, its most notable features are modulation of the immune system, and activities against stress effect^(34,35). Several studies have demonstrated that the immunostimulatory functions of Gs could be due to the effects of polysaccharides⁽³⁶⁾. Xi et al.,⁽³⁾ reported that dietary maternal Gs polysaccharides supplementation would affect the immune function of sows and then improve the immune function and growth of pigs. The saponins and polysaccharides derived from Gs could enhance immunity in vitro and perform a variety of functions, including immunomodulation, anti-tumor, and anti-oxidant actives^(37,6).

Kim,⁽³⁸⁾ suggested that Gs may improve physiological function and immunity because this herb is rich in monosaccharides that meet most of the requirements and functions of the immune system. While, Ao et al.,⁽³⁹⁾ concluded that influence of fermented red Gs extract has positive effect on immune system of broilers and laying hens, that effects may

attribute to the saponins the main bioactive ingredient in ginseng⁽¹⁷⁾. Experiments of the farm animals indicated that Gs had adjuvant effects in stimulating antibody responses to immunization against various pathogens in cattle and pigs^(40,41). The results of this study indicated that dietary supplementation of ginger and ginseng improves performance and may be utilized as an immunostimulant, therefore, they can be considered as a potential functional ingredient to improve immune response against AI disease of broilers.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Obtained from Institutional ethical committee

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