Zingiber Officinale Effect on Immune Event Against Newcastle Disease Virus with Productive Performance of Broilers

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Abstract

Study the effects of different concentration of Zingiber officinale or called ginger (GG)on productive performance, blood biochemistry as White blood cells (WBC), Red blood cells (RBC), Packed cell volume (PCV), haemoglobin (Hb) and immune status against Newcastle disease (ND) virus of broilers. These experiment used (180) broilers chicks of one day age type Hubbard . All chickens vaccinated against ND on day 7 the chicks, which divided randomly into (4) groups and each group of (45) chicks. The study showed the effects of different concentration of (GG) given in 2g/kg, 4g/kg and 6g/kg with feed Groups of T0, T1, T2, T3, T0 as control and T1, T2, T3, as treatment. Parameters of body weight, weight gain, feed consumption and feed conversion . Statistical significant ($P < 0.05$) increased value of body weight, weight gain, feed consumption and feed conversion was observed in T3, then T2 . A non-significant value was observed in T1 (2g/kg of GG) as compared to T0 (control). Significant ($P < 0.05$) increases in the WBC, RBC, PCV and Hb. The ginger additives groups showed significant ($P < 0.05$) increases in hemagglutination inhibition (HI) titer against ND virus. In conclusion, 4 - 6 g/kg of GG additives to broiler chicks feed, enhanced growth performance, enhance WBC, RBC, PCV, Hb and showed significant ($P < 0.05$) increases in hemagglutination inhibition (HI) titers against ND virus, while group T1 had less significant effects compared to the other groups.

Keywords: *Zingiber officinale, Newcastle virus, Feed Additives, broilers .*

Introduction

The growth and laying performances of birds are frequently improved by using growth promoters or feed additives that have a positive impact on the growth and immune responses. Among these substances antibiotics are no longer used as feed additives, because they are associated with residues in eggs and meat products, and their use has been restricted in many countries[1]. The beneficial effects of natural products are greater than those observed with antibiotics[2], including a lower cost of production and reduced toxicity hazards[3]. Pseudo-fowl pest or Newcastle disease (ND), a devastating disease of poultry seen in chickens and turkeys, caused by Newcastle disease virus (NDV). The signs of disease are high mortality, hemorrhagic intestinal lesions, severe respiratory distress, decrease of egg production, and nervous disorders[4]. The NCV injected in embryonated eggs could grow in cells lining the allantoic cavity. The virus grows in these cells, destructs them and is then released in the allantoic fluid reaching high titers in approximately 24 hours. If virulent NDV strains are inoculated, most of the embryos die two days after inoculation. Injected NCV causes remarkable histopathological changes in dead or alive embryos[1]. Vaccination programs can provide protection against NDV outbreaks, but they are not sufficient because infections by NC virus have remained frequent around the world in the recent years[5]. There is no known specific treatment for NDV, like other viral diseases . Several antiviral drugs are known to treat mammalian viruses, however their use in avian disease are limited because these agents may be toxic for the host cells . Although there is little documentation, there has been experimental evidence regarding the ability of several plants to treat numerous diseases[6]. Zingiber officinale Roscoe, belonging to the Zingiberaceae family,

popularly known as ginger, is a monocotyledonous herbaceous plant and one of the most common food-flavoring spices used worldwide[7]. In recent years, several pharmacological properties of ginger, such as ant inflammatory, analgesic, gastrointestinal regulating agent, antioxidant and antimicrobial properties have been identified[8]. Live microbial feed preparations such as probiotics, prebiotics, or symbiotic play an important role in increasing the resistance to disease by improved immune response, thereby reducing the use of antibiotics[9,10]. Some probiotic microorganisms have been reported to produce different types of bacteriocins, organic acids and reuterin which act by preventing pathogen growth[9]. Furthermore, probiotics supplements can affect the intestinal environment by increasing desirable microbial growth[9]. In parallel, there are few studies evaluating the performance and health-related traits of broilers receiving either ginger (Z. officinale) or particular mixtures of probiotics cultures to verify the possible beneficial effects of natural feed additives as substitutes of probiotics.

Materials and Method

Plant material and preparation: GG (Zingiber officinale) rhizomes were purchased from a local market in,Babylon,Iraq to be used in dietary treatment .

Experimental Animals: This study was conducted at the period for (42) days started from Febraury-June 2019 in physiology department of veterinary medicine of AL-Qassim green university. One hundred eighty broilers chicks one day old age type Hubbard chicks,. were divided randomly into (4) groups, (45 chicks per group) treatment had three replicates (15 birds) and received various treatments during the experimental period (6)weeks . Chicks were given starter diet (7-21) days and a finisher diet (22-42) days, GG was purchased from a local market, sundried, ground to a fine powder, and stored in an airtight polyethene bag until required for use, as shown in **table** (1). The additives were mixed with basic feedings to form the following parameters :

T0 : Control group chicks fed the standard diet.

T1 : Chicks fed standard diet plus 2g/kg GG.

T2 : Chicks fed standard diet plus 4g/kg GG.

T3 : Chicks fed standard diet plus 6g/kg GG.

A room was used inside the field controlling its thermal conditions at (32-35)°C. It was washed with soap and water,then Fumigation with formalin and potassium permanganate. It was sprayed with wood sawdust and supplied with a number of feeders and Fountains. The chicks and feed were weighed by One-sided balance. Body weight, weight gain, feed intake and feed conversion ratio were included within the experiment period. Hemagglutination inhibition (HI) six blood samples were collected from each group at 21, 28, 35 and 42 days old. The blood samples were centrifuged to separate the serum and estimate the antibody titer against the NC using a hemagglutination inhibition test, according to [11]**.**

Haematological Assay: On the 43th day of study, blood samples were randomly collected from groups of treatment. The blood samples were collected via the wing veins using sterile needles and syringes. The blood samples for hematological parameters were collected into well-labeled and sterilized bottles containing ethylene diamine tetra acetic acid (EDTA), as anticoagulant. The samples were investigated for the following hematological parameters as white blood cell (WBC), red blood cell count (RBC), haemoglobin (Hb) and packed cell volume (PCV).[12]

Vaccination of chicks: The birds were vaccinated against infectious bronchitis day 1 and 14 day, ND day 1 and day 7, avian influenza day 1 and infectious bursal disease day 21.

Statistical Analysis: The statistical analysis was carried by using the mean differences between the averages of the studied traits were determined at the probability level of (0.05) using the Duncan test **(13)**. Statistical data were analyzed using the (SAS,2010)[14].

Table 1: The nutritional composition of dietary treatments

Ingredients (%)	Starter (7-21) days	Finisher (22-42) days
Yellow corn	35	40
Wheat	25	25
Soybean meal (44 %)	25	25

Ingredients (%)	**Starter (7-21) days**	**Finisher (22-42) days**
Protein concentration	10	5.0
Dicalcium phosphate	2.0	2.0
Limestone	1.0	1.0
Vitamin/Mineral premix	1.5	1.5
Salt	0.5	0.5
Total	**100**	**100**
Calculation composition		
Crude protein (%)	22.5	20.4
Kcal ME/Kg diet	3155	3213
Calorie: protein ratio	140	157.5
Calcium (%)	0.9	0.8
Phosphorus (%)	0.8	0.5

Table 2: Effect of different levels of *Zingiber officinale* with feed on broiler on body weight g/time period

Ages	**T0**	**T1**	**T2**	**T3**
Initial weight (gm)	42.58 ± 0.22 A	42.40 ± 0.27 A	42.12 ± 0.20 A	42.99 ± 0.41 A
7 day	136.170 ± 0.66 A	133.200 ± 0.26 B	133.700 ± 0.69 B	135.880 ± 0.45 A
14 day	288.640 ± 0.80 B	287.500 ± 0.60 B	289.710 ± 1.23 B	293.620 ± 0.60 A
21 day	539.334 ± 0.58 C	539.894 ± 0.58 C	544.456 ± 0.77 B	548.16 0± 0.50 A
28 day	841.216 ± 0.71 C	842.660 ± 0.66 C	850.640 ± 0.66 B	855.360 ± 0.91 A
35 day	1260.570 ± 0.68 D	1263.350 ± 0.25 C	1275.530 ± 0.51 B	1282.530 ± 0.67 A
42 day	1678.32 ± 0.59 C 0.59 C	1684.58 ± 0.31 C	1697.29 ± 0.35 B	1705.39 ± 0.54 A

The trait which carried out different letters horizontally indicates significant differences at 0.05 .

Table 3: Effect of different levels of *Zingiber officinale* with feed on some productive performance parameters on broilers

Parameters	**T0**	**T1**	**T2**	**T3**
Average feed intake (g)	2902.47± 0.59 C	2905.16 ± 0.55 B	2908.00 ± 0.52 A	2915.72± 0.52 A
Average weight gain (g)	1636.11± 0.45 C	1642.97± 0.71 C	1658.28± 0.70 B	1665.36± 0.58 A
Feed conversion ratio (FCR)	1.774 ±0.01 A	1.768 ± 0.01 B	1.753 ± 0.06 A	1.750 ± 0.08 A

The trait which carried out different letters horizontally indicates significant differences at 0.05

Table 4: Effect of different levels of *Zingiber officinale* with feed on the blood parameters (White blood cells (WBCs), red blood cells (RBCs), haemoglobin (Hb), packed cell volume (PCV)) of the broiler chickens

Parameters	**T0**	**T1**	**T2**	**T3**
WBCs (103)	19.82 ± 0.63 A	20.08 ± 0.59A	21.14 ± 0.54B	21.22a ± 1.15 B
RBCs (106)	1.93± 0.02 A	1.94 ± 0.94 A	2.11 ± 0.03 B	1.93 ± 0.8 B
Hb (g)	6.54 ± 0.33 A	6.75 ± 0.25 B	6.75 ± 0.21 B	6.77 ± 0.95 B
PCV%	24.66 ± 2.89 A	26.66 ± 2.08 B	28.20 ± 2.23 C	30.19 ± 3.04 D

The trait which carried out different letters horizontally indicates significant differences at 0.05.

WBC: White blood corpuscles, RBC: red blood corpuscles, Hb: haemoglobin, PCV: packed cell volume

Table 5: Effect of different levels of *Zingiber officinale* with feed on mean antibody titer (log2) against the Newcastle Disease virus in all groups

Age of birds (Days)	T0	T1	T2	T3
21	3.38±0.22 A	4.01±.50 A	3.94±0.37 A	3.97±0.31 A
28	3.15±0.17 A	3.55±0.55 A	3.73±0.37 A	3.84±0.34 A
35	3.26±0.30 A	4.56±0.25 B	4.98±0.00 B	4.74±0.23 B
42	2.16±0.27 A	4.18±0.52 B	466±0.22 B	4.53±0.45 B

The trait which carried out different letters horizontally indicates significant differences at 0.05

Result and Discussion

The parameters of growth performance, were examined in the current study, these parameters are good indicators of the improvement effect of ginger supplementation at different levels on broiler performance. In the present study, final body weight, body gain, feed intake and feed conversion ratio improved after supplementation of ginger at levels of 4 g/kg - 6 g/kg,while diet .. The GG had significant effects ($P < 0.05$) on total body weight, feed intake, weight gain and feed conversion ratio . There were significant differences in all performance traits (Table 3,4). Chickens on T2 and T3 better than those in T1 and T0 groups. The results showed significant effects ($P < 0.05$) on the growth performance of broilers, the advanced may be due to stimulatory effect of ginger extract on digestive juices, microflora and nutrient absorption in digestive tract. The present results are in agreement with the findings of[15] who observed that active compounds of ginger (shogaols, gingerdione, gingerol, phenolic and gingerdiol) . Similar results were observed by[16]. who observed that ginger acts as stimulant for feed digestion and conversion which increase body weight gain. Its active compounds which improves feed digestion and stimulates enzymes thus enhancing feed conversion ratio which lead to an increase body weight. Ginger contains volatile oils like borneol, camphene, citral, eucalyptol, linalool, phenllandrene, zingibaine, zingiberol, gingerol, zingironeand, shogaol and resin. Ginger's have medicinal properties are chemicals responsible for the taste, the most noteworthy being gingerol and shogaol. Ginger speeds digestion, and enhances by a protein digesting enzyme, zingibaine found in ginger. It has antibacterial and anti inflammatory actions[17]. This observation however, disagree with the reports of[18] who reported that the inclusion of ginger did not improve the weight gain of broilers, also[19] reported that no significant difference among birds fed on 0.5%, 1% and 1.5% ginger powder on feed conversion ratio.[20] examined the effect of processed ginger with different size on growth performance and showed that the ginger additive had no significant effect on the feed efficiency. There was significant increase ($P < 0.05$) in the WBC, RBC, PCV and Hb, of birds on the ginger T2 and T3 than T0,[21] reported that the number of erythrocytes (RBC) in chicken is influenced by the conditions of the animal. The increase in PCV, Hb, and RBC contents of the blood of birds fed the test ingredients is an indication of improved oxygen carrying capacity of the cells which translated to a better availability of nutrients to the birds consequently affecting their well-being,while [22] stated that The inclusion of ginger in broiler diets in the current study did not affect the haematological parameters of the chickens except for the total WBC and percentage of neutrophils. There was a significant increase in the total WBC as the ginger level increased in the diet[23] reported that there are significance increase was found among the groups but 2% ginger treated birds show relatively high PCV with least standard deviation and other hematological parameters are almost similar as positive control.

Conclusion

Conclusion Based on the current findings, dietary supplementation of different levels of ginger powder at level up to 6 g/kg diet plays a role in enhance broiler growth performance and improving of WBC, RBC, PCV and Hb. Moreover, inclusion of ginger up to level 6 g/kg diet contributed to improvements of the immune response. This improvement on growth and health may be due to the biological activities of this plant to improve growth or that may be due to its role as enhanced digestibility, anti-oxidant, and anti-microbial, activities and properties and the prevention of gastric toxicity.

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Conflict of Interest: None to declare.

Ethical Clearance: All experimental protocols were approved under the College of Veterinary Medicine and all experiments were carried out in accordance with approved guidelines.

References

1. Botsoglou NA, Florou-Paneri E, Christaki E. Effect of dietary oregano essential oil on performance of chickens and on iron-induced lipid oxidation of breast, thigh and abdominal fat tissues. Br. Poult. Sci. 2002; 43: 223-230.
2. Manesh M, Kazemi S, Asfari M. (Teucrium polium) and watercress (Nasturtium officinale) extract on performance, carcass quality and blood metabolites of male broilers. Research Opinions in Animal and Veterinary Science. 2012; 2: 66-68.
3. Devegowda G. Herbal medicines, an untapped treasure in poultry production. Proceedings, 20th World Poultry Congress, September 2-5, 1996, New Delhi, India. 1996.
4. Al-Garib SO, Gielkens AL. Tissue tropism in the chicken embryo of non-virulent and virulent Newcastle diseases strains that express green fluorescence protein. Avian Pathol. 2003; 32(6):591–6.
5. Yi J, Liu C. Detecting Newcastle disease virus in combination of RT-PCR with red blood cell absorption. Virol J. 2011; 8:202.
6. Mtambo MMA, Mushi E. Evaluation of the efficacy of the crude extracts of Capsicum frutescens, Citrus limon and Opuntia vulgaris against Newcastle disease in domestic fowl in Tanzania. J Ethnopharmacol. 1999; 68(1-3):55–61
7. Wang W.H., Wang Z.M. Studies of commonly used traditional medicine-ginger. China J. Chin. Mater. Med. 2005;30:1569–1573. [PubMed] [Google Scholar
8. Khan R, Naz S, Nikousefat Z. Potential applications of ginger (Zingiber officinale) in poultry diets. World's Poult. Sci. J. 2012; 68:245–252.
9. Talebi A, Amirzadeh B, Mokhtari B, Gahri H. Effects of a multi-strain probiotic (PrimaLac) on performance and antibody responses to Newcastle disease virus and infectious bursal disease virus vaccination in broiler chickens. Avian Pathol. 2008; 37: 509–512.
10. Azzaz H, Morsy T. Microbial feed supplements for ruminant's performance enhancement. Asian J. Agric. Res. 2016; 10:1–14.
11. Tambekar D, Bhutada S. An evaluation of probiotic potential of Lactobacillus sp. from milk of domestic animals and commercial available probiotic preparations in prevention of enteric bacterial infections. Recent Res. Sci. Technol. 2010; 2:82–88.
12. Grimes S. A basic laboratory manual for the small-scale production and testing of I-2 Newcastle disease vaccine. In FAO Regional Office for Asia and the Pacific, Bangkok, Thailand. 2002; 139.
13. Lamb G. Manual of veterinary laboratory technique. CIBA-GEIGY, Kenya. 1991; 98-99.
14. Duncan C. Multiple range and multiple (F) test. Biometrics. 1995; 11: 1-12 .
15. SAS, institute. Statistical analysis system. SAS users Guide: Statistical version,9.12 end., SAS institute Inc.Release 9.12 Tsozo, North Carolina state University of Cary NC,U.S. 2010.
16. George, O.S., Kaegon, S.G.. Effects of graded levels of ginger (Zingiber officinale) meal as feed additive on growth performance characteristics of broiler chicks. International Journal of Science and Research. 2013; 6: 521- 524
17. Conley M. Ginger-Part Ii. Available At: Http://www.Accessnewage.Com/Articles/Health/Ginger2.Htm. Diakses Pada 2005.
18. Zomrawii WB, Abdel Atti K. The effect of ginger root powder (Zingiber officinale) Supplementation on broiler chicks performance, blood and serum Constituents. Online Journal of Animal and Feed Research. 2012; 1, 6: 457-460.
19. Ademola S. Serum lipid, growth and haematological parameters of broilers fed garlic, ginger and their mixtures. World Journal of Agricultural Science, 2009; 5: 99-104
20. Wafaa B, Khadiga A. The Effect of Ginger Root Powder (ZingiberOfficinale) Supplementation on Broiler Chicks Performance, Blood and Serum Constituents. Online Journal of Animal and Feed Research. 2012; 1(6): 457-460
21. Zhang GF, ZB Yang, Y Wang, WR Yang, SZ Jiang, GS Gai. Effects of ginger root (Zingiberofficinale)

processed to different particle sizes on growth performance, antioxidant status, and serum metabolites of broiler chickens. Poultry Science. 2009; 88: 2159-2166

22. Mitruka B, Rawnsley H, Vadehra, B. Clinical biochemical and haematological reference values in normal experimental animals. Masson Publishing USA Inc. 1977; 272.
23. H Al-Khalifa A. Al-Nasser G.. Effect of Ginger on Haematological Parameters in Broiler Chickens International Journal of Science, Engineering and Management (IJSEM). 2018;3(4)