Effect Of Propolis As Natural Supplement On Productive And Physiological Performance Of Broilers

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ABSTRACT: This study was carried out on 180, 1-day old, unsexed broiler chicks to evaluate the effect of propolis on growth and immunological parameters, and some biochemical parameters. Chicks were divided into 6 equal groups with 30 chicks in each group and each subgroup was allotted into 5 replicates (6 each) in a complete randomized design. The dietary treatments were control (without supplementation), Tylosin at 100 mg/kg diet (as a positive control), and propolis at levels of 100,200,300 and 400 mg/kg diet. The study resulted that adding propolis to broiler's diets improved body weight, and body weight gain. Chicks fed on diets supplemented with propolis were significantly decrease their feed consumption. On contrary, chicks consumed the maximum quantity of feed from the control diet. The best ratio in FCR was recorded in chicks fed on 300 mg propolis. Propolis caused significant decreases ($P \leq 0.01$and 0.001) in red blood cell (RBC) counts, packed cell volume (PCV), and hemoglobin (Hb). While a nonsignificant increase in white blood cell (WBCs) counts was detected. Serum total lipids, cholesterol, high-density lipoprotein, and triglycerides significantly decreased ($P \leq 0.01$) with the inclusion of different levels of propolis and Tylosin as compared to the control group. The results showed a significantly increased ($P \leq 0.001$) in serum total antioxidant capacity and a significantly decreased ($P \leq 0.05$) in malondialdehyde (MDA) compared to the control group. These results mean that supplementing the dietary with propolis might be useful in productive parameters and can be used as an alternative antibiotic in broiler diets.

Keywords: Boiler, Propolis, Performance, Hematology, and Immunity.

INTRODUCTION

In 2006, the European Union restricted using antibiotic growth promoters (AGPs) in the poultry feed industry (El-Hack et al., 2016). Moreover, there are concerns about the risks of synthetic feed additives causing toxic effects, and that led manufacturers to search for various natural dietary additives. Poultry nutritionists have made great efforts to find natural additives that could increase the immune system maintenance growth, meat quality, and feed utilization in turkeys, and broilers and laying hens (Raheema, 2016; Aguihe et al., 2017). At present, many studies have revealed the important role and positive effects of natural feed additives as substitutes for antibiotics in various avian species (El-Hack et al 2016., Arain et al., 2018). Bee products is used as folk medicine since ancient times. There is a recent promising insight into the study of bee products like honey, royal jelly, propolis, bee venom, and bee pollen (Seven et al., 2014). The purified active compounds, various extracts (crude extracts), and the other raw substances of bee products have been demonstrated strong act of antioxidant, antimicrobial, and anti-inflammatory characteristics (Premratanachai and Chanpen, 2014). The worker bee gathers the sap of plants, leaves, and buds from various plants and produces the propolis which is a resinous mixture substance (Aygun et al., 2012). According to findings from animal studies, propolis may alleviate the negative effects of oxidative stress on the body's immune system. Propolis includes about 300 ingredients (Seven et al., 2012b) and the different types of pollens, plants, and exudates that the honeybee pests collected to influence the chemical composition and structure of propolis. Therefore, propolis' biological characteristics are related to its topographical area, which may affect how it could enhance the health of chickens when fed as a dietary supplement. (Bankova, 2005). Flavonoid compounds are used in different biological and pharmacological products and play an important role in providing antimicrobial, anticancer, anti-inflammatory, and antioxidant actions (Aygun et al., 2012). Moreover, some trials demonstrated that propolis might improve the adverse effects of oxidative stress that are produced by factors like keeping density and heat stress (Mahmoud et al., 2015) .

Propolis has previously been used in chicks as an antioxidant agent, growth promoter, and immunity enhancer (Seven, 2008). The concentrations of triglyceride and cholesterol were remarkably reduced in chicks fed on 300 ppm propolis per kilogram at 35 days (Attia et al., 2014). These results might be due to the potential of antioxidants in propolis that improve the biological acts (lipid absorption and liver morphological composition) (Babinska et al., 2013). Seven et al. (2012a) indicated that the positive results of bee propolis on the digestibility of nutrients could be related to its beneficial palatable, immunomodulatory properties, antimicrobial, and antioxidant. Propolis's phenolic components, which include flavonoids, phenolic acid, caffeic acid, phenethyl ester, and terpenoids, are what give it its antioxidant properties. (Wang et al., 2004), that enhance glucocorticoid receptor movement in the hippocampus, and reduce the production of ROS molecules and the level of corticosterone, thus improving stress effects. The aim of the study is to investigate the effect of dietary propolis on the productive performance, carcass characteristics, blood components and antioxidative properties of broiler chickens.

MATERIALS AND METHODS

The trial procedures and methods were done by following relevant guidelines and regulations. The Faculty of Agriculture Saba Basha, Alexandria University, approved all experimental protocols.

Propolis obtained as a powder from the Egyptian market (HNBOOMBP- 01, code: 410004900, Henan Boom, China). Tylosin was obtained from Chemical Industries Development (CID) El-Tlbia-Pyramids-Giza-A.R.E-G.C.R19717- Giza, Egypt).

Experimental design

One hundred and eighty, 1-day-old Ross 308 chicks were randomly divided into 6 groups with 30 chicks in each group and each subgroup was allotted into 5 replicates in a complete randomized design. Chicks were wing -banded, weighted and randomly housed in cages. The house temperature was kept at about 35°C through the first 72 hours, then reduced weekly by 2 ° C until reached 24° C and kept until the end of the experimental period. In all the experiment groups, the birds were subjected to 23 hours of light at an intensity of 3 watts / m2 along the experiment period which extended to the age of 42 days, feed and water were available ad libitum throughout the experimental period. Chicks were fed a starter diet from 1-21 days of age, and a growing diet from 22-42 days of age. The composition and chemical analyses of the trial basal diets are shown in (Table 1) .

experimental groups were as follows: the first group was fed the basal diet and served as control; while the 2nd was fed a basal diet supplemented with 100 mg tylosin /kg diet, 3rd,4th 5th, and 6th groups were fed a basal diet supplemented with different level of propolis 100,200,300 dnd 400 mg / kg diet respectively .

Collected performance data.

Live body weight, weight gain and feed consumption of chicks were recorded weekly. The feed conversion ratio was calculated (g feed / g gain) .

Blood collection and hematobiochemical analyses.

At 6 weeks of age, five chickens from each treatment were randomly taken and slaughtered, and blood samples were collected and divided into two equal parts: the first part was collected on heparin as anticoagulant (0.1 ml of heparin to 1 ml of blood) according to Hawk et al. (1965) to determine the blood hematology (white blood cell counts (WBCs) and the differential of white blood cells, red blood cells (RBCs), hemoglobin concentration (Hb), and packed cell volume (PCV), and the remaining part was immediately centrifuged at 3500 rpm for 15 min and the clear serum was separated and stored in a deep freezer at − 20 °C until
biochemical analysis (total protein, albumin, alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase, uric acid, creatinine, total lipids, cholesterol, low-density lipoprotein, high-density lipoprotein, triglycerides) were performed using the commercial kits produced by Biodiagnostic, Egypt (www.bio-diagnostic .com).
Serum total antioxidant capacity, and malondialdehyde were analyzed using the commercial kits produced by Biodiagnostic, Egypt (www.bio-diagnostic .com), in accordance with the method of Motor et al.(2014) .

Lymphoid organ weights. At the end of the experimental period, five birds from each dietary treatment were randomly taken, fasted for 12 h then weighed and slaughtered to complete bleeding, and weighed to determine the relative weight of the immune organs (spleen, bursa, and thymus gland) Toghyani et al.(2010) .

Statistical analysis. The differences among treatments were statistically analyzed by one-way ANOVA using SPSS® (2012) statistical software package for windows version 11.0. The significant differences between treatment means were separated by Duncan's Multiple Range-test (Duncan, 1955).

Table (1): Composition and calculated analysis of the basal experimental diet

Ingredients (%)	Starter	Grower
Yellow Corn	55.750	59.590
Soybean meal(48%cp)	38.000	33.150
Sunflower oil	2.000	3.000
Mono Calcium phosphate	1.600	1.600
Limestone	1.600	1.650
Sodium Chloride	0.300	0.300
Vit. and Mineral mix*	0.300	0.300
DL-Methionine	0.210	0.210
Lysine	0.200	0.200
Total	100.00	100.00
Calculated analyses: **		
Crude protein (%)	22.98	20.98
ME kcal/kg	3004	3104
Crude fat (%)	2.50	2.60
Crude fiber (%)	2.71	2.60
Calcium (%)	0.99	1.00
Phosphorus available (%)	0.49	0.48
Mathionine(%)	0.57	0.48
Mathionine+cysteine(%)	0.84	0.83
Lyine (%)	1.37	1.25

* Each kg of vitamin and minerals mixture contained: Vit. A, 4,000,000 IU; Vit. D_3, 500,000 IU; Vit, E, 16.7 g., Vit. K, 0.67 g., Vit. B1, 0.67 g., Vit. B2, 2 g., Vit. B 6, .67 g., Vit. B12, 0.004 g., Nicotinic acid, 16.7 g., Pantothenic acid, 6.67 g., Biotin, 0.07 g., Folic acid, 1.67 g., Choline chloride, 400 g., Zn, 23.3 g., Mn, 10 g., Fe, 25 g., Cu,1.67 g., I, 0.25 g.,Se, 0.033 g. and,Mg, 133.4 g.

[1] According to **NRC (1994).**

RESULTS AND DISCUSSION

1. Productive performance

Results presented in (Table 2) indicate that there are no significant differences in initial body weight among different treatments.

Results showed that various treatments had insignificant effects on body weight up to 42 days of age, however, there were significant ($P \leq 0.01$) differences on body weight recorded at 21 days of age, groups that fed varying levels of propolis had heavier body weights than control group. The highest value was observed in chicks fed 300 mg propolis/kg diet as compared to the other experimental groups at 42 days of age. This group surpassed the control one by 3.3%, while body weight gain was insignificantly affected due to different treatments. These observations are in the same line with the Mahmoud et al. (2013) observed that addition of 100, 250, 500 and 750 mg propolis /kg diet not improved broiler performance. Also, Kleczek, et al. (2014), and Zeweil et al. (2016a) detected that body weight and weight gain did not significantly affect in broiler and quail. Propolis as well as its extracts sources vary based on geographical diversity therefore, differences in the results for performance characteristics may be related to this (Denli et al. 2005).

In contrast Tayeb and Sulaiman, (2014), Attia, et al. (2014), Abou-Zeid et al. (2015), Zafarnejad et al. (2016), Babaei et al. (2016), Dosoky et al. (2016) and El-Neney et al. (2017) all approved that there is significant increase in live body weight with the supplementation of propolis. that effect could be a result of the antimicrobial activity of propolis components, follow-on in improving the digestive system as reported by Denli et al. (2005). Propolis promising as an alternative to antibiotics in the animal industry because of its high potential biological properties such as antimicrobial, antioxidant and antiseptic activities, and the results have proven that propolis decrease the lactate bacteria population growth, which predominates in the upper gastrointestinal tract of the broiler. Although these bacteria (Lactobacillus, Streptococci and Staphylococci) may prohibit Salmonella implantation in pigs and chickens (O'connor- dennie, 2004). In addition to its antimicrobial properties, propolis may also contain micronutrients that have positive effects on bird health and metabolism. (Viuda-Martos et al., 2008). Babińska et al. (2012) and Attia, et al. (2014) attributed the Improving in reproductive parameters with respect to the state of the gastrointestinal tract (mainly due to antibacterial activity), the digestive process and the antioxidant properties of flavonoids that have a positive effect on the absorption of nutrients. The current results also showed that the higher levels the propolis, the

Table (2): Effect of propolis treatments on growth performance of chicks through growing period

Items	Dietary treatments*							
	T1	T2	T3	T4	T5	T6	MSE	*P* value
Live body weight (g/bird/period)								
1 day	42.22	42.40	42.33	42.28	42.53	42.14	0.177	0.992
21days	787.17^{c}	876.67^{a}	844.83^{ab}	849.00^{ab}	852.00^{ab}	816.83^{bc}	7.505	0.012
42days	2585.20	2630.80	2567.30	2607.50	2670.70	2625.70	19.805	0.729
Body weight gain (g/bird/period)								
1-21 days	744.95	834.26	802.50	806.72	809.47	774.70	9.849	0.127
21-42 days	1798.10	1874.30	1722.50	1758.50	1818.70	1808.90	24.211	0.595
1-42 days	2542.80	2708.30	2524.90	2565.00	2628.10	2568.70	25.671	0.335
Feed consumption (g/bird/ period)								
1-21 days	1055.80	1075.70	1082.20	1086.70	1067.20	1081.30	7.189	0.854
21-42 days	3021.30	3010.20	3014.70	2992.90	3010.40	2995.20	29.584	1.000
1-42 days	4077.10	4085.90	4096.90	4079.60	4077.60	4076.50	30.549	1.000
Feed conversion ratio								
1-21 days	1.417^{a}	1.289^{c}	1.348^{abc}	1.347^{abc}	1.318^{bc}	1.395^{ab}	0.014	0.054
21-42 days	1.680	1.606	1.750	1.701	1.655	1.655	0.022	0.771
1-42 days	1.603	1.508	1.590	1.590	1.551	1.586	0.015	0.484

*T1 (Control) - T2 (Control +100 mg Tylosin/kg diet) - T3 (Control +100mg propolis/kg diet) - T4 (Control +200mg propolis/kg diet) - T5 (Control +300mg propolis/kg diet) - T6 (Control +400 mg propolis/kg diet).

$^{a-c}$ different superscripts within a row indicate significant differences ($p \leq 0.05$)

increasing in the feed intake. These results go with (Canogullari et al. 2009, Abdel-Rahman, and Mosaad, 2013 and Mahmoud et al. 2013) who indicated supplementing poultry diets with propolis has no significant effect on average daily feed consumption when compared with the control. And that's opposed to the results of (Abou-Zeid et al. 2015, Attia et al. 2015 and Babaei et al. 2016). Zeweil et al. (2016a) showed a significantly decreased ($P \leq 0.05$) decrease in the quail feed intake which supplemented with 500 mg propolis in comparison with the control group.

The best value of feed conversion ratio was noticed in the group fed Tylosin and 300 mg propolis/kg as compared with other experimental groups. This improvement in feed conversion ratio could be attributed to their antimicrobial, antioxidant activity and improving nutrient utilization due to the presence of phenolic and flavonoids compounds (Tatli seven et al., 2009, Haro et al. 2000) .

These effects may be due to the content of antioxidants, vitamins, minerals, phenolic constituents, and enzymes (El-Hanoun et al., 2007). In addition,it contains essential fatty acids and aromatic oils, protein, amino acids, vitamins, flavonoids, and minerals like Al and Ca (Viuda-Martos et al., 2008). These results are well agreed with the previous results of Babaei et al. (2016) and Dosoky et al. (2016) and El-Neney et al. (2017). The result may be due to that Propolis supplementation affects feed consumption. Also, this effect is due to high content of flavonoids and healthy conditions of birds fed Propolis.

2. Hematological parameters:

Hematological parameters are good indicators of physiological or pathophysiological health status of the body (Khan and Zafar, 2005) .

The results revealed that, red blood cells count, packed cell volume, hemoglobin concentration heterophils (H), H/L ratio, and basophils were significantly affected ($P \leq 0.01$and 0.001) affected by different treatments. However, white blood cells count, lymphocytes (L), monocytes and eosinophils were not significantly affected by different treatments (Table 3). It was observed that group received 100 mg Tylosin significantly contained the highest number of red blood cells compared to other groups. while the fourth group had the significant minimum blood counts compared to control groups.

In this respect, the continuous or intermittent addition of propolis in broiler rations in a 300 mg/kg diet, increases erythrocytes and hemoglobin. Attia et al. (2014). The same results for Sasso chickens obtained by Omar et al. (2014), and Sherif and El-Saadani (2016) for laying hens. In quail, Dosoky et al. (2016) found that propolis supplementation significantly enhanced RBC count while, WBCs, PCV, heterophils (H), H/L ratio, basophils and Hb were not significantly affected by different levels of Propolis. Shaddel-Tili et al. (2017) refer that propolis had not affected erythrocyte and leukocytes counts, PCV, and Hb concentration of broiler ($P>0.05$). Moreover, the heterophils were increased in group suppled with high propolis levels. Recently, Fouad et al. (2021) found that propolis supplementation significantly increased blood components; Hb, RBC, PCV, WBCs, and lymphocyte.

3. Lymphoid organs:

Results illustrated in Table 3 indicated that the relative weight of bursa of fabricius was significantly affected ($p<0.05$) with the addition of 400 mg propolis /kg diet when compared with control and other dietary treatments .

Data in (table3) revelated that, the relative weight of the thymus and spleen were insignificantly affected with by the addition of propolis levels or Tylosin in broiler diets.

The results agreed with Zeweil et al. (2016a), Dosoky et al. (2016) and El-Neney et al. (2017). The increase in lymphoid organs for treated groups could primarily related to the increase in growth performance. Also, the enhancement in growth performance resulted from the addition of propolis the better absorption of amino acids or/and due to antibacterial properties of propolis.

In fact, the central lymphoid organs in poultry are the bursa of Fabricius and the thymus glands which have an essential role in the ontogenetic development of adaptive immunity in birds, and the T- and B-cell concept entered the vocabulary of immunology only after basic research with the chicken model revealed an immunological role for the bursa of Fabricius (Cooper et al., 1966) and the avian thymus (Cooper et al., 1966) which involved in regulating the humoral- and cellular- mediated immunity.

4. Blood constituents:

As shown in Table 4, serum total protein and globulin values were increased, also, serum albumin values were increased, except in the group fed on 100 mg propolis. On other hand A/G ratio was decreased at 6 weeks of age.

Abdel-Rahman and Mosaad, (2013) noticed that Muscovy ducks which raised at 33°C and fed on 2g propolis per kilograms diets, its serum total protein was significantly higher in total globulin and albumin concentration. Mahmoud et al. (2014) found that the addition of 250 mg/kg propolis, insignificantly increased the serum total protein and total globulin concentrations and decreased the albumin / globulin ratio. But the opposite effect occurred at higher doses (750 mg/kg) .

The different levels of propolis did not significantly ($P \leq 0.05$) influence the serum uric acid and aspartate aminotransferase concentration

Table (3): Effect of propolis treatments on hematological parameters lymphoid organ weights (%) of chicks at 6 weeks of age

Items	Dietary treatments*						MSE	*P* value
	T1	T2	T3	T4	T5	T6		
Hematological parameters								
Red blood cells (RBCs10^6/mm^3)	1.96^{b}	2.34^{a}	1.86^{b}	1.69^{b}	1.85^{b}	1.78^{b}	0.053	0.001
White blood cells (WBCs10^3/m^3)	19.60	21.20	18.50	18.86	18.78	18.60	0.320	0.107
Hemoglobin (Hb g/dl)	9.33^{ab}	10.97^{a}	8.83^{b}	6.37^{c}	8.80^{b}	8.40^{b}	0.350	0.001
Packed cell volume (PCV %)	24.00^{b}	26.93^{a}	22.23^{bc}	19.70^{c}	21.23^{bc}	21.73^{bc}	0.589	0.001
Lymphocytes%	62.07	59.53	60.55	65.11	64.60	61.81	0.72	0.149
Heterophils%	30.33^{bc}	33.67^{a}	33.67^{a}	29.67^{bc}	29.00^{c}	32.67^{ab}	0.54	0.010
H/L ratio	0.49^{ab}	0.57^{a}	0.56^{a}	0.46^{b}	0.46^{b}	0.53^{ab}	0.01	0.020
Monocytes%	5.67	4.00	4.00	3.00	3.67	4.33	0.38	0.528
Eosinophils%	0.67	1.00	1.00	1.00	1.00	0.67	0.06	0.213
Lymphoid organ weights%								
Spleen%	0.089	0.077	0.089	0.086	0.089	0.097	0.002	0.237
Bursa%	0.130^{b}	0.151^{b}	0.173^{ab}	0.164^{b}	0.150^{b}	0.212^{a}	0.008	0.024
Thymus%	0.354	0.305	0.254	0.350	0.281	0.335	0.015	0.283

*T1 (Control) - T2 (Control +100 mg Tylosin/kg diet) - T3 (Control +100mg propolis/kg diet) - T4 (Control +200mg propolis/kg diet) - T5 (Control +300mg propolis/kg diet) - T6 (Control +400 mg propolis/kg diet).

a - c different superscripts within a row indicate significant differences ($p \leq 0.05$).

of chicks, while serum creatinine, alkaline phosphatase, and alanine aminotransferase significantly ($P \leq 0.05$ and 0.001) increased in the group given 400mg propolis diet in comparison with control .

The obtained results agreed with the studies of El-Neney et al. (2017), Tatli Seven et al. (2009) and Attia, et al. (2014) showed that there is no effect on AST to propolis supplementation showed in chicks also insignificant on ALT due to propolis supplementation to broilers dietary. On the other hand, El-Hanoun, et al. (2007) and Zeweil et al. (2016 b) reported that treatment with propolis caused significantly decreased ($P \leq 0.05$) in serum liver enzymes activity (ALT) compared with the control group. Findings on ALT and AST concentration in serum suggested the presence of a hepato-protective activity for propolis as indicated by maintaining AST, ALT., and alkaline phosphatase activities in liver. Previous studies demonstrated that quinic acid derivatives naturally present in propolis have strong liver-protective effects and promote the healing of toxic liver cells (Seo et al., 2003). In the study of Abbas (2012) propolis result in an increase in the level of serum creatinine and did not provoke changes in the serum urea level when compared to control; a study suggests that bee propolis might provide a protective effect against kidney injury (Nagyova et al., 1994). As shown in Table (4), serum total lipids, cholesterol, high - density lipoprotein, and triglycerides significantly decreased ($P \leq 0.01$) with the inclusion of different levels of the propolis and Tylosin as compared to the control group. The lowest values were recorded in the group fed

100,200,300 and 400 mg propolis, respectively. The essential fatty acids as one of propolis components and glutathione enzyme activity play the main role as antioxidant material in inhibiting hepatic 3-hydroxy-3- methylglutaryl coenzyme A (HMG-CO A) which reduces cholesterol synthesis (Crowell, 1999). These results agree with those obtained by Shreif and El-Saadany (2016), Dosoky et al. (2016) and El-Neney et al. (2017) they reported that the treatment with propolis caused a significant decrease in plasma cholesterol compared to the control group .Similarly, Kolankaya et al. (2002) found that HDL level increased, and LDL cholesterol and triglyceride levels were decreased by supplementing rats' diets with 200 mg propolis /kg body weight/day. Contradicting results, propolis intake led to a decrease in the level of plasma triglycerides concentrations (Fuliang et al., 2005), and that decrease can be attributed to the regulatory mechanism of the flavonoids as one of these natural products ingredients for blood circulation and stimulation of triglycerides use for energy generation. (Tekeli et al, 2011). However, Daneshmand et al. (2015) found that adding propolis to the diet of broiler chickens resulted in non-significant differences in the blood lipid profile when compared to the control group. Additionally, Denli et al. (2005) demonstrated that propolis had no appreciable impact on the triglycerides, total cholesterol, high-density lipoprotein, or low-density lipoprotein of quail when compared to the control .

Antioxidative status

Table 4 presented the effects of various feed treatments on the total antioxidant and lipid peroxidation capacity of blood serum. Serum total antioxidant capacity was significantly increased ($P \leq 0.001$) increased in the groups had 100 and 200mg propolis in their diet as compared to the group that had 300 mg propolis/ kg diet, Tylosin and the control group, while serum lipid peroxide concentrations were significantly decreased ($P \leq 0.05$) in the groups had 400mg propolis and tylosin as compared to other experimental groups .It has been observed that several flavonoids can prevent DNA damage (Russo et al., 2000). According to Jeon et al. (2002), propolis flavonoids have been shown to increase the mRNA synthesis of the antioxidant enzymes glutathione peroxidase, catalase, and superoxide dismutase. Propolis flavonoids reduce the number of free radicals or ROS produced and enhance the synthesis of molecules defense against oxidative stress by increasing the activities of antioxidant enzymes. Propolis and its polyphenolic/flavonoid components have been shown in experiments to improve the activity of the antioxidant enzymes superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), glutathione reductase (GR), and glutathione (GSH) (Molina et al., 2003; Orsolic and Basic., 2005) .

The flavonoids present in propolis have the ability to protect cells from the damage caused by free radicals also affects the activities of enzymes involved in antioxidative defense and provide a reasonable explanation for the decreased DNA damage in leukocytes of mice treated before or after irradiation with propolis and its flavonoids. It is likely that more various cooperative and synergistic mechanisms of propolis and its polyphenolic compounds are involved in the protection of organisms against radiation. The increase of antioxidant enzyme activities like SOD, GSH and CAT might have a protective mechanism against lipid peroxidation and heat-induced free radical synthesis (Tatli Seven et al., 2009).

CONCLUSION

The results of this study suggested that propolis, at a dose of 300 mg/kg diet, may have positive effects on chicken performance, hematology, immunity, and anti-oxidative properties.

Table (4). Effect of propolis treatments on serum metabolites of chicks at 6 weeks of age

Items	Dietary treatments*							
	T1	T2	T3	T4	T5	T6	MSE	*P* value
Serum metabolites								
Total Protein (g/dl)	5.53	6.44	6.25	6.24	6.26	6.27	0.095	0.073
Albumin (g/dl)	3.33	3.40	3.12	3.44	3.23	3.35	0.037	0.108
Globulin (g/dl)	2.20	3.04	3.13	2.80	3.03	3.91	0.058	0.035
Albumin /Globulin ratio	1.513	1.118	0.996	1.228	1.066	0.856	0.637	0.878
Alkaline phosphatase (IU/L)	170.67^{c}	211.67^{abc}	187.67^{bc}	251.00^{a}	218.33^{abc}	233.00^{ab}	8.259	0.037
Alanine aminotransferase(U/L)	9.30^{c}	15.67^{abc}	12.00^{bc}	18.00^{ab}	18.33^{ab}	21.67^{a}	1.135	0.005
Aspartate aminotransferase (U/L)	36.10	39.07	37.43	34.23	32.00	30.63	1.424	0.547
Total lipids (mg/dl	560.60^{a}	501.20^{ab}	479.17^{b}	507.73^{ab}	477.60^{b}	390.10^{c}	13.361	0.002
Total Cholesterol (mg/l)	158.67^{a}	149.33^{ab}	122.83^{cd}	102.20^{d}	133.27^{bc}	69.03^{e}	6.866	0.001
Low density lipoprotein (mg/l)	87.67^{a}	85.00^{a}	89.00^{a}	77.67^{b}	50.00^{c}	56.33^{c}	3.331	0.001
High density lipoprotein (mg/l)	66.33^{a}	53.00^{c}	64.33^{ab}	64.00^{ab}	56.33^{bc}	40.67^{d}	2.091	0.001
Triglycerides(mg/dl)	154.67^{a}	163.33^{a}	125.00^{ab}	120.33^{ab}	108.67^{b}	108.33^{b}	6.684	0.042
Uric acid (mg/dl)	3.53	3.35	3.06	2.86	2.35	2.78	0.165	0.379
Creatinine (mg/dl)	0.608^{b}	0.650^{b}	0.588^{b}	0.573^{b}	0.658^{b}	0.843^{a}	0.023	0.001
Antioxidative status								
Total antioxidant capacity (mg/dl)	2.27^{b}	2.20^{b}	2.82^{a}	2.81^{a}	2.36^{b}	2.51^{ab}	0.065	0.002
Malondialdehyde MDA (nmol/ml)	4.16^{a}	3.59^{bc}	4.13^{a}	4.06^{ab}	3.89^{abc}	3.51^{c}	0.081	0.046

*T_1 (Control) - T_2 (Control +100 mg Tylosin/kg diet) - T3 (Control +100mg propolis/kg diet) - T_4 (Control +200mg propolis/kg diet) - T5 (Control +300mg propolis/kg diet) - T6 (Control +400 mg propolis/kg diet).

$^{a-e}$ different superscripts within a row indicate significant differences ($p \leq 0.05$).

REFERENCES

Abbas, Amany A., M. M. El-Asely, Amel and M. M. Kandiel, (2012). Effects of Dietary Propolis and Pollen on Growth Performance, Fecundity and Some Hematological Parameters of *Oreochromis niloticus.* Turkish Journal of Fisheries and Aquatic Sciences, 12: 851-859.

Abdel-Rahman, M.A, and G.M. Mosaad (2013). Effect of propolis as additive on some behavioural patterns, performance and blood parameters in Muscovy broiler ducks. J. of Advanced Veterinary Res. 3: 64-68.

Abou-Zeid, A. E, S. Z. El-Damarawy, Y. A. Mariey, and S. M. El-Kasass (2015). Effect of dietary propolis supplementation on performance and activity of antioxidant enzymes in broiler chickens. Egyptian J. Nutrition and Feeds, 18(2): 391- 400.

Aguihe, P.C, A.S. Kehinde, I.C. Ospina-Rojas, and A.E. Murakami (2017). Comparative effect of different detoxified rubber seed meal on hematological and serum biochemical indices of broilers. J. Anim. Health Prod. 5(2): 50-57 .

Arain, M. A. Z., Mei, F.U. ,Hassan , M. ,Saeed , M. ,Alagawany , A.H. ,Shar , and I.R.R . Rajput, (2018). Lycopene: a natural antioxidant for prevention of heat-induced oxidative stress in poultry. World's Poult. Sci. J.74 (1).

Attia, Y. A, F. Bovera, W. S. El-Tahawy, A. M.El-Hanoun, M. A. Al-Harthi, and H. I. Habiba (2015). Productive and reproductive performance of rabbits does as affected by bee pollen and/or propolis, inulin and/or mannan-oligosaccharides. World Rabbit Sci. 23: 273-282.

Attia, Y.A, A.E.A. Al-Hamid, M.S. Ibrahim, M.A. Al-Harthi, F. Bovera, and A.S. Elnaggar (2014). Productive performance, biochemical and hematolo , gical traits of broiler chickens supplemented with propolis, bee pollen, and mannan oligosaccharides continuously or intermittently. Livestock Sci. 164: 87-95. https://doi.org/10.1016/j.ijvsci.2014.03.005 .

Aygun, A. D. , Sert , and G. , Copur , (2012). Effects of propolis on eggshell microbial activi ,ty, hatchability, and chick performance in Japanese quail (Coturnix coturnix japonica) eggs. Poult. Sci. 91 (4): 1018-1025. https://doi.org/10.3382/ps.2011-01944 1303-62.

Babaei, S., S. Rahimi, M. A. K.Torshizi, G. Tahmasebi, and S. N. Khaleghi Miran (2016). Effects of propolis, royal jelly, honey and bee pollen on growth performance and immune system of Japanese quails. Vet. Res. 7 (1): 13 – 20.

Babinska, I. K . , Kleczek , W. ,Makowski , and J. , Szarek , (2013). Effect of Feed Supplementation with Propolis on Liver and Kidney Morphology in Broiler Chickens. Pakistan Vet. J. 33 (1): 1-4.

Bankova,V. (2005). Chemical diversity of propolis and the problem of standardization. J. Ethnopharma. 100 (1-2): 114-117. https://doi.org/10.1016/j.jep.2005.05.004.

Canogullari, S., M. Baylan, N. Sahinler, and A.Sahin (2009). Effects of propolis and pollen supplementations on growth performance and body components of Japanese quails (*Coturnix coturnix* japonica). Archive fur Geflügelkunde. 73:173–178.

Cooper, M. D., D. A. Raymond, R. D. Peterson, M. A.South, and R. A. Good,(1966). The functions of the thymus system and the bursa system in the chicken. J. Exp. Med. 123, 75–102 (1966).

Crowell, P.L. (1999). Prevention and therapy of cancer by dietary monoterpenes. J. Nutr., 129: 775S-778S.

Daneshmand, A., G. H. Sadeghi, A. Karimi, A. Vaziry, and S.A. Ibrahim (2015). Evaluating the complementary effects of ethanol extract of propolis with probiotic on growth performance, immune response and serum metabolites in male broiler chickens. Livestock Science 178: 195201.

Denli, M., , S. Cankaya, S. Silici, F. Okan, and A. N. Uluocak (2005). Effect of dietary addition of Turkish propolis on the growth performance, carcass characteristics and serum variables of quail (Coturnix coturnix japonica). Asian-Aust. J .Anim. Sci. 18, (6): 848-854.

Dosoky, W.M., H. Zeweil., and S.A. Farag.(2016). Influence of dietary supplementation of propolis on productive performance, immunological and physiological parameters of growing

japanese quail. Egyptian J. Anim. Prod 53 (2), 117-127.

Duncan, D. B. (1955). Multiple range and F., test Biometric. 11:42.

El-hack, E.A. M., M.R. Alagawany, R. Farag, K. Tiwari, K. Karthik, J. Dhama, J. Zorriehzahra, and M . Adel (2016). Beneficial impacts of thymol essential oil on health and production of animals, fish and poultry: a review. J. Essent. Oil Res. 28 (5): 365-382. https://doi.org/10.1080/10412905.2016.1153002

El-Hanoun, A. M, K. I. Kamel, M. S. El-Sebaie, and H. A. M. Gad (2007). Effect of Egyptian propolis supplementation on productive, reproductive performance and some hematobiochemical parameters and steroid hormones of female rabbits during winter and summer seasons.-4th World Poultry Conference 27- 30 March.

El-Neney, Battaa, A. M., Nasra B. Awadien and Eid, Y. Z. (2017). The use of bee propolis as a source of natural additives to improve the productive performance and immune system of local chickens. 9th Int. Poult. Conf. proceeding 7 – 10 November 2016, Hurghada, Red Sea – Egypt.

Fouad, W., Kassab, A. Y. and M. M. Badr (2021). Impact of propolis supplementations on growth performance and physiological responses in Japanese quail. Egypt. Poult. Sci. Vol. (41) (III): (659-673).

Fuliang, H. U, H. R. Hepburn and H. Xuan (2005). Effects of propolis on blood glucose, blood lipid and free radicals in rats with Diabetes mellitus. Pharmacol Res, 51, 147-152.

Haro, A., I. López-Aliaga, F. Lisbona, M. Barrionuevo, M. J. M. Alférez, and M. S. Campos, (2000). Beneficial effect of pollen and/or propolis on the metabolism of iron, calcium, phosphorus, and magnesium in rats with nutritional ferropenic anemia. J. Agric. Food Chem. 48:5715-5722.

Hawk, P.B., B.L. Oscar and W. Summerson (1965). Hawk's [physiological chemistry]. London J., and A. Churchill Ltd. 14th Ed.

Babińska, Izabella, B., K. Kleczek, J. Szarek, and W. Makowski (2012). Modulating effect of propolis and bee pollen on chicken breeding parameters and pathomorphology of liver and kidneys in the course of natural infection with salmonella enteritidis. Bull Vet Inst Pulawy 56: 3-8.

Jeon, S. M, S. H. Bok ,M. K. Jang, Y. H. Kim, K. T. Nam,T. S. Jeong,Y. B. Park, and M. S. Choi (2002). Comparison of antioxidant effects of naringin and probucol in cholesterol-fed rabbits. Clin. Chim. Acta., 317: 181—190.

Khan, T. A. and F. Zafar, (2005). Haematological study in response to varying doses of oestrogen in broiler chicken. International Journal of Poultry Sciences 4(10), 748-751.

Kleczek, K., E. Wawro, K.Wawro, , W.Makowski, D. Murawska, and M .Wawro (2014). The effect of dietary propolis supplementation on the growth performance of broiler chickens. Poul. J .Natur. Sci., 29(2): 105–117.

Kolankaya, D., G. Selmanoglu, K. Sorkun , and B. Salih (2002). Protective effects of Turkish propolis on alcoholinduced serum lipid changes and liver injury in male rats. Food Chem., 78: 213-217.

Mahmoud, U. T, M. A. Abdel-Rahman , and Madeha Darwish (2013). The Effect of Chinese Propolis Supplementation on Ross Broiler Performance and Carcass Characteristics. Journal of Advanced Veterinary Research, 3: 154-160.

Mahmoud, U. T, M.R. Fahmey, M. A. Abdel-Rahman, and Madeha Darwish (2014). Effect of Propolis Supplementation on Serum Calcium, Phosphorus and Proteins Concentrations in Heat Stressed Broilers. Journal of Advanced Veterinary Research, 4: 117-122.

Mahmoud, M.A.M., H.S. Abdelmohsein and M.R.F. Farghali (2015). Antioxidant properties of Chinese propolis in Ross broilers NE US Academic Publishers Journal of Animal Health and Production August 2017 | Volume 5 | Issue 4 | Page 140 exposed to heat stress in Egypt. Open J. Vet. Med. 5 (9): 197-209. https://doi.org/10.4236/ojvm.2015.59027.

Molina, M. F, I. Sanchez-Reus, I. Iglesias, and J. Benedi (2003). Quercetin, a flavonoid antioxidant, prevents and protects against ethanol-induced oxidative stress in mouse

liver. Biological and Pharmaceutical Bulletin, 26(10):1398-1402.

National Research Council. (1994). Nutrient Requirements of Poultry. (9th Edition). Subcomittee on Poultry Nutrition. National Academy Press, Washington, USA. pp. 27-31.

Motor S, S Ozturk, O Ozcan, AB Gurpinar, Y Can, R Yuksel, JZ Yenin, G Seraslan, and O.H. Ozturk (2014). Evaluation of total antioxidant status, total oxidant status and oxidative stress index in patients with alopecia areata. Int J Clin Exp Med 7:1089.

Nagyova, A., S.Galbavy, and E. Ginter 1994. Histopathological evidence of vitamin C protection against Cd-nephrotoxicity in guinea pigs. Exp. Toxicol. Pathol, 46: 11-14.

O'connor-Dennie, T. I. (2004). Mineral utilization in poultry as affected by virginiamycin or mineral source. Master's Thesis, Louisiana State Uni., Louisiana, USA, 54 pages.

Omar, R.E. M., E. A.Mahmoud, M. M. Karousa, and S. A. Randa (2014). Effects of Additives propolis and nigella sativa seed oil on some behavioural patterns, Performance products and blood parameters in Sasso chickens. World Poult. Sci.J., 70:140- 154.

Orsolic, N. I. and Basic, (2005). Water-soluble derivative of propolis and its polyphenolic compounds enhance tumoricidal activity of macrophages. Journal of Ethnopharmacology, 102:37–45.

Premratanachai, P., and C. Chanchao (2014). Review of the anticancer activities of bee products. Asian Pac. J. Trop. Biomed. 4 (5): 337-344. https://doi.org/10.12980/APJTB.4.2014C1262.

Raheema, R.H. (2016). Effect of pomegranate peel extract on some biochemical and histopathological parameters in experimental induced mice with Staphylococcus aureus. J Anim. Health Prod. 4(2): 42-49. https://doi.org/10.14737/journal.jahp/2016/4.2.42.49.

Russo, A., R. Acquaviva, A, Campisi, V. Sorrenti, C. Di Giacomo, G. Virgata, M. L. Barcellona, and A. Vanella (2000). Bioflavonoids as antiradicals, antioxidants and DNA cleavage protectors. Cell Biol. Toxicol. 16: 91- 98.

Seo, K. W., M. Park, Y. J. Song, S. J. Kim, and K. R. Yoon (2003). The protective effects of Propolis on hepatic injury and its mechanism. Phytother Research, 17: 250-253.

Seven , P.T. S. , Yilmaz , I. , Seven , and G.T. , Kelestemur , (2012b). The effects of propolis in animals exposed oxidative stress. Oxidative Stress-Environmental Induction and Dietary Antioxidantsed., InTech. 267-288.

Seven ,I. T. , Aksu ,and P.T. , Seven , (2012a). The effects of propolis and vitamin C supplemented feed on performance, nutrient utilization and carcass characteristics in broilers exposed to lead. Livestock Sci. 148 (1-2): 10-15. https://doi.org/10.1016/j.livsci.2012.05.001.

Seven, I. U.G. , Simsek , Gokce , P. , Tatli Seven , A. , Arslan , and O. , Yilmaz , (2014). The effects of royal jelly on performance and fatty acid profiles of different tissues in quail (Coturnix coturnix japonica) reared under high stocking density. Turkish J. Vet. Anim. Sci. 38 (3): 271-277. https://doi.org/10.3906/vet- 1303-62.

Seven,P.T. (2008). The effects of dietary Turkish propolis and vitamin C on performance, digestibility, egg production andegg quality in laying hens under different environmental temperatures. Asian-Australasian J. Anim. Sci. 21 (8): 1164-1170. https://doi.org/10.5713/ajas.2008.70605.

Shaddel-Tili, A., B. Eshratkhah, H. Kouzehgari, and M. Ghasemi-Sadabadi, (2017). The effect of different levels of propolis in diets on performance, gastrointestinal morphology and some blood parameters in broiler chickens. Bulgarian J. Vet. Med. 20(3), 215-224. https://doi.org/10.15547/bjvm.986.

Shreif, Effat Y., and S. El-Saadany, Amina (2016). The effect of supplementing diet with propolis on bandrah laying performance. Egypt. Poult. Sci. 36 (I I): 481-499.

SPSS (2012). SPSS User's Guide Statistics Version 19. Copyright IBM, SPSS Inc., USA.

Tatli Seven, P., S. Yılmaz, I. Seven, , H. Cercı, A. Azmanand, and M.Yılmaz (2009). Effects of propolis on selected blood indicators and antioxidant enzyme activities in broilers under heat stress. ACTA VET. 78: 75–83.

Tayeb, I. T, and B. F. Sulaiman (2014). Effect of propolis supplementation on productive performance in local quail. Iranian J. of Applied Anim.Sci, 4(3): 621-627.

Tekeli, A., H. R. Kutlu , and L. Celik (2011). Effects of Z. officinale and propolis extracts on the performance, carcass and some blood parameters of broiler chicks. Current Research in Poultry Science, 1(1):12-23.

Toghyani, M., M. Toghyani, A, Gheisari, G.Ghalamkari, and M. Mohammadrezaei (2010). Growth performance, serum biochemistry and blood hematology of broiler chicks fed different levels of black seed (Nigella sativa) and peppermint (Mentha piperita). Livest Sci 129:173–178. https:// doi. org/ 10. 1016/j. livsci. 2010. 01. 021.

Viuda-Martos ,M., Y. Ruiz-Navajas, J. Fernández-López, and J. A. Pérez-Álvarez (2008). Functional properties of honey, propolis, and royal jelly. J. Food Sci. 73: R117–R124.

Wang,B. J. Y.H., Lien ,and Z.R .Yu. (2004). Supercritical fluid extractive fractionation - study of the antioxidant activities of propolis. Food Chem. 86 (2): 237-243. https://doi.org/10.1016/j. foodchem.2003.09.031.

Zafarnejad, K., N. Afzali, and M. Rajabzadeh (2016). Effect of bee glue on growth performance and immune response of broiler chickens. J. of Applied Anim. Res. ISSN: 0971-2119 (Print) 0974-1844 (Online) Journal homepage: http://www.tandfonline.com/loi/taar20.

Zeweil, H. S, M. H. A.Abd El-Rahman1, W. M. Dosoky, H. Salma Abu Hafsa, and A. B. A.Abdulhamid (2016a). Effects of ginger and bee propolis on the performance, carcass characteristics and blood constituents of growing Japanese quail. Egypt. Poult. Sci. 36 (I): 143 159.

Zeweil, H. S., Zahran, S. M, Abd El-Rahman1, M. H. A., Dosoky, W. M., Salma Abu Hafsa, H. and Moktar, A. A. (2016 b). Effect of using bee propolis as natural supplement on productive and physiological performance of Japanese quail. Egypt. Poult. Sci. 36 (I): 161-175.

الملخص العربي

تأثير البروبوليس كاضافة طبيعية على الأداء الإنتاجي والفيسيولوجي لدجاج التسمين

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أجريت هذه الدراسة على 180 كتكوت تسمين غير مجنس عمر يوم وذلك لتقييم تأثير البرويوليس على النمو والمعايير المناعية ، وبعض المتغيرات البيوكيميائية. قسمت الكتاكيت عشوائيا الى 6 مجموعات بكل مجموعة 30 كتكوت وبكل مجموعة 5 مكررات (6 كتاكيت بكل مجموعة) وكانت العلائق التجريبية كالاتى: المعامله الاولى كنترول والمعامله الثانيه تايلوسين بمستوى 100 ملجم / كجم علف والمعاملات الثالثة والرابعة والخامسة والسادسة تم اضافه البربوليس بالمستويات الاتيه (100 – 200–300 –400) ملجم / كجم علف على التوالى .

أظهرت النتائج أن إضافة البروبوليس الى العلائق أدى إلى زيادة وزن الجسم وانخفاض استهلاك العلف مقارنتاً مع الكنترول و تم تسجيل أفضل معدل لمعامل تحويل العلف للكتاكيت المغذاة على البرويوليس بمعدل 300 ملجم/كجم علف . حدث انخفاض معنوي فى عدد كريات الدم الحمراء وحجم الدم المعبا والهيمو جلوبين . لوحظ زياده غير معويه في عدد كريات الدم البيضاء . وانخفض معنويا تركيز الدهون الكلية والكوليسترول والليبوبروتين عالي الكثافه والدهون الثلاثيه وكذلك لوحظ زيادة معنوية فى المقدرة الضد تاكسيدية الكلية فى حين ان المالوندالدهيد انخفض معنويا نتيجة المعاملات التجريبية المختلفة.

الخلاصه

يمكن القول ان استخدام البرويوليس مفيد في تحسين الاداء الانتاجي لدجاج التسمين وكذلك يمكن استخدامه كبديل للمضادات الحيوية كمنشط للنمو في اعلاف دجاج التسمين.