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EFFECT OF USING BEE PROPOLIS AS NATURAL SUPPLEMENT ON PRODUCTIVE AND PHYSIOLOGICAL PERFORMANCE OF JAPANESE QUAIL

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ABSTRACT: This study was conducted to investigate the effect of supplementing bee propolis as a growth promoter and antioxidant material on laying performance, egg quality traits, blood parameters, antioxidant status during laying period of quails. A total number of 72 laying quails, 15-wks-old were randomly divided into four groups, 18 birds each, and each treatment replicated three times in a completely randomized design. The birds were selected on basis of more than 70 % egg production rate after two-week of observation period. Dietary treatments were as follows: control (without supplementation), bee propolis at levels of 250 and 500 mg/kg diet and ascorbic acid at level 250 mg/kg diet (as a positive control). Results showed that quails fed diets supplemented with different levels of propolis or ascorbic acid had similar body weight change, egg laying rate, egg weight and egg mass as compared to those fed the control diet throughout the experiment. Feeding quails on different levels of propolis or ascorbic acid in the diet improved feed conversion ratio, but differences were not significant compared to the control. All studied egg quality parameters were not significantly affected by different treatments. Yolk total cholesterol concentration was significantly ($P \leq 0.05$) lower for groups fed 500 mg propolis diet and this decrease reached to 3.6 % as compared to those fed the control diet, whereas, yolk total lipids were significantly ($P \leq 0.05$) decreased for groups fed ascorbic acid or different levels of propolis as compared to the control group. The decrease in yolk total lipids reached to 18.9, 23.5 and 10.2 % for the groups given 250 mg ascorbic acid, 250 and 500 mg propolis / kg diet, respectively. The studied serum constituents were significantly influenced for quails fed ascorbic acid or different levels of propolis diets. Feeding both ascorbic acid and propolis supplementation diets resulted in significantly lower total lipids, triglycerides, total cholesterol and LDL values than those fed the control diet. Malondialdehyde was significantly decreased whereas, total antioxidant capacity and glutathione peroxidase significantly increased in all treatments compared to the control. In conclusion, results indicated that propolis could effectively be added to quail ration to improve laying performance and to optimize lipid profile in egg yolk and blood and enhance the antioxidative status under summer conditions.

Key Words: Quail, Bee propolis, Ascorbic acid, Laying performance, Blood parameters.

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INTRODUCTION

Factors causing stress include physiological factors such as climate, environment, nutrition, and diseases, and physical conditions, such as cage density and transport (Freeman, 1987). Under stress, rapid and temporary changes occur in the body initially; with continuous stress, these are followed by permanent and irreversible changes. Finally, a decline in yield and resistance to diseases may occur. Animals under stress become ill more easily, and excess medicine may be necessary to maintain health. As a result, drug residues increase in animal products and threaten public health directly. Stock health and welfare management are key factors in animal health and food safety. For this reason, stress conditions in animals need to be examined carefully (Onbaşılar and Aksoy, 2005). The suitable temperature for poultry is between16-25°C (Filizciler *et al.,* 2002; Cerci *et al.,* 2003). Heat stress begins when the ambient temperature climbs above 25°C and is readily apparent above 30°C. Heat stress in laying hens is prompted by combinations of environmental temperature and humidity that prevent the bird's thermoregulatory process from effectively dissipating the heat produced during metabolism (Webster, 1983). High environmental temperatures the major problem faced by laying hens as well as by poultry farmers, usually in summer months. Heat stress in laying hens reduces live weight gain, feed intake, feed efficiency; production and quality of eggs and increases mortality (Ciftci *et al.,* 2005). Researchers have tried to minimize the effect of heat stress by changing the environment and diets of laying hens. Environmental approaches include increasing the air flow over birds to increase heat loss, by increasing ventilation rates or by using evaporative cooling systems in enclosed houses and lowering stocking densities. Nutritional modifications usually made are the optimization of diets to meet the altered needs of stressed birds for protein and energy and for providing some additional nutrients. Because it is expensive to cool poultry houses, methods are focused mainly on nutritional modifications. For this aim, antioxidants such as ascorbic acid (vitamin C) and natural materials including antioxidants like propolis are used in the poultry diet because of their anti-stress effects and also because their synthesis is reduced during heat (Tatli Seven *et al.,* 2006; Ipek *et al.,* 2007; TatliSeven *et al.,* 2008).

Vitamin C, or L-ascorbic acid, is a water-soluble vitamin widely distributed in plants and animals. It is of major importance in nutrition to maintain a good health status. Generally, ascorbic acid is not regarded as a dietary requirement for poultry because it can be synthesized at a sufficient rate to meet the needs under normal conditions. Mayand McNaughton (1980) could not demonstrate apositive effect of 0.1% ascorbic acid supplementation on body weight of broiler chickens and did not found any effects on thyroid hormone functions. However, dietary vitamin C has been reported to improve resistance to a variety of stress or including environmental (e.g. heat stress), nutritional and pathological conditions (Agudelo, 1983). Several studies revealed a beneficial effect of vitamin C supplementation on growth rate, egg production, egg shell strength and thickness in stressed laying hens and broilers (Bains, 1996; TatliSeven, 2006).

Propolis is an adhesive, dark yellow to brown colored balsam that smells like resin. It is collected from buds, leaves and similar parts of trees and plants by bees and mixed with wax, sugar and plant exudates collected by bees from certainplant sources. More than 300 constituents have been identified in different propolis samples (Valle, 2000; Banskota *et al.,* 2001; Shalmany and Shivazad, 2006). Propolis usually contains variety of chemical compounds, such as polyphenols

(flavonoids, phenolic acids and their esters), terpenoids, steroids and amino acids. The composition of propolis depends on the vegetation at the site of collection (Kumazawa *et al.,* 2003). Propolis has many positive effects like increase in feed intake, body weight increase, flavonoid content, taste improvement, antioxidant and antimicrobial properties. Antioxidative, cytostatic, anti-mutagenic and immune modulatory properties of propolis are based on its rich, flavonoid, phenolic acid and terpenoid contents (Kimoto *et al.,* 1999; Prytzyk*et al.,* 2003; Wang *et al.,* 2004). Although it is known that propolis is effective in cell membrane similarly to vitamin C in oxidative stress conditions. The objective of this study was to compare the efficacy of propolis and ascorbic acid as antioxidants in amelioration of heat stress impact and improving performance of laying Japanese quail under Egyptian summer conditions.

MATERIALS AND METHODS

The present study was carried out at the Poultry Research Laboratory, Department of Animal and Fish Production, Faculty of Agriculture (Saba Basha), Alexandria University, Egypt. The experiment was conducted in summer season of Alexandria city from July to September 2014, and the average temperature was 30ºC. Seventy-two laying hens, 15-wks-old weeks were randomly divided into four groups, 18 birds each and each treatment replicated three times in a completely randomized design. The birds were selected on basis of more than 70 % egg production rate after two-week of observation period. Dietary treatments were as follows: control (without supplementation), bee propolis at levels of 250 and 500 mg/kg diet and ascorbic acid at level 250 mg/kg diet. All quails were reared in wire batteries under the same managerial, hygienic and environmental conditions. Light regimen was (16L: 8D) for 8 weeks from July to September. Feed and water were available *ad libitum* all the time throughout the experimental period. The basal diet was formulated to meet the birds dietary nutrient requirements (NRC, 1994). It contained 20 % crude protein and 2903 kcal /kg metabolizable energy, the composition of basal diet is shown in Table 1. Body weight and feed consumption were recorded weekly. Feed conversion ratio was calculated (g feed / g egg). Egg production, number of eggs, egg weight and mortality rate were monitored daily. Egg quality measurements were conducted using an average of 21 eggs from each treatment and were performed through two consecutive days per month. Shell thickness was determined from measurements of the mean thickness at three locations on the egg (air cell, equator and sharp end) using a dial pipe gauge (Mitutoyo, 0.01–20 mm, Tokyo, Japan). Yolk cholesterol was determined by nine eggs from each treatment and measured by the method of Folch *et al.,* (1956) as modified by Washburn and Nix (1974).

At the end of the experiment, blood samples were collected from the brachial vein of 6 hens randomly chosen from each group then serum were immediately centrifuged at 3500 r.p.m. for 15 min. and stored at -18°C until use. Serum total protein, albumin, creatinine, uric acid, alkaline Phosphates, total lipids, triglycerides, cholesterol, HDL, LDL cholesterol, glutamic-pyruvate transaminase (GPT), glutamic-oxaloacetic transaminase (GOT), total antioxidant capacity, glutathione peroxidase and malondialdehyde (MDA) were calorimetrically determined using commercial kits (Biomerieux, Poains, France). The proximate chemical analysis of diet was determined according to AOAC (2005).

Data were analyzed by analysis of variance using the general linear model procedure (Proc GLM; SAS Institute, 1996). For the overall means, data was classified according to 4 treatments and the mean of each treatment was used. Differences

among means were determined using Duncan test (Duncan, 1955).

RESULTS AND DISCUSSIONS

No significant differences in body weight change, egg laying rate, egg weight, egg number and egg mass due the supplementing ascorbic acid or different levels of propolis as compared with the control group throughout the experiment (Table 2). In a study conducted by Nockels (1988) indicated that supplementing 2,600 mg /kg of ascorbic acid, egg production was not affected as compared with birds given control diet. On the other hand, Attia *et al.* (2015) found that vitamin C resulted in higher ($P \leq 0.05$) body weight change, egg number, egg weight, egg mass and egg production in Dokki-4 laying hens through Egyptian summer season. Ozkok *et al.* (2013) reported that different propolis doses, 100, 200 and 400 mg/kg diet did not have significant effects on egg production and egg weight of Bevans White strain laying hens. Tayeb and Sulaiman (2014) showed that the propolis supplementation had not been significantly affected the egg production. Our results are contrast with the finding of Galal *et al.* (2008) who reported that egg number/hen was significantly increased by feeding diet supplemented with 100 and 150 mg propolis /kg diet during laying period. Tatli Seven (2008) reported that egg production and egg weight were significantly improved by feeding diets supplemented with vitamin C and propolis for laying hens reared under heat stress conditions.

The results in Table (2) showed insignificant decrease in feed consumption for the group given 250 mg propolis /kg diet as compared to the other experimental groups through the experiment. Ascorbic acid and 500 mg propolis fed groups were equal to the control group. The obtained results were in agreement with those presented by Babaei *et al.* (2004) who reported that Japanese quail fed diet contained 1000 ppm alcoholic extract of propolis was not significantly affected feed consumption compared with the control quails. Also, Ozkok *et al.* (2013) reported that different propolis doses, 100, 200 and 400 mg /kg diet did not have significant effects on feed consumption of Bevans White strain laying hens as compared with the control group. On the other hand, Tatli Seven *et al.* (2008) reported that propolis supplementation with (5 g/kg) to laying diet had increased feed intake.

Feeding quails on different levels of propolis or ascorbic acid in the diet improved feed conversion ratio, but differences were not significant compared to the control. The group of birds received 250 mg propolis /kg diet improved by 3.9 % followed by 250 mg ascorbic acid group 2.1 % and 500 mg propolis fed groups 1.8 % as compared with the control group, respectively. The improvement in feed conversion ratio may be due to the ability of bee propolis to improving nutrients digestibility and absorption as a result to improvement the activities of saccharase, amylase and phosphatase (Marieke *et al.*, 2005) or easily prepared enzymatic hydrolysates from using two gastrointestinal proteases (pepsin and trypsin) and a protein (papain) protease (Kročko *et al.*, 2012). Also, may be due to gut microflora is a nutritional "burden" in fast-growing broiler chickens, since an active microflora component may have an increased energy requirement for maintenance and a reduced efficiency of nutrient utilization (Dibner and Richards, 2005 and Lan *et al.*, 2005). These results are similar with those obtained by Villar-Patino *et al.* (2002) who reported that feed efficiency increased statistically with antioxidant supplementation. Some researchers demonstrated that when propolis was added to broiler chickens diets under heat stress conditions at 5 g/kg (Tatli-Seven, 2008), at doses of 200 and 250 mg/ kg (Roodsari *et al.*, 2004) and 1000

ppm/kg (Ziaran *et al.*, 2005) and to quail diets at doses of 0.5, 1.0 and 3.0 g/kg, improved feed conversion ratio. Also, Attia *et al.* (2015) found that vitamin C supplementation in the diet of Dokki-4 laying hens through Egyptian summer season resulted in higher (P≤0.05) feed intake and improved feed efficiency.

Results of Table (3) showed insignificant differences in all egg quality parameters except yolk index significantly (P≤0.05) affected due to feeding the experimental diets. Propolis 500 mg /kg fed groups had significantly (P≤0.05) the highest yolk index value as compared to the other groups. Our findings are in agreement with earlier reports Nockels (1988) showed that egg shell thickness of birds was insignificantly affected by supplementing 2,600 mg /kg of ascorbic acid compared with the control. Also, (Silici *et al.*, 2006) indicated that the addition of propolis at levels of 0.5, 1.0, 3.0 and 6.0 g/kg to rations of laying hens, at levels of 2.0 and 5.0 g/kg in laying hens (Tatli-Seven, 2008), at levels of 1.0 and 4.0 g/kg in quail (Silici and Guclu-Kocaoglu, 2010) did not affect egg quality traits under heat stress. Ozkok *et al.* (2013) stated that different propolis levels (100, 200 and 400 mg/kg diet) did not have significant effects on egg quality criteria (P≤0.05) for Bevans White strain laying hens as compared with the control group. On the other hand, Tatli Seven (2008) reported that propolis supplementation increased egg shell thickness and egg shell weight in heat stressed laying hens.Yolk total cholesterol concentration was significantly (P≤0.05) lower for groups fed 500 mg propolis diet and this decrease reached to 3.6 % as compared to those fed the control diet, whereas, yolk total lipids were significantly (P≤0.05) decreased for groups fed ascorbic acid or different levels of propolis as compared to the control group. The decrease reached to 18.9, 23.5 and 10.2 % for the groups given 250 mg ascorbic acid, 250 and 500 mg propolis/ kg diet, respectively (Table 3).

The results in Table (4) indicated that the different treatments induced significant changes in blood serum total protein and globulin concentration. Serum total protein was significantly higher by 6.3 % for the group fed 500 mg proplois /kg diet, whereas, Albumin was insignificantly higher by feeding 500 mg proplois /kg diet as compared to those fed the control diet. Also, diet contained 500 mg propolis showed significant (P≤0.05) increase in globulin level as compared to the control group. Ascorbic acid had insignificant effect on serum protein fractions. This implies that ascorbic acid or propolis used in the present study did not impair the synthesis and concentration of serum total protein, albumin and globulin. The significant increase of protein and globulin concentration may be attributed to the increase in the level of metabolic processes. Mahmoud *et al.* (2014) showed that addition of low dose of propolis (250 mg/kg) insignificantly increased serum total protein and globulin values, but the highest dose (750 mg/kg) had conversely affect. Abdel-Rahman and Mosaad, (2013) indicated that adding propolis (2g/kg) to the diet of Muscovy ducks maintained at 33°C was reflected with significant higher contents of its serum total protein, albumin and total globulin. Also they attributed the improvement of serum total protein and its fractions in the group fed propolis may be related to its stimulating effect on the liver exhibiting anabolic action favoring protein synthesis and also it's preserving effect on the body protein from degeneration. Attia *et al.* (2015) reported that ascorbic acid increased serum concentrations of total protein, albumin and globulin in laying hens as compared with the control group. Also, Sahin *et al.* (2002) reported that serum total protein and albumin concentrations increased with vitamin C supplementation. However, Konca *et al.* (2014) reported that dietary ascorbic acid

(150 or 300 mg/kg) was not significantly affected blood serum total protein, albumin and globulin of turkeys under summer temperatures that do not exceed 31.7 ^{0}C.

Results in Table 4 indicated a significant (P≤0.05) decrease in serum creatinine and uric acid due to feeding the different experimental diets. This may due to decreasing the load of the oxidative stress in quails according to the antioxidative proprties of the treatments which lead to better function of kindney. Serum GOT and GPT concentrations were significantly decreased for the groups fed the different experimental diets as compared to the control. The decrease was more pronounced (P≤0.05) with propolis than with ascorbic acid. Konca *et al.* (2009) reported that dietary ascorbic acid (150 or 300 mg/kg) was not significantly affected blood serum urea and uric acid and GPT, however, it significantly decreased serum GOT as compared with the control group in turkeys reared under summer temperatures that do not exceed 31.7 C

Serum total lipids, triglycerides, total cholesterol and LDL cholesterol were significantly decreased, however, Serum HDL cholesterol was significantly increased by feeding diets supplemented with Ascorbic acid and different levels of propolis as compared with those fed the control diet. Generally, cholesterol is primarily biosynthesized in the liver of laying hens and incorporated into vitellogenin and very low density lipoprotein particles, which are secreted into the blood stream and subsequently taken up by growing oocytes through receptor mediated endocytosis (Elkin, 2006). The decrease in triglycerides and cholesterol may be attributed to propolis that play a major role as antioxidant material which increased glutathione enzyme activity, or/ and propolis contains some components such as essential fatty acids which inhibit hepatic 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CO A) reductase activity (Crowell, 1999) which is a key regulatory enzyme in cholesterol synthesis. These results are in agreement with those obtained by Babaei *et al.* (2004) who reported that Japanese quail diet containing 1000 ppm alcoholic extract of propolis significantly lowered total cholesterol, triglycerides and LDL cholesterol and increased level of HDL cholesterol in the blood as compared with quail fed control diet. Awad *et al.* (2013) found that serum LDL cholesterol was significantly decreased by 18.83 and 17.94% for the hens fed diet supplemented with 1.0 and 1.5 g BB/kg, respectively as compared to the control. Also, Zhao *et al.* (1990) who reported that pollen extract lowered blood lipid levels in both animals and humans. Čeksterytė *et al.* (2008) reported that the effects of plant pollen and honey on the antioxidative processes and immune system have shown a decrease of lipid peroxidation in the blood. Similarly, Kolankaya *et al.* (2002) found that HDL level increased and LDL, cholesterol and triglycerides levels were decreased by giving propolis with 200 mg/kg body weight/day in rats. It was expressed in the findings of diverse studies that propolis intake lead to a decrease in the level of plasma triglycerids concentrations (Fuliang *et al.* 2005). This lowering effect can be attributed o the regulatory mechanism of the flavanoids as one of the ingredients in these natural products for blood circulation and stimulation of triglycerids use for energy generation. (Tekeli *et al,* 2011). On the other hand, Daneshmand *et al.* (2015) reported that propolis supplementation in broiler chicken diet resulted in non-significant difference was detected with regard to serum lipid profile as compared with control. Also, Denli *et al.* (2005) demonstrated that propolis had no significant effect on triglycerides, total cholesterol, high density lipoprotein and low density lipoprotein in quail compared to the control.

Ascorbate is necessary for the transformation of cholesterol to bile acids

by controlling the microsomal 7 α-hydroxylation. As this reaction is the rate-limiting step of the cholesterol catabolism in the liver, ascorbic acid deficiency induces a marked deceleration of this reaction, leading to cholesterol accumulation in the liver and the blood (Naidu, 2003). In the present study, dietary ascorbic acid supplementation decreased serum cholesterol. The reduction of blood cholesterol concentrations due to the addition of ascorbic acid has been demonstrated in Ahmed *et al.* (2005). Similar to our results, Sahin *et al.* (2002) reported that serum triglycerides and cholesterol concentrations were decreased with inclusion vitamin C in the diet of chickens as compared with control group. Also, Konca *et al.* (2009) reported that dietary ascorbic acid (150 or 300 mg/kg) caused a quadratic decrease in serum cholesterol and LDL in turkeys reared under summer temperatures that do not exceed 31.7 C.

Feeding laying Japanese quails on diets supplemented with Ascorbic acid at level 250 mg/kg diet and different levels of propolis 250 and 500 mg/kg diet during summer season resulted in decreased ($P \leq 0.05$) serum MDA but increased ($P \leq 0.05$) serum total antioxidant capacity and serum glutathione peroxidase as compared to the control group (Table 4). Quail hens fed 500 mg propolis diet had the lowest level of serum MDA (as a marker of the oxidative stress and as an indicator of lipid peroxidation); this may refer to the strong antioxidant activity of propolis; due to the phenols compound in propolis. Also, Propolis prevents lipid oxidation because it contain chyrisin as one of the propolis compounds which having hepatoprotective and antioxidant activities (Sathiavelu *et al.,* 2009) also benzoic acid derivative exhibits antioxidant effects using inhibition assays of luminal luminescence, 2, 2-diphenyl-1-picrylhydazyl and lipoperoxidation, particularly caffeic acid, caffeoylquinic acid and cinamic acid are effective O_2-scavenging activity (Christov *et al.,* 2006; Nakajima *et al.,* 2007). Besides, flavonoids inhibit lipid peroxidation, platelet aggregation, capillary permeability and fragility, and the activity of enzyme systems, including cyclooxygenase (COX) and lipoxygenase (Havsteen, 2002). It has been reported that phenolic compounds exhibit antioxidant activity which is correlated with health benefits (Kähkönen *et al.,* 1999). Čeksterytė *et al.* (2008) reported that the effects of plant pollen and honey on the antioxidative processes and immune system have shown a decrease of lipid peroxidation in the blood. In addition, Attia *et al.* (2015) reported that vitamin C (ascorbic acid) significantly ($P \leq 0.05$) decreased cholesterol and MDA concentrations compared with the control group. Tatli-Seven *et al.* (2009) found that plasma MDA level was significantly decreased in vitamin C fed group compared to the control group. Heat stress causes increased free radical production (Halli well and Gutteridge, 1989) and lower the concentrations of antioxidant vitamins and minerals such as E, C, A and Zn in serum and tissues (Sahin and Kucuk, 2003).

CONCLUSION

Results indicated that propolis could effectively be added to quail ration to improve laying performance and to optimize lipid profile in egg yolk and blood and enhance the antioxidative status under summer conditions.

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

Ingredints	Experimental diets %
	Laying
Yellow corn	55.50
Soybean meal (44 %)	24.50
Concentrate (50 %) *	10.00
Di-calcium phosphate	2.00
Limestone	5.50
Sunflower oil	2.50
Vit. and min. mix.**	0.50
Salt (NaCl)	0.50
Total	100
Calculated analyses[1]:	
Crude protein, %	20.00
ME (Kcal/ Kg diet)	2903.89
Ether extract, %	2.60
Crude fiber, %	3.04
Methionine, %	0.71
Methionine + cystine, %	0.90
Lysine, %	1.15
Calcium, %	2.58
Av. phosphorus	0.40

* Concentrate : ME (K cal/kg) 2870, Crude protein 50%, Crude fiber 1.51%, Crude fat 1.54%, Calcium 4.29%, Phosphorus 2.39%, NaCl0.8%, Methionine 4.6%, Methionine &Cystine5.38%, Lysine 3.90%.

** 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., Nicotinicacid, 16.7 g., Pantothenicacid, 6.67 g., Biotin, 0.07 g., Folicacid, 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).

Table (2): Effect of ascorbic acid and propolis on laying performance of Japanese quails.

Items	Control	Ascorbic acid (250 mg/kg)	Propolis 250 mg/kg	Propolis 500 mg /kg
Body weight Change (g)	18.56±2.4	14.49±2.2	15.01±1.7	16.47±1.6
Egg laying rate (%)	89.14±0.6	87.99±1.5	88.10±1.4	86.86±0.9
Egg weight (g)	13.22±0.2	13.42±0.3	13.53±0.2	13.58±0.1
Egg number(hen/ day)	0.89±0.01	0.88±0.01	0.88±0.01	0.87±0.01
Egg mass(g/hen/day)	11.78±0.2	11.79±0.2	11.92±0.3	11.79±0.1
Feed consumption (g/hen/day)	32.93±0.6	32.23±0.7	31.79±0.8	32.44±0.8
Feed conversion ratio (g feed/g egg)	2.80±0.02	2.74±0.09	2.69±0.08	2.75±0.05

Table (3): Effect of ascorbic acid and propolis on egg quality parameters of laying Japanese quails.

Items	Control	Ascorbic acid (250 mg/kg)	Propolis 250 mg/kg	Propolis 500 mg /kg
Egg weight(g)	13.45±0.1	13.51±0.2	13.75±0.2	13.39±0.2
Egg specific gravity	1.077±0.00	1.079±0.00	1.080±0.00	1.078±0.00
Egg shape index	77.87±0.7	78.17±0.9	77.09±0.9	77.73±0.8
Yolk index	4.67±0.1^{ab}	4.44±0.2^{b}	4.42±0.1^{b}	4.98±0.1^{a}
Yolk weight	4.43±0.1	4.41±0.1	4.50±0.1	4.34±0.1
Yolk weight (%)	32.64±0.4	32.66±0.5	32.77±0.4	32.43±0.3
Yolk height(mm)	10.40±1.0	9.85±0.9	11.17±0.3	11.47±0.6
Yolk color	4.50±0.3	4.50±0.2	4.60±0.3	4.70±0.3
Albumin weight(g)	7.79±0.1	7.85±0.1	7.96±0.1	7.78±0.1
Albumin weight (%)	57.92±0.4	58.16±0.4	57.88±0.4	58.01±0.3
Albumin height	3.00±0.2	2.82±0.1	2.92±0.1	2.92±0.1
Egg shell thickness	0.223±0.00	0.222±0.01	0.237±0.00	0.221±0.00
Egg shell weight(g)	1.27±0.03	1.24±0.03	1.29±0.02	1.28±0.02
Egg shell (%)	9.44±0.2	9.19±0.2	9.40±0.2	9.57±0.1
Yolk total Cholesterol (mg/g yolk)	18.47±0.2^{a}	18.09±0.4^{ab}	18.34±0.2^{a}	17.80±0.3^{b}
Yolk total Lipids (mg/g yolk)	323.3±0.2^{a}	262.0±0.1^{c}	247.2±0.1^{c}	290.2±0.2^{b}

a - c: different superscripts within a raw indicate significant differences ($P \leq 0.05$).

Table (4): Effect of ascorbic acid and propolis on blood serum constituents of laying Japanese quails.

Items	**Control**	**Ascorbic acid (250 mg/kg)**	**Propolis 250 mg/kg**	**Propolis 500 mg /kg**
Total protein (g/dl)	4.79±0.01^{b}	4.85±0.01^{b}	4.91±0.05^{ab}	5.11±0.01^{a}
Albumin (g/dl)	3.09±0.03	3.05±0.02	3.03±0.05	3.17±0.05
Globulin (g/dl)	1.70±0.08^{c}	1.79±0.06^{bc}	1.87±0.05^{ab}	1.94±0.07^{a}
Creatinine (mg/dl)	0.29±0.03^{a}	0.24±0.03^{b}	0.24±0.02^{b}	0.23±0.02^{b}
Uric acid (mg/dl)	4.98±0.1^{a}	4.32±0.1^{b}	4.35±0.2^{b}	4.24±0.2^{b}
Alkaline Phosphates (U/L)	96.91±3.5^{a}	92.08±3.1^{b}	87.90±3.1^{c}	85.09±2.9^{d}
GOT (U/L)	82.00±1.8^{a}	80.25±1.4^{b}	78.25±1.7^{c}	75.75±1.6^{d}
GPT (U/L)	77.13±1.0^{a}	73.88±1.9^{b}	69.88±2.2^{c}	66.38±1.9^{d}
Total Lipids (mg/dl)	1141.63±51.20^{a}	1046.38±47.90^{b}	996.50±52.40^{c}	932.63±46.10^{d}
Triglycerides (mg/dl)	731.50±40.4^{a}	671.25±40.9^{b}	621.00±39.6^{c}	554.89±39.8^{d}
Total cholesterol (mg/dl)	192.60±5.9^{a}	182.42±6.3^{b}	175.28±6.4^{c}	130.31±5.9^{c}
LDL (mg/dl)	5.89±0.2 ^{a}	5.18±0.3 ^{b}	5.21±0.2 ^{b}	4.70±0.2 ^{c}
HDL (mg/dl)	51.65±1.1^{c}	55.83±2.2^{b}	56.50±1.8^{b}	59.69±1.4^{a}
Malondialdehyde (nmol/ml)	9.31±0.8 ^{a}	7.16±0.2 ^{b}	7.11±0.1 ^{b}	6.91±0.1 ^{c}
Total antioxidant Capacity (mM/L)	0.78±0.06 ^{c}	0.94±0.07 ^{a}	0.85±0.04 ^{b}	0.94±0.05 ^{a}
Glutathione peroxidase (mU/ml)	23.83±0.7^{c}	27.46±1.1^{ab}	25.79±1.3^{bc}	29.35±1.3^{a}

a - d: different superscripts within a raw indicate significant differences (P≤0.05).

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الملخص العربى

تأثير إستخدام بروبوليس نحل العسل كإضافه طبيعيه علي الأداء الإنتاجي والفسيولوجي للسمان الياباني

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أستخدم فى هذا البحث ٧٢ سمانه بياضه عمر ١٥ أسبوع والمنتجة للبيض لمدة تسعة أسابيع تم وزنها وتوزيعها عشوائيا فى تصميم عشوائى كامل يحتوى ٤ معاملات تجريبية بكل منها ١٨ طائر وكل معاملة تحتوى على ثلاث مكررات. تم أختيار الطيور على أساس أنتاج بيض أكثر من ٧٠ % نتيجة لاختبار الطيور لمدة أسبوعين قبل بدء التجربة. تم تكوين ٤ علائق حيث كانت المعاملة الأولى تحتوى على عليقة أساسية بدون أى إضافات وأستخدمت كمجموعة كنترول سلبيه. والمجموعة الثانيه أضيف لها الاسكوربيك أسيد بمعدل ٢٥٠ ملجم / كجم عليقة (كمجموعه مقارنه ايجابيه)، بينما المجموعه الثالثه والرابعه إحتوت على العليقة الأساسية مضاف لها البروبوليس بمعدل ٢٥٠ و ٥٠٠ ملجم بروبوليس / كجم عليقة.

أوضحت النتائج أنه لم يكن هناك أى تغير معنوى فى معدل التغير فى وزن الجسم، معدل وضع البيض، وزن البيض، وكتلة البيض نتيجة لاضافة الاسكوربيك أسيد أو البروبوليس مقارنة مع مجموعة الكنترول خلال مدة التجربة. لوحظ تحسنٍ غير معنوى فى الكفاءة التحويلية للغذاء لجميع الطيور نتيجة للاضافات المختلفة، وكان معدل تحسن الكفاءة التحويلية لمجموعة الطيور التى تناولت ٢٥٠ ملجم بروبوليس / كجم عليقة ٣,٩ % مقارنة بمجموعة الكنترول، والمجموعة التالية لها فى معدل التحسن التى تناولت ٢٥٠ ملجم أسكوربيك أسيد وكان التحسن ٢,١ % والمجموعة التى تناولت ٥٠٠ ملجم بروبوليس / كجم عليقة ١,٨ %. لم تتأثر صفات جودة البيضة بالمعاملات المختلفة ولكن لوحظ أنخفاض معنوى فى نسبة الدهون الكلية فى صفار البيضة نتيجة لاضافة الاسكوربيك أسيد أو البروبوليس مقارنة مع مجموعة الكنترول. كان معدل الانخفاض فى دهون البيضه ١٨,٩ ، ٢٣,٥ ، ١٠,٢ % للمجاميع التى تناولت ٢٥٠ ملجم أسكوربيك أسيد ، ٢٥٠ و ٥٠٠ ملجم بروبوليس / كجم عليقة على التوالى مقارنة بمجموعة الكنترول. كما لوحظ أيضا أنخفاض فى نسبة كولسترول صفار البيضه عند أضافة ٥٠٠ ملجم بروبوليس / كجم وصلت نسبته الى ٣,٦ % مقارنة مع الكنترول. ولم يكن هناك أى تأثير معنوى على نسبة كولسترول صفار البيضة نتيجة لاضافة الاسكوربيك أسيد أو ٢٥٠ ملجم بروبوليس / كجم عليقة. أدى أضافة الاسكوربيك أسيد أو البروبوليس فى العليقة الى إنخفاض معنوى فى تركيز الدهون الكلية، الجلسريدات الثلاثية، الكولسترول الكلى بينما زاد تركيز الكولسترول عالي الكثافة مقارنة مع مجموعة الكنترول فى سيرم الدم. كما لوحظ إنخفاض معنوى فى تركيز الكولسترول منخفض الكثافة نتيجة لإضافة كل من الاسكوربيك أسيد أو البروبوليس مقارنة مع مجموعة الكنترول. لم يكن هناك أى تغير معنوى فى تركيز المالونديهيد نتيجة للمعاملات المختلفة. كما لوحظ أرتفاع تركيز السعة الضد تأكسدية بصورة معنوية وزيادة معنوية فى تركيز الجلوتاثيون بيروكسيديز نتيجة للمعاملات المختلفة مقارنة مع مجموعة الكنترول. وقد خلصت الدراسة الى أن البروبوليس يمكن أضافته لعلائق السمان كمنشط نمو وإضافه طبيعيه لتحسين أداء انتاج البيض وتحسين مستوى الدهون فى صفار البيضة وسيرم الدم وتعزيز المناعه كالصفات الضد تأكسدية تحت ظروف الصيف الحار.