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**INFLUENCE OF SOME HONEY BEE PRODUCTS ON SOME  
HAEMATOLOGICAL AND IMMUNOLOGICAL PARAMETERS  
AND MEAT QUALITY IN BROILERS**

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**ABSTRACT:** The present study was conducted to evaluate the effects of propolis, bee-pollen and bee-venom on meat quality and immune response of broiler chickens. A total of 408, one week old, Cobb 500 broilers were randomly divided into 8 experimental groups (3 replicate, 17 chicks each). The first treatment was fed basal diet without any additives and served as a control. The second treatment was fed the basal diet supplemented with the growth promoter Biox-Y<sup>®</sup> 0.5g per kg of diet. The third and the fourth treatments were fed basal diet supplemented with propolis (200 or 400 mg/kg diet). The fifth and the sixth treatments were fed basal diet supplemented with bee-pollen (1 or 2 g/kg diet). The seventh and the eighth treatments were fed basal diet and its water was supplemented with bee-venom (1 or 2 mg/L water). Blood samples were obtained at the end of experiment to determine blood parameters. The obtained results showed that broiler chicks fed diet supplemented with propolis (400 mg/kg diet) or bee-pollen (2 g/kg diet) had significantly higher breast muscles protein, moisture concentration and bone strength compared to the control and Biox-Y<sup>®</sup> treatments. Chicks fed diets with propolis (200 mg/kg diet) or drinking water with bee-venom (1 or 2 mg/L) resulted in significantly higher Haemoglobin and Hematocrit concentration compared to the control treatment. Humoral immune response against sheep red blood cells was increased in propolis (400 mg/kg diet) or bee-venom (2 mg/L water) treatments compared to the control treatment. While, cell mediated immune response (PHA-L injection) was increased significantly in propolis (400 mg/kg diet) treatment than the control or Biox-Y<sup>®</sup> treatments. The chicks fed diet with bee-pollen (1 or 2 g/kg diet) or Biox-Y<sup>®</sup> (0.5 g/kg diet) had significantly higher relative thymus weight. Also, bee-venom (2 mg/L water) treatment had significantly higher relative spleen and bursa weights compared to the control treatment.

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**Keywords:** Broiler- meat quality-immune respons- blood parameters- honey bee products.

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## INTRODUCTION

Antibiotics used as supplements in poultry diets to improve the growth performance, stabilize intestinal microflora and prevent infection by specific pathogenic micro-organisms. Improve immunity response is very important to prevent infectious disease (Babaei et al., 2016).

The use of antibiotics, as growth promoters, is negatively understood because pathogenic bacteria of animals and humans have shared and developed a variety of antibiotic resistance mechanisms that may be easily distributed within microbial communities. Nowadays, antibiotic resistance mechanisms spread of worldwide, resulting from the use of antibiotics has reduced treatment options and therapeutic efficacy in human medicine (Diarra and Malouin, 2014). Hence, there is need to identify eco-friendly alternatives to reduce antibiotic use. One of the most hopeful methods of reducing antibiotics is prophylactic administration of natural immunostimulants of birds (Jung et al., 2010). Therefore, there are many of studies on alternate products that may result in improved feed utilization, promotion of the growth and maintenance of intestinal health are taking place.

Moreno et al. (2000) reported that propolis contains a variety of chemical compounds such as amino acids, polyphenols, terpenoids, steroids and inorganic compounds. It has many biological properties which including antiviral, anti-bacterial, antioxidant, antifungal, hepatoprotective and immuno-stimulating activities (Revington 2002). Khojasteh and Shivazad (2006) reported that bee-pollen is extremely rich of carotenes which are converted to vitamin A in the liver. Also, it has

vitamin B complex and other vitamins (E, D, C and lecithin), and contains over 50% protein than beef, and its fat content is very low. Also, bee-pollen contains digestive enzymes from the bees.

Oršolić (2012) reported that bee-venom plays a major role in the defence of bee colonies. It is produced from the venom gland of the bee. The bee-venom (natural toxin) is a complex mixture of proteins, peptides (melittin, apamine and adolapine) and other molecular components (dopamine, histamine and norepinephrine). It has recently been demonstrated that whole bee-venom and some of its components, particularly melittin, possess antinociceptive and anti-inflammatory activities in very small doses (Kwon et al., 2002).

The aim of this study was to evaluate the effect of using bee products (propolis, pollen and venom) and a growth promoter on meat quality and immune response in broiler chickens, in order to produce chicken products more safety for human consumption.

## MATERIALS AND METHODS

This study was carried out at the Poultry Unit, Agricultural Experimental station, Faculty of Agriculture, Cairo University, Giza, Egypt. A total of 408 unsexed one week old Cobb 500 broilers were randomly divided into 8 equal experimental treatments with 3 replicate of 17 chicks each. Chicks were placed in an open sided house, under similar natural environmental conditions of the season (December 2015 to January 2016), with a brooder temperature started at 30°C and was reduced 2°C every week until 24°C. The relative humidity ranged between 58 to 62%. The birds were exposed to 23 h light and 1 h darkness. Water and feed were provided ad libitum. Birds were vaccinated against infectious

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Avian Influenza, Newcastle disease and Infectious bursal disease (IBD, Gumboro) at the time of placement.

Throughout the experimental period, the control treatment was fed a basal diet (Table 1) without any additives and drank plane water. The second treatment was fed the basal diet supplemented with the growth promoter Biox-Y<sup>®</sup> at a level of 0.5g per kg of diet, which it's containing of a) dried yeast cell walls (*Saccharomyces cerevisiae*) containing Mannan oligosaccharide 18% and Beta Glucan 20%. b) Carrier: Silicates containing Calcium silicates 36%, Sodium aluminium silicate 32%, and Silicic acid 12%, it is produced by Biochem Co., Germany. The third and the fourth treatments (chemical composition of propolis accorging to Christov et al., 1998) were fed the basal diet supplemented with propolis (200 or 400 mg/kg diet), respectively. The fifth and the sixth treatments (chemical composition of bee-pollen according to Campos et al., 2010) were fed basal diet supplemented with bee-pollen (1 or 2 g/kg diet), respectively. The seventh and the eighth treatments (composition of bee-venom according to Urtubey, 2005) were fed basal diet and their water was supplemented with bee-venom (1 or 2 mg/L water, respectively).

At 42 days from starting the experiment, 72 birds (3 birds per replicate per treatment) were chosen at random. Birds were slaughtered, then the dressing percentage was calculated. Spleen, Bursa of Fabricius gland and Thymus gland were also weighted.

Also, 72 samples were taken from the tibia to measure bone strength by Digital Force Gauge (SHIMPO) equipment, which measure Penetration resistance,

Compression and Tensile. Its model (standard type FGC-50), accuracy ( $\pm 0.2\%$  of maximum load  $\pm 1/2$  digit at 23°C), a Trescal Company, Brampton, Ontario Canada, according to Szeremeta et al. (2003) method. Another, 40 samples were chosen from the breast muscles to measure the protein and moisture content in breast muscles.

A total of 48 blood samples, collected from the brachial vein, at the end of the experiment (2 blood samples per replicate per treatment). Blood samples were collected in heparinized plastic tubes, then centrifuged at 4000 rpm/min for 10 minutes, plasma were decanted and stored at -20 °C in 3-mL eppendorf for subsequent analyses (Rabie et al., 2018). Plasma total protein (g/dl) was determined according to Gornal, et al. (1949). In addition, Plasma albumin (g/dl) was determined according to Doumas et al. (1971). Haemoglobin (g/dl) was determined according to Drabkin and Austin (1932).

At 28 days of age, 72 birds (3 birds per replicate per treatment) were injected in the wing vein with a volume of 0.2 mL of a 7.5% suspension of SRBC's. At 35 days of age, blood samples were collected in non-heparinized tubes by puncturing the brachial vein. Serum was separated by centrifugation at 3000 rpm/min for 10 min at 4°C, and stored at -20°C until assayed. Individual serum samples were analysed for antibody responses against SRBC by the ELISA technique, and the plates were read at 405 nm on an ELISA reader, according to Van der Zijpp (1983) method.

At 42 days of age, 72 chicks were injected with 0.2 ml Phytohemagglutinin-L 100 mg (PHA-L) concentration (3 birds per replicate per treatment) in their wattles. Phytohemagglutinin (0.2 mL)

was injected in the right wattle of each bird. The same volume of saline was injected in the left wattle as a negative control. The wattles thickness was measured, using a digital caliper, before and after 24hrs from injection. The response was obtained by calculating the difference between the thickness (in mm) of the wattle before to and after injection of phytohemagglutinin-L.

**Statistical analysis:**

One-way analysis of variance for the data was done using the SAS General Linear model procedure (SAS Institute, 2004). Mean values were compared using Duncan's multiple rang test (Duncan, 1955) when significant differences existed. The significance level was set at 5%.

**RESULTS AND DISCUSSION**

**a) Meat quality:**

The results displayed in Table 2 indicate that broiler chicks fed diet supplemented with propolis (400 mg/kg diet) or bee-pollen (2 g/kg diet) resulted in significantly higher protein and moisture concentration in the breast muscles compared to the control and Biox-Y® treatments. There were no significant differences in protein or moisture concentration of breast muscles between chicks that drank water with bee-venom (1 or 2 mg/L) and each of control and Biox-Y® treatments.

The propolis extract, resulted in improved digestion, absorption and intestinal health. In addition to its antimicrobial activity (Kujumgiev et al., 1999), propolis possesses biological activities such as that of antioxidants (Orhan et al., 1999). Haro et al. (2000) found that propolis supplementation had significantly improved the availability and utilization of dietary calcium and phosphorus, which has a beneficial effect on the skeleton.

Also, they observed that propolis supplementation to laying hen, compared to the control group, significantly improve egg shell weight and egg shell thickness. This may be due to improved digestibility and absorption of calcium resulting from chemical composition of propolis (contains benzoic, 4-hydroxy-benzoic. etc.).

Lin et al. (2006) stated that the bee-pollen increased the moisture content of breast muscles. The moisture content is considered an important factor more than cooking temperature for product sensory characteristics. Haščík et al. (2013) reported that bee-pollen has a positive impact on the tenderness, aroma, taste and juiciness of chickens breasts and thighs. This result may be because bee-pollen increase meat water content, might that reason which has been explained why the bee-pollen increase the cooling and freezing loss.

Haščík et al. (2014) reported that bee-pollen has a positive effect on broiler meat chemical composition. The great values of moisture content in breast muscles were found in the experimental groups compared with control group. Protein content values were comparable in all evaluated groups. Bee pollen addition has a lowering effect on fat content of chicken meat. This led to improve the meat quality and better effects on human health.

Results in Table 2 indicate that after 6 weeks of feeding broiler chicks with propolis (400 mg/kg diet) or bee-pollen (2 g/kg diet), their bone strength of the tibia than was significantly higher compared to the control and Biox-Y® treatments.

Zuo and Xu, (2003) reported that bee-pollen contains vitamin D which improves calcium absorption in the small intestine. Also, according to Wang et al.

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(2007), bee-pollen enhancing calcium absorption, increases the intestinal absorption surface and so its deposition in the bones. According to Yamaguchi et al. (2007), bee-pollen has stimulatory effects on bone formation and inhibitory effects on bone desorption.

From this study it can be concluded that propolis (400 mg/kg diet) or bee-pollen (2 g/kg diet) to broilers diet is very important in improvement meat quality for human consumption.

### **b) Haematological parameters:**

#### **1. Haemoglobin and hematocrit**

Results in Table 3 indicate that chicks fed diet supplemented with propolis (200 mg/kg diet) or added bee-venom (1 mg/L) to their drinking water had significantly higher Haemoglobin (Hb) concentration and Hematocrit % (PCV) compared to the control treatment. Also, bee-venom (2 mg/L) recorded significantly higher Haemoglobin concentration and Hematocrit % than the control and Biox-Y® treatments.

These results are in agreement with Shreif and El-Saadany (2017), who reported significant increases in red blood cells (RBCs), Hb and PCV when propolis was supplemented in chicks rations compared with birds fed the control diet. Attia et al. (2014a) also, concluded that adding propolis to broiler rations, continuously or intermittently, at a level of 300 mg/kg, resulted in increases in their RBCs and Hb.

The positive effects of propolis on the previous parameters may be due to the direct effect on haemopoietic tissue and due to improve digestive utilization of iron which is required for the regeneration of hemoglobin (Haro et al., 2000). Omar et al. (2002) showed that the improvement in Hb, PCV%, serum protein and its fractions in propolis and

Nigeria sativa seed oil groups, may be due to their direct effect on the haemopoietic tissue.

Our results indicated that feeding bee-pollen at the level of 1 g/kg diet, resulted in a significantly higher Hb content and PCV% over the control treatment (Table 3). This is in agreement with Farag and El-Rayes, (2016) who found that the PCV% and Hb concentration in birds fed bee-pollen diets (0.6% BP) were significantly higher than the control group. They also, stated that feeding bee-pollen to broilers increased Hb and RBCs and helped increase energy levels. Since the hemoglobin is in the RBCs that carry O<sub>2</sub> for energy metabolism, this may interpret the relationship between energy and bee-pollen. The positive impact on RBCs, PCV% and Hb values could be due to vitamins and minerals contained in bee-pollen. Vitamins and minerals have a role in formation and maturation of RBCs (El-Wafa et al., 2002) which in turn caused an increase in hemoglobin and hematocrit, so there are positive relationships between RBC's and hemoglobin and hematocrit (Sturkie, 1986).

El-Neney and El-Kholy (2014) studied the effects of feeding bee-pollen to rabbits on plasma Hb and Hct values. They stated that treatment with bee-pollen caused a significant increase in hemoglobin. This indicates the positive impact of this treatment on the different hematological parameters and the positive impact on liver as well as, other tissues like bone marrow where red blood cells are synthesized (Feldman et al., 2000). In general, bee-pollen causes an increase in total RBC's, which in turn caused an increase in hemoglobin (Sturkie, 1986).

#### **2. Plasma protein, albumin and globulin concentrations (mg/dl)**

Results in Table 4, indicate that the chicks fed diets supplemented with propolis (200 or 400 mg/kg diet) or bee-pollen (1 or 2 g/kg diet) had significantly higher total plasma protein compared to the control treatment. Also, broiler chicks treated with both levels of propolis; bee-pollen (2 g/kg diet), both levels of bee-venom and Biox-Y® had significantly higher plasma albumin compared to the control treatment. Also, significantly higher plasma globulin levels were observed when chicks were fed propolis (200 or 400 mg/kg diet) or bee-pollen (1 g/kg diet), than the control treatment. On the other hand, no significant differences in plasma globulin were observed when chicks drank water containing bee-venom compared to the control treatment.

These results are in agreement with Shreif and El-Saadany (2017) who reported a significant increase in plasma total protein, albumin and globulin when chicks were fed diet containing propolis. Also, they stated that the beneficial effects of propolis on protein fractions may be due to its stimulating effect on the liver exhibiting an anabolic action favoring protein synthesis and its preserving effect to the body protein from degeneration.

Mahmoud et al. (2017) indicated that broiler chickens fed 100 or 3000 mg.kg<sup>-1</sup> propolis had significantly higher serum albumin concentration compared to the control birds. Also, they reported no differences in total protein, globulin concentration or albumin:globulin ratio between propolis treated broilers and controls.

Farag and El-Rayes (2016) indicated that plasma albumin, total protein and globulin increased significantly in birds fed diets with bee-pollen compared with

birds fed the control diet. Bell et al. (1983) reported that the increase in the plasma albumin and protein may be due to the bee-pollen has protein and amino acids with a high concentrations. It's known that the changing in the plasma albumin level reflects the change in liver function, where it is the site of albumin synthesis while the lymphatic tissues are the site of globulin formation.

The results in this study are in agreement with the findings of Attia et al. (2014a), who noted that bee-pollen has positive effects on serum albumin, total protein and globulin in broiler chicks. On the other hand, these results are different from those observed by Attia et al. (2014b) who reported that total protein, albumin and globulin increased insignificantly with bee-pollen supplementation in growing rabbit diets.

Han et al. (2010) reported no significant effects of bee-venom supplementation on albumin, total protein and globulin. Also, they observed that bee-venom supplementation via drinking water did not induce major organ damages. Although globulin level was significantly elevated with high-dose (2.5 mg/kg) of bee-venom treatment in piglets (Han et al., 2009) this suggests that bee-venom requires a high dose to elicit any physiological effects.

#### **c) Immunological parameters:**

##### **1. Relative weight of lymphoid organs**

The results displayed in Table 5 indicate that the chicks fed diet with bee-pollen (1 or 2 g/kg diet) or Biox-Y® (0.5 g/kg diet) had significantly higher thymus relative weights. However there were no significant effects on spleen or bursa relative weight compared to the control treatment. Also, bee-venom (2 mg/L water) treatment resulted in significantly higher relative weights of both the spleen

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and bursa compared to the control treatment.

These results are in agreement with Farag and El-Rayes (2016) who found that the relative weight of thymus increased significantly in broilers that received diet containing bee-pollen compared with birds fed the control diet. Also, they indicated that this may be due to the supplementation of bee-pollen to chicks diet and that it promoted the growth of thymus and resulted in positively influencing the immunity of broilers. Song et al. (2005) also reported that bee-pollen can improve the antibodies production speed and the cell immune responses.

El-Neney and El-Kholy (2014) reported that bee-pollen supplements in rabbits diet improved the production of more T-cells, which resulted from enhanced lymphocytes percentage. Stephen (2007) indicated that T-cells play a major role in cell-mediated immunity, undergo maturation in the thymus gland. These positive effects may be due to the bee-pollen which has specific components (nucleic acids) that stimulate the Natural killer cells (NK cells) and T-lymphocyte activities, which promote the differentiation and proliferation of immune system cells (Wang et al., 2005).

### **2. Humoral immune response**

The results displayed in Table 6 indicate that at 35 days of age, the chicks fed diets containing propolis (400 mg/kg diet) or bee-venom (2 mg/L water) had significantly higher Humoral immune response (Hi titer) against SRBC's than of control treatment.

These results are in agreement with Zafarnejad et al. (2017) who reported significantly higher antibodies responses against SRBC at 35 days of age in broiler chicks receiving 700 to 900 mg.kg<sup>-1</sup>

propolis in their diet compared with birds fed the control diet. Also, Daneshmand et al. (2015) indicated that propolis is able to improve Ig production and may be used as adjuvant in vaccines to improve immunogenicity in male broiler chickens. Park et al. (2004) found that propolis supplementation activates the immune system in broilers, raising macrophage and natural killer cells activities, and increases levels of cytokines (IL-1, IL-2, and IL-4). These cytokines enhance B-lymphocytes activities, which would be able to produce immunoglobulins (Banskota et al., 2000). Our results are in contrast with the findings of Freitas et al. (2011). They studied the effects of supplementing diet with propolis and antibiotic on broilers immune responses. They found that there was no effect of dietary treatment on immune related parameters that they assessed including antibody titers against NDV, AI, SRBC, and H:L ratio. They stated that this might be due to the low levels used (2, 10, and 50 mg/kg). These levels might not enough to improve immune responses of broiler chicks.

The effect of bee-venom on humoral and cellular immune responses has been tested in different reports. Hadjipetrou-Kourounakis and Yiangou (1984) indicated a significantly decreased in the number of plaque-forming cells which present in the spleens of rats immunized with SRBCs as well as the splenocytes responses to T cell mitogens. Both enhancement and suppression of immune reactivity was seen using bee-venom when examined on the splenic lymphocytes (Hyre and Smith, 1986).

### **3. Cell mediated immune response:**

Results presented in Table 7 indicate that broiler chicks fed diet supplemented with propolis (400 mg/kg diet) had

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significantly higher cell mediated immune response (PHA-L injection) than to the control and growth promoter (Biox-Y<sup>®</sup>) treatments. On the other hand, the bee-pollen and bee-venom treatments did not have any significant effects on cell mediated immune response compared to the control treatment.

These results are in agreement with Galal et al. (2008) who reported that hens fed propolis supplemented diets (50, 100 and 150 mg.kg<sup>-1</sup> diet) had significantly hyper responder to PHA-P injection compared with birds fed the control diet. Chen et al. (1999) reported that propolis stimulate lymphocyte proliferation, antibody production after immunization and development and stimulate the activity of T & B lymphocytes in broiler chickens, depending on the time and dose of administration.

Several studies have showed that propolis activates the immune system in different animal species, increasing macrophage activity and increasing IL-1, IL-2 and IL-4 levels, also increase antibody response (Park et al., 2004), which can stimulate

the proliferation of other immune cells (Taheri et al., 2005).

Our results are in contrast with the findings of Sforcin (2007) who reported that propolis act directly on the T lymphocyte, inhibiting their differentiation. Park et al. (2004) also, indicated that the active component of propolis (caffeic acid phenethyl ester), directly or indirectly causes the immune cells to reduce in cell number (especially T cells). Song et al. (2005) reported that bee-pollen supplemented to broilers diet could increase the antibody production speed, improve the cell immune responses and reinforce the immunological system.

### **CONCLUSION**

It can be concluded that it is recommended to add propolis (400 mg/kg diet) or bee-pollen (2 g/kg diet) to broilers diets or to add bee-venom (2 mg/L water) to Cobb broilers drinking water. This is an eco-friendly alternative to replace the use of antibiotics in broilers feed. This may result in improve meat quality and immune response for broiler chickens.

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**Table (1):** Composition and calculated analysis of the basal diet fed to the experimental birds

<b>Ingredients (%)</b>	<b>Starter (7 – 21 day)</b>	<b>Finisher (22 – 49 day)</b>
Yellow corn	43.69	56.05
Soybean (46% CP)	26.40	--
Soybean (44% CP)	--	33.00
Wheat bran	10.00	--
Corn gluten 60%	5.00	--
Full fat soya	5.00	--
Dried corn dist.	3.00	--
Soya oil crude	2.80	7.20
Di-calcium phosphate	2.00	1.70
Limestone	1.10	1.10
Premix* (Vitamin & Minerals)	0.30	0.30
L Lysine HCL	0.23	--
DL-Methionine	0.18	0.27
Salt	0.30	0.38
<b>Total</b>	<b>100</b>	<b>100</b>
<b>Calculated chemical analysis (%)**</b>		
Crude protein	23.208	18.99
Crude fiber	3.407	3.698
Crude fat	6.441	9.824
Calcium	0.962	0.891
Available phosphorus	0.526	0.462
Lysine	1.316	1.107
Methionine	0.601	0.590
Cysteine	0.196	--
Met.+cysteine	0.979	0.902
Sodium	0.156	0.163
ME (Kcal/ Kg diet)	3019.8	3226.06

\* Supplied per kg of diet: Vit. A, 13000 IU; Vit. D<sub>3</sub>, 5000 IU; Vit. E, 80 mg; Vit. K<sub>3</sub>, 4 mg; Vit. B<sub>1</sub>, 5 mg; Vit. B<sub>2</sub>, 9 mg; Vit. B<sub>6</sub> 4 mg; Vit. B<sub>12</sub>, 0.020 mg; Niacin, 60 mg; Pantothenic acid, 15 mg; Folic acid, 2 mg; Biotin, 0.15 mg; Choline, 400 mg; Copper, 20 mg; Iron, 50 mg; Managanese, 100 mg; Zinc, 100 mg; Calcium carbonate, 300 mg; Iodine, 1.3 mg; Selenium, 0.2 mg; Cobalt, 0.2 mg.

\*\* According to NRC (1994)

**Table (2):** Influence of some honey bee products and a growth promoter on protein, moisture in breast muscles and bone strength of tibia at 7 weeks old in Cobb 500 broilers

Treatments Traits	Control	Biox-Y® 0.5 g/kg diet	Propolis		Bee Pollen		Bee Venom		P-value
			200 mg/kg diet	400 mg/kg diet	1 g/kg diet	2 g/kg diet	1 mg/L water	2 mg/L water	
Protein (g.100 g <sup>-1</sup> )	25.5 <sup>b</sup> ±1.1	26.1 <sup>b</sup> ±0.5	27.7 <sup>ab</sup> ±0.3	29.2 <sup>a</sup> ±0.3	26.2 <sup>b</sup> ±1.6	29.0 <sup>a</sup> ±0.4	27.3 <sup>ab</sup> ±0.9	26.9 <sup>ab</sup> ±0.3	<0.0286
Moisture (g.100 g <sup>-1</sup> )	74.2 <sup>c</sup> ±0.9	73.8 <sup>c</sup> ±1.9	74.8 <sup>bc</sup> ±0.2	78.3 <sup>ab</sup> ±0.9	77.5 <sup>abc</sup> ±1.5	80.3 <sup>a</sup> ±1.1	74.8 <sup>bc</sup> ±0.4	75.2 <sup>bc</sup> ±0.8	<0.0025
Bone Strength (Newton)*	337 <sup>c</sup> ±25	371 <sup>bc</sup> ±33	427 <sup>abc</sup> ±28	472 <sup>a</sup> ±27	387 <sup>abc</sup> ±40	438 <sup>a</sup> ±18	361 <sup>bc</sup> ±27	352 <sup>bc</sup> ±26	<0.0164

<sup>a,b,c</sup> Means followed by different superscripts, between treatments within trait, differ significantly (P<0.05)

\*Newton (symbol: N) is the International System of Units (SI) derived unit of force.

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**Table (3):** Influence of some honey bee products and a growth promoter on haemoglobin and hematocrit in Cobb 500 broilers after 6 weeks of starting the experiment

Treatments Traits	Control	Biox-Y® 0.5 g/kg diet	Propolis		Bee Pollen		Bee Venom		P-value
			200 mg/kg diet	400 mg/kg diet	1 g/kg diet	2 g/kg diet	1 mg/L water	2 mg/L water	
Haemoglobin(g/dL)	11.0 <sup>b</sup> ±0.48	12.5 <sup>ab</sup> ±0.93	13.3 <sup>a</sup> ±0.47	12.8 <sup>ab</sup> ±0.5	13.3 <sup>a</sup> ±0.39	12.6 <sup>ab</sup> ±0.52	13.8 <sup>a</sup> ±0.49	13.9 <sup>a</sup> ±0.66	0.0236
Hematocrit %	28.7 <sup>bc</sup> ±0.88	26.1 <sup>c</sup> ±1.39	32.0 <sup>a</sup> ±0.55	28.6 <sup>bc</sup> ±0.60	31.8 <sup>a</sup> ±0.66	28.6 <sup>bc</sup> ±0.44	31.8 <sup>a</sup> ±1.31	29.9 <sup>ab</sup> ±1.02	0.0001

<sup>a,b,c</sup> Means followed by different superscripts, within trait between treatments, differ significantly (P<0.05).

**Table (4):** Influence of some honey bee products and a growth promoter on plasma total protein, albumin and globulin concentration in Cobb 500 broilers after 6 weeks of starting the experiment

Treatments Traits	Control	Biox-Y® 0.5 g/kg diet	Propolis		Bee Pollen		Bee Venom		P-value
			200 mg/kg diet	400 mg/kg diet	1 g/kg diet	2 g/kg diet	1 mg/L water	2 mg/L water	
Total Protein (mg/dl)	3.12 <sup>c</sup> ±0.09	4.02 <sup>abc</sup> ±0.24	4.89 <sup>a</sup> ±0.61	4.79 <sup>a</sup> ±0.41	4.60 <sup>ab</sup> ±0.28	4.71 <sup>ab</sup> ±0.19	3.12 <sup>c</sup> ±0.12	3.60 <sup>bc</sup> ±0.62	0.0022
Albumin (mg/dl)	1.51 <sup>b</sup> ±0.10	1.94 <sup>a</sup> ±0.13	1.99 <sup>a</sup> ±0.14	1.99 <sup>a</sup> ±0.11	1.80 <sup>ab</sup> ±0.11	2.18 <sup>a</sup> ±0.13	1.92 <sup>a</sup> ±0.15	2.13 <sup>a</sup> ±0.06	0.0135
Globulin (mg/dl)	1.60 <sup>bc</sup> ±0.15	2.08 <sup>abc</sup> ±0.24	2.91 <sup>a</sup> ±0.49	2.81 <sup>a</sup> ±0.35	2.80 <sup>a</sup> ±0.30	2.53 <sup>ab</sup> ±0.29	1.20 <sup>b</sup> ±0.07	1.47 <sup>bc</sup> 0.67	0.0052

<sup>a,b,c</sup> Means followed by different superscripts, between treatments within trait, differ significantly (P<0.05).

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**Table (5):** Influence of some honey bee products and a growth promoter on relative weights of lymphoid organs at 7 weeks of age in Cobb 500 broilers

Treatments Traits (%live weight)	Control	Biox-Y® 0.5 g/kg diet	Propolis		Bee Pollen		Bee Venom		P-value
			200 mg/kg diet	400 mg/kg diet	1 g/kg diet	2 g/kg diet	1 mg/L water	2 mg/L water	
Spleen	0.136 <sup>b</sup> ±0.008	0.135 <sup>b</sup> ±0.015	0.144 <sup>ab</sup> ±0.012	0.130 <sup>b</sup> ±0.007	0.136 <sup>b</sup> ±0.012	0.127 <sup>b</sup> ±0.012	0.159 <sup>ab</sup> ±0.006	0.172 <sup>a</sup> ±0.008	0.0393
Bursa	0.065 <sup>b</sup> ±0.003	0.074 <sup>b</sup> ±0.007	0.077 <sup>ab</sup> ±0.004	0.070 <sup>b</sup> ±0.003	0.070 <sup>b</sup> ±0.005	0.065 <sup>b</sup> ±0.005	0.079 <sup>ab</sup> ±0.005	0.091 <sup>a</sup> ±0.006	0.0057
Thymus	0.228 <sup>b</sup> ±0.008	0.282 <sup>a</sup> ±0.017	0.256 <sup>ab</sup> ±0.011	0.237 <sup>b</sup> ±0.011	0.274 <sup>a</sup> ±0.014	0.276 <sup>a</sup> ±0.013	0.263 <sup>ab</sup> ±0.007	0.264 <sup>ab</sup> ±0.009	0.0168

<sup>a,b</sup> Means followed by different superscripts, between treatments within trait, differ significantly (P<0.05).

**Table (6):** Influence of some honey bee products and a growth promoter on humoral immune response against sheep red blood cells (SRBC's) in Cobb 500 broilers

Treatments Trait	Control	Biox-Y® 0.5 g/kg diet	Propolis		Bee Pollen		Bee Venom		P- value
			200 mg/kg diet	400 mg/kg diet	1 g/kg diet	2 g/kg diet	1 mg/L water	2 mg/L water	
Hi titer	5.22 <sup>bc</sup> ±0.83	5.22 <sup>bc</sup> ±1.01	6.67 <sup>abc</sup> ±0.91	8.33 <sup>a</sup> ±0.50	5.67 <sup>bc</sup> ±0.96	4.56 <sup>c</sup> ±0.88	7.22 <sup>ab</sup> ±0.72	8.78 <sup>a</sup> ±0.57	0.0025

<sup>a,b,c</sup> Means followed by different superscripts, between treatments within trait, differ significantly (P<0.05).

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**Table (7):** Influence of some honey bee products and a growth promoter on cell-mediated immune response in Cobb 500 broilers

Treatments Traits	Control	Biox-Y® 0.5 g/kg diet	Propolis		Bee Pollen		Bee Venom		P- value
			200 mg/kg diet	400 mg/kg diet	1 g/kg diet	2 g/kg diet	1 mg/L water	2 mg/L water	
PBS (control)	0.117±0.04	0.113±0.03	0.082±0.35	0.104±0.05	0.076 ±0.02	0.128±0.03	0.058±0.01	0.186±0.05	NS
PHA-L Wattle swelling response	0.628 <sup>bc</sup> ±0.08	0.540 <sup>c</sup> ±0.08	0.680 <sup>bc</sup> ±0.09	0.969 <sup>a</sup> ±0.08	0.787 <sup>abc</sup> ±0.13	0.794 <sup>abc</sup> ±0.1	0.612 <sup>bc</sup> ±0.04	0.852 <sup>ab</sup> ±0.07	0.0112

<sup>a,b,c</sup> Means followed by different superscripts, between treatments within trait, differ significantly (P<0.05). NS: not significant.

PBS = Phosphate buffered saline

PHA-L = Phytohemagglutinin-L

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### الملخص العربي

تأثير بعض منتجات نحل العسل على بعض قياسات الدم والمناعة وجودة اللحم في دجاج التسمين

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أستخدم في هذه الدراسة 408 ككتوت تسمين Cobb عمر اسبوع واستمرت حتى عمر 7 أسابيع حيث تم تقسيمهم عشوائيا الى 8 مجاميع وكل مجموعة تم تقسمها الى 3 مكررات كل مكرر يحتوى على 17 ككتوت وتم معاملة هذه المجاميع كما يلى :

المعاملة الاولى وهى الكنترول (Control) وفيها لا تحتوى العليقة على اى اضافات.  
المعاملة الثانية حيث تم اضافة منشط النموالتجارى Biox-Y® بمعدل 0.5 جم/كجم علف الى العليقة سابقة الذكر.  
المعاملة الثالثة والرابعة تم اضافة مادة البروبليس الى العليقة الاساسية بمعدل 200 أو 400 ملجم/كجم علف على التوالى.

المعاملة الخامسة والسادسة تم اضافة مادة حبوب اللقاح الى العليقة الاساسية بمعدل 1 أو 2 جم/كجم علف على التوالى.

المعاملة السابعة والثامنة تم اضافة مادة سم النحل الى مياه الشرب بمعدل 1 أو 2 ملجم/لتر مياه على التوالى.  
تم اخذ عدد 40 عينة من اللحم (عضلة الصدر) فى نهاية التجربة لتقدير المحتوى البروتينى والمائى فيها. كما تم اخذ عدد 72 عظمة ساق فى نهاية التجربة لتقدير قوة صلابة العظم. وتم حقن 72 طائر بخلايا كرات الدم الحمراء لدم الغنم لتقدير الاستجابة المناعية ضد خلايا دم الغنم الحمراء. كما تم حقن الطيور بمادة PHA-L فى الدلايات لتقدير الاستجابة المناعية الخلوية.

اظهرت النتائج زيادة معنوية للمحتوى البروتينى والمائى لقطع اللحم كما لوحظ ايضا زيادة معنوية لقوة صلابة العظم فى كلا من معاملة البروبليس (400 ملجم/كجم علف) ومعاملة حبوب اللقاح (2 جم/كجم علف) وذلك بالمقارنة بالكنترول أو معاملة منشط النمو Biox-Y®. كما لوحظ زيادة معنوية للاستجابة المناعية ضد خلايا كرات الدم الحمراء لدم الغنم لمعاملات البروبليس (400 ملجم/كجم علف) أو معاملة سم النحل (2 ملجم/لتر ماء شرب) مقارنة بمعاملة الكنترول. ايضا وجد زيادة معنوية للاستجابة المناعية الخلوية لمعاملة البروبليس (400 ملجم/كجم علف) مقارنة بمعاملة الكنترول ومعاملة منشط النمو.

نستخلص من هذه الدراسة انه يمكن استخدام البروبليس (400 ملجم/كجم علف) او حبوب اللقاح (2 جم/كجم علف) أو سم النحل (2 ملجم/ لتر مياه) كبدائل طبيعية فى تغذية دجاج التسمين واحلالها محل منشطات النمو حيث اثبتت حدوث تحسن معنوية فى جودة اللحم وزيادة الاستجابة المناعية لدى الطيور.