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IMPACT OF USING PROPOLIS ON PERFORMANCE, HEMATOLOGICALAND BLOOD BIOCHEMICAL PARAMETERS AND IMMUNE RESPONSE OF DUCKS (*CAIRINA MOSCHATA*).

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ABSTRACT: The study aimed to determine the effect of propolis on productive performance, immune response, blood parameters, and bacterial count.A total number of 200 unsexed 7 d old ducklings (*Cairina moschata*) were divided randomly into four dietary treatment groups, 50 birds each in five equal replicates. The first group was fed a commercial basal diet without supplementation (control), the 2nd,3rd and 4th groups were fed basal diet supplemented with propolis at levels of 150,300,600 mg/kg feed. Growth performance (BW, BWG, FCR), some carcass characteristics and economic efficiency were recorded. At the end of the study (65 d), samples of blood were collected to determine blood hematological and biochemical constituents. In addition, bacterial counts of the digestive tract contents were measured. Results showed that ducklings fed the basal diet supplemented with different levels of propolis had significantly greater BW, BWG, economic efficiency and better feed conversion as compared to control.

All dietary supplements decreased serum AST, urea, total lipids, cholesterol, LDL and increased T_3, T_4, TAC, GSH, GPX, SOD, glucose, total protein, globulin, γ-globulin, IgA, IgM, IgG, LA, BA, LTT, phagocytic activity, phagocytic index, RBCs and hemoglobin as compared to control. Different levels of propolis increased dressing percentage and total edible parts compared to control. Moreover, propolis decreased total bacterial count, *Salmonella*, *E.coli* and *proteus* spp. compared to control group. In conclusion, propolis could be used safely as natural growth promoter to improve growth and immune response of ducklings.

Key words: Duckling-Propolis-Performance-Blood Profiles-Immune response.

INTRODUCTION

Worldwide, sub- therapeutic antibiotics doses have been used to improve performance, control pathogens and animal health. However, the use of antibiotics in animal nutrition as growth promoters have been banned in the European Union since 2006 due to consumer concerns (Diarra *et al*., 2007). This prompted research for natural, environmentally friendly alternatives growth promoters.

Propolis is a resinous substance collected from plants, and buds' exudates by bees (Ghisalberti, 1979). Propolis (Pro), is a natural antibiotic belongs to the group of naturally occurring substances of plant origin and animal which are collected by honeybees (Talas and Gulhan, 2009). There are many factors affecting propolis composition such as time, plant source and collecting location (Markham *et al*., 1996). Components of propolis were quantitatively and qualitatively variable, depending on plant ecology. It contains a substance including phenolic such as flavonoids. (Sforcin, 2007). It is a complex mixture of resins, essential oils, waxes and pollen. (Eyng *et al*., 2015). Propolis has pharmacological effects and recently used as an antibacterial agent for poultry and mammals (Szliszka, *et al*., 2013), in addition to its use as an antiseptic and anti-inflammatory agent for healing burns and wounds (Burdock, 1998).

Propolis includes more than 300 constituents including cinnamic and benzoic acids and their esters substituted phenolic acids and flavonoids, bee wax, and amino acids (Bankova *et al.*, 2000). Ethanol is the best solvent for pro. preparation among other solvents like water, methanol, ethyl ether, and chloroform can be used for identification and extraction of pro. compounds (Szliszka *et al.*, 2013).

In addition, some studies have found that compounds of pro. such as flavonoids exhibit antitumor effects (Matsuno *et al*.,1997).It has been found that the source of propolis is poplar bud exudates (Velikova *et al*., 2000) and that it has anti-inflammatory activities , antifungal , antibacterial , and antioxidant (Silici and Kaftanoglu, 2003).

Flavonoids, aglycones, and their esters are confirmed as performed by GC-MS (Popovab *et al*., 2005). It was found that propolis is an alternative to the use of dietary antibiotics and has a positive effect on meat quality (Haščík *et al*., 2016). The effect of propolis on the level of SOD, CAT, GSH, and GSH-Px in poultry exposed to heat stress was also reported by (Seven *et al*., 2009).

In general, studies on the use of pro. in ducks (*Cairina moschata*) feeding are few. Therefore, this study was designed to investigate the productive performance, carcass traits, some blood parameters, bacterial count, antioxidant status and the immune response of growing ducks fed different levels of propolis supplemented diets.

MATERIALS AND METHODS

This study was conducted at the Poultry Research Unit (El-Bostan Farm), Department of Animal and Poultry Production, Faculty of Agriculture, Damanhour University, Damanhour, Egypt, from March, to May 2019. The main objective was to evaluate the efficacy of using levels of propolis as natural growth promoters in diets of ducks from 7 to 65 days of age.

Two hundred unsexed day-old ducklings obtained from a commercial hatchery, were distributed randomly into four groups, each group contain 50 ducklings in five replicates, 10 birds each**.** Ducks were reared in floor pens (1.5*1.5m), and were allocated to the following dietary

treatments: the first group was fed a commercial basal diet without supplementation (control), the 2nd,3rd and the 4th groups were fed same basal diets supplemented with propolis at 150, 300 and 600 mg/ kg of diet .Chemical analysis of the experimental propolis are shown in (Table 1). The experimental diets (Table 2) were formulated to nutrient requirements of ducklings according to NRC (1994).

Ducklings in all treatments were reared under same hygienic and managerial conditions. They were housed in well-ventilated brooders and water and feed were provided *ad-libitum* throughout the experimental during the starter (1-35 d of age) and grower- finisher period (36-65 d of age). Birds in each replicate were weighed (g) weekly and body weight gain (g/bird) was calculated. Feed intake was recorded for each replicate (g/bird) and thereby feed conversion ratio (g feed/g gain) was calculated. Economical evaluation (EE) was estimated at the end of the experiment as 100 times net revenue divided by total feed costs. While net revenue was calculated as total revenue minus total feed costs. European production efficiency index (EPEI) was measured throughout the experimental period (7-65d of age), according to Hubbard broiler management guide (1999).

$$\text{EPEI} = \frac{\text{BW (kg) x SR}}{\text{PP x FCR}} \text{x } 100$$ Where

European Production Efficiency Index=EPEI. Body weight (kg)=BW

Survival rate (100% - mortality) =SR

Production Period (days)=PP

Feed conversion (kg feed / kg gain) =FCR

At 65 d of age, ten samples of blood were randomly collected in heparinized test tubes from each treatment to determine red blood cells (RBCs) and white blood cells (WBCs) counts and different types of leukocytes according to Hepler (1966). Packed cell volume (PCV %), hemoglobin (Hb) concentration and red blood cell indices were calculated as reported by Jain (1986).

Additional fifteen serum samples were obtained also from each treatment for biochemical analysis using commercial kits. Such biochemical determinations include glucose concentration (mg/dl) according to Trinder (1969) , total protein (g/dl) according to Henry *et al.* (1974), albumin (g/dl) according to Doumas (1971), and different types of globulin (α, β and γ-globulin) according to Bossuyt *et al*.(2003), besides, serum globulin concentration was calculated by difference. Moreover, serum levels of creatinine and urea were also determined using method of Bartles *et al.*(1972), triglycerides according to Fossati and Prencipe (1982), total cholesterol according to Stein (1986), HDL-cholesterol according to Lopez-Virella *et al.,(*1977), LDL according to Friedewald *et al*.(1972) and Alkaline phosphatase (ALP) concentration according to the colorimetric method of Bauer (1982).Besides, the activity of serum aspartate aminotransferase (AST), and serum alanine aminotransferase (ALT), were estimated according to Reitman and Frankel (1957) using commercial kits. Serum samples were assigned also for determination of total antioxidant capacity (TAC) according to Koracevic *et al.* (2001), superoxide dismutase (SOD) activity according to Misra and Fridovich (1972), glutathione peroxidase (GPX) activity according to Paglia and Valentine (1967) and blood reduced glutathione

(GSH) concentration according to Ellman, (1959). Phagocytic activity and index were determined according to Kawahara ***et al***. (1991). Serum immunoglobulin (IgY, IgM and IgA) were determined using commercial ELISA kits (Kamiya Biomedical Company, USA) according to Bianchi *et al.* (1995). Lymphocyte transformation test (LTT) was done following the method described by Balhaa *et al. (*1985). Serum bactericidal activity to *Aeromonas hydrophila* strain was determined according to Rainger and Rowley (1993). Serum lysozyme activity was measured with the turbidimetric method described by Engstad *et al*. (1992) and the results are expressed as one unit of lysozyme activity that defined as a reduction in absorbance at 0.001/min.

The effect of dietary treatments on the microbial activity of the digestive system was evaluated through measuring total bacterial count and also counting some pathogenic bacteria harboring the intestine such as salmonella, E. coli and proteus spp. according to methods described by ICMSF (1980).

Data obtained were analyzed using the GLM procedure (Statistical Analysis System
(SAS, 2002), using one-way ANOVA using the following model:

$Y_{ij}= \mu+ T_i + e_{ij}$.

Where, Yis the dependent variable; μ is the overall mean; T is the effect of
experimental treatments; and e is the experimental random error. Before analysis, all
percentages were subjected to logarithmic transformation (log10x+1) to normalize data distribution. The differences among means were determined using Duncan's new multiple range test (Duncan, 1955).

RESULTS

The production performance, economic efficiency and production index of ducks fed basal diet supplemented with graded levels of propolis during days 7-65 of age are shown in Table 3. Ducks fed basal diet supplemented with propolis at different levels had significantly ($p\leq0.05$) greater body weight (BW) and body weight gain (BWG) than the control group. Ducks fed graded levels of propolis recorded lower FI and better FCR during 7-65d of age as compared to the control group. Ducks fed propolis at different levels had significantly better values of economic efficiency and production index compared to the control group.

The immune indices of ducks are shown in Tables 4 and 5. All levels of propolis recorded higher levels of total protein, globulin, γ –globulin, BA, LTT, PI, PA, IgA, IgG, IgM, INFγ, IL.2 and IL.10compared to control group. No significant effects of different levels of propolis were detected on albumin, Albumin/globulin ratio, α–globulin, β – globulin and LA. The biochemical blood constituents of ducks are shown in Table 6. All different levels of propolis decreased serum levels of urea, and activity of AST as compared to control group. Furthermore, no significant effect of treatments was detected on creatinine, ALT and alkaline phosphatase**.** In addition, all dietary supplements increased serum glucose and concentration of T_3 and T_4 than the control group, On the other hand, serum

antioxidants indices and enzymes including TAC, GSH, GPX and SOD were higher in ducks fed the basal diet supplemented with different levels of propolis as compared to the control group (Table 7). Moreover, all dietary supplements decreased serum total lipids, cholesterol and LDL. On the other hand, no significant effects of different levels of propolis were detected on TRI and HDL (Table 8). Feeding diet with different levels of propolis increased RBCs, hemoglobin, PCV, lymphocyte and monocytes as compared to control group (Table 9).Dietary supplementation of propolis at the tested levels increased significantly percentage of dressing and total edible parts and percentages of spleen and thyme and decreased abdominal fat compared with the control (Table 10).All dietary levels of propolis decreased total bacterial count, *Salmonella*, *E.Coli* and *proteus spp*. Moreover, all levels of propolis increased Lactobacillus as compared to the control group. (Table11).

DISCUSSION

The present study indicates that the addition of propolis to diets could improve the growth, FCR, economic efficiency, production index and decreased FI of ducklings as compared to the un-supplemented control birds.

Propolis is a rich source of vitamins (Moreira, 1986), enzymes (Khalil and El-Sheikh, 2010) and other biological constituents including fatty acids, amino acids and flavonoids (Wagh, 2013) which showed that propolis may be used as natural growth promoter in poultry (Attia *et al*., 2015).Similarly, propolis showed positive influences on growth, immune response and antibody of poultry (Yang *et al*., 2008; Popiela-Pleban *et al*., 2012). This may be attributed not only due to antibacterial specific effect of propolis with positive effects on metabolism (Aygun *et al*., 2012), but also to its antiparasitic (Freitas *et al*., 2006),antifungal (Sforcin, 2007), antiviral (Gekker *et al*., 2005), immunomodulatory (Dimov *et al*., 1992), anti-inflammatory (Dobrowolski *et al.*, 1991), and antioxidative (Krol *et al*., 1990) effects.

The improving percentage of dressing in treatments supplemented with propolis may be attributed to the greater BW at slaughter. However, the decreasing FI due to poultry fed the supplements had no a specific effect on the development of the gastrointestinal tract. In fact, the percentage of the intestinal tract was unaffected. While, the percentage of proventriculus was reduced just in some treatments. These results partly agree with the findings of Kacániová *et al*. (2012). Further evidences for improving the health of chickens provided Pro were found by the reduction for serum cholesterol and triglycerides, creatinine, urea, and AST compared with control, indicating improved renal and liver functions and lipid metabolism. This could be due to the effect of Pro on catabolism muscle.

The positive effect of Pro as natural growth promoter on growth, FCR and dressed carcass percentage of broilers was concurred with somewhat decrease in feed intake and increased villi length (Farag and El-Rayes, 2016). They also showed that pro is a rich source of CP, amino acids, fatty acids, carbohydrate

and gross energy (GE) showing anenhancement in feed utilization.

In addition, Omar *et al.*, (2002) found that the improvement in blood hemoglobin, PCV, RBC, and protein by Pro can be due to the direct effect of the anabolic action for synthesis protein, which can protect protein body from degeneration. The effect of pro on plasma metabolites might be attributable to its contents of minerals, vitamins, and phospholipids (Leja *et al*.,2007) and antioxidant effects (Šarić *et al*.,2009). In addition, the improve in plasma cholesterol may be due to poly unsaturated fatty acids and phospho-lipids, particularly linolenic acid in pro. (Xu*etal*., 2009). The effects of propolis on cholesterol, triglycerides, creatinine and urea, are in agreement with those reported by Fuliang *et al.* (2005). This could be due to the influence of propolis on metabolizable lipid (Matsui *etal*.,2004). Newairy, *et al*. (2009) found that propolis induced improvement in the serum AST in rats.

CONCLUSION

Under the prevailing experimental conditions, propolis are shown to be effective in improving productive performance, immune response and general health of ducklings.

Table (1): The major compounds of Egyptian propolis

Proximate analysis of propolis	**%**
Crude protein	1.9
Ash	4.1
Fat	1.4
Carbohydrates	1.7
Essential oils	4.1
Major fatty Acids of propolis	%
Palmitic	12.9
Stearic	7.2
Oleic	13.3
Linoleic	1.9
Linolenic	0.79
Palmitoleic	9.1
Flavonoids (Total)	27.9

Table (2): Composition and nutrient contents of the basal diets of growing ducks from 7 to 65 days of age

Ingredients (%)	**Starter (7-35 d)**	**Grower (36- 65 d)**
Yellow corn	56.00	67.10
Soybean meal (44%)	38.40	27.60
Limestone	1.11	1.02
Dicalcium phosphate	2.11	2.00
Salt (NaCl)	0.32	0.27
Vit+Min.premix1	0.31	0.30
DL-Methionine	0.11	0.12
Sunflower oil	1.51	1.48
Antifungal	0.11	0.11
Total	99.98	100.0
Calculated analysis (NRC, 1994)		
ME,kcal/Kg	2871	3017
Crude protein, %	21.8	17.61
Crude fiber, %	3.91	3.39
Ether extract, %	3.94	4.31
Lysine, %	1.17	0.91
Methionine %	0.45	0.38
Meth. + Cyst., %	0.78	0.68
Calcium, %	0.93	1.61
Total phosphorus, %	0.44	0.45
Available phosphorus%	0.53	0.33
Determined analysis: on DM basis (AOAC, 2000)		
Dry matter, %	91.90	90.62
Organic matter, %	90.85	91.88
Crude protein, %	24.06	19.11
Crude fiber, %	4.14	3.45
Ether extract, %	4.33	4.22
Ash, %	**9.15**	8.12
Nitrogen free extract, %	58.32	65.10

[1]Vit+Min mix. Provided per kilogram of the diet Vit A: 6000 IU, Vit. E (dl-α-tocophérol acetate : 10 IU, mena dione : 2.5 mg, Vit. D3: 2000 ICU, riboflavin: 2.5 mg, calcium pantothenate: 10 mg, nicotinic acid: 12 mg, Choline chloride: 300 mg, vit. B_{12}: 4 µg, vit. B_6: 5 mg, thiamine: 3 mg, folic acid: 0.50 mg,and biotin: 0.02 mg. Trace mineral (mg/ kg of diet: Mn: 80 mg, Zn: 60 mg, Fe: 35 mg, Cu: 8 mg and Se: 0.1 mg).

Table (3): Performance of growing ducks as affected by dietary level of propolis.

Items	Control	Propolis 150 mg/kg feed	Propolis 300 mg/kg feed	Propolis 600 mg/kg feed	SEM	P value
Live body weight (g) at						
7 day	128.5	129.0	130.0	129.1	0.44	0.334
35 day	1200^{b}	1420^{a}	1500^{a}	1480^{a}	12.8	0.002
65 day	2320^{b}	2850^{a}	2760^{a}	2890^{a}	25.4	0.001
Body weight gain (g)						
7-35 d	1071^{b}	1291^{a}	1370^{a}	1350^{a}	8.7	0.01
36-65 d	1120^{b}	1430^{a}	1260^{a}	1410^{a}	35.1	0.003
7-65 d	2191^{b}	2721^{a}	2630^{a}	2871^{a}	71.3	0.001
Feed intake (g):						
7-35d	2820^{a}	2450^{b}	2340^{b}	2300^{b}	21.1	0.001
36-65 d	5980^{a}	5120^{b}	5200^{b}	5500^{ab}	33.9	0.01
7-65 d	8800^{a}	7570^{b}	7540^{b}	7800^{b}	51.1	0.001
Feed conversion ratio (g feed/g gain).						
7-35d	2.63^{a}	1.89^{b}	1.70^{b}	1.70^{b}	0.244	0.01
36-65 d	5.34^{a}	3.58^{b}	4.12^{ab}	3.90^{b}	0.321	0.002
7-65 d	4.01^{a}	2.78^{b}	2.87^{b}	2.72^{b}	0.331	0.002
Economic efficiency and production index						
EE	0.150^{b}	0.344^{b}	0.411^{b}	0.400^{b}	0.0138	0.001
REE, %	100^{c}	280.9^{a}	240.5^{b}	200.5^{b}	8.66	0.002
EPEI, %	65.9^{c}	100.5^{a}	89^{b}	90^{b}	1.23	0.001

^{a,b,}Means in the same row followed by different superscripts are significantly different at($p \leq 0.05$); SEM= Standard error of means. REE = Relative economical efficiency (REE) = (Economical efficiency/economic efficiency of the control) *100

Table (4): Immune indices of growing ducks as affected by dietary levels of propolis.

Items	Control	Propolis 150 mg/kg feed	Propolis 300 mg/kg feed	Propolis 600 mg/kg feed	SEM	P value
Total protein (g/dl)	6.01^{b}	6.17^{a}	6.90^{a}	6.99^{a}	0.11	0.001
Albumin (g/dl)	3.11	3.20	3.21	3.00	0.19	0.233
Globulin (g/dl)	2.90^{b}	3.57^{a}	3.69^{a}	3.99^{a}	0.21	0.002
Albumin/globulin	1.07	0.89	0.86	0.76	0.18	0.236
α–globulin, (µg/dl)	0.91	0.81	0.77	0.88	0.002	0.234
β -globulin, (µg/dl)	0.77	0.92	0.86	0.79	0.09	0.190
γ -globulin, (µg/dl)	1.21^{b}	1.84^{ab}	2.06^{a}	2.32^{a}	0.01	0.001

^{a,b} Means in the same row followed by different superscripts are significantly different at($p \leq 0.05$); SEM= Standard error of means.

Table (5): Immune indices of growing ducks as affected by dietary level of propolis.

Items	Control	Propolis 150 mg/kg feed	Propolis 300 mg/kg feed	Propolis 600 mg/kg feed	SEM	P value
LA, (IU %)	11.2	13.9	17.7	16.1	0.33	0.123
BA, (%)	22.2[b]	42.4[a]	37.5[a]	33.5[a]	0.67	0.001
LTT, (%)	19.5[b]	28.5[a]	29.6[a]	27.6[a]	0.91	0.002
PI, (%)	17.6[b]	21.3[a]	23.8[a]	25.8[a]	0.76	0.002
PA, (%)	19.7[b]	24.1[a]	27.9[a]	29.1[a]	0.56	0.001
IgA, (mg/100 ml)	68.7b	77.3[a]	81.1[a]	83.2[a]	0.99	0.112
IgG, (mg/100 ml)	935[c]	966[b]	982[a]	988[a]	0.81	0.001
IgM, (mg/100 ml)	188[b]	249[a]	250[a]	254[a]	1.99	0.001
INFγ (pg/mL)	4.00[b]	4.87[a]	4.67[a]	4.53[a]	0.998	0.002
IL.2 (pg/mL)	6.47[b]	7.80[a]	7.60[a]	7.80[a]	0.665	0.003
IL10 (pg/mL)	14.7[b]	20.7[a]	19.0[a]	18.0[a]	0.239	0.001

[a,b,] Means in the same row followed by different superscripts are significantly different at($p \leq 0.05$); SEM= Standard error of means. PI= Phagocytic index PA: Phagocytic activity;;LA= lysozyme activity ;LTT= Lymphocyte transformation test;; IgG= Immunoglobulin G; IgA= Immunoglobulin A IgM= Immunoglobulin; BA= bactericidal activity

Table (6): Some biochemical constituents of blood serum of growing ducks as affected by dietary levels of propolis.

Items	**Control**	**Propolis 150 mg/kg feed**	**Propolis 300 mg/kg feed**	**Propolis 600 mg/kg feed**	**SEM**	**P value**
Urea, (mg/dl)	2.29[a]	1.77[b]	1.98[b]	1.78[b]	0.098	0.012
Creatinine, (mg/dl)	1.59	0.778	0.989	0.897	0.091	0.231
AST, (U/L)	63.1[a]	60.9[b]	59.2[b]	60.2[b]	2.90	0.001
ALT, (U/L)	65.9	66.9	61.9	59.9	2.20	0.123
Alk P, (U/100ml)	10.9	12.4	11.9	13.9	0.998	0.0890

[a,b] Means in the same row followed by different superscripts are significantly different at($p \leq 0.05$); SEM= Standard error of means. ALT=alanine amino transferase AST=aspartate amino transferase; Alk. P =Alkaline phosphatase;

Table (7): Blood biochemical parameters and antioxidant defense system indicatorsof growing ducks as affected by dietary level of propolis

Items	Control	Propolis 150 mg/kg feed	Propolis 300 mg/kg feed	Propolis 600 mg/kg feed	SEM	P value
Glucose, (mg/dl)	180^{b}	199^{ab}	210^{a}	250^{a}	0.320	0.001
T3, (ng/ml)	2.00^{b}	2.30^{a}	2.41^{a}	2.55^{a}	1.09	0.002
T4, (ng/ml)	10.9^{b}	15.1^{a}	14.9^{a}	13.6^{a}	0.998	0.01
TAC, (Mmol/dl)	400^{b}	420^{a}	423^{a}	420^{a}	1.99	0.002
GPX, (U/L)	40.2^{b}	44.9^{a}	49.9^{a}	48.8^{a}	1.09	0.003
GSH, (U/L)	955^{b}	980^{a}	979^{a}	986^{a}	2.99	0.002
SOD, (U/L)	238^{b}	260^{a}	276^{a}	258^{a}	2.09	0.001

^{a,b,} Means in the same row followed by different superscripts are significantly different at ($p \leq 0.05$); SEM= Standard error of means. T4=thyroxine; T3= triiodothyronine; GPX =glutathione peroxidase; TAC= total antioxidant capacity; SOD=superoxide dismutase ; GSH= reduced glutathione

Table (8): Some biochemical constituents of blood serum of growing ducks as affected by dietary levels of propolis.

Items	Control	Propolis 150 mg/kg feed	Propolis 300 mg/kg feed	Propolis 600 mg/kg feed	SEM	P value
T.Lipids, (mg/dl)	500^{a}	399^{b}	410^{b}	420^{b}	1.99	0.011
TRI, (mg/dl)	95.8	91.9	91.8	97.5	0.99	0.122
CHO, (mg/dl)	90.9^{a}	77.6^{b}	65.9^{b}	66.1^{b}	2.55	0.99
HDL, (mg/dl)	39.7	38.1	37.8	35.1	2.09	0.890
LDL, (mg/dl)	32.4^{a}	21.1^{b}	9.74^{c}	11.5^{c}	1.11	0.001

^{a,b} Means in the same row followed by different superscripts are significantly different at($p \leq 0.05$); SEM= Standard error of means. ;; TRI= triglycerides'; LDL=low-density lipoprotein.HDL=high-density lipoprotein CHO= total cholesterol

Table (9): Hematological traits of growing ducks as affected by dietary levels of propolis.

Items	Control	Propolis 150 mg/kg feed	Propolis 300 mg/kg feed	Propolis 600 mg/kg feed	SEM	P value
RBC's, (10^6/mm^3)	2.02^b	2.99^a	3.02^a	3.19^a	0.377	0.001
Hb, (g/100ml)	9.81^c	12.2^b	14.1^a	12.9^b	0.311	0.002
PCV, %	22.4^b	33.5^a	37.6^a	36.2^a	1.81	0.011
WBC's, (10^3/mm^3)	26.1^b	27.9^a	28.9^a	29.7^a	0.390	0.002
Lymphocytes, (%)	42.4^b	45.4^a	47.8^a	45.9^a	0.678	0.02
Monocytes, (%)	13.3^b	17.1^a	16.8^{ab}	17.9^a	0.377	0.002
Basophils, (%)	0.99	0.01	1.00	0.01	0.241	0.789
Eosinophils, (%)	17.8	16.3	12.1	11.6	0.546	0.991
Heterophils, (%)	25.7	21.1	22.3	24.6	0.599	0.899

^{a,b} Means in the same row followed by different superscripts are significantly different at($p \leq 0.05$); SEM= Standard error of means.HB= Hemoglobin; RBC's=red blood cell; WBC's=white blood cell. PCV=packed cell volume;

Table (10): Relative weight of carcass characteristics and lymphoid organs of growing ducks as affected by dietary levels of propolis.

Items	Control	Propolis 150 mg/kg feed	Propolis 300 mg/kg feed	Propolis 600 mg/kg feed	SEM	P value
carcass yield, %	62.9^c	71.8^a	72.5^a	68.6^b	1.77	0.001
T. edible parts, %	65.6^c	76.7^a	74.1^a	70.5^b	0.77	0.002
Liver, %	1.77^b	2.18^a	1.99^{ab}	2.88^a	0.11	0.003
Gizzard, %	2.44	3.29	3.09	3.18	0.18	0.989
Heart, %	0.45	0.61	0.81	0.74	0.09	0.776
Fat, %	0.81^a	0.43^b	0.39^b	0.41^b	0.11	0.987
Spleen, %	0.025^b	0.035^a	0.038^a	0.038^a	0.11	0.011
Thymus, %	0.291^b	0.392^a	0.301^a	0.333^a	0.009	0.002

^{a,b,c} Means in the same row followed by different superscripts are significantly different at ($p \leq 0.05$); SEM= Standard error of means

Table (11): Bacterial counts in digestive tract contents of growing ducks as affected by dietary levels of propolis

	Control	**Propolis 150 mg/kg feed**	**Propolis 300 mg/kg feed**	**Propolis 600 mg/kg feed**	**SEM**	**P value**
TBC	4.99[a]	3.99[b]	4.30[b]	4.06[b]	0.092	0.001
Lactobacillus	1.22[b]	1.49[a]	1.92[a]	1.88[a]	0.071	0.003
Salmonella	1.34[a]	0.882[b]	0.681[ab]	0.450[c]	0.180	0.005
E.coli	1.31[a]	1.00[b]	1.11[b]	0.99[b]	0.270	0.011
Proteus.	0. 800[a]	0.551[b]	0.440[b]	0.610[b]	0.120	0.002

[a,b,c,d] Means in the same row followed by different superscripts are significantly different at($p \leq 0.05$); SEM= Standard error of meansTBC=Total-Bacterial-Count

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الملخص العربي

تأثير مستويات مختلفة من البروبوليس علي الاداء الانتاجي ،خصائص الدم البيوكيمياوية والهيماتولوجية والاستجابة المناعية لسلالة البط الفرنساوي *Cairina moschata*

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أجريت هذه الدراسة في وحدة بحوث الدواجن بمزرعه البستان، قسم الانتاج الحيواني والداجني، كلية الزراعة جامعة دمنهور. هدفت الدراسة إلى تقييم تأثيرإضافة مستويات مختلفة من البروبوليس على أداء النمو،والكفاءة الاقتصادية، والصفات البيوكيميائية والهيماتولوجية للدم والاستجابة المناعية عند عمر65 يوما لسلالة البط الفرنساوي *Cairina moschata*. إستخدم في هذه التجربة عدد مائتان من كتاكيت البط الفرنساوي غير المجنسة عمر 7 أيام و التي وزعت عشوائيا علي اربعه معاملات بكل منها عدد 50 كتكوت موزعة علي خمسة مكررات بكل مكرر عشرة طيور. إستخدمت المجموعة الأولي للمقارنة (كنترول) بينما غذيت المعاملات رقم 2، 3 ،4 علي علائق أضيف إليها البروبليس بمستويات 150 ، 300 ،600 مجم/ كجم علف

أظهرت النتائج حدوث زيادة معنوية في وزن الجسم الحي ومعدل الزيادة الوزنية للجسم وحدوث انخفاض في استهلاك العلف وكذلك حدوث تحسن في الكفاءة الغذائية والكفاءة الاقتصادية ووزن الذبيحة في المجموعات التي غذيت علي البروبوليس مقارنة بمجموعة الكنترول.

أظهرت النتائج أيضا حدوث زيادة معنوية في مستوي بروتينات و ألبيومينات الدم والجلوبيولينات المناعية في المجموعات المضاف لها البروبوليس بمستوياتها المختلفة مقارنة بمجموعة الكنترول. بينما كان هناك انخفاض معنوي في مستوي الدهون الكلية في الدم و الكوليسترول وكذلك انخفاض مستوي LDL في المجموعات المغذاة علي البروبوليس مقارنة بمجموعة الكنترول. سجلت زيادة في مستوي جلوكوز الدم وكذلك زيادة في تركيزات هورمونات الغدة الدرقية وأيضا تحسن في مستوي انزيمات الاكسدة المختلفة في سيرم الدم في المجموعات المغذاة علي البروبوليس مقارنة بمجموعة الكنترول. حسنت الإضافات المستخدمة من وظائف الكبد والكلى مقارنة بالكنترول . من ناحية أخرى أدت هذه الإضافات الي زيادة معنوية في عدد كرات الدم البيضاء ، كرات الدم البيضاء الليمفاوية، زيادة جلوبيولين السيرم والألفا والجاما جلوبيولين بالمقارنة مع مجموعه الكنترول

أدت جميع الإضافات إلى زيادة مستوى انزيم (SOD) و الجلوتاثيون(GSH)والجلوتاثيون بيروكسيديز والقدرة المضادة للأكسدة والنشاط البلعمى ودليل النشاط البلعمى ومعامل تحويل الخلايا الليمفاوية ونشاط مقاومة البكتريا والنشاط الليسوسومى بالمقارنة مع مجموعه الكنترول.

أدت جميع الإضافات إلى زيادة الجلوبيولينات المناعية (IgG - IgM - IgA) بالمقارنة مع مجموعه الكنترول. كما أدت جميع الإضافات إلى حدوث انخفاض في أعداد البكتريا الممرضة في الامعاء مقارنة بالكنترول .

مما سبق يتضح أن إضافة البروبوليس إلي علائق البط الفرنساوي *Cairina moschata* بأي من المستويات المدروسة ادت الي تحسن في الاداء الانتاجي والاقتصادي والفسيولوجي والمناعي تحت ظروف إجراء هذه الدراسة .