Egypt. Poult. Sci. Vol. (39)(I): (153-171)) (2019) (**1809-1038)**

Egyptian Poultry Science Journal

http://www.epsj.journals.ekb.eg/

ISSN: 1110-5623 (Print) – 2090-0570 (Online)

EFFECT OF SUPPLEMENTING DATE PALM POLLEN AND ITS AQUEOUS EXTRACT ON FAYOUMI COCKS PERFORMANCE DURING GROWTH PERIOD

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Received: 30/ 01/ 2018 Accepted: 05 /03 / 2019

ABSTRACT : This study aimed to evaluate the effect of dietary supplementing date palm pollen (DPP) and it's aqueous extract (DPPE) on Fayoumi cocks growth performance, antioxidant status, immune response, meat quality and economical efficiency. A total number of 180 – day old cocks, were divided to 6 groups, each had 30 chicks in 3 replicates. The 1st group was fed a basal diet (Control group), 2nd group was fed the basal diet supplemented with 0.0125% Butylated hydroxytoluene (BHT), 3rd and 4th groups were fed the basal diet supplemented with 0.1% and 0.3% DPP, respectively and 5th and 6th groups were fed the basal diet supplemented with 0.1% and 0.3% DPPE, respectively. The growth trail lasted for 12 weeks of age. The results obtained reveal that chicks fed either 0.1% DPP (T3) or 0.1% DPPE (T5) recorded an improvement in final live weight by 4.93% and 2.88% as well as enhancing feed conversion ratio during overall period (1-12 wks) by 6.94% and 2.02% respectively compared to control. While, Newcastle disease virus titer did not affected significantly by any supplementation studied. Chicks fed dietary 0.0125% BHT, 0.1% DPP and 0.1% DPPE recorded significantly lower serum total cholesterol compared to control group. All groups recorded a significant decline in MDA values in chicks' tissue in relative to control. In opposite, total antioxidant capacity in tissue was increased significantly by 5.05% and 7.03% in T3 and T5, respectively relative to the control. Chicks fed 0.0125% BHT, 0.1% DPP and 0.1% DPPE achieved significantly higher hemoglobin values compared to control. Finally, two groups of T3 (0.1% DPP) and T5 (0.1% DPPE) recorded the highest economical return being (118.8%) and (102.15%), respectively compared to control.

Conclusion: supplementing Fayoumi cocks diet with either 0.1% DPP or DPPE could enhance performance, antioxidant status, meat quality as well as increasing economical profit.

Key words: Fayoumi cocks-performance-date palm pollen-date palm pollen extract-meat antioxidant

INTRODUCTION

Egypt is an agro-based developing country and livestock especially poultry production considered a great role as a major supply of meat and basis of income. Chicken production also used for poverty alleviation and efficient transforming feed protein and energy into consumable human diets (Tesfa et al., 2013). Fayoumi chicken is a pure Egyptian strain, which known global by its high immunity, with a small sized bird, has low carcass yield and hence low economic return (Rajput et al., 2005). There are many factors may be responsible for the poor production of local strains, one of them is oxidative stress. This stress influence livestock production, by making many health problems as a result of biological damage occurred at the level of cell (Yang et al., 2013; Sharma et al., 2011). Likewise, lipid oxidation increase post-mortem rancidity in meat and its products (Morrissey et al., 1998). In this respect, Lin et al. (2016) showed that supplementing synthetic antioxidants to poultry enhance their health, growth performance and meat quality, but its side effects make their uses is limited. So, nowadays a growing concern has been encouraging to use natural antioxidants in poultry nutrition fields (Alloui et al., 2014).

Male gametophyte of the date palm (Phoenix dactylifera L.) is known as date palm pollens (DPP). Also, its extract was showed to have a strong antibacterial (Saddiq and Bawazir 2010), anti-fungal (Shraideh et al. 1998), antiparasitic (Metwaly et al. 2012a), antiviral (Jassim and Naji 2010), antioxidants (Al-Farsi et al., 2005) anti-coccidial activity and anti-apoptotic agent (Metwaly et al., 2014) and have hepatoprotective activities (Al-Qarawi et al. 2004; Saafi et al. 2011; Metwaly et al. 2012b). Approximately, 1000 tons of DPP are produced every year by millions of palm trees grown in the Arabian region (El-Neweshy et al., 2013). By analyzing the DPP, Hassan (2011) showed that it contains 28.80% moisture, 4.57% ash, 1.37% crude fiber, 20.74% crude fat, 31.11% crude protein and 13.41% carbohydrate. Also, it contains considerable amount of total phenol (57.9 mg/g) as reported by Farouk et al. (2015). These polyphenolic components (such as flavonoids) have strong antioxidant properties which benefits the body. Few researchers studied the effect of DPP as an antioxidant in poultry industry, in this respect, Canogullari et al. (2009) studied the effect of supplementing pollen at level of 0, 5, 10, 20g/kg diet, to Japanese quail diet and concluded that birds fed 20 g pollen/kg diet achieved significantly higher body weight gain during 1-28 days of age. Also, Iftikhar et al. (2014) concluded that aqueous extract of DPP in rate of 120 mg/kg/ day for a period of 18 or 35 days, improved body weight in male rats. Moreover, Nady et al. (2014) reported that oral administration (1mg DPP/kg body weight) for 14 days simultaneously or post the exposure to incense smoke revealed a significant improve in spleen weight and decrease in malodialdehyde (MDA) as compared to that of incense group of mice.

The available literature ascertain there is a scarcity on data showing the promising effect of date palm pollen as natural antioxidant and immune enhancer on poultry performance. So, the present work aimed at studying the effect of supplementing Fayoumi chicken diets with various levels of DPP or its extract

on growth performance, immunological parameters and meat quality.

MATERIALS AND METHODS

The experimental work of the present study was carried out at El-Fayoum Poultry Research Station, Animal Production Research Institute, Egypt.

Collection and extraction of date palm pollen (DPP): The DPP sample was obtained from a local herbal market in Al-Fayoum Governorate, Egypt. Water suspension of DPP was freshly prepared according to Bahmanpour et al. (2006) by adding 5 grams of DPP within 28.5 ml of distillated water, with dynamic shaking and kept at 60°C for 90 minutes in a water bath. Then set aside in refrigerator at 3°C overnight, subsequently, centrifuged at 2,500 rpm for 10 minutes. The clear supernatant was mixed into diets.

Experimental design and diets: One -hundred and eighty, day-old Fayoumi cocks were distributed to 6 groups of 30 birds of 3 replicates (10 chicks each). Chicks in the first group were fed the basal diet and served as control group (T1), the second group was fed the basal diet supplemented 0.0125 % butylated hydroxytoluene; BHT (T2) , while, third and fourth groups were fed the basal diet supplemented with 0.1% and 0.3% date palm pollen (DPP) as T3 and T4, respectively. Fifth and sixth groups were fed the basal diet supplemented with 0.1% and 0.3% as date palm pollen extract (DPPE) as T5 and T6, respectively. Chicks were fed iso-caloric (2750 and 2900 kcal/kg diet) and iso-nitrogenous (17% and 15% CP) diets during starter-grower period (1-8 wks) and finisher period (8-12 wks), respectively. Birds received feed and water ad libitum. All diets were formulated to save the nutritional requirements of Fayoumi chickens Table 2 according to Agricultural Ministerial Decree (1996) for local strain recommendations. Chicks were housed in wire battery cages, kept under the same managerial, hygienic and environmental conditions, and vaccinated against common diseases up to 12 weeks of age. Body weight and feed intake were recorded at the end of each growth periods. Consequently, body weight gain and feed conversion were calculated.

Slaughter Test: At the end of the experimental period (12 wks of age), 6 cocks from each dietary treatment were chosen based on average treatment weight ±10% to evaluate carcass characteristics. Including relative weights of carcass yield, giblets (liver, gizzard and heart), and lymphoid organs (bursa, thymus and spleen) as a percentages of live body weight.

Chemical traits of chicken Meat: six meat samples of each treatment group were taken to evaluate chemical properties of chickens' meat. Mixture (of equal weights) of breast and thigh meat of each bird were stored on -20°C for 60 days to determine total lipids (TL), total protein (TP), malondialdehyde (MDA) and total antioxidant capacity (TAC) contents via colorimetric methods using analytical kits imported by Biodiagnostic Company, Egypt.

Blood Hematological analyses: two blood samples per replicate were withdrawn from wing vein in heparinized test tubes to determine hemoglobin (Hb , g/dl), hematocrit (Ht %), red blood cells (RBCs, 10^6 / mm3) and white blood cells (WBCs, 10^3/µl). The following parameters were

calculated:- Mean Corpuscular Volume (MCV) = Ht × 10/ RBC's (µm3), Mean Corpuscular Hemoglobin (MCH) = Hb × 10/ RBC's (Pg) and Mean Corpuscular Hemoglobin Concentration (MCHC) = Hb×100/ Ht (g/dl). All measurements conducted according to Clark et al (2009).

Blood constituents: six blood samples of each group, during slaughter procedure, were taken into tubes without anticoagulant centrifuged at 3000 rpm for 5 minutes and serum was stored at -20^{o}C until analyzed for total cholesterol (TC), low density lipoprotein cholesterol (LDL), high density lipoprotein cholesterol (HDL), tri-glycerides (TG), total protein and albumin. Whereas, globulin was calculated by subtraction of serum albumin from total serum protein. Also, albumin/globulin ratio was calculated. Another 6 blood samples/ treatment were collected, from the same previous birds, in non-heparinized tubes to evaluate antibody titer against Newcastle Disease Virus (NDV) according to OIE (2012).

Statistical analysis: Data collected were statistically analyzed by the analysis of variance with General Linear Model (GLM) procedure of SAS Institute (SAS, 2004). Significant differences between treatments were performed using Duncan's Multiple Range Test (Duncan, 1955). The statistical model used was:

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

Where :

Y_{ij} = an observation

μ = the overall mean

T_i = Effect of treatments, (i; 1, 2,… 6)

e_{ij}= Experimental error.

Economical efficiency: All treatments were economically evaluated by calculating the net revenue per unit of total feed cost.

RESULTS AND DISCUSION

Growth performance: Effect of dietary supplementation of synthetic antioxidant (BHT), different dietary DPP and its extract (DPPE) on live body weight and live weight gain of Fayoumi cocks is presented in Table 3. At the end of starter-grower period (8 wks) chicks fed either control diet or 0.1% DPP recorded insignificantly higher body weight values compared to those fed diet with 0.0125% BHT. Whereas, the worst value was recorded for chicks fed dietary 0.3% DPP. At finisher period (12 wks), chicks fed 0.1% date palm pollen as powder or aqueous extract form recorded the best final body weight without significant differences between them. The improvement was 4.93% and 2.88% for T3 (fed 0.1% DPP) and T5 (fed 0.1% DPPE), respectively compared to control group.

According to body weight gain values, chicks fed control diet, 0.1% DPP and 0.0125% BHT recorded insignificantly higher weight gain compared to other groups during 1-8 wks of age. While, during 9-12 wks all groups fed date pollen supplemented diet at different forms and levels achieved an improvement in weight gain comparing to control group or others supplemented with BHT. During overall period (1-12 wks), the two groups fed lower level of date pollen (0.1%) either at powder or aqueous extract form recorded the best values of body weight gain. The enhancement in these groups was 4.85% and 2.87%, respectively compared to control group. The improvement in growth performance as a result of feeding DPP may be due to enhancement of digestion enzymes as well as increase the intestinal absorption of nutrients (Salami et al., 2015). However, a high dose of

antioxidant (0.3% DPP), may have adverse effect on performance of chicks. In this respect, Chen et al. (2016) studied the effect of supplementing geese diet with 150, 300 and 450 mg alfalfa flavonoids/kg diet and concluded that 300 mg flavonoid/kg diet achieved significantly the best final weight whereas this improvement disappear in the highest level (450 mg flavonoids). These findings are supported by Skibola and Smith (2000) who documented that higher rates of flavonoids may appear mutagens; in turn it acts as pro-oxidants that produce free radicals, also inhibit some enzymes involved in hormone metabolism. In this context, Shanoon et al. (2015) reported that laying hens fed high DPP levels (0, 6, 8 and 10 g/kg diet) showed a significant decrease in body weight. While, Paraskeuas et al., (2017) concluded that increasing phytogenic level (0, 100 and 150 mg/kg diet) in Cobb ration increased live body weight gain. In addition, the results agree with the finding of Jang et al. (2006) who reported that supplementing plant extracts to broilers diet, stimulate the gastrointestinal enzyme activity. Also, Biavatti et al. (2003) showed an improvement of broilers growth performance from 14 to 21 days as a consequence of adding their diets with Alternanthera brasiliana extracts at level of 180 ml/200 kg feed. In addition, Ouyang et al. (2013) and Xie et al. (2002) reported that inclusion of flavonoids could improve the chicken's growth performances. The explanation for the growth promotion of either DPP or DPPE supplemented diet, may be that they include flavones which could up-regulate the mixture of growth hormone and hepatic growth hormone receptor which stimulate the insulin-like growth factor 1, hence promotes the growth of animal Ouyang et al. (2016). Besides that, muscles protein is enhanced by feeding iso-flavone and induces the growth (Kamboh and Zhu 2013).

Results illustrated in Table 4 show that feed intake of all groups during all growth periods did not affect significantly by the addition of BHT or various levels of DPP or its extract. The results are in line with Batista et al. (2007) who reported that feed intake of broilers did not affect by flavonoid addition (rutine, hesperidine, quercetine and naringine) . On the other hand, chicks fed 0.3% DPP/kg diet recorded significantly the worst FCR during 1-8 wks comparing to other treatments but without significant differences to group fed dietary 0.3% DPPE. While, during 9-12wks, all groups fed date palm pollen either as powder or aqueous extract form recorded better FCR comparing to control group or others fed BHT supplemented group. Feed conversion values during 1-12 wks of age were improved in groups fed dietary 0.1% DPP or 0.1% DPPE without significant differences between them. The enhancement was 6.94% and 2.02% in these two groups respectively comparing to control group. This result is in accordance with Shanoon et al. (2015) who concluded that feed conversion of laying hens was significantly improved in DPP supplemented diet. Hassan et al. (2015) found that phytogenic extract (150 mg artichoke extract/kg diet; as a source of flavonoids) had significantly better feed conversion ratio during all growth periods of broiler chicks comparing to dietary organic acids or control group.

Carcass characteristics: Effect of different treatments on carcass characteristics is listed in Table 5. Chicks fed 0.1%DPP/kg diet (T3) achieved significantly the best carcass % (69.52%)

followed by group fed 0.1% DPPE/ kg diet (T5) being 68.79%. While, the lowest values were recorded for control group, T4 and T6 without significant differences between them. The enhancement in T3 and T5 comparing to control is 9.83% and 8.67%, respectively. The results agree with the previous result of Ouyang et al. (2016) who concluded that breast percentage of broiler chicks were significantly increased by supplementation of 10 and 15 mg flavinoids per kg diet. While the results disagree with Batista et al. (2007) who concluded that supplementation of flavonoids to broilers diet did not affect carcass and parts yields. On the other hand, no treatment effect was observed on liver %, heart%, gizzard% and geblits %. In this connection, Canogullari et al. (2009) who reported that there were no significant differences in liver, gizzard and heart weight % in quails fed various levels (0, 5, 10 and 20 g/kg diet) of pollen.

Immunological parameters: Lymphoid organs and NDV titer as affected by various treatments are presented in Table 6. Chicks fed either 0.1% DPP/kg diet (T3) and 0.1% DPPE/kg diet (T5) recorded higher percentage of bursa comparing to control group. While, thymus % and spleen % did not affected significantly by treatments. Furthermore, neither synthetic antioxidant (BHT) nor natural antioxidant (DPP and DPPE) affect the Newcastle disease virus titer in compared to control group. The result disagree with Hassan et al. (2015) who concluded that antibody response were improved by adding phytogenic (artichoke) in diet when broilers were reared under heat stress condition. None significant differences in antibody titer against NDV could be due to body weight enhancement observed in Table (3) and this explained by Tajodini et al. (2014) who postulated that negative effect on growth performance as a result of immune-stimulation, because more nutrients are controlled towards developing immune organs, thereby lowering the total nutrients available for growth.

Blood constitute: Impact of different treatments on serum lipid profile, total protein and their fractions are presented in Table 7. Chicks fed control diet recorded significantly the highest value of triglyceride comparing to other treatments. Whereas, serum total cholesterol values were ($P<0.05$) reduced in chicks fed dietary 0.0125% BHT, 0.1% DPP and 0.1% DPPE compared to control group. The reduction was 4.26%, 3.63% and 4.88%, respectively. The decline in this component may be due to that bio-flavonoids could decrease cholesterol synthesis by delaying Acyl-CoA Cholesterol Transferase (ACAT) activity in HepG2 cells (Borradaile et al. 1999), which reduce the hepatic production of apo-B containing lipoproteins, thereby reducing the serum LDL concentration (Burnett et al. 1998). Also, the results confirming the previous conclusion of Ouyang et al., (2016) who reported that TC was decreased by supplementing broilers diet with 15 mg flavonoids.

Chicks fed dietary 0.1% DPP and 0.1% DPPE recorded significantly higher HDL values (100.8 and 102 mg/dl) compared to the other groups. While, control group, T4 (0.3% DPP) and T6 (0.3% DPPE) recorded significantly the highest LDL value (64.5, 63.3 and 64.5 mg/dl, respectively) compared to other groups. In this respect, Ouyang et al., (2016) found that addition of 15 mg flavonoids in broilers diet could significantly reduce

LDL level while, increase HDL value compared to control group.

The group of chicks fed 0.1% DPP and 0.1% DPPE recorded significantly higher serum total protein and globulin values relative to un-supplemented group and other treatments. On the other hand, these two groups (T3 and T5) recorded significantly lower A/G ratio by 20.51% and 23.08% respectively comparing to control group. The increase in serum globulin content may be due to the immune stimulant effect of DPP or its extract. Moreover, these findings suggest improved rate of growth as reported in Table (3) and immunity in Fayoumi cocks. The results are in agreement with those Elagib et al. (2012) who treated broiler diets with cinnamon, cumin, fenugreek and ginger as natural feed antioxidant having flavonoids as a main component, and concluded that the total proteins and globulins was increased, while, albumin still unaffected and this impact lowered A/G ratio.

Meat quality: Results of the effect of studied treatments on meat quality are presented in Table 8. Total protein in cocks' tissues did not influenced by dietary treatments. While, control group, T4 (0.3% DPP/kg diet) and T6 (0.3% DPPE/ kg diet) recorded significantly the highest tissue total lipid comparing to T2, T3 and T5. And this result confirms the previous findings observed in Table (7) which total cholesterol was reduced in these groups hence reflected in chicks' tissues. Whereas, T3 (0.1% DPP/kg diet), T5 (0.1% DPPE/kg diet) significantly increased TAOC values by 5.05% and 7.03% respectively relative to the control group. As a result of increasing TAOC in tissues the lipid peroxidation decreased. Results are in line with Bhale et al. (2007) who shown that extracts form oregano and rosemary, where they contain flavonoids, inhibit the peroxidation of polyunsaturated fatty acids. Moreover, flavonoids from DPP and DPPE may be responsible for inhibition of oxygen radicals (superoxide ions and hydroxyl radicals), which are strong peroxidation agent (Al-Farsi et al. 2005**)**

Malondialdehyde (MDA) in tissue was significantly improved in all groups compared with un-supplemented one. The highest reduction was recorded for T6 group being 43.35% in comparison to control group. The result from the current study show that DPP and its extract have the potential to inhibit lipid oxidation of cocks meat because of the transfer of antioxidant into meat, thereby improving the shelf life and quality of meat. The results agree with Sáyago-Ayerdi et al. (2009) who reported that polyphenol decreased the MDA level in broilers meat as a result of the change of Fe and Cu content then leading to the MDA production decreased. The significant improvement in meat quality as a result of supplementing chicks diet by date palm pollen could be regarded in its high contents of polyphenolic substances especially flavonoids (Kroyer and Hegedus, 2001) which has several benefits to the body through its antioxidant properties. In this respect, Sebastián et al. (2003) concluded that flavonoids had a better effect on carcass quality when they added to swine diets. Moreover, Batista et al. (2007) treating broiler diet with flavonoid + mannan oligosaccharide and recorded lower oxidation index in thigh meat than control. Also, Jo et al. (2009) found that broilers thigh meat had high anti-oxidative effect when their ration supplemented by medicinal plant extracts

mixture (mulberry leaf + Japanese honeysuckle + gold thread). Furthermore, Park et al. (2014) reported that addition of Saposhnikovia divaricata, Lonicera japonica, and Chelidonium majus extracts mixture to broilers diet lowered breast meat TBARS values in relative to control group.

Hematological parameters: Effect of different treatments on hematological parameters is listed in Table 9. It is clear that hematological and serum biochemical profile may be functional marker for assessing the safety or monitoring for deleterious impacts of experimental material and its extract on bird health. Chicks fed 0.0125% BHT, 0.1% DPP and 0.1% DPPE/ kg diet recorded significantly higher WBC count and Hb values comparing to control group.

Regarding to red blood cells counts, T2 (fed 0.0125%BHT/ kg diet) recorded significantly higher rate comparing to control group and others fed dietary 0.1% DPPE. On the other hand, chicks fed 0.3% DPP/kg diet recorded significantly the lowest Ht% comparing to other treatments. In this connection, Toghyani et al. (2010) who supplemented nigella sativa to broiler diets and found that increased RBC count, hemoglobin and hematocrit concentrations. In addition, Park et al. (2014) concluded that supplementation of medicinal plant extract (Saposhnikovia divaricata, Lonicera japonica, and Chelidonium majus) in broiler diet did not affect WBC count. While, increased values of RBC, hemoglobin and hematocrit.

Mean corpuscular volume (MCV) values were higher in control group and T5 group (0.1% DPPE/kg diet) while, higher MCH value was achieved for only T5 group. Moreover, all treated groups recorded significantly higher MCHC values relative to control group. Under such conditions, the oxygen carrying capacity of blood in Fayoumi cocks fed DPP or DPPE would be increased so, it reflect their positive effect on hematopoiesis.

Economical efficiency: Impact of various levels of date palm pollen and its extract in relative to synthetic antioxidant (BHT) and control group is illustrated in Table 10. It is worthy to note that cocks fed dietary 0.1% DPP/kg diet recorded the highest profit (118.8%) followed by those fed 0.1% DPPE/ kg diet being (102.15%) comparing to control and other treatments. In this respect Scheuermann et al. (2009) used 150 ppm phytogenic product (mixture of essential oil, capsaicin and saponin) in cobb broiler diets and concluded that this mixture of dietary phytogenic product gave economical advantage comparing to control group. Also, Hassan et al. (2015) indicated that artichoke extract supplementation decrease the relative cost per unit of body weight and thus increase profitability from broiler production.

Overall, this study provides evidence for the beneficial role of DPP as a natural antioxidant in local cocks growth performance that needs to be further confirmed in field studies.

Table (1): Chemical composition of date palm pollen*

Item	**Amount**	**Item**	**Amount**
Moisture (%)	28.8	Minerals (mg/100 g)	
Ash %	4.57	Zinc	281.0
Crude fiber%	1.37	Selenium	305.0
Crude fat%	20.74	Iron	241.0
Crude protein%	31.11	Manganese	284.0
Carbohydrate %	13.41	Copper	319.6
Vitamins		Cobalt	305.4
A (IU/100 g)	7708.33	Nickel	302.4
E (IU/100 g)	3030.92	Molybdenum	302.2
C (mg/100g)	89.09	Boron	309.4
Total phenolic components (mg/g) **	57.9		
Determined total flavonoids (mg/100g)	200.18		

*According to Hassan (2011), ** according to Farouk et al., (2015)

Table (2): Ingredients and chemical composition of starter-grower and finisher diets.

Ingredients	**Starter –Grower (1-8 wks)**	**Finisher (9-12 wks)**
Yellow corn	62.14	71.40
Soybean meal (44%)	24.97	20.38
Wheat bran	9.32	4.52
Di-calcium phosphate	1.32	1.45
Limestone	1.36	1.36
NaCl	0.30	0.30
Minerals*	0.30	0.30
Vitamins**	0.10	0.10
DL- methionine	0.07	0.07
L-lysine HCl	0.02	0.02
Sodium bicarbonate	0.10	0.1
Total	100	100
Price (LE)/ ton	4934	4840
Calculated analyses***		
CP %	17.00	15.00
ME (kcal/kg)	2750	2900
Calcium%	0.90	0.90
Available Phosphorus %	0.40	0.40
Lysine %	0.85	0.75
Methionine %	0.35	0.32
Methionine+cystine	0.65	0.63
Sodium	0.18	0.18

*Supplied minerals per kg of diet: Copper 4 mg; Iron 30 mg; Manganese 60 mg; Zinc 50 mg; Iodine 0.3 mg ; Cobalt 0.1 mg and Selenium 0.1 mg.

**Supplied vitamins per kg of diet: Vit. A, 10000 IU; Vit. D3, 2000 IU; Vit. E, 10 mg; Vit K3, 1 mg; Vit. B1, 1 mg; Vit. B2, 5 mg; B6, 1.5 mg; B12, 10 mcg; Nicotinic acid 30 mg; Folic acid 1mg; Pantothenic acid 10 mg and Biotine 50 mcg; Choline 250 mg.

*** According to the Egyptian Regional Center for Food and Feed (RCFF, 2001).

Table (3): Effect of date palm pollen and its extract on live weight and weight gain of Fayoumi chicks

Treatment	Live body weight (g)			Live weight gain (g)		
	IW*	8 wks	12 wks	1day -8 wks	9-12 wks	1 day -12 wks
T1 (Control)	28.6	534.2 ^{a}	886.3 ^{bc}	505.6 ^{a}	352.1^{b}	857.7 ^{bc}
T2 (0.0125% BHT)	29.9	526.4 ^{ab}	886.0 ^{bc}	496.5 ^{ab}	359.6 ^{b}	856.1 ^{bc}
T3 (0.1% DPP)	30.7	533.6 ^{a}	930.0 ^{a}	502.9 ^{a}	396.4 ^{a}	899.3^{a}
T4 (0.3% DPP)	30.0	495.3 ^{c}	868.0 ^{c}	465.3 ^{c}	372.7 ^{ab}	838.0 ^{c}
T5 (0.1% DPPE)	29.5	514.5^{b}	911.8 ^{ab}	485.0^{b}	397.3 ^{a}	882.3 ^{ab}
T6 (0.3% DPPE)	29.3	514.0^{b}	883.3 ^{bc}	484.7 ^{b}	369.3 ^{ab}	854.0 ^{bc}
SEM	0.97	6.40	15.10	6.36	11.9	15.00
P value	0.50	0.0007	0.028	0.001	0.008	0.032

a, b and c Means in each column, with same superscripts are not significantly different.*IW: Initial weight

BHT: Butylated hydroxytoluene, DPP: date palm pollen, DPPE: date palm pollen extract

Table (4): Effect of date palm pollen and its extract on feed intake and feed conversion ratio of Fayoumi chicks

Treatment	Feed intake (g)			Feed conversion ratio (g feed /g gain)		
	1day-8wks	9-12 wks	1 day-12 wks	1 day-8wks	9-12 wks	1 day-12 wks
T1 (Control)	1660	1310	2970	3.28 ^{b}	3.72 ^{a}	3.46 ^{a}
T2 (0.0125% BHT)	1671	1299	2970	3.37 ^{b}	3.61 ^{a}	3.47 ^{a}
T3 (0.1% DPP)	1629	1263	2892	3.24 ^{b}	3.19 ^{b}	3.22 ^{b}
T4 (0.3% DPP)	1660	1300	2960	3.57 ^{a}	3.49 ^{ab}	3.53 ^{a}
T5 (0.1% DPPE)	1637	1358	2995	3.38 ^{b}	3.42 ^{ab}	3.39 ^{ab}
T6 (0.3%l DPPE)	1660	1310	2970	3.42 ^{ab}	3.55 ^{ab}	3.48 ^{a}
SEM	23.5	24.0	33.03	0.07	0.13	0.08
P value	0.61	0.07	0.161	0.017	0.027	0.032

a and b Means in each column, with same superscripts are not significantly different.

BHT: Butylated hydroxytoluene, DPP: date palm pollen, DPPE: date palm pollen extract.

Table (5): Effect of date palm pollen and its extract on carcass characteristics of Fayoumi chicks

Treatments	Carcass %	Liver %	Heart %	Gizzard %	Giblets %
T1 (Control)	63.3 ^{d}	2.29	0.39	2.83	5.51
T2 (0.0125% BHT)	67.15^{c}	1.95	0.47	2.83	5.25
T3 (0.1% DPP)	69.52 ^{a}	2.48	0.50	3.47	6.45
T4 (0.3% DPP)	63.9 ^{d}	2.42	0.46	3.78	6.66
T5 (0.1% DPPE)	68.79 ^{b}	2.66	0.45	3.73	6.83
T6 (0.3% DPPE)	63.30 ^{d}	2.27	0.51	2.52	5.30
SEM	0.13	0.199	0.065	1.30	1.58
P value	0.0018	0.350	0.6735	0.7947	0.6875

a and b Means in each column, with same superscripts are not significantly different.
BHT: Butylated hydroxytoluene, DPP: date palm pollen, DPPE: date palm pollen extract.

Table (6): Effect of date palm pollen and its extract on lymphoid organs and NDV titer of Fayoumi chicks

Treatments	Thymus %	Bursa %	Spleen %	NDV Titer
T1 (Control)	0.23	0.22 ^{c}	0.24	7.17
T2 (0.0125% BHT)	0.22	0.26 ^{bc}	0.25	7.60
T3 (0.1% DPP)	0.21	0.31 ^{ab}	0.31	7.83
T4 (0.3% DPP)	0.22	0.23 ^{c}	0.29	7.65
T5 (0.1% DPPE)	0.23	0.33 ^{a}	0.38	7.50
T6 (0.3% DPPE)	0.24	0.21 ^{c}	0.26	7.27
SEM	0.039	0.010	0.022	0.154
P value	0.9913	0.0353	0.1379	0.0807

a,b and c Means in each column, with same superscripts are not significantly different.
BHT: Butylated hydroxytoluene, DPP: date palm pollen, DPPE: date palm pollen extract.

Table (7): Effect of date palm pollen and its extract on serum lipid profile, total protein and their fractions of Fayoumi chicks

Treatments	TG (mg/dl)	TC (mg/dl)	HDL (mg/dl)	LDL (mg/dl)	TP (g/dl)	Alb. (g/dl)	Glu. (g/dl)	A/G ratio
T1 (Control)	53.5 ^{a}	159.8 ^{a}	95.3 ^{b}	64.5 ^{a}	4.03^{d}	1.14	2.89^{e}	0.39 ^{ab}
T2 (0.0125% BHT)	47.0 ^{b}	153.0 ^{b}	96.2 ^{b}	56.8 ^{b}	4.43 ^{b}	1.17	3.26 ^{b}	0.36 ^{bc}
T3 (0.1% DPP)	46.7 ^{b}	154.0 ^{b}	100.8 ^{a}	53.2 ^{bc}	4.89 ^{a}	1.15	3.74 ^{a}	0.31^{c}
T4 (0.3% DPP)	48.0 ^{b}	159.0 ^{a}	95.7 ^{b}	63.3 ^{a}	4.20 ^{cd}	1.24	2.96^{d}	0.42^{ab}
T5 (0.1% DPPE)	46.5 ^{b}	152.0 ^{b}	102.0 ^{a}	50.0 ^{c}	4.83^{a}	1.12	3.71^{a}	0.30^{c}
T6 (0.3% DPPE)	48.0 ^{b}	158.5 ^{a}	94.0 ^{b}	64.5 ^{a}	4.36^{bc}	1.30	3.06^{c}	0.43^{a}
SEM	0.59	0.76	0.87	1.07	0.07	0.06	0.01	0.02
P value	0.0001	0.0001	0.0001	0.0001	0.0001	0.367	0.0001	0.0015

a and b Means in each column, with same superscripts are not significantly different.
BHT: Butylated hydroxytoluene, DPP: date palm pollen, DPPE: date palm pollen extract.

Table (8): Effect of date palm pollen and its extract on meat quality of Fayoumi chicks

Treatments	TP (mg/100g)	TL (mg/100g)	TAC (mmol/100g)	MDA (mmol/100g)
T1 (Control)	4.13	510 ^{a}	37.82 ^{b}	1.73 ^{a}
T2 (0.0125% BHT)	4.38	489.9 ^{b}	37.2 ^{b}	1.23 ^{b}
T3 (0.1% DPP)	4.34	491.0^{b}	39.73 ^{a}	1.02 ^{c}
T4 (0.3% DPP)	4.27	503.3 ^{a}	37.23 ^{b}	1.02 ^{c}
T5 (0.1% DPPE)	4.16	490.7 ^{b}	40.48 ^{a}	1.06 ^{bc}
T6 (0.3% DPPE)	4.29	504.3 ^{a}	37.40 ^{b}	0.98 ^{c}
SEM	0.115	3.21	0.26	0.058
P value	0.102	0.0022	0.0001	0.0001

a, b and c Means in each column, with same superscripts are not significantly different.
BHT: Butylated hydroxytoluene, DPP: date palm pollen, DPPE: date palm pollen extract, TP: total protein, TL: total lipid, TAOC: total antioxidant capacity, MDA: malodialdehyde.

Table (9): Effect of date palm pollen and its extract on hematological parameters of Fayoumi chicks

Treatments	WBC ($\times 10^3$/ µl)	Hb (g/dl)	RBCs (10^6/mm^3)	Ht (%)	MCV (µm3)	MCH (Pg)	MCHC (g/dl)
Rage*	10.2-30	7-13	2.5- 3.5	22-35	90-140	33-47	26-35
T1 (Control)	18.30 ^{d}	10.0^{d}	2.94 ^{b}	30.8^{a}	104.80 ^{a}	34.01 ^{d}	32.47 ^{b}
T2 (0.0125%BHT)	21.25 ^{ab}	12.4^{ab}	3.34 ^{a}	31.8 ^{a}	95.20 ^{bc}	37.13 ^{bcd}	38.99 ^{a}
T3 (0.1% DPP)	21.00 ^{abc}	12.6^{a}	3.12 ^{ab}	31.6 ^{a}	101.30^{ab}	40.38 ^{ab}	39.87 ^{a}
T4 (0.3% DPP)	19.40 ^{cd}	11.5^{c}	3.22 ^{ab}	29.0 ^{b}	90.10 ^{c}	35.71 ^{cd}	39.66 ^{a}
T5 (0.1% DPPE)	21.80 ^{a}	12.4^{ab}	2.99 ^{b}	32.0 ^{a}	107.02 ^{a}	41.47 ^{a}	38.75 ^{a}
T6 (0.3% DPPE)	19.93 ^{bcd}	12.0^{bc}	3.10 ^{ab}	31.8 ^{a}	102.60^{ab}	38.71 ^{abc}	37.74 ^{a}
SEM	0.514	0.178	0.085	0.443	2.67	1.196	0.641
P value	0.0039	0.001	0.05	0.004	0.0054	0.0081	0.001

a, b…e: Means in each column, with same superscripts are not significantly different.
BHT: Butylated hydroxytoluene, DPP: date palm pollen, DPPE: date palm pollen extract.
Mean Corpuscular Volume (MCV) = Ht × 10/ RBC's (µm3), Mean Corpuscular Hemoglobin (MCH)=Hb × 10/ RBC's (Pg) Mean Corpuscular Hemoglobin Concentration (MCHC) = Hb×100/ Ht (g/dl).
Jain (1993)

Table (10): Effect of date palm pollen and its extract on economical efficiency

Treatments	Live weight (Kg)	Total Feed intake (kg)	Total feed cost (LE)	Total revenue (LE)/chick [1]	Net revenue[2]	Economical efficiency (%) [3]	Relative economical efficiency [4]
T1(Control)	0.8863	2.970	14.53	22.16	7.63	52.51	100
T2 (0.0125% BHT)	0.886	2.970	14.58	22.15	7.57	51.92	98.88
T3 (0.1% DPP)	0.930	2.892	14.32	23.25	8.93	62.36	118.80
T4 (0.3% DPP)	0.868	2.960	15.03	21.70	6.67	44.38	84.52
T5 (0.1% DPPE)	0.9118	2.995	14.84	22.80	7.96	53.64	102.15
T6 (0.3% DPPE)	0.8833	2.970	15.11	22.08	6.97	46.13	87.85

Total price for feeds was calculated according to the price of different ingredients available in ARE.
[1]The price was calculated due to the local market the price of one Kg of DPP (60 LE), DPPE (65 LE), BHT (95 LE) and price of one Kg live weight was 25 LE.
[2]Net revenue= total revenue per chick -total feed cost.
[3]Economic efficiency (%) = net revenue/ total feed coast *100.
[4]Relative economic efficiency of the control, assuming that the relative E1 of the control =100

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الملخص العربى

تأثير اضافة طلع النخل ومستخلصه المائى على الاداء الانتاجى لديوك الفيومى خلال فترة النمو

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تهدف الدراسة الحالية لتقييم اضافة طلع النخل و مستخلصة المائى على الاداء الانتاجى وحالة مضادات الاكسدة والاستجابة المناعية وجودة اللحم والكفاءة الاقتصادية لديوك الفيومى فى مرحلة النمو. حيث استخدم 180 ديك عمر يوم وتم تقسيمهم الى 6 مجاميع تجريبية بكل منها 30 طائر (10 طائر/ مكرر). تغذت المجموعة الاولى على عليقة المقارنة بينما تغذت المجموعة الثانية على عليقة المقارنة مضاف اليها BHT بمعدل 0,0125%. وتغذت المجموعة الثالثة والرابعة على عليقة المقارنة مضاف اليها 0,1 و 0,3% من مسحوق طلع النخل على التوالى ، وتغذت المجموعة الخامسة والسادسة على عليقة المقارنة مضاف اليها 0,1و 0,3% من المستخلص المائى لطلع النخل. وقد تم تسكين الطيور تحت نفس الظروف الرعائية خلال فترة الدراسة والتى استمرت حتى 12 أسبوع. وكانت اهم النتائج المتحصل عليها كالاتى:

سجلت الطيور المغذاة على علائق مضاف اليها0,1% طلع النخل سواء فى صورة مسحوق أو مستخلص مائى تحسنا معنويا فى وزن الجسم النهائى بمعدل 4,93% و 2,88% على التوالى بالاضافة لتحسن معامل التحويل الغذائى خلال فترة الدراسة كاملة (1-12 اسبوع) بمعدل 6,94% و 2,02% على التوالى مقارنة بمجموعة المقارنة. بينما لم تسجل ايا من المعاملات المختلفة تأثيرا معنويا على تتر الاجسام المناعية للنيوكاسل.

سجلت الطيور المغذاة على كلا من BHT 0,0125% ، 0,1% مسحوق طلع النخل أو 0,1% مستخلص طلع النخل انخفاضا معنويا فى الكولستيرول الكلى بسيرم الدم مقارنة بمجموعة المقارنة.

حققت جميع المعاملات انخفاضا معنويا فى قيم أكسدة الدهون للحم الطيور مقارنة بمجموعة المقارنة. على العكس فقد حققت المعاملتان الثالثة (0,1% مسحوق طلع النخل) والخامسة (0,1% مستخلص طلع النخل) زيادة معنوية فى كثافة مضادات الاكسدة الكلية فى لحم الطيور بمعدل 5,05% و 7,03% على التوالى مقارنة بمجموعة المقارنة.

اظهرت الطيور المغذاة على BHT 0,0125% ، 0,1% مسحوق طلع النخل ، 0,1% مستخلص طلع النخل زيادة معنوية فى قيم هيموجلوبين الدم مقارنة بمجموعة المقارنة. وأخيرا فان الطيور المغذاة على كلا من 0,1% مسحوق طلع النخل أو 0,1% مستخلص طلع النخل سجلا اعلى كفاءة اقتصادية (118,8% و 102,15%) على التوالى مقارنة بمجموعة المقارنة.

الخلاصة: اضافة 0,1% من طلع النخل سواء فى صورة مسحوق أو فى صورة مستخلص الى علائق ديوك الفيومى النامية تعمل على تحسين ادائها الانتاجى وحالة مضادات الاكسدة وجودة لحومها بالاضافة لزيادة الربح الاقتصادى.