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EFFECT OF USING BEE BREAD AS A NATURAL SUPPLEMENT ON PRODUCTIVE AND PHYSIOLOGICAL PERFORMANCE OF LOCAL SINAI HENS

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ABSTRACT : A total number of 150 Sinai birds at 24-weeks-old were weighed and divided into five groups to investigate the effect of supplementing bee bread (BB) as a growth promoter and antioxidant material at levels of 0 , 0.5 , 1.0 and 1.5 g / kg diet as well as a group supplemented with 250 mg ascorbic acid/kg as a positive control (PC) on laying performance, egg quality traits, hatchability traits, serum constituents , blood parameters and carcass traits as well as nutrients digestibility coefficients and economical efficiency during laying period (24-47 wks of age).

The results indicated that hens fed diets supplemented with BB had similar body weight gain as compared to those fed the control and PC diet during the overall experimental period (24-47wks),whereas, they had higher viability percentage as compared to the control. Egg number and egg mass per hen and laying rate were significantly improved for the groups fed diets supplemented with different BB levels as compared to the control group during the overall experimental period (24-47 wks), whereas, the group fed 0.5 g BB/kg had insignificantly higher values of these traits as compared to PC group. Feed consumption per hen was insignificantly increased as a result of supplementing varying BB levels to the diet as compared to the control and PC groups during overall experimental period (24-47 wks), while, feed conversion ratio was significantly improved as compared to the control and was approximately similar to PC group. All studied egg quality parameters were not significantly affected by feeding BB diets as compared to the control. Fertility percentage was significantly improved by feeding BB diets as compared to the control groups, whereas, hatchability percentage of set eggs was significantly improved for the group fed 0.5 g BB/kg than the control group. Early , late and total embryonic mortality values were insignificantly lower for the groups fed BB diets as compared with those fed the control diet, whereas, the group fed 0.5 g BB/kg diet had lower total embryonic mortality than those fed PC diet. Chick weight at hatch was insignificantly higher for BB diets groups as compared with control diets. Eviscerated carcass and edible parts

Key Words: bee bread, laying performance, blood parameters, local Sinai hens.

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percentages were insignificantly improved by supplementing 0.5 and 1.0 g BB / kg diet compared to the control.

The studied serum constituents for hens fed BB diets were not significantly affected except of LDL cholesterol and ALT enzyme. Feeding both 1.0 and 1.5 g BB/kg diet resulted in significantly lower LDL cholesterol value than those fed the control diet, while, the groups fed 0.5 and 1.5 g BB/kg diet had significantly lower ALT enzyme. White blood cells count was significantly decreased in hens fed 0.5 g BB/ kg diet as compared to the control, whereas, heterophils percentage and heterophils /lymphocyte ratio were significantly decreased by feeding BB diets. Nutritive value and nutrient digestibility coefficients were insignificantly improved by feeding diets supplemented with different BB levels except of crude fiber which significantly improved by feeding 1.0 and 1.5 g BB/kg diet as compared to those fed control diet. Economic efficiency and net return were improved by feeding BB diets as compared to the control during 24-47 wks of age. These results indicate that BB could be supplemented to local hen's diet up to 1.5 g / kg to improve laying performance, hatchability, nutrients digestibility and nutritive value as well as economical efficiency, without negative effects on hen's viability.

INTRODUCTION

Poultry plays an important role in human nutrition, employment and income generation. Poultry rations are formulated to contain an optimum nutrient concentration obtainable at reasonable cost for desirable growth, production and efficiency of feed utilization, so certain non nutritive feed additives are sometimes used. Alternative additives such as herbs, spices essential oils extracted form aromatic plants, enzymes, organic acids and probiotics were used as growth promoters in poultry diets in many countries for organic poultry production (Griggs and Jacob, 2005).

The suitable temperature for poultry is between 16-25°C (Filizciler et al., 2002; Cerci et al., 2003). Heat stress begins when the ambient temperature climbs above 25°C and is readily apparent above 30°C. Stress due to high environmental temperature is widely recognized as one of the primary problems in poultry production (Aberra and Lengerken, 2005). Heat stress in birds cause many biochemical and physiological changes such as shift in acid-base balance, hyperthermia, increased of O_2 consumption and CO_2 production, increased production of free radicals and corticosterone (Mebta and Sbingari ,1999). In laying hens, egg shell is affected by acid-base balance in the blood because it is a restricted factor for accumulation of $CaCO_3$ in egg shell because high environmental temperature may affect the feed especially calcium (Ca) intake of the bird, thus, resulting in a decreased availability of Ca for shell deposition (Okoli et al., 2006).

Antioxidants such as vitamin C, vitamin E and honey or bee products are used in the poultry diet because of their anti-stress effects (Tatli Seven et al., 2009; Ipek et al., 2007 and Tatli Seven et al., 2008). Numerous studies demonstrate that a great number of medicinal and aromatic herbs, as well as fruits and leaves of some berry plants biosynthesize phytochemicals possessing antioxidant activity and may be used as a natural source of free radical scavenging compounds (Sacchetti et al., 2005 and Yu et al., 2005), the majority of these plants are used by the bees to collect honey nectar; consequently plant origin bioactive components can be transferred to honey or bee products.

Bee products such as bee bread are known to be rich in both enzymatic and non-enzymatic antioxidants, including glucose oxidase, catalase, ascorbic acid, flavonoids, phenolic acids, carotenoid derivatives, organic acids, maillard reaction products, amino acids and proteins (Aljadi and Kamaruddin, 2004 and Schramm et al., 2003). Bee bread is made of pollen, which has been gathered by bees and mixed with its digestive enzymes, carried back to the hive, packed into pellets and preserved with tiny bit of honey and bee wax (Awad et al., 2013). It is considered as a valuable functional food with varied enhancing effects in health (Bogdanov, 2004) as a result of antimicrobial action which has been attributed to their several biological components that have different important physiological and pharmacological activities such as antioxidant activity (Carpes et al., 2007 , Koru et al., 2007 and Awad et al., 2013). The objective of this study was to determine the effect of supplementing bee bread to local Sinai hen's diet on laying performance, egg quality, hatchability traits, blood parameter and serum constituents as well as nutrients digestibility coefficients and economic efficiency during laying period under summer condition.

MATERIALS AND METHODS

This study was carried out at El – Serw Poultry Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt. The experiment was conducted from May to October 2012. One hundred and fifty Sinai birds (135 hens and 15 cocks) 24-wks-old were weighed and randomly distributed into five experimental groups, 30 birds each (27 hens and 3 cocks), three replicates (9 hens and one cock). All birds were reared under similar hygienic and managerial conditions. Throughout the experimental period, feed and fresh water were available all the time. The basal diet (layer) was formulated, and then divided into five groups and supplemented with graded levels of bee bread (0 , 0.5 , 1.0 and 1.5 g / kg diet), whereas the fifth group diet was supplemented with 250 mg / kg ascorbic acid (positive control) . The composition and calculated analysis of the basal diet are shown in Table 1.

Parameters estimated and data collection:

1. Laying performance traits:

Body weight of hens and mortality number were recorded during the experiment period (24 - 47 wks of age). Egg number and mass and feed consumption were recorded then were averaged and expressed per hen / 4 wks through the periods 24-27, 28-31, 32-35, 36-39, 40-43, 44-47 and the overall experimental period (24-47 wks of age). Laying rate and feed conversion ratio were calculated through the same periods as well as body weight gain and viability percentage.

2. Egg quality parameters:

At 35 weeks of age a total number of 45 eggs (9 from each treatment) were taken to determine egg components and quality. Fertility and hatchability traits were measured by collecting eggs for 7 days during the laying period at three hatches along with different ages, then stored and transferred to hatchery for incubation, data were recorded and parameters were calculated.

3. Hematological parameters:

At 45 wks of age, three blood samples per treatment (one from each replicate) were collected randomly in vial tubes containing EDTA as anticoagulant. Differential white blood cells (WBC) counts were performed by using standard avian guidelines introduced by Ritchie et al. (1994). Total white blood cells were determined by the Unopett method (Campbell, 1995). Heterophils (H) and lymphocytes (L) were counted in different

microscopic fields in a total of 200 WBC by the same person, and the H: L ratios were calculated (Gross and Siegel, 1986).

4. Slaughter trail:

At the end of experimental period, three hens per treatment (one from each replicate) were randomly taken and slaughtered. Data of carcass traits (including eviscerated carcass, giblets, edible parts and abdominal fat) and pancreas were calculated as a percentage of live weight.

5. Blood constituents:

At time of slaughter, blood sample from each hen was collected without anticoagulant and kept at room temperature for one hour to clot. Tubes were centrifuged at 3000 rpm for 15 minutes to separate clear serum that used for determination of serum total protein (Peters, 1968), total cholesterol (Ellefson and Caraway, 1976), triglycerides (Bucolo and David, 1973), HDL , LDL cholesterol (Siedel, 1983) , AST and ALT enzymes (Reitman and Frankel,1957). These biochemical measurements were performed colorimetrically by using commercial kits.

6. Nutrients digestibility:

At the end of experiment, 15 Sinai cocks (three from each treatment) were taken to evaluate the digestibility of nutrients for all experimental diets. Cocks were fed their experimental diets for seven days as a preliminary period, followed by three days collection period, where excreta were quantitatively collected. Simultaneously, records of daily feed consumption for each cock were maintained. The daily excreta was voided from cocks in each treatment, pooled and thoroughly mixed. Then, representative excreta samples were taken and dried immediately for chemical analysis (AOAC 1995). The procedure described by Jakobsen et al. (1960) was used for separating fecal protein from excreta samples. Urinaly organic matter (UOM) was determined according to Abou-Raya and Galal (1971). Digestion coefficients of dry matter (DM) , organic matter (OM), crude protein (CP), crude fiber (CF) , ether extract (EE) and nitrogen free extract (NFE) as well as total digestible nutrient (TDN) and metabolizable energy (ME) were calculated according to (Fraps, 1946).

7. Economic efficiency and net return:

Data were calculated based on the prices of bee bread (50 LE/ one kg) , 100 g vitamin C 100% (20.0 LE) and one kg of live body weight (14.0 LE) prevailing during year 2012.

Statistical analysis: Data were analyzed by the analysis of variance according to SAS (2004) and significant differences among means were detected by the Duncan's Multiple Range Test (Duncan, 1955).The following model was used : $Y_{ij} = \mu + T_i + e_{iJ}$ where, Y_{ij} = an observation, μ = overall mean, T_i = Effect of treatment (1, 2 , … , 5) and e_{iJ} = Random error

RESULTS AND DISCUSSION

Laying performance:

No significant differences in live body weight (LBW) and body weight gain (BWG) due to supplementing bee bread to laying diet (Table 2). The LBW and BWG of Sinai hens were approximately similar at the end of experimental period. Similar reports were drawn by Galal et al. (2008) who reported that no significant differences were observed on body weight among hens fed 100 and 150 mg propolis / kg diet during laying period.

Viability values were insignificantly improved by feeding different BB diets and PC as compared to those fed control diet during the overall experimental period. Hens fed 1.0 and 1.5 g BB/kg diet had the highest viability value than other treatment. These results may be due to antimicrobial action of bee bread which has been

attributed to their several phenolic and flavonoids compounds with antioxidant activity (Carpes et al., 2007 and Koru et al., 2007), the effect of bee bread which could stimulate the immune system and increase vitality (Kročko et al. , 2012), regulation of the intestinal microflora by reducing count of Enterobacteriaceae family in chicken's crops (Basim et al. , 2006) and increasing number of beneficial lactic acid bacteria (Kumova et al. , 2002 and Bankova et al. , 2007). This result are on the line with those obtained by Awad et al. (2013) who reported that mortality rate of local Sinai chickens was decreased by supplementing bee bread up to 1.5 g/kg to their diet during the growing period.

Results in Table (3) showed significant differences among the experimental groups in egg number (EN) and laying rate (LR) during all the interval periods except of the periods 24-27, 28-31 and 44-47 wks of age. EN per hen and LR were significantly improved by feeding diets supplemented with BB levels at 32-35, 36-39, 40-43 and 24-47 wks of age as compared to the control group. EN and LR were significantly improved by 15.64, 9.01 and 10.79 % for the groups fed 0.5, 1.0 and 1.5 g BB/kg diets, respectively as compared to those fed the control diet during the overall experimental period (24-47 wks of age). Hens fed 0.5 g BB/kg diet had significantly higher EN and LR by 6.09 % than those fed 1.0 g BB/kg diets during the overall experimental period. Also, EN and LR were insignificantly improved by 4.02% for the group fed 0.5 g BB/kg diet as compared to CP diet during 24-47 wks of age.

Egg mass (EM) per hen was significantly affected by feeding diet supplemented with BB during all experimental periods except 24-27, 28-31 and 44-47 wks of age. Hens fed diet supplemented with 0.5, 1.0 and 1.5 g BB had significantly higher EM than those fed the control diet during 32-35, 36-39, 40-43 and 24-47 intervals. EM per hen was significantly higher by 15.49, 11.81 and 11.14% for the groups fed 0.5, 1.0 and 1.50 g BB/kg diets than those fed control diet , respectively during the overall experimental period. While, hens fed diets supplemented with BB had insignificantly higher EM than those fed PC diet during overall experimental period.

These improvements could be attributed to active components of bee bread (flavonoid, phenolic acid and terpenoid) which act as antimicrobial, antifungal and antioxidant and improve the bird's utilization of dietary nutrients (Seven et al., 2010). Also, flavonoids and various phenolics in bee products have been appeared to be capable of scavenging free radicals and thereby defending lipids and other compounds such as vitamin C from being oxidized or destroyed during oxidative damage (Tatli Seven et al., 2009). These results are in agreement with those obtained by Ali et al. (2007) who found that addition of 0.25% thyme leaves (natural antioxidants) to laying hens numerically increased egg number compared to hens fed basal diet . Galal et al. (2008) reported that egg number per hen was significantly increased by feeding diet supplemented with 100 and 150 mg propolis / kg diet during laying period. Tatli Seven (2008) reported that hen day egg production and egg weight were significantly improved by feeding diets supplemented with vitamin C and propolis for laying hens reared under heat stress conditions. Radwan et al. (2008) reported that addition of natural antioxidants (1.0% of thyme, rosemary, oregano or 0.50 % Curcuma longa) to laying hens diets increased egg mass and egg production. Ariana et al. (2011) reported that egg production was significantly improved by 6 - 7.5% for laying hens fed diet supplemented with green tea (natural antioxidants) than the control group.

Feed consumption (FC) per hens was insignificantly affected by BB supplementation during all experimental

periods (Table 4). It was insignificantly increased by 1.95, 1.07 and 0.39% for the groups fed diet supplemented with 0.5, 1.0 and 1.5 g BB/kg than those fed the control diet, respectively during the overall experimental period. Whereas, hens fed BB diets had slightly higher FC than those fed PC diet during the overall experimental period. These results may be indicated that the palatability of the diet was not changed by addition bee bread (BB) to the diet. These results are in agreement with those obtained by Demir et al. (1995) who reported that vitamin C supplementation in feed (200 mg/kg) during heat stress insignificantly increased feed intake. Acikgoz et al. (2005) and Tatli Seven et al. (2008) reported that supplementation with propolis (5 g/kg) to laying diet had increased feed intake. Kojima and Yoshida (2008) and Radwan et al. (2008) reported that feed intake was not significantly changed due supplementing natural antioxidant materials (green tea, thyme, oregano or rosemary leaves) to laying diet. Similarly, Ariana et al. (2011) reported that supplementing green tea, marigold and α-tocopherol acetate (as a natural antioxidants) to laying diet had no significant effects on feed intake as compared to the control. In contrast, Uuganbayar et al. (2005) reported that feed intake for layers fed diets containing 1.5% green tea was significantly higher than those fed the control diet.

Hens fed 0.5 and 1.5 g BB/kg diets had significantly better feed conversion ratio (FCR) as compared with those fed the control diet during 32-35 and 40-43 wks of age (Table 4). FCR was significantly improved by 11.84 , 9.74, 9.74 and 10.00% for the groups fed diet supplemented with 0.5 , 1.0 , 1.5 g BB/kg and PC , respectively than those fed the control diet during the overall experimental period. This result may be due to the ability of BB to reduce heat stress or improving nutrients digestibility and absorption as a result to improvement the activities of saccharase, amylase and phosphatase (Marieke et al., 2005) or easily prepared enzymatic hydrolysates from using two gastrointenstinal proteases (pepsin and trypsin) and a protein (papain) protease (Kročko et al., 2012). Also, may be due to gut microflora is a nutritional "burden" in fast-growing broiler chickens, since an active microflora component may have an increased energy requirement for maintenance and a reduced efficiency of nutrient utilization (Dibner and Richards, 2005 and Lan et al., 2005) .These results are on the line of those obtained by Villar-Patino et al. (2002) who reported that feed efficiency increased statistically with antioxidant supplementation. Shalmany and Shivazad (2006) concluded that feed efficiency were significantly higher for Ross 308 birds fed propolis in comparison to control diet. Similarly, McKee and Harrison (1995) detected an improvement in FCR of broilers as a result of vitamin C supplementation during heat stress. Banomi et al. (2002) reported that propolis supplementation to ducks diet caused significant improvement on feed conversion ratio. Awad et al. (2013) reported that feed conversion ratio was significantly better by supplementing bee bread up to 1.5 g/kg to local Sinai chickens diet during the growing period. In contrast, Uuganbayar et al. (2005) found un significant differences in feed conversion ratio among layers fed diets containing 1.0, 1.5 and 2.0% green tea powder and the control groups. Ariana et al. (2011) reported that hens received green tea extract had lower ($P<0.05$) feed conversion ratio than those fed the control diet.

Egg quality parameters:

Results of Table (5) showed insignificant differences in all egg quality parameters except relative albumin weight and shape index due to feeding the experimental diets. Relative egg shell and yolk weights were insignificantly higher by feeding BB diets than the control group,

whereas, relative egg albumin weight was insignificantly decreased. Relative egg albumin weight was significantly decreased by feeding 1.0 and 1.5 g BB/kg diets than those fed PC diet. Shape index was insignificantly affected due to feeding BB diets as compared with the control group, whereas, it was significantly decreased by 3.22% for the group fed diet supplemented with 1.5 g BB/kg than those fed 0.5 g BB/kg diet. Eggs produced from hens fed diet supplemented with different levels of BB had thick shell thickness and higher yolk index as well as HU than those fed the control diet. The improvement of egg shell thickness and egg shell weight may be due to improve calcium digestibility and absorption resulting from the acid derivates such as benzoik, 4-hydroxy-benzoic, etc., which are found in bee products (Haro et al., 2000; Tatli Seven, 2008). These results are in agreement with those obtained by Tatli Seven (2008) who reported that propolis supplementation increased egg shell thickness and egg shell weight in heat stressed laying hens. Ghasemi and et al. (2010) and Habib et al. (2011) reported that egg shell weight was increased by feeding diet supplemented with thyme or oregano (1.5%) than those fed the control diet. The highest relative yolk weight values may be due to the effects of antioxidants which may be attributed to release of vitellogenin from liver to improve those measurements (Whitehead et al., 1998 and Bowry and Ingold, 1999). These results are on the line with those obtained by Ariana et al. (2011)who reported that layer hens fed diet supplemented with natural antioxidant materials (α-tochopherol acetate, green tea powder and extract) produced eggs had a greater yolk weight and yolk index than those fed the control diet.

Fertility and hatchability:

Results of table (6) showed that significant differences in fertility and hatchability of set eggs percentages due to feeding diet supplemented with BB during laying period. Hens fed diet supplemented with BB had significantly higher fertility percentage than those fed the control diet. Fertility percentage was significantly improved by 5.17, 3.41 and 4.35% for the groups fed 0.5 , 1.0 and 1.5 g BB/kg diets , respectively than those fed the control diet. Hatchability percentage of set eggs was significantly improved by 14.98% for the group fed 0.5 g BB/kg diet as compared to the control, while, it was insignificantly improved by 8.65 and 9.52 % for hens fed diets supplemented with 1.0 and 1.5 g BB/kg, respectively. On the other hand, hens fed PC diet had significantly lower fertility percentage and insignificantly lower hatchability of set egg as compared with those fed BB diets. Hatchability percentage of fertile eggs was insignificantly higher as a result of supplementing BB to laying diet while both early or late embryonic mortality (EEM or LEM)) percentages were insignificantly decreased as compared to the control.

The good effect of dietary treatment on fertility and hatchability percentages of both fertile and set eggs could be explained on the base that these parameters may be affected by free radical production which removes by supplying these natural antioxidants. This result may be due to lowering egg yolk cholesterol as a result of feeding bee products diet, Yilmaz and Sahan (2007) found negative correlations between egg yolk cholesterol content and hatchability of fertile and set eggs. These results are in agreement with those obtained by Kemp et al. (2001) who reported that hatchability was increased by feeding natural antioxidants material in the diet. Ali et al. (2007) found that addition of thyme to hen diets significantly increased the hatchability of eggs compared to those fed the control diets. Radwan et al.(2008) found that addition of 1.0% oregano, rosemary or 0.5% curcuma longa significantly increased the percentages of fertility, while, 1.0% thyme or 0.5-1.0% curcuma longa significantly increased the

percentages of hatchability of fresh eggs. Similarly, Ali et al. (2012) and Rosa et al. (2012) observed an increase in hatchability of set and fertile eggs in breeders fed canthaxanthin.

Carcass traits:

Effect of BB supplementation on relative weights of some carcass traits of Sinai hens are presented in Table (7). Relative eviscerated carcass, liver, total edible parts and abdominal fat were not significantly affected by feeding BB diets. Hens fed 1.5 g BB/kg and PC diets had significantly higher gizzard percentage than the control group, whereas, heart percentage was significantly higher of hens fed 0.5 g BB/kg diet than other treatments. Hens fed diet supplemented with 0.5 and 1.50 g BB/kg had insignificantly higher total giblets by 2.17 and 9.40% as compared to those fed the control diet. Abdominal fat percentage was insignificantly decreased by 6.16, 9.42 and 19.93% of the groups fed diets supplemented with 0.5 , 1.0 and 1.5 g BB/kg diet as compared with those fed the control diet , respectively. These results are in agreement with those obtained by Ali et al. (2007) who reported that adding natural antioxidant (thyme and anise) had no significant effect on carcass parameters. Peoa et al. (2008) reported that addition of ascorbic acid and citric flavonoids (quercitin and rutin) to the broiler diets did not affect carcass yield or meat quality parameters. Similarly, Radwan et al. (2008) reported that the percentage of the dressing, liver, heart, gizzard and spleen were not significantly affected by supplementing thyme or rosemary at 1.0% to the diets. Imik et al. (2010) reported that no significant effect on carcass composition produced by the addition of antioxidants (vitamin E, C, and lipoic acid) to the rations of quails under heat stress. Awad et al. (2013) reported that eviscerated carcass and total edible parts percentage were insignificantly improved by supplementing bee bread up to 1.5 g/kg during growing period.

Serum constituents and Blood parameters:

Results of Table (8) showed insignificant differences on all serum constituents except LDL cholesterol and ALT enzyme for Sinai hens due to feeding diets supplemented with varying BB levels. Serum total protein and albumin were insignificantly higher by 2.40 and 4.64 % for the group fed 1.0 g BB/kg diet, respectively as compared to those fed the control diet, whereas, A/G ratio was insignificantly higher by feeding different BB diets as compared to those fed the control and PC diets. Serum total cholesterol was insignificantly decreased by 10.57 and 9.09 % for the groups fed 0.5 and 1.0 g BB/kg diets, whereas, it was decreased by 8.04 and 6.52 % than those fed PC diet, respectively. Serum LDL cholesterol was significantly decreased by 18.83 and 17.94% for the groups fed diet supplemented with 1.0 and 1.5 g BB/kg , respectively as compared to the control. Hens fed BB diets had insignificantly lower LDL cholesterol than those fed PC diet. Serum HDL cholesterol was insignificantly increased by 10.71- 19.65% by feeding diets supplemented with different BB levels as compared with those fed the control diet. HDL cholesterol / total cholesterol and HDL/LDL cholesterol ratios were insignificantly higher by feeding diet supplemented with different BB levels, hens fed diet supplemented with 1.0 g BB/kg recorded the higher value of these ratios than other groups. Serum triglycerides was insignificantly lower by 20.45, 28.69 and 26.88 % for the groups fed 0.5 , 1.0 and 1.5 g BB/kg diets, respectively as compared to the control, whereas, it was insignificantly lower by feeding BB diets than those fed PC diet. Serum AST value for the groups fed 0.5 and 1.5 g BB/kg diet was higher, whereas, it was insignificantly lower for the group

fed 1.0 g BB/kg diet than those fed the control. Serum ALT value for the groups fed 0.5 and 1.5 g BB/kg diet was significantly lower by 17.52 and 19.31%, whereas, it was insignificantly lower by 12.26 % for the group fed 1.0 g BB/kg diet than those fed the control, respectively. Hens fed BB diets had no significant differ on AST and ALT enzymes with those fed PC diet.

Generally, cholesterol is primarily biosynthesized in the liver of laying hens and incorporated into vitellogenin and very low density lipoprotein particles, which are secreted into the bloodstream and subsequently taken up by growing oocytes through receptor-mediated endocytosis (Elkin, 2006). The decrease in triglycerides and cholesterol may be attributed to bee bread that play a major role as antioxidant material which increased glutathione enzyme activity or bee bread contains some components such as essential fatty acids which inhibit hepatic 3- hydroxy-3-methylglutaryl coenzyme A (HMG-CO A) reductase activity (Crowell, 1999) which is a key regulatory enzyme in cholesterol synthesis. These results are in agreement with those obtained by Zhao et al. (1990) who reported that pollen extract lowers blood lipid levels in both animals and humans. Case et al. (1995) found that feeding of thymol with a dietary concentration of 150 ppm to Leghorn chickens for 21 days reduced serum cholesterol by 9 % than the control. Čeksterytė et al. (2008) reported that the effects of plant pollen and honey on the antioxidative processes and immune system have shown a decrease of lipid peroxidation in the blood. Similarly, Kolankaya et al. (2002) found that HDL level increased and LDL , cholesterol and triglyceride levels were decreased by giving propolis with 200 mg/kg body weight/day in rats . Ali et al., (2007) found that addition of thyme to hen's diets significantly decreased plasma LDL, HDL, total cholesterol, triglyceride and total lipid. Radwan et al. (2008) reported that adding thyme or rosemary at 1.0% significantly decreased plasma total lipid, while total cholesterol and LDL- cholesterol were insignificantly decreased in comparison to the control. Ariana et al. (2011) reported that serum cholesterol, triglycerides and LDL cholesterol were significantly reduced by supplementing green tea extracts (antioxidant) to laying diet in comparison to control. On the other hand, El-Mallah et al. (2011) reported that plasma total protein, albumin and globulin were increased by adding an antioxidant (Vit. E) to diet. Awad et al.(2013) reported that supplementing bee bread to chickens diet resulted in increase serum HDL cholesterol and decrease total cholesterol, LDL cholesterol and triglycerides during growing period.

Results of Table (8) indicate that using different dietary BB levels during laying period of Sinai hens resulted in a significant effects on studied blood parameters . Blood hemoglobin was insignificantly higher by about 5.70 and 7.63 % for hens fed 0.5 and 1.0 g BB/kg, respectively than those fed control diet, whereas, the group fed 1.5 g BB/kg diet was insignificantly lower by 4.99 % . White blood cells count was significantly decreased by 16.43 % for hens fed diet supplemented with 0.5 g BB/kg, while, it was insignificantly decreased by 13.04 and 9.66 % for hens fed 1.5 g BB/kg and PC diet than those fed the control diet, respectively. In addition, the hens fed diet supplemented with 1.0 and 1.5 g BB/kg and PC were characterized by low heterophils and high lymphocyte percentages when compared with those fed the control diet. Hens fed diets supplemented with all BB levels had insignificantly high lymphocyte and low heterophils percentage comparing to PC group except those fed 0.5 g BB/kg diets. In hens fed BB and PC diets, the heterophils – to- lymphocyte ratio (H/L) was significantly lower than the control group. On the other hand, hens fed 1.0 and

1.5 g BB/kg diet had insignificantly lower heterophils – to- lymphocyte ratio as compared to hens fed the PC diet. These results may be due to bee bread offer indirect protection by activating endogenous defensive systems and by modulating different physiological processes (Brudzynski and Miotto , 2011). Also, this might be due to the effects on hemopoietic organs because it contains some vitamins such as vitamin E, vitamin B_{12}, pantothenic acid, folic acid and biotin , which are essential for normal growth of the haemopoietic organs and erythropoiesis. Mckee and Harrison (1995) reported that ascorbic acid supplementation (150 or 300 mg/kg) to broiler diets had positive effects on the reduction of plasma corticosterone levels and on the heterophil/lymphocyte ratio. Biswas et al. (2008) reported that supplementing antioxidants (vitamin E and Se) to diets gave best results in terms of physio-biochemical and hematological profiles of broilers chicken at high altitude. Čeksterytė et al. (2008) reported that feeding pollen and honey caused increase in lymphocyte count because it contains antioxidant materials which affected on antioxidative processes and immunity.

Nutrients digestibility:

Percentages of digestion coefficients of DM, OM, CP, EE, NFE, CF and ash retention as well as nutritive value (TDN and ME) are illustrated in Table (9). No significant effects were found on ash retention and all digestion coefficients except of CF due to supplementing BB to Sinai hens diets. DM, OM, CP, EE and NFE digestibility coefficient were insignificantly improved by feeding BB and PC diets than those fed the control diet, whereas, CF digestibility coefficient was significantly decreased by feeding the control diet as compared with those fed 1.0 , 1.5 g BB/kg diet and PC, whereas, it was insignificantly decreased than those fed 0.5 g BB/kg diet. TDN and ME kcal/kg values were insignificantly higher by feeding diets supplemented with BB levels as compared to the control. These results may be due to bee bread is rich in both enzymatic and non-enzymatic antioxidants, including glucose oxidase, catalase, ascorbic acid, flavonoids, phenolic acids, carotenoid derivatives, organic acids, maillard reaction products, amino acids and proteins (Aljadi and Kamaruddin, 2004 and Shalmany and Shivazad, 2006) and it is a valuable source of water-soluble vitamins and minerals, which affect feed metabolism and considerably exhibit antimicrobial and antifungal activity due to the phenolic compounds . A possible explanation for the improvement of CF digestibility and ash retention as follow, the fiber fraction holds nutrients which may be released during microbial fiber degradation, additionally, short-chain fatty acids, originating from microbial fiber fermentation, may promote nutrient absorption due to electrophysiological changes in the enterocytes, resulting in improved mineral absorption (Butzner et al., 1994) and reduced endogenous secretion of minerals (Krishnan et al., 1999).In this respect, Tatli Seven (2008) reported that supplementation with propolis (5 g/kg diet) was improved digestibility of dry matter, organic matter, crude protein and ether extract in laying hens. Safid Kan et al. (2006) reported that nutrients digestibility of diets were improved as a result of supplementing thyme and oregano (natural antioxidants) to the diet , which may be stimulate digestive enzymes such as amylase, protease and lipase. Radwan et al. (2008) reported that the addition of Vit. E (100 or 200 mg/Kg) or herbs (0.5 or 1.0%) to hen's diets numerically increased the nutrient digestibility coefficients.

Economical efficiency:

Calculations of economical efficiency were listed in Table (10). Economical efficiency (EEF) values of Sinai hens fed diets supplemented with bee

bread during the studied period were 0.290 , 0.476 , 0.391 and 0.411 for feeding 0 , 0.5 , 1.0 and 1.5 g BB/kg diets, respectively. Relative EEF values were improved by 64.14 , 34.94 and 41.89 % for the groups fed 0.5 , 1.0 and 1.5 g BB/kg diet, respectively as compared to the control group, whereas, it was improved by 3.03 % of hens fed 0.5 g BB/kg as compared to the PC group. Therefore, increasing BB levels in the diet seems to improve net return per hen compared to those of the control. This may be due to improving feed conversion ratio and egg number. These results are similar to that obtained by Angelovi et al. (2010) and Hashmi et al. (2012) who reported that average efficiency scores increase only when bee pollen used by 5 g / kg of feed mixture but it decreased with increasing the amount of bee pollen above (5 g kg) of feed mixture. Awad et al. (2013) reported that net return and economical efficiency were improved by supplementing bee bread as compared to those fed the control diet during growing period.

CONCLUSION

Bee bread could be used as a growth promoter and natural antioxidant in the hens diets up to 1.5 g BB/kg for improving laying performance , egg quality, hatchability traits and nutrients digestibility coefficients as well as economical efficiency of Sinai hens, without negative effects on hens viability .

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

Ingredients	%
Yellow corn	67.60
Soy bean meal (44 %)	23.25
Di-calcium phosphate	1.70
Limestone	6.70
Vit & Min. premix [1]	0.30
NaCl	0.35
DL- Methionine (99%)	0.10
Total	100
Calculated Analysis [2]	
Crude protein %	16.08
ME (Kcal / kg)	2750
Crude fiber %	3.11
Ca. %	3.00
Av. Phosph.%	0.43
Lysine (%)	0.80
Methionine (%)	0.36
Meth. + Cyst. (%)	0.63
Na %	0.16
Price , (LE/kg) [3]	2.823

1- Each 3kg of Vit .and Min. premix contains 100 million IUVit A;2 million IU Vit.D3;10 g Vit.E; 1 g Vit.K_3 ; 1 g Vit B1; 5 g Vit B2 ;10 mg Vit.B12 ; 1.5 g Vit B6; 30 g Niacin ;10 g Pantothenic acid ;1g Folic acid;50 mg Biotin ; 300 g Choline chloride; 50 g Zinc; 4 g Copper; 0.3 g Iodine ; 30 g Iron; 0.1 g Selenium; 60g Manganese ;0.1 g Cobalt; and carrier $CaCO_3$ to 3000 g .

2- According to NRC (1994).

3- Price of one kg (LE) at time of experiment for different ingredients : yellow corn ,2.50 ; Soy been meal, 3.80 ; Di-calcium,8.0 ; limestone, 0.10 ; Vit&Min.,20.0 ; Nacl,0.50 and Meth.,45.0.

Table (2): Effect of supplementing bee bread to laying diet on LBW and BWG of local Sinai hens.

Parameters	PC	Bee bread, g/kg			
		0.0	0.5	1.0	1.5
Initial LBW (g)	1332.6±10.5	1339.3±7.5	1333.3±9.4	1333.8±3.6	1340.9±6.3
Final LBW (g)	1789.3±14.6	1803.6±17.6	1822.6±13.4	1801.2±19.5	1792.4±49.1
BWG (g)	456.7±23.2	464.2±24.8	489.3±5.3	467.4±21.7	451.5±45.2
Viability, %	96.67±3.33	93.33±3.33	96.67±3.33	100.0±0.0	100.0±0.0

PC = positive control (250 mg ascorbic acid /kg diet)
LBW = live body weight , BWG = body weight gain
All parameters was not significant

Table (3): Effect of supplementing bee bread to laying diet on laying performance of local Sinai hens.

Age (wks)	PC	Bee bread, g/ kg				Sig.
		0.0	0.5	1.0	1.5	
Egg number per hen						
24-27	15.02±0.36	14.42±0.80	16.36±0.46	15.49±1.42	16.58±0.86	NS
28-31	22.04±1.10	20.33±1.00	22.67±0.64	20.18±1.02	20.16±0.90	NS
32-35	21.76±0.26 ^{a}	19.18±0.60 ^{b}	22.38±0.52 ^{a}	21.31±0.59 ^{a}	21.69±0.76 ^{a}	*
36-39	20.62±0.65 ^{a}	17.98±0.75 ^{b}	22.07±0.71 ^{a}	21.51±0.53 ^{a}	21.20±0.60 ^{a}	**
40-43	19.76±0.39 ^{a}	17.22±0.73 ^{b}	20.18±0.50 ^{a}	19.20±0.60 ^{a}	19.82±0.81 ^{a}	*
44-47	17.09±0.46	15.46±0.64	17.31±0.45	16.34±0.68	16.44±0.52	NS
24-47	116.29±1.63^{ab}	104.60±3.21^{c}	120.96±1.57^{a}	114.02±0.72^{b}	115.9±2.02 ^{ab}	**
Laying rate, %						
24-27	53.65±1.30	51.51±3.16	58.41±1.63	55.32±5.09	59.21±3.07	NS
28-31	78.73±3.92	72.62±3.57	80.95±2.27	72.06±3.65	71.98±1.99	NS
32-35	77.70±0.93 ^{a}	68.49±2.13 ^{b}	79.92±1.86 ^{a}	76.11±2.13 ^{a}	77.46±2.72 ^{a}	*
36-39	73.65±2.30 ^{a}	64.20±2.68 ^{b}	78.81±2.55 ^{a}	76.83±1.89 ^{a}	75.71±2.16 ^{a}	**
40-43	70.56±1.39 ^{a}	61.51±2.60 ^{b}	72.06±1.74 ^{a}	68.57±2.15 ^{a}	70.79±2.89 ^{a}	*
44-47	61.03±1.66	55.24±2.27	61.82±1.61	58.34±2.42	58.73±1.86	NS
24-47	69.22±0.97^{ab}	62.26±1.91 ^{c}	72.00±0.93 ^{a}	67.87±0.43 ^{b}	68.98±1.20^{ab}	**
Egg mass (g/ hen)						
24-27	567.8±15.1	558.3±35.0	626.7±20.6	618.9±66.4	641.5±33.6	NS
28-31	926.7±41.6	857.4±41.6	953.3±21.0	868.8±38.5	850.2±33.4	NS
32-35	993.1±17.1 ^{a}	878.0±30.7^{b}	1018.1±30.4^{a}	1001.7±20.8^{a}	1009.4±24.6^{a}	**
36-39	997.3±30.8 ^{a}	866.3±30.0^{b}	1072.9±44.9^{a}	1077.7±34.8^{a}	1043.0±60.2^{a}	**
40-43	994.7±22.0 ^{a}	874.8±33.0^{b}	1014.3±29.5^{a}	986.6±26.3^{a}	985.3±33.7^{a}	*
44-47	876.4±19.3	797.44±29.7	895.92±31.3	849.69±34.5	841.3±29.4	NS
24-47	5356.0±83.1^{a}	4832.4±96.6^{b}	5581.1±98.5^{a}	5403.3±84.9^{a}	5370.7±81.1^{a}	*

PC = positive control (250 mg ascorbic acid /kg diet) , Sig. = significance
NS= non significant, * = $P \leq 0.05$ and ** = $P \leq 0.01$
a,b :means in the same row bearing different superscripts are significantly different ($P \leq 0.05$).

Table (4): Effect of supplementing bee bread to laying diet on feed consumption and conversion of local Sinai hens.

Age (wks)	PC	Bee bread, g/ kg				Sig.
		0.0	0.5	1.0	1.5	
Feed consumption (g/ hen)						
24-27	2531.2±18.8	2531.3±12.5	2533.3±73.0	2575.0±12.5	2537.5±66.8	NS
28-31	3090.8±73.2	3269.2±73.8	3227.9±93.2	3103.6±48.6	3182.3±122.5	NS
32-35	3287.1±67.5	3248.9±41.9	3300.2±96.6	3355.5±48.6	3273.3±89.9	NS
36-39	3026.2±26.6	2749.1±61.9	3069.1±195.1	2984.0±149.2	2956.9±67.7	NS
40-43	3219.8±29.0	3371.9±117.9	3309.4±103.4	3387.5±86.42	3357.3±76.4	NS
44-47	3157.3±37.0	3175.0±81.4	3263.6±134.0	3135.6±43.9	3109.4±118.8	NS
24-47	18312.5±160.0	18345.3±122.7	18703.5±345.8	18541.2±272.7	18416.7±99.7	NS
Feed conversion ratio (g F./ g EM) :						
24-27	4.46±0.15	4.57±0.30	4.06±0.14	4.24±0.42	3.97±0.23	NS
28-31	3.34±0.09	3.84±0.27	3.39±0.15	3.59±0.19	3.76±0.28	NS
32-35	3.31±0.01ab	3.71±0.18a	3.25±0.17b	3.35±0.10ab	3.25±0.13b	*
36-39	3.04±0.07	3.18±0.14	2.87±0.20	2.77±0.13	2.84±0.08	NS
40-43	3.24±0.08 b	3.86±0.12a	3.27±0.17b	3.44±0.13b	3.41±0.12b	*
44-47	3.61±0.08	3.99±0.15	3.66±0.25	3.70±0.10	3.71±0.18	NS
24-47	3.42±0.02 b	3.80±0.11a	3.35±0.10b	3.43±0.05b	3.43±0.07b	**

PC = positive control (250 mg ascorbic acid /kg diet) , Sig. = significance
NS= non significant, * = $P \leq 0.05$ and ** = $P \leq 0.01$
a,b :means in the same row bearing different superscripts are significantly different ($P \leq 0.05$).

Table (5): Effect of supplementing bee bread to laying diet on egg quality parameters of local Sinai hens.

Parameters	PC	Bee bread, g/kg				Sig.
		0.0	0.5	1.0	1.5	
Egg Wt. (g)	49.24±0.77	49.68±0.53	48.23±0.41	49.63±0.53	47.83±0.63	NS
Shell Wt.,%	11.50±0.19	11.35±0.26	11.45±0.13	11.72±0.12	11.73±0.16	NS
Yolk Wt.,%	28.52±0.65	29.31±0.23	29.50±0.19	29.69±0.43	29.92±0.25	NS
Albumen wt.,%	59.97±0.54 ^{a}	59.34±0.40^{ab}	59.05±0.21^{ab}	58.59±0.28^{b}	58.35±0.49^{b}	*
Yolk index	46.44±0.78	46.22±0.70	45.66±0.41	46.33±0.75	46.33±0.67	NS
Shape index	81.72±0.43^{ab}	81.65±0.75^{ab}	82.82±0.37^{a}	81.82±0.64^{ab}	80.15±0.56^{b}	**
Shell thick.	0.33±0.01	0.31±0.01	0.32±0.01	0.32±0.01	0.32±0.01	NS
Hough unit	88.85±1.35	88.09±1.32	89.93±1.42	88.62±0.75	88.91±1.34	NS

PC = positive control (250 mg ascorbic acid /kg diet) , Sig.= significance
NS= non significant, * = $P \leq 0.05$ and ** = $P \leq 0.01$
a,b :means in the same row bearing different superscripts are significantly different ($P \leq 0.05$).

Table (6): Effect of supplementing bee bread to laying diet on fertility, hatchability and embryonic mortality percentages traits of local Sinai hens.

Parameters %	PC	Bee bread, g/kg				Sig.
		0.0	**0.5**	**1.0**	**1.5**	
Fertility	92.81±1.21^{b}	92.57±0.95^{b}	97.36±0.67^{a}	95.73±0.14^{a}	96.60±0.88^{a}	*
Hatch. of set eggs	84.39±2.59^{ab}	78.37±2.58^{b}	90.11±1.93^{a}	85.15±0.79^{ab}	85.83±4.98^{ab}	*
Hatch. of fertile eggs	90.96±2.46	84.63±2.16	92.58±2.47	88.95±0.94	88.81±4.68	NS
EEM	2.51±0.79	3.36±0.69	1.58±0.14	3.02±0.87	1.99±0.24	NS
LEM	6.53±1.0	12.01±2.12	5.84±2.57	8.03±1.73	9.80±3.99	NS
Total EM	9.04±2.46	15.37±2.16	7.42±2.48	11.05±1.06	11.79±4.21	NS
Chick Wt. (g) at hatch	34.50±0.27	35.73±0.95	36.17±0.86	35.98±0.95	36.01±0.79	NS

PC = positive control (250 mg ascorbic acid /kg diet). , Sig. = significance

EEM & LEM = early and late embryonic mortality

NS= non significant and * = $P \leq 0.05$

a,b : means in the same row bearing different superscripts are significantly different ($P \leq 0.05$).

Table (7): Effect of supplementing bee bread to laying diet on the relative weights (%) of carcass parts of local Sinai hens .

Parameters	PC	Bee bread, g/kg				Sig.
		0.0	0.5	1.0	1.5	
SBW (g)	1816.3±37.5	1830.7±27.7	1805.0±19.1	1875.0±92.4	1808.7±46.2	NS
%						
Eviscerated carcass	67.71±1.16	67.76±1.15	68.10±0.29	68.15±0.93	67.74±0.17	NS
Liver	2.44±0.14	2.33±0.24	2.14±0.14	2.24±0.16	2.46±0.12	NS
Gizzard	1.60±0.10 ^{a}	1.32±0.10^{b}	1.51±0.07^{ab}	1.45±0.03^{ab}	1.60±0.06^{a}	*
Heart	0.45±0.02 ^{b}	0.50±0.03^{b}	0.58±0.03^{a}	0.47±0.02^{b}	0.48±0.02^{b}	*
Total giblets	4.49±0.16	4.15±0.26	4.24±0.23	4.16±0.17	4.54±0.12	NS
Total ed. parts	72.20±1.31	71.91±0.89	72.34±0.49	72.31±1.06	72.28±0.09	NS
Abd. fat	2.11±0.24	2.76±0.21	2.59±0.30	2.50±0.14	2.21±0.13	NS

PC = positive control (250 mg ascorbic acid /kg diet) ; SBW= slaughter body weight

Sig. = significance, NS= non significant and * = P≤ 0.05

a,b : means in the same row bearing different superscripts are significantly different ($P \leq 0.05$).

Table (8): Effect of supplementing bee bread to laying diet on serum constituents and some blood parameters of local Sinai hens

Parameters	PC	Bee bread, g/kg				Sig.
		0.0	0.5	1.0	1.5	
Serum constituents						
Total protein (g/ dl)	5.95±0.57	5.83±0.33	5.70±0.01	5.97±0.33	5.63±0.33	NS
Albumin (g / dl)	2.86±0.12	2.80±0.17	2.77±0.03	2.93±0.13	2.80±0.12	NS
Globulin (g/ dl)	3.09±0.67	3.03±0.20	2.93±0.03	3.03±0.29	2.83±0.24	NS
A/G	0.93±0.12	0.92±0.03	0.95±0.02	0.97±0.06	0.99±0.04	NS
Total cholest. (mg/ dl)	153.33±8.81	157.67±8.17	141.00±6.66	143.33±0.51	166.67±14.53	NS
HDL cholest. (mg/ dl)	117.67±14.1	93.33±12.01	103.33±4.41	111.67±10.14	103.33±19.22	NS
LDL cholest. (mg/ dl)	161.0±5.0 ^{ab}	187.67±10.40^{a}	160.3±14.72^{ab}	152.33±5.48^{b}	154.00±1.73^{b}	*
HDL/T.chol.,%	76.40±5.87	59.26±7.66	73.51±3.81	77.79±6.37	61.04±6.35	NS
HDL/LDL, %	72.84±7.26	49.35±4.12	6543±6.18	73.70±7.93	67.20±12.64	NS
Triglycerides (mg/ dl)	486.67±41.0	586.67±63.52	466.67±59.49	418.33±33.20	429.00±36.70	NS
AST (U/ dl)	26.67±2.20	27.83±1.09	29.42±2.24	25.42±2.73	30.5±1.04	NS
ALT (U/ dl)	16.67±0.33 ^{ab}	19.00±0.99^{a}	15.67±0.33^{b}	16.67±0.88^{ab}	15.33±1.20^{b}	*
Blood parameters						
Hemoglobin (g/ dl)	14.33±0.67 ^{ab}	14.03±1.73^{ab}	14.83±1.86^{a}	15.10±0.67 ^{a}	13.33±0.33^{b}	*
White Blood Cell (x10^3/mm^3)	18.7±0.18 ^{ab}	20.7±0.07 ^{a}	17.3±0.07^{b}	20.7±0.07 ^{a}	18.0±0.12^{ab}	*
Heterophils (H), %	30.00±0.58 ^{b}	33.67±0.67 ^{a}	30.33±0.88 ^{b}	29.67±0.88 ^{b}	28.67±1.33 ^{b}	*
Lymphocyte (L), %	70.00±0.58 ^{b}	66.33±0.67 ^{a}	69.67±0.88 ^{b}	70.33±0.88 ^{b}	71.33±1.33 ^{b}	*
H/L	0.43±0.01 ^{b}	0.51±0.02 ^{a}	0.44±0.02 ^{b}	0.42±0.02 ^{b}	0.40±0.03 ^{b}	*

PC = positive control (250 mg ascorbic acid /kg diet) , Sig. = significance , NS= non significant and * = $P \leq 0.05$

a,b : means in the same row bearing different superscripts are significantly different ($P \leq 0.05$).

Table (9): Effect of supplementing bee bread to laying diet on digestibility coefficient of nutrients and nutritive value of Sinai hens.

Parameters	PC	Bee bread, g/kg				Sig.
		0.0	0.5	1.0	1.5	
Digestibility coefficient, %						
DM	70.21±2.43	68.53±1.88	69.99±1.78	72.09±2.98	70.79±0.79	NS
OM	72.11±2.02	71.37±1.51	72.14±1.91	72.78±2.19	74.99±1.14	NS
CP	93.80±1.00	92.81±0.87	93.92±0.34	94.73±0.79	94.68±0.30	NS
EE	86.97±2.08	84.52±0.93	85.13±0.79	84.93±1.43	88.91±1.18	NS
NFE	74.22±2.05	74.05±1.55	74.49±2.07	77.23±2.28	74.74±1.41	NS
CF	19.19±1.17^{ab}	12.89±1.09^{c}	15.97±2.18^{bc}	22.57±0.25 ^{a}	18.45±0.35^{b}	*
Ash ret.	58.07±5.08	50.34±4.36	56.22±1.38	58.04±9.34	53.57±1.52	NS
Nutritive value						
TDN, %	70.36±1.59	69.71±1.18	70.32±1.47	72.48±0.82	70.95±1.71	NS
ME(kcal/kg)	2944.5±66.6	2917.3±49.4	2943.0±61.8	3033.3±71.4	2969.1±34.4	NS

PC = positive control (250 mg ascorbic acid /kg diet) , Sig. = significance

TDN = total digestibility nutrients , ME = metabolizable energy

NS= non significant and * = $P \leq 0.05$

a,b,c :means in the same row bearing different superscripts are significantly different ($P \leq 0.05$).

Table (10): Effect of supplementing bee bread to laying diet on feeding economical efficiency of local Sinai hens during 24 – 47 wks of ages.

Items	PC	Bee bread , g/kg			
		0.0	0.5	1.0	1.5
Total layer diet consumed (kg)	18.313	18.345	18.704	18.541	18.417
Total feed consumed cost (LE) [1]	51.70	51.79	52.80	52.34	51.99
Total bee bread cost (LE) [2]	0.00	0.00	0.47	0.93	1.38
Total Vit C cost (LE) [2]	0.92	0.00	0.00	0.00	0.00
Total cost (LE)	51.70	52.71	53.27	53.27	53.37
Egg number per hen	116.29	104.6	120.96	114.02	115.89
Price of one egg (LE)	0.65	0.65	0.65	0.65	0.65
Total return (LE)	75.59	67.99	78.62	74.11	75.33
Net return (LE)	23.89	15.28	25.35	20.84	21.96
EEF [3]	0.462	0.290	0.476	0.391	0.411
Relative EEF %[4]	159.39	100.00	164.14	134.94	141.89

PC = positive control (250 mg ascorbic acid /kg diet) ; L.E = Egyptian pound

1- According to price at the experimental time.
2- local price of one kg of bee bread = 50 LE and 100 g of vitamin C 100% = 20 LE at the experimental time.
3- EEF = economic efficiency = (Net return LE / Total feed cost LE).
4- Relative EEF = assuming EEF of the control equals 100%

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الملخص العربي

تأثير إستخدام خبز النحل كإضافة طبيعية على الأداء الانتاجى والفسيولوجي لدجاج السينا المحلى

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أجرى هذا البحث لدراسة تأثير إضافة مستويات متدرجة (صفر ، ٠,٥ ، ١,٠ ، ١,٥ جم / كجم عليقه) من خبز النحل و ٢٥٠ ملجم فيتامين جـ / كجم (مجموعة مقارنة موجبه) إلى علائق دجاج السينا المحلى خلال فترة إنتاج البيض على مظاهر إنتاج البيض وصفات الجودة والتفريخ للبيض الناتج وبعض ومكونات السيرم وصفات الدم وصفات الذبيحة ومعاملات هضم العناصر الغذائية بالإضافة الى الكفاءة الاقتصادية. حيث تم استخدام عدد ١٥٠ طائر سينا (١٥ ديك +١٣٥ دجاجة) عمر أربعة وعشرون أسبوع قسمت إلى خمسة مجاميع تجريبية بكل منها ٣٠ طائر في ثلاث مكررات متساوية . استخدمت في الدراسة العليقة البياض حيث قسمت إلى خمسة أجزاء ليضاف إليها المستويات المختلفة من خبز النحل ومستوى فيتامين جـ للمقارنة الموجبة وتم تقديمها للمجموعات التجريبية الخمسة خلال فترة إنتاج البيض (٢٤-٤٧ أسبوع). تم وزن الطيور فى بداية ونهاية التجربة وتم تسجيل استهلاك العليقة وعدد النافق وعدد وكتلة البيض التاتج، وتم حساب الزيادة في وزن الجسم وكذلك معدل التحويل الغذائي لإنتاج البيض لكل فترة ، تم إجراء اختبار جودة للبيض الناتج وتم إجراء تجربة تفريخ لتقدير نسبتي الخصوبة والفقس للبيض الناتج، و تم أخذ عينات دم لتقدير بعض صفاته ، تم إجراء تجربة ذبح لتقدير بعض قياسات الذبيحة وتم أخذ عينات سيرم للدم لتقدير محتواه من البروتين الكلى والجلسريدات الثلاثية والكولسترول الكلى وHDL, LDL وعند نهاية التجربة تم اجراء تجربة هضم لتقدير معاملات هضم العناصر الغذائية وتم حساب الكفاءة الاقتصادية خلال فترة التجربة (٢٤-٤٧ أسبوع) .

وتوضح النتائج ما يلي :

سجلت معدلات الزيادة فى الأوزان الحية للطيور التى تغذت على العلائق المضاف لها خبز النحل قيما متشابهة مع تلك التى تغذت على عليقتى المقارنة والمقارنة الموجبة بينما تحسنت نسبة الحيوية لهذه الطيور خلال فترة التجربة (٢٤-٤٧ أسبوع من العمر) . تحسن عدد وكتلة البيض لكل دجاجة معنويا بالتغذية على العلائق المضاف لها خبز النحل مقارنة بعليقة المقارنة خلال الفترة الكلية للتجربة (٢٤-٤٧ أسبوع من العمر) بينما كان التحسن غير معنوى بالمقارنة مع تلك التى تغذت على عليقة المقارنة الموجبه. كمية العليقة المأكولة لكل طائر ارتفعت ولكن بدون معنوية بالتغذية على العلائق المضاف لها خبز النحل مقارنة بعليقتى المقارنة والمقارنه الموجبة خلال الفترة الكلية للتجربة ، كما تحسن معدل التحويل الغذائي لإنتاج البيض معنويا لطيور المعاملات التي تغذت على العلائق المضاف لها خبز النحل مقارنة بعليقة المقارنة بينما كانت متشابهة تقريبا مع تلك التى تغذت على عليقة المقارنة الموجبه.

كل مقاييس جودة البيض المدروسة لم تتأثر معنويا بالتغذية على العلائق المضاف لها خبز النحل مقارنة بعليقة المقارنة .تحسنت نسبة الخصوبة معنويا للبيض الناتج من الطيور التى تغذت على علائق خبز النحل مقارنة بعليقتى المقارنة والمقارنة الموجبة كما تحسنت معنويا نسبة الفقس للبيض الكلى الموضوع للطيور التي تغذت على ٠,٥ جم خبز النحل / كجم مقارنة بعليقة المقارنة . انخفاض غير معنوي فى نسب النفوق الجنينى أثناء التفريخ للبيض الناتج من الطيور التى تغذت على علائق خبز النحل بالمقارنة بالكنترول . حدث تحسن غير معنوي للوزن النسبي للذبيحة المجوفة والأجزاء المأكولة للطيور التي تغذت على العليقة المضاف لها ٠,٥ و ١,٠ جم / كجم مقارنة بعليقة المقارنة .

لم تتأثر كل محتويات السيرم المدروسة باضافة خبز النحل للعليقة فيما عدا الكولسترول منخفض الكثافة وانزيم ALT حيث حدث انخفاض معنوى لمحتوى السيرم من الكولسترول منخفض الكثافة للمعاملات التي تغذت على العلائق المضاف ١,٠ و ١,٥ جم خبز النحل/كجم بينما حدث انخفاض معنوى لانزيم ALT للطيور التي تغذت على العلائق المضاف لها ٠,٥ ، ١,٥ جم خبز النحل / كجم مقارنة بعليقة المقارنة . كما انخفض عدد كرات الدم البيضاء معنويا في دم للطيور التي تغذت على العلائق المضاف لها ٠,٥ جم خبز النحل/كجم عليقة مقارنة بعليقة المقارنة ، كما انخفضت نسبة كرات الدم المتعادلة وكذلك نسبة كرات الدم المتعادلة الى الليمفاوية فى دم الطيور التى تغذت على العلائق المضاف لها خبز النحل وعليقة المقارنة الموجبة مقارنة بعليقة المقارنة . حدث تحسن غير معنوى فى القيمة الغذائية ومعاملات هضم كل العناصر الغذائية للطيور التى تغذت على العلائق المضاف لها خبز النحل فيما عدا معامل هضم الالياف الخام حيث كان التحسن معنويا للطيور التي تغذت على العلائق المضاف لها ١,٠ و ١,٥ جم خبز النحل /كجم عليقة مقارنة بعليقة المقارنة . تحسنت الكفاءة الاقتصادية للتغذية وصافى العائد لطيور المعاملات التي تغذت على العلائق المضاف لها خبز النحل مقارنة بعليقة المقارنة خلال فترة التجربة (٢٤-٤٧ أسبوع).

وقد خلصت الدراسة إلى إمكانية اضافة خبز النحل لعلائق الدجاج المحلي كمنشط نمو وإضافة طبيعية بمستوى يصل حتى ١,٥ جم / كجم لتحسين أداء انتاج البيض و صفات الجودة والتفريخ له والقيمة الغذائية للعليقة ومعاملات هضم العناصر الغذائية فضلا عن الكفاءة الاقتصادية دون أي تأثير ضار على الحيوية .