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PHYSIOLOGICAL RESPONSES AND PRODUCTIVE PERFORMANCE OF LAYING HENS FED OLIVE CAKE UNDER SOUTH SINAI CONDITIONS

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ABSTRACT: The present study was conducted to investigate the effects of dietary different levels of olive cake (OC) on laying hens' performance and some blood constituents under Egyptian desert conditions. A total number of 150 Mamora laying hens (22 weeks old and body weight of 1461.20 ± 30.74 g) were used until 34 week of age. One hundred and fifty hens were randomly distributed into five equal treatments (30 hens of each) and randomly distributed into three equal replicates (10 hens each). The 1st treatment was fed a basal diet as a control (0 % OC), while, the 2nd, 3rd, 4th and 5th treatments were fed diets containing 4, 8, 12 and 16 % OC, respectively.

The results showed that hens fed 12 and 16 % OC recorded an increase ($P<0.05$) in egg weight by 4.9 and 2.9 %, respectively, while, shell thickness was decreased ($P<0.05$) in 8, 12 and 16 % OC as compared to control group. However, egg number was decreased ($P<0.05$) in 12 and 16 % OC as compared to those fed based diet.

Hens fed 16 % OC showed a significantly decreases in the count of red blood cells, hemoglobin and albumin concentrations as compared to other treatments. While, diets containing 4, 8, 12 and 16 % OC significantly reduced the levels of cholesterol and triglycerides concentrations compared to the control group. Hens fed 16 % OC showed significantly increased in aspartic transaminase concentration as compared to other treatments, while, total antioxidant capacity was decreased ($P<0.05$) in the hens fed 16 % OC as compared to the hens fed 4 % OC and control group.

Conclusively**,** olive cake could be successively and safely included up to 12 % in laying hens diets without adversely effect on productive performance and blood constituents under Egyptian desert conditions.

Key words:laying hens,Olive cake(OC), productive performance and physiological responses.

INTRODUCTION

Twenty six million ton of Agro-industrial by-products are available in Egypt (El Shaer, 2004), some of such Agro-industrial by-products are characterized by high nutritive value (Youssef et al., 2006). So, these materials can be used as supplementary feed ingredients in animal rations (Mohamed and El-Saidy, 2003).

The major single cost in any system of poultry production is feed, accounting for up to 70% of total production cost. In order to reduce feeding costs, efforts have been made to use agricultural and industrial by-products as feed ingredients. Feeding agricultural by-products to livestock advantages by less dependency of livestock on grains that can be consumed by humans and the reduction of costs related to waste management. Mediterranean countries represent 65% of the world's surface area cultivated in olives (Molina-Alcaide and Yáñez-Ruiz, 2008). Many technologies used for plant oil manufacturing are very different, so that a wide range of by-products are obtained (olive cake, olive leave, olive molasses and olive pulp (Amici et al., 1991).

The olive oil industry generates large amounts of by-products that are harmful to the environment. According to the Food and Agriculture Organization of the United Nations (FAO, 2006), 2.7 milions tones of olive oil are produced annually worldwide, 76% of which are produced in Europe, with Spain (35.2%), Italy (23.1%) and Greece (16.1%) being the highest olive oil producers other olive oil producers are Africa (12.5%), Asia (10.5%) and America (0.9%). After the removal of the seed fractions, Olive pulp (OP) is the raw material resulting from extraction of olive oil. It can be achieved by sieving the dry olive cake to separate most of the seeds. About 0.3 of cell wall fraction will be removed by sieving (Abo Omar J., 2000).

Olive cake is considered as a good source of calcium, copper and cobalt but poor in phosphorus, magnesium and sodium and with fair levels of manganese and zinc (Harb, 1986). Rabayaa et al. (2001) reported that olive pulp tended to have low levels of lysine, methionine and histidine. So, olive cake is seldom integrated into poultry feeding due to low nutritive value (low in energy, digestible proteins and minerals and high in lignin), in addition, presence of xyloglucan (non-starch polysaccharides) on olive pulp cell walls which has anti-nutritive effects on poultry (Gil-Serrano and Tejero-Mateo,1988 and Coimbra et al., 1995). Olive cake a by-product of olive oil industry- contains a high content of residual unextracted olive oil (rich of oleic, linoleic and linolenic fatty acids) along with high content of crude fiber (300-400g/kg, Francisco et al., 1989).

The utilization of olive by-products as animal feed is a good way of recycling these waste products. But there is a need to formulate optimized rations for different animal uses to avoid metabolic disorders caused by the unbalanced rations of energy and protein and to limit the tasty factors which might reduce feed intake and then the animal performance that leads to low profitability. Indeed, the olive mill waste could be of particular interest in chickens for its level of residual oil (6.8%), this can form an integral energy source and for its particular composition of unsaturated fatty acids (62.4% of oleic acid, 18.2% of linoleic acid, 1.1% of linolenic acid and 2.7% of palmitoleic acid) which could influence the accumulation of fatty acid in the various body compartments during the animal's life and as such could have a certain impact on the positive animals performance and meat quality (El hachemi et al., 2007). Abo Omar (2005); Abo Omar (2000) and Rabayaa et al. (2001) reported that utilization of OP in broiler diets (50 and 100g/ kg) had no significant effects on visceral organ mass, gastrointestinal tract weight, carcass cuts, carcass composition and dressing percent; however, chicks consuming 100 g OP/kg increased in average live body weights. Samira and Torki (2011) reported that including OP in diets of laying hens up to 9% did not have deleterious effects on bird's productive performance.

Dietary inclusion of OP would have beneficial effect on laying hens' performance in terms of egg weight, yolk index and blood level of triglycerides (Zarei et al., 2011). Meysam et al. (2014) found that OP can be included in laying hens diets up to 16% with no adverse effect on productive performance.

A very high percentage of raw fiber (27–41%), tannin and phenol have unfavorable effects on its nutritive value. In Egypt, a scarce research has been carried out to date on the use of olive cake in the physiological and productive performance of laying hens. Therefore, this study was conducted to investigate the effects of dietary different levels of OC as an olive by-product on laying hens' performance and some blood constituents under Egyptian desert conditions.

MATERIALS AND METHODS

The present experiment was accomplished in South Sinai experimental research station (Ras-Suder city) which belongs to the Desert Research Center, Egypt. The experiment started in June to September 2012. The experiment aimed to study the effect of feeding olive cake on the productive and some blood constituents of Mamora laying hens.

Olive cake was collected from local olive processing factory during summer 2012 at Ras- Suder city then transported to experimental research station (Ras-Suder city). Crude olive cake: The residue of the first extraction of oil from the whole olive by pressure. The chemical analysis of the tested by product was as follows: 91.5 % DM, 7.02 % CP, 40.27 % CF, 10.07 % EE, 13.63 % Ash, 29.01 % NFE and 86.37 % OM.

A total number of 150 Mamora laying hens (22 weeks old and body weight of 1461.20 ± 30.74 g) were used until 34 week of age. Hens were randomly distributed into five equal treatments (30 hens of each) and randomly distributed into three equal replicates (10 hens each). The first treatment was fed a basal diet as a control (0 % of olive cake), while, the 2nd, 3rd, 4th and 5th treatments were fed diets containing 4, 8, 12 and 16 % olive cake, respectively. The experimental diets (Table 1) were formulated in granular form according to NRC (1994). Experimental hens were housed from the start to end experiment in wire cages of triple deck batteries.

All treatments during production period were reared under hot month's condition (average maximum indoor ambient temperature, relative humidity and temperature-humidity index were 36.7 ^{o}C, 25.5 % and 31.4, respectively). The temperature-humidity index values were divided to, absence of heat stress (<27.8), moderate heat stress (27.8-28.8), severe heat stress (28.9-29.9) and very severe heat stress (>30.0) according to Marai et al. (2001).

Birds were exposed to 15 h at 22 weeks of age (natural day- light and provided with artificial light to increase the day light length until reaching to 15 h). Then, the day light length period was increased 30 minutes every other week until fixed at 16 h daily from 22 weeks of age to the end of experiment (34 weeks). Birds were rearing under the same hygienic and managerial conditions. Birds were vaccinated against diseases and treated with antibiotics and drugs to keep them healthy.

Individual body weight was recorded at the beginning of experiment (22 weeks) and at the end of experiment (34 weeks). Body weight changes were calculated as the differences between the final and initial body weights. Egg number and weight were recorded daily for ninety days during experimental period. Egg mass was calculated as follows: egg mass= average egg number * egg weight. Daily feed intake was recorded and feed conversion was calculated by dividing feed intake (g) on egg mass (g).

Blood samples (5 ml) were randomly withdrawn from10 birds/treatment (two times during the experimental periods at 28 and 34 weeks of age) into tube containing EDTA to examine immediately red blood cells counted in blood under the microscope by means of hemocytometer and record hemoglobin concentration according to Jaime (2000). Hematocrite (%) estimated using micro-hematocrit tubes by win-trobe methods. Serum was separated by using centrifugation for 15 minutes at 3000 rpm and then it collected and stored at –20 $^{\circ}$C until analysis. Blood metabolites (albumin, total protein, triglycerides, cholesterol, total antioxidant capacity, alanine transaminase and aspartic transaminase) were determined calorimetrically by using commercial kits. Globulin was calculated by subtracting albumin from total protein.

Concentrations of tri-iodothronine, progesterone and estradiol-17β hormones were determined by ELISA method using commercial kits of company of Monobind Inc. Lake Forest, CA 92630 USA and IBL international GMBH, Flughafenstrasse 52a, D-22335 Hamburg, Germany, respectively.

Statistical analysis was carried out using General Linear Model (GLM) procedures by SAS (2004) using simple one-way analysis of variance according to this model: $Y_{ij} = \mu + T_i + e_{ij}$

Where: Y_{ij} = Any observation of i^{th} bird within j^{th} treatment, μ = Overall mean, T_i = Effect of i^{th} treatment (i: 1-5), e_{ij} = Experimental error.

Significant differences among treatment means were tested using Duncan multiple range test (Duncan, 1955).

RESULTS AND DISSCUSION

1. Productive performance:

Final body weight and body weight change showed insignificant increase in the hens fed different levels of olive cake (OC) than that of the control diet (Table 2).

Hens fed 12 and 16 % OC recorded an increase (P<0.05) in egg weight (EW) and by 4.93 and 2.95 %, respectively than that of control diet (Table 2). However, egg number (EN) was decreased (P<0.05) in the hens fed 12 and 16 % OC by 4.41 and 8.51 %, respectively as compared to the hens fed basal diet. OC contains residual un-extracted oil that contains high concentration of polyunsaturated fatty acids, mainly linoleic acid (Mehrez and Mousa, 2011). Linoleic acid of OC might increase shell weight. It may be a result of increasing EW due to OC feeding.

No significant differences among 0, 4 and 8 % treatments in the EW and EN. It is clear that substitution of diet by 16 % OC level tend to get smallest of egg number and egg mass. EM was insignificantly decreased in the hens fed 16 % OC by 5.80 % as compared to control diet.

It is clear that substitution of diet by different levels of OC tend to significantly increased in feed intake. Taklimi et al. (1999) reported that OC at 15% and 20% increased crude fiber concentration and resulted in higher FI, either to meet energy requirements or because OC was more palatable.

Substitution of diet by 16 % OC level tends to delayed feed conversion (FC) by 9.57 % as compared to the based diet containing 0 % OC. This delayed may be attributed to its lowest egg mass as compared to that of experimental diets. No significant differences among control, 4, 8 and 12 % OC treatments in the FC. The efficiency of feed conversion was statistically approximately the same in all treatments except the hens fed 16 % OC. However, the difference between the highest (hens fed 16 % OC) and the lowest conversion (control group) efficiency value is 0.36. The values of feed conversion indicated that olive cake can be added to hen diets to levels up to 12 % without any negative effect on feed conversion efficiencies. El-Kerdawy (1997) found that no significant differences when fed rabbits on 5, 10 and 15% olive cake in weight gain and live body weight, feed conversion and feed consumption compared to control diets. The findings were agreement with those obtained by Mousa and Abd El-Samee (2002) who found no significant differences observed when fed rabbits on diets containing 0, 10 and 20% olive cake in final and daily body weight gain and feed efficiency. Also, Rabayaa et al. (2001) reported that weight gain decreased in chicks fed the level of 10% olive cake than the chicks fed the level of 7.5% of olive cake. Similar trends were observed with chicks for feed intake and feed conversion efficiency. On the other hand, Abd El-Galil (2001) found that body weight gain of growing rabbits decreased by increasing olive pulp meal level more than 10% during the starter period (5-9 weeks of age) and 15% during the finisher period (9-13 weeks of age periods).

It is worth noting that shell thickness was decreased ($P<0.05$) in 8, 12 and 16 % OC by 7.97, 5.83 and 10.50 %, respectively as compared to control group (Table 2).

2. Hematological parameters

Hens fed 16 % OC showed a significantly decreases in the count of red blood cells (by 14.3, 18.5, 16.7 and 18.2 %) and hemoglobin (by 14.4, 17.6, 21.8 and 26.0 %) concentrations as compared to the hens fed 12, 8, 4 and 0 % OC, respectively (Table 3). However, no significant differences were observed between the diets containing 0, 4, 8 and 12 % OC in the count of RBC and Hb concentration.

No significant differences between treatments in the Ht %. Blood serves as an indicator of the health status of birds and it is normal to assess the cause of an abnormality or malfunctioning of a bird by examining its blood (Olurotim, 2011). The lower RBC count and Hb level for hens fed a 16 % OC might be attributed to the more presence of anti-nutritional factors in OC particularly phenols and condensed tannins, that have been reported to have an antinutritional action (Robins and Brooker, 2005 and Rubanza et al., 2005).

3. Biochemical parameters

Effects of dietary treatments on serum biochemical parameters are shown in Table (4). Hens fed 16 % OC recorded a decrease ($P<0.05$) in albumin concentration (Alb) by 27.8, 34.2, 30.6 and 36.8 % as compared to 12, 8, 4 % OC and control diets, respectively.

However, no significant differences between all diets in total protein (TP), globulin (Glo), albumin globulin ratio (A/G ratio). Feeding OC insignificantly decreased serum total protein; though, the values were within the normal physiological ranges (Coles, 1986). These results might be due to the lower degradability of protein in olive by-products (Theriez and Boule, 1970; Molina-Alcaide and Yanez-Ruiz, 2008). This results agree with the results of Tortuero et al. (1989); Ben Rayana et al. (1994); El-Kerdawy (1997); Abd El-Naby (1998); Abd El-Galil (2001); Abdel-Ghaffar (2002) and Mousa and Abd El-Samee (2002). On the other hand, the lower total protein, albumin and A/G ratio of hens fed 16 % OC is an indication of the relatively poor protein quality of the OC and hence, the level and availability of the dietary protein (Mehrez and Mousa, 2011).

These data show that diets containing 4, 8, 12 and 16 % OC significantly reduced the levels of cholesterol (by 48.3, 53.53, 50.9 and 52.0 %, respectively) and TG (by 15.7, 12.2, 8.7 and 8.8 %, respectively) concentrations in laying hen serum compared to the control group (Table 4). These results agree with the results of El-Husseiny et al. (1997) and Laila and Samia (2007). Taneja and Rakha (2005) suggested that it is not the low cholesterol content alone but also omega-3 fatty acids present in smart eggs that act synergically to prevent a substantial change in blood lipid profile and impose no serious risk to the health of the consumers. Also, decreases in blood cholesterol levels were reported for chicks fed pectin in their diets (Griminger and Fisher, 1967) and hens fed a standard layer diet with added 15% cellulose (Menge et al., 1974).

Dietary fiber has been implicated in recent years as causing a reduction in serum and body cholesterol which referred to a natural hypocholesteremic agent (Hassan, Mona et al., 2013). The mechanism of egg cholesterol reduction is thought to be through the lowering of plasma concentrations of LDL (James and McNaughton, 2012). During digestion in the intestine, cholesterol is the main component of bile acids secreted. The fiber coats the bile acids in the intestine and is excreted in the body, subsequently causing the body to draw cholesterol from the blood to form bile acids, and thus lowering blood cholesterol level (Yukio and Tatsuro, 2011).

Inclusion of OC in laying hen diets may be useful effects on decreasing plasma cholesterol and triglycerides which is associated with production of better quality eggs characterized with great decreases in yolk concentrations of total lipids, cholesterol, LDL, triglycerides and phospholipids with a decrease in the concentration of saturated fatty acids in yolk lipids associated with great increases in concentrations of monounsaturated (n-9) and polyunsaturated (n-6 & n-3) fatty acids resulting in decreasing the ratio of n-6 : n-3 fatty acids in egg yolk lipids (Laila and Samia, 2007).

The significantly increase in AST and insignificantly increase in ALT concentrations of hens fed 16 % OC may reflect malfunction of the liver, which was supported by the serum albumin decrease (Mehrez and Mousa, 2011). However, no significant differences between 0, 4, 8 and 12 % OC groups in AST. Also, this increased may be due to the direct effect of tannins on the liver function. The liver and kidney suffer serious damage from feeding tannins. Tannins cause liver polyribosome disaggregation, inhibition of microsomal enzymes, inhibition of protein and nucleic acid synthesis, fibrosis, coagulation and necrosis in the liver cells (Singleton, 1981).

On the other hand, total antioxidant capacity (TAC) was decreased ($P<0.05$) in the hens fed 16 % OC by 14.2 and 17.2 %, respectively as compared to the hens fed 4 % OC and based diet (control), respectively. The lowest TAC indicates of decreased antioxidant status in the hens fed 16 % OC. So, increase tannins concentration in the hens fed 16 % OC may be caused a low antioxidant status has been regarded as one of the major factors negatively affecting bird's performance (Zhao et al., 2011 and Abd El-Galil et al., 2014).

4. Blood hormones

There were no significant differences between the treatments in the values of triiodothyronine (T_3), estradiol (E_2) and progesterone (P_4) hormones (Table 5). However, T_3, E_2 and P_4 hormones were decreased in the hens fed 16 % OC by 5.9, 5.5 and 37.7 %, respectively as compared with control group.

CONCLUSIVELY,

olive cake could be successively and safely included up to 12 % in laying hens diets without adversely affecting productive performance and blood constituents under Egyptian desert conditions.

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Table (1):Composition and calculated analysis of the experimental diets

Ingredients (%)	**0 %**	**4 %**	**8 %**	**12 %**	**16 %**
Olive cake (OC)	0.00	4.00	8.00	12.00	16.00
Yellow corn	62.00	59.80	58.30	56.20	52.90
Soybean meal (44 % CP)	14.65	14.38	18.20	18.20	16.50
Corn gluten meal (60 % CP)	5.00	5.35	3.30	3.50	4.60
Wheat bran	8.25	6.37	2.10	0.00	0.00
Limestone ground	7.80	7.80	7.80	7.80	7.70
Dicalcium phosphate	1.70	1.70	1.70	1.70	1.70
Vit. and min. premix*	0.30	0.30	0.30	0.30	0.30
Salt	0.30	0.30	0.30	0.30	0.30
Total	100	100	100	100	100
Calculated values**					
Crude protein	15.56	15.50	15.43	15.36	15.32
Crude fiber	3.50	4.85	6.19	7.53	8.96
Ether extract	3.01	3.27	3.46	3.70	3.97
Metabolizable energy (kcal/kg)	2700	2700	2700	2700	2700
Calcium (%)	3.49	3.46	3.47	3.48	3.51
Available phosphorus (%)	0.46	0.44	0.43	0.43	0.48
Methionine (%)	0.32	0.32	0.30	0.29	0.29
Lysine (%)	0.71	0.71	0.78	0.71	0.72
Methionine+ Cyc (%)	0.60	0.59	0.55	0.54	0.53

* Each 3 kg Vitamins and minerals premix contains (per ton of feed), Vit. A 10000000 IU, Vit. D_3 2000000 IU, Vit.E I0g, Vit.K_3 1000 mg, Vit. B_1 1000 mg, Vit. B_2 5000mg, Vit. B_6 1.5g, Vit. B_{12} 10 mg, Pantothenic acid 10 g, Niacin 30 g, Folic acid 1g, Biotin 50 mg, Iron 30g, Manganese 70g, Choline chlorite 10g, Iodine 300 mg, Copper 4 g, Zinc 50 g and Selenium 100 mg.
** According to NRC (1994)

Table (2): Effect of feeding different levels of olive cake (OC) on the productive performance and egg shell thickness of Mamora laying hens.

Traits	**Levels of OP (%)**				
	Control	**4**	**8**	**12**	**16**
IBW(g)	1462.01±26.58	1457.56±34.09	1463.01±32.82	1462.20±35.05	1461.21±25.18
FBW(g)	1602.43±24.59	1649.51±46.88	1641.98±40.01	1666.01±37.92	1638.54±40.11
BWC(g)	140.42±22.29	191.95±31.23	178.97±29.04	203.81±33.77	177.33±28.02
EW (g)	49.49^{c}±0.29	49.88^{c}±0.34	49.70^{c}±0.36	51.93^{a}±0.31	50.95^{b}±0.24
EN	0.634^{a}±0.07	0.625^{ab}±0.14	0.618^{ab}±0.05	0.606^{bc}±0.03	0.580^{c}±0.05
DFI (g)	118.11^{b}±0.51	121.37^{a}±0.64	122.29^{a}±0.63	122.36^{a}±0.57	121.63^{a}±0.49
EM	31.37±0.39	31.17±0.74	30.71±0.44	31.46±0.25	29.55±0.22
FC	3.76^{b}±0.05	3.89^{b}±0.10	3.98^{b}±0.06	3.88^{b}±0.03	4.12^{a}±0.02
ST(mm)	0.514^{a}±0.01	0.508^{ab}±0.01	0.473^{c}±0.01	0.484^{bc}±0.01	0.460^{c}±0.02

IBW=initial body weight; FBW=final body weight; BWC=body weight changes; EW=egg weight (g); EN=egg number (egg/hen/day); DFI=daily feed intake; EM=egg mass (g egg/hen/day); FC=feed conversion; ST=shell thickness.
a, b, c Means with different superscript among columns are significant differences (P<0.05).

Table (3): Effect of feeding different levels of olive cake (OC) on the hematological parameters of Mamora laying hens.

Traits	Levels of OC (%)				
	Control (0)	4	8	12	16
RBC (×10⁶)	$5.10^{a}\pm0.14$	$5.01^{a}\pm0.19$	$5.12^{a}\pm0.52$	$4.87^{a}\pm0.13$	$4.17^{b}\pm0.05$
Hb (g/dl)	$13.50^{a}\pm0.26$	$12.77^{a}\pm0.86$	$12.12^{a}\pm0.64$	$11.66^{a}\pm0.66$	$9.98^{b}\pm0.38$
Ht (%)	34.91±1.21	34.00±0.64	33.16±1.26	34.25±0.87	34.41±0.96

RBC's, red blood cells; Hb, hemoglobin; Ht, hematocrite %.
a, b, c. Means with different superscript among columns are significant differences (P<0.05).

Table (4): Effect of feeding different levels of olive cake (OC) on the biochemical parameters of Mamora laying hens.

Traits	Levels of OC (%)				
	Control	4	8	12	16
TP (g/dl)	7.49±0.41	7.25±0.27	6.67±0.35	6.49±0.27	6.52±0.52
Alb(g/dl)	$4.81^{a}\pm0.27$	$4.38^{a}\pm0.21$	$4.62^{a}\pm0.21$	$4.21^{a}\pm0.31$	$3.04^{b}\pm0.36$
Glo(g/dl)	2.68±0.49	2.87±0.33	2.05±0.38	2.28±0.36	3.48±0.51
A/GRatio	1.79±1.54	1.52±0.48	2.25±0.14	1.84±0.86	0.87±0.05
Cho(mg/dl)	$178.08^{a}\pm11.47$	$148.36^{b}\pm12.65$	$153.53^{b}\pm12.84$	$150.98^{b}\pm13.51$	$152.07^{b}\pm10.14$
TG (mg/dl)	$605.30^{a}\pm18.49$	$509.76^{b}\pm19.16$	$530.98^{b}\pm20.52$	$552.48^{b}\pm21.98$	$551.78^{b}\pm19.90$
ALT(I.U./L)	23.28±1.45	23.47±3.30	20.95±2.51	27.32±8.67	37.32±8.76
AST(I.U./L)	$49.86^{b}\pm1.42$	$46.56^{b}\pm6.22$	$51.50^{b}\pm5.66$	$56.60^{b}\pm5.52$	$76.60^{a}\pm5.52$
TAC(mM/L)	$0.58^{a}\pm0.01$	$0.56^{a}\pm0.01$	$0.52^{ab}\pm0.04$	$0.50^{ab}\pm0.02$	$0.48^{b}\pm0.02$

TP=total protein; Alb=albumin; Glo=globulin; A/G ratio=albumin / globulin ratio; Cho=cholesterol; TG=triglycerides; ALT=Alanine transaminase; AST=Aspartic transaminase; TAC= Total antioxidant capacity.
a, b, c. Means with different superscript among columns are significant differences (P<0.05).

Table (5): Effect of feeding different levels of olive cake (OC) on the blood hormones of Mamora laying hens.

Traits	Levels of OC (%)				
	Control	4	8	12	16
T_3 (ng/ml)	2.71±0.22	2.79±0.17	2.78±0.31	2.75±0.23	2.55±0.24
E_2 (pg/ml)	60.95±10.56	74.27±11.97	73.29±11.89	70.52±12.10	57.60±9.76
P_4 (ng/ml)	0.45±0.10	0.43±0.07	0.40±0.11	0.42±0.04	0.28±0.04

T_3=Triiodothyronine hormone; E_2=estradiol hormone; P_4=progesterone hormone.

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الملخص العربى

الأستجابات الفسيولوجية والأداء الإنتاجى للدجاج البياض المغذى على تفلة الزيتون تحت ظروف جنوب سيناء

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يهدف البحث إلى دراسة تأثير استخدام مستويات مختلفة من تفلة الزيتون كمخلف غذائى على الأداء الإنتاجى وبعض صفات الدم للدجاج البياض تحت الظروف الصحراوية المصرية. استخدم مائة وخمسون دجاجة معمورة بياضة (عمر 22 اسبوع ووزن جسم 1461,2±30,7 جم) تم توزيعهم عشوائيا إلى خمسة معاملات تجريبية متساوية (30 دجاجة / معاملة). وكل معاملة وزعت عشوائياً لثلاثة مكررات متساوية (10 دجاجات / مكررة). المعاملة الأولى غذيت على عليقة أساسية وأعتبرت مجموعة كنترول (0,0 % تفلة زيتون) بينما غذيت المعاملة الثانية والثالثة والرابعة والخامسة على علائق تحتوى نسب متدرجة من تفلة الزيتون 4 و 8 و 12 و 16 % من العليقة الكلية، على التوالى.
أظهرت النتائج ان الدجاج المغذى على 12 و 16 % من تفلة الزيتون سجل زيادة معنوية فى وزن البيضة بـ 4,9 و 2,9 %، على التوالى مقارنة بالمجموعة الكنترول. بينما لوحظ انخفاض معنوي لسُمك قشرة البيضة فى الدجاجات المغذاة على مستويات 8 و 12 و 16 % تفلة زيتون عند المقارنة بالمجموعة الكنترول. ومع ذلك عدد البيض قل معنويا فى الدجاجات المغذاة على 12 و16 % مقارنة بالمجموعة الكنترول. انخفاض معنويا قيم كرات الدم الحمراء والهيموجلوبين وتركيز الالبيومين فى الدجاجات المغذاة على 16 % تفلة زيتون مقارنة بالمعاملات الأخرى. كذلك انخفض معنوياً تركيزات الكلوسترول والجلسريدات الثلاثية فى الدجاج المغذى على 4 ، 8 ، 12 ، 16 % من تفلة الزيتون مقارنة بالمجموعة الكنترول. زادت معنوياً تركيزات الأنزيمات الناقلة لمجموعة الأمين فى الدجاج المغذى على 16 % من تفلة الزيتون مقارنة بالمعاملات الأخرى. سجل الدجاج المغذى على 16 % من تفلة الزيتون انخفاض معنوى فى مضادات الأكسدة الكلية عند المقارنة بالمجموعة الكنترول والمعاملة المغذاة على 4 % من تفلة الزيتون، على التوالى.
تخلص الدراسة إلى أنه يمكن إستخدام تفلة الزيتون بأمان حتى مستوى 12 % في عليقة الدجاج البياض دون حدوث تأثيرات سلبية على الأداء الإنتاجى وصفات الدم تحت الظروف الصحراوية المصرية.

الكلمات الدالة : الدجاج البياض ، تفلة الزيتون ، الاداء الانتاجى ، الاستجابات الفسيولوجية