Journal of Animal and Poultry Production

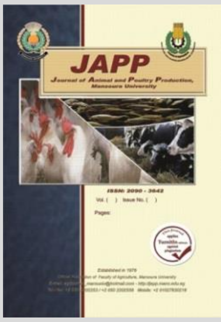
Journal homepage: www.japp.mans.edu.eg
Available online at: www.jappmu.journals.ekb.eg

Productive and Physiological Performance of Broilers Fed Diets Containing Different Levels of Olive Pulp

ELbaz, A. M.[1]; H. A. Thabet[2*] and Ghada G. Gad[2]

[1] Desert Research Center, Mataria, Cairo, Egypt.
[2] Poultry Production Department, Faculty of Agriculture, Ain Shams University, Egypt.

Cross Mark



ABSTRACT

This study was conducted to investigate the effect of using different levels of olive pulp in broiler diets on productive performance, carcass traits, protein fractions, lipids profile and antioxidant activity. One hundred eighty one-day old chicks were divided into four experimental groups (three replicates of 15 birds per treatment). Four experimental diets were used as follow: control, 5, 10, or 15% of olive pulp (OP) and fed up to five weeks of age. At 35 d of age, results showed that body weight and feed conversion ratio were declined ($P < 0.05$) in groups fed OP_{10} and OP_{15}compared with the control group. Moreover, feed intake decreased in group OP_{15} compared to other groups. Abdominal fat was decreased ($P < 0.05$) in groups fed OP_{15} and OP_{10},, also gizzard weight was decreased in all treatment groups except the OP_{15} group. Thymus gland weight was increased in groups fed OP_{15} and OP_{10}.Blood plasma low-density lipoprotein cholesterol (LDL) content increased linearly with increasing OP levels, while total protein, albumin, and triglycerides content decreased linearly. OP increased malondialdehyde (MDA) level but had no effects on other antioxidant traits (total antioxidant capacity (TAC) and superoxide dismutase (SOD). It seems that the addition of OP at 5% in broiler diets had the highest relative economic efficiency without detrimental effects on their biological performance. However, OP can be used safely in broiler diets up to 10%.

Keywords: Olive pulp, Broiler, Performance, Blood parameters, Antioxidant status.

INTRODUCTION

Rapid developments in the Egyptian economy led to higher feed prices so, forcing nutritionists to think about local alternative ingredients for diets since the cost of feed represents about 60-65% of the total production costs (Molina and Yanez, 2008).Therefore, agricultural wastes such as oil extraction products (canola meal and olive meal, etc.) were used for reducing environmental pollution from agricultural wastes. The technologies used for oil extracting are very different so that a wide range of by-products including olive cake, olive leaves, olive molasses and olive pulp (OP) were obtained (Abo Omar, 2005).

Olive pulp (OP) is one of the products of extracting olive oil. After the removal of the seed fractions, olive pulp can be achieved by sieving the dry olive cake to separate most of the seeds (Sadeghi *et al*., 2009). It is distinguished by the fact that it contains quantities of oil remaining from the squeezing process, which varies according to the method of oil extraction. The oil residue consists of unsaturated fatty acids (56.4% oleic acid, 13% palmitic acid, and 7% linoleic acid) which impact on the positive poultry performance and meat quality via the accumulation of fatty acid in the carcass (El-Hachemi *et al*., 2007; Tufarelli *et al*., 2013). It is considered 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), while contains low levels of lysine, and methionine (Rabayaa *et al*., 2001).It also contains a high percentage of fiber(24–40%), which affects the use of it in monogastric animals and some anti-nutrients such as tannins and phenols (Abo Omar, 2005). OP can be used as an energy and protein source in poultry feeding, so the aim of this study was to use different levels of olive pulp in broiler diets to minimize the production cost and evaluate its effects on productive performance, carcass traits, protein fractions, lipid profile and antioxidant status.

MATERIALS AND METHODS

Birds, housing and experimental diets

A total of 180 chicks (one day old) of the Ross 308 strain were distributed randomly into four experimental groups, each group contain three replicates (15 chicks/ replicate). Olive pulp (OP) was introduced in the experimental diets at 0 (control), 5, 10, 15% at the expense of yellow corn and SBM. The experimental diets (Table 1) were formulated based on National Research Council (NRC, 1994) and nutrient requirements suggested by the guidebook of Ross (308) strain. The chemical composition of olive pulp (AOAC, 1998) showed, 91.5% dry matter, 10.4% crude protein, 23.8% crude fiber, 13.5% crude fat, and 2230 kcal/kg metabolizable energy. Feed (mash form) and water were provided *ad libitum*. The temperature was set at 33 °C at placement and then decreased gradually until it reached 28 °C from the second week until the end of the experiment with natural temperature. Lighting was continuous at first three days, and then from 4thday till the end of the study, light regime was 22L: 2D.The birds were vaccinated against Newcastle disease (1st, 11th and 20thday of age), Infectious bronchitis disease (1st, and 11th day of age), Gumboro disease (7th and 15rd day of age) and influenza (H5) disease (7st day of age).

Productive performance and carcass traits

Live body weight (LBW) of the chicks and feed intake (FI) were weekly recorded by replicate and feed conversion ratio (FCR) was calculated as: feed to gain g/g. At 35 days, after

* **Corresponding author.**
E-mail address: hanythabet@agr.asu.edu.eg
DOI: 10.21608/jappmu.2020.128930

6 h of fasting to guarantee for complete evacuation of the gut, six birds per group that had weights closest to the mean weight for the group were selected and euthanized by slaughtering to determine carcass traits. Weights of the abdominal fat, heart, liver, gizzard, and immune organs (thymus, spleen, and bursa of Fabricius) were recorded.The performance index (PI) and the production efficiency factor (PEF) were calculated according to North and Bell (1981) and Emmert (2000), respectively.

Table 1. Composition and calculated analysis of experimental diets fed to broiler chickens

Ingredients (%)	Starter 1-21 d				Grower 22-35 d			
	CON	**OP_5**	**OP_{10}**	**OP_{15}**	**CON**	**OP_5**	**OP_{10}**	**OP_{15}**
Yellow corn	55.77	51.80	47.80	42.70	61.27	57.54	52.31	47.91
Soybean meal (44 %)	31.50	29.00	26.70	25.80	26.00	22.95	22.40	21.20
Corn gluten meal (60 %)	6.00	7.50	8.80	9.30	6.00	7.70	7.90	8.00
Corn oil	2.00	2.00	2.00	2.50	2.50	2.50	3.00	3.50
Olive pulp	0.00	5.00	10.00	15.00	0.00	5.00	10.00	15.00
Di-calcium phosphate	2.10	2.10	2.10	2.10	1.85	1.85	1.90	1.90
Calcium carbonate	1.26	1.24	1.24	1.24	1.05	1.10	1.10	1.05
Premix*	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
NaCl	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
DL-Methionine	0.33	0.32	0.32	0.32	0.29	0.29	0.31	0.35
L-lysine HCL	0.44	0.44	0.44	0.44	0.44	0.47	0.48	0.49
Sodium bicarbonate	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total	100	100	100	100	100	100	100	100
Price / Ton L.E.	6925	6765	6603	6478	6597	6459	6360	6216
Calculated analysis								
ME (kcal/kg)	3000	3000	3000	3000	3150	3150	3150	3150
Crude protein (%)	23	23	23	23	21	21	21	21
Crude fiber (%)	3.51	4.45	5.41	6.43	3.24	4.16	5.20	6.21
Calcium (%)	1.05	1.05	1.05	1.05	0.9	0.9	0.9	0.9
Available phosphorus (%)	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45

*** Each 2.5 kg Vitamins and minerals premix contains :vitamin A, 7700,000 IU; vitamin D3, 3300,000 IU; vitamin E, 6,600 mg; vitamin K3, 550mg; thiamine, 2200 mg; riboflavin, 4400 mg; vitamin B , 4400 mg; Ca Pantothenate, 550 mg; nicotinic acid, 200 mg; folic acid, 110 mg; choline chloride, 6275,000 mg; biotin, 55 mg; vitamin B12, 8.8 mg; Trace mineral (milligrams per 2.5 kilogram of diet): Mn, 66000; Zn, 66000; Fe, 33000; Cu, 8800; Se,300; and I, 900.**

Blood sampling and biochemical analysis

For measuring blood plasma metabolites and antioxidant status at 35 days of age, six birds per group (two from each replicate) were selected as above to collect 3 ml of blood from their brachial veins into heparinized tubes. After centrifuging blood samples (4500 rpm for 15 min), plasma was harvested and stored at -20º C until assayed.

The measured parameters were protein fractions (total protein, albumin, and globulin), lipids profile [triglycerides, total cholesterol, low-density lipoprotein (LDL) cholesterol and high-density lipoprotein (HDL)] and antioxidant status (TAC= total antioxidant capacity and MDA = malondialdehyde), SOD=superoxide dismutase. These parameters were measured colorimetrically in erythrocytes using suitable commercial kits.

Economical traits

A production cost analysis and economical evaluation was carried out for all dietary treatments in an attempt to investigate effects of different levels of olive pulp on relative economic efficiency. Where: Economic efficiency = net return/total feed cost, whereas net revenue= total return - total feed cost.

Statistical analysis

Data were analysed by one-way analysis of variance (ANOVA) using the General Linear Models (GLM) procedure of the statistical SAS (2004)

Data were subjected to one-way ANOVA variance analysis of General Linear Model (GLM) procedure of SAS software (2004) user's guide along with the following model:

$$Yij = \mu + Ti + eij$$

Where; μ = overall mean, Ti = dietary treatment, eij = experimental error. Individual effects of treatments were compared using multiple range tests at α level that is equal to 0.05 or 0.01, (Duncan, 1955).

RESULTS AND DISCUSSION

Productive performance

The effects of using different levels of olive pulp on productive performance are presented in Table (2). The addition of 15% OP (OP15) in diet resulted in negatively affect LBW at starter phase, while FI and FCR were not affected. At 35 day of age, LBW significantly reduced ($P<0.05$) in both OP_{15} and OP_{10} groups (1673g and 1785g) compared to the control and OP_5 groups (1839g and 1855g). Also, there was a decrease ($P<0.05$) in FI at OP_{15} and OP_{10} groups compared to the OP_5 and control groups (2951g, 3086g, 3131g and 3148g respectively). However, FCR f OP_5 was the best ($P<0.05$) compared to other experimental groups and control. The results indicate that using OP at 15% in broiler diets adversely affected broiler performance (LWG, and FCR), while 10% (OP_{10}) or 5% (OP_5) did not significantly affect broiler performance compared with control group. Broiler growth performance was not affected when the olive pulp was included in the diet at 100g/kg (Sayehban *et al*., 2016) and (Ibrahim *et al*., 2018). This indicates that diets containing up to 100g/kg of olive cake, provide adequate nutrients for productive performance (Al-Harthi, 2014). Also similar results obtained when including 90g/kg of OP in layers diet (Afsari *et al*., 2013). On the contrary hand, Abo Omar *et al*. (2003) indicated that 16% of OP in broiler diets did not observe any influence on performance (FI or WG). Although the inclusion of OP at 10% in the present study did not cause any performance losses, but OP at the level of 15% caused performance losses. This supports the hypothesis that OP may be used as an ingredient in poultry diets up to 10%.

Because olive pulp contains a high percentage of fiber (insoluble), which caused a relative increase in fiber in the diet, has a harmful effect on the utilization of nutrients, and the difficulty of digesting fiber in poultry and intestinal lumen erosion (Knudsen *et al*., 2008).The high level of fiber in the diet is working with high swelling and water-binding capacity. It also negatively affects the intestinal mucosal layer that can act as a barrier protects the epithelial surface from potential luminal insults (Forstner and Forstner, 1994), therefore, any harm or erosion can affects on the absorption of dietary nutrients. Furthermore, presence of xyloglucan (non-starch polysaccharides, NSP) on olive pulp cell walls has an anti-nutritive effect upon feed utilization and poultry productivity (Rosario and Domingues, 2002). This may explains the reason for the low LBW and inferior FCR with an increase in the level of olive pulp. The decreased FI of the broilers chickens fed 10% and 15% OP compared with other diets probably is related to increasing the intestinal viscosity (Van Der Klis *et al*., 1993) which causes an increase of feed retention time in the gastrointestinal tract (GIT) (Shakouri *et al*., 2006). As there is a relationship between the rate of feed passage through the gut and feed intake in chickens (Almirall *et al*., 1995)., Previous experiments have reported that increasing fiber levels decreased growth rate and feed efficiency in chickens (Rick *et al*., 1982).Values of PI and PEF were in the same manner with body weight, feed consumption and feed conversion ratio, where, OP_5 was better than other treatments including control, these results were in harmony with those obtained by Sayehban *et al*., (2016).

Table 2. Effect of feeding different levels of olive pulp on productive performance of broilers.

Items	CON	OP_5	OP_{10}	OP_{15}	SEM	P-value
21 day						
Live body weight(g)	836^a	839^a	807^{ab}	788^b	13.51	0.008
Feed intake (g)	992	985	966	954	18.06	0.365
Feed conversion ratio	1.187	1.175	1.197	1.211	0.061	0.511
35 day						
Live body weight(g)	1839^a	1855^a	1785^b	1673^c	32.42	0.022
Feed intake (g)	3148^a	3131^a	3086^{ab}	2951^b	38.60	0.036
Feed conversion ratio	1.712^b	1.688^c	1.729^b	1.764^a	0.076	0.001
Performance Index (PI)	107.42	109.89	103.24	95.18	-	-
Production Efficiency Factor (PEF)	267.75	307.00	281.86	253.82	-	-

a,b,c, Means within rowof different experimental sub-groups with different superscripts are significant differences at P <0.05. CON=fed a basal diet (control); OP_5=fed 5% Olive pulp; OP_{10}= fed 10% Olive pulp;OP_{15}= fed 15% Olive pulp.

Carcass traits

The dressing carcass percentage did not differ (P ≥0.05) in broilers fed diets containing OP (Table 3). These results are in agreement with those of Abo Omar (2005), who found that adding up to 10% of OP in broiler diet had no significant effect on carcass characteristics. It was observed that the addition of OP could not affect any values of carcass traits, with the exception of abdominal fat, gizzard, and thymus. On the opposite of these results, Abo Omar (2005) found that, the addition of 10% OP in diet had no effect on the weight of edible (i.e. liver, heart, and gizzard) organs. Adding 10% and 15% OP resulted in less abdominal fat compared with those fed on 5% OP and 0% OP (control). Adding OP by 15% led to increased gizzard % compared to other experimental groups. These findings are inagreement with those reported by Al-Shanti and Abo Omar (2003).The increase in the relative weight of gizzard could be attributed to the increase in mechanical digestion and the growth of muscles required for digesting the olive cake fiber (AlHarthi, 2015).

The increase in dietary fiber contents led to a decrease in relative weight of abdominal fat. The results of numerous studies indicated that high fiber inclusion reduced abdominal fat in broiler breeders (Mohiti-Asli *et al*.,2012). Abdominal fat was greatly depressed by feeding birds with high fiber diets (Mourao *et al*., 2008).

Moreover, as reported in Table 4, the weight of spleen, and Bursa of Fabricius were not differ (P ≥0.05) when broilers were fed different levels of OP, while there is a difference in thymus weight. Also, the addition of 10% and 15% OP diet led to a significant increase in the thymus weight compared to controls.

Table 3. Effect of feeding different levels of olive pulp on carcass traits (% live weight).

Item	Experimental Treatments				SEM	P-value
	CON	OP_5	OP_{10}	OP_{15}		
Body weight (g)	1849^a	1836^a	1790^b	1668^c	48.12	0.002
Carcass weight (g)	1316^a	1314^a	1291^a	1178^b	43.51	0.046
Dressing (%)	71.17	71.57	72.13	70.60	0.941	0.416
Abdominal fat (%)	4.21^a	4.26^a	3.74^b	3.38^c	0.078	0.003
Heart (%)	0.57	0.54	0.61	0.58	0.023	0.254
Liver (%)	2.64	2.70	2.81	2.85	0.116	0.109
Gizzard (%)	2.84^b	2.81^b	2.96^b	3.52^a	0.151	0.015

a, b,c Means within row of different experimental sub-groups with different superscripts are significant differences at P <0.05. CON= control; OP_5=fed 5% Olive pulp; OP_{10}= fed 10% Olive pulp; OP_{15}= fed 15% Olive pulp.

Table 4. Effect of feeding different levels of olive pulp on immune organs.

Item	Experimental Treatments				SEM	P-value
	CON	OP_5	OP_{10}	OP_{15}		
Thymus (%)	0.215^b	0.209^b	0.264^a	0.258^a	0.026	0.001
Spleen (%)	0.112	0.116	0.109	0.113	0.008	0.127
Bursa of Fabricius (%)	0.165	0.168	0.157	0.161	0.017	0.206

a,b Means of different experimental sub-groups with different superscripts are significant differences at P <0.05. CON=fed a basal diet (control); OP_5=fed 5% Olive pulp; OP_{10}= fed 10% Olive pulp; OP_{15}= fed 15% Olive pulp.

Blood plasma parameters

The results presented in Table (5) show the influence of OP levels on plasma protein and lipid components. However, the Lipids profile (triglycerides, total cholesterol, and HDL) was not affected by adding the OP except LDL-cholesterol, total protein and albumin values were decreased (P < 0.05) in OP_{10} and OP_{15} groups compared with the control and OP_5 groups. These results are in agreement with those of Al-Harthi and Attia (2015), who found that adding up to 10% of OP in laying diet had a significant effect on plasma total protein. This is probably due to the low protein digestibility of olive cake (Rabayaa *et al*., 2001; Abo Omar, 2005) because of its high fibre content (Al-Harthi, 2014). Also, the tannins content which was found to reduce the digestibility of protein and dry matter (Priolo *et al*., 2000).

Table 5. Effect of feeding different levels of olive pulp on blood parameters.

Item	Experimental Treatments				SEM	P-value
	CON	OP_5	OP_{10}	OP_{15}		
Protein fractions (g/dl)						
Total protein	3.92^a	4.06^a	3.36^b	3.28^b	0.281	0.006
Albumin	2.04^a	2.13^a	1.38^b	1.27^b	0.164	0.003
Globulin	1.98	1.99	1.98	2.01	0.190	0.241
Lipid profile (mg/dl)						
Triglycerides	191.1^a	188.7^a	176.3^b	169.1^b	9.06	0.057
Total cholesterol	169.0	165.4	172.1	177.0	7.15	0.715
HDL-cholesterol	72.04	72.65	73.10	71.62	3.59	0.213
LDL-cholesterol	59.25^b	61.14^b	64.25^b	78.51^a	6.04	0.011

a,bMeans within row of different experimental sub-groups with different superscripts are significant differences at P <0.05. CON= control; OP_5=fed 5% Olive pulp;OP_{10}= fed 10% Olive pulp;OP_{15}= fed 15% Olive pulp.

A significant increase (P < 0.05) in LDL value was observed only in OP15 group compared with all treatment groups; however, the remaining indications of lipids profile were not affected by the addition of the OP. In line with our results, Zangeneh and Torki (2011) stated that dietary OP inclusion did not exert any significant effect on the blood parameters. While, Zarei *et al.* (2011) reported that the inclusion of OP in hens diet decreased triglycerides level but not affected levels of total cholesterol, HDL and LDL. It has been proposed that the existence of soluble fibres led to increased viscosity which may postpone the emptying of the gastrointestinal tract, decrease intestinal motility and fat absorption thereby reducing lipid absorption (Razdan and Pettersson, 1994).

Antioxidant status parameters

All examined antioxidant enzymes (TAC and SOD) parameters were insignificantly affected by supplemented OP during the experimental periods (Table 6). However, MDA increased significantly in groups OP_{10} and OP_{15} in comparison to OP5 and control group. Increasing the MDA concentration in the serum were related to increasing of lipid peroxidation of polyunsaturated fatty acids (PUFA), which leads to cell damage (Ostalowska *et al*., 2006). Abd El-Moneim and Sabic (2019) demonstrated that using 5 and 10% of olive pulp had a significant effect on oxidative status (GSH and GSR value). Increased MDA of the broiler chicks fed 10% and 15% OP compared with other groups, probably is related to high levels of LDL observed which led to increase the oxidative stress, In this connection, Parthasarathy *et al* (2010) confirmed that the increased level of MDA may be associated with the increased oxidation of LDL cholesterol.

Table 6. Effect of feeding different levels of olive pulp on antioxidant status.

Item	Experimental Treatments				SEM	P-value
	CON	OP_5	OP_{10}	OP_{15}		
TAC(mm/L)	0.530	0.552	0.496	0.529	0.092	0.144
SOD(U/mL)	1.852	1.826	1.914	1.882	0.126	0.089
MDA (µmol/mL)	0.358^b	0.345^b	0.407^a	0.419^a	0.075	0.018

a,b Means within row of different experimental sub-groups with different superscripts are significant differences at P <0.05. CON= control; OP_5=fed 5% Olive pulp;OP_{10}= fed 10% Olive pulp;OP_{15}= fed 15% Olive pulp. TAC= total antioxidant capacity; SOD=superoxide dismutase; MDA = malondialdehyde.

Economical traits

Data presented in Table (7) showed the economical evaluation of applying olive pulp in broiler feeding.Results showed that, relative economic efficiency values of broiler were enhanced by 113.52 and 107.97% for the groups fed OP_5 and OP_{10}, respectively as compared to the control group (100%).On the other hand, birds fed OP_{15} were the worst rate. The improvement in economic efficiency values might be explained by the cheaper price of OP compared with conventional feedstuffs, moreover, normal broiler performance occur. These findings were in harmony with those obtained by Rabayaa *et al* ., (2001) who found that, about 1.3 million can be saved to broiler farmers in Palestine each year by using OP in broiler diets in rate of 7.5%.

Table 7. Effect of feeding different levels of olive pulp on some economic traits.

Item	Experimental Treatments			
	CON	OP_5	OP_{10}	OP_{15}
Feed Cost / Bird (LE)	21.09	20.52	19.86	18.59
Total Cost[1] / Bird (LE)	31.59	31.02	30.36	29.09
Total Return[2]/ Bird (LE)	39.54	39.88	38.38	36.10
Net Return / Bird (LE)	7.95	8.86	8.02	7.01
Economic Efficiency[3]	0.25	0.28	0.26	0.24
Relative Economic Efficiency[4] (%)	100.00	113.52	107.97	95.74

[1] Total cost = (feed cost + price of one-day live chicks + incidental costs); L.E.: Egyptian Pound, [2] According to the local price of Kg sold live birds which were 21.50 L.E.M, [3] Economic efficiency = net return/total feed cost. Whereas net revenue= total return - total feed cost. , [4] Assuming that the relative economic efficiency of control group equals 100.CON= control; OP_5=fed 5% Olive pulp; OP_{10}= fed 10% Olive pulp;OP_{15}= fed 15% Olive pulp.

CONCLUSION

From the Previousresults of the present study, it can be concluded that OP can be included in broiler diets up to 10% with no adverse effect on their biological performance and with increase in relative economic efficiency, however, OP at 5% was the best.

REFERENCES

Abd El-MoneimA.E. and E.M. Sabic (2019).Beneficial effect of feeding olive pulp and Aspergillus awamori on productive performance, egg quality, serum/yolk cholesterol and oxidative status in laying Japanese quails.Journal of Animal and Feed Sciences, 28, 52–61.

Abo Omar, J.M. (2005). Carcass composition and visceral organ mass of broiler chicks fed different levels of olive pulp. Gaza Univ. J., 13: 75-84.

Abo Omar J.M, Ottoman RA, Abu Baker BM and A.Zaazaa (2003). Response of broiler chicks to a high olive pulp diet supplemented with two antibiotics. Dirasat, Agriculture Sciences, 30:137-142.

Afsari M, Mohebbifar A and Torki M. (2013). Effects of phytase supplementation of low phosphorous diets included olive pulp and date pits on productive performance of laying hens, egg quality traits and some blood. Parameters Annual Review & Research in Biology, 3(4):777-793.

Al-Harthi MA.(2014). The chemical composition and nutrient profiles and energy values of olive cake for poultry diets. Life Science Journal, 11(9):159-165.

Al-Harthi, M.A.,(2015). The effect of differentdietary contents of olive cake with or without Saccharomyces cerevisiae on egg production and quality, inner organs and blood constituents of commercial layers. Europe.Poult. Sci.:79.

Al-Harthi, M.A. and Y.A. Attia,(2015). Effect of citric acid on the utilization of olive cake diets by laying hens. Ita. J. of Anim. Sci.

Almirall, M.; Francesch, M.; Perez-Vendrell, A. M.; Brufau, J. and Esteve-Garcia,E., (1995). The differences in intestinal viscosity produced by barley and betaglucanase alter digesta enzyme activities and ileal nutrient digestibilities more in broiler chicks than in cocks. The Journalof Nutrition 125, 947–955.

Al-Shanti, H.A. and Abo Omar, J.M., (2003).Effect ofolive cake on layers performance and eggquality. J. Al-Azhar University, Gaza Nat.Sci. 6:1-6.

AOAC, (1998). Official Methods of Analysis of the Association of Official Analytical Chemists. 16th ed. Association of Official Analytical Chemists, Washington DC.

Duncan, D. B.; 1955. Multiple range and multiple F tests. Biometrics, 11: 1-42.

Emmert, J. (2000). Efficiency of phase feeding in broilers. Proceeding, California Animal Nutrition Conference. FresnoCalifornia, USA.

El-Hachemi, A.; El-Mecherfi, K.E.; Benzineb, K. and Saidi, D.(2007). Supplementation of olive mill wastes in broiler chicken feeding. Afr. J. Biotechnol., 6: 1848-1853.

Forstner, J. and Forstner, G., (1994). Gastrointestinal mucus. Physiology of the Gastrointestinal Tract 2, 1255–1283.

Harb, M.(1986).Use of olive cake pulp for fattening Awassi lambs.Dirasat. 13: 37-55.

Ibrahim N.S., E.M. Sabic, and A.M. Abu-Taleb (2018). Effect of inclusion irradiated olive pulp in laying quail diets on biological performance. Journal of Radiation Research and Applied Sciences 11, 340–346.

Knudsen, K. B., Lærke, H. N. and Hedemann, M. S., (2008). The role of fibre in piglet guts health. Gut Efficiency 65–95.

Mohiti-Asli, M.; Shivazad, M.; Zaghari, M.;Aminzadeh, S.; Rezaian, M. and Mateos, G.G., (2012). Dietary fibers and crude protein content alleviate hepatic fat deposition and obesity in broiler breeder hens.Poultry Science 91, 3107–3114.

Molina-Alcaide, E. and Yanez-Ruiz, D. R.,(2008). Potential use of olive by-products in ruminant feeding: A review. Animal Feed Science and Technology, 147, 247–264.

Mourao J.L., V.M. Pinheiro, J.A.M. Prates, R.J.B. Bessa, L.M.A. Ferreira,C.M.G.A. Fontes and P.I.P. Ponte, (2008). Effect of dietary dehydrated pasture and citrus pulp on the performance and meat quality of broiler chickens.Poult. Sci., 87: 733–743.

National Research Council (1994). Nutrient Requirements of Poultry. 9th edition. National Academic Press. Washington, D.C.

North, M.O. and D.D. Bell (1981). Breeder Management.In "Commercial Chicken Production Manual" 4th Ed., Van Nostrand Reinhold.New York, USA.

Ostalowska A, Birkner E, Wiecha M, Kasperczyk S, KasperczykA,Kapolka D and Zon-Giebel A (2006). Lipid peroxidation and antioxidantenzymes in synovial fluid of patients with primary and secondary osteoarthritis of the knee joint. Osteoarthritis Cartilage, 14: 139-145.

Parthasarathy S, Raghavamenon A, Garelnabi M O and Santanam N (2010). Oxidized Low-Density Lipoprotein. Methods MolBiol 610: 403–417.

Priolo, A.; Waghorn, G. C.; Lanza, M.; Biondi, L. and Pennisi, P.(2000). Polyethylene glycol as means for reducing the impact of condensed tannins and carob pulp: effects on lambs growth performance and meat quality. J. Anim. Sci., 78 (4): 810.

Rabayaa, E.; Abo Omar, J.M and Othman, R.A. (2001). Utilization of Olive Pulp in Broiler Rations. An-Najah Univ. J. Res., 15: 133-144.

Razdan A. and Pettersson D.,(1994). Effect of chitin and chitosan on nutrient digestibility and plasma lipid concentrations in broiler chickens. Br. J. Nutr. 72: 277–288

Rick, S.C., Van Der Aar, P. J., Fahey, G. C. and Berger, L. L., (1982). Influence of dietary fiber onperformance and fermentation characteristics of gut contents from growing chicks. Poult.Sci. 61:, 1335 – 1343

Rosario, M., and Domingues, M.(2002). Structural characterisation of underivatised olive pulp xylo-oligosaccharides by mass spectrometry using matrix-assisted laser desorption/ionisation and electrospray ionization. Rapid Communications in Mass Spectrometry, 16: 2124–2132.

Sadeghi1, H., A. TeimouriYnsari and Z. AnsariPirsarai, (2009). Effects of different olive cake by products on dry matter intake, nutrient digestibility and performance of Zel sheep. Int. J. Agr. Biol., 11: 39-43.

SAS Institute (2004). SAS User's Guide: Statistics. Release 9.1. SAS Institute Inc., Cary, NC.

Sayehban P ., A Seidavi., M Dadashbeiki., A Ghorbani., WAG Araújo., and LFT Albino., (2016). Effects of different levels of two types of olive pulp with or without exogenous enzyme supplementation on broiler performance and economic parameters. Brazilian Journal of Poultry Science 18: 489 - 500

Shakouri, M.; Kermanshahi, H. and Mohsenzadeh, M.,(2006). Effect of different nonstarch polysaccharides in semi purifieddiets on performance and intestinalmicroflora of young broiler chickens. International Journal of Poultry Science 5:557–561.

Tufarelli, V., Introna, M., Cazzato, E., Mazzei, D., and Laudadio, V., (2013). Suitability of partly destoned exhausted olive cake as by-product feed ingredient for lamb production. J. Anim. Sci. 91, 872-877.

Van Der Klis, J.; Van Voorst, A. and VanCruyningen, C., (1993). Effect of a soluble polysaccharide (carboxy methyl cellulose) on the physico-chemical conditions in the gastrointestinal tract ofbroilers. British Poultry Science 34: 971–983.

Zangeneh S. and Torki M.,(2011). Effects of β-mannanase supplementing of olive pulp-included diet on performance of laying hens, egg quality characteristics, humoral and cellular immune response and blood parameters.GlobalVet. 7: 391–398

Zarei M., Ehsani M., and Torki M.,(2011). Productive performance of laying hens fed wheat-based diets included olive pulp with or without a commercial enzyme product. Afr. J. Biotechnol. 10: 4303–4312.

الأداء الإنتاجي والفسيولوجي لدجاج التسمين المغذى على عليقة تحتوي على مستويات مختلفة من تفلة الزيتون

أحمد محمد الباز[1] ، هاني علي ثابت[2]* و غادة جودة راشد جاد[2]

[١] مركز بحوث الصحراء – مركز البحوث الزراعية – المطرية – القاهرة - مصر

[٢] قسم إنتاج الدواجن- كلية الزراعة- جامعة عين شمس- مصر

أجريت هذه الدراسة لبحث تأثيرإستخدام مستويات مختلفة من تفلة الزيتون في علائق دجاج التسمين على الأداء الإنتاجي وصفات الذبيحة ومكوناتالدم ونشاط مضادات الأكسدة. تم استخدام عدد مائة و ثمانون كتكوت تسمين عمر يوم (روس ٣٠٨) و تم تقسيمهم إلى أربع مجاميع تجريبية كل منها فى ثلاث مكررات حتى عمر ٣٥ يوم . أستخدام أربع علائق تجريبية كالتالي: المجموعة الأولى غُذيت على عليقة كنترول (لا تحتوي على تفلة الزيتون) ، المجموعة الثانية غُذيت على عليقة تحتوي على ٥%تفلة الزيتون،المجموعةالثالثةغُذيت على عليقة تحتوي على ١٠% تفلة الزيتون،المجموعة الرابعة غُذيت على عليقة تحتوي على ١٥% تفلة الزيتون. أظهرت النتائج مايلى: عند عمر ٢١ يوم لوحظ إنخفاض في الوزن الحى للمجموعة التي تغذت على عليقة تحتوي على ١٥ % تفلة الزيتون ولكن معامل التحويل لم يتأثر معنوياً بين المجموعات التجريبية. بينما عند عمر ٣٥ يوم (نهاية التجربة) لوحظ انخفاض كبير في الوزن الحى في المجموعة المغذاة على ١٥% تفلة الزيتون مقارنة مع مجموعة الكنترول . كذلك ظهر تأثير عكسي على الوزن الحي فيالمجموعةالمغذاةعلى ١٠% تفلة الزيتون. تأثر التركيب الكيميائي للدم بإضافة تفلة الزيتون إلى العليقة . لوحظ إنخفاض ملحوظ فيمستوى كل من الدهون الثلاثية و البروتين الكلي و الأليبومين في البلازما بينما حدث إرتفاع في مستوي الكوليستيرول منخفض الكثافة مقارنة مع الكنترول.أيضا كان لإضافة تفلة الزيتون تأثير محفز لنشاط بعض مضادات الأكسدة. بوجه عام كان لإضافة تفلة الزيتون بنسبة ٥% لعليقة دجاج اللحم كان لهأعلى كفاءة إقتصادية بدون أي تاثير سيئ على الأداء الإنتاجي . من النتائج السابقة يمكن إضافة تفلة الزيتون إلي عليقة دجاج التسمين بنسبة حوالي ١٠% دون أي تأثير ضار على الأداء الإنتاجي . يوصى بمزيد من الدراسات لكيفية معالجة تفلة الزيتون للمساعدة في امكانية اضافته بكميات أكبر في علائق الدواجن.