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UTILIZATION OF OLIVE CAKE AS A NON-CONVENTIONAL FEEDSTUFF IN GROWING TURKEY DIETS

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The present work was carried out at Maryout Research Station, in an attempt to evaluate olive cake as an ingredient in growing turkey, and study its effect on growth performance, feed utilization, digestibility coefficients of nutrients and carcass characteristics. A total number of 468 one- month unsexed turkey poults (Black Baladi) were distributed randomly into four experimental treatments. Each treatment involved 117 poults in three replicates of 39 poults each. Olive cake was incorporated in the experimental diets at 0, 10, 15 and 20% of the total diet, respectively. The experiment extended for 16 weeks (from 4 up to 20 weeks of age).

Data revealed that olive cake had a high level of crude fibers (27.85%) with moderate amount of crude protein (10.38%). Ether extract and ash% showed values of 7.24% and 5.22%, respectively. Olive cake showed a considerable content of the true metabolizable energy, ME (2700, kcal/kg).

At the end of the growing period (20 weeks of age), poults fed on olive cake up to 15% of the total diet showed no significant differences in their body weight and body weight gain when compared to those of the control group. The insert of olive cake at a level of 20% of the total diet followed by a significant ($P<0.05$) decrease in body weight and weight gain of poults. Values in this respect were 4559.27, 4548.38, 4437.59 and 4247.81g for body weight and 36.47, 36.38, 35.43 and 33.71g/day for body weight gain when diets were included 0, 10, 15 and 20% olive cake, respectively.

Average feed intake (g/poult/day) was gradually increased with the increasing of olive cake level in diet, while feed conversion values (g feed/ g gain) negatively

influenced by the increasing of olive cake levels in diets. Digestibility coefficients and nutritive values as indicated by total digestible nutrients (TDN) and ME were significantly ($P<0.05$) decreased with the increasing of olive cake in the experimental diets.

Carcass weight, dressing percentage, some of carcass parts (breast, thigh and wings) as well as the sensory evaluation of carcass meat (appearance, odour, taste, texture, tenderness and juiciness) were not significantly influenced by olive cake levels in diets. Viscosity of digesta was insignificantly increased when olive cake level increased in diets. The relative weight of the edible giblets, particularly liver and gizzard recorded significantly higher ($P<0.05$) values when olive cake was inserted at a higher level in poults diets. Chemical analysis of carcass meat showed that ether extract content was significantly ($P<0.05$) decreased with the increasing of olive cake in diets.

Poults fed a diet with 10% olive cake followed by those fed on 15% olive cake showed the best economical efficiency. However, the worst economical efficiency was noticed in 20% olive cake followed by the control group. Finally, it could be advisable to use olive cake at a level of 15% in growing turkey diets without detrimental effects on productive performance and carcass characteristics.

Keywords: body weight, feed utilization, digestibility, carcass, growing turkey, olive cake.

The waste residues of fruits and vegetables after harvesting and processing could be used as sources of protein and energy in poultry feeding. Recently, the application of non-conventional feedstuffs in poultry feeding in developing countries has received considerable attention, particularly with the increasing of poultry feeding cost.

Olive by-products can be incorporated in poultry diets as a cheap nutritional feedstuff to decrease the feeding cost and alleviate the pollution problems. During the processing, oil can be pressed or centrifuged out olives leaving 33-40 kg olive cake per 100 kg of olives. Exhausted or solvent extracted olive cake contains 15% water, 4% oil, 55% shells and 26% pulp. Olive pulp is obtained when the stone are separated before oil extraction (Boucque and Fiems, 1988). Chemical analysis of olive cake varieties

revealed values of 85-90% dry matter, 9-14% crude protein, 4-6% ether extract, 15-35% crude fibers and 6-8% ash (Sansoucy *et al.*, 1985).

A little work was found on the use of olive cake in some poultry species. In laying hens, Hashish and Abd El-Samee (2002) found that 10% of olive cake had no significant effects on body weight changes and feed utilization. In broiler chickens, El-Husseiny (1981) and Al- Shanti (2003a) recommended to use the olive cake at a level of 10% of the total diets without significant effects on productive performance and carcass characteristics. Abd El-Maksoud (2001) increased olive cake level up to 12% and found no significant effects on body weight and carcass characteristics of broilers. The same author reported a negative effect on feed conversion values, dry matter, crude protein and crude fibers digestibility when olive cake used at a level more than 6% of diet. In contrast to poultry species, rabbits tolerated up to 20% olive cake in their diets without significant effects on body weight, weight gain, feed utilization and carcass characteristics (Tortuero *et al.*, 1989; Ben Rayana *et al.*, 1994; Ghazalah and El-Shahat, 1994; Zaza *et al.*, 2001 and Al-Shanti, 2003b).

Olive cake may be used in turkey diets at higher levels than the other poultry species, as the examination of caecal microflora of turkeys indicated that the feeding of high-fiber diets resulted in increased numbers of cellulose digesters microorganisms. Therefore, turkeys were able to obtain slightly more energy than the chickens from the high fiber feedstuffs (Scott, 1987). There is no available data on the use of olive cake in turkey diets. Therefore, this research was done to study the effect of olive cake on growth performance, feed utilization, digestibility coefficients of nutrients and carcass characteristics of growing turkey.

MATERIALS AND METHODS

The present work was carried out at Maryout Research Station, belonging to the Desert Research Centre, in an attempt to evaluate olive cake as an ingredient in growing turkey and study its effect on growth performance, feed utilization, digestibility coefficients of nutrients and carcass characteristics.

A total number of 468 one - month unsexed turkey poults (Black Baladi) of nearly similar body weight were housed on litter floor pens, wing banded, weighed and distributed randomly into 4 experimental treatments. Each treatment involved 117 poults in three replicates of 39 poults each. Feed and water were supplied *ad libitum*. Olive cake was incorporated in the experimental diets at 0, 10, 15 and 20% of the total diet, respectively. The experiment extended for 16 weeks (from 4 up to 20 weeks of age).

Olive cake; a mixture of skin, pulps, woody endocarp and seed were ground to be suitable for chemical analysis and feed formulation. The

experimental diets were formulated from vegetable ingredients to be isocaloric and isonitrogenous according to NRC (1994). Composition of the experimental diets and calculated analysis are shown in table (1).

Body weights (g) were recorded at the beginning of the experiment (4 wks of age) and then at 8, 12, 16 and 20 weeks of age. Body weight gain, feed consumption and feed conversion values were calculated at the same interval periods.

Two digestion trials were carried out; the first trial was to evaluate the nutrients digestibility coefficients of olive cake (at 4 weeks of age). The gross energy content of the feedstuff (olive cake) and excreta samples were determined in a bomb calorimeter. The value of the metabolizable energy (ME) was expressed as apparent metabolizable energy (AME), nitrogen corrected apparent metabolizable energy (AMEn), true metabolizable energy (TME) and nitrogen corrected true metabolizable energy (TMEn). These values were calculated according to Sibbald (1980). The second trial was carried out at 3 months of age, to determine the digestibility coefficients and the nutritive values of the experimental diets. In each experiment, sixteen turkey poults were used (four poults from each treatment). Samples of feed and dried excreta were collected for chemical analysis according to the official methods (A.O.A.C, 1990). ME of the experimental diets were calculated according to Titus and Fritz (1971).

At the end of the growing period, six poults representing each treatment were randomly chosen and slaughtered after 12h of fasting. The pre-slaughter weight was recorded and eviscerated carcass were individually weighed in order to evaluate the carcass characteristics. Carcass percentage was calculated as carcass weight divided by the pre-slaughter body weight. Giblets (heart, liver and gizzard) were calculated as percentage of empty carcass.

Measurement of ileal digesta viscosity was estimated (in centipoises) using 24 samples (six poults × four treatments) from the slaughtered poults. Viscosity was measured according to a Brookfield Programmable DV-II Viscometer, described by Bedford and Classen (1993). Moisture, protein, fat and ash content of carcass meat were analyzed according to A.O.A.C (1990), using sixteen samples (four poults x four treatments).

Organoleptic properties of breast meat were estimated using 24 samples, at Maryout Research Station. Trained participants were asked to give numerical value to indicate their evaluation of the tested samples.

Economical efficiency (EE) was calculated based upon the price of total weight gain and total feed cost/kg. Data were statistically analyzed using the General Linear Model Procedure (SAS Institute, 1994). Duncan's Multiple Range Test was used to test the significance of mean differences (Duncan, 1955).

TABLE (1). Experimental diets of growing turkey with different levels of olive cake

Ingredients%	4-8wks				8-12wks				12-16wks				16-20wks			
Olive cake	0	10	15	20	0	10	15	20	0	10	15	20	0	10	15	20
Yellow corn	51.71	42.60	37.60	32.31	59.51	51.60	46.21	41.51	68.45	58.00	53.40	48.51	73.31	63.86	59.56	54.41
Soybean 48%	37.40	34.50	33.66	33.00	30.80	26.01	25.70	24.50	19.46	18.81	17.71	16.30	14.50	11.90	9.75	9.40
Gluten meal	6.20	7.70	8.10	8.50	4.00	6.70	6.80	7.40	6.70	6.70	7.20	8.00	5.90	7.20	8.50	8.50
Dried fat	0.00	0.51	0.95	1.50	1.00	1.00	1.60	1.90	0.70	1.80	2.00	2.50	1.60	2.35	2.50	3.00
Dicalcium phosphate .	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Limestone	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35
NaCl	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Vit and min. premix*	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34
Lysine	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
DL-Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total,kg	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated analysis																
Metabolizable energy, ME (Kcal/kg)	2905	2900	2901	2905	3012	3000	3004	3001	3109	3109	3100	3110	3200	3204	3204	3202
Crude protein, CP%	26.07	26.00	26.00	26.06	22.15	22.01	22.05	22.03	19.11	19.07	19.04	19.03	16.62	16.54	16.53	16.50
Crude fibers, CF%	2.67	5.15	6.39	7.64	2.58	5.04	6.29	7.54	2.42	4.93	6.18	7.41	2.34	4.82	6.05	7.31
Ether extract, EE%	3.73	4.41	4.89	5.46	4.68	4.96	5.56	5.94	4.58	5.72	6.01	6.54	5.40	6.26	6.52	7.05
Calcium, Ca%	1.13	1.15	1.16	1.17	1.11	1.13	1.14	1.15	1.09	1.11	1.12	1.13	1.07	1.10	1.10	1.12
Available phosphorus, Av. P. %	0.58	0.58	0.58	0.59	0.54	0.53	0.54	0.54	0.48	0.49	0.50	0.50	0.46	0.46	0.45	0.46
Lysine%		1.60	1.57	1.55	1.50	1.39	1.37	1.34	1.25	1.21	1.18	1.14	1.12	1.05	1.00	0.98
Methionine%	0.69	0.68	0.68	0.67	0.62	0.62	0.62	0.62	0.60	0.59	0.58	0.58	0.57	0.56	0.56	0.55
Price/kg,LE	1.45	1.39	1.36	1.34	1.40	1.33	1.31	1.28	1.35	1.30	1.27	1.25	1.33	1.27	1.24	1.22

*A commercial vitamin and mineral premix contained (per 3 kg premix) Vit.A 12000 000 IU; Vit.D3 2000 000 IU; Vit.E 10 000mg; Vit.k3 2000mg. Vit. B1 1000mg; Vit. B2 5000 mg;
Vit. B6 1500mg; Vit. B12 10 mg; Choline chloride 250 000 mg; Nicotenic acid 30 000mg; Pantothenic acid 10 000mg; Folic acid 1000mg; Biotin 50mg; Mn 60 000mg; Zn 50 000mg;
Fe 30 000mg; Cu 10 000mg; I 1000mg; Se 100mg; Co 100mg; calcium carbonate carried add to 3.0 kg.
CP= crude protein CF= crude fibres EE= ether extract Ca= Calcium Av. P= available Phosphorus.

RESULTS AND DISCUSSION

Chemical and Biological Evaluation of Olive Cake

Chemical evaluation

Chemical composition of olive cake used in the present experiment compared to other studies are listed in table (2). Data revealed that olive cake had a higher level of crude fibers (CF) as 27.85% with moderate amount of crude protein (CP) as 10.38%. Ether extract (EE) and ash% showed values of 7.24% and 5.22% for the two components, respectively. However, data in table (2) showed some fluctuations among the different studies. For instance, Al-Shanti (2003a and b), reported higher level of CF (37.23 and 33.00%), while the values of Accardi *et al.* (1979) and Abd El-Maksoud (2001) were almost the same as the value of this study (29.0 and 27.66 vs.27.85%). Accardi *et al.* (1979) reported a higher value of EE than that of this study (23% compared to 7.24%). The values were affected by method of oil extraction and the proportion of the fruit components in the residue, in addition to the variation of the seed sources and stage of fruit maturity (El-Kerdawy, 1997; Al-Shanti, 2003a).

TABLE (2). Chemical composition of olive cake compared to other studies

Item	The present study	Accardi *et al.* (1979)	Abd El-Maksoud (2001)	Al-Shanti (2003 a)	Al-Shanti (2003b)
DM%	89.05	---	90.50	---	---
CP%	10.38	12.80	9.67	10.72	8.00
EE%	7.24	23.00	8.98	6.43	5.20
CF%	27.85	29.00	27.66	37.23	33.00
NFE%	38.36	31.00	33.24	37.72	36.80
Ash%	5.22	3.72	10.95	7.90	4.00

DM= dry matter, CP= crude protein, EE= ether extract, CF= crude fibers, NFE= nitrogen free extract

Biological evaluation

The nutrient digestibility coefficients and metabolizable energy content of olive cake using growing turkey are reported in table (3). Highest values were for NFE, EE, followed by CP. The values were 81.48, 74.3 and 55.08%, respectively. While the poults digested only 13.03% of olive cake CF, DM and OM digestibility coefficients revealed nearly the same value (49.5%). These results were in harmony with the values given by Abd El-Maksoud (2001). Energy content (kcal/kg) of olive cake in terms of gross energy (GE), apparent metabolizable energy (AME), nitrogen corrected apparent metabolizable energy (AMEn), true metabolizable energy (TME) and nitrogen corrected true metabolizable energy (TMEn) showed that olive cake has a considerable content of metabolizable energy. Abd El-Maksoud (2001) reported that metabolizable energy content of olive cake for broiler

was 2398 kcal/kg, while the value in this study was 2423 kcal/kg, for turkey poults.

Metabolizable energy content of olive cake may vary between turkey and chickens. Therefore, it is better to use the values derived from turkey poults in formulating turkey diets (Singh, 1991). The previous results showed the high nutritive value of olive cake, especially as a source of energy.

TABLE (3). Nutrients digestibility coefficients and metabolizable energy of olive cake estimated by using growing turkeys

Digestibility coefficients	%
Dry matter	49.44
Organic matter	49.49
Crude protein	55.08
Ether extract	74.30
Crude fibres	13.03
Nitrogen free extract (NFE)	81.48
Energy (kcal/kg)	
Gross energy	4507
Metabolizable energy	2385
Apparent metabolizale energy	2507
Nitrogen corrected apparent metabolizable energy	2423
True metabolizable energy	2808
Nitrogen corrected true metabolizable energy	2700

*ME calculated according to Titus and Fritz (1971)

The Effect of Olive Cake on the Growth Performance and Feed Utilization

Data presented in tables (4, 5, 6 and 7) showed averages of body weight, weight gain, feed intake and feed conversion values of the experimental treatments. Olive cake had a significant effect ($P<0.05$) on each of body weight and weight gain of turkey poults (Tables 4 and 5). Incorporating 15% olive cake in turkey diets, from 4 to 12 weeks of age had no significant effect on both body weight and body gain, when compared with the control (0% olive cake). While the birds tolerated 15% olive cake, after 12 weeks of age (either at 16 or 20 weeks of age). Least values were for 20% olive cake, which decreased body weight and weight gain, significantly as compared to the control diet.

Average feed intake (g/poult/day) was gradually increased, generally with the increasing of olive cake level in the diet, through the experimental periods (Table 6). The differences were not significant, between 0 and 10%, while 15 or 20% olive cake increased feed intake, significantly when compared to the control diet. The same trend was observed with feed

conversion values (g feed/ g gain), which were negatively influenced by 15 or 20% olive cake, but not 10% (Table 7).

The results obtained in the present study concerning the effects of olive cake on body weight, body weight gain and feed utilization were partially agreed with the findings of El-Husseiny (1981) and Al-Shanti (2003a) who found that olive cake up to 10% of the total diet had no significant effect on body weight, weight gain and feed utilization. Also, Hashish and Abd El-Samee (2002) found the same results using olive cake in laying hen diets. The negative effect of increased olive cake level on feed conversion of poults in the present study was previously confirmed by Abd El-Maksoud (2001) who reported that feed conversion of broilers negatively influenced by incorporating more than 6% olive cake in the diet. The high fibers content of the diets (Table 1) was found to be responsible for the poor feed utilization in broiler chickens (Vieira *et al.*, 1992; Soliman *et al.*, 1996). A reasonable explanation for increasing feed intake due to increasing olive cake could be attributed to the increase of fat levels (Table 1), or that olive cake was more palatable (Taklimi *et al.*, 1998).

TABLE (4). Effect of olive cake levels on body weights, g($\bar{x}$ ±SE).

Olive cake level	Ages (weeks)				
	4	8	12	16	20
0	474.27 ±7.71	1334.66^{a} ±22.02	2686.69^{a} ±42.71	3604.13^{a} ±59.39	4559.27^{a} ±65.22
10%	473.62 ±7.01	1328.86^{ab} ±20.29	2606.62^{ab} ±29.91	3572.73^{a} ±50.91	4548.38^{a} ±61.44
15%	469.86 ±7.23	1269.78^{bc} ±19.27	2548.75^{bc} ±34.99	3497.04^{ab} ±48.69	4437.59^{a} ±61.62
20%	472.76 ±9.67	1257.78^{c} ±25.18	2463.06^{c} ±43.47	3347.78^{b} ±55.84	4247.81^{b} ±63.12

^{a,b} Means in column bearing different letters are significantly different (P<0.05).

TABLE (5). Effect of olive cake levels on body weight gain, g/day, ($\bar{x}$ ±SE).

Olive cake level	Ages (weeks)			
	4-8	4-12	4-16	4-20
0	30.73^{a} ±0.56	39.51^{a} ±0.65	37.26^{a} ±0.64	36.47^{a} ±0.54
10%	30.54^{a} ±0.53	38.09^{ab} ±0.47	36.89^{a} ±0.56	36.38^{a} ±0.51
15%	28.57^{b} ±0.57	37.12^{bc} ±0.57	36.04^{a} ±0.55	35.43^{a} ±0.53
20%	28.04^{b} ±0.62	35.54^{c} ±0.67	34.23^{b} ±0.58	33.71^{b} ±0.51

^{a,b} Means in column bearing different letters are significantly different (P<0.05).

TABLE (6). Effect of olive cake levels on feed intake, g/poult/day, ($\bar{x}$ ±SE).

Olive cake level	Ages (weeks)			
	4-8	4-12	4-16	4-20
0	77.41^{b} ±0.85	105.57^{b} ±0.57	119.71^{b} ±0.46	134.65^{b} ±0.45
10%	76.15^{b} ±0.65	104.82^{b} ±0.56	119.93^{b} ±0.57	135.27^{b} ±0.65
15%	80.54^{a} ±0.96	107.76^{a} ±0.52	122.05^{a} ±0.30	137.66^{a} ±0.17
20%	81.44a ±0.84	108.71^{a} ±0.54	122.53^{a} ±0.46	138.19^{a} ±0.48

^{a,b} Means in column bearing different letters are significantly different (P<0.05).

TABLE (7). Effect of olive cake levels on feed conversion, g.feed/g.gain ($\bar{x}$ ±SE)

Olive cake level	Ages (weeks)			
	4-8	4-12	4-16	4-20
0	2.52^{b} ±0.04	2.68^{c} ±0.05	3.22^{c} ±0.05	3.69^{c} ±0.05
10%	2.51^{b} ±0.07	2.76^{bc} ±0.05	3.26^{bc} ±0.04	3.73^{c} ±0.05
15%	2.83^{a} ±0.06	2.91^{b} ±0.04	3.39^{b} ±0.04	3.89^{b} ±0.05
20%	2.92^{a} ±0.06	3.09^{a} ±0.08	3.59^{a} ±0.06	4.11^{a} ±0.04

^{a,b} Means in column bearing different letters are significantly different (P<0.05).

The Effect of Olive Cake on Digestibility Coefficients and Nutritive Values of the Experimental Diets

Results in table (8) showed that digestibility coefficients and nutritive values were significant (P<0.05) and gradually decreased with increasing olive cake level in the diets. There were no differences between 15 and 20% in most cases. The nutritive values of the experimental diets as expressed as total digestible nutrients (TDN) and metabolizable energy (ME) ranged between 69.66 to 62.19% and 2925 to 2595 kcal/kg, for the control and 20% olive cake diet, respectively. These results agreed with the findings of Abd El-Maksoud (2001) who found a significant decrease in all digestibility coefficients of nutrients (except EE) and the nutritive value of the diets when olive cake inserted at more than 6% of total broiler diets. Also, Hashish and Abd El-Samee (2002) reported a significant decrease in OM, DM and CF digestibility when laying hens fed on a diet containing 10% olive cake. Ben Rayana *et al.* (1994) reported a significant decrease in CP and CF digestibility coefficients when rabbits fed diets containing 11.5% olive cake. Also, Al-Shanti (2003b) found that the digestibility coefficients of CP and

CF significantly decreased when olive cake was incorporated at 15 or 20% of the rabbits diets.

The reduction in digestibility coefficients due to increasing olive cake level was explained by Sandford *et al.* (1979) who indicated that as the proportion of fiber rises, the dry matter digestibility falls. Moreover, fibers tend to protect the nutrients from digestion enzymes, hence a lower digestibility coefficients of nutrients could be occurred (Zaki El-Din, 1996). Aguilera (1987) revealed that the high lignin content of olive cake and the fact that most of its total nitrogen is linked to lignocellulose are the two main factors limiting the digestion of olive residues.

TABLE (8). Nutrients digestibility coefficients and nutritive values of the experimental diets as affected by olive cake level in growing turkey diets

Olive cake, %	Nutrient digestibility coefficients%						TDN %	ME* Kcal/ Kg
	DM	OM	CP	CF	EE	NFE		
0.0	68.10^{a} ±0.66	67.88^{a} ±0.79	78.95^{a} ±0.77	27.09^{a} ±0.50	84.36^{a} ±2.76	65.45^{a} ±0.84	69.66^{a} ±0.84	2925^{a} ±34.8
10	63.86^{b} ±0.33	64.22^{b} ±0.43	73.27^{b} ±0.54	22.61^{b} ±0.67	75.24^{b} ±0.68	63.45^{ab} ±0.56	66.13^{b} ±0.41	2772^{b} ±17.12
15	60.85^{c} ±0.84	61.65^{c} ±0.90	66.95^{c} ±0.66	19.59^{c} ±0.39	74.09^{b} ±0.71	61.33^{b} ±1.18	63.15^{c} ±0.82	2652^{c} ±34.5
20	58.25^{d} ±0.39	60.18^{c} ±0.34	61.61^{d} ±0.82	17.70^{d} ±0.34	70.60^{b} ±1.86	63.42^{ab} ±0.57	62.19^{c} ±0.45	2595^{c} ±25.95

a,b,c Means in column bearing different letters are significantly different (P<0.05)

*Calculated according to Titus and Fritz (1971)

DM= dry matter, OM= organic matter, CP= crude protein, CF= crude fibres, EE= ether extract, NFE= nitrogen free extract, TDN= total digestible nutrients, ME= metabolizable energy

Carcass Characteristics

The effects of olive cake levels on carcass weight, dressing percentage, giblets percentage (heart, liver and gizzard) and edible giblets as percentage of live weight are shown in table (9). Olive cake levels had no significant difference on carcass weight, dressing percentage, breast, thigh, wings and heart weight percentage. Values in this respect ranged between 71.18 to 73.57, 43.28 to 45.54, 40.07 to 41.75, 7.20 to 7.87 and 0.649 to 0.720% for dressing percentage, breast, thigh, wings and heart weight percentage, respectively. Liver weight percentage was significantly (P<0.05) influenced by olive cake levels. In this concern, liver weight percentage showed values of 2.14, 2.12, 2.37 and 2.46% for 0, 10, 15 and 20% olive cake, respectively. Gizzard percentages were increased significantly (P<0.05) by increasing olive cake level up to 15%, there was no significant difference between 15 and 20%. Total edible viscera (giblets) as percentage of live weight was increased significantly by 15 or 20% olive cake, but not

10%, recording a range between 6.26 and 7.81% for the control and 15% olive cake, respectively.

The results obtained herein concerning the effects of olive cake levels on carcass characteristics were in accordance with the findings of El-Husseiny (1981), Said (1998), Abd El-Maksoud (2001) and Al-Shanti (2003a) on broilers. Also, Ben Rayana *et al.* (1994), Zaza *et al.* (2001) and Al-Shanti (2003b) found no significant effects on carcass percentages of rabbits when they fed diets included olive cake up to 20%.

The increasing of relative weight percentage of gizzard with the increasing of olive cake, consequently the fiber content of the diets, may be explained by Shires *et al.* (1987) who reported that gizzard is the major site for grinding of digesta and Branion (1963) who revealed that gizzard size may be affected by the amounts of work required of the muscular walls of the organ to comminute the feed particles.

Ileal digesta viscosity (Table 9) was insignificantly increased by increasing olive cake level from 5.29, for the control to 5.94, for the 20% olive cake diet. In this regard, analysis of fiber fractions of olive cake showed its high cell wall constituents 72% neutral detergent fibers (NDF), lignocellulose, 60% acid detergent fibers (ADF), lignin, 31% acid detergent lignin (ADL), 29% cellulose and 12% hemicellulose, which act as anti-nutritional factors (Nefzaoui, 1979). These components result in increasing the viscosity of the gut digesta and impairment of the digestion and absorption of dietary nutrients, which led to growth depression (Choct and Annison, 1990).

Organoleptic Properties of Turkey Meat

Values of organoleptic properties of breast meat were not affected significantly ($P<0.05$) by olive cake levels (Table 10). The values of overall acceptability were between 5.91 and 6.07%, for 20% olive cake and the control diet, respectively. However, the appearance or the color may be the one which was affected slightly by olive cake, where the value ranged between 5.92 and 6.35 for 10% and the control diet, respectively.

Chemical Analysis of Carcass Meat

Chemical compositions of carcass meat (Table 11) were not significantly ($P<0.05$) influenced by olive cake level, except EE, which decreased gradually by increasing olive cake level, but the difference was significant only between 20% olive cake and the control diet (2.73 vs.3.17%). The values were between 27.69 to 28.33, 22.75 to 23.14 and 2.06 to 2.17% for DM, CP and ash, respectively.

The decrease in ether extract content of carcass meat with increasing of olive cake level in the diets was confirmed by Al-Shanti (2003a) who noted low proportion abdominal fat of carcass due to higher level of olive cake in the diet. Also, El-Kerdawy (1997) and Al-Shanti (2003b) showed a gradual decrease in ether extract content in carcass meat of rabbits due to

increasing of olive pulp or olive cake in the diets. This can be explained by two mechanisms. The first is the formation of bile salts from fatty acids to face up the digestion of oil which included in olive cake (Wahba, 1969; Al-Shanti, 2003a). The second is the high fiber content of the experimental diets due to increasing olive cake level may play a role in reducing the fat content of carcass, as it interrupts enter hepatic circulation by binding the circulating bile acids and preventing their subsequent reabsorption (Story and Kritchersky, 1976).

Economical Evaluation

Economical evaluation of the experimental treatments as affected by olive cake levels are listed in table (12). It could be indicated that poults fed a diet with 10% olive cake followed by those fed on 15% olive cake showed the best economical efficiency. However, the worst economical efficiency was noticed in 20% olive cake followed by the control group. These results were satisfactory agreed with the results of Said (1998), Zaza *et al.* (2001), Abd El-Maksoud (2001), Hashish and Abd El-Samee (2002) and Al-Shanti (2003b). It must be mentioned that economical efficiency may differs among the experiments depending on some factors like the total feed cost, feed prices and the total weight gain of bird.

In conclusion, it could be advisable to use olive cake at a level of 15% in growing turkey diets without detrimental effects on productive performance and carcass characteristics.

TABLE (9). Effect of olive cake levels on carcass characteristics ($\bar{x}$ ±SE)

Olive cake level	Carcass weight	Dressing %	Relative weights%							Viscosity
			Breast	Thighs	Wings	Heart	Liver	Gizzard	Edible giblets	
0	3279.4 ±108.6	73.57 ±1.80	45.54 ±1.02	40.19 ±0.86	7.40 ±0.27	0.649 ±0.020	2.14^{b} ±0.125	3.47^{c} ±0.127	6.26^{b} ±0.197	5.29 ±0.11
10%	3315.4 ±112.9	73.18 ±0.77	45.04 ±0.66	40.07 ±0.41	7.87 ±0.29	0.692 ±0.018	2.12^{b} ±0.076	4.00^{b} ±0.197	6.81^{b} ±0.259	5.42 ±0.13
15%	3091.8 ±64.3	73.0 ±0.62	43.28 ±0.74	41.75 ±0.61	7.82 ±0.18	0.693 ±0.021	2.37^{ab} ±0.11	4.55^{a} ±0.125	7.81^{a} ±0.197	5.63 ±0.14
20%	3030.2 ±92.5	71.18 ±0.73	45.23 ±0.78	40.28 ±0.76	7.20 ±0.30	0.720 ±0.059	2.46^{a} ±0.040	4.52^{a} ±0.145	7.70^{a} ±0.196	5.94 ±0.14

^{a,b} Means in column bearing different letters are significantly different (P<0.05).

TABLE (10). Effect of olive cake levels on sensory evaluation of carcass meat ($\bar{x}$ ±SE)

Olive cake level	Sensory traits, ($\bar{x}$ ±SE)						
	Appearance	Odour	Taste	Texture	Tenderness	Juiciness	Overall acceptability
0	6.35 ±0.13	6.12 ±0.14	6.06 ±0.13	6.11 ±0.12	5.99 ±0.15	5.79 ±0.15	6.07 ±0.10
10%	5.92 ±0.12	6.16 ±0.10	6.19 ±0.13	6.05 ±0.14	5.95 ±0.12	5.45 ±0.24	5.95 ±0.09
15%	5.98 ±0.13	6.11 ±0.12	6.06 ±0.14	6.10 ±0.16	6.00 ±0.13	5.47 ±0.21	5.95 ±0.10
20%	5.97 ±0.10	6.02 ±0.12	6.06 ±0.10	5.94 ±0.13	5.91 ±0.10	5.52 ±0.17	5.91 ±0.08

TABLE (11). Effect of olive cake levels on chemical analysis of carcass meat($\bar{x}$ ±SE)

Olive cake level	Dry matter%	Crude protein%	Ether extract%	Ash%
0	28.05 ±0.20	22.75 ±0.21	3.17[a] ±0.10	2.07 ±0.05
10%	28.33 ±0.17	23.14 ±0.23	3.10[a] ±0.11	2.06 ±0.05
15%	28.25 ±0.23	23.02 ±0.25	3.09[a] ±0.07	2.13 ±0.06
20%	27.69 ±0.15	22.79 ±0.21	2.73[b] ±0.06	2.17 ±0.06

[a,b] Means in column bearing different letters are significantly different (P<0.05).

TABLE (12). Economical evaluation of growing turkey diets with different levels of olive cake (4- 20wks of age)

Olive cake	Total feed intake/poult	Price/kg feed	Total cost/feed	Total weight gain	Selling revenue*	Net revenue	Economic efficiency ratio	Relative economic efficiency
%	kg	LE	LE	Kg	LE	LE	%	%
0	15.08	1.39	20.81	4.09	49.06	28.27	135.85	100
10	15.15	1.33	20.15	4.07	48.84	28.59	142.38	104.81
15	15.42	1.32	20.05	3.97	47.64	27.59	137.60	100.29
20	15.48	1.27	19.66	3.77	45.36	25.70	130.72	96.22

* Price of kg live body weight =12 LE

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الإستفادة من كسب الزيتون كخامة علفية غير تقليدية فى علائق الرومى النامى

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أجريت هذه التجربة بمحطة بحوث مريوط فى محاولة لتقييم كسب الزيتون كخامة علفية فى علائق الرومى النامى ودراسة تأثير ذلك على الأداء الإنتاجى، الإستفادة من الغذاء، معاملات الهضم وصفات الذبيحة. استخدم فى هذه التجربة عدد ٤٦٨ طائر عمر شهر من سلالة البلدى الأسود والتى وزعت فى ٤ مجموعات تجريبية، اشتملت كل مجموعة على ١١٧ طائر فى ٣ مكررات، اشتملت كل مكررة على ٣٩ طائر.تم اضافة كسب الزيتون بمعدل صفر، ١٠، ١٥ و ٢٠% من اجمالى العليقة الكلية، هذا وقد استمرت التجربة لمدة ١٦ أسبوع.

أظهرت النتائج أن كسب الزيتون يحتوى على معدل مرتفع من الألياف الخام (٢٧,٨٥%) مع كمية مناسبة من البروتين الخام (١٠,٣٨%). سجل كلا من مستخلص الإثير والرماد قيما هى ٧,٢٤% و ٥,٢٢% للمكونين على التوالى. أظهر كسب الزيتون قدرا معقولا من الطاقة الممثلة (٢٧٠٠ ك كالورى/كجم).

فى نهاية فترة التسمين (٢٠ أسبوع من العمر)، أظهرت التجربة أن استخدام كسب الزيتون حتى مستوى ١٥% من اجمالى العليقة الكلية لم يكن له تأثيرا معنويا على وزن الجسم و متوسط الزيادة فى وزن الجسم بينما أظهر المستوى ٢٠% من كسب الزيتون تأثيرا سلبيا على كلتا الصفتين وعموما كان متوسط وزن الجسم للطيور ٤٥٥٩,٢٧، ٤٥٤٨,٣٨، ٤٤٣٧,٥٩ و ٤٢٤٧,٨١ جم وذلك لمستويات ٠، ١٠، ١٥ و ٢٠% من كسب الزيتون على التوالى بينما كان متوسط الزيادة فى وزن الجسم هو ٣٦,٤٧، ٣٦,٣٨، ٣٥,٤٣ و ٣٣,٧١ جم/يوم لنفس المستويات السابقة من كسب الزيتون على التوالى. زاد معدل استهلاك العليقة مع زيادة نسبة كسب الزيتون، على النقيض من ذلك انخفضت كفاءة تحويل الغذاء مع زيادة نسب الكسب فى العليقة. كذلك انخفضت معاملات هضم المكونات الغذائية مع زيادة نسبة كسب الزيتون بالعليقة.

لم يتأثر وزن الذبيحة، نسبة التصافى، نسب أجزاء الذبيحة، المتوسط النسبى لبعض أعضاء الذبيحة وأيضا الإختبارات الحسية واختبارات التذوق بمستويات كسب الزيتون المختلفة فى العليقة. زادت درجة لزوجة محتويات الأمعاء بصورة غير معنوية مع زيادة نسبة كسب الزيتون فى العليقة. سجل كلا من متوسط وزن القونصة والكبد زيادة معنوية عند مستويات الكسب المرتفعة فى العليقة. لم يتأثر التركيب الكيماوى لعينات الذبيحة باستثناء محتواها من مستخلص الإثير والذى انخفض معنويا بزيادة مستوى الكسب فى العليقة.

أظهرت الطيور المغذاة على ١٠% كسب زيتون متبوعة بتلك التى غذيت على ١٥% كسب فى علائقها أعلى كفاءة اقتصادية بينما كانت أقل القيم لطيور المجموعة المغذاة على عليقة بها ٢٠% كسب زيتون متبوعة بمجموعة الكونترول. مما سبق يمكن النصح باستخدام كسب الزيتون بمعدل ١٥% فى علائق الرومى النامى دون تأثير سلبى على معدل الأداء وصفات الذبيحة.