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Effect of Olive Cake Pulp as A Partial or A Complete Substitute of Wheat Bran in Growing Rabbits' Diet on Growth Performance, Carcass Traits and Blood Constituents under North Sinai Conditions

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ABSTRACT

Sixty weaned New Zealand white rabbits of both sexes aged 6 wk and weighed 715 g were randomly divided into four treatment groups (15 rabbits each) to evaluate the possibility of feeding growing rabbits on diets containing olive cake pulp (OCP) as partial or complete substitution of wheat bran. The first group (C) was fed the basal diet as control (0%OCP), while the other three treatment groups (L, M, H) were fed diets containing 15, 20 and 25%OCP, respectively replacing wheat bran in the basal diet. All the experimental diets contained nearly the same level of crude protein (CP) and digestible energy (DE). All the experimental diets were formulated to cover the nutrient requirements of rabbits. Results revealed that dietary treatments had no significant effect on live body weight (LBW), total weight gain (TWG), average daily gain (ADG) and daily fed intake (DFI) at different ages (6-14 wk). At the same time, LBW, TWG and ADG tended to be higher in rabbits fed M and H diets than those fed C and L diets. Daily feed intake of the L group tended to be lower ($P>0.05$) than that of the other groups (C, M and H). Feed conversion of H group was the best compared with the other groups (C, L and M groups). Glucose and triglycerides levels in blood serum of rabbits decreased significantly ($P<0.05$) due to treatment. However, serum total protein, albumin, globulin, Alb/Glo, cholesterol, urea, creatinine, AST and ALT were not affected significantly ($P>0.05$) by treatment. Almost carcass traits (empty carcass, edible giblets and dressing) were not affected ($P>0.05$) by treatment. From the economic point of view, it appears that the inclusion of OCP in growing rabbit diets by 15, 20, 25% instead of wheat bran as fed basis decreased feed cost/ kg gain by 9.11, 7.25 and 14.32%, respectively. The economic efficiency values of the experimental diets were increased by 23.88, 20.15 and 26.73%, respectively compared with the control diet. In conclusion, olive cake pulp (OCP) could be incorporated in growing rabbits diets up to 25% without adverse effects on growth performance, carcass traits, blood constituents and economic efficiency.

Keywords: Rabbits, olive cake pulp, productive performance, carcass traits, blood constituents, economic efficiency.

INTRODUCTION

In some developing countries, rabbits are considered a good source for meat production because of their high reproductive rates, short generation period, rapid growth rates, high feed efficiency and simple housing requirements. Also, they can be fed a diet containing fibrous by-products (Aboul-Ela *et al.,* 2011). These fibers play a role in maintaining micro-ecological balance of the gut, promoting digestive system development and raising reproductive performance of rabbits (GU, 2002).The acute shortage of energy sources and their increasing costs are the main limiting factors for improving and increasing animal production. Therefore, many efforts to find economical energy sources that are less competitive with human foods have been intensified. Using agro-industrial by-products such as olive cake pulp in animal diets may participate in solving the problem of energy sources shortage, decrease the feeding cost and hence marketing price of animal products and alleviate pollution problems.

Olive cake pulp (OCP) as agro-industrial by-product has been demonstrated by many investigators as an energy source for rabbits (EL-Kerdawy, 1997; Abdel-Naby, 1998; EL-Sayed, 2010 and Mehrez and Mousa, 2011). In North Sinai, olive cake pulp represents the majority of agro-industrial by-products. About 35000 ton of olive fruits are annually produced and about 3000 ton olive cake pulp remain after oil extraction (North Sinai governorate, 2000). The operation of olive oil extraction is seasonal, starts from September to November. Each 1000 kg of fresh olive fruits produce 214 kg olive oil, 496 kg crude olive cake and 40 kg of leaves (V. Christodoulou *et al.,* 2008). Olive cake pulp is a moderate protein and ether extract source, but it is a high crud fiber source. It contains from 8 to 10 % protein (EL-Kerdawy, 1997; Abdel Samee *et al.*, 2003; Abd EL-Galil, 2001; Rabayaa *et al*., 2001 and Mehrez and Mousa, 2011). It contains about 9 to 18% ether extract and about 18.5 to 33% crud fiber (EL-Kerdawy, 1997; EL-Sayed, 2010 and Mehrez and Mousa, 2011). The feeding values of olive cake pulp (as-fed basis) are 46.48% TDN, 40.33% S.V and 8.56 MJ DE/g (Ghazalah and EL-Shahat, 1994). Also, EL-Lathy (2001) showed that DE of olive cake pulp was 3654 kcal/kg. Many investigators studied the effects of different levels of olive cake pulp (up to 30%) in rabbit diets on growth performance and feed efficiency (EL-Kerdawy, 1997; Abdel-Naby, 1998; EL-Sayed, 2010; Aboul-Ela *et al*., 2011 and Mehrez and Mousa, 2011). Their results showed that inclusion of OCP up to 25% in rabbit diets did not greatly affect either body weight changes or feed efficiency and had no effect on carcass traits.

The objective of this study was to investigate the effects of a partial or complete substitution of wheat bran by olive cake pulp in growing rabbit diets on growth performance, biochemical changes of the blood, carcass traits and economic efficiency.

MATERIALS AND METHODS

This study was carried out for 8 wk during the period from April to June 2015 at the rabbitry farm, Department of Animal and Poultry Production, Faculty of Environmental Agricultural Sciences, Arish University, North Sinai, Egypt.

The olive cake pulp was collected during the olive pressing season from September to November 2014. Olive cake pulp was spread on a plastic sheath for sun-drying until its content of moisture roughly reached 10%.

Separation of stones was performed using a 2mm sieve where big particles of stones were removed. Partly stoned olive cake pulp (OCP) obtained was stored in bags until it was used and sample of (OCP) was analyzed for crude protein (CP), crude fibre (CF), ether extract (EE),

ash, calcium (Ca) and phosphorus (P) according to A.O.A.C. (2012).

Feeding and Management. Sixty weaned New Zealand White (NZW) rabbits (6 wk old, 715 g body weight) were randomly allocated into 4 similar groups (15 rabbits each). The experimental period lasted for 56 days (from 6 to 14 wk of age). The first group (Control, C) was fed a pelleted control diet, while the other three groups (L, M and H) were fed diets containing 15, 20 and 25% of OCP to substitute 60, 80 and 100% of the wheat bran in the control diet, respectively (Table 1). OCP was mixed with feed ingredients and then the experimental diets under temperature of 65-70^{o} were pelleted at 0.4 cm diameter and 2 cm length. The experimental diets were formulated to be iso-nitrogenous (17%CP) and iso-caloric (2500kcal DE/kg diet). Diets were formulated to meet the recommended nutrient requirement of growing rabbits according to Agriculture Ministry Decree (1996). The composition of the experimental diets is presented in Table 1.

Rabbits were housed in galvanized wire cages measured (40*40*30 cm) in a well-ventilated building (natural through the window). The growing rabbits were housed as three in each cage. Cages were provided with feeders and automatic nipple drinkers.

Diets were offered to rabbits *ad libitum* and fresh water was available all the time. Urine and feces dropped from cages on the floor were cleaned every day in the morning. All rabbits were kept under the same managerial, hygienic and environmental conditions. All rabbits were individually weighed at the start of the experiment (6 wk of age) and weekly thereafter until marketing age (14 wk).

Weighing was done before offering the morning meal and feed consumption was recorded weekly. Body weight gains, feed conversion (g feed/g gain) and economic efficiency were calculated.

Carcass Traits. At the end of the experimental period (14 wk of age), three rabbits were randomly chosen from each treatment to study carcass traits. Rabbits were kept off feed overnight and body weights were recorded next morning prior to slaughter. After bleeding and skinning were completed, the carcass was opened down and all entrails were removed. The empty carcass with head, liver, kidneys and heart were weighed separately (Cheeke, 1987) and were calculated as percentage of live body weight at slaughtering.

Blood Constituents: At the end of the experimental period, individual blood samples from the same slaughtered rabbits were collected in dry clean centrifuge tubes and allowed to clot at room temperature for 30 min. Serum was then separated by centrifugation at 3000 rpm for 15 min and was subsequently decanted into glass vials and stored at -20Ċ until it was analyzed. Serum total protein and glucose were colorimetrically determined using Kits supplied by Bio-merleux, France. Urea and creatinine colorimetrically determined using Kits supplied by Diamond, Egypt. Albumin, ALT and AST were colorimetrically determined using Kits supplied by Randox, England. Serum globulin was obtained by difference (Total protein minus albumin) and albumin/globulin (Alb/Glob) ratio was calculated. Cholesterol and triglycerides were colorimetrically determined using Kits supplied by Spectrum, Egypt.

Table 1. Composition and calculated analysis of the experimental diets.

Item	Dietary Treatment[1]			
	C	L	M	H
Ingredients %				
Alfalfa hay (12% CP)	32	25	22	20
Yellow corn	10	12	12	10
Barley	15	17	18	21
Soya bean meal (44% CP)	12	15	17	18
Wheat bran	25	10	5	-
Olive cake pulp (OCP)	-	15	20	25
Molasses	3	3	3	3
Salt	0.3	0.3	0.3	0.3
Limestone	1.2	1.2	1	1
Vitamins and mineral mixture[2]	0.3	0.3	0.3	0.3
Di-calcium phosphate	1.2	1.2	1.4	1.4
Total	100	100	100	100
Calculated analysis[3] :				
Digestible energy (DE)[4] kcal/kg	2540	2480	2470	2440
Crude protein (CP),%	17.30	17.45	17.80	17.91
Crude fiber (CF),%	12.41	14.17	14.68	15.44
NDF,%	37.77	38.23	38.57	39.07
Ether extract (EE), %	2.800	4.650	5.251	5.810
Calcium (CA), %	1.260	1.240	1.206	1.205
Phosphorus (P), %	0.764	0.600	0.587	0.534
Available phosphorus,%	0.465	0.380	0.392	0.365
Lysine,%	0.849	0.800	0.800	0.790
Methionine,%	0.290	0.230	0.210	0.193
DE:CP	158.0	159.9	157.9	157.2
Price/kg diet[5]	2.440	2.300	2.280	2.240

[1]Dietary Treatment; C= Control, containing no OCP; L= containing 15% OCP; M= containing 20% OCP; H= containing 25% OCP%.

[2]Vitamens and Min. mixture per kg contains: 12000 IU Vit. A; 2200 IU D3; 10mg Vit. E; 2.0 mg Vit. K_3; 1.0 mg Vit. B1; 4.0 mg Vit.B2; 1.5 mg Vit. B6; 0.0010 mg Vit. B12; 6.7 mg Vit. Pantothenic acid; 6.67 mg Vit. B5; 1.07 mg Biotin; 1.67 mg folic acid; 400 mg Choline chloride; 22.3 mg Zn; 10 mg Mn; 25 mg Fe; 1.67 mg Cu; 0.25 mg I; 0.033 mg Se and 133.4 mg Mg.

[3]According to MOA 2001

[4]Calculated according to Cheeke (1987): DE (kcal/g) = 4.36 - 0.0491 (%NDF).
%NDF=28.924+0.657(%CF).

[5]According to price of feed ingredients (2015).

Economic Efficiency (EE): The EE is defined as the net revenue per unit feed cost calculated from input output analysis as described by Abd EL-Maksoud (2011). The EE was calculated according to prices of feed and live body weight of rabbits (2015) as follows :

Feed cost = total feed intake (kg)/rabbit * price of kg feed (LE)

Selling revenue = Body weight gain/rabbit * price of kg for live body weight

Net revenue = Difference between selling revenue and feed cost

Economic efficiency = (Net revenue / total feed cost)*100

Relative economic efficiency (R. E. E), assuming control group =100

Statistical analysis: The collected data were statistically analyzed by One-Way analysis of variance. Data were analyzed using SPSS 16.0 software for windows (2007). The results were reported as mean ± standard error. Differences between treatment means were determined by Duncan's method (1955). Difference were considered significance at $p<0.05$.

RESULTS AND DISCUSSION

Chemical Composition of Olive Cake Pulp (as- fed):

Chemical analysis of olive cake pulp (as - fed) is presented in Table 2. The OCP contained 90.7% DM, 85.5% OM, 12.65% CP, 16.76% EE, 30.68% CF, 25.41%NFE and 5.2% ash. Values of CP%, CF% and EE% of olive cake pulp in these study were higher than those obtained by Abd EL-Galil (2001), Rabayaa *et al.* (2001) and Mehrez and Mousa (2011). This may be due to the type of olive, stage of maturity of the fruits, the method of oil extraction and the environmental conditions (local of plantation).

Table 2. Chemical composition of olive cake pulp (as-fed).

Item	Olive cake pulp	Wheat bran2
Dry matter (DM),%	90.7	88
Organic matter (OM),%	85.5	82
Crude protein (CP),%	12.65	15
Crude fiber(CF) ,%	30.68	11
Ether extract (EE), %	16.76	4
Nitrogen free extract (NFE), %	25.41	52
Ash %	5.2	6
Neutral detergent fiber (NDF),%	49.08	36.9
Acid detergent fiber (ADF),%	37.41	12.1
Ca,%	0.55	0.15
P ,%	0.07	0.92
DE[1](kcal/kg)	1950	2550

DE[1] Calculated according to Cheeke (1987). DE (kcal/g) =4.36-0.0491 (%NDF). %NDF=28.924+0.657(%CF). %ADF=9.432+0.912 (%CF). [2]According to MOA (2001).

Growth Performance and Feed Efficiency:

Data presented in Table 3, showed that live body weight, total weight gain and daily weight gain of growing rabbits at different ages did not differ significantly due to treatment. Live bod weight at 14 wk of age and total weight gain at 10-14 wk and at 14 wk of age of rabbits of M and H treatment groups were improved slightly (P>.05) compared with those of C or L groups. Average daily gain (ADG) followed the same trend as the live body weight (LBW). Similar results were obtained by Rupic *et al.* (1999), Aboul-Ela *et al.* (2011) and Ali *et al.* (2011) who found that different proportion up to 28% olive cake pulp inclusion in rabbit's diets had no adverse effects on final body weight and daily weight gain.

Daily feed intake (DFI) did not differ significantly among treatments (Table 3). Averages of DFI during the whole experimental period (6-14week) were 102.7, 93.2, 106.5 and 102.1 for C, L, M and H groups, respectively. The L group tended to be lower in DFI compared with other groups. These results were in agreement with those reported by Abou-Ela *et al.* (2011) who found that averages of DFI were 101.6, 102.6,93.63,104.8 and 105 for rabbits fed diets containing 0, 7, 14, 21 and 28 % olive cake meal for eight wk (from 5-13 wk).

Feed conversion efficiency during the whole experimental period (6-14 wk) was the best in H group (4.27) followed by L group (4.41) while C and M groups had similar means 4.58 and 4.54 (Table 3). Similar results were obtained by Rupic *et al.* (1999) who found that rabbits fed diet containing 20% olive cake had the best feed conversion while those fed diet containing no olive cake had the lowest. In the contrast, Ali *et al.* (2011) observed that feed conversion of rabbits fed diet containing 22% OK was lower (P<0.05) than that fed basal diet.

Table 3. Growth performance and feed efficiency of growing New Zealand White rabbits as affected by dietary level of olive cake pulp.

Item	Dietary Treatment*			
	C	L	M	H
Live body weight (g)				
6 wk	715 ± 50	714 ± 51	715±50	715±50
10 wk	1544 ± 82	1421 ± 87	1556±69	1605±91
14 wk	1982 ± 94	1908 ± 67	2064±118	2116±68
Total weight gain (g)				
6-10 wk	820±69	698±49	808±61	829±58
10-14 wk	438±35	487±64	506±54	511±58
6-14 wk	1257±91	1185±50	1314±113	1339±71
Daily weight gain (g)				
6-10 wk	29.2±2.5	24.9±1.8	28.9±2.2	29.6±2.1
10-14 wk	15.7±1.3	17.4±2.3	19.2±1.7	18.2±2.1
6-14 wk	22.5±1.7	21.2±0.9	23.5±2.0	23.9±1.3
Feed intake g/h/d				
6-10 wk	105.8±9.8	91.5±5.5	108.3±16.6	98.7±11.4
10-14 wk	99.6±7.6	95.0±7.7	104.7±9.3	105.6±5.6
6-14 wk	102.7±5.9	93.2±4.4	106.5±8.8	102.1±6.0
Feed conversion ratio (g)				
6-10 wk	3.42±0.05^{a}	3.67±0.03^{a}	3.75±0.06^{a}	3.33±0.05^{b}
10-14 wk	6.37±0.02^{a}	5.46±0.02^{c}	5.72±0.06^{b}	5.79±0.03^{b}
6-14 wk	4.58±0.02^{a}	4.41±0.01^{b}	4.54±0.05^{a}	4.27±0.02^{c}
No. of dead rabbits	2	2	4	5
Viability %	86.7	86.7	73.3	66.7

^{a,b,c}Means in the same row with different superscripts differ (P<0.05). *Dietary Treatment; C= Control, containing no OCP; L= containing 15% OCP; M= containing 20% OCP; H= containing 25% OCP%.

Viability (V %):

Viability percentage from 6-14 wk of age decreased gradually with increasing the OCP level in rabbits' diet as shown in Table 3. However, all deaths occurred during the first three wk. These findings are in agreement with those obtained by Abd EL-Galil (2001) who found that mortality rate (MR) of growing rabbits increased gradually with increasing OCP level up to 20% in rabbits' diet.

Carcass Traits:

Data in Table 4 showed that OCP inclusion in growing rabbits diets at varying levels (15, 20 and 25%) did not show any significant effect on all carcass traits (empty carcass with head, total edible parts, head and edible giblets either as weight or percentage of pre-slaughter weight except edible giblets and liver %. However, edible giblet and liver % of rabbits of H group were lower (P<0.05) than those of C but did not differ significantly with those of L or M treatment groups. Similarly, Abd EL-Galil (2001) showed non-significant differences in carcass traits of rabbits fed either control or 20% olive pulp meal. Abou-Ela *et al.* (2011) found that carcass traits as percentage of pre-slaughter weight did not differ significantly with up to 28% OKM in rabbits' diets.

Table 4. Effect of the different levels of olive cake pulp in growing New Zealand White rabbit diets on carcass characteristics.

Item	Dietary Treatment[1]			
	C	L	M	H
Live-body weight (LBW)	2166.7±62	2141.7±62	2116.7±139	2040.0±59
Empty carcass weight (g)	1359.7±50	1358.7±73	1341.7±132	1271.0±107
% of LBW	62.8±0.86	63.4±0.39	63.5±1.29	62.3±3.84
Total edible parts (g)[2]	1443.3±27	1436.7±47	1420.0±85	1338.3±65
% of LBW(dressing),	66.7±0.6	67.07±0.36	67±0.54	65.59±2.37
Edible giblets (g)[3]	85.3±1.2	78.0±5.86	78.3±9.21	67.33±3.76
% of LBW	3.95±0.14[a]	3.63±0.17[ab]	3.68±0.20[ab]	3.30±0.16[b]
Head (g)	127.7±11	129.6±6.89	115.3±5.36	127.0±2.65
% of LBW	5.9±0.41	6.05±0.18	5.46±0.11	6.24±0.29
Liver(g)	66.3±1.^	60.3±4.48	61.0±7.94	51.0±2.65
% of LBW	3.07±0.14[a]	2.81±0.13[ab]	2.86±0.20[ab]	2.50±0.13[b]
kidney (g)	12.7±0.3	13±1.15	11.6±1.20	10.6±0.67
% of LBW	0.58±0.03	0.61±0.04	0.55±0.02	0.52±0.02
Heart (g)	6.3±0.9	4.67±0.33	5.67±0.33	5.67±0.67
% of LBW	0.29±0.04	0.22±0.01	0.27±0.02	0.28±0.03

[a,b]**Means in the same row with different superscripts differ (P<0.05).**

[1]**Dietary Treatment; C= Control, containing no OCP; L= containing 15% OCP; M= containing 20% OCP; H= containing 25% OCP%.**

[2]**Total edible parts wt. = empty carcass wt. (with head) + edible giblets wt.**

Total edible parts % = total edible parts wt. /fasted wt. * 100

[3]**Edible giblets wt. = Liver + Kidneys wt. +Heart wt.**

Blood Constituents:

Blood constituents and metabolites changes could be used as indicator for the nutritional and physiological status of the animal. Data presented in Table 5 showed that all serum constituents were within the normal range (Manning *et al.,* 1994) and that olive cake pulp in the present treatments had no significant effect on most of the selected serum constituents. The insignificant decrease (P>.05) in serum total protein in H group and the slightly lower (P>.05) urea concentration in L, M and H groups than that of C group could be attributed to lower degradability of protein in olive cake pulp. However, 75 to 90% of its nitrogen is linked to the lingo-cellulose fraction which are the two main factors limiting the digestive utilization of olive by-products (Aguilera 1987). Sansoucy (1983) found that crude protein digestibility of olive by-product reaches only 20 to 25%.

Glucose and triglycerides concentrations in serum of rabbits fed diets containing OCP at varying levels (L, M and H %) were lower (P<0.05) than those fed the control diet. The decrease in glucose, triglycerides and cholesterol of rabbits fed diets containing OCP may be linked to the presence of phenolic compounds and saponins in olive cake pulp. Abo-Zaid *et al.* (1993) found that rats injected with phenolic compounds showed significantly lower total lipids, triglycerides, phospholipids and cholesterol. Plasma glucose and urea levels showed a fluctuation response due to the same treatment. The same authors found an increase in liver enzymes (AST and ALT) as well as alkaline phosphate (Ap) in rats treated with phenolic compounds compared with untreated ones. Also, saponins are known to bind with bile acids and cholesterol, thereby such compounds can purge these fatty compounds from the body and consequently decrease blood cholesterol (Michael, 2005). In addition, Leto and Giaconne (1981) found that oleic acid was greater and myristic, plamitic, stearic, linoleic and linolenic acids were lower in perirenal fat of rabbits fed olive cake than those fed the control diet. Similary, EL-Kardawy (1997) found that cholesterol and total lipids decreased (P<0.01) in blood serum of rabbits given olive pulp at 10 and 15% of the diet compared with those given the control or olive pulp at 5% level.

The insignificant effects of dietary treatments on most serum constituents may be attributed to the adequacy of nutrients especially crude protein in all the experimental diets.

Table 5.Effect of the different levels of olive cake pulp in growing New Zealand White rabbits' diets on some blood constituents.

Items	Dietary Treatment*			
	C	L	M	H
Total protein (g/dl)	6.47±0.39	6.55±0.15	6.33±0.40	5.83±0.10
Albumin (g/dl)	3.70±0.16	3.50±0.15	3.70±0.12	3.58±0.11
Globulin (g/dl)	2.76±0.26	3.06±0.25	2.63±0.48	2.25±0.21
Alb/ Glo	1.35±0.08	1.16±0.13	1.53±0.36	1.64±0.23
Glucose (mg/dl)	116.30±18.98[a]	65.67±7.88[b]	72.00±6.66[b]	76.33±7.36[b]
Cholesterol (mg/dl)	63.67±19.37	49.67±14.17	44.33±9.24	40.33±10.33
Triglycerides (mg/dl)	59.00±6.66[a]	33.67±3.48[b]	28.33±5.61[b]	46.33±10.73[ab]
Urea (mg/dl)	30.33±2.33	23.33±4.67	22.67±1.86	25.67±5.46
Creatinine (mg/dl)	1.50±0.06	1.17±0.10	1.38±0.15	1.36±0.11
AST (U/L)	61.00±5.69	49.67±3.28	55.33±11.20	43.67±6.77
ALT (U/L)	35.67±2.40[ab]	41.00±4.16[a]	40.67±5.78[a]	26.00±0.58[b]

*** Dietary Treatment; C= Control, containing no OCP; L= containing 15% OCP; M= containing 20% OCP; H= containing 25% OCP%.**

[a, b] **Means in the same row with different superscripts differ (p<0.05).**

Economic Efficiency:

Feed cost/kg gain, net revenue (NR), economic efficiency (EE) and relative economic efficiency (REE) are listed in Table 6. It is evident that the lower price of OCP is reflected on the price of the experimental diets. Feeding growing rabbits on diets containing 15, 20 and 25% OCP decreased the feed cost/kg gain by 9.11, 7.25 and 14.32% while net revenue values were increased with OCP inclusion by 5.83, 15.73 and 23.62%, respectively compared with those fed the control diet. It was clear that the economic efficiency (EE%) and relative economic efficiency (REE%) were highest with the diet containing 25% OCP followed by those containing 15 and 20% OCP compared with the control diet. These results were in agreement with those obtained by Abdel-Naby (1998), EL-Lathy (2001), EL-Sayed (2010) and Abdel- Shafi (2015).

Table 6. Economic efficiency as affected by olive cake pulp inclusion in rabbits' diet.

Item	Dietary Treatment*			
	C	L	M	H
Price/kg diet	2.44	2.30	2.28	2.24
Total feed intake/rabbit(g)	5751	5221	5966	5719
Total feed cost/rabbit (L.E)	14.03	12.01	13.6	12.81
Total weight gain/rabbit(gm)	1256.87	1185	1313.57	1339.28
Feed cost/kg gain	11.17	10.13	10.36	9.57
Price/kg weight gain (L.E)	27	27	27	27
Total revenue/weight gain(L.E)	33.91	31.99	35.45	36.15
Net revenue/rabbit (L.E)	18.88	19.98	21.85	23.34
Economic efficiency (E.E)	1.34	1.66	1.61	1.82
Relative E. E (%)	100	123.88	120.14	135.82

* **Dietary Treatment; C= Control, containing no OCP; L= containing 15% OCP; M= containing 20% OCP; H= containing 25% OCP%.**

CONCLUSION

It could be concluded that the use of by-products is necessary to reduce the price of feed, because feed cost is one of the main obstacles to the development of rabbit production. Therefore, olive cake pulp (OCP) could be used in feeding growing rabbits up to 15 % and 25% of the diet during 6-9 and 9-14 wk of age, respectively with no adverse effects on growth performance, physiological status, carcass traits. In addition, due to the lower prices of olive cake pulp compared to traditional feeds, the economic efficiency could be increased when using it as a substitute.

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تأثير الإحلال الجزئى أو الكلى لتفل الزيتون محل نخالة القمح فى علائق الأرانب النامية على الأداء الإنتاجى وصفات الذبيحة وبعض مكونات الدم تحت ظروف شمال سيناء.

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أجريت هذه الدراسة على عدد ٦٠ أرنب مفطوم نيوزيلاندى أبيض عمر ٦ أسابيع بمتوسط وزن ٧١٥ جراماً ، وزعت على ٤ مجموعات بكل منها ١٥ أرنبا , مجموعة كنترول, ثلاث مجموعات معاملة , مجموعة الكنترول غذيت على عليقة مقارنة (٠% تفل زيتون) والثانية والثالثة والرابعة على عليقة تحتوى ١٥, ٢٠, ٢٥% تفل زيتون ، وكانت جميع العلائق متساوية فى محتواها من الطاقة (2500 كيلو كالورى/كجم) والبروتين (١٧.٥%) تقريبا.بحيث تغطى الاحتياجات الغذائية للأرانب النامية. وفى نهاية مدة التجربة (عند عمر١٤ أسبوعاً) تم ذبح ٣ أرانب من كل مجموعة لدراسة صفات الذبيحة وبعض مكونات الدم. أوضحت النتائج المتحصل عليها مايلى: إحلال تفل الزيتون كإحلال جزئى أو كلى لنخالة القمح فى علائق الأرانب النامية لم يظهر أى اختلافات معنوية بين المعاملات الغذائية فى وزن الجسم الحى, المعدل الكلى للزيادة فى الوزن ,معدل النمو اليومى, والغذاء المأكول خلال الأعمار المختلفة (٦-١٤ أسبوعاً). كان هناك زيادة فى الوزن الحى , الزيادة الكلية فى الوزن ومعدل النمو اليومى فى المجموعات المغذاه على ٢٠% و ٢٥% تفل زيتون مقارنة بمجموعتى الكنترول وال١٥% تفل زيتون ولكن الزيادة كانت غير معنوية. المجموعة الثانية (١٥% تفل زيتون) سجلت انخفاضاً غير معنوياً فى المأكول اليومي من العليقة مقارنة بالمجاميع الأخرى(الكنترول, الثالثة والرابعة) سجلت مجموعة ال٢٥% أفضل معامل تحويل يليها مجموعة ال١٥% ثم ال٢٠% والكنترول على التوالى. أشارت النتائج الى وجود انخفاض معنوى فى مستوى الجلوكوز والدهون الثلاثية فى المجموعات المعاملة مقارنة بالكنترول ، بينما لم تتأثر مكونات الدم الأخرى. لم يكن هناك تأثير واضح للمعاملات الغذائية على صفات الذبيحة والاجزاء الماكولة. أدى استخدام تفل الزيتون كإحلال جزئى أو كلى محل نخالة القمح الى انخفاض تكلفة الإنتاج وبالتالى زيادة الكفاءة الاقتصادية.

الخلاصة: يمكن الاستفاده من تفل الزيتون فى تغذية الأرانب النامية بنسبة تصل الى ٢٥%من مكونات العليقة مع عدم وجود أى تاثير سلبى على الأداء الإنتاجى وصفات الذبيحة والوظائف الفسيولوجية.