UTILIZATION OF BIOLOGICALLY TREATED OLIVE CAKE OF EGYPTIAN BALADI CALVES'RATIONS. I- PARTIAL SUBSTITUTION OF YELLOW CORN BY BIOLOGICALLY TREATED OLIVE CAKE.

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SUMMARY

Twenty Egyptian Baladi calves (about 18 months old, and average body weight: 275 kg) were randomly allotted to four groups (five each) to study the effect of partial substitution of yellow corn in the concentrate feed mixture (CFM) by biologically treated olive cake at different levels (0, 11, 22 and 33% in C1, C2, C3, and C4 groups, respectively) on performance of calves. Animals were kept during the experimental period indoor condition. Calves in the treatment groups were fed individually with experimental rations which consisted of CFM plus corn silage at 2% and 1% of body weight, respectively. The daily ration was given in two equal portions (8 am and 3 pm), while drinking water was available twice daily at 10 pm and 5 pm. At the end of the feeding trial which lasted 127 days, digestibility trials were carried with three randomly selected animals from each group. Some hematology and blood chemistry parameters and economic efficiency was also studied. The results showed that partial substitution of yellow corn by biologically treated olive cake at rate of 11, 22 or 33% in CFM for calves significantly ($P<0.05$) effected the digestibility of DM, OM, CF and NFE, as well as TDN as compared to the control ration. The feeding value as DCP did not differ significantly ($P<0.05$) among the rations. Blood chemistry parameters were in the normal physiological ranges with no adverse effect on animal health. The economic efficiency was significantly ($P<0.05$) higher for calves fed ration containing biologically treated olive cake as compared to the control ration. In the light of the present results, rations containing biologically treated olive cake at the rate of 22 or 33% improved the economic efficiency of meat production under Egyptian conditions.

Keywords: *biological treatment, olive cake, calves performance, digestibility, nutritive value, blood parameters.*

INTRODUCTION

The shortage in feed resources represents a major constraint to animal production in many developing countries. Expanding the feed resource base through utilization of non-conventional feed resources (NCFRs), especially those do not compete with human food has become a compelling task. The NCFRs include a variety of feeds from perennial crops, multipurpose trees and shrubs, and agro-industrial by-products such as olive cake (OC). This source is still not fully and appropriately integrated into livestock feeding, in despite of there are about 110057 tons of olive cake are produced per year in Egypt

(Agriculture Economics and Statistics, 2006). These products could be incorporated in ruminant diets as un-traditional feedstuffs to decrease the feeding cost and alleviate the pollution problems (Hadjipanayiotou, 1999).

Many experiences have shown poor digestive "utilization" of olive cake by ruminants. This may be caused by decreased activity of the rumen microflora which may decrease by 40% after ingestion of crude olive cake (Theries and Boule, 1970). The ammonia content of rumen fluid of sheep receiving olive cake also confirms the decreased activity of rumen micro flora (Balti, 1974, Nefzaoui and Abdouli, 1979, Nefzaoui *et. al.*, 1983).

Different ways to include OC in animal diets have been described, varying from feeding it fresh, dried, and ensiled, or as a component in concentrate pellets and multi-nutrient feed blocks. Using olive cake in the multi-nutrient feed blocks allows farmers to decrease the daily cost of feeding lambs by 38% (El Hag *et al.*, 2002) or 18% (Ben Salem *et al.*, 2003). Giozelgiannis et al. (1978) found no differences in feed intake, weight gain or carcass quality of lambs fed diet containing 15-25% olive cake.

Olive cake is highly fibrous (Holed and Bakr, 1982, Alibis and Berge, 1983, Hadjipanayiotou, 1994) feed material. Moreover, a large proportion of the protein (80 to 90 %) is linked to the lingo-cellulose fraction (Nefzaoui, 1983). There are many methods for improving the nutritive value of these by- products such as physical, chemical and biological treatments. The biological treatments may be a useful method for improving the nutritive value of agricultural by-products (Gado *et.al.* 2007).

The objectives of this work were to study: (i) the effect of biologically treated olive cake in feeding Baladi calves on apparent digestibility of nutrients, nutritive value of rations, performance and economic efficiency; (ii) to find the most appropriate level of biologically treated olive cake for replacing yellow corn in Egyptian calve rations.

MATERIALS AND METHODS

The required quantities for feeding animals during the experimental period from olive cake were obtained from olive factories in Wadi El – Natron, Behira governorate, Egypt. The olive cake treated by two strains of microorganisms, the first was yeast (*Saccharomyces cervisiae* F- 707) and the second was a filamentous fungi (*Trichoderma reesei* F- 418). Twenty kg urea, 5 kg magnesium sulfate, 10 kg ammonium nitrate, 25 kg molasses, 0.5 kg *Saccharomyces cervisiae* (2×10^{10}/1g dried yeast), and 5 liters *Trichoderma reesei* (10^6/1 ml) were dissolved in 500 liters of water. Prepared solution was put in motor sprays' tank, and sprayed on one ton of olive cake with completely stirring every 2 days. The treatment period lasted 15 days, and then the treated olive cake used in formulation four experimental concentrate (Table1).

Twenty Egyptian Baladi calves (18 months old, and average body weight 275 kg) were randomly allotted to four groups (five in each). Animals were housed during the experimental period indoor condition. The first group was fed control ration (0% olive cake) and the other groups 2, 3 and 4 were fed the rations containing CFM with a content of 11, 22 or 33% treated olive cake instead of corn. The feeding trial was lasted for 127 days. The rations were offered to animals in two equal portions at 8 am and 3 pm. Drinking

water was available for animals twice daily at 10 am and 5 pm. The body weight of animals was recorded each 15 days before offering the morning meal to adjust feed intake. Animals were fed daily on experimental concentrate and corn silage at rate of 2% and 1% of live body weight, respectively.

Table (1). Formulation of experimental concentrates mixtures.

Ingredients, %	Concentrate mixtures			
	C1(control)	C2	C3	C4
Yellow corn	45	40	35	30
Wheat bran	25	25	25	25
Soybean meal	7	7	7	7
Undecoraticated cotton seed meal	18	18	18	18
Biologically treated olive cake	0	5	10	15
Limestone	2	2	2	2
NaCl	1	1	1	1
Bicarbonate	1	1	1	1
Vit. &Min. Mix.	0.5	0.5	0.5	0.5
Fungicidal	0.5	0.5	0.5	0.5

The apparent digestibility trial was conducted at the end of the feeding trial using 4 mol HCl insoluble ash as internal marker according to Gallup *et al.*, 1945. Digestibility of nutrients is calculated as follows:

$$\text{Digestibility} = 100 - \left\{\left(\frac{\%\ indicator\ in\ feed}{\%\ indicator\ in\ feces} \times \frac{\%\ nutrient\ in\ feces}{\%\ nutrient\ in\ feeds}\right)\right\} \times 100$$

Chemical analysis of feed and feces were determined according to A.O.A.C (1990).

Blood samples were taken from jugular vein in hap ringed test tubes before morning feeding at the end of digestibility trial to determine blood hemoglobin concentration and packed cell volume. Blood plasma was taken after centrifuging blood samples 4000 rpm for 20 min, and stored at – 20° C to determine other blood constituents. Total protein was measured using biuret method as described by Gornall *et al.*, (1949), albumin was determined according to Doumas *et al.*, (1971) and globulin was calculated by difference between total protein and albumin. Aspartate-aminotransferase (AST) and alanine-aminotransferase (ALT) were measured according to Retiman and Frankel (1975). Urea was measured as described by Patton and Crouch (1979). Creatinine was measured using colorimetric kinetic method according to Folin (1994).

Statistical analysis:

Data collected were subjected to statistical analysis as one way analysis of variance according to Sendecor and Cochran (1980) using SAS (1998) procedure. The model used was:

$Y_{ij} = \mu + T_i + e_{ij}$

Where: - Y_{ij} = experimental observation
μ = general mean of treatments
T_i = effect of treatment
e_{ij}= experimental error

Significant differences among means were tested by Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition of feeds:

Chemical composition of feed ingredients, concentrate feed mixtures and experimental rations on DM basis are shown in Table (2).

The chemical composition of olive cake was within the range reported by Morgan and Trinder (1980) and Sansoucy et al. (1985). The biologically treated olive cake had similar CP content as compared to wheat bran but it was higher than yellow corn. Moreover, it was higher in EE and CF contents than yellow corn or wheat bran.

The chemical composition of experimental concentrate feed mixtures showed that CP, EE and CF contents were gradually increased by increasing the levels of olive cake and decreasing yellow corn content in the mixture. This due to the higher contents of CP, EE and CF in olive cake than yellow corn.

The chemical composition of the experimental rations had similar trend which detected of the experimental mixtures, these due to corn silage was mixed with concentrate and offered fed for all animal groups at the same rate.

Digestibility of nutrients and nutritive values:

Data in Table (3) showed the effect of partial substitution of yellow corn by biologically treated olive cake on digestion coefficients and nutritive values of the experimental rations. Apparent digestibility of DM, OM, CF, and NFE were gradually decreased by increasing olive cake content in the rations. These results may be due to increasing the CF content in olive cake which had high percentage of seed stone (Nefzaoui, 1983). The apparent nutrient digestibility of ration 4 showed the lowest values than that of the other rations except EE digestibility which improved when the yellow corn substituted by treated olive cake.

These results are in agreement with those reported by many researchers that apparent digestibility of DM, OM, CP of the olive cake were low but EE digestibility was high in sheep. It was also found that the activity of the rumen micro flora decreased by 40 percent after ingestion of crude olive cake in diet (Theries and Boule, 1970). Moreover, the ammonia production in rumen of sheep was also decreased (Balti, 1974, Nefzaoui and

Abdouli, 1979, Nefzaoui *et al.*, 1982). Therefore the digestibility of nutrients in rations containing olive cake was lower than that of control ration (0% olive cake) except the apparent digestibility of EE. These results are in agreement with the finding by Nefzaoui (1983).

Table (2): Chemical composition of feed ingredients, concentrate feed mixture and experimental rations (as DM basis).

Items	DM%	Chemical composition, %(DM basis)					
		OM	CP	EE	CF	NFE	Ash
I.Ingredients							
Yellow corn	88.70	98.60	8.30	4.30	3.50	82.50	1.40
Wheat bran	90.39	94.57	14.50	2.76	10.85	66.46	5.43
Soybean meal	90.40	93.14	40.90	1.98	7.30	42.96	6.86
Undecorticatid cotton seed meal	93.50	95.62	24.49	2.06	20.20	48.87	4.38
Biologically treated olive cake	95.84	96.37	12.31	6.01	38.66	39.39	3.63
Corn silage	30.00	96.80	8.50	2.60	22.10	63.60	3.20
II. Concentrate mixtures							
C1	90.19	91.74	14.64	3.14	8.44	65.52	8.26
C2	90.56	91.60	14.80	3.22	10.19	63.39	8.40
C3	90.44	91.49	15.04	3.31	11.96	61.18	8.51
C4	91.32	91.41	15.23	3.39	13.71	59.08	8.59
III. Experimental rations*							
R1 (control)	70.88	93.43	12.59	2.96	13.00	64.88	6.57
R2	70.60	93.34	12.70	3.02	14.16	63.46	6.69
R3	70.81	93.26	12.86	3.08	15.34	61.98	6.74
R4	70.78	93.21	12.99	3.13	16.51	60.58	6.79

*Experimental rations were included concentrate mixture and corn silage. (2:1)

The nutritive value of experimental rations as TDN and DCP were ranged from 58.16 to 63.52% for TDN and from 9.35 to 9.64% for DCP. Ration 4 showed the lowest values for TDN and DCP as compared to the other rations. These result due to the lowest digestibility of most nutrients in ration 4.

Table (3): Apparent digestibility coefficients and nutritive values of experimental rations

Items, %	Rations			
	R1 (control)	R2	R3	R4
Nutreints digestibilies %				
DM	57.86[a]	56.52[a]	53.30[b]	49.33[c]
OM	72.35[a]	72.10[a]	67.80[b]	66.15[b]
CP	76.55[a]	75.65[a]	73.55[b]	72.10[b]
EE	79.00[b]	83.71[a]	82.20[a]	82.60[a]
CF	53.53[a]	52.53[a]	49.05[a]	44.13[b]
NFE	63.88[a]	64.27[a]	61.96[b]	58.94[c]
Nutritive value %:				
TDN	63.30[a]	63.52[a]	61.08[b]	58.16[c]
DCP	9.64	9.61	9.46	9.35

[a.b.c] Means within the same row with different superscripts are differ (P<0.05)

Table (4): some blood parameters of calves fed the experimental rations.

Item	Animals groups			
	G1 (control)	G2	G3	G4
Hematocrite, %	34.67	34.33	34	35.5
Hemoglobin, g/dl	13.06	14.49	14.13	13.82
Total protein, g/dl	6.59	6.12	5.26	5.76
Albumin, g/dl	4.29	3.34	3.21	3.1
Globulin, g/dl	2.39	2.78	2.05	2.66
Creatinine, %	0. 45	0. 45	0.48	0.42
Urea, mg/dl	26.58	19.94	23.07	25.82
AST, U/l	30	29	25	25
ALT,U/l	24	24	29	28

Blood parameters:

Data in Table (4) showed the effect of the partial substitution of yellow corn by biologically treated olive cake on some blood parameters of the experimental animals. The values were within the normal physiological range (Rowland, 1980).There was no adverse effects on animal health as a result of including biologically treated olive cake in animal rations during the feeding trial.

Animal performance and feed efficiency:

Data in Table (5) showed the effect of partial substitution of yellow corn by biologically treated olive cake on the performance and economic efficiency of calves. The average of initial live body weight of animals in four groups was similar. The third group

which fed ration containing olive cake at rate of 22% instead of yellow corn showed the highest daily weight gain as compared to the other groups. However, the control group had the lowest final body weight, total weight gain and daily weight gain, respectively.

Table (5): Effect of partial substitution of yellow corn by biologically treated olive cake on the performance and economical efficiency of calves.

Item	Animals groups			
	G1 (control)	G2	G3	G4
Initial live body weight, kg.	273.33	278.00	273.00	274.33
Final live body weight, kg.	394.00^{b}	416.33^{a}	416.00^{a}	408.00^{a}
Total live body gain, kg	120.67^{b}	138.33^{a}	143.00^{a}	133.67^{a}
Average daily weight gain[(1)], kg	0.95^{b}	1.09^{a}	1.13^{a}	1.05^{a}
Daily feed intake, kg DM				
Concentrate	6.67	6.94	6.89	6.80
Corn silage	3.34	3.47	3.45	3.40
Total	10..01	10.41	10.34	10.20
DM intake kg / 1 kg gain	10.54	9.55	9.15	9.71
Economic efficiency :				
Feed cost (h/d) LE[2]	12.17^{a}	12.16^{a}	11.57^{b}	10.93^{b}
Price of daily gain[3]	16.15^{b}	18.53^{a}	19.21^{a}	17.85^{a}
Economic efficiency (feed cost, L.E/1kg gain)	12.81^{a}	11.16^{b}	10.24^{b}	10.41^{b}
Relative economic efficiency[4], %	100^{a}	87.12^{b}	79.94^{b}	81.26^{b}

[(1)]Daily gain = total gain, kg / 127 days. [(2)]Price of one ton of C1 = 1726.96, C2, 1654.71, C3, 1582.46 and C4, 1510.21 LE (including BTOC), Price of one ton corn silage = 193.5 LE. [(3)]Market Price of one KG live body weight in (07/2008) = 17 LE.
[(4)]Relative economic efficiency= the cost of feed to produce one kg gain relative to the control group.

[a.b.c] Means within the same row with different superscripts are differ ($P<0.05$)

Data of economic efficiency showed that control group had the highest feed cost to produce one kilogram daily weight gain and the feed cost decreased by increasing the level of olive cake content in feed intake. The third group had better relative economic efficiency as compared to the control. The feed cost to produce 1 kg of weight gain was decreased by 13, 20 and 18.7% in groups 2, 3 and 4, respectively as compared to the control. In this connection, El Hag *et al* ., (2002) and Ben salem *et al*., (2003) reported an economic advantage of using olive cake in feeding lambs and the feeding cost decreased by 38% (El Hag *et al* 2002) or 18% (Ben Salem *et al* 2003).

The overall results indicated that calves fed rations containing biologically treated olive cake at rate of 22 or 33% from yellow corn improved the economic efficiency of growing calves and decreased the feeding cost up to 20% for meat production in Egypt.

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الإستفادة من تفل الزيتون المعامل بيولوجيا فى تغذية العجول البلدى المصرية. ١- الإحلال الجزئى لحبوب الذرة الصفراء بتفل الزيتون المعامل بيولوجيا فى العلائق

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استخدم ٢٠ عجل بلدى مصرى متوسط أوزانها ٢٧٥ كجم وعمرها ١٨ شهر وقسمت إلى أربع مجاميع بمعدل خمسة عجول بكل مجموعة لدراسة تأثير إحلال تفل الزيتون المعامل بيولوجيا محل حبوب الذرة الصفراء فى مخلوط العلف المركز بمستويات مختلفة (صفر، ١١، ٢٢، ٣٣% فى المخاليط ١، ٢، ٣، ٤ على الترتيب) على معاملات الهضم والقيم الغذائية للعلائق وعلى بعض صفات الدم ومعدل النمو اليومى والكفاءة الغذائية والاقتصادية .غذيت الحيوانات على علف مركز بمعدل ٢% بالإضافة لى سيلاج الذرة الكامل بمعدل ١% من الوزن على اساس المادة الجافة. وتم تسجيل الاوزان كل اسبوعين وتم اجراء تجارب الهضم والتقييم الغذائى للعلائق فى نهاية تجربة التغذية وتم حساب الزيادة اليومية ومعاملات الهضم والقيمة الغذائية للعلائق ومعدل النمو اليومى والكفاءة الغذائية والاقتصادية وتم اخذ عينات دم من الحيوانات فى نهاية التجربة وتم تقدير الهيموجلوبين والمكونات الخلوية وبروتين البلازما والالبيومين والجلوبيولين والكرياتين واليوريا وبعض أنزيمات الكبد.

اوضحت النتائج أن إحلال تفل الزيتون المعامل بيولوجيا محل جزء من الذرة بمستويات ١١ ، ٢٢، ٣٣% كان له تأثيرا معنويا على معاملات الهضم والقيمة الغذائية للعلائق بالمقارنة بالعليقة الكنترول. ولم يكن لها تأثيرا معنويا على البروتين المهضوم. وكانت جميع قياسات الدم فى الحدود الطبيعية ولم يكن هناك تأثيرات سلبية على صحة الحيوان وأدى الى زيادة معنوية فى معدل النمو اليومى للعجول كما أدى إلى زيادة معنوية فى الكفاءة الإقتصادية لنتاج ١ كيلو جرام نمو للعجول المغذاه على تفل الزيتون المعامل كبديل للذرة الصفراء فى العلف المركز.

ونستخلص من هذه الدراسة أن إستخدام تفل الزيتون المعامل بيولوجيا فى علائق تسمين العجول البلدية بنسبة إحلال ٢٢، ٣٣% من الذرة الصفراء فى العلف المركز أدى إلى تخفيض تكاليف التغذية لإنتاج اللحم تحت الظروف المصرية.