

Olive Oil Cake as Animal Feed
C. Use of Olive Oil Cake Supplemented with Soybean
Seeds in the Rations of Growing Barbary Lambs

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ABSTRACT

Olive Oil Cake (OOC) was used to replace part of the commercial concentrate (14% CP) of Barbary lambs on a dry matter basis at the rates: commercial concentrate without OOC (control), 15%, 25% and 40%. Supplemental soybean seeds were added to make the rations isonitrogenous at 16% CP. Each ration was fed to one group of lambs for the entire experimental period and oat hay was fed as roughage. Lambs performance and ration digestibility were determined.

Differences in daily weight gain between groups were not significant except that the group fed the highest OOC level showed a significantly lower rate of gain when compared with the control group. The digestibility of CP and CF of the ration that contained the highest level of OOC was reduced.

It is concluded that the high fat and fiber contents of rations for growing lambs depressed digestibility and therefore growth rate. However, OOC successfully replaced 25% of the commercial concentrate for growing lambs, when it was supplemented with soybean seeds.

INTRODUCTION

Our previous studies indicated that OOC, supplemented with urea, could substitute 50% of the dry matter of the commercial concentrate mixture of growing heifers (13) and of growing Barbary lambs (12). Other studies with OOC (1) did not reveal any significant differences in body gains of sheep when OOC was fed at 30% level in their concentrate mixture. The reduction in growth rate and feed intake of OOC containing rations compared to the control observed in this study, was attributed to the high fat content of OOC.

There is evidence that high fat content in sheep diets depress, ration digestibility (7), cellulose and protein digestibility (4) and the rate of voluntary feed intake (3, 9, 12). Earlier digestibility studies (1) with sheep fed rations containing OOC in their concentrate mixtures showed a reduction in the digestibility of organic matter and protein.

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The objective of this study was to provide further information about the effect of substitution of OOC, when supplemented with soybean seeds, on growth rate of lambs and ration digestibility.

MATERIALS AND METHODS

Ration

OOC containing 14% fat, was obtained from local factories. Further processing in our laboratory included sun drying and milling in a hammer mill to a coarse mesh. The control group was given commercial concentrate without OOC (ration 1). The other 3 groups received commercial concentrates containing 15, 25 and 40% OOC on DM basis (ration 2, 3 and 4, respectively). Ground soybean seeds were added as a supplement to all rations to make them isonitrogenous at 16% CP. Proximate analysis, using AOAC methods (2) was carried out on all rations. The experimental rations and their chemical composition are shown in Table 1.

Table 1. The experimental rations and their chemical compositions.*

	Experimental rations (% on DM of ration)			
	A	B	C	D
Feed				
Commercial concentrate	93	73	60	40
Olive oil cake (OOC)	0	15	25	40
Soybean seeds	7	12	15	20
Chemical composition (% on DM)				
Crude protein	16.02	16.07	16.02	16.10
Ether extract	3.76	6.46	8.21	10.95
Crude fiber	13.00	14.00	14.70	15.65
Ash	8.85	8.54	8.35	8.05
Nitrogen-free extract	58.37	54.89	52.72	49.26

* Oat hay was fed as a basal diet to all lambs. It contained 5.9, 26.0, 2.0 and 5.7 percent of crude protein, crude fiber, ether extract and ash, respectively.

Animals

Fifty two, four months-old Barbary lambs of comparable weights were randomly assigned to 4 groups (A, B, C and D), each group consisted of 8 males and 5 females. The males and females were housed separately.

Feeding and management

The feeding and management were similar for all groups of lambs. Each group of lambs was randomly assigned to one of the experimental rations with oat hay being fed as a basal roughage. Feed intake was estimated according to the NRC (11) recommendations, and was adjusted at regular intervals. Each lamb, whether male or female, received 300–800 g mixed concentrate and 200–500 g oat hay daily. The concentrate was daily fed at 9.00 a.m. and the hay at 4.00 p.m. and the feed refused by each group was recorded weekly during the 71 days of the experiment. Water and salt blocks were

available *ad. libitum*. All animals were allowed to adjust their rations for 10 days before the start of the experiment.

Digestibility

Digestion trials were simultaneously conducted with the experimental diets using six more sheep which has previously been maintained on an oat hay and concentrate diet. An adjustment period of 10 days was followed by 7 days of faeces collection. Faeces were collected daily and stored in plastic bags until analysed (AOAC 1965 methods). Concentrate mixtures only were fed at the rate of one kilogram daily, offered in the morning and evening in equal portions. Water was provided twice daily. Feed refusals were recorded.

For statistical analysis of results, analysis of variance (Snedecore, 1957) and Duncan's new multiple range test (Duncan, 1955) were conducted (14).

RESULTS AND DISCUSSION

Live weight gain, feed intake and feed efficiency

Significant reductions in liveweight gains (Table 2), over the control, were found only for ration D, although non-significant reductions were observed with increasing levels of OOC in the diet. The total feed intake and feed conversion efficiency were lowered (Table 3) as the level of OOC increased in the ration, with group D males and females being the lowest.

Table 2. Liveweight daily gains (g) of the experimental lambs.*

Groups	Males	Females	(Overall average) (Males + Females)
A (Control)	121 ± 15 ^a	98 ± 11 ^a	117 ± 10
B (15% OOC)	117 ± 11 ^{ab}	92 ± 9 ^{ab}	107 ± 8
C (25% OOC)	106 ± 10 ^{ab}	92 ± 10 ^{ab}	100 ± 8
D (40% OOC)	69 ± 9 ^b	66 ± 9 ^b	68 ± 7

* Mean ± S.E. Means with different superscripts within a column are statistically different at 5% level.

Table 3. Daily feed intake and feed conversion of the various lamb groups.

Group	Sex	Kg/lamb/day		
		Hay	Concentrate	Total
A (Control)	Males	0.32	0.61	0.93
	Females	0.32	0.59	0.91
B (15% OOC)	Males	0.39	0.52	0.91
	Females	0.35	0.51	0.86
C (25% OOC)	Males	0.35	0.51	0.86
	Females	0.36	0.51	0.87
D (40% OOC)	Males	0.35	0.49	0.84
	Females	0.32	0.48	0.80

It is evident from the findings in this study, that use of OOC upto 25% in the concentrate mixture of sheep supplemented with soybean seeds as a nitrogen source, did not show significant difference when compared with the control. This is in agreement with our previous studies with OOC in sheep rations (12). Also in agreement with other similar studies (1) which reported that use of OOC upto 30% in sheep concentrate mixture did not show any significant difference in body gains when compared with the control. The proportional reductions observed in rate of gain, feed intake and feed conversion efficiency, by increasing OOC levels in the rations are also consistent with our previous findings. In this study the incorporation of 40% OOC in ration 4 caused a significant reduction in the rate of gain. This could be attributed to the high fat content of the added soybean seeds (18% EE). The average liveweight gains obtained (males and females combined) in this study were 107, 100 and 68 g/day for rations containing 15, 25 and 40% OOC, respectively, compared to 129, 117 and 87 g/day for rations containing 15, 25 and 50% OOC with urea added, obtained in previous studies (12), respectively. High fat in sheep rations was reported to affect ration digestibility (7). Other studies (8) reported a depression in organic matter digestibility when sheep rations were supplemented daily with 40 g of vegetable oil/kg feed. The proportional reduction in feed intake by increasing ration fat levels in this study is also consistent with other findings (3, 5). This could be attributed to a reduction in the rate of digestion which prolongs rumen retention time and consequently reduces voluntary feed intake (9). It is evident from the findings with OOC studies that the higher the fat content of the rations the lower is the feed conversion efficiency. This could possible be due to a reduction in the voluntary feed intake (Table 3). Values obtained for the highest OOC level fed is 12.17–12.24 and 10.5 kg feed/kg gain for the present and previous studies, respectively. The difference in values in favour of the previous studies is attributed to the lower fat content of the ration fed (40 g fat/kg feed) compared to the present studies (72–76 g fat/kg feed).

Digestibility

Apparent digestibilities and TDN intake were higher for ration 2 (15% OOC) compared to control group but the differences were not significant (Table 4). Rations 3 and 4 showed proportional reductions in the digestibility of nutrients (except EE) as a result of increasing levels of OOC in the rations. The crude protein in rations 3 and 4 was significantly reduced and there were non-significant reductions in DM and CF digestibility. EE digestibility was not much affected by dietary treatments.

The reduction in digestibility of rations 3 and 4 (mainly CP and CF) due to

Table 4. Digestion coefficients and total digestible nutrients (TDN) of the experimental diets¹ (%).

Rations	Dry matter	Crude protein	Crude fiber	Ether extract	Nitrogen-free extract	TDN
A (Control)	73.6	76.9 ^{ab}	45.33 ^{ab}	90.07	80.06 ^a	72.6
B (15% OOC)	79.4	82.1 ^a	62.2 ^a	93.23	82.7 ^a	80.9
C (25% OOC)	76.6	69.7 ^{bc}	48.03 ^{ab}	90.4	69.73 ^b	70.1
D (40% OOC)	67.9	66.3 ^c	33.3 ^b	93.1	58.83 ^c	67.7

¹ Each value is a mean of data for 3 animals. Values within a column having the same letter designations are not statistically significant at the 5% level.

increasing levels of OOC agrees with other similar digestibility trials with OOC (1, 4), which indicated reductions in digestibility of organic matter and protein of OOC containing rations. These studies also reported 40–50% reduction in the activity of rumen microflora of sheep when OOC was incorporated in their ration. Henderson (6) reported that high lipids content in sheep rations inhibit some rumen microbes particularly the cellulolytic bacteria which reduces the rumen acetate. Ether extract digestibilities in rations 3 and 4 were least affected by treatments. This is in agreement with the findings of Kowalczyk *et al.* (9). The higher digestibility coefficient and TDN values of ration 2 (15% OOC), compared to control, could be attributed to the low fiber intake by control lambs. The lower fiber intake is expected to reduce performance of ruminants (10). The estimated TDN consumption per day (growth trial) was slightly higher on the control ration than ration 2 due to the normal fiber and fat intake; this could explain the better performance shown by the control group.

The results obtained in this study further support the findings of previous studies that OOC can be used as bulky or semi-bulky feed for Barbary lambs and can successfully replace upto 25% of the commercial concentrate, when the rations are supplemented with soybean seeds.

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كسب بذرة الزيتون (الفيتورا) كعلف للحيوان

ج. استعمال كسب بذرة الزيتون المضاف إليه كسب فول الصويا في علائق حملان أغنام البربري

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المستخلص

تم إحلال كسب بذرة الزيتون بنسبة صفر، ١٥، ٢٥ و ٤٠٪ من المادة الجافة للعليقة المركزة للأغنام (١٤٪ بروتين خام) وأضيف كسب فول الصويا لجعل العلائق المختلفة متساوية في نسبة البروتين الخام (١٦٪ بروتين خام).

لقد تم تقديم كل من العلائق المركزة الأربع إلى مجموعة من الحملان طوال فترة التجربة مع تزويدهم بخطان الشوفان كعلف حشن، وتم قياس معدلات النمو، كما أجريت تجارب لتعيين معدلات الهضم.

إن الفروق في الزيادة اليومية للوزن لم تكن معنوية إلا بين المجموعة التي تم إضافة أعلى مستوى (٤٠٪) من كسب بذرة الزيتون مقارنة بمجموعة التحكم، كما إنخفضت معدلات هضم البروتين الخام والدهن في العلائق التي احتوت على أعلى مستوى كسب بذرة الزيتون.

ويمكن الإستخلاص من هذه التجارب أن الزيادة في محتويات علائق الحملان من الدهن نتيجة إضافة كسب بذرة الزيتون مع كسب فول الصويا أدت إلى انخفاض معامل هضم البروتين الخام والدهن ومن ثم نمو الحملان، إلا أن كسب بذرة الزيتون أمكن إحلالها محل حوالي ٢٥٪ من المادة الجافة للعليقة المركزة للأغنام دون حدوث أية نتائج عكسية.