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The Nutritive Value of Safflower Meal with Sheep and its Effect on Fat and Milk Yield with Lactating Cows and Buffaloes

M.M. El-Shinnawy and A. Abou-El-Hassan

Animal Production Department, Faculty of Agriculture, Mansoura University, Mansoura and Animal Production Department, Faculty of Agriculture, Cairo University, Giza, Egypt.

THIS STUDY was conducted to make use of a by-product from safflower, a newly promising oil crop in Egypt. Two comparative feeding experiments were undertaken to study the replacement effect of unextracted undecorticated safflower meal on milk and fat yield with lactating Friezian cows and buffaloes.

The meal was fed alone to sheep (direct feeding) in a digestion trial to determine its digestibilities, feeding value and nitrogen balance. The daily intake as well as the nutritive value index of the feed were investigated.

The feeding value of the meal as fed was 44.6% SV, 54.7%TDN and 115%DP. The maximum level of intake by sheep was 1.65kg daily for ram weighing, 50 kg without any abnormal symptoms. Such intake on metabolic body size basis corresponded to 85.9g dry matter, 37.9g SV and 12.8 DCP.This daily intake would cover the maintenance requirements from SV and DP for sheep with an excess to cover an appreciable part of production requirements.

Replacemnt of undecorticated safflower meal (3.75kg) to undecorticated cotton seed cake (3kg) was successful with lactating Friezian cows and buffaloes, produced the same yield of milk and its fat. The meal provided up to 40% of the energy and about 70% of DP in the ration.

Introducing such oil seeds in reclaimed area such as safflowe would participate in providing both edible oil for human con sumption and useful by-products for feeding animals.

There is a great shortage of animal feeds in Egypt particularly in concentrates. The calculated feed requirements for farm livestock for moderate production (8.60 million tons starch value)cannot be coveredd by the available feed supply which is estimated to be approximately 5.53 million tons starch value the present available concentrates (cereal grains, cotton seed cake, rice bran and wheat bran) have share of only ca 17.7 of the total available feed stuffs.

Accordingly, this study was undertaken to make practical use of the avai lable undecorticated safflower meal as a newly produced by product of this crop. This will inturn save a part of the dear and scarce concentrates participating in solving the problem of feed shortage in Egypt.

TABLE 1. Daily feed requirements and the daily ration offered.

No. of animal	Live weight	Average milk yield before expt.	Average fat yield	F.C.M.	Feed requirements maintenance and production		Daily ration					
							Control ration			Tested ration		
					Starch value	Digestible protein	Wheat straw	Rice bran	Undecorticated cotton seed cake	Wheat straw	Rice bran	Undecort. safflower meal
Cows	kg	kg	%		kg	g	kg	kg	kg	kg	kg	kg
1	288	7.56	3.8	7.32	3.57	671	3.00	2.00	3.00	3.00	2.00	3.75
2	335	8.32	3.9	8.20	4.07	760	3.00	2.50	3.00	3.00	2.50	3.75
3	395	9.36	3.7	8.94	4.61	842	3.00	3.50	3.00	3.00	3.50	3.75
4	385	9.52	3.8	9.33	4.66	875	3.00	3.50	3.00	3.00	3.50	3.75
Buffaloes												
1	432	7.11	7.0	10.31	4.88	958	3.00	3.75	3.00	3.00	3.75	3.75
2	412	7.62	6.9	10.94	4.94	993	3.00	3.75	3.00	3.00	3.75	3.75
3	398	6.95	7.2	10.29	4.70	940	3.00	3.50	3.00	3.00	3.50	3.75
4	382	6.12	7.3	9.15	4.33	850	3.00	3.25	3.00	3.00	3.25	3.75

Material and Methods

A metabolism trial using 2 mature rams (50 and 55 kg) was carried out to determine nutrient digestiblities, feeding value and N-balance of undecorticated safflower meal fed directly. Feed intake was determined by ad libitum feeding.A ten day preliminary period was followed by 10 days collection offering 1.5 kg daily. Coposite urine and faecal samples were prepared. The faecal samples were dried first at 60° then at 105° for 3 hr. Faecal N was considered 0.5g/100 g dry matter intake (Maynard and Loosli, 1965) and endogenous urinary nitrogen as 0.093g/lkg metabolic body size (W 0.75) (Soliman, 1968).

Two comparative feeding experiments were undertaken, one with 4 cows and the second with 4 buffaloes, following the "Swing over method" as established by Abou-Hussein (1959). The control ration included 3 kg undecorticated cotton seed cake, which were replaced by 3.75 kg undecorticated safflower meal having practically the same energy and digestible protein content. The control was given at first, followed by the tested one and then back to the control using 15 days milk collection period after 10 days transition period. Data in Table 1 indicate the daily feed requirements and the daily ration offered for each animal. The calculated requirements (S.V. and protein) followed Ghoneim standared (1967), for maintenance and milk production. The feeding values of the feeds (SV and DP) used for calculating feed levels were taken from average recorded by Abou Raya (1967). The feeding value and N- balance of the undecorticated safflower meal was determined by direct feeding in metabolism trial with mature rams. The percentage changes in milk and fat yield for each animal were determined,using the test of nill hypothesis for the average results.

Daily milk yield was recorded for each animal as well as each fat percentage (using Gerber method). Analyses of feeding stuff, faecal material and urine were generally carried out by the methods of the Association of Official Agricultural Chemists (A.O.A.C. 1970).

Results and Discussion

Digestibility, feeding value and N-retention of the meal

Regarding the chemical composition, little work was done on this product either abroad or in Egypt. The average analytical data recorded on dry matter basis along with the range of nutrients by different workers (Gross and Otagaki, 1954; Beeson, *et al*; 1971 and Mc Dowell, *et al.* (1974) are : 4.87 (4.2-6.1) for ash, 34.10 (28.7-37.8) for C F, 3.66 (1.1-6.6) for EE, 23.27 (20.7-25.9) for CP and 34.1(26.9-42.8) for NFe. Data of the chemical analysis experimentally obtained in this study (Table 2) are similar to the average values reported by the previous authors.

Considering CF content, the meal could be categorised under class 1 roughage feeds, Harris *et al.*, 1968)while its high protein content recommended the feed to be under class 4 (protein supplements). It seems better to consider

it under the other class belonging to concentrates rather than to roughages. The effect of the crude fibre content in the feed on its feeding value appeared to be still debatable. The source of the crude fibre itself (stems, green fodders as well as different seeds) appeared to be more important than the level.

Regarding the results of metabolism trial, the digestibilities obtained indicated that all nutrients were moderately digested being high with CP and EE (Table 2). The calculated SV was 44.55°% which is approximately 81% of undecorticated (unextracted) cotton seed cakes (55% SV). The digestible protein was 15% with a narrow nutritive ratio (1 :3.89). This recommended the feed as a protein supplement for certain level of production.

TABLE 2. **Composition, digestibility and feeding value of undecorticated safflower meal.**

Nutrients	Moisture	Ash	Cp	EE	CF	NFE	TDN	SV
Composition as fed . . .	10.00	5.50	19.04	3.92	32.50	29.04	54.7	44.6
Composition, DM basis . .	—	—	21.15	4.36	36.11	32.27	60.7	49.5
Digestibility %	—	—	78.91	87.20	44.82	59.81		
Digestible nutrients% as fed	—	—	15.02	3.42	14.57	17.37		

On the basis of the present findings it was clear that the meal could be fed either alone or along with moderate quantities of roughages and lor concentrates according to the type of production. It could replace undecorticated cotton seed cake (unextracted) 3.75 kg from the meal being equivalent to 3 kg from the cakes as has been designed for the next experiment for milk production. Moreover, the crude protein utilization in the meal ranked well. The percentage of apparently retained N was 73 % from apparently digested nitrogen (aparent B.V). The true B.v. was 85% being comparable with the results obtained by Abd-El- Motagally (Miss), (1966) for hay and hay common concentrate mixture.

Regarding the daily intake the present results indicatd that sheep ate readily the meal up to a maximum level of 1.65kg for ram weighing 50kg and this could be considered a suitable dry matter intake (85.9 g/ 1 kg metabolic body zise). This implies also that the daily intake was 712.8 g SV and 240.3g DCP equivalent which corresponds to a daily intake of 37.91g SV and and 12.78 g DCP/kg metabolic body size respectively. Considering the maintenance requirements for sheep to be 25g SV and 2.75g DCP/kg metabolic body size (Abou Raya, 1967), the daily intake of this meal appears to be satisfactory with a relatively high nutritive value index (N.V. I). This would allow the energy intake to cover an appreciable part of production requirements. The experimental animals behaved normally, keeping their weight during the experimental period without any physiological disturbance. It appears that the extra energy level of intake was used for producing fat replacing water in the animal body tissues without noticeable increase in live weight.

Effect of replacement of undecorticated safflower meat to undecorticated cotton seed cake on milk production of Friesian cows and buffaloes

In this experiment, 2 trails of the Swing over method were conducted using Friesian cows and buffaloes. In both trails 3.75 kg undecorticated safflower meal replaced 3 kg undecorticated cotton seed cakes in the tested rations.

The results indicated that the initial milk yield of cows fed the control ration ranged between 7.12 kg and 8.98 kg with an average of 8.21 kg (Table 3). In buffaloes however the yield ranged from 5.81 kg to 7.08 kg with an average of 6.53 kg. Replacement of safflower meal resulted in a slight insignificant increase of milk yield in both cows and buffaloes (0.82 $\pm$ 0.68 and 1.57 $\pm$0.99 respectively).

TABLE 3. **Effect of replacement of undecorticated cotton seed cake to undecorticated safflower meal on milk production of Friesian cows and buffaloes.**

	Initial yield for control ration at 23 *rd* day kg	Final yield for control at 83 *rd* day kg	Calculated yield at 53 *rd* day $\frac{a+b}{2}$ kg	Actual yield at 53 *rd* day kg	% difference from calculated yield at53 *rd* day $\frac{c-d}{c} \times 100$ %	"t"
	(a)	(b)	(c)	(d)		
Cows						
1	7.12	5.78	6.45	6.54	1.39	
2	7.83	6.71	7.27	7.40	1.79	
3	8.90	7.52	8.21	8.14	0.85	
4	8.98	7.63	8.31	8.39	0.96	
Average	8.21	6.91	7.56	7.62	0.83 0.68	1.21
Buffaloes						
1	6.79	5.69	6.22	6.30	1.29	
2	7.08	6.02	6.55	6.49	—0.92	
3	6.63	5.33	5.88	6.00	2.04	
4	5.81	5.02	5.42	5.63	3.87	
Average	6.53	5.51	6.02	6.11	1.57$\pm$0.99	1.59

The averages of fat yield with control ration were 0.312 kg and 0.463 kg for cows and buffaloes, respectively (Table 4). The replacement of safflower meal resulted also in a slight increase in fat yield of both cows and buffaloes. The average percentage increases are 2.01 $\pm$ 1.38 and 1.70 $\pm$ 0.83 for cows and buffaloes respectively, being insignificant.

In both trials, the replacement of undecorticated safflower meal to undecorticated cotton seed cakes resulted in slight insignificant increases in milk

TABLE 4. Effect of replacement of undecorticated cotton seed cake to undecorticated saffower meal on fat yield of Friezian cows and buffaloes.

	Initial yield for control ration at 23 *rd* day kg	Final yield for contrl at 83 *rd* day kg	Calculated yield at 53 *rd* day kg $\frac{a+b}{2}$	Actual yield 53 *rd* day kg	%difference form calculated yield at 53 *rd* $\frac{c-d}{c}$	't'
	(a)	(b)	(c)	(d)		
Cows						
1	0.271	0.208	0.240	0.235	—2.08	
2	0.305	0.238	0.272	0.282	3.68	
3	0.329	0.249	0.289	0.300	3.81	
4	0.341	0.273	0.307	0.315	2.61	
Average	0.312	0.242	0.277	0.283	2.01±1.38	1.46
1	0.475	0.364	0.420	0.417	—0.71	
2	0.489	0.392	0.441	0.450	2.04	
3	0.463	0.358	0.410	0.420	2.44	
4	0.424	0.300	0.362	0.373	3.04	
Average	0.463	0.354	0.408	0.415	1.70+0.83	2.05

and fat yield which could be neglected in practical application. This indicated that the replacement did not affect the yield producing similar milk and fat yield in both lactating cows and buffaloes. In this connection, Baker *et al.* (1951) and Faulkner and Paul s (1952) indicated that the undecorticated safflower meal could replace other oilseed meals, if comparisons are made on the basis of equal quantities of protein. This condition was fullfilled in this study. Weibel (1951) had shown also that safflower seed meal competes directly with cottonseed, linseed, peanut and soybean meal, all being interchangeable in livestock feeds.

On the other hand, the experimental animals ate readily the safflower meal, remaining healthy without any observed changes in faecal texture.

Therefore, safflower meal appears to be a promising feed in practice to cover a part of the energy and protein requirements in the ration of lactating cattle . The present study revealed an advantage of expanding the croping of safflower, introducing the useful crop in the rotation. Perhaps the newly reclaimed areas are especially more suitable for this crop.

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القيمة الغذائية لكسب القرطم مع الغنم وتأثيره فى العلائق على محصـــول اللبن والدهن فى البقر والجاموس

محمد محمد الشناوى و عبد الرؤف أبو الحسن محمد

كلية الزراعة ، جامعة القاهرة و جامعة المنصورة

يوجد نقص كبير فى كميات الاعلاف المتاحة للحيوانات بجمهورية مصر العربية وتزداد حدة هذا النقص فى المواد المركزة والتى لا يتعدى الناتج منهـا ١٧٪ من هذه الاعلاف • ولظروفنا الاقتصادية ولأمور تتعلق بالدورة الزراعية فانه يصعب المساس بالتراكيب الزراعية الموجودة ، ويستلزم الامـر البحـث عن مصادر جديدة أملا فى سد هذا العجز •

لذلك أجريت هذه الدراسة بهدف الاستفادة من كسب القرطم ، هذاالمحصول الزيتى الذى ادخلت زراعته حديثـا فى مصر فى الأراضى الجـيرية والأراضى المستصلحة ، وقد شملت هذه الدراسة التحليل الغذائى للكسب ثم ادخالهفى

تجربة هضم على كباش تامة النمو لمعرفة شهية الحيوان ومدى الماكول منهعند التغذية علية وجده ولتقدير معاملات الهضم والقيمة الغذائية وميزان الازوت

وأدخل هذا الكسب فى تجربتين ليحل محل مادة مركزة نمطية وهى كسب القطن لدراسة تأثيره على محصول اللبن والدهن فى علائق الجاموس والبقر الفريزيان وأظهرت النتائج ان القيمة الغذائية لهذا الكسب جاف هوائى هى ٤٤ر٦٪ معادل نشا ، ٥٤ر٧ مركبات مهضومة كلية ١٥٪ بروتين مهضوم ٠

ولقد تناولته وحدة بشهية دون ظهور أى أعراض ضارة عليها ودون تغير فى قوام الروث وكانت كمية المأكول يوميا (١ر٦٥ كجم/رأس ٥٠ كجم) أى أن كل كجم حيز جسم تمثيلى حصل على ٨٥ر٩ جم مادة جافة بها ٣٧ر٩١ جم معادل نشا ، ١٢ر٧٨ جم بروتين مهضوم وهذا يغطى احتياج العليقة الحافظة من النشا والبروتين بزيادة كبيرة تستغل فى الانتاج ٠

وأظهرت الدراسةأنه يمكن احلالة محل كسب القطنفى علائق أبقار الفريزيان الحلوب والجاموس ليغطى ٤٠٪ من الطاقة الكلية ، ٧٠٪ من البروتين المهضوم فى العليقة دون حدوث أى تأثير معنوى فى محصول اللبن والدهن وكانت حالة الحيوانات وانتاجها طبيعيا دون أدنى تأثير فسيولوجى ضار ٠

وتبين هذه الدراسة أمكانية الاستفادة من هذا الكسب فى التغذية العملية لتغطية جزء من النشا والبروتين فى علائق ماشية اللبن وبذلك تسهم مخلفات تلك المحاصيل الجديدة فى سد جزء من نقص الغذاء اللازم للحيوانات ٠