

Use of Undecorticated Sunflower Cake as a Critical Protein Supplement in Sheep and Goats Fed Wheat Straw

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ABSTRACT : The effect of undecorticated sunflower cake (USFC) as critical protein supplement was assessed and compared with deoiled groundnut cake (DGNC) in adult goats and sheep. The animals were fed a basal diet of wheat straw *ad libitum* and supplemented with either USFC or DGNC to meet their protein requirement for maintenance. Total dry-matter intake by sheep and goats (g/kg BW^{0.75}) on USFC was similar to their counterparts on DGNC supplemented group. However, while intake of cake moiety was significantly ($p < 0.05$) higher in USFC, the intake of wheat straw was significantly ($p < 0.05$) higher by animals on DGNC. Digestibility of various nutrients, except lower crude protein digestibility by goats in USFC group, did not differ significantly between animals given DGNC or USFC. DCP and TDN concentration (% DM) was comparable in sheep and goats irrespective of dietary supplement. Similarly, the intake (g/kg W^{0.75}) of DCP, DDM, DOM, and TDN was similar between DGNC and USFC in both sheep and goats. It may be concluded that undecorticated sunflower cake is comparable to deoiled groundnut cake as a critical protein supplement to the roughage based diet of small ruminants. (*Asian-Aust. J. Anim. Sci.* 2002, Vol 15, No. 6 : 834-837)

Key Words : Sunflower Cake, Protein Supplement, Nutritive Value, Goat, Sheep

INTRODUCTION

Crop residues occupy now a prominent place in small holder ruminant production systems with the deterioration of natural rangelands due to overgrazing (Jodha, 1986), and the tendency to divert better feeds (brans and cakes) to cities for use on specialized peri-urban dairy farms (Kiran Singh et al., 1997). The major limitations with crop residues include their bulkiness and poor nutritive value. With various enrichment (treatment) technologies available to improve the nutritive value finding little acceptance by farmers (Owen and Jayasuriya, 1989; Dolberg, 1992; Devendra, 1997), the only viable option left is to concentrate on critical supplementation with other feeds that provide additional protein, minerals and energy. Of the several alternative supplementation strategies that may be adopted, the most common is the use of purchased protein supplements, such as oil cakes (Devendra, 1997). However, the choice of oil cake by resource poor farmers is usually driven by two factors, viz. availability and cost.

In India, sunflower (*Helianthus annuus*) is being increasingly grown, primarily as a source of vegetable oil for the food industry. The sunflower seeds are usually used for extraction of oil without dehulling. The resultant undecorticated oil cake (USFC) is available in increasing quantities for use as livestock feed. According to latest estimates, about 0.83 million tonnes of sunflower cake is available per annum. The nutritive value of the USFC so produced depends on the oil extraction process, the variety of sunflower and the proportion of the hulls removed during

processing (Topps and Oliver, 1993; Mandibaya et al., 1999). USFC is at present less costly (Rs.3000/t) compared to the conventionally used oil cakes such as groundnut cake (Rs.9000/t) and mustard cake (Rs.6500/t), so its potential as an efficient animal feed appears to be under exploited. The objective of present study was to assess and compare the value of USFC with deoiled groundnut cake (DGNC) as a critical protein supplement to sheep and goats fed a basal diet of wheat straw.

MATERIALS AND METHODS

The effect of undecorticated sunflower cake and groundnut cake as a critical supplement was ascertained in two independent experiments (Experiments I and II) using adult Barbari male goats and adult female sheep.

Experiment I

Six adult Barbari bucks (avg. BW 25±1.9 kg) in a 2×3 change over design, (two treatments and two periods) were fed a basal diet of wheat straw *ad libitum*. They were given either DGNC or USFC as protein supplements to meet their protein requirement for maintenance (Kearl, 1982). The animals were given mineral mixture and common salt daily to meet their mineral requirements. Goats were fed in individual feeding stalls for a preliminary period of 35 days to adjust to the basal diet and supplements followed by a 7 days collection period with free access to water twice daily during each period. The animals were weighed at fortnightly intervals in the morning before offering the feed. During each experimental period, total dry matter intake and faecal out put (24 h) were recorded daily in each trial and a 20% sub-sample collected and dried in a forced

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drought oven to a constant weight for dry matter estimation. Representative samples of each daily faecal collection were drawn, pooled for seven days and preserved in diluted (25%) sulphuric acid for N-estimation. The other samples were retained for further chemical analysis.

Experiment II

Three adult female sheep (avg. BW 28.58±0.83 kg) were fed a basal diet of wheat straw supplemented with USFC for 35 days followed by a 7 day collection period. After the digestion trial, sheep were switched over to supplement DGNC without altering the basal diet and duration of preliminary or collection period. The sheep were provided free access to water and weighed at fortnightly intervals in the morning before offering the feed. Daily dry matter intake and faecal out-put (24 h) were recorded. Pooled samples were ground and stored for chemical analysis.

Analytical procedure

The pooled feed, residue and faeces samples, collected daily during the digestion trial of Experiments I and II, were analysed for proximate composition (AOAC, 1990) and fibre fractions (Goering and Van Soest, 1970). The data were analysed for variance ignoring the period effect and treatment means were compared using t-test (Snedecor and Cochran, 1980).

RESULTS AND DISCUSSION

The chemical composition of oil cakes and wheat straw used in these experiments is given in table 1. The CP content of wheat straw was below the critical level required at normal forage consumption by sheep and goats (NRC, 1981; Kearl, 1982). USFC had lower CP value and higher cell wall fractions than DGNC.

Total dry matter intake of goats and sheep (% BW and g/kg BW^{0.75}) was similar between USFC and DGNC treatments (tables 2 and 3). The results indicated that supplementation of USFC with wheat straw does not have

Table 1. Chemical composition of wheat straw and supplements (% DM basis)

Attributes	Feeds		
	DGNC	USFC	Wheat straw
DM	93.00	92.0	92.8
CP	42.0	27.33	4.7
EE	1.02	2.40	1.50
Total Ash	6.50	10.44	11.0
NDF	29.75	41.10	79.01
ADF	15.23	28.38	48.50

DGNC: Deoiled groundnut cake, USFC: Undecorticated sunflower cake.

Table 2. Effect of cakes supplementation on intake, digestibility and nutrient concentration in goats

Attributes	Treatments		SEM
	DGNC	USFC	
DMI, % B. Wt.	1.97	2.01	0.07
Intake, g/kg W ^{0.75}			
DM	44.0	44.85	1.60
Wheat straw	34.47 ^b	29.90 ^a	0.76
Cake	9.62 ^a	14.95 ^b	0.25
Digestibility coefficient			
DM	55.73	55.12	0.67
OM	58.94	56.66	0.77
CP	57.02 ^b	50.64 ^a	1.42
NDF	55.08	54.21	0.98
ADF	53.41	52.74	0.94
Nutrient concentration (%)			
DCP	7.10	6.20	0.54
TDN	55.70	53.02	0.72
Nutrient intake, g/kg W ^{0.75}			
DCP	3.15	2.78	0.08
DDM	24.57	24.72	0.79
DOM	23.38	22.66	0.83
TDN	24.55	23.79	0.80

^{a,b} Means with different superscript in the row differ (p<0.05).

DGNC: Deoiled groundnut cake, USFC: Undecorticated sunflower cake.

Table 3. Effect of supplementation on intake, digestibility and nutrient concentration in sheep

Attributes	Treatments		SEM
	DGNC	USFC	
DMI, % Wt.	2.01	1.93	0.11
Intake, g/kg W ^{0.75}			
DM	45.98	43.78	1.80
Wheat straw	38.81 ^b	34.08 ^a	0.69
Cake	7.17 ^a	9.67 ^b	0.30
Digestibility coefficient			
DM	56.60	55.11	1.02
OM	59.67	58.16	0.90
CP	51.15	50.82	1.30
NDF	56.81	56.60	1.05
ADF	55.18	53.18	0.97
Nutrient concentration (%)			
DCP	5.36	4.88	0.60
TDN	52.66	51.17	0.80
Nutrient intake, g/kg W ^{0.75}			
DCP	2.46	2.14	0.10
DDM	26.02	24.12	0.81
DOM	23.06	21.30	0.80
TDN	24.27	22.36	0.85

DGNC: Deoiled groundnut cake, USFC: Undecorticated sunflower cake.

any adverse effect on the palatability of the diet. These results are corroborated with the earlier findings that reported no adverse influence of sunflower cake on DMI by various classes of ruminant livestock as compared to other vegetable protein supplements (Nishino et al., 1980; Kuldip et al., 1995; Sihag et al., 1997; Ashok Kumar et al., 2001). However, intake of wheat straw moiety by sheep and goats was significantly ($p < 0.05$) higher on DGNC while intake of cake supplement was significantly ($p < 0.05$) higher on USFC supplement. This is understandable because USFC being low in CP content (27%) as compared to DGNC (42%) had to be offered in comparatively higher amount to sheep and goats to meet their protein requirement. The higher intake of cell wall constituents by sheep and goats given USFC depressed their straw intake. These results are consistent with the findings of Mosi and Butterworth (1985), who reported that cell wall content is the primary restrictive determinant of feed intake.

The digestibility coefficient of DM, OM, NDF and ADF of composite diet (*straw plus supplement*) did not differ between USFC and DGNC treatments in both sheep and goats. However, though the CP digestibility was significantly ($p < 0.05$) depressed by supplementation of USFC in the diet of goats it remained comparable with DGNC treatment in sheep. Kuldip et al. (1995) reported similar crude protein digestibility in sheep supplemented either with sunflower or mustard cake.

Nutrient concentration in term of DCP and TDN was comparable between USFC and DGNC treatments (tables 2 and 3) in sheep and goats. Ashok Kumar et al. (2001) recently reported comparable concentration of DCP and TDN in crossbred calves when about 66% crude protein of DGNC based concentrate was replaced by deoiled sunflower cake. Similarly, the mean intake of DCP, DDM, DOM and TDN ($\text{g/kg BW}^{0.75}$) was also comparable between DGNC and USFC treatments in sheep and goats. Present results are in agreement with earlier reports which indicate that incorporation of sunflower cake resulted in similar intake of energy and protein by sheep and goats when compared to mustard cake or soybean meal (Kuldip et al., 1995; Economides, 1998). The intake of DCP ($\text{g/kg BW}^{0.75}$) was sufficient to meet the maintenance requirement of both sheep and goats (Kearl, 1982). Though TDN intake ($\text{g/kg BW}^{0.75}$) was slightly lower than the recommended allowance for sheep and goats irrespective of dietary supplement, the animals remained apparently in good health. The body weight of goats (25.3 ± 1.86 kg) and sheep (28.7 ± 0.95 kg) were not influenced by nature of protein supplement and remained unaltered throughout the experiment.

Feeding supplements with varying proportions of locally available ingredients to small ruminants is an accepted practice among the farmers. Although the present

study demonstrated that undecorticated sunflower cake as critical protein supplement is comparable to deoiled groundnut cake, its large scale adoption in the prevailing feeding system will be influenced by its accessibility within the vicinity of the households.

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