

Effect of feeding different levels of formaldehyde treated sesame cake on nutrients intake, milk production and economic returns in lactating crossbred cows

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ABSTRACT

Lactating crossbred (Holstein Friesian × Tharparker) cows (15), randomly divided into 3 equal groups were allotted to 3 dietary treatments, viz. T₁, green berseem and concentrate containing untreated sesame cake (control); T₂, green berseem and concentrate containing 1.0% FA treated (1.0g FA/100g CP) sesame cake; and T₃, green berseem and concentrate containing 1.5% FA treated (1.5g FA/100g CP) sesame cake to discuss the effect of feeding formaldehyde treated sesame cake as a bypass protein on nutrients intake, milk production and economic returns in lactating cows. Sorghum stover was fed *ad lib*. in all the groups. The experiment lasted for 90 days. The DM, DCP and TDN intake per kg metabolic body size were 117.79, 9.66 and 72.78 in T₁, 120.95, 9.89 and 75.28 in T₂ and 140.81, 10.97 and 87.11 in T₃, respectively, which were significant in T₃ as compared to T₂ and T₁. However, DM, DCP and TDN intake in T₂ and T₁ groups did not show any significant difference. The average milk yield was significantly higher in T₃ and T₂ (10.21 and 9.80) as compared to group T₁ (8.73). The total milk yield during 90 days period was also higher in T₃ and T₂ (918.90 and 882.0kg) as compared to group T₁ (785.70 kg). The average feed cost per kg milk production was Rs.6.32, 5.92 and 6.15 in T₁, T₂ and T₃ groups, respectively, indicating that feeding of formaldehyde treated sesame cake can have beneficial effect in lactating crossbred cows, it may be concluded that FA treated sesame cake @ 1.5g/100g CP in place of untreated sesame cake in the concentrate mixture of lactating crossbred cows can prove economically beneficial.

Key words: Bypass protein, Crossbred cows, Feed cost milk yield, Sesame cake

Bypass protein technology involves feed management through passive rumen manipulation and by it the dietary proteins, especially from highly degradable oil cakes in rumen, are protected from proteolysis, allowing these proteins to bypass rumen and get digested and then absorbed at the lower tract. Through this approach, there is a significant reduction in the wasteful ammonia production in rumen from dietary proteins and a proportionate increase in the supply of amino acids to the host ruminant for productive/reproductive purpose (Walli 2008) and an overall increase in the efficiency of protein and energy utilization (Yadav and Chaudhary 2006). Inclusion of bypass protein supplement has the potential to increase milk production (Chaturvedi and Walli 2001), provided they are cheaper to produce (Garg 1998). Walli (2005) concluded that treatment of mustard cake (MC) improved its palatability as well as nutrient utilization in ruminants. Keeping this in view, the present work was undertaken to investigate the effect of

feeding formaldehyde treated sesame cake on intake and productive performance in crossbred cows.

MATERIALS AND METHODS

Lactating crossbred (Holstein Friesian × Tharparker) cows (15) of almost similar BW (393.80 kg) and milk yield (8.22) were selected from the livestock farm herd, and randomly divided into 3 groups of 5 animals each in a randomized block design after deworming and vaccination. The cows were housed in individual stalls having provision for feeding and watering. Three nitrogenous and isocaloric concentrate mixtures were formulated (Table 1) and offered to lactating cows in 3 dietary treatments, viz. T₁: green berseem (*Trifolium alexandrinum*) and concentrate mixture containing untreated sesame cake (control); T₂: green berseem and concentrate mixture containing 1.0% formaldehyde treated (1.0g FA/100CP) sesame cake; and T₃: green berseem and concentrate mixture containing 1.5% formaldehyde treated (1.5gFA/100gCP) sesame cake. For formaldehyde treatment sesame cake was broken down in small flakers with the help of hand pushed stone roller and was uniformly spread over a cement floor. Formaldehyde solution (40% w/v) was sprayed

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Table 1. Feed ingredient (%) and chemical composition (% on DM basis) of feed during experimental period

Particulars	Green berseem	Sorghum stover	Concentrate mixtures		
			T ₁	T ₂	T ₃
<i>Ingredient</i>					
Til	—	—	30	30	30
Barley	—	—	27	27	27
Wheat bran	—	—	28	28	28
Deoiled rice polish	—	—	12	12	12
Mineral mixture	—	—	2	2	2
Common salt	—	—	1	1	1
<i>Chemical composition</i>					
DM	16.62	89.28	90.96	90.96	90.20
OM	87.62	90.44	91.91	91.86	91.88
CP	16.86	3.50	20.16	20.09	20.10
CF	24.21	34.63	8.21	8.11	8.07
EE	1.96	1.21	4.38	4.32	4.28
NFE	44.59	51.10	59.16	59.34	59.34
TA	12.38	9.56	8.09	8.14	8.12

with the help of a hand sprayer @ 1–0 (T₂) and 1.5g (T₃) formaldehyde per 100g CP over the material uniformly as per Gupta and Gupta (1984). The sprayed cake was mixed well and stored in air tight polythene bags for 7 days for the reaction to be completed after which the bags were opened. In all the treatments, each cow was offered 10 kg green berseem and *ad lib.* sorghum (*Sorghum bicolor*) stover and the respective concentrate mixture as per requirement of animals (Ranjhan 1998). The feed intake was recorded daily to calculate DM intake. Water was provided twice daily. Milk yield for individual cow was recorded daily throughout experimental period (90 days). Animals were weighed at the beginning of experiment and then after at monthly intervals for a period of 90 days. The weight was recorded in the morning before providing water and feed to the animals. Amount of concentrate mixture was adjusted weekly as per change in milk yield. Health status of animals was monitored daily. At the end of experimental feeding, a 7-day digestion trial was conducted to know the digestibility of nutrients. Feeds and fodder and faecal samples were analyzed for proximate principle (AOAC 1995). Assessment of dietary treatments were evaluated by input and output ratio in respect of body weight and milk yield at the end of the experiment. Returns were calculated on the basis of prevailing market rates of individual feed ingredients and milk yield.

To ascertain the effect of different treatments, the experimental data were subjected to analysis of variance (ANOVA) and the differences between the treatment means were compared by using statistically as per the procedure of Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

The chemical composition (Table 1) of green berseem and sorghum stover (% DM basis) was in agreement with the

Table 2. Mean intake of dry matter, nutrient and water in lactating crossbred cows

Attribute	Treatment		
	T ₁	T ₂	T ₃
<i>Dry matter and nutrient intake</i>			
DMI/day (kg)	10.53 ^b ±0.24	10.85 ^b ±0.11	12.74 ^a ±0.35
DMI/day g/w ^{0.75}	117.79 ^b ±1.89	120.95 ^b ±3.45	140.81 ^a ±1.52
CPI/day (kg)	130 ^b ±30.65	1.329 ^b ±25.04	1.508 ^a ±34.72
CPI/day g/w ^{0.75}	14.55 ^b ±0.26	14.81 ^b ±0.48	16.67 ^a ±0.10
DCPI/day (g)	863.46 ^b ±20.02	887.53 ^b ±9.15	993.0 ^a ±26.63
DCPI/dy g w ^{0.75}	9.66 ^c ±0.16	9.89 ^b ±0.28	10.97 ^a ±0.11
TDNI/day (kg)	6.50 ^b ±0.14	6.76 ^b ±0.12	7.86 ^a ±0.29
TDNI/day g/w ^{0.75}	72.78 ^b ±1.46	75.28 ^b ±68	87.11 ^a ±0.71
<i>Water intake</i>			
Voluntary WI (litre)	40.20 ^b ±1.11	45.00 ^a ±1.48	48.00 ^a ±1.84
WI through feed (litre)	9.23±0.04	9.35±0.06	9.55±0.25
Total WI (litre)	49.43 ^b ±2.54	54.35 ^{ab} ±1.47	57.55 ^a ±1.90
VWI/kg DMI (litre)	3.80 ^b ±0.10	3.94 ^b ±0.14	5.29 ^a ±0.06
Total WI/kg DMI (litre)	4.68 ^b ±0.16	5.00 ^b ±0.23	6.05 ^a ±0.05
VWI/kg milk yield (litre)	4.62±0.18	4.59±0.10	4.70±0.17
Total WI/kg milk yield (litre)	5.68±0.36	5.54±0.10	5.63±0.17

abc, Values in a row bearing different superscripts differ significantly* (P<0.05, **P<0.01).

reported values (Ranjhan 1998). The average dry matter intake per kg metabolic body size (W^{0.75}) was significantly (P<0.01) higher in T₃ as compared to T₂ and T₁ treatment (Table 2) indicating that the FA treated concentrate mixture influenced the voluntary feed intake and palatability. These results are in agreement with feeding formaldehyde treated (FA) cakes to lactating crossbred cows reported by Mishra *et al.* (2006), Yadav and Choudhary (2006) and Sahoo (2002).

The CP intake per kg w^{0.75} (g) significantly (P<0.01) differed among treatments, indicating better performance of animals in T₃ as compared to T₂ and T₁. These results are in close agreement with the findings of Bhardwaj *et al.* (2000) and Mehta and Srivastava (2001) who reported that protected protein fed groups consumed more CP as compared to untreated protein fed group. Meisogaru *et al.* (2006) and Yadav and Choudhary (2006) also reported significantly effect on crude protein intake in lactating crossbred goats and cows on feeding FA treated GNC. The digestible crude protein (DCP) intake per kg w^{0.75} (g) was significantly (P<0.01) higher in FA treated sesame cake groups as compared to control group, which indicated better utilization of protein in animals of T₃ and T₂ groups. The TDN intake g/kg w^{0.75} was significantly (P<0.05) higher in T₃ followed by T₂ and T₁, which was in close agreement with the findings of Mehta and Srivastava (2001) who reported higher nutrient intake in crossbred cows on feeding formaldehyde treated

groundnut cake. However, there was a nonsignificant difference between T_1 and T_2 for CPI and TDNI. The higher CP, DCP and TDNI in T_3 as compared to T_2 and T_1 may be due to high dry matter intake by the animals fed 1.5% FA treated sesame cake.

The average voluntary water intake (VWI) in T_1 , T_2 and T_3 treatments was 40.20, 45.00 and 48.00 litre, respectively. The higher ($P<0.05$) VWI in T_3 animals might be due to higher amount of sorghum stover intake. The ratio of VWI and DMI in T_1 , T_2 and T_3 was 3.80:1, 3.94:1 and 5.29:1 respectively. The water consumption of the animals depends on many factors, such as: type of diet, quality of roughage, types of animals, physical environment etc. Accordingly the variation has been observed by different workers in the consumption of water and DMI ratio 5.0:1 (Singh and Mudgal 1967), 5.29:1 (Sebastian *et al.* 1970) in buffaloes and cows. The voluntary water intake and total water intake per kg milk yield was not influenced ($P<0.05$) by levels of FA treated sesame cake given to lactating crossbred cows.

Milk yield and composition: The average daily FCM yield (kg/d) was significantly higher ($P<0.01$) in T_3 and T_2 groups as compared to T_1 group (Table 3). However, nonsignificant ($P<0.01$) differences were observed between T_2 and T_1 groups in terms of FCM and SCM yield. The higher milk production in group T_3 may be attributed to the supplementation of bypass protein in the concentrate mixture through required amount of amino acids and ME to the host animal at cellular level. Higher milk production was also

Table 3. Milk yield, protein and energetic efficiency and nutrients utilization per kg milk produced

Attribute	Treatment		
	T_1	T_2	T_3
Milk yield			
Initial milk yield (kg/day)	8.22 $\pm$ 2.20	8.40 $\pm$ 2.23	8.14 $\pm$ 2.23
Milk yield (kg/day)	8.73 ^b $\pm$ 0.24	9.80 ^a $\pm$ 0.24	10.21 ^a $\pm$ 0.16
FCM yield (kg/day)	8.88 ^c $\pm$ 0.21	10.09 ^b $\pm$ 0.24	10.82 ^a $\pm$ 0.19
SCM yield (kg/day)	8.98 ^c $\pm$ 0.21	10.51 ^b $\pm$ 0.26	11.25 ^a $\pm$ 0.19
Protein efficiency			
Gross efficiency	39.48 $\pm$ 1.20	43.10 $\pm$ 1.22	40.18 $\pm$ 0.81
Net efficiency	55.91 $\pm$ 1.49	61.05 $\pm$ 2.37	54.44 $\pm$ 1.24
Energetic efficiency			
Gross efficiency	29.11 $\pm$ 0.58	32.83 $\pm$ 1.54	30.14 $\pm$ 0.67
Net efficiency	54.49 $\pm$ 2.11	61.02 $\pm$ 3.90	49.86 $\pm$ 2.32
Efficiency of nutrient utilization			
DM consumed (kg)/kg FCM yield	1.19 $\pm$ 0.03	1.08 $\pm$ 0.03	1.18 $\pm$ 0.02
CP consumed (g)/per kg FCM yield	146.72 $\pm$ 3.86	131.77 $\pm$ 1.64	139.33 $\pm$ 1.42
TDN consumed (kg)/kg FCM yield	0.73 $\pm$ 0.01	0.67 $\pm$ 0.03	0.73 $\pm$ 0.02

abc, Values in a row bearing different superscripts differ significantly* ($P<0.05$, ** $P<0.01$).

observed in crossbred cows fed concentrate mixture with FA treated GNC and cereal straws (Sampath *et al.* 1997, Chatterjee and Walli 2003b). Yadav and Chaudhary (2006) reported significant increase in milk yield, FCM yield and SCM yield in crossbred cows fed formaldehyde treated GNC. Walli *et al.* (1995), Sampath *et al.* (1997), Yadav and Chaudhary (2004) and Chaturvedi and Walli (2000) also reported significant higher milk yield, fat corrected milk yield and solid corrected milk yield in lactating crossbred cows fed formaldehyde treated GNC. The increase in milk production reported on feeding protected protein in the present study could also be due to more availability of protein for digestion in the intestine, thereby increasing supply of precursors of milk production (Forster *et al.* 1983 and Mishra *et al.* 2006).

Feed conversion efficiency: The average gross efficiency of protein was 39.48, 43.10 and 40.18%, respectively, in T_1 , T_2 and T_3 treatments (Table 3), while net protein efficiency was 55.91, 61.05 and 54.44% in T_1 , T_2 and T_3 respectively. The efficiency of protein was not influenced by the 3 feeding regimens. These results are similar with the findings of Yadav and Chaudhary (2006). Similarly, gross energetic efficiency and net energetic efficiency observed were statistically nonsignificant, the present findings are in close agreement with Yadav and Chaudhary (2006) who could not find any significant effect of feeding FA treated cakes on gross energetic efficiency. Though it was higher in FA treated group as compared to untreated group. The energetic efficiency ranged from 49 to 61% in the present experiment, which is within the range reported by Walli (2008) and Patle and Mudgal (1976) in lactating crossbred cows.

Thus, essentially the feeding of bypass protein increases the efficiency of protein and energy utilization within the ruminant system. However, when bypass protein is fed, there is substantial increase in the efficiency of conversion of the already existing nutrients in the diet into milk. By feeding

Table 4. Feed cost (Rs) in lactating cows fed rations containing FA treated and untreated sesame cake

Attribute	Treatment		
	T_1	T_2	T_3
Av daily feed cost/animal (Rs)	55.24	58.01	62.82
Milk yield (kg) (90 days)	985.70	882.0	918.90
FCM yield (kg)	799.20	908.10	973.80
SCM yield (kg)	808.20	945.90	1012.50
Feed cost per kg milk yield	6.33	5.92	6.15
Feed cost per kg FCM yield	6.22	5.75	5.80
Feed cost per kg SCM yield	6.15	5.52	5.58
Total returns from sale of milk	9 428.40	10 584.00	10 26.8
Total return over feed cost from sale of milk	4 456.33	5 362.66	5 371.86
Mean daily return over feed cost from sale of milk	49.51	59.59	59.69

bypass protein, the farmer gets extra milk without giving any extra feed (Walli 2008).

Feed cost and cost of feeding per kg milk yield: The cost of formaldehyde treatments of the cake for 1.0% FA treated sesame cake was 73 paisa/kg and for 1.5% FA treated sesame cake was Rs 1.15/kg (Table 4). Similarly, the average feed cost per kg milk production was 6.33, 5.92 and 6.15 in T₁, T₂ and T₃ groups, respectively. The corresponding figures for per kg 4% FCM yield was Rs 6.22, 5.75 and 5.80 in T₁, T₂ and T₃ groups, respectively, indicating that feeding of FA treated sesame cake can have beneficial effect in lactating crossbred cows. The higher return over feed cost in T₃ and T₂ may be due to more production of milk. These results are in agreement with the findings of Garg *et al.* (2004) in lactating cows. Thus the feeding of formaldehyde treated @ 1.5 g/100 CP not only resulted in better nutrient utilization, milk production and feed conversion efficiency by the cows, but also resulted in better economics, of rising of crossbred cows in terms of feed cost per kg milk yield.

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