Indian Journal of Animal Sciences **81** (9): 965–967, September 2011

Effect of exogenous fibrolytic enzyme supplementation or treatment of wheat straw on nutrient utilization and milk yield in crossbred cows

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Received: 10 January 2011; Accepted: 21April 2011

ABSTRACT

The study was undertaken to study the effect of fibrolytic enzyme supplementation or treatment of wheat straw on nutrient utilization and milk yield in crossbred cows. Crossbred lactating cows (15; average body weight, 13.50 kg) were randomly divided in to 3 groups of 5 each. The animals of control group (T1) were fed untreated wheat straw, sorghum stover and concentrate as per requirement, whereas the animals of T2 and T3 were fed exogenous fibrolytic enzymes supplemented and treated wheat straw with fibrolytic enzyme, sorghum stover and concentrate mixture for a period of 90 days. At the end, a digestibility trial of 7-day collection was conducted. The dry matter intake was 8.69, 9.61 and 9.88 kg/day/animal, respectively, in T1, T2 and T3. DMI as per cent body weight was relatively higher in T2 and T3 than T1, though values were not statistically significant. Digestibility coefficient of DM and OM were comparable among the groups; however, digestibility of NDF and ADF was significantly higher in T2 and T3 than T1. DCP intake by the cows in different groups was similar, however, TDN intake (kg/day/animal) was comparatively higher in T2 (5.40) and T3 (5.59) than T1 (4.79). Milk yield and its composition were comparable among the groups. It can be concluded that fiber digestibility was improved by fibrolytic enzyme supplementation or feeding of wheat straw treated with fibrolytic enzymes, however, milk yield and its composition was unaffected in crossbred cows.

Key words: Crossbred cows, Fibrolytic enzyme, Milk composition, Milk yield, Nutrient utilization

Crop residues like wheat straw, paddy straw, stovers, the major components of ruminant diet in India, are deficient in nitrogen, available energy and poor palatability limits their voluntary intake and consequently affects production performance of livestock. Enzyme addition to the dietary forage or concentrate improved the performance of cows, reflecting the importance of a close association between the feed and enzymes for fiber hydrolysis (Beauchemin *et al.* 1999). Some of the studies also indicated that fibrolytic enzymes when applied to forage or TMR immediately prior to feeding lactating cows, increased digestibility, feed intake and milk yield (Yang *et al.* 2000, Beauchemin *et al.* 2000). Hence, the present experiment was undertaken to study the effect of fibrolytic enzyme supplementation or treatment of wheat straw on nutrient utilization and milk yield in crossbred cows.

MATERIALS AND METHODS

Crossbred lactating cows (15; average body weight, 13.50 kg) were randomly divided in to 3 groups of 5 each. The animals of control group (T1) were fed untreated wheat straw, sorghum stover and concentrate as per requirement whereas the animals of T2 and T3 were fed fibrolytic enzyme supplemented and treated wheat straw, sorghum stover and concentrate mixture for a period of 90 days. At the end, a digestibility trial of 7-day collection was conducted. All the animals were housed in well ventilated stalls having arrangements for individual feeding and watering. Dry matter (DM), ash, ether extract of various samples were determined according to AOAC (1995). The trial samples were analyzed for neutral detergent fibre (NDF), acid detergent fibre (ADF) and lignin (Goering and Van Soest 1970). Total nitrogen was determined by microkjeldhal method (AOAC 1995). The milk samples collected at fortnightly intervals were analyzed for milk fat (BIS 1989), total solids (BIS 1989) and milk protein (AOAC 1995). Solid not fat content of milk was calculated by subtracting fat percentage from total solids. The statistical analysis of the data was carried out in accordance with Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The CP content of untreated and enzyme treated or supplemented wheat straw was similar (Table 1). However,

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Table 1. Chemical composition of wheat straw, sorghum stover and concentrate mixture (% DM basis)

Parameter	Wheat straw			Sorghum stover	Concentrate mixture
	Untreated	Supplemented	Treated		
OM	89.45	89.81	89.45	93.10	93.20
NDF	80.36	80.36	77.63	71.55	32.72
ADF	48.56	48.26	51.02	43.23	11.52
EE	1.15	1.15	1.18	1.83	3.48
CP	3.30	3.30	3.43	4.70	16.76
NFE	49.93	50.16	50.80	54.43	68.21

Table 2. Effect of fibrolytic enzyme supplementation or treatment of wheat straw on nutrient utilization in lactating cows

Parameter	Untreated	Enzyme supplemented	Enzyme treated
Average body wt (kg)	342.9 ± 18.69	352.1±9.18	355.5±11.91
DMI (kg/d/animal)	8.696±0.55	9.611±0.54	9.882±0.42
DMI/100kg Bwt (kg)	2.57 ± 0.19	2.73 ± 0.15	2.78 ± 0.10
Digestibility coefficient (%)			
DM	54.33±2.16	56.25±1.27	55.96±1.52
OM	57.636±1.92	59.184±1.14	58.74±1.49
NDF	52.94^{a}±2.15	55.11^{b}±2.35	55.21^{b}±1.39
ADF	35.39^{a}±0.34	38.24^{b}±1.80	40.71^{b}±2.38
EE	76.96±1.98	74.11±1.55	75.91±1.71
CP	52.04^{a}±1.41	55.82b±3.32	52.10^{a}±1.6
NFE	57.32±1.96	58.83±1.90	58.30±1.65
Nutrient intake (kg/d)			
DCP	0.428±0 .03	0.489± 0.06	0.458±0.05
TDN	4.790±0.25	5.399±0.30	5.585 ± 0.43
Nutrient density (%)			
TDN%	55.02±1.91	56.221±1.09	56.464±1.32

the fibrolytic enzyme treatment resulted in reduction in fiber content of the treated wheat straw. The reason for reduction in fiber content particularly, NDF might be due to partial dissolution of many water-soluble polysaccharides during enzyme treatment (Forsberg *et al.* 2000). DMI (Table 2) as per cent body weight was relatively higher in T2 and T3 than T1, though not statistically significant. This indicated that enzyme treatment or supplementation did not affect the palatability of the diet significantly. Similar findings were also reported earlier in enzyme treated total mixed ration (McAllister *et al.* 2000) and enzyme treated concentrate to lactating cows (Vahora and Pande 2006).

Crossbred cows maintained on enzyme treated or supplemented ration showed that the digestibility coefficient of DM and OM were comparable among the groups; however, digestibility of NDF and ADF was significantly ($P<0.05$) higher in T2 and T3 than T1. The higher digestibility of fiber in T2 and T3 might be attributed due to the partial solubilization of fiber that resulted in improved degradation through easy colonization and penetration of cellulolytic microbes on to exposed surface of feed particles . The other reason may be due to the higher CMCase and xylanase activity in the rumen resulting in higher digestibility of fiber (Yang *et al.* 2000). The DCP intake by the cows in different groups was similar. However, TDN intake was comparatively higher in T2 (5.40) and T3 (5.59) than T1 (4.79) though not statistically significant. Enzymes had no effect on intake of either DCP or TDN. Intake of DCP and TDN was close to the requirement (ICAR 1998). The enzyme did not impact most of the variables estimated in this study and contrary to the reports of Pinos-Rodriguez *et al.* (2002) who observed that fibrolytic enzymes positively impacted intake, ruminal digestion in lambs fed alfalfa or ryegrass hay. These divergent results may be due to the higher NDF content in fibrous portion of the diet especially in wheat straw (804 g/kg) and sorghum stover (716 g/kg) versus alfalfa and ryegrass hay (<458 g/kg DM). These results are in general agreement with Dean *et al.* (2008) who did not find positive effects of fibrolytic enzymes on digestion of high fiber tropical grasses.

Table 3. Milk yield and composition

Parameter	Untreated	Enzyme supplemented	Enzyme treated
Average milk yield (L/d/animal)	6.49±0.54	6.64±0.65	6.59±0.58
Protein (%)	4.18±0.20	4.11±0.15	4.03±0.12
Fat (%)	5.72±0.52	5.56±0.55	5.52±0.50
SNF (%)	9.05±0.48	9.67±0.88	9.49±0.82
Total solids (%)	14.77±0.67	15.23±0.81	15.01±0.61

The milk yield was comparable among the groups (Table 3). Milk protein and milk fat were also comparable among the groups. Similarly Adesogan *et al.* (2007) also observed that enzyme addition did not affect intake or apparent digestibility of DM, CP etc. and consequently milk production, milk fat and true protein yields were not improved or unaffected by enzyme supplementation in dairy cows.

Thus it can be concluded that although fiber digestibility was improved by fibrolytic enzyme supplementation or treatment of wheat straw, increases the availability of energy (TDN) non-significantly, however, milk yield and its composition was unaffected in crossbred cows fed enzyme supplemented or treated wheat straw based ration.

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