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Effect of varying levels of fibrolytic enzyme supplementation on feed intake, growth performance and feed conversion ratio in Gir calves

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Abstract
The present study was conducted to investigate the effect of fibrolytic enzyme on feed intake, growth performance and feed conversion ratio in Gir calves. Fifteen male Gir calves of around one year age was randomly selected and calves were randomly divided into three group with five calves in each for duration of 90 days. Three treatments were: only TMR (T_1), TMR supplemented with EFEs at 0.025% of DM (T_2) and TMR supplemented with EFEs at 0.050% of DM (T_3). Statistical analysis revealed that no significant effect was observed on DMI in both treatments. Whereas, DMI was numerically increased in both treatments as compared to control. TBWG (Kg) (63.6 & 62.1 vs. 52.4), ADG (g/d) (706.67 & 690.00 vs. 582.22) and FCR (8.01 & 8.19 vs. 9.24) were significantly ($p<0.05$) improved in both T_2 and T_3 as compared to T_1. Based on overall result EFEs were significantly improved ADG, FCR and TBWG.

Keywords: Average daily gain, dry matter intake, feed conversion ratio, total body weight gain

Introduction
Livestock plays a vital role in the Indian economy, providing an income for two-thirds of the rural population. About 8.8% of the population of India is employed by it as well. The livestock industry generates 4.11 percent of the nation's GDP and 25.6 percent of all of agriculture's GDP Anonymous (2020) [1]. According to 20th livestock census, in Gujarat total cattle and buffalo population is about 26.9 million and 10.5 million, respectively Anonymous (2021) [2]. Agricultural by-products and cereal crop residues are commonly fed to nursing ruminants, although they are low in nutrients and less digestible due to the presence of lignocellulose linkages, high levels of silica, and anti-nutritional elements. This not only limits production capacity but also has an impact on farmer profitability. In such circumstances, the use of feed additives looks to be a tempting replacement. Ruminants are provided with a vast array of microorganisms that may utilize such feeds, but appropriate management of the ruminant ecosystem can boost feed digestibility and economic returns even further. EFEs enhance the microbial protein synthesis, efficient digestion and utilization of lignocellulosic agricultural fibrous feeds and fodder residues. Keeping the above facts in view, the effect of supplementing exogenous fibrolytic enzymes on feed intake, growth performance and feed conversion ratio in male Gir calves were investigated.

Materials and Methods
Experimental animals
Fifteen male Gir calves of around one year age was randomly selected and calves were randomly divided into three group with five calves in each. Average body weight of calves was around 160 to 162 kg. They were assured for the health and disease. The duration of experiment was 90 days.
T_1 = TMR was supplemented without EFEs.
T_2 = TMR was supplemented with 0.025% EFEs.
T_3 = TMR was supplemented with 0.050% EFEs.

Experimental feeds and fodders

All the experimental calves were fed with total mixed ration (TMR). The nutrient requirements of growing Gir calves in term of DCP and TDN were met as per ICAR (2013) [7] feeding standards. TMR was prepared by mixing roughage and concentrate in the ratio of 60:40 after grinding/chaffing. The proportions of different ingredients used to prepare respective TMR are given in Table 1.

Table 1: Parts composition of total mixed ration used in experiment

Sr. No.	Ingredients	TMR
1	Groundnut haulm	50
2	Maize fodder	10
3	ISI grade-I cattle feed	20
4	Cotton seed cake	13.5
5	Ground maize	05
6	Mineral mixture	01
7	Salt	0.5
	Total	100

Estimation of proximate composition and fibre fractions

Samples of different feed ingredients and TMR were analysed for proximate composition as per the AOAC (2005) [3] and fibre fraction as per Goering and Van Soest (1970) [6].

Growth trial

Daily intake of total mixed ration was recorded for individual animals. Weighed quantities of total mixed ration was offered to animals as per the protocol and the left over was collected next day in the morning and weighed. The daily records of feed offered and residue left was maintained to calculate the feed consumption per calf. DMI of individual animal was calculated from the figures of average dry matter intake and average live weight during experimental period. Body weight of all the calves were recorded at the commencement of experiment and subsequently at fortnightly interval for entire experimental period. Average daily gain was calculated by the standard formula using weight gain of calf/ calves (g) divided by number of experimental days. FCR was calculated by the standard formula using total feed consumed (kg) divided by total body weight gain (kg).

Statistical analysis

The data generated during this experiment were subjected to statistical analysis using one-way and two-way ANOVA as suggested by Snedecor and Cochran (1994) [9]. The significance of mean differences was tested by Duncan's new multiple range test (DNMRT).

Results and Discussions

Proximate composition and fibre fractions (% DMB) of different feed ingredients and TMR are presented in Table 2. The TMR contain 85.70, 86.83, 14.77, 3.16, 20.61, 48.27 and 13.17% DM, OM, CP, EE, CF, NFE and TA, respectively. By using Van Soet method cell wall and cell constituents of different feed ingredient used in TMR were analysed. NDF, ADF, hemicellulose and cellulose of TMR were 36.90, 27.52, 9.38 and 17.52%, respectively.

Table 2: Chemical composition of different feed ingredients and total mixed ration (TMR) (%DM basis)

Ingredients Attributes	Groundnut Haulms	Green Maize	ISI grade-I Cattle Feed	Cotton Seed Cake	Ground Maize	Mineral Mixture	TMR
DM	95.00	32.85	86.95	95.65	92.30	-	85.70
OM	84.00	90.79	91.65	92.62	98.42	-	86.83
CP	10.99	8.00	22.10	25.82	11.44	-	14.77
EE	1.55	1.34	3.97	9.65	3.20	-	3.16
CF	22.31	28.58	11.63	30.77	2.47	-	20.61
NFE	49.15	52.87	53.95	26.38	81.31	-	48.27
Ash	16.00	9.21	8.35	7.38	1.58	-	13.17
ADF	30.20	39.42	17.39	35.62	3.75	-	27.52
NDF	38.11	58.42	26.77	44.62	12.45	-	36.90
Cellulose	18.57	30.19	10.23	22 .72	2.20	-	17.52
Hemicelluloses	7.91	19.00	9.38	9.00	8.70	-	9.38
Lignin	7.87	5.52	5.61	10.92	0.80	-	7.13
Calcium	1.80	0.51	1.5	0.54	0.05	25.40	1.83
Phosphorus	0.43	0.20	0.8	0.84	0.47	12.72	0.67

Note: DM- dry matter, OM- organic matter, CP- crude protein, EE- ether extract, CF- crude fibre, NFE- nitrogen free extract, TA- total ash, NDF- neutral detergent fibre, ADF- acid detergent fibre

Effect of fibrolytic enzymes on dry matter intake is present in Table 3. DMI (kg/d), DMI (kg/100kg BW) and DMI (g/kg $W^{0.75}$) were non-significantly ($p>0.05$) improved in both enzymes treated groups as compared to control. Similar finding was also reported by many workers. Barbadikar (2012) [5] and Thube (2016) [11], they reported that enzyme supplementation had no significant ($p>0.05$) effect DMI (kg/d), DMI (kg/100kg BW) and DMI (g/kg $W^{0.75}$).

Effect of fibrolytic enzymes on growth performance and feed conversion ratio are presented in Table 4. TBWG (Kg) and ADG (g/d) were significantly ($p<0.05$) increased in both enzymes treated groups (T_2 and T_3) as compared to control group (T_1) but treatment difference between T_2 and T_3 was non-significant. The enzyme supplementation had significant effect ($p<0.01$) on daily weight gain on 45th days during 90 days of experiment. The improved performance was might be due to increased digestibility of nutrients and increased flow of microbial protein from the rumen which yields more energy and/or nutrient availability. Similar finding was also reported by many workers. Kady *et al* (2006) [9], Thakur *et al* (2010) [10] and Yuangklang *et al* (2017) [12] revealed significant effects ($p<0.05$) of the enzyme supplementation on TBWG and ADG. FCR was significantly ($p<0.05$) improved in both enzymes treated groups (T_2 and T_3) as compared to control group (T_1) but treatment difference between T_2 and T_3 was non-significant. The enzyme supplementation had significant effect ($p<0.01$) on FCR on 45th days during 90 days of experiment. The improved FCR observed in the current study might be attributable to the enhanced digestibility of the feed. Similar finding was also reported by many workers. Kady *et al* (2006) [9] and Balci *et al* (2007) [4] reported significant effects ($p<0.05$) of the enzyme supplementation on FCR.

Table 3: Dry matter intake of different treatments

Days	T_1	T_2	T_3	p value
DMI (Kg/d)				
15	4.43±0.09	4.48±0.13	4.44±0.10	0.94
30	5.12±0.15	5.25±0.16	5.15±0.16	0.83
45	5.52±0.17	5.61±0.18	5.69±0.09	0.74
60	5.58±0.15	5.88±0.13	5.78±0.11	0.29
75	5.70±0.13	5.97±0.11	5.81±0.11	0.30
90	5.49±0.15	5.72±0.10	5.49±0.13	0.37
Mean±SE	5.31±0.19	5.49±0.23	5.39±0.22	
DMI (Kg/100kg BW)				
15	2.69±0.06	2.74±0.10	2.75±0.13	0.90
30	2.97±0.03	3.06±0.13	3.04±0.12	0.82
45	3.05±0.02	3.05±0.08	3.17±0.12	0.53
60	2.94±0.03	3.00±0.09	3.01±0.10	0.80
75	2.86±0.05	2.88±0.10	2.85±0.09	0.97
90	2.62±0.05	2.61±0.06	2.55±0.08	0.72
Mean±SE	2.86±0.07	2.89±0.07	2.89±0.09	
DMI (g/kg $BW^{0.75}$)				
15	96.38±1.54	97.83±2.48	97.91±3.59	0.90
30	107.70±0.75	110.58±3.74	109.56±3.45	0.79
45	111.92±0.59	112.20±2.33	115.86±3.39	0.84
60	109.10±0.25	112.09±2.42	111.87±2.76	0.56
75	107.39±0.92	109.13±2.86	107.69±2.54	0.85
90	99.82±1.44	100.45±2.31	97.59±2.31	0.60
Mean±SE	105.38±2.44	107.05±2.56	106.75±3.05	

DMI – dry matter intake

Table 4: Growth performance and FCR of different treatments

Days	T_1	T_2	T_3	p value
BW (Kg)				
0	162.2±6.37	161.6±8.85	160.0±7.57	0.98
15	168.3±6.22	167.8±8.54	165.6±7.55	0.96
30	176.5±6.57	178.3±8.30	174.8±7.36	0.95
45	185.1±6.66	191.1±8.22	187.1±7.34	0.85
60	194.7±7.09	202.8±7.89	198.8±7.41	0.75
75	204.6±7.54	214.2±7.45	210.6±7.60	0.67
Final b. wt.	214.6±8.10	225.2±7.30	222.1±7.98	0.63
Mean±SE	186.5±7.25	191.5±9.00	188.4±8.79	
TBWG (kg)	52.4±2.79[a]	63.6±3.26[b]	62.1±3.26[b]	
ADG (g/d)				
15	406.67±19.44	413.33±27.08	373.33±24.50	0.47
30	546.67±45.46	700.00±43.46	613.33±27.08	0.053
45	573.33[b]±42.69	853.33[a]±40.28	820.00[a]±38.87	0.001
60	640.00±45.22	780.00±42.95	780.00±57.35	0.1
75	660.00±46.43	760.00±50.99	786.67±48.99	0.20
90	666.67±48.31	733.33±38.01	766.66±34.96	0.25
Mean±SE	582.22[b]±40.28	706.67[a]±62.32	690.00[a]±69.87	
FCR				
15	10.89±0.67	10.84±1.04	11.90±0.54	0.60
30	9.36±0.79	7.50±0.69	8.394±0.34	0.13
45	9.62[a]±0.72	6.57[b]±0.46	6.93[b]±0.29	0.001
60	8.71±0.50	7.53±0.56	7.41±0.51	0.19
75	8.63±0.42	7.85±0.59	7.38±0.38	0.20
90	8.23±0.47	7.80±0.43	7.16±0.17	0.13
Mean±SE	9.24[a]±0.40	8.01[b]±0.62	8.19[b]±0.78	

Note: [ab] Means with different superscripts within row differ significantly from each other.
BW – body weight, TBWG – total body weight gain, ADG – average daily gain, FCR – feed conversion ratio

Conclusion

The results of the present study indicated that supplementation of fibrolytic enzymes (Cellulase and xylanase) @ 0.025% and 0.05% in TMR significantly improved body weight gain in Gir calves. Feed conversion efficiency was better in both enzyme supplemented group over control**.** Based on the overall results of study it could be inferred that utilization of fibre rich feed could be increased by fibrolytic enzyme supplementation at 0.025 percent level without any adverse effect on animal health.

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