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Note on the influence of levels of concentrate feeding on the microbial population in goat rumen

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The present investigations were undertaken to study the effect of feed environment on microbial population in the goat rumen.

Three adult fistulated cross-bred bucks (Saanan × Alpine × Beetal) were taken for the study. Four treatment rations comprising different ratios of roughage to concentrate (A, 100:0 ; B, 80:20 ; C, 60:40 ; and D, 40:60) were allotted following randomized block design. The animals were first kept on treatment A for 30 days. The observations were recorded during the last 10 days. Thereafter the animals were shifted to treatments B, C and D in a similar fashion. The samples of rumen liquor were collected at 0, 2, 4, 6 and 8 hr after feeding. Feed was offered twice daily in equal amounts just after the first and last collection. The feed constituted roughage as green oat and concentrate mixture (barley, 45 parts ; wheat bran, 30 parts, groundnut-cake, 22 parts ; mineral mixture, 2 parts ; and common salt, 1 part) containing 15% DCP and 71% TDN. Processing of rumen liquor was carried out as reported earlier (Punia *et al.*, 1980). For total bacterial counts, the method described by Gall *et al.* (1949) and for total and differential count of protozoa the method of Langer *et al.* (1968) was followed. The data were analysed statistically as described by Snedecor and Cochran (1968).

The animals consumed dry matter from roughage and concentrate in the proportion of 100:0 in group A, 81:19 in group B, 56:44 in group C, and 38:62 in group D. The intake of roughage and concentrate was close to the proportions offered to goats (Table 1). The dry matter, acid-detergent fibre (DAF) and neutral-detergent fibre (NFD) contents of the roughage increased, but crude protein decreased as the crop matured.

Microbial population

The bacterial and protozoal populations are presented in Table 1. The bacterial count linearly increased ($P<0.01$) from treatments A to D at all sampling intervals. This revealed directly the degree of ruminal protein synthesis. Maki and Foster (1959) also recorded higher bacterial counts where levels of concentrate to hay in the diet were more.

The peak bacterial counts in our study were at 4 hr sampling. Kurihara *et al.* (1968) observed it between 4 and 6 hr after feeding. Sutherland (1976) observed higher relative outflow in animals on diets of fresh forage than in those on concentrate feeds. In our studies, the retention of feed for longer time when high concentrate was fed may have affected the turnover rates and subsequently increased the microbial population. Eadie *et al.* (1970) claimed that the change of diet had no significant effect on the volume of rumen fluid but the rate of outflow from the rumen in their studies was significantly lower on the barley diet than on equal proportion of hay and barley in the diet.

The ciliate protozoal count increased ($P<0.01$) with increase in concentrate level in the diet (Table 1), possibly because of their ability to ingest starch. Maximum protozoal counts were observed at 4 hr in all the treatments. Eadie *et al.* (1970) observed large variations in rumen ciliate population on rations of restricted and

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Table 1. Bacterial and ciliate protozoal counts in goat rumen on levels of concentrate

Treatments	Hours after feeding					Treatment average
	0	2	4	6	8	
	Total bacterial counts ($\times 10^9$/*ml SRL*)					
A	29.42±3.43	37.86±4.56	48.29±3.87	38.35±2.88	29.11±3.19	36.60
B	34.47±2.22	50.37±2.13	58.64±2.14	46.20±2.93	30.70±1.61	44.07
C	37.95±2.52	51.13±3.80	76.30±4.03	48.71±1.85	40.59±1.46	50.93
D	42.38±2.65	54.35±3.82	80.90±4.17	52.10±1.45	47.24±2.33	55.39
	Total ciliate protozoal count ($\times 10$ /*ml SRL*)					
A	1.55±0.11	2.16±0.14	2.52±0.11	1.82±0.13	1.77±0.09	1.96
B	2.43±0.09	4.52±0.34	6.62±0.31	5.87±0.55	2.71±0.15	4.43
C	3.75±0.38	5.40±0.51	6.67±0.50	6.13±1.12	3.91±0.26	5.17
D	1.85±0.14	5.90±0.31	8.73±0.24	7.07±0.20	3.36±0.15	5.38

*Average of 9 observations; ± standard error.

Table 2. Types of ciliate protozoa in goat rumen on levels of concentrate (%)*

Type	Treatments				Average
	A	B	C	D	
Holotricha	7.41	4.52	5.38	2.38	4.92
Entodinia	62.01	63.88	65.46	67.53	64.72
Diplodinia	11.35	14.30	13.00	15.34	13.74
Eudiplodinia	3.82	2.39	2.52	2.41	2.78
Polyplastron and others	15.41	14.91	13.64	12.34	14.07

*Average of 45 observations.

ad lib. crushed barley to complete roughage diet.

Distribution of ciliate protozoa

Entodinia formed the major bulk of protozoa (Table 2). *Polyplastron* and other large protozoa were also abundant, followed by *Diplodinia*, *Holotricha* and *Eudiplodinia*.

Ciliates failed to establish due to low rumen pH on all-concentrate diet and barley diet given in amounts below appetite favoured the development of a large ciliate population representing 75% *Entodinium* spp. (Eadie *et al*., 1967, 1970). They also recorded exceptionally high counts for *Epidinium* spp. and *Eremoplastron* spp. Percentages of *Entodinia* and *Diplodinia* in the rumen liquor were more (<0.01) on concentrate fed groups, whereas all the other types of protozoa showed the reverse trend. Reports of Naga and El-Shazly (1969) and Sinha *et al.* (1974) were quite comparable with the protozoal number recorded in the present studies. The same trend was observed by Punia *et al.* (1980) in buffalo rumen when animals were kept on similar proportions of roughage to concentrate. The data indicated that feed environment has a specific role to effect the type and count of microflora in the rumen of goats.

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