EFFECT OF NITROGEN SOURCE ON RUMEN FERMENTATION IN DIETS BASED ON SUGAR CANE

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Four Zebu bulls fitted with permanent rumen cannulas were used in a 4 x 4 Latin square design to examine the fermentation pattern resulting from supplementing a basal diet of sugar cane/urea and ammonium. sulphate with 33 g/kg cane of fish silage (chopped fish ensiled with 3.5% formic acid); 12.5 g/kg cane of fish meal/soybean meal (1:3); 20 ml of 5N ammonium propionate/kg sugar cane. Experimental periods were 14 days and samples of rumen fluid were taken on days 10, 12 and 14, immediately before and 3 hr after feeding. There was a tendency for voluntary intake to be higher with the fish meal/soybean meal supplement while the fish silage was associated with significantly lower intakes than on the other treatments. There were no differences in rumen fermentation between the different dietary treatments, but highly significant effects due to time of feeding. The results confirm that the rumen fermentation pattern on sugar cane diets is extremely stable and not affected by the nature of the supplements that are given.

Key words: Sugar cane, rumen fermentation, N sources

In the majority of diets the rumen VFA pattern is largely determined by the quantity and nature of the energy fraction. However, in diets based on sugar cane the rumen fermentation pattern appears to be very stable. In a slaughter experiment (Minor et al 1977), a wide range of energy/protein supplements (maize grain, rice polishings, cotton seed cake) had no effect on the relative proportions of the rumen VFA even at relatively high levels of addition (up to 2 kg daily in the case of maize grain). Monensin, an additive which has been shown to change VFA proportions in cattle fed high concentrate diets (Richardson et al 1976) had no effect when given to cattle receiving sugar cane (Lopez et al 1977 a). In an exhaustive study of rumen fermentation patterns on sugar cane diets, involving hourly sampling over 24 hours and repeated sampling on different days (Valdez et al 1977), the pattern in terms of VFA proportions, concentrations of ammonia and protozoal biomass, showed no change when rice polishings were also given, even though this supplement is known to bring about very significant improvements in animal performance (Preston et al 1976; Lopez et al 1977b).

The objective of the present experiment was to determine if different sources of dietary nitrogen would affect the rumen fermentation.

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Materials and Methods

Treatments Design and Animals: A 4 x 4 latin square with periods of 14 days was used to evaluate the following nitrogen sources given as a supplement to a basal ration of chopped sugar cane: a) basal diet with 10 g urea and 1 g ammonium sulphate/kg fresh sugar cane; b) basal diet plus 33 g fish silage/kg fresh sugar cane; c) basal diet plus 12.5 g fish meal/soybean meal (1:3)/kg fresh sugar cane; d) basal diet plus 20 ml 5N ammonium propionate/kg fresh sugar cane. Four Zebu bulls fitted with permanent rumen cannulas were used; they had a mean live weight of 312 kg.

Diets: The whole sugar cane was chopped to a particle size of between 5 and 20 mm and mixed with an aqueous solution of urea (10 g/kg cane) and ammonium sulphate (1 g/kg cane). This part of the diet was fed ad libitum, salt, minerals and water were always freely available. The fish silage was prepared by grinding the fish and adding formic acid (3.5 g/kg fresh fish) in order to give a final pH at 14 days of between 4.0 and 5.0. The ammonium propionate was prepared from 370 g propionic acid, 300 ml ammonia (28% NH;w/v) made up to 1 litre with distilled water. The freshly prepared sugar cane mixture was given twice daily at 9:00 am and 3:00 pm.

Sampling and Analysis: Samples of rumen fluid were taken on days 10, 12 and 14 of each period, immediately before and 3 hr after feeding. Measurements were made immediately for pH (with a pH meter) and protozoal biomass. 30 ml of sample were preserved with concentrated sulphuric acid for subsequent determination of lactic acid (via the technique of Barker and Summerson, 1941), and for total VFA and molar proportions by gas liquid chromatography (total VFA were estimated using an internal standard of caproic acid. Ammonia concentration was determined by diffusion using a simplified version of the Conway technique. Details of the methods used are described in the paper by Valdez et al (1977).

Results and Discussion

Mean values for the different fermentation parameters and for voluntary consumption index are shown in table 1. The only supplement which would be expected to function as by-pass protein (Kempton et al 1977), was the mixture of fish meal/soybean meal and there was a tendency for this treatment to be associated with a higher voluntary intake of dry matter. However, the only significant effect ($P < .05$) was accounted for by the low intake (possibly due to the bad odour) of the diet containing fish silage. Rumen parameters were not affected by the dietary supplements but there were highly significant differences for all of them due to time of sampling ($P < .001$).

The changes in the rumen fermentation parameters with time after feeding are typical of those associated with the feeding of sugar cane diets and have been reported by many other workers (Montpellier et al 1977; Meyreles et al 1977; Silvestre et al 1977; Valdez et al 1977).

Table 1 :
Feed consumption index and rumen parameters

	Time of sampling	Supplement: Urea/ $(NH_4)_2SO_4$	Fish silage	Fishmeal/ soya	Ammonium propionate	SEx
Consumption index[1]		1.43	1.30	1.59	1.40	.09
Rumen pH	0	6.7	6.6	6.7	6.7	.06
	3	6.4	6.3	6.3	6.3	.08
Protozoal biomass % in rumen fluid	0	0.52	0.53	0.25	0.25	0.17
	3	0.58	0.57	0.64	0.56	.10
Total VFA, mM/litre	0	92.8	87.4	93.1	102.3	4.8
	3	101.2	110.6	116.0	108.0	6.0
Molar %VFA						
Acetic	0	74.8	77.9	76.0	74.6	1.21
	3	70.4	71.8	72.6	72.7	1.35
Propionic	0	16.4	14.6	15.5	17.8	.83
	3	20.4	20.1	19.5	20.2	.97
Butyric	0	8.0	6.8	7.7	6.6	.46
	3	8.3	7.4	7.3	6.5	.41
Lactic acid, m equiv/litre	0	0.37	0.28	0.42	0.39	.15
	3	0.28	0.31	0.28	0.28	
Rumen NH_3, mequiv/litre	0	4.5	4.7	5.4	3.6	.18
	3	5.9	7.0	7.4	6.5	.12

[1] Daily DM intake (kg)/100 kg live weight
[2] Before or 3 hr after feeding in the morning

Conclusion

The results of this experiment provide further evidence for the stability of the rumen fermentation pattern on sugar cane diets. It seems that this is not affected by the nature of the carbohydrate supplement or even, as in this experiment, by a wide range of sources of nitrogen/protein.

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Received 8 June 1977