RUMEN FERMENTATION IN CALVES REARED ON RESTRICTED SUCKLING, SUGARCANE AND MOLASSES/UREA

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Summary

Rumen fluid was taken from 12 calves of different ages in the range 23 to 266 days. The animals were from a dual purpose milking herd of crossbred Holstein/Zebu. The feeding system was based on restricted suckling twice daily, the calves having access to their dams for a few seconds before milking to stimulate let down and after milking for 30 minutes. The rest of the time they were housed in shaded pens where they had free access to chopped whole sugar cane and a mixture of molasses/urea (100 g urea/kg of solution). They also received 250 g/d of cotton seed meal and minerals. The rumen samples were taken with a stomach tube at 1100 hr, approximately three hr after the morning feeding of sugar cane. The pattern of fermentation was uniform in all the animals older than 60 days . Mean value for pH was 6.93 , and % molar VFA's were: acetic 50, propionic 35 and butyric 15. Packed cell volume of holotrichs was .32 (% of rumen fluid) and entodinea 1.25 X 105/ml. There was a significant relationship between daily live weight gain and molar proportion of propionic acid (r2 = .71). The results indicate that by 60 days of age, calves raised by restricted suckling and supplemented with sugar cane and molasses/urea reach a degree of rumen development typical of adult animals.

Key words: Sugarcane, calves, rumen fermentation

Introduction

Most studies on rumen development in calves have related to systems of artificial rearing, usually with milk substitutes and/or early weaning.

Few studies has been made on calves reared by suckling, and specifically the system of restricted suckling combined with normal milking which was developed in Cuba (Preston and Ugarte 1972), and which forms the basis of the calf rearing method in the dual purpose integrated milk and beef programme proposed by Preston (1976).

The objective of the study reported here was to measure certain parameters of rumen fermentation in calves raised by restricted suckling and having free,access both to chopped sugar cane and molasses/urea.

Materials and Methods

Animal and Diets:

The 12 calves used in the experiment were from the same herd and under the same management system described in a previous paper (MacLeod et al 1976). They were Holstein/Zebu crosses in the age range 23 to 130 days and with a range in live weight from 41 to 180 kg.

All the calves were suckled by their dams twice daily for approximately 30 minutes after the morning and afternoon milkings; on average,the daily quantity of milk consumed was 2.5 kg . Chopped sugar cane was offered ad lib as was molasses/ urea (100 g urea/kg molasses). 250 g/d of cotton seed meal and 50 g/d of minerals were also given. Housing was in shaded corrals adjoining the milking parlour and the feed and molasses troughs had adequate protection against the rain.

Rumen samples:

These were obtained with a hand pump and stomach tube at 1100 hr, approximately 3 hr after the calves had been offered the chopped sugar cane. pH and protozoal counts were determined immediately on the freshly strained rumen fluid. Holotrich protozoa were determined by the method of Leng et al (1976) using a packed cell volume technique, while the entodinea were counted directly. Other samples were preserved with concentrated sulphuric acid for subsequent volatile fatty acid (VFA) analysis according to the method described by Gonzalez and MacLeod (1976).

Results and Discussion

The data on the performance of the selected group of calves are summarised in table 1, while rumen fermentation parameters are in table 2. Some relationships between these different paramenters are given in figures 1 and 2.

The pH value is probably unreasonably high in view of the samples having been taken by stomach tube and the risk of contamination with saliva. The molar proportions of VFA are similar to,those found normally in weaned calves reared on mixed diets of concentrates and roughage . They vary slightly from the normal picture in fattening cattle receiving sugar cane based diets, where average values (24 hr sampling) were acetic 62, propionic 24 and butyric 14 (Leng and Preston 1976); thus propionic was considerably higher and acetic lower in the young as opposed to the adult animals.

Table 1: Age and live weight of calves

	Mean	Range
No	12	
Live weight, kg		
At birth	38.1	32 - 45
At sampling	104.9	41 - 187
Daily gain	.43	.17 - .66
Age at sampling, days	139	23 - 240
Intake, kg/d		
Milk		2.5 - 2.8
Sugarcane		1 - 5
Molasses/urea[1]		.3 - 1.5

[1] Contains 10% urea.

There was a wide range in concentrations of protozoa. The maximum values observed were lower than has been reported in adult animals fed sugar cane (maximum values were as high as 4 and the average in a group of slaughter animals was 2.6 PCV, % rumen fluid) (Minor et al 1976). There was a tendency for protozoa counts to increase with age (r^2 = .61 for entodinea and .214 for

holotrichs; figure 1). This supports the suggestion that the values recorded were lower than would be expected normally in adult animals fed sugar cane diets. .

There was a positive relationship between molar proportion of propionic acid and rate of live weight gain (r^2 = .71), which is in line with reports on sugar cane where these two parameters have been related (Alvarez and Preston 1976; Ferreira and Preston 1976). Such relationships are in line with the hypothesis that availability of glucose precursors is a constraint to animal productivity on sugar cane based rations (Leng and Preston 1976).

Conclusions

The data show conclusively that calves raised by restricted suckling, and receiving the major part of their diet in the form of sugar cane and molasses/urea, have normal rumen fermentation parameters by 60 days of age . In this respect they differ from adult animals fed the same ration only in the ratio of the end products and in the numbers of protozoa. This conclusion is substantiated by the shape of the growth curve (figure 3), which shows a marked acceleration of growth at the 50 to 60 day of age mark, indicating higher intakes of the basal ration of sugarcane and molasses/urea, commensurate with achieving full rumen function.

Figure 1: Effect of age on protozoal population

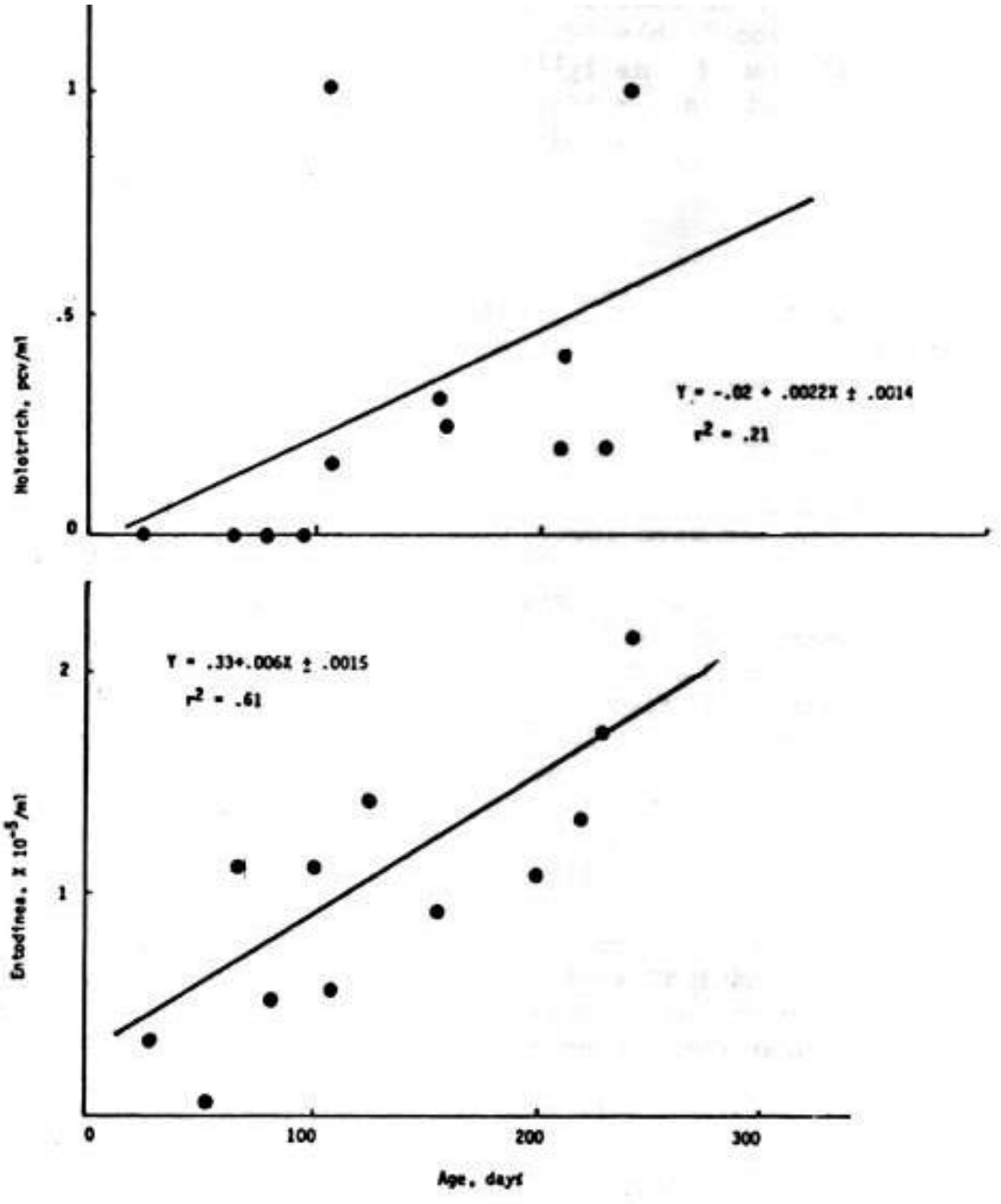

Figure 2: Relationship between gain in live weght and molar % propionic acid in rumen fluid

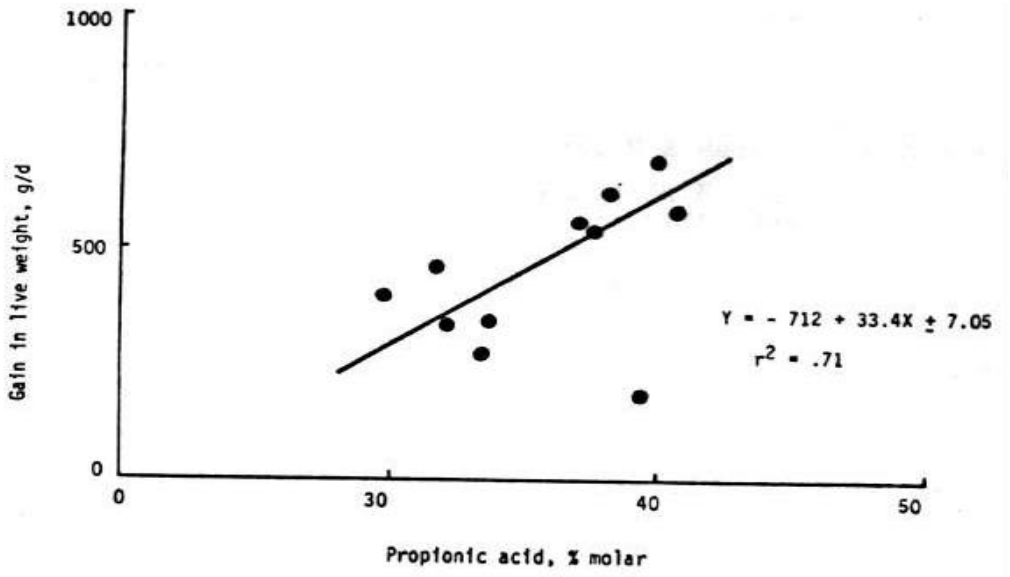

Figure 3: Growth rate of crossbred calves reared by restricted suckling, supplemented with sugarcane and molasses/urea (from Giraldez et al 1976)

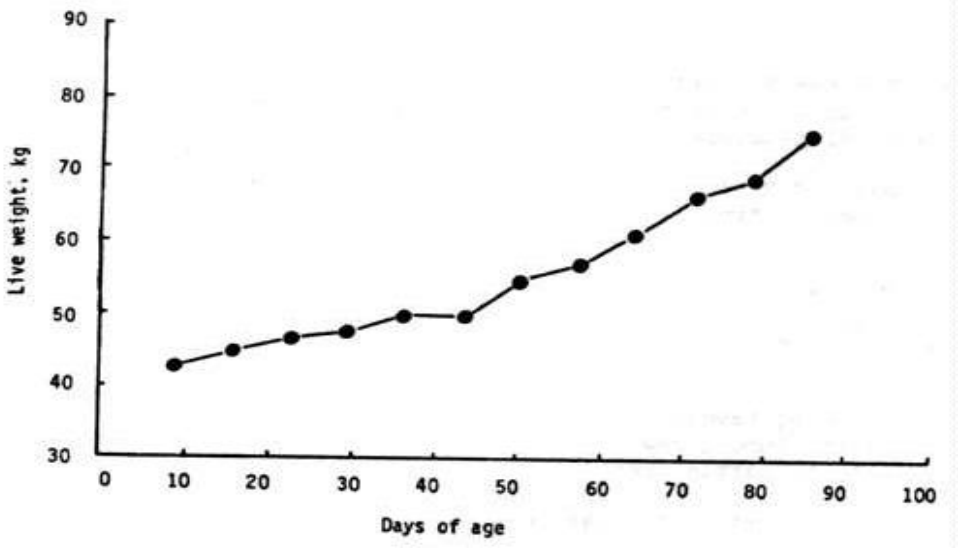

Table 2: Fermentation parameters

	Mean ± SE_X	Range
pH	6,93 ± ,24	5.7 - 7,6
VFA, % molar		
Acetic	50 ± 1,4	36 - 55
Propionic	35 ± 1.0	31 - 36
Butyric	15 ± 1.1	11 - 24
Protozoa Holotrich PCV[1], %		
rumen fluid	.32 ± .10	0 - 1.0
Entodinea, X 10^5/ml	1.25 ± .15	.3 - 2.1

[1] Packed cell volume

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Received 1 April 1976