Digestion in the capybara *(Hydrochoerus hydrochaeris)*

A. Baldizán, R.M. Dixon and R. Parra

Instituto de Producción Animal, Facultad de Agronomía, Universidad Central, Maracay, Venezuela

A study was undertaken to examine the digestion and fermentation in the capybara *(Hydrochoerus hydrochaeris)* fed either forage or a predominantly concentrate diet. The large volume of digesta (3,66 and 2,73 kg), pH (6,6 and 6,3), NH_3-N (78 and 146 mgN/l) and VFA (44 and 41 mM) in the caecum of animals fed forage and high concentrate, respectively, indicate an active hindgut fermentation. This is in accord with previous observations that capybara and sheep have the same ability to digest forage diets.

Die vertering en fermentasie van die capybara *(Hydrochoerus hydrochaeris)* is ondersoek op ruvoer en 'n oorheersende konsentraat dieet. Die groot volume verteringsmateriaal (3,66 en 2,73 kg), pH (6,6 en 6,3), NH_3-N (78 en 146 mgN/l) en VFA (44 en 41 mM) in die sakderm van diere wat ruvoer en hoë konsentraat onderskeidelik gevoer is, dui op 'n aktiewe agterderm fermentasie. Dit stem ooreen met vorige waarnemings dat die skaap en die capybara dieselfde vermoë het om ruvoer diëte te verteer.

Keywords: Capybara, digestion, fermentation, caecum, particle size

Introduction

The capybara is a herbivorous hindgut fermenter with a natural habitat in the inundated savannah of tropical South America. It belongs to the family Rodentia and adults usually weigh 30 – 50 kg. The digestive physiology of the capybara and the problems of domestication and production of meat and hides have been reviewed (González-Jiménez 1977a, b). The following study was undertaken to examine digestion and fermentation in capybara fed either forage or a predominantly concentrate diet.

Materials and Methods

Eight mature capybaras (18 – 24 months; 35 – 45 kg) were randomly allocated to two dietary treatments of restricted fresh-chopped *Pennissetum purpureum* forage (570 g DM/d containing 13 g N and 711 g neutral detergent fibre per kg DM) or pelleted commercial concentrate (551 g DM/d containing 26 g N per kg DM) with 150 g DM/d of the above forage. Commencing four hours after the daily feed was offered, animals were anaesthetized (4 – 6 ml Rompun + Ketaset mixture) and digesta from the stomach, ileum and four sections of the caecum were obtained, preserved and analysed using procedures similar to those described by Dixon & Nolan (1982) for sheep. In each of the segments sampled, measurements were made of the weight of wet digesta, DM content, pH, concentration of NH_3-N and concentrations and proportions of volatile fatty acids (VFA). Particle size distribution was determined by the wet-sieving techniques of Dixon & Milligan (1983) using screens of 1,0, 0,7, 0,5, 0,25 and 0,15 mm.

Results and Discussion

The results for weight of wet digesta, DM content, pH and NH_3-N concentration for the stomach, and the mean of the four sections of the caecum and the colon are shown in Table 1. There tended to be more wet digesta present in the caecum of animals fed forage than those fed concentrate (3657 g and 2726 g, respectively). Since the DM content was also slightly greater in animals given the forage diet (8,8 and 8,4%, respectively), there was a similar difference in the weight of DM in the caecum. In contrast, the stomach of animals fed concentrate contained more wet digesta (917 g) than those fed forage (545 g). The pH of the caecum, pH 6,6 and pH 6,3 for animals given forage and concentrate diets, repectively, was within the range suitable for active microbial fermentation. Concentration of NH_3-N in the caecum of animals fed forage (78 mg N/l) was possibly insufficient for maximum rate of microbial growth, and was unexpected in view of the high NH_3-N concentrations observed in the caecum of sheep fed low N diets in other experiments. The concentration of NH_3-N in the caecum of animals given the concentrate diet (146 mg N/l) was significantly ($P<0,05$) higher, reflecting the greater concentration of N in this diet.

For both diets the concentrations of VFA in the caecum and colon (41 – 44 mM; Table 2) were lower than those usually observed in the rumen of sheep given forage diets, and may have been associated with the low quality of the

Table 1 Measurements in the gut at slaughter 4 h after feeding in eight capybaras given forage or a predominantly concentrate diet.

Diet	Gut section	Weight wet digesta (g)	DM (%)	pH	NH_3-N (mg N/l)
Forage	Stomach	545	12,4	2,5	183
	Caecum	3657	8,8	6,6	78
	Colon	371	13,7	7,0	120
Concentrate	Stomach	917	10,0	3,4	305
	Caecum	2726	8,4	6,3	146
	Colon	244	13,8	6,5	246
	SEM	165	1,4	0,4	49

Table 2 Concentrations and proportions of volatile fatty acids (VFA) in the gut measured at slaughter 4 h after feeding in eight capybaras fed forage or a predominantly concentrate diet

Diet	Gut section	Total VFA (mM)	Proportions (%)		
			Acetate	Propionate	Butyrate
Forage	Stomach	6	73	21	6
	Caecum	44	83	15	2
	Colon	26	80	17	3
Concentrate	Stomach	6	65	28	7
	Caecum	41	81	14	4
	Colon	21	77	16	7
	SEM	5	6	3	1

Table 3 Accumulative proportions of dry matter retained by successive screens in digesta from the stomach, caecum and colon of eight capybaras given forage or a predominantly concentrate diet[a]

	Forage			Concentrate		
Screen size mm²	Stomach	Caecum	Colon	Stomach	Caecum	Colon
1,00	4,2	1,7	2,8	4,1	3,5	2,1
0,71	9,2	6,6	5,2	8,0	8,0	4,3
0,50	19,9	14,2	11,6	16,9	14,2	9,5
0,25	46,5	36,5	35,9	35,3	36,2	25,9
>0,15	53,5	46,3	45,6	42,3	42,3	33,6
<0,15	100,0	100,0	100,0	100,0	100,0	100,0

[a]SEM for DM retained by each screen size = 4,2

forage and the digestion of the majority of the concentrate anterior to the caecum. The proportion of acetate (81 – 83%) was higher, and the proportion of butyrate (2 – 4%) lower than that generally observed in the rumen or caecum of sheep and cattle. There was no effect of diet on the proportion of acetate, but for butyrate the difference between diets was significant ($P<0,05$).

The accumulative distribution of DM retained by various screens for digesta sampled from the stomach, caecum and colon of each diet are shown in Table 3. There were no significant differences in the proportion of total DM retained by each screen either between diets or between the sampling sites. For the forage diet there was a tendency for a greater proportion of stomach digesta DM to be retained by the 0,25 mm or larger screens (46,5%) than for the caecum and colon (36,5 and 35,9% respectively). However, perhaps any such difference was associated with diurnal variations in particle size distribution in the intestinal tract with an increased proportion of larger particulate matter in the stomach associated with the meal 4 h before sacrifice, rather than with an actual decrease in particle size in passage from the stomach to the caecum. With the concentrate diet the tendency for a greater proportion of very fine material (<0,15 mm screen) to be present in the colon rather than in the caecum (66,4% and 57,7% respectively) suggests that under these dietary conditions selective retention of larger particulate matter in the caecum could occur. Perhaps such a differential selection of larger particulate matter could be associated with a lower flow of DM through the caecum and colon (approximately 140 g DM/d versus 280 g DM/d for the forage diet) and a lesser amount of digesta present in the caecum (2,80 kg and 3,66 kg for concentrate and forage diets respectively). The ability of the capybara to reduce the physical dimensions of dietary material by mastication is demonstrated by the observation that 46 – 66% of digesta DM was of a sufficiently small particle size to pass through the 0,15 mm screen.

In conclusion, the large volume of digesta and the results for pH, NH_3-N and VFA indicate an active microbial fermentation in the caecum. This extensive caecal fermentation is in accord with previous observations that capybara and sheep have the same ability to digest forage diets (González-Jiménez & Escobar, 1975; A. Baldizán & R.M. Dixon, unpublished results). The high concentrate diet was associated with less digesta in the gastro-intestinal tract. The caecal fermentation values were lower than those usually observed in the rumen.

References

DIXON, R.M. & NOLAN, J.V., 1982. Studies of the large intestine of sheep. 1. Fermentation and absorption in sections of the large intestine. *Br. J. Nutr.* 47, 289.

DIXON, R.M. & MILLIGAN, L.P., 1983. Breakdown and removal of particulate material from the rumen of steers. *Br. J. Nutr.* (submitted).

GONZÁLEZ-JIMÉNEZ, E. & ESCOBAR, A., 1975. Digestibilidad comparada entre Chigüire *(Hydrochoerus hydrochaeris),* Conejos con raciones diferentes proporciones de forages y concentrados. *Agronomía Tropical.* 25, 283.

GONZÁLEZ-JIMENEZ, 1977a. Digestive Physiology and feeding of capybaras. *In* Handbook Series in Nutrition and Food; Section G. Diets, Culture Media and Food Supplements. (ed. M. Rechcigl), Vol. I, 167 – 177. CRC Press: Cleveland, USA.

GONZÁLEZ-JIMÉNEZ, 1977b. El Capybara una fuente indegena de carne de la América Tropical. *Revista Mundial de Zootecnía.* 21, 24.