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SUPPLEMENTATION WITH *BROSIMUM ALICASTRUM* SWARTZ TO PELIBUEY SHEEP FED LOW QUALITY RATIONS

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Abstract

The objective of the present study was to assess the influence of supplementing increasing levels of ramón (*Brosimum alicastrum*) foliage to Pelibuey sheep fed guinea grass (*Panicum maximum*) hay. Rate and extent of rumen degradation of organic matter (OM) and crude protein (CP) of ramón foliage were high. Dry matter (DM) intake of the diet was increased by the inclusion of ramón foliage. However, rate and extent of digestion of guinea grass was not affected by the ramón foliage. Rate of passage of solid was linearly increased as a result of the inclusion of ramón foliage in the ration. Supply of microbial N to the small intestine was significantly increased by the tree foliage. Ramón foliage is a suitable source of nutrients for ruminant during the dry season in tropical Mexico.

Keywords: *Brosimum alicastrum*, Pelibuey sheep, rumen digestion, Voluntary intake

Introduction

Ramón (*Brosimum alicastrum* Swartz) is a tropical tree used in South México for different purposes (NAS, 1975). It is one of the few trees that keep its leaves during the dry season. Currently, ramón foliage is utilized by small-scale dairy farmers in Yucatan, México as a source of forage. However, the limited knowledge about its nutritive value precluded its effective use supplementing in low quality rations. The present work was carried out to assess the effect of incorporating increasing levels ramón foliage mixed with guinea grass (*Panicum maximum*) on intake and rumen digestion and kinetics of passage.

Material and Methods

Four rams Pelibuey (37.4 ±4.9 kg LW), surgically fitted with plastisol cannulas (7.5 cm internal diameter; Bar Diamond Inc., Idaho, USA) in the dorsal sac of the rumen, housed in metabolic crates were used. Ramón foliage was sun-dried for two days, chopped and mixed with guinea grass hay, in the ratios: 0:100; 15:85, 30:70 and 45:55 (DM). The *in sacco* technique (Orskov et al., 1980) was used to assess rumen degradation of DM, OM, CP and NDF. Nylon bags (5 x 7 cm and 53 μm pore size; Bar Diamond Inc.) were employed. Three grams of sample were placed into each bag, which were incubated in the rumen for 3, 6, 9, 12, 24, 48, 72 and 96 h., and then washed ands dry in a forced-air oven at 60°C for 72 h. The non-linear model $p = a + b\ (1 - e^{-ct})$ (Orskov and McDonald, 1979) was used to describe kinetics of nutrient disappearance from the rumen. Washing loss (zero time) was estimated following the procedures described by López et al. (1994).

The experimental diets were offered *ad libitum* every morning (08:00 h), and a 10% refusal, relative to the amount offered, was allowed. Voluntary intake was measured as the difference between the amount offered and that refused the following day. The urinary purine derivative technique (Chen et al., 1990) was used to estimate the supply of microbial nitrogen (N) to the small intestine. Daily urine output was collected on 10% H_2SO_4, diluted with water (5:1). Uric acid was assayed with the colorimetric technique. Xantine plus hypoxantine were quantified as uric acid after enzymatic treatment of urine with xantine oxidase (EC 1.2.3.2) to convert all the xantine plus hypoxantine into uric acid (Fujihara et al., 1987). Calculations were carried out with the Newton-Rhapson iterative procedure (StatSoft, 1994). The amount of microbial purines absorbed (mmol/d) was estimated from the daily excretion of purine derivatives by means of the model $Y = 0.84X + (0.15W^{0.75}\ e^{-0.25x})$. The supply of microbial N to the small intestine was estimated from the amount of purine derivatives absorbed (PA) by using the following factors: digestibility of microbial purines = 0.83 and the purine-N:total microbial-N ratio is 0.116:1.00. The supply of microbial N to the small intestine was equal to PA x 70/0.83 x 0.116 x 1000 = 0.727 x PA, where 70 is the N content (mg/mmol) of purines (Chen et al., 1992).

Rate of passage of solid digesta was estimated with the Cr-mordanting technique (Udén et al., 1980). Forty grams of Cr-mordanted fiber were introduced through the rumen cannula and fecal samples were taken at 0, 6, 8, 10, 12, 16, 24, 36, 48, 72, 96 and 120 h to describe the excretion curve of marker. The two-compartment model $Y = A\ e^{k1(t-TT)} - A\ e^{k2(t-TT)}$ suggested by Grovum and Williams (1973) was used to estimate by regression techniques k_1 (rumen outflow rate) and k_2 (rate of passage through the caecum and proximal colon).

The experimental design was a 4 x 4 Latin square design with four periods of twenty days each, ten days for adaptation and ten days for measurements. Data were subjected to analysis of variance with the General Linear Model of SAS (SAS, 1994). Animal, treatment and period were sources of variation in the model.

Results and discussion

Organic matter and CP of ramón foliage degraded rapidly and extensively in the rumen (95.26% and 11.6%/h for potential and rate of degradation respectively (Table 1). Dry matter, OM, NDF and ME intakes were linearly increased ($P < 0.01$) as the level of ramón foliage was augmented, which is associated with the high rate and extent of rumen degradation of ramón foliage (Table 1). Nevertheless, ramón foliage did not affect potential DM and OM degradation of the basal ration (Table 1).

Rate of passage of solid digesta through the rumen (k_1) was linearly ($P < 0.05$) increased as the level of ramón foliage augmented. The faster emptying of the rumen of sheep fed ramón foliage, may have been the mechanism facilitating the increase in feed intake. Supply of microbial protein to the small intestine of sheep was linearly increased as the level of ramón foliage was augmented (Table 2). This may be the result of an increased intake of digestible organic matter.

Ramón foliage is a good source of nutrients for sheep, improving DM intake, outflow from the rumen and microbial nitrogen supply to the small intestine. It is a readily source of highly digestible nutrients for ruminants and may be a suitable choice in the quest to develop sustainable systems of sheep production in the tropical regions of Latinamerica.

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Table 1 - Rumen degradation of DM and OM of *P. maximum* and of experimental diets incubated in sheep fed increasing levels of *B. alicastrum* foliage.

	Level of inclusion of *B. alicastrum* (% DM)			
Constant	0	15	30	45
Guinea grass				
		Dry matter		
a	10.9	10.9	10.9	10.9
b	31.3	30.1	30.6	29.0
a + b	42.3	41.1	41.6	40.0
c	2.9	3.5	3.6	4.4
		Organic matter		
a	7.0	7.0	7.0	7.0
b	34.5	33.6	32.9	31.6
a + b	41.5	40.6	39.9	38.6
c	2.9	3.4	3.5	3.9
Experimental ration				
		Dry matter		
a	22.11	21.54	23.93	23.99
b	28.66	29.92	33.21	38.98
a+b	50.77	51.46	57.14	62.97
c	2.23	5.15	9.29	9.6
		Organic matter		
a				
b	33.42	36.71	45.47	54.59
a + b	50.11	50.93	56.20	62.72
c	2.24	4.92	9.0	9.3

Table 2 - Urinary excretion of purine derivatives and microbial nitrogen supply to the small intestine of Pelibuey sheep fed increasing levels of *B. alicastrum* foliage.

	Level of incorporation of *B. alicastrum* foliage				Linear
	0	15	30	45	model
Alantoin	2.29	4.25	6.42	7.24	**
Uric acid	1.14	1.72	2.66	3.65	***
Xantine + Hipoxan.	0.20	0.26	0.41	0.45	*
Total	3.63	6.23	9.50	11.34	***
MNSSI	2.20	4.92	7.93	9.72	***
Grams	12.71	17.01	16.69	17.54	NS

NS, Not significant; *, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.001$