



# Effects of supplementing sugar-based by products on ingestive behavior and ruminal fermentation parameters of small ruminants

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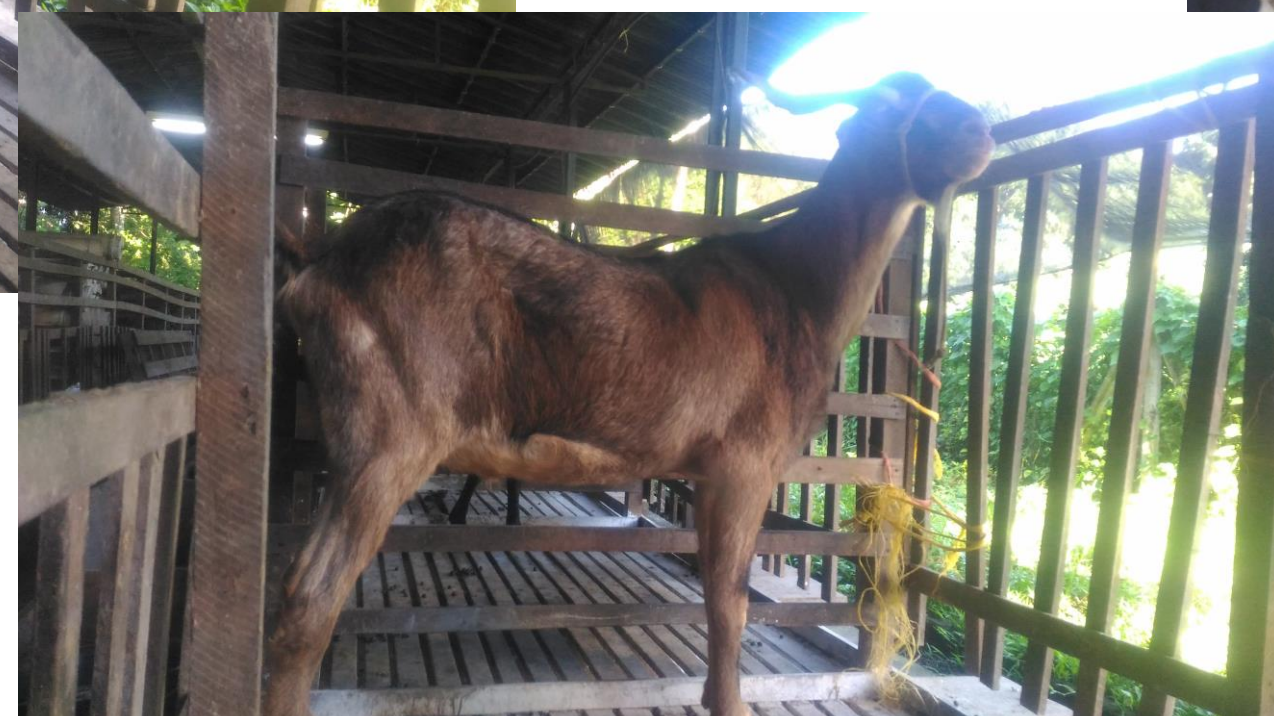


## Introduction

- According to data from the Brazilian Association of the Industry of Chocolates, Cocoa, Peanuts, Candies and Derivatives (BAICAB, 2018), the volume produced of candies and gums in 2018 was 278 million tons, of this total, 204 were of apparent consumption, 88 were exported and 13 million imported; it is understood that 74 thousand tons would be discarded. The State of Pernambuco has a significant number of industries in the segment, demonstrating possibilities of using co-products in animal feeding.
- The objective of this study was to evaluate the effects of replacing ground corn grain (GCG) by sugar-based by products plus corn gluten feed (SBB-CGF) on ingestive behavior and ruminal fermentation parameters in small ruminants.

## Materials and Methods

- Four ruminally cannulated wether sheep and four wether goats (72 and 65 ± 2.3 kg BW, respectively) were individually allocated to 8 pens, over 4 periods of 19-d each (12 d adaptation plus 7 d of sample collection);
- Receive a diet containing 50% roughage (bermudagrass hay; *Cynodon* sp.) and 50% concentrate (80% GCG, 16% soybean meal, and 4% premix) with 4 levels of inclusion of SBB-CGF in replacement of GCG (0, 33, 66, and 100%, DM basis). Corn gluten feed was used with SBB to maintain the diets isonitrogenous;
- Ruminal fluid was collected at 0, 2, 4, and 6 h after the morning feeding;
- Ingestive behavior was assessed on the d 12 of each period for 24 h;
- Duplicated 4 × 4 Latin square design.



## Results

**Table 1. Effect of replacing ground corn by sugar-based by products on ingestive behavior of small fistulated ruminants**

Item	Specie		SEM <sup>1</sup>	Replacement level				SEM <sup>1</sup>	P-value			
	Goat	Sheep		0	33	66	100		E <sup>2</sup>	E*NS <sup>3</sup>	L <sup>4</sup>	Q <sup>5</sup>
h/day												
FT	2.67	2.48	2.67	2.75	2.46	2.63	2.46	0.10	0.508	0.365	0.377	0.723
RT	4.29b	6.49a	0.84	5.58	5.81	5.42	4.75	0.27	0.001	0.426	0.080	0.213
IT	17.04a	15.03b	0.27	15.67	15.73	15.96	16.79	1.47	0.002	0.650	0.045 <sup>6</sup>	0.314
g/h												
FTDM	294.63b	415.89a	30.48	321.63	393.98	363.94	341.51	38.08	0.009	0.939	0.840	0.163
FTNDF <sub>acp</sub>	119.33b	160.97a	15.55	132.29	156.18	139.22	132.90	19.30	0.042	0.972	0.837	0.365
RTMS	196.74	153.20	24.07	155.19	168.38	182.38	193.94	21.46	0.248	0.159	0.073	0.958
RTNDF <sub>acp</sub>	79.95	59.15	11.58	63.57	67.58	70.20	76.86	10.22	0.251	0.169	0.198	0.853

FT = feeding time; RT = rumination time; IT = idle time; FTDM = Feed efficiency based on DM; FTNDF<sub>acp</sub> = Feed efficiency based on NDF<sub>acp</sub>; RTDM = Rumination efficiency based on DM; RTNDF<sub>acp</sub> = Rumination efficiency based on NDF<sub>acp</sub>. <sup>1</sup>SEM = Standard error of the mean (n = 32). <sup>2</sup>E = Effect of the species. <sup>3</sup>E \* LS = Effect between species and levels of substitution. <sup>4</sup>L = Linear effect. <sup>5</sup>Q = Quadratic effect. <sup>6</sup>Y = 15.496 + 0.0109x

**Table 2. Ruminal parameters of goats and sheep fed sugar-based by products**

Item	Specie		SEM <sup>1</sup>	Replacement levels, %				SEM <sup>1</sup>	P-Value				
	Goat	Sheep		0	33	66	100		E <sup>2</sup>	L <sup>3</sup> TREAT	Q <sup>4</sup> TREAT	L <sup>3</sup> TIME	Q <sup>6</sup> TIME
pH	6.039	6.105	0.065	6.088	6.078	6.053	6.069	0.064	0.337	0.594	0.714	<.0001	<.0001
N-NH <sub>3</sub> , mg dL <sup>-1</sup>	11.644	12.007	1.816	13.291	13.198	10.385	10.428	1.847	0.869	0.049	0.958	0.006	<.0001
SCFA [ ]													
Acetic	44.261	55.870	6.999	58.927	49.645	48.552	43.138	6.894	0.094	0.001	0.531	0.260	0.323
Propionic	22.779	27.370	0.296	17.869	23.017	30.593	28.819	4.054	0.296	0.006	0.286	0.073	0.132
Butyric	6.361	8.568	1.338	7.433	7.996	7.797	6.632	1.494	0.057	0.538	0.361	0.513	0.563
ACE:PROP	2.416	2.526	0.293	3.632	2.389	1.987	1.876	0.300	0.788	<.0001	0.019	0.002	<.0001

SCFA = Short-chain fatty acids. ACE: PROP = acetic: propionic relationship. <sup>1</sup>SEM = Standard error of the mean (n = 32). <sup>2</sup>E = Effect of the species. <sup>3</sup>LTREAT = Linear effect of treatment. <sup>4</sup>QTREAT = Quadratic effect of treatment. <sup>5</sup>LTIME = Linear effect of time. <sup>6</sup>QTIME = Quadratic effect of time.

## Conclusions

- The sugar-based by products plus corn gluten feed can replace ground corn grain up to 100% in the diets of goats and sheep consuming a 50:50 roughage:concentrate diet without compromising the ingestive behavior and ruminal fermentation parameters.