

Effect of supplementation on early lactation on secretion rate of milk constituents in *B. taurus* x *B. indicus* cattle*

H. Magaña Sevilla and C.A. Sandoval Castro¹

*Animal Nutrition Department, Faculty of Veterinary Medicine and Animal Science,
Universidad Autónoma de Yucatán
P.O. Box 4-116 Itzimna, 97100, Mérida, Yucatán, México*

ABSTRACT

Eight cows grazing star grass (*Cynodon nlemfluentis*) were divided into four supplement treatments: Control 3 kg/day soyabean meal/sorghum supplement (16% CP), HP: High protein (2 kg soyabean meal 1 kg sorghum 31.5% CP), HE: High energy (1 kg sorghum 2 kg Ca-soap) and HPE: High protein-High energy (2 kg Ca-soap, 1 kg soyabean meal). Treatments were balanced in two 4 × 4 latin squares groups as cows received or not supplement during the dry period (3 kg 18% CP). Milk secretion rate and efficiency was not affected by treatment. However, supplementation during the dry period increased milk protein and lactose concentration. Protein and lactose secretion rate and udder efficiency were also increased.

KEY WORDS: milk secretion rate, udder efficiency, tropical cattle, dry period

INTRODUCTION

Bos taurus x *B. indicus* cows are commonly used in tropical dairy systems. Production systems are based mainly on grazing tropical pastures and supplements. Low productivity levels achieved in tropical dairy systems has been usually attributed to nutritional limitations arising from the tropical feeds quality (Stobbs and Thompson, 1975). However, little research has been done on the biological constraints for increased milk production. The objective of the present work was to obtain biological indicators of milk production and udder efficiency in tropical dairy systems and to evaluate if increased productivity can be achieved by increasing the nutrient supply.

* H. Magaña PhD. work supported by a CONACYT-México Scholarship

¹ Corresponding author: e-mail: ccastro@tunku.uady.mx

MATERIAL AND METHODS

Eight multiparous cows, calved within a 1.5 week interval, grazing star grass (*Cynodon nlemfluensis*), were divided into four supplement treatments: Control 3 kg/day soyabean meal/sorghum supplement (16% CP), HP: High protein (2 kg soyabean meal 1 kg sorghum 31.5% CP), HE: High Energy (1 kg sorghum 2 kg Ca-soap) and HPE: High protein-High energy (2 kg Ca-soap, 1 kg soyabean meal). At the beginning of the experiment, ~45 days of lactation, cows had an average milk yield of 16 ± 4 kg/d. Treatments were designed to cover in excess their nutrient requirements. Treatments were balanced in two 4 x 4 latin squares groups as cows received or not supplement during the dry period (3 kg 18% CP supplement). Experimental periods were 2-weeks long. During the second week milk yield was recorded with a flow meter (Waikato, inc) and samples were taken for protein, fat and lactose analysis. Oxytocin was used to achieved complete udder emptiness in both current and previous milking. Udder volume was measured as described by Magaña and Sandoval (2003). Data was analyzed according to the experimental design using the GLM procedure of Minitab 12 (Minitab, 1997).

RESULTS AND DISCUSSION

In spite of different theoretical levels of nutrient supply to the udder, milk composition, secretion rate and udder efficiency were not affected ($P > 0.05$) by any of the treatments (Table 1). Then, other factors apart from nutritional stress were influencing the productivity of these cows. In agreement, it has been shown that the potential productivity of cows in the tropics is mainly constraint by other stressing factors as the climate (Pongpiachan et al., 2000).

The effect of supplementation during the dry period on milk composition, secretion rate and udder efficiency is summarized in Table 2. Milk protein and lactose content were increased by dry period supplementation but not fat. However, the apparent efficiency of the udder was increased for all three constituents.

Looking at secretion and efficiency an apparent dichotomy is observed. Secretion was higher for supplemented cows, but, efficiency was lower. Possible explanations are that as result of supplementation during the dry period cows had a bigger udder volume due to fat depots, or, higher number of cells, but, lower number of actually differentiated secretory cells. Although, udder volume is only a relative measure of the amount of secretory tissue, the last hypothesis is supported by the biological model analysis of the lactation curve reported by Magaña-Sevilla and Sandoval-Castro (2002) using the model described by Pollot (2000) and it is also supported by the finding of Akers (2000) that non dairy breeds had lower number of secretory cell per alveoli and their cells are less differentiated.

Table 1. Milk composition and secretion rate of milk and its main constituents in *B. taurus* x *B. indicus* cows during early lactation

	Control ¹	HP	HE	HPE	SEM	P
<i>g/100 g milk</i>						
protein	3.30	3.28	3.23	3.26	0.04	0.33
fat	3.46	3.40	3.47	3.70	0.17	0.79
lactose	4.88	4.94	4.92	4.95	0.05	0.69
<i>mg/min</i>						
protein	21.23	21.32	20.11	21.75	0.68	0.968
fat	22.56	22.39	22.33	24.85	1.43	0.703
lactose	31.87	32.57	30.91	33.51	1.15	0.864
g milk/min	10.80	10.89	10.44	11.16	0.35	0.929
<i>µg/cm³ udder</i>						
protein	3.85	3.93	3.77	4.04	0.12	0.893
fat	4.13	4.19	4.08	4.69	0.26	0.715
lactose	5.71	5.96	5.75	6.159	0.21	0.662
milk	117.29	120.61	117.50	124.44	3.88	0.709

¹ Control 3 kg/day soyabean meal/sorghum supplement (16% CP), HP: High protein (2 kg soyabean meal, 1 kg sorghum, 31.5% CP), HE: High energy (1 kg sorghum, 2 kg Ca-soap) and HPE: High protein-High energy (2 kg Ca-soap, 1 kg soyabean meal)

Table 2. Effect of supplementation during the dry period on milk composition, secretion rate and udder efficiency during early lactation

Supplement	Protein	Fat	Lactose
<i>g/100g milk</i>			
without	3.19	3.62	4.68
with	3.34	3.38	5.16
SEM	0.037	0.120	0.037
P	**	NS	**
<i>mg/min</i>			
without	19.41	22.82	29.13
with	22.69	23.05	35.14
SEM	0.592	1.024	0.914
P	**	NS	**
<i>µg/cm³ udder</i>			
without	4.25	4.91	6.28
with	3.53	3.61	5.48
SEM	0.084	0.165	0.136
P	**	**	**

The crossbred cows in the present experiment could have a predominant non-dairy genetic make up, thus explaining the lack of response to the increased

amount of nutrients supplied to the udder by supplementation. Thus, once lactation has established nutrient supply do not seems to be constraint for milk production as high quality diets can be supplied to the cows as in the present experiment. On the other hand, as supplementation during the dry period had a significant effect, it seems that might be nutritional constraints to udder development (prepuberal and/or prepartum) which require further research in order to obtain proper mammary gland development and potentially increase productivity of crossbred cows.

CONCLUSIONS

Milk secretion rate and efficiency of *B. taurus* x *B. indicus* cows was not affected by supplementation during early lactation, maybe because the treatment periods were too short for the effect of feeding to take action. However, supplementing during the dry period increased protein and lactose milk concentration. It also increased protein and lactose secretion rate as well as udder efficiency during early lactation.

REFERENCES

- Akers R.M., 2000. Selection for milk production from a lactation biology viewpoint. *J. Dairy Sci.* 83, 1151-1158
- Magaña Sevilla H., Sandoval Castro C.A., 2002. An analysis of dual purpose cattle (*Bos taurus* x *Bos indicus*) lactation curve. *Proc. Brit. Soc. Anim. Sci.*, p. 191
- Magaña-Sevilla H., Sandoval-Castro C., 2003. Calibration of a simple udder volume measurement technique. *J. Dairy Sci.* 86, 1985-1986
- Minitab, 1997. Minitab User's Guide 2: Data Analysis and Quality Tools. State Collage, PA (USA)
- Pollok G.E., 2000. A biological approach to lactation curve analysis for milk yield. *J. Dairy Sci.* 83, 2448-2458
- Pongpiachan P., Rodtian P., Ota K., 2000. Lactation in cross- and purebred friesian cows in norteen Thailand and analyses on effects of tropical climate on their lactation. *Asian-Austr. J. Anim. Sci.* 13, 1316-1322
- Stobbs T.H., Thompson P.A., 1975. Milk production from tropical pastures. *World Anim. Rev.* 13, 27-31