ULTRASOUND MEASUREMENTS OF GOATS MAMMARY GLAND CISTERNS DURING LACTATION. FIRST RESULTS

ULTRAZVUKOVÉ MERANIA CISTERIEN VEMENA KÔZ POČAS LAKTÁCIE. PRVÉ VÝSLEDKY

P. Makovický[1], J. Poráčová[2], M. Konečná[2], M. Nagy[1], V. Sedlák[2], M. Mydlárová Blaščáková[2], M. Milerski[3], M. Margetín[4,5]

[1]J. Selye University, Department of Biology, Faculty of Education, Komárno, Slovakia

[2]University of Prešov, Faculty of Humanities and Natural Sciences, Prešov, Slovakia

[3]Research Institute of Animal Production, Prague Uhříněves, Czech Republic

[4]Slovak University of Agriculture in Nitra, Faculty of Agrobiology and Food Resources, Nitra, Slovakia

[5]National Agricultural and Food Centre, Research Institute for Animal Production Nitra, Lužianky, Slovakia

Abstract

The mammary glands of ruminants develop a system for milk storage known as cisterns (Sinus lactiferi). Four different methods of udder ultrasonography were used for the measurements of udder cisterns sizes (n=60) in goats. Ultrasonography done by 5 MHz sectorial probe placed in the upper part of the intramammary ligament can be recommended as a useful and quick tool for the in vivo evaluation of cisterns in goats.

Keywords: ultrasonography, udder cistern size, dairy, goats

INTRODUCTION

The goat udder is divided into two separate and independent glands, each with its own secretory tissue and cisternal cavity and each drained by a separate teat (Bruckmaier and Blum, 1996). Milk is produced in the secretory tissue in the alveoli and in ruminants this milk is stored in two udder fractions, as cisternal and alveolar milk. The cisternal milk is located in teats, gland cistern and large milk ducts. The alveolar milk is found in small ducts and alveoli, which are surrounded by myoepithelial cells with OT receptors (Cross, 1977). The proportion of milk stored in the cisternal and alveolar fractions varies according to species, breed, age, stage of lactation and milking interval (Marnet and Komara, 2008). In contrast to cows, goats have large gland cisterns, where between 40-80% of the milk can be stored (Marnet and McKusick, 2001). In the dairy cow, most of the milk (80-100%) is stored in the alveolar fraction (Bruckmaier, 2005). The cisternal milk can be easily obtained without a neuroendocrine milk ejection reflex, while milk stored in the alveolar fraction can only be expressed into the cistern after contraction of the myoepithelial cells (Andersson, 1951; Soloff et al., 1980; Bruckmaier and Blum, 1994; Marnet and McKusick, 2001). Moreover, a larger cistern plays an important role in storage of milk between milkings, which further affects the removal of milk during milking (Marnet and McKusick, 2001). In goats, large volumes of milk can be obtained without milk ejection (Marnet and McKusick, 2001) and caprines are thus less dependent on milk ejection (Peris et al., 1997). Therefore, pre-stimulation for longer than 30 s is not necessary during machine milking of goats (Basic et al., 2009), but the pre-stimulation time required varies between breeds depending on differences in cistern size. In addition, animals with large cisterns are able to store milk more effectively between milkings (Marnet and McKusick, 2001). Greater storage capacity also leads to higher milk yield in goats and minimises the milk losses in once daily milking (Marnet and Komara, 2008).

The aim of the work was to compare suitability of using different methods of ultrasonography of the udders of dairy goats.

MATERIALS AND METHODS

The experiment was performed in one experimental goat dairy farm. In 15 dairy goats 12 hours after previous milking, ultrasonographic measurements of the cross-sectional area of the udder cisterns were performed in 4 ways:

1. Using a 2-5 MHz linear probe placed to the groin on the opposite side of the udder.
2. Using a 3.5 MHz linear probe placed to the udder from behind, above the teat, parallel to its axis.
3. Using a 5 MHz trans-vaginal convex probe placed to the back of the udder.
4. Using a 5 MHz convex probe placed to the back of the udder at the top of the udder near the lateral suspensory ligament with orientation to the axis of the teat.

Measurements were performed on all animals on both, the right and left cisterns and repeated the following day.

RESULTS AND DISCUSSION

Measurements using linear probes (methods 1 and 2) were characterized by good repeatability of measurements. In method 1, the correlation between repeated measurements was r=0.92. Placement of the probe and its direction was easily performed. In method 1, (placing the probe to the groin) some animals reacted irritably, especially with a full udder. In method 2, the cross-sectional shape of the cistern was affected by pressing the probe too hard. When using a trans-vaginal convex probe, small details of the internal structure of the udder were more noticeable due to the shorter wavelength. However, due to the problematic handling of the probe and its short range, this probe proved to be the least suitable for ultrasonography of the goat udders. In contrast, method 4 proved to be the most appropriate. It provided an easily detectable cross-sectional image of the cisterns, and thanks to the small area of the probe and easy availability of the measuring point, the measurement was fast and stress-free for the animals. In concordance with our results, Melo et al. (2012) established cistern size of 1.36 cm in transgenic and 2.25 cm in non-transgenic goats.

CONCLUSION

We recommend this method for measuring the size of the milk cisterns and for indirect selection for traits of milkability and milk yield of goats.

ACKNOWLEDGEMENT

This work was supported by the Ministry of Education, Science, Research and Sport of the Slovak Republic (project VEGA 1/0364/15 and project KEGA 015SPU-4/2019). Michal Milerski was supported by project No. MZE RO0718.

REFERENCES

ANDERSSON B. 1951. Några nyare synpunkter på laktations fysiologi. *Nordisk veterinär medicin*. 3, 327-341.

BASIC Z., DZIDIC A., KOSTELIC A. 2009. The effect of prestimulation on milking characteristics during machine milking of goat. *Mljekarstvo*, 59, 83-87.

BRUCKMAIER R.M., RITTER C., SCHAMS D., BLUM J.W. 1994. Machine milking of dairy goats during lactation: udder anatomy, milking characteristics, and blood concentrations of oxytocin and prolactin. *J Dairy Res*, 61, 457-466.

BRUCKMAIER R.M., BLUM, J.W. 1996. Oxytocin release and milk removal in ruminants. *J Dairy Sci*, 81, 939-949.

BRUCKMAIER R.M. 2005. Normal and disturbed milk ejection in dairy cows. *Domest Anim Endocrinol.* 29, 268-273.

CROSS B. 1977. Comparative physiology of milk removal. In: Peaker, M. (Ed.), Comparative Aspects of Lactation. Symp. Zool. Soc. London, vol. 41. Academic Press, London, pp. 193- 210.

MARNET P.G., McKUSICK B.C. 2001. Regulation of milk ejection and milkability in small ruminants. *Livest Prod Sci*, 70, 125-133.

MARNET P.G., KOMARA M. 2008. Management systems with extended milking intervals in ruminants: Regulation and production and quality of milk. *J Anim Sci*, 86, 47-56.

MELO C.H.S., SOUSA F.C., TELES FILHO A.C.A,, MOURA R.R., ALBUERQUE E.S., PEREIRA A.F., MELO L.M., FREITAS,V.J.F., TEIXERIA D.I.A. 2012. Ultrasound measurements of the mammary gland of transgenic hormone-induced lactating goat. *Arq Bras Med Vet Zootec*, 64, 491-494.

PERIS S., CAJA G., SUCH X., CASALS R., FERRET A., TORRE C. 1997. Influence of kid rearing systems on milk composition and yield of Murciano- Granadina dairy goat. *J Dairy Sci*, 80, 3249-3255.

SOLOFF M.S., CHAKRABORTY J., SADHUKHAN P., SENITZER D., WIEDER M., FERNSTROM, M.A., SWEET P. 1980. Purification and characterization of mammary myoepithelial and secretory cells from the lactating rat. *Endocrinol*, 106, 887-899.

Abstrakt

Mléčné žlázy přežvýkavců uchovávají mléku v tzv. cisternách (Sinus lactiferi). K měření velikosti cisteren vemene (n = 60) u koz byly použity čtyři různé metody ultrasonografie vemene. Ultrasonografie prováděná sektorovou sondou 5 MHz umístěnou v horní části intramamárního vazu může být doporučena jako užitečný a rychlý nástroj pro hodnocení cisteren koz in vivo.

Klíčová slova: ultrazvuk, velikost mléčné cisterny, mléčné výrobky, kozy

Kontaktní adresa:
Ing. Pavol Makovický, Ph.D.
Department of Biology
Faculty of Education
J. Selye University
Komárno, Slovak Republic
+421 35 3260856
makovicky.pavol@gmail.com

Recenzovali: Ing. J. Frydrych, Ing. A. Sedláček, Ph.D.