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Original Research

Ultrasonographic Evaluation of Mammary Gland in Boer Local Goats

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Abstract

Two-dimensional ultrasonographic examination of the udder and teats were performed in lactating and non-lactating Boer local she-goats (n=6 each) using 7.5 to 12.5 MHz linear transducer in a transverse and longitudinal plane. The udder was examined by the direct contact method. In, both the groups, the mammary gland parenchyma was uniformly echogenic. However, in lactating animals, the parenchyma showed an increased anechoic field due to accumulation of milk and increased vascularity of blood vessels. Right and left teats were examined by the water bath technique. In teat, three different layers were observed viz., anechoic teat cistern, hyperechoic teat skin, moderately echogenic middle layer and hyperechoic inner teat mucosa. Furstenberg's rosette region appeared as round, homogenous hypoechoic to anechoic. Teat orifice was hyperechoic, teat canal observed as a thin hyperechoic line between two thicker parallel hypoechoic bands. Between lactating and non-lactating animals, statistically no significant difference was observed in teat canal length (TCL), teat canal width (TCW), teat cistern diameter (TCD), teat wall thickness (TWT) and in diameter at Furstenberg's rosette (DFR).

Keywords: Boer Local She-Goat, Teat, Udder, Ultrasonography

Introduction

Mammary ultrasonography was an efficient method to evaluate the size and the productive capacity of the ovine mammary gland. The technique was highly correlated with milk production (Adam *et al.*, 2017). Ultrasonography is a unique imaging modality for soft tissue structures in the body. Its characteristic features are non-invasiveness, free from radiation hazards, providing quick, instant and dynamic visualization. It helps in determining the shape, size and internal consistency of the organ (Rambabu *et al*., 2009). It could be used as a helpful tool for the diagnosis of alterations in the teat such as inflammation, tissue proliferation, mucosal lesions, foreign bodies, milk stones, congenital changes, abscess and hematoma (Franz *et al.*, 2009). It is effective, simple technique, safe to both the subject and the operator, portable and ultra-rapid. It facilitated immediate interpretation and diagnosis.

Knowledge on ultrasonographic anatomy of the normal mammary gland in healthy adult sheep and goat is essential to understand the pathological alterations occurring in mammary gland such as mastitis. Boer local is a crossbreed goat evolved by crossing Boer and Local goats at Post Graduate Research Institute in Animal Sciences unit of Tamil Nadu Veterinary and Animal Sciences University. They are meat type, reared in semi-intensive system and milked by manually. Hence, the present study was conducted to establish the basic data about ultrasonography of udder and teat measurements in lactating and non-lactating Boer local she-goats, which are manually milked.

Materials and Methods

The present study was conducted in Boer local she-goats (n=6 each) at the Post Graduate Research Institute in Animal Sciences unit of Tamil Nadu Veterinary and Animal Sciences University, Kattupakkam, Chengalpet. Goats were placed over a table on a non-slippery surface, restrained and placed in a standing position with their legs perpendicular to the long axis of the body. B-Mode two-dimensional ultrasonography of udder and teat was carried out in longitudinal and transverse planes using DS50 plus Sonoray machine. Linear transducer with a frequency of 7.5 to 12.5 MHz was used. Ultrasonographic examination of the udder was performed by direct contact method on the external skin surface (Transcutaneous method). The transducer was placed both vertically and horizontally over the skin.

Ultrasonographic examination of teat was done as per the guidelines given by Cartee *et al*. (1986). Warm water was filled in the plastic cup and the teats immersed into the cup. Contact gel applied to the external surface of cup and probe was placed over the surface. The ultrasound measurements such as Teat canal length (TCL), Teat canal width (TCW), Teat cistern diameter (TCD), Teat wall thickness (TWT) and Diameter at Furstenberg's rosette (DFR) were made in both right and left side teats. Supramammary lymph nodes were examined at the caudal base of udder halves. Data obtained from micrometry were subjected to statistical analysis. SPSS® 26.0 for Windows was used for statistical analysis of data (Senthilkumar *et al*., 2020).

Results and Discussion

In the present study, B-mode ultrasonography of the mammary gland in Boer local she goats revealed the different anatomical structures of the mammary parenchyma. In lactating animals, visualization was found to be clear in lactating animals than non-lactating animals. In lactating she goats, mammary gland parenchyma was observed as a homogenous and uniformly echogenic structure. Distribution of anechoic zones within the parenchyma helped to visualize the blood vessels, alveoli and lactiferous ducts (Fig. 1A, 1B).

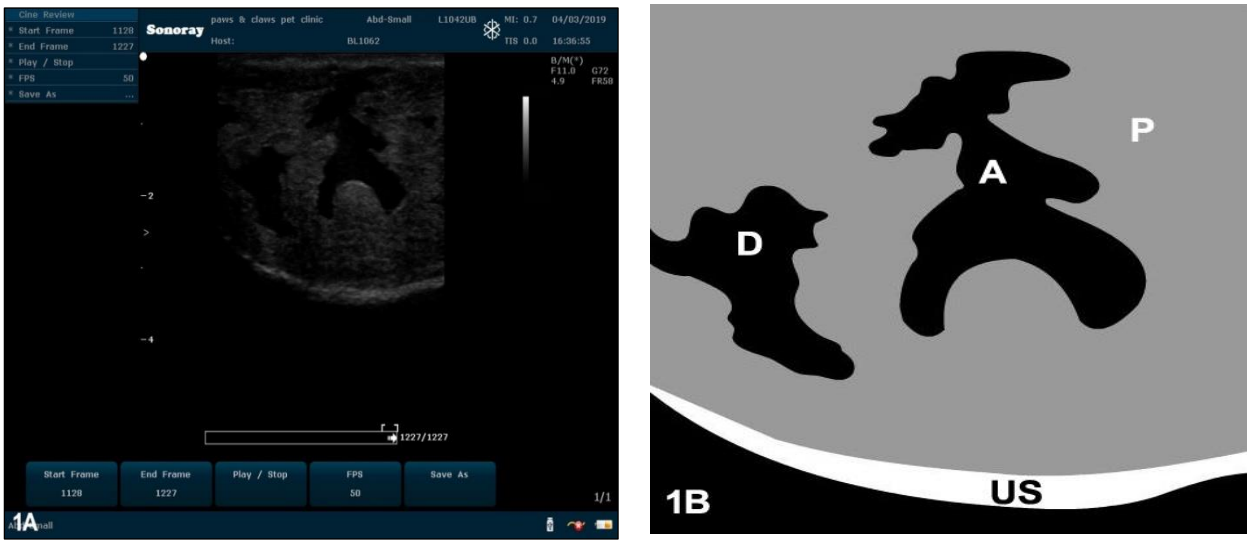


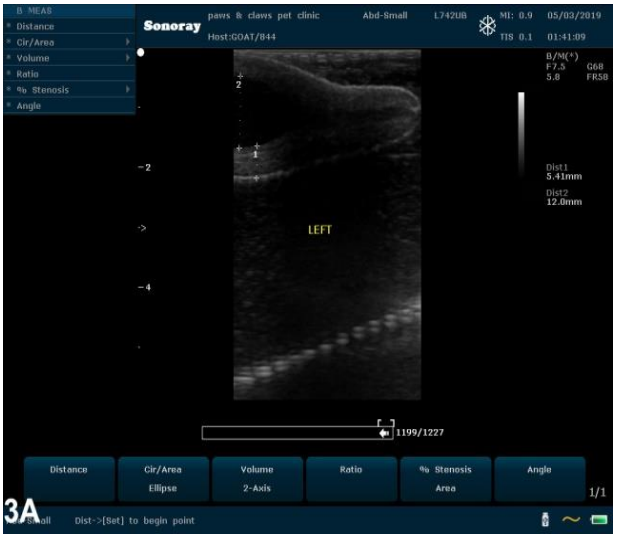
Figure 1A, 1B: Two dimensional ultrasonographic image of mammary gland of lactating adult she-goat showing anechoic alveoli (A) and duct (D), hyperechoic udder skin (US), homogenous parenchyma (P).

The results were in accordance with the findings of Franz *et al*. (2003) in ewes and Adam *et al*. (2017) in she-goats. In non-lactating groups, the echogenic pattern was similar to lactating groups. However, the amount and distribution of anechoic pattern indicated the blood vessels and lactiferous ducts were found to be less and hence, poorly visualized in non-lactating group (Fig. 2). This is in total agreement with the findings in cows by Fasulkov *et al*. (2014) in cows.

Figure 2: Two dimensional ultrasonographic image of right and left udder halves of non-lactating adult she-goat showing, the homogenous parenchyma (P).

Ultrasound image of the teat wall in both the groups of she-goats appeared as a tri-laminar structure. The outer most layer (teat skin) was seen as a mild hyperechoic line, the middle layer (fibromusculo-vascular layer) was found to be homogenous and thick with moderate echogenicity (hypoechoic layer). The innermost layer, teat mucosa was identified as a hyperechoic layer (Figs. 3A, 3B). A similar observation was made in ewes by Franz *et al*. (2009) and in local Bulgarian goats by Franz *et al*. (2001). Ragab *et al*. (2017) observed five differentiated layers in teat wall of cows. They were skin, hyperechoic musculature, connective tissue, sub mucosa and mucosa. This difference in layers might be due to difference in echogenicity. Teat cistern appeared as an anechoic structure as reported by Sendag and Dinc (1999) in cows. The transition area of teat cistern into a narrow teat canal was designated as Furstenberg's rosette, which was observed as round, homogenous hypoechoic or anechoic structure. This is agreement with the findings of Fasulkov *et al.* (2010) in she-goats. However, Franz *et al.* (2009) observed it as a hyperechoic structure in cows. Teat canal observed as thin hyperechoic line between two thicker parallel hypoechoic

bands. These results are in concurrence with Franz *et al*. (2001) in ewes. Teat orifice was observed as a hyperechoic structure. The finding was supported by Couture and Mulon (2005) in cows. In contrary, teat orifice appeared as anechoic as reported by Cartee *et al*. (1986) in cows. The mean ± SE values of various ultrasonographic parameters of both right and left teat in lactating and non-lactating Boer local she-goats were presented in Table 1.



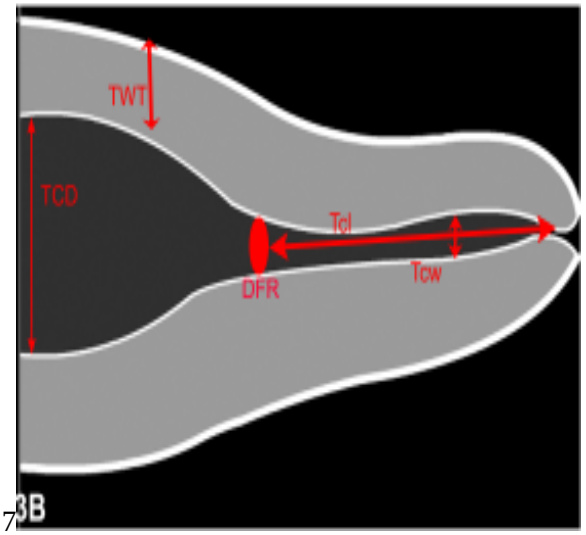


Figure 3A, 3B: Two dimensional ultrasonographic image of adult lactating she-goat showing the teat structures such as Teat canal length (Tcl), Teat Cistern Diameter (TCD), Teat wall thickness (TWT), Teat canal width (Tcw) and and Diameter of Furstenberg's rosette (DFR).

Table 1: Ultrasonographic parameters in the mammary gland of Boer local she-goats (Mean ± SE)

Parameters (µm)	Mean ± SE		t value
	Lactating (N=6)	Non-lactating (N=6)	
R-TCL	9.11 ± 1.45	6.51 ± 0.27	2.16^{NS}
R-TCW	1.18 ± 0.20	1.11 ± 0.10	0.49^{NS}
R-DFR	1.81 ± 0.21	1.59 ± 0.36	0.55^{NS}
R-TCD	8.67 ± 2.17	5.39 ± 2.13	0.94^{NS}
R-TWT	4.26 ± 0.35	3.11 ± 0.22	2.14^{NS}
L-TCL	9.16 ± 1.87	4.99 ± 0.90	1.48^{NS}
L-TCW	1.35 ± 0.26	1.07 ± 0.12	0.71^{NS}
L-DFR	2.18 ± 0.13	1.32 ± 0.20	2.12^{NS}
L-TCD	10.23 ± 1.84	6.69 ± 1.11	1.26^{NS}
L-TWT	4.16 ± 0.41	4.36 ± 0.35	0.30^{NS}

^{NS} - No significant difference between lactating and non-lactating groups (P≥0.05)

No significant difference was observed in R-TCL and L-TCL of both groups in she-goats. Length of teat canal was used for assessing the health status of the animals. Scherzer (1992) informed that longer teat canal provided more space in between pathogens and for teat. Teat canal width, Furstenberg's rosette diameter, teat cistern diameter and teat wall thickness of right and left teats did not differ significantly between lactating and non-lactating and she-goats.

Supramammary Lymph Node

In the present study, an ultrasound image of supramammary lymph nodes showed echogenic capsule, hypoechoic cortex and hyperechoic inner medullary area in both the groups of she-goats (Fig. 4). These findings were supported by earlier findings in supramammary lymph node of cows by Szenziova and Strapak (2012).

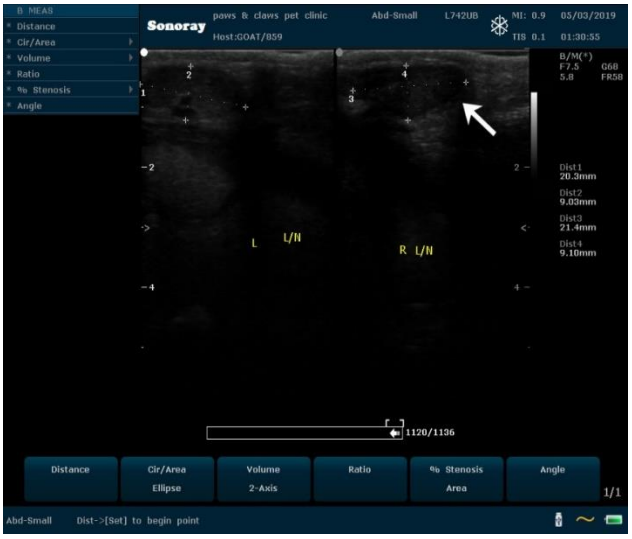


Figure 4: Two dimensional ultrasonographic image of lactating adult Boer local she-goat showing supramammary lymph node (arrow).

Conclusion

Statistically no significant difference was observed in ultrasonographic variables of teat between lactating and non-lactating goats. Reference values for the Boer local goats will be used as a baseline for conducting further studies. Normal sonographic examination of udder and teat will be used for correlating with the pathological disease conditions such as mastitis.

Conflict of Interests

There is no conflict of interest.

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References

1. Adam, Z. E. A. S., Ragab, G. A. N., Awaad, A.S., Tawfiek, M. G. and Maksoud, M. K. M. A. (2017). Gross anatomy and ultrasonography of the udder in goat. *Journal of Morphological Sciences*, 34(3): 137-142.
2. Cartee, R. E., Ibrahim, A. K and McLeary, D. (1986). B-mode ultrasonography of the bovine udder and teat. *Journal of American Veterinary Medical Association*, 188: 1284-1287.
3. Couture, Y. and Mulon, P. Y. (2005). Procedures and surgeries of the teat. *Veterinary Clinic of North America: Food Animal Practice*, 21:173–204.
4. Fasulkov, I. R., Georgiev, P. I., Antonov, A. L and Atanasov A. S. (2010). B-mode ultrasonography of mammary glands in goats during the lactation period. *Bulgarian Journal of Veterinary Medicine*, 13(4): 245−251.
5. Fasulkov, I., Vasilev, N., Karadaev, M. and Dineva, G. (2014). Visualization and measurement of teat structures in black-and-white cows through ultrasonography. *Macedonian Veterinary Review*, 37(1): 89-93.
6. Franz, S., Hofmamm-parisot, M., Gutler, S. and Baumgartner, W. (2003). Clinical and ultrasonographic findings in the mammary gland of sheep. *New Zealand Veterinary Journal*, 51(5): 238-243.
7. Franz, S., Hofmamm-parisot M, Baumgartner, W., Windischbauer, G., Suchy, A. and Bauder, B. (2001). Ultrasonography of the teat canal in cows and sheep. *The Veterinary Record*, 149:109-112.
8. Franz, S., Floek, M. and Hofmann-Parisot, M. (2009). Ultrasonography of the bovine udder and teat. *Veterinary Clinics of North America: Food Animal Practice*, 25: 669– 685.
9. Ragab, G. H, Seif, M. M. and Qutp, M. M. (2017). Ultrasonography of the mammary gland in ruminants. *Journal of Veterinary Medical Research*, 24(1): 1 - 4.
10. Rambabu, K., Sreenu, M., Sureshkumar, R.V. and Rao, T. S. C. (2009). Ultrasonography of the udder and

teat in buffaloes, *Buffalo Bulletin*, 28(1): 5-10.
11. Senthilkumar, S., Kannan, T.A., Geetha Ramesh and Sumathi, D. (2020). Effect of lactation on the mammary gland in Madras Red ewe - An histomorphometric study. *International journal of livestock research* 10 (1):40-47.
12. Scherzer, J. (1992). Ultrasound examination of the bovine teat – influence of teat canal length and other factors on the udder health. Thesis submitted to University of Veterinary Medicine-Vienna, Austria.
13. Sendag, S. and Dinc, D. (1999). Ultrasonography of the bovine udder. *Turkish Journal of Veterinary and Animal Sciences*, 23: 545– 552.
14. Szencziova, I. and Strapak, P. (2012). Ultrasonography of the udder and teat in cattle: perspective measuring technique. *Slovak Journal of Animal Science*, 45(3): 96–104.

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