ULTRASONOGRAPHY OF TEAT IN SURTI GOATS

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ABSTRACT
The present study was conducted on twenty clinically healthy adult surti goats weighing 15 to 20 kg, free from clinical and sub-clinical mastitis or teat injuries. Teats were examined by ultrasonography (USG) with 7.5 -10 MHz linear transducer using direct contact and water bath techniques. Ultrasonographically, parenchyma, lobes, major duct, gland cistern, teat cistern, teat/streak canal were visualized. Measurement of the structures i.e. teat end width (TEW), teat canal length (TCL), teat cistern width (TCW) and teat wall thickness (TWT) were also recorded using in build caliper in USG machine. The mean ± SE measurements of TEW, TCL, TCW and TWT in lactating goats were 1.34± 0.07, 1.74± 0.13, 0.38± 0.04 and 0.55± 0.02 cms, respectively, whereas the corresponding mean ± SE values in non lactating goats were 1.02± 0.03, 1.06± 0.06, 0.24± 0.01 and 0.46± 0.02 cms.

Key words: Goat, Teat, Ultrasonography.

INTRODUCTION
The goat’s udder is an exocrine epithelial gland in the inguinal region with two glands, one on either side of the midline. Each gland is having a single teat and each teat has a single orifice. The assurance of mammary gland health is the basis of economic milk production. In Veterinary Medicine, examination of the mammary gland, particularly the teat is an important application (Seeh, 1996; Braun and Euter, 1997; Hospes and Seeh, 1999 and Swill et al., 2004). With the development of the ultrasonographic biometry technique, it became possible to measure the dimensions of the udder in small ruminants, along with the assessment of the size of the gland cistern to predict milk yield of the animal (Ruberte et al., 1994). Ultrasonography (USG) allows for the localization and demarcation of the extent of teat stenosis and other abnormalities of the teat and is also useful for monitoring the healing process after surgical removal of proliferative tissue. The present article deals with the study of normal ultrasonographic features of the teat in lactating and non lactating surti goats.

MATERIALS AND METHODS
Twenty clinically healthy adult surti goats weighing 15 to 20 kg, free from clinical and sub-clinical mastitis or teat injuries from a flock, were selected for the present study. These animals were randomly divided into lactating (n=10) and non-lactating (n= 10) groups. Teats were scanned using a real time B mode ultrasonography machine (esaote MY LAB 40 NETHERLAND) with 7.5-10 MHz linear/sector transducer in standing position. Sagittal and transverse ultrasonographic images of the teat were recorded. Prior to the study, a pilot study was conducted on ten goats to standardize the USG procedure for scanning and teat biometry.

Prior to ultrasonographic examination, teats were physically examined by palpation. Ultrasonographically, the teats were scanned using direct contact and water bath technique (Fig. 1). In direct contact technique, the ultrasound coupling gel was applied to the teat to ensure intimate contact between transducer and teat. Since goat teats are conical in shape, direct contact between probe head and tip of teat was prevented as this deforms the image. During ultrasound scanning of the tip, the teat was immersed in water (35°C) in an infusion bottle resected transversely to the desired length. The probe with sufficient contact jelly was held against the teat and bottle lateral to the teat. Teats are not completely circular, therefore the position of the probe on the teat during the USG was held uniformly on
lateral side. After capturing the image, structures visualized were lobes, major duct, gland cistern, teat cistern and teat/streak canal.

The gel from the teat and transducer was cleaned and the measurement of the structures was made i.e. teat canal length (TCL), teat end width (TEW), teat wall thickness (TWT) and teat cistern width (TCW) with an in build caliper in USG machine (Fig 2). The USG measurement was taken separately both lactating and non-lactating goats.

RESULTS AND DISCUSSION

In the present study, real time B-mode ultrasonography was conducting using 7.5-10 MHz linear/sector transducer in the sagittal and transverse plane. Ultrasonographic examination of both the group animals was well appreciated and showed that each quarter consisted of two distinct glands, each leading to a separate gland cistern; and each gland cistern connected to the teat cistern, which were completely separated from each other. In all animals, the teat sphincter, teat sinus, gland sinus, lactiferous ducts and mammary parenchyma were imaged easily. The teats on USG appeared as hypo-echoic structures with anechoic lumens and the teat wall showed three distinct layers: a hyper-echoic outer layer, a thicker hypo-echoic middle layer and a hyper-echoic inner layer (Fig. 3). Similar findings were also reported by earlier workers (Cartee et al., 1986; Gungor et al., 2005 and Nak et al., 2005).

Furstenberg’s B-mode USG was not perceptible. The teat canal appeared unclearly as linear striæ, bordered by the sonographic image of the adjacent teat wall. The glands of sinuses appeared as an anechoic area continuous with the teat sinus. The lining of the wall of the glands sinus appeared as mixed hyper to hypoechoic areas within the hypoechoic material of the glands.

The USG of udder and teat was performed by direct contact of transducer with teat and in a water-bath. Direct contact can be easily applied; however, the shape of the teat may change because the teat wall near the probe and the rosette of Furstenberg area can not be seen completely by conventional method. To visualize streak canal water bath technique was superior as compared to direct contact but when ample amount of gel is applied at
the tip of teat, images are of high quality, can be obtained by both techniques. Franz et al. (2001) reported that coupling the probe directly to the teat had satisfactory results. But the quality of the image was satisfactory only when the teat was held in a water-bath. Cartee et al. (1986) observed that the use of the water-bath increased the acoustic impedance difference between the teat wall and the surrounding medium. Filling the teat with milk (or a natural solution) is considered to be an important factor for obtaining images of high quality (Neijenhuis et al., 2001). Therefore, goats which were in lactation, yielded better images. The presence of milk in the teat sinus acted similarly as a “window” of acoustic impedance difference for imaging the deeper structures and far wall of the teat.

The glandular parenchyma of the teats was hypoechoic and the lactiferous ducts appeared as anechoic areas due to their fluid content (Fig. 4). The anechoic areas within the glandular parenchyma may have been blood vessels, but others certainly were lactiferous ducts, because they could be seen entering the gland sinuses. Similar observations were also reported by Cartee et al., (1986). The result of this study shows the presence of defined gland and teat cisterns in goats. Saleh et al. (1971) measured only the length and diameter of the goat udder manually. The ultrasonographic measurements (Mean ± SE) of teat canal length, teat end width, teat wall thickness and teat cistern width were taken in lactating and non lactating goats (Table 1).

The different teat measurements in lactating and non lactating goats established range to be used for reference. Results of conducted analyses indicate high suitability of non invasive imaging technique (USG) in the analysis of teat and udder morphology. Direct contact of 10 MHz linear probe to the teat reveals good quality images. But images in water bath are of better quality. With 10 MHz linear probe it becomes easy to visualize the gland cistern, parenchyma, teat wall, and teat canal. It is necessary to provide thorough training for the personnel taking ultrasound measurements, since significant differences were found in values of individual measurements between operators varying in experience.

**CONCLUSIONS**

Ultrasoundography of udder and teat is a safe and noninvasive procedure which indicates its high suitability for visualization of teat internal architecture and its morphology. Moreover, ultrasonographic study of teat anatomy is highly appreciable in the lactating goats as compared to non-lactating goats.

**REFERENCES**


