Research article

Journal of Veterinary and Life Sciences

Journal homepage: www.acspublisher.com

Year 2025, Volume-1, Issue-1 (January–June)

Ultrasonographic study of gallbladder in the Barbari goats

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Keywords:

Barbari goats
B-mode ultrasound
Gallbladder
Ultrasonography

ABSTRACT

Ultrasonography is an important non-invasive tool for diagnosis or assessing abdominal organs in veterinary medicine. While its application in veterinary for liver disease diagnosis is well-established, ultrasonographic evaluation of the gallbladder in goats remains limited. The objective of this study was to characterize the ultrasonographic evaluation of the gallbladder in clinically healthy adult Barbari goats. A total of 30 goats were examined using a 5–12 MHz linear transducer in a standing position, focusing on the 9th and 10th right intercostal spaces. The gallbladder appeared pear-shaped with anechoic content and was visualized in one or both intercostal spaces. The common bile ducts and intrahepatic bile ducts were not visualized. The mean gallbladder dimensions recorded were: length 17.11 mm, width 9.79 mm, wall thickness 0.71 mm, surface area 245.50 mm^2, and circumference 67 mm. The findings provide baseline ultrasonographic data for the gallbladder in Barbari goats, which can serve as a reference for diagnosing hepatic and biliary disorders in this breed.

1. Introduction

Ultrasonography is an important non-invasive diagnostic technique for diagnosis of diseases in animal. B-mode ultrasound, or brightness mode ultrasound, is a widely used diagnostic imaging technique in veterinary medicine (Oliveira et al., 2025). It generates two-dimensional grayscale images that provide technical information about the size, shape, position, and internal architecture of organs (Szatmári et al., 2023). In this mode, echoes reflected from tissue interfaces are converted into dots of varying brightness on the screen, with the intensity corresponding to the strength of the echo (Cloutier et al., 2021). This allows visualization of the echotexture and structural composition of soft tissues, making it particularly useful for evaluating abdominal organs like liver, kidneys, spleen and gallbladder (Mencarini et al., 2024). It facilitates early detection of pathological changes such as fluid accumulation, organ enlargement, masses, or structural abnormalities (Banzato et al., 2016). The real-time imaging technique's capability

How to cite:Singh, P.K., Kumar, V., Kaushal, S., Malik, V. & Tyagi, S.K. (2025). Ultrasonographic study of gallbladder in the Barbari goats. *Journal of Veterinary and Life Science*, 1(1), 25-28. 10.48165/jvls.2025.1.1.3

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DOI: https://doi.org/10.48165/jvls.2025.1.1.3
Received 10-04-2025; Revision 12-04-2025; Accepted 07-05-2025

also supports dynamic assessment, such as observing organ movement and guiding procedures like fluid aspiration or biopsies (Gouda et al., 2020). The B-mode images obtained using this technique shows echotexture of abdominal viscera. Ultrasonography is a well-established technique for diagnosing liver diseases in sheep and cattle (Da Silva et al., 2025). In goats, however, its application has largely been confined to screening for hydatid cysts caused by Echinococcus granulosus (canine tapeworm) (Maxson et al., 1996; Sage et al., 1998; Njoroge et al., 2000). Nevertheless, ultrasound imaging holds potential for identifying other hepatic conditions in goats, including abscesses, neoplasms, hepatomegaly, and fascioliasis. Accurate diagnosis of liver disorders using ultrasonography depends on a comprehensive understanding of the normal ultrasonographic appearance of the liver. In cattle, several studies have documented the sonographic features associated with pyelonephritis (Flock, 2007; Braun et al., 2008). Based on above background the present experiment aimed to the ultrasonographic examination of gallbladder in healthy Barbari Goats.

2. Materials and methods

2.1. Ethical approval

The experiment was approved by the Committee for the purpose of control and supervision of experiments (CPCSEA) on animals, Krishi Bhawan, New Delhi-110001, vide order no. V-11011(13)/19/2020-CPCSEA-DADF, dated 04th December, 2020.

2.2. Experimental design

The experiment was conducted at Sardar Vallabhbhai Patel University of Agriculture and Technology (SVPUAT) in Meerut, on 30 clinically healthy adult Barbari goats between February 2021 and September 2021. The average age of animals and body weight were 2.86 (range: 2-4) years and 21.17 (range: 16.4-29.5) Kg, respectively. These goats were from Livestock Farm Complex II, SVPUAT, Meerut. A digital ultrasound system (EXAGYNE, ECM Noveko International Inc., France) with a 5-12 MHz linear transducer (L738P) was used to study the gallbladder of each goat. The hair over the appropriate site was clipped and acoustic gel was liberally applied. A transabdominal ultrasonographic examination was performed in a quiet room between in standing position.

The gallbladder of the Barbari goats were ultrasonographically examined using the method described for Saanen goats (Braun and Steininger, 2011). The intercostal spaces (between 9th and 10th) of the right thoracic wall were scanned (Fig 1). The gallbladder was examined by scanning each intercostal space in a dorso-ventral direction with a transducer held parallel to the ribs (Fig 1). The size, shape, and location of the gallbladder was assessed and recorded. The surface area and circumference of the gallbladder were determined by manual tracing.

2.3. Statistical analysis

The data were statistically evaluated using one-way analysis of variance (ANOVA) with the help of SPSS software. The data presented as the means ± standard error of the mean (SE). (Snedecor and Cochran, 1994).

3. Results and discussion

The gallbladder appeared pear-shaped and sometimes extended beyond the ventral border of the liver, depending on the quantity of bile present (Fig. 2). In Barbari goats, it was typically located between the 9th and 10th intercostal spaces, although in some cases, it was observed within a single intercostal space. Its size varied with bile volume, and the content appeared anechoic on ultrasonography. The intrahepatic bile ducts, common hepatic duct, and common bile duct were not visible. The average length and width of the gallbladder were measured at 17.11 ± 2.88 mm and 9.79 ± 0.39 mm, respectively. The wall thickness was recorded as 0.71 ± 0.05 mm, while the surface area and circumference were found to be 245.50 ± 48.41 mm² and 67 ± 7.79 mm, respectively, in Barbari goats.

The gallbladder in Barbari goats appeared pear-shaped with anechoic content and was typically observed in the 9th to 10th right intercostal spaces. A similar finding has been observed by Braun and Steininger (2011) in the Saanen goats. Its size varied with bile volume, with an mean wall thickness of 0.71 mm, length of 17.11 mm, and width of 9.79 mm. The circumference and surface area were 67 mm, and 245.50 mm² respectively. These values are lower than the values reported by Braun and Steininger (2011) in the Saanen goats. Differences in their body size might be responsible for these differences. The smaller size of the gallbladder in Barbari goats may be attributed not only to breed-specific anatomical differences but also to their overall lower body weight and compact stature compared to larger breeds. The positional consistency of the gallbladder in relation to the liver and ribs, as well as its response to bile volume fluctuations, underscores the reliability of B-mode ultrasonography for its evaluation (Strnad et al., 2025). The findings of this study establish a normal reference range for gallbladder morphology in Barbari goats, which

is essential for identifying deviations in cases of hepatic or biliary pathology, such as cholecystitis, bile duct obstruction, or neoplasia. This study also highlights the utility of high-frequency linear transducers (5–12 MHz) in small ruminant abdominal imaging, allowing detailed evaluation of gallbladder anatomy without the need for sedation or invasive procedures. While ultrasonography has traditionally been underutilized in goats except for hydatid cyst surveillance, our findings support its broader application in caprine hepatic diagnostics. The ultrasonographic parameters documented here can serve as a valuable diagnostic baseline for veterinarians and researchers, aiding in the early detection and differentiation of hepatobiliary conditions in Barbari goats.

Fig. 1: Images showing scanning area for gall bladder (A) in Barbari goats.

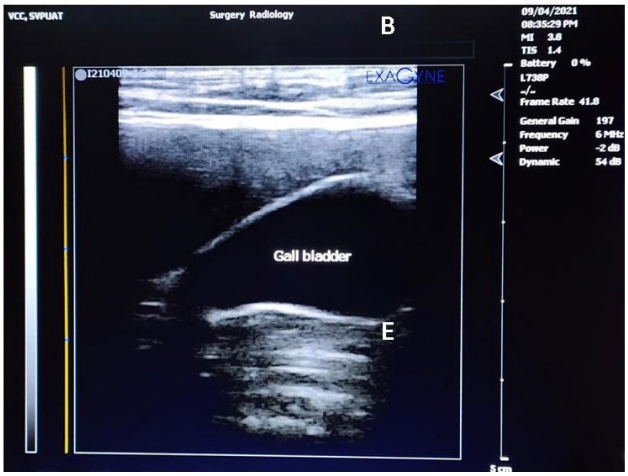

Fig. 2: Ultrasonograms showing in liver parenchyma pear-shaped gallbladder (B)

4. Conclusion

The present study successfully established the baseline ultrasonographic characteristics of the gallbladder in clinically healthy adult Barbari goats. The gallbladder was consistently visualized in the 9th and 10th right intercostal spaces as a pear-shaped, anechoic structure with well-defined margins. Quantitative measurements, including gallbladder length, width, wall thickness, surface area, and circumference, were recorded and found to be lower than those reported in larger breeds such as the Saanen goat, likely due to breed-related anatomical differences. These findings provide valuable reference data that can aid in the ultrasonographic diagnosis of hepatobiliary disorders in Barbari goats and enhance clinical assessment protocols in caprine practice.

Acknowledgement

We express our sincere gratitude to Dean, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, India for providing financial and necessary support to carry out this study.

Conflicts of interest and financial disclosures

The authors state that there are no conflicts of interest to disclose.

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