

Research Article

COMPARATIVE GROSS AND HISTOMORPHOLOGICAL STUDIES ON THE SPLEEN OF SHEEP AND GOAT OF JAMMU REGION OF INDIA

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ABSTRACT: The study was conducted on the histology and micrometry of the spleen of sheep and goat of Jammu region. The spleen of goat was quadrangular whereas that of sheep was triangular. The biometrical measurements of the spleens of sheep and goat revealed that the weight of spleen of sheep was 81.39 ± 12.79 gm while that of goat was 64.48 ± 7.82 gm. The length of the spleen was 12.70 ± 0.81 cm and 11.48 ± 0.73 cm in sheep and goat, respectively. The width of spleen of sheep was recorded to be 9.26 ± 0.38 cm and that of goat was measured as 9.37 ± 0.79 cm and the thickness of spleen was found to be 2.69 ± 0.2 cm and 2.37 ± 0.21 cm in sheep and goat, respectively. Histologically, spleen was covered by thick capsule with thickness 282.27 ± 14.88 μ in goat and 150.13 ± 8.14 μ in sheep. The thickness of trabeculae in goat was 224.67 ± 67 μ and in sheep was 104.35 ± 8.92 μ . Average diameter of white pulp was 478.20 ± 26.88 μ in sheep and 412.22 ± 47.85 μ in goat. Number of white pulps per field at 100 X magnification was 1.30 ± 0.21 in sheep and 1.60 ± 0.23 in goat. Similarly, number of white pulps per mm² was 1.32 ± 0.22 in sheep and 1.62 ± 0.23 in goat. Red pulp consisted of splenic cords and sinusoids. Sinusoids were lined by endothelial cells with large nuclei bulging into the sinusoidal lumen.

Key words: Gross Morphology, Biometry, Histomorphology, Spleen, Sheep, Goat.

INTRODUCTION

Small ruminants are important source of meat, milk and wool. It is well known that the lymphoid tissue plays an important role in the defense mechanism against the micro-organism. Spleen is the largest and major secondary lymphatic organ, serving as filter for the blood and preserves iron for use in haemoglobin synthesis (Samuelson 2007). These important functions are carried out by the peculiar stroma and parenchyma components (Onkar and Govardhan 2013). Relative scant literature on comparative gross, histological and micrometrical features of spleen of sheep and goat prompted the present study.

MATERIALS AND METHODS

Spleen samples used for this study were collected from local slaughter houses in and around Jammu city. A total of 13 spleens (7 sheep and 6 goats) from apparently healthy slaughtered animals were randomly collected irrespective of sex and immediately transported to the laboratory for gross examination and histological works. The following gross measurements were recorded.

a. Spleen length: Between two opposite highest vertical

points of the spleen. Measured using a meter rule (cm) and a non-stretchable thread.

b. Spleen width: Between two opposite mid-point of the spleen. Measured using a meter rule (cm) and a non-stretchable thread.

c. Spleen thickness: Recorded at mid-point of the spleen using Vernier caliper.

d. Spleen weight: Spleen weight (in gm) was measured using digital weighing balance.

For histological study, spleen tissues were fixed in 10% formalin, processed using Alcohol-Benzene method, obtained paraffin sections and stained with Haematoxylin and Eosin (Luna 1968). Comparative micrometry was done under light microscope using an ocular micrometer calibrated with a stage micrometer. Measurements *viz.* Spleen capsule thickness (μ), trabecular width (μ), diameter of white pulp (μ), number of white pulp per field (100 X magnification) and number of white pulp (per mm²) were recorded.

All the data generated was presented as Mean \pm Standard deviation and analyzed by one-way ANOVA (Snedecor and Cochran 1994).

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RESULTS AND DISCUSSION

Gross morphology and Biometry

The spleen of goat was roughly quadrangular in outline with blunt edges (Fig. 2). It appeared reddish gray in colour macroscopically whereas the spleen of sheep was triangular with reddish brown coloration (Fig. 1). These findings were in agreement with Nickel *et al.* (1979). In both, sheep and goat, spleen presented two surfaces *i.e.* parietal and visceral. Parietal surface was convex whereas

Table 1. Gross parameters of the spleen of sheep and goat.

| Parameters | Sheep (N=7) | Goat (N=6) | p value |
|----------------|---------------|--------------|---------|
| Weight (g) | 81.39 ± 12.79 | 64.48 ± 7.82 | 0.394 |
| Length (cm) | 12.70 ± 0.81 | 11.48 ± 0.73 | 0.294 |
| Width (cm) | 9.26 ± 0.38 | 9.37 ± 0.79 | 0.898 |
| Thickness (cm) | 2.69 ± 0.26 | 2.37 ± 0.21 | 0.352 |

Table 2. Correlations of different gross anatomical parameters of spleen in sheep and goat.

| Parameters | Length (cm) | Width (cm) | Thickness(cm) | Length (cm) | Width (cm) | Thickness(cm) |
|------------|--------------|-------------|---------------|--------------|-------------|---------------|
| | Sheep | | | Goat | | |
| Weight (g) | 0.97* ± 0.11 | 0.61 ± 0.35 | 0.80* ± 0.27 | 0.81* ± 0.29 | 0.61 ± 0.40 | 0.50 ± 0.53 |
| Length(cm) | — | 0.67 ± 0.33 | 0.71 ± 0.31 | — | 0.77 ± 0.32 | 0.78 ± 0.31 |
| Width (cm) | — | — | 0.33 ± 0.44 | — | — | 0.85* ± 0.26 |

* p < 0.05

visceral surface was concave and presented hilus (Fig. 1 and Fig. 2).

The biometrical measurements of the spleens of sheep and goat are presented in Table 1. The weight of spleen of sheep was 81.39 ± 12.79 gm while that of goat was 64.48 ± 7.82 gm. However, the variation was non-significant. The length of the spleen was 12.70 ± 0.81

cm and 11.48 ± 0.73 cm in sheep and goat, respectively which was also non-significant. The width of spleen of sheep was recorded to be 9.26 ± 0.38 cm and that of goat was measured as 9.37 ± 0.79 cm. The thickness of spleen was found to be 2.69 ± 0.2 cm and 2.37 ± 0.21 cm in sheep and goat, respectively. Both the variations in regard to width and thickness of spleen in sheep and goat were non-significant.

However, spleen weight was measured about 69 ± 6.663 gm by Khaleel (2010) in Awasi sheep. He also measured average length, width and thickness of spleen of Awasi sheep to be 9.93 ± 0.342 cm, 6.48 ± 0.233 cm and 2.48 ± 0.142 cm, respectively. Sinha *et al.* (2013) found mean weight of spleen of Black Bengal goats to be 47 ± 2 gm. The mean length and width were 10.3 ± 0.21 cm and 7.9 ± 0.15 cm, respectively.

Usende *et al.* (2014) recorded weight, length, width and thickness of goat's spleen and found it to be 68 ±

5.43 gm, 9.2 ± 0.77 cm, 5.825 ± 0.73 cm and 1.5 ± 0.18 cm, respectively. These findings by various workers were comparable to the present study.

The correlations between different anatomical parameters of spleen of sheep and goat are presented in Table 1 and Table 2. In sheep, the data reflected that all the correlation values were positive and moderate to high.

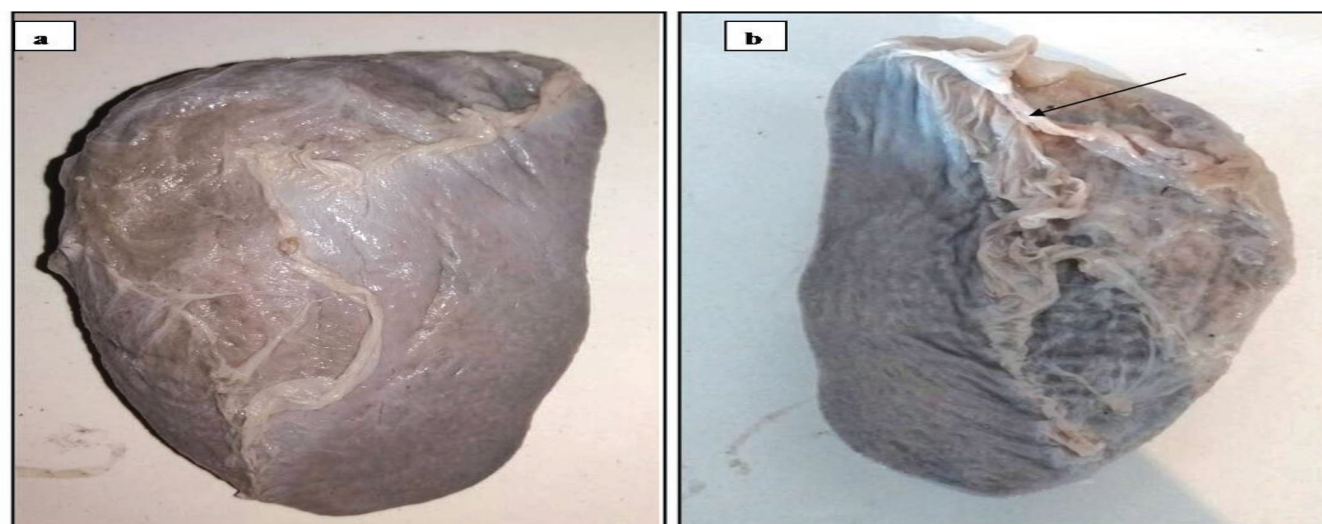


Fig. 1 Photograph of spleen of sheep showing parietal surface (a) and visceral surface (b) with hilus (arrow)

Table 3. Histomorphometrical parameters of the spleen of the sheep and goat.

| Parameters | Sheep | Goat | p value |
|--|--------------------|--------------------|---------|
| Thickness of capsule (μ) | 150.13 \pm 8.14 | 282.27 \pm 14.88 | < 0.001 |
| Thickness of trabeculae (μ) | 104.35 \pm 8.92 | 224.67 \pm 20.19 | < 0.001 |
| Average diameter of white pulp (μ) | 478.20 \pm 26.88 | 412.22 \pm 47.85 | 0.206 |
| Number of white pulp per field at 10X | 1.30 \pm 0.21 | 1.60 \pm 0.23 | 0.352 |
| Number of white pulp per mm ² | 1.32 \pm 0.22 | 1.62 \pm 0.23 | 0.352 |

The significant correlations were obtained between length and weight ($p < 0.01$) and thickness and weight ($p < 0.05$). In case of goat, correlation values were also positive and high. Although the correlations obtained between weight and length ($p < 0.05$) and width and thickness ($p < 0.005$) were significant.

Histomorphometry

The histological study revealed that spleen of both sheep and goat were similar in architecture and consisted of red and white pulps enclosed by capsule and subdivided by trabeculae. Spleen had a thick fibro-muscular capsule (Fig. 3). The thickness of capsule varied among sheep and goat. The thickness of capsule was significantly higher in goat (282.27 \pm 14.88 μ) as compared to sheep (150.13 \pm 8.14 μ) (Table 3). Our findings were in close corroboration with the findings of Khalel (2010) in Awasi sheep (140.5 \pm 13.712 μ) and Alim *et al.* (2012) in goat (251.44 \pm 12.56 μ).

From the innermost zone of capsule, connective tissue trabeculae extended into the splenic parenchyma in form of bands (Fig. 3). These trabeculae were composed of

predominantly smooth muscles that serve as a rigid framework of the pulp (Usende *et al.* 2014). Sub-capsular and peri-trabecular sinus were also observed (Fig. 3) as earlier reported by Zidan *et al.* (2000) in camel. Sub-capsular and peri-trabecular sinuses were more distinct in sheep as compared to goat. The thickness of trabeculae in goat was 224.67 \pm 67 μ , that was significantly higher than in sheep (104.35 \pm 8.92 μ) (Table 3). Khalel (2010) measured trabecular thickness in spleen of Awasi sheep and found it to be 82.75 \pm 9.7 μ , whereas Usende *et al.* (2014) recorded trabecular thickness in spleen of goat as 52.17 \pm 3.07 μ . The lower values in regard to trabecular thickness in similar species might be due to breed variation.

The white pulp of spleen was composed of mainly two components namely splenic nodule or lymphatic nodule and peri-arterial lymphatic sheath (PALS) (Fig. 4) as also reported by Devi *et al.* (2016) in Marwari goat. Eccentrically situated central artery was seen in the nodule (Fig. 4). There was clear demarcation between white and red pulp. The demarcation was more distinct in goat as compared to sheep. White pulp showed

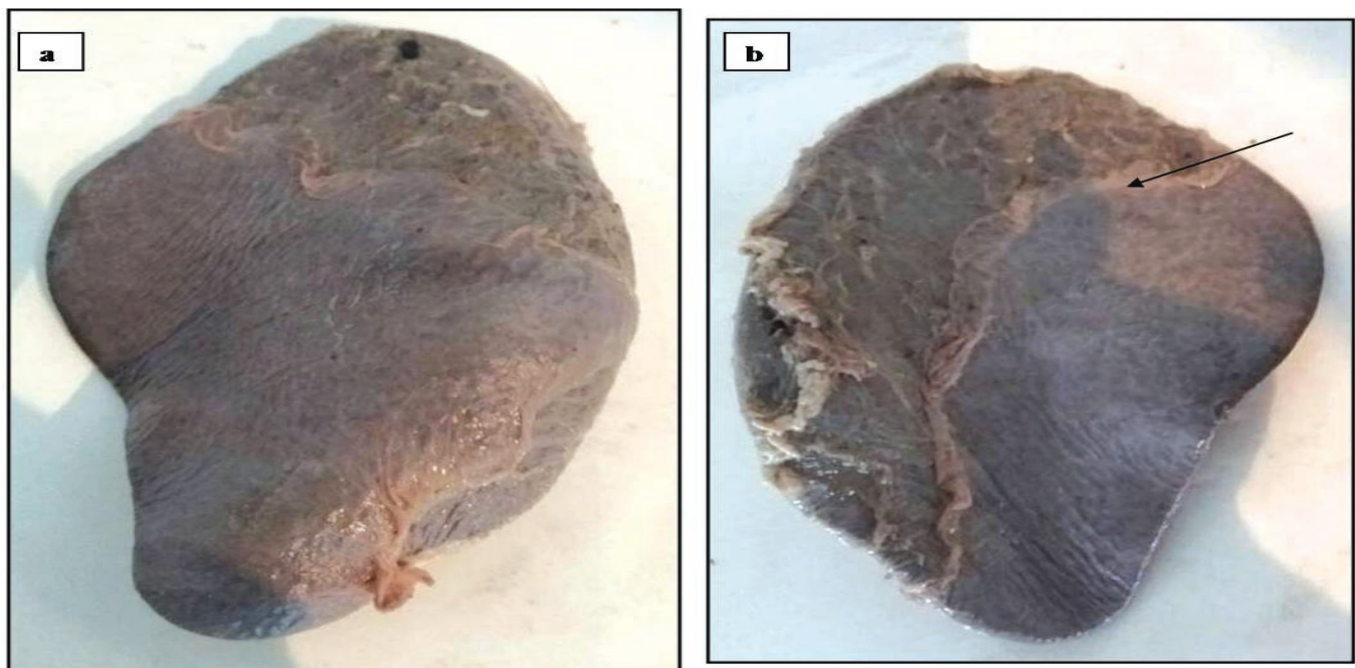


Fig. 2 Photograph of spleen of goat showing parietal surface (a) and visceral surface (b) with hilus (arrow)

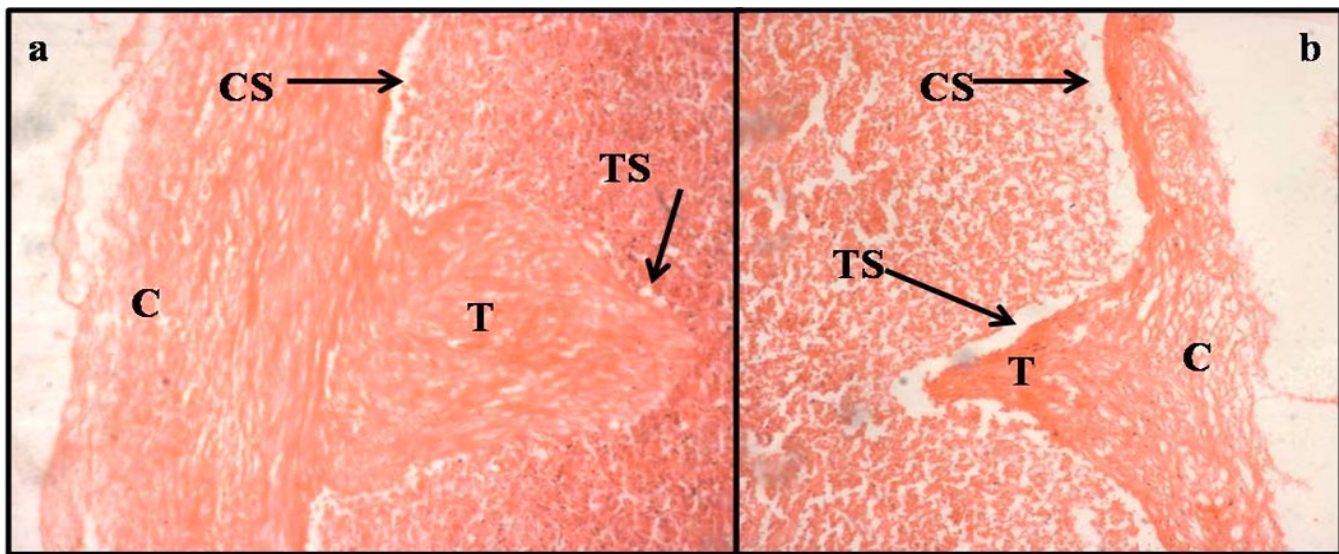


Fig. 3 Photomicrograph of spleen of goat (a) and sheep (b) showing capsule (C), trabeculae (T), sub-capsular sinus (CS) and peri-trabecular sinus (TS). H&E stain, 100X

presence of two important zones *i.e.* mantle zone (corona) and marginal zone as described by Banks (1993).

The average diameter of white pulp was measured in both sheep and goat and the result showed no significant difference. Average diameter of white pulp was $478.20 \pm 26.88 \mu$ in sheep and $412.22 \pm 47.85 \mu$ in goat (Table 3). Khalel (2010) measured average diameter of white pulp in spleen of Awasi sheep as $505 \pm 34.245 \mu$. Alim *et al.* (2012) measured average diameter of white pulp in spleen of goat as 0.35 ± 0.03 mm and 0.35 ± 0.05 mm in cow. Number of white pulp per field at 100 X magnification and number of white pulp per mm^2 were also measured. These values also showed no significant difference

between the spleen of sheep and goat. Number of white pulps per field at 100 X magnification was 1.30 ± 0.21 in sheep and 1.60 ± 0.23 in goat. Similarly, number of white pulps per mm^2 was 1.32 ± 0.22 in sheep and 1.62 ± 0.23 in goat (Table 3). Alim *et al.* (2014) also observed the number of white pulp per mm^2 in both goat and cow and it was recorded as 1.98 ± 0.69 in both the species.

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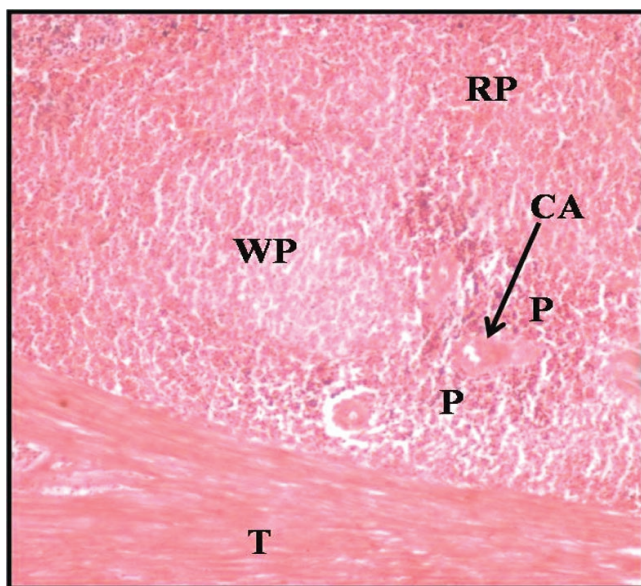


Fig. 4 Photomicrograph of spleen of goat showing trabeculae (T), white pulp (WP), red pulp (RP), PALS (P), central artery (CA) H&E stain, 100X

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