

Article

## Comparative Histomorphological Study of Spleen in Goat, Sheep, Cow and Buffalo

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**Abstract:** Immunity in some animals, such as goats, stands for unique properties by which they withstand unpleasant environments. Spleen influences animals' immunity through its hematopoietic and immunological roles. Because of that, we emphasized the average morphological and histological properties of the Goat, Sheep, Cow and Buffalo spleen. We randomly collected three spleens for every species from healthy slaughtered Goats, Sheep, Cows and Buffalo. All the animals were adult and weighed about 71, 80, 400 and 500 grams, respectively. Histological cutting was followed according to the paraffin method; then, the samples were ready for microscopic exam. The structure results revealed that the spleen of animals is supported externally by a thick fibromuscular connective tissue capsule, which vascularizes by subcapsular sinus. Stromal trabeculae emerge from the capsule, entering the splenic parenchyma. The parenchyma of animals' spleen differentiates into white pulp, which organizes into the periarterial lymphatic sheath along with lymph nodules, red pulp ropes in splenic sinuses among splenic cords, and marginal zone in which macrophage occupies excellent importance. This study concluded that the amount of smooth muscle in the spleen septa in goats was more than in the rest of the experimental animals.

**Keywords:** Histomorphology; Spleen; Goat; Sheep; Cow; Buffalo.

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### Introduction

The spleen is the largest of all lymphoid organs for immunological defense<sup>1</sup>. The organ was of central interest to many scientists in different mammals to understand its immunological role<sup>2,4</sup>. The spleen is classified into defensive type, storage type and intermediate type. The defensive type occurs in men, rabbits and mares. Storage type occurs in horses, dogs and cats. The intermediate type occurs in ruminants and swine<sup>3</sup>. The organ is demanding constant attention from anatomical, immunological and clinical points of view. The spleen is an essential site for hemopoiesis in early life. Medical teaching in the majority of the colleges is based on animal tissues. Comparative histology not only gives an insight into understanding an organ's functions but also explains human features in detail even if tissues from lower mammals are available<sup>5</sup>. The spleen stands for the primary secondary lymphatic organ.

Normal spleens comprise white pulp, marginal zone and red pulp; the lymphoid tissue of white pulp is composed of 2 parts: the thin periarteriolar lymphoid sheath, which is rich in T lymphocytes, contrary to lymphoid follicles that are composed mainly of B lymphocytes. On the other hand, the marginal zone includes the area that separates white pulp from the red one. Meanwhile, the red

pulp is represented by splenic cords and sinuses, as reported in cattle <sup>6</sup>, humans <sup>7</sup> and yak <sup>8</sup>. Structurally, the spleen specializes in immunological defense, as it filters, retains, and deals with the Blood-borne pathogens in white pulp <sup>9</sup>. Besides, it acts as a pool of red blood cells and platelets during periods of unusual demand in the red pulp <sup>10</sup> in camel.

Meanwhile, in the marginal zone of the spleen, the bloodstream throws across an accessible system of reticular cells and fibers in which a variety of myeloid and lymphoid cells are sited. They feature perfectly positioned macrophages to identify pathogens besides their ability to sieve the blood through distinctive mixtures of pattern recognition receptors. Other immune cells, like natural killer cells, are similarly testified to perform a starring role in protective immunity via secreting the inflammatory cytokines <sup>11</sup>. The pattern by which cells organize is a key issue in our guard against blood-borne hazards as humans <sup>6</sup>. The clinical and managing immunotoxicity signals may be linked with apparent splenic morphological alterations. Society of Toxicological Pathology issued a guideline for best practices to evaluate the lymphoid organ separately using descriptive rather than interpretive terms to diagnose changes within these parts, aiming to improve the sensitivity and specificity of lymphoid organ-related changes. That is why the spleen assessed the potential target for treatment in toxicology and carcinogenicity studies <sup>12</sup>.

This current work aimed to accurately and practically assess the immunological activity of animals' experimental spleen and the general anatomical and histological examination, which are essential to interpreting any specific splenic disorder. Moreover, it would help other investigators categorize disease, treatment, and vaccination strategies.

## **Material and Methods**

The local slaughterhouses in and around Basrah City provided the spleen samples used in this investigation. 12 spleens in total, 3 from experimental animals, from reportedly healthy creatures that had been killed at random regardless of sex and promptly brought to the laboratory for histological research and physical examination. The weight of the spleen (in grams) was recorded.

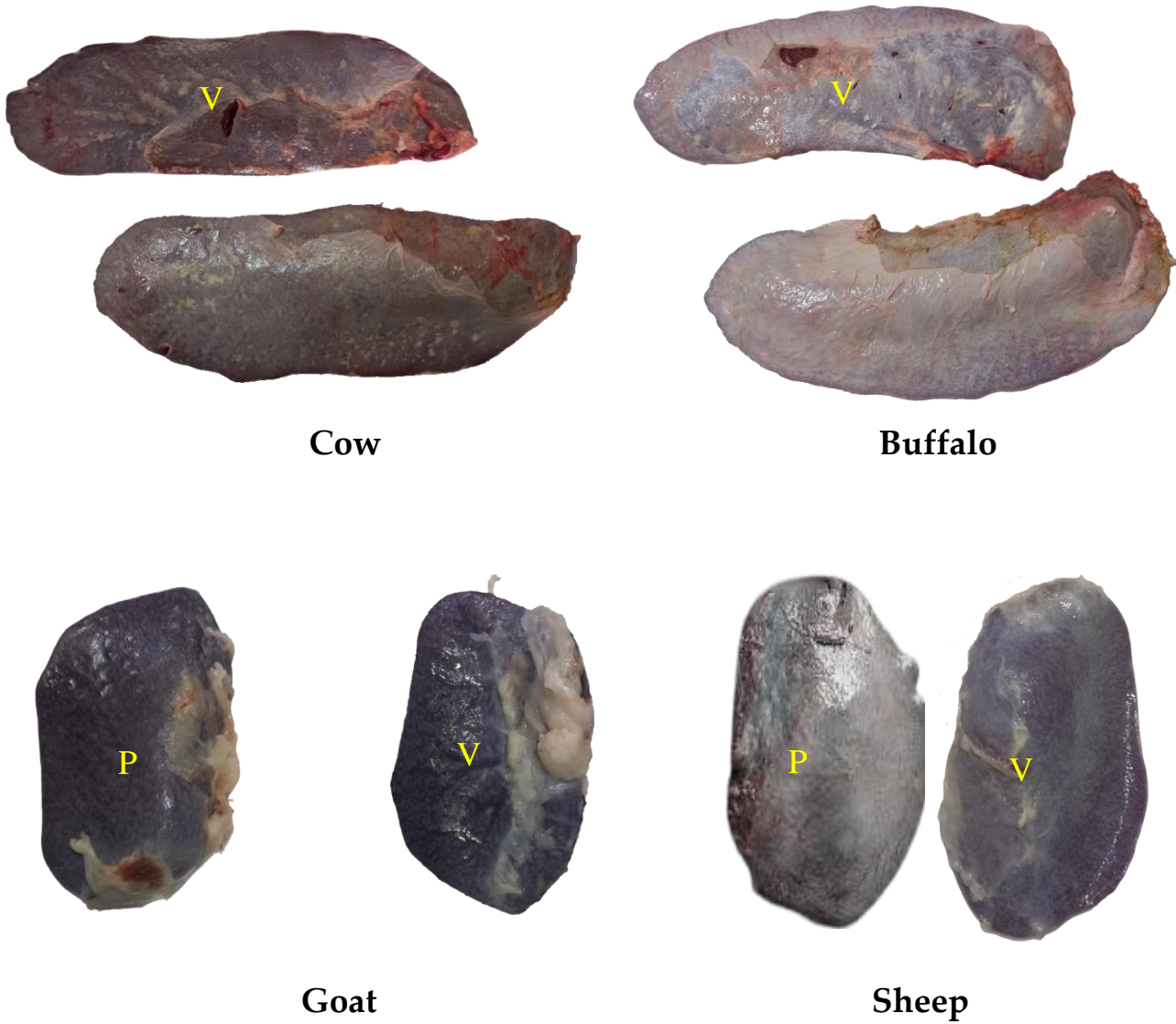
Microscopic analysis of cells and tissues requires the preparation of fragile, high-quality sections (slices) mounted on glass slides and appropriately stained to demonstrate normal and abnormal structures.

Most fresh tissue is very delicate and easily distorted and damaged. It is thus impossible to prepare thin sections from it unless it is chemically preserved or "fixed" and supported in some way while it is being cut. Broadly, there is a strategy that can be employed to provide this support via the paraffin method and staining by routine stain

## **Results**

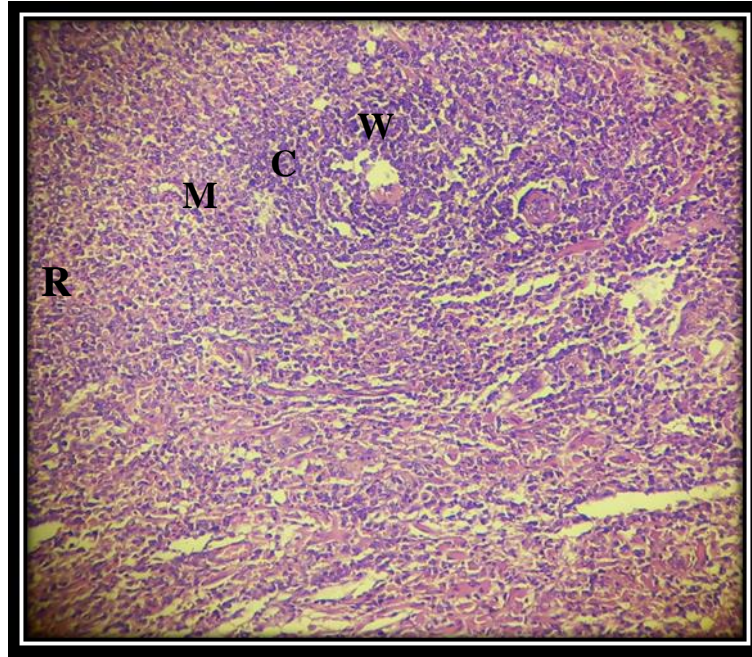
Dark brown, the experimental animal spleen had an elliptical form, was extended cranially, and was narrow and rounded caudally (Fig. 2,3,4 and 5). It is located on the left side of the rumen, with the parietal or diaphragmatic surface facing the musculature of the diaphragm and the visceral or gastric surface of the spleen facing the upper left quadrant of the abdominal cavity. Goat, Sheep, Cow and Buffalo all the animals were adult age and weighed about 71, 80, 400 and 500 grams, respectively. The results of histological cutting and staining were obtained according to the required specifications to show the histological structures of the spleen organ clearly, and the following is a review of those results, illustrated by the microscope according to high power, which is X40. White pulp lymphoid

tissue is divided into two parts: the thin periarteriolar lymphoid sheath, which is rich in T lymphocytes, and lymphoid follicles, which are primarily constituted of B lymphocytes. The marginal zone, on the other hand, encompasses the space between white and red pulp. Splenic cords and sinuses, as seen in experimental animals, depict the red pulp that is shown in Figures 2,3,4 and 5.

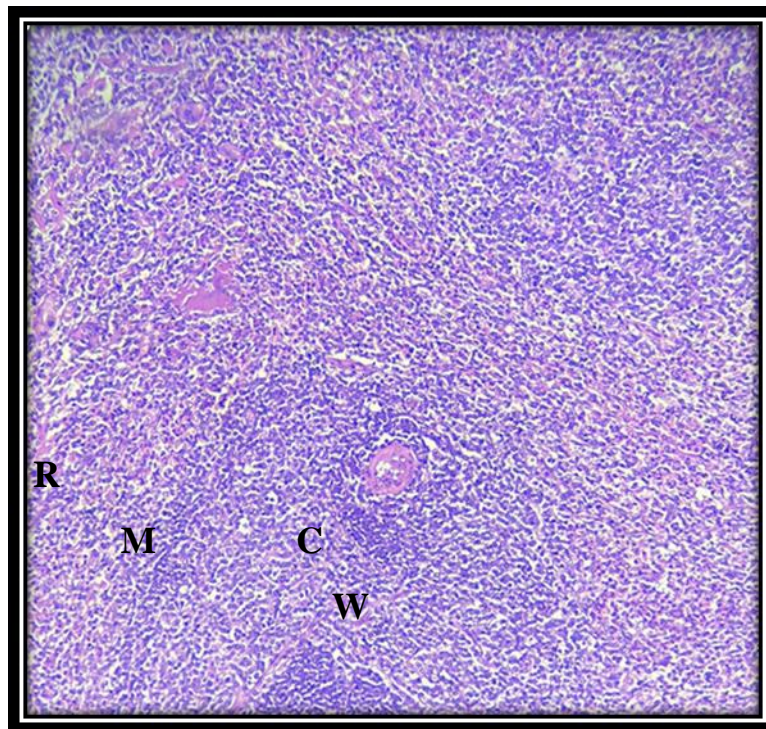


**Figure 1. Gross anatomical photographs of experimental animals' spleen showing the (P) parietal and (V) visceral surface.**



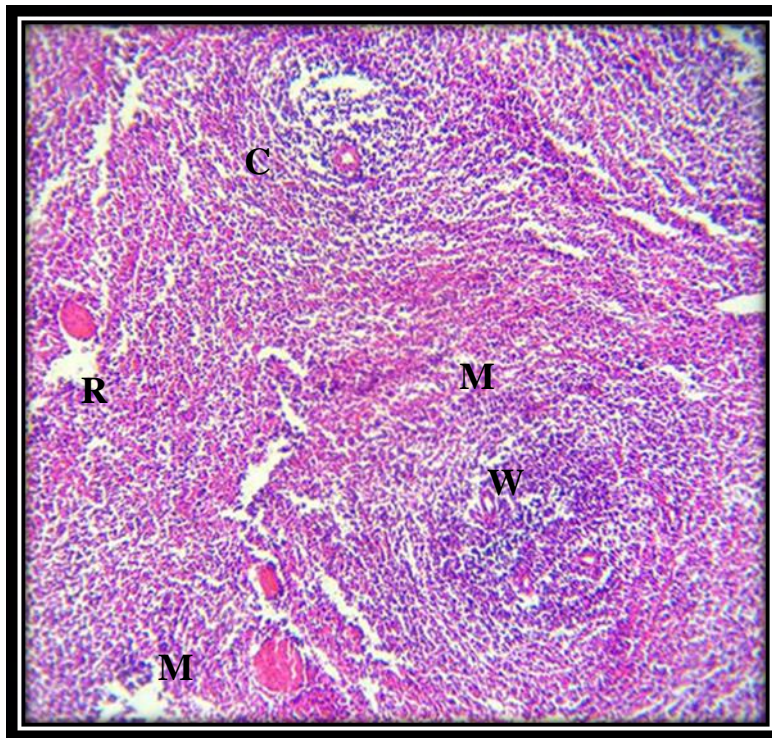


**Figure 2.** Photomicrograph clarified the stromal elements of cow spleen: (W) white pulp, (M) marginal zone, (R) red pulp and (C) central artery H&E (X400).

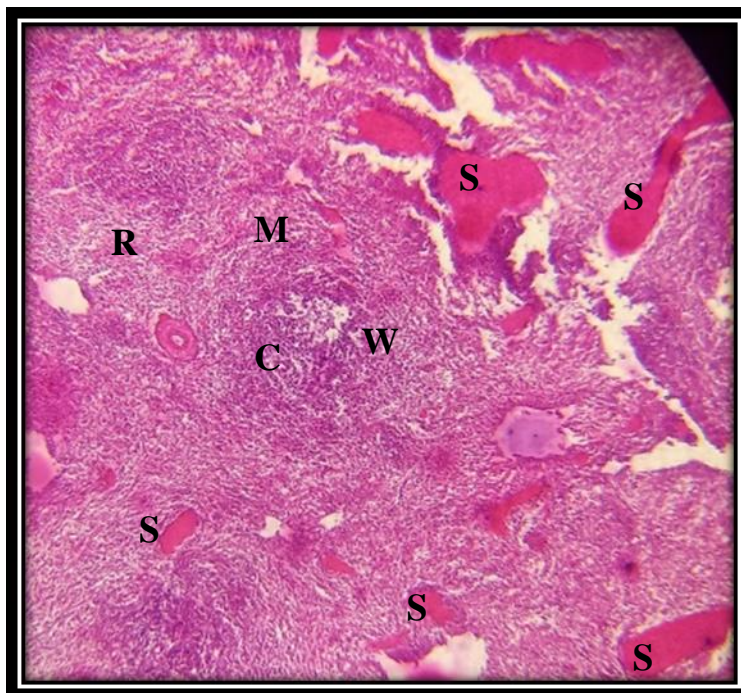


**Figure 3.** Photomicrograph clarified buffalo spleen: (W) white pulp, (M) marginal zone, (R) red pulp and (C) central artery H&E (X400).





**Figure 4. Photomicrograph clarified sheep spleen: (W)white pulp (M) marginal zone (R) red pulp (C) central artery and (S) smooth muscle H&E (X400.)**



**Figure 5. Photomicrograph clarified goat spleen:(W) white pulp, marginal zone (M), (R) red pulp, (C) central artery and (S) smooth muscle H&E (X400).**

### **Discussion**

In the current investigation, the Figure 1 spleen in experimental animals has two surfaces: parietal and visceral. The parietal surface was convex, while the visceral surface was concave, with a hilus at the dorsal end of the cranial boundary, agreed with as reported by <sup>14</sup>. In sheep, it was triangular, whereas it was roughly quadrangular in outline with blunt edges like goats. A similar

finding was observed by <sup>15</sup>. Histological investigation revealed that the quantity of smooth muscle in the goat spleen stroma was higher than in the other experimental animals. We could not find any researchers who noted this distinction in Figure 5. This difference in the histological structure of the spleen of goats may be due to the excessive activity of the goats, which is more than the rest of the experimental animals. In experimental animals, the parenchyma was covered by a thick capsule composed of fibro-elastic and muscular capsules, as reported by <sup>16</sup>. Histoarchitecture of the parenchyma in both sheep and goats was found to be similar Figures in 4 and 5. It was composed of white pulp and red pulp, and the proportion of these was almost equal, which indicated that the spleen of cow, buffalo, sheep and goat belongs to the intermediate type, in contrast to storage and defensive type in other domestic animals as reported by <sup>17</sup> figure 2,3,4 and 5. The white pulp of the spleen was composed of splenic nodules and peri-arterial lymphatic sheath distributed among the red pulp. The splenic lymphatic nodules were almost circular in outline, composed of a germinal center at the center, and were surrounded by a marginal zone, as reported by <sup>18</sup>. Periarterial lymphatic sheaths were observed as a diffuse lymphatic sheath adjacent to the central artery. It comprised closely packed small lymphocytes and several medium to large-sized lymphocytes and reticular cells. The Trabecula of the spleen was found to be thickest in buffalo and thinnest in cows Figures 2 and 3.

### Conclusion

This study found that the amount of smooth muscle present in the septa and within the stroma was much more than that of the rest of the experimental animals.

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