



## Histomorphological descriptive study of the Iraqi wild rabbit spleen

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### ABSTRACT

This study aimed to describe the anatomical and histological parameters in the spleen of the wild rabbits. Ten healthy adult wild rabbits were included. The spleen was collected and prepared for histological and morphological studies. The spleen of wild rabbit is dark red color and locate in abdominal cavity beneath the diaphragm. The histological study showed that the wild rabbit spleen has thick capsule, covered the white and red pulps.

### 1. Introduction

Leporidae is the family contain more than 60 surviving mammals species in addition to hare and rabbit. Those latin expressions leporidae implies "those that look like lepus" (hare). Together with those pikas, those leporidae family constitute those mammalian request lagomorpha. *Leporidae* vary starting with pikas in that they bring short, fuzzy tails Also lengthened ears What's more rear legs. The "rabbit" name

is typically applies to all members in the family except *Lepus*, while members of *Lepus* usually are called hares (Hoffman and Smith ,2005).

The spleen is consider a secondary lymphoid organ. It's the most embryonic type present in cyclostomes, the tissue of spleen represents part of the digestive tract wall. In higher mammals, the parenchyma of spleen is divided into : the

white and red pulps which could be recognized eventually by the color in new spleen areas during faint amplification (Aughey and Frye, 2001). The Spleen is located in the abdominal cavity, beneath the diaphragm, connected to the stomach, the spleen acts as a big filter for blood in the body, in fact, the spleen will be well-arranged similarly as a 'tree' about ramified blood vessel vessels, in which the minimal arterioles terminus in a venous sinusoidal system. Spleen surrounded entirely by fibrous capsule of connective tissue, it has many trabeculae which are extending to support the major vasculature (Steiniger and Barth, 2000). It is dark red to dark blue color elongated triangular shape and located near the proximity of greater curvature of stomach. It has variable size due to the age status and pressure of surrounding organs (Barone, 1997, gesta, 2006).

The length of spleen in rabbit varied from 32.7 mm to 33.3 mm. The dorsal end of the spleen showed the greatest width, varied from 12.7 mm to 13.3 mm. The middle part of the spleen is narrow, the shape of the organ was oval to triangular (Dimitrov, 2012). Little elongated, slim, tongue like spleen, red in color. The mean length of

spleen in New Zealand rabbit was  $(3.3 \pm 0.16)$  cm and mean width is  $(0.5 \pm 0.04)$  cm, mean thickness was  $(0.12 \pm 0.07)$  cm, mean size is  $(0.4 \pm 0.03)$  mm<sup>3</sup>, mean body weight is  $(0.6 \pm 0.001988)$ . (Hiba *et al*, 2015). The morphology and size of the spleen are variable, depending on the species and the degree of expansion; nonetheless, spleen weights can be important in its evaluation. The percentage of splenic weight to body weight remains constant regardless of age and, in rats, is typically around 0.2% (Losco, 1992). The spleen is enclosed by fibrous connective tissue capsule sent trabecula and extending to support the major vasculature. The splenic red pulp is composed of a three dimensional meshwork of venous sinuses as well as splenic cords. The splenic cords are composed of reticular fibers, reticular cells, and associated macrophages (Saito *et al*, 1988). The nature of reticular cells in splenic cords are myofibroblasts may play a role in splenic contraction. The white pulp is partitioned into the periarterial lymphatic sheaths (PALS), the follicles, and the marginal zone. It is a collection of lymphocytes, macrophages, dendritic cells, plasma cells, arterioles, and capillaries in a reticular framework similar to that established in the red pulp (Saito *et al*, 1988).

## 2. Materials and methods

Ten healthy adult wild rabbits were used. The rabbits were euthanized by administration of over dose of sedatives (Xylazine 5mg per kg B.w) and Ketamine 15 mg per kg B.w). The rabbits were weighted then the spleen were taken, after the

rabbits were lying on their back and abdomen was opened. Spleen was quickly removed and weighted after that washed with water and cut into small pieces and fixed in Neutral buffer formalin for 24 hrs. Then Paraffin-embedded. They were sectioned at 6-7  $\mu$ m for histology. The paraffin sections were stained with

Haematoxylin and Eosin for routine examinations( Bancroft, 1984).

The thickness of capsule, diameter of white and red pulp and diameter of sinusoids as

well as the diameter of lymphocytes were measured manually by using ocular micrometer and digitally by using image J software.

### 3. Results

#### 3.1 Morphological and morphometric observations

The spleen in wild rabbit was elongated and tongue like shape with dark red color . It was located in the left abdominal sub region on the left side of dorsal or parietal surface of stomach. The spleen is composed of body and two poles(dorsal and ventral), two surfaces( visceral and parietal). The visceral surface of spleen characterized by a shallow depression extend along the surface that was a hillus which divided the spleen into 2 unequal parts and connected it to the stomach by gastro- splenic ligament (Fig1) The mean weight is  $0.7 \pm 2.2$ . g . while the mean length and width are ( $1.6 \pm 2.2$  ,  $0.3 \pm 2.3$ ) respectively. The relative weight of spleen in wild and domesticated rabbit are 0.02 % (Tab.1).

#### 3.2 Histological and histometric observations

Typical spleen is surrounded by thin capsule consists of fibrous connective tissue with bundles of collagen fibers and fibrocytes. Thin trabeculae originated from splenic capsule pass through parenchyma. There are subcapsular sinuses containing erythrocytes (Fig.2). The thickness of wild rabbit spleen capsule is  $78.8 \pm 5.2$   $\mu\text{m}$  . The parenchyma of the spleen is composed of white pulp (lymphocytes) and red pulp

(sinusoids and blood vessels and erythrocytes). White pulp appear as network of lymphocytes and reticular fibers. B and T cells were distributed in the white pulp as lymphatic nodules or scattered around the central arteries (Fig.3).

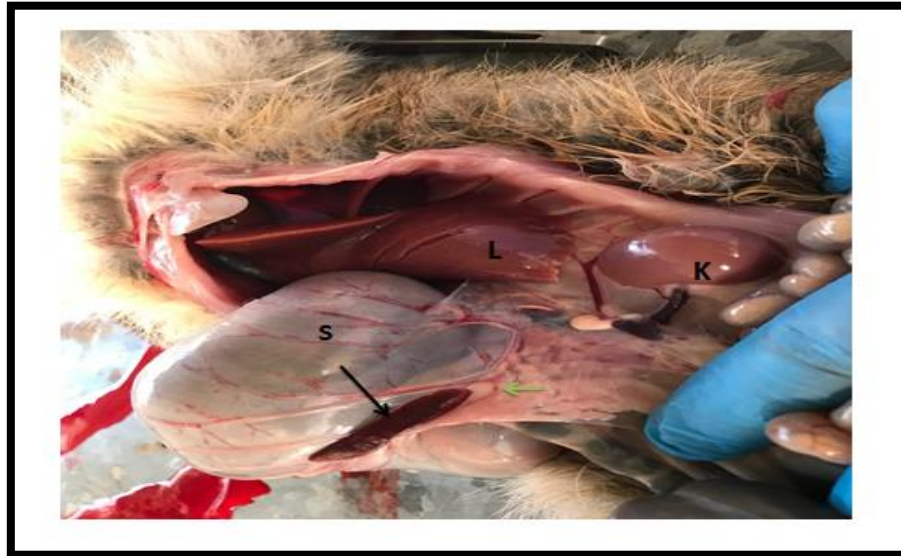
The thickness of white pulp in wild rabbit spleen is  $135.9 \pm 2$   $\mu\text{m}$  Red pulp was composed of erythrocytes in blood sinusoids, many macrophages, reticular cells and blood cells were arranged as cords. The rest of the red pulp was occupied by many venous sinuses. The red pulp intermingles with white pulp, There were many central arteries(pencillus arteries) surrounded by cuboidal cells (Fig.3). The thickness of red pulp in the spleen of wild rabbit is  $164.3 \pm 5.6$   $\mu\text{m}$ (Tab. 2) . The white pulp contained many types of diffused lymphatic tissue contain lymphocytes and lymphatic nodules. Peri arterial lymphatic sheath(PALS) is surrounded the central arterioles(Fig.3). The lymphoid nodules measurements in wild rabbit spleen is  $157.2 \pm 3.9$   $\mu\text{m}$  . The lymphocytes measurements in wild rabbit spleen is  $55.4 \pm 4.1$   $\mu\text{m}$ (Tab.2) . The lymphocytes represent the main constituent of the white pulp of the spleen and it is either large or small lymphocytes and showed variable degrees of mitotic activity(fig.4). The sinusoids measurements in wild rabbit spleen is  $13 \pm 4.7$   $\mu\text{m}$  (Tab.2 ) .

Table.1 show the anatomical parameters of the spleen in wild rabbits.

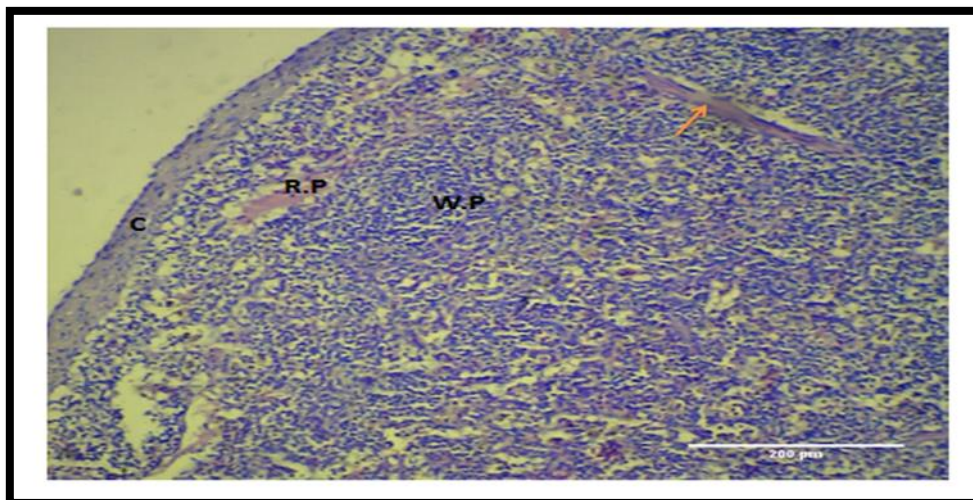
| parameters                | Wild rabbit(um) |
|---------------------------|-----------------|
| Mean weight of spleen     | 0.7 ± 2.2       |
| Mean width of spleen      | 0.3 ± 2.3       |
| Mean length of spleen     | 1.6 ± 2.2       |
| Relative weight of spleen | 0.02%           |

Table .2 show the histological parameters of the spleen in wild rabbits.

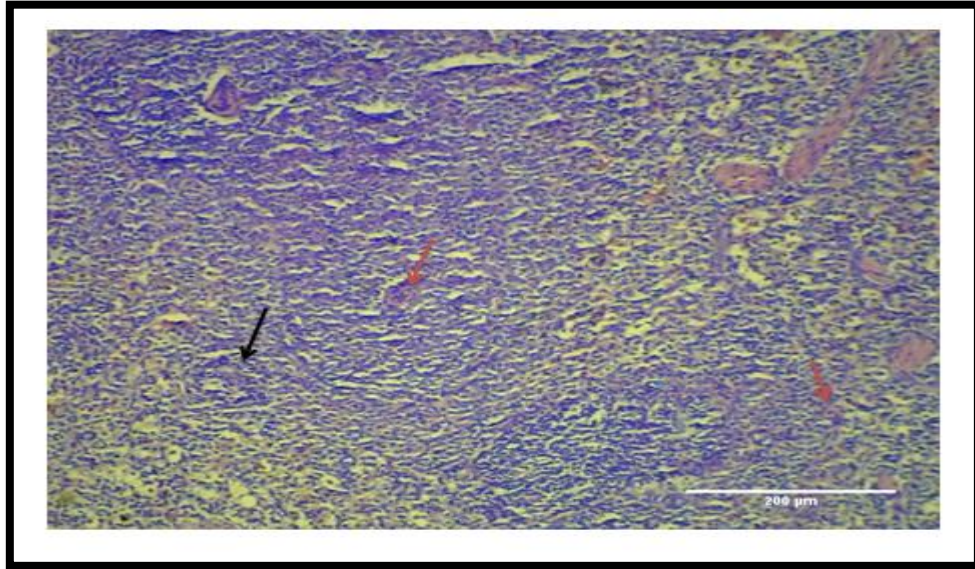
| parameters                    | Wild rabbit |
|-------------------------------|-------------|
| Capsule thickness             | 78.8±5.2    |
| White pulp thickness          | 135.9±2     |
| Red pulp thickness            | 164.3±5.6   |
| Sinusoid measurement          | 13±4.7      |
| Lymphocytes measurements      | 55.4±4.1    |
| Lymphoid nodules measurements | 157.2±3.9   |



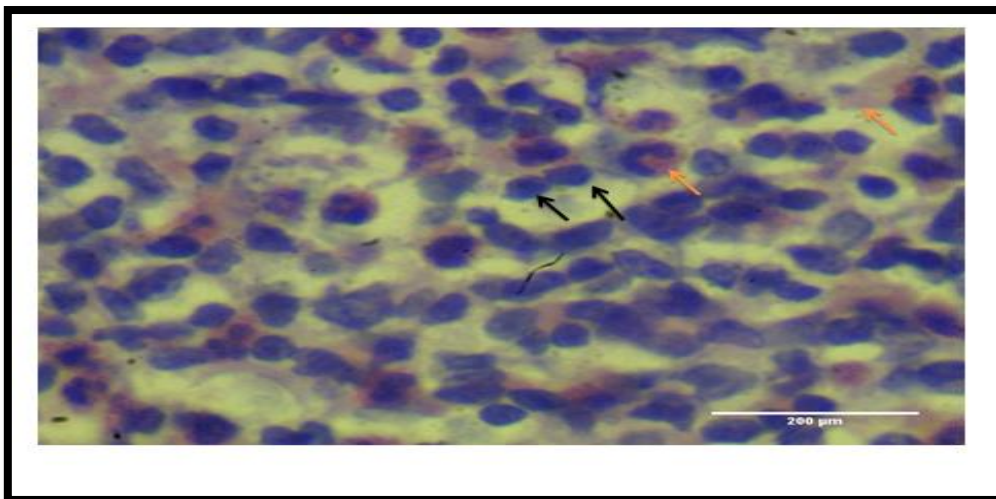
**Figure 1. the spleen of wild rabbit(black arrow),splenic artery(green arrow),stomach(s),liver(L) and kidney(k).**



**Figure 2. The parenchyma of spleen in wild rabbit shows capsule(C), red pulp(R.P)and white pulp(W.P),trabecula(arrow)(H&E stain40x).**



**Figure 3. The parenchyma of spleen in wild rabbit shows lymphatic nodules (arrow). (H&E stain 40x).**



**Figure 4. lymphocytes of wild rabbit spleen (black arrows), erythrocytes (brown arrows) (H&E stain 100x).**

### **3. Discussion**

The wild rabbit in the present investigation has elongated and shape with dark red color spleen. It is composed of body and two poles, With two surfaces and connected with stomach by gastro-splenic ligament this result agreement with (Steiniger and Barth, 2000). The mean weight of wild rabbit spleen is ( $0.7 \pm 2.2$ ) . The mean length and width of spleen in wild rabbit are ( $1.66 \pm 2.2$  and  $0.3 \pm 2.3$ ) respectively.. This result was accepted by( Hiba et al., 2015). The relative weight of spleen in wild rabbit is 0.02 %.. this result is differ from the result

that found by (Losco, 1992) in rat. Typical spleen was surrounded by thin capsule consisted of fibrous connective tissue with bundles of collagen fibers and fibrocytes. This result also found by( Steiniger, and Barth, 2000). Our study found the spleen composed of two compartments red and white pulp. (Saito et al., 1988) also refers to the same result in rat.

White pulp appear as network of lymphatic cells and reticular fibers. B and T cells were distributed in the white pulp as lymphatic nodules this result was accepted with (Saito et al., 1988) in rat.

## دراسة وصفية نسيجية لطحال الأرنب البري العراقي

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### الملخص

هدفت هذه الدراسة الى وصف المؤشرات التشريحية والنسجية في طحال الارنب البري. اشتملت الدراسة على عشرة ارناب برية بصحة جيدة تم جمعها وتحضيرها للدراسة التشريحية والنسجية. كان لون طحال الارنب البري احمر قاتم ويقع ضمن التجويف البطني فيما بعد الحجاب الحاجز. الدراسة النسيجية بينت ان الطحال يمتلك محفظة تغطي مكونات اللب الابيض واللح احمر

الكلمات المفتاحية: أرنب بري ، لب أحمر ، كبسولة ، الحجاب حاجز

## References

1. Hoffman, R.S.; Smith, A.T. (2005). "[Order Lagomorpha](#)". In [Wilson, D.E.](#); Reeder, D.M (eds.). [Mammal Species of the World: A Taxonomic and Geographic Reference](#) (3rd ed.). Johns Hopkins University Press. pp. 194–211.
2. Aughey, E. and FRYE, E. , ( 2001) Comparative Veterinary Histology with Clinical Correlation. Iowa State University Press, AMIS. p. 247.
3. Steiniger, B. and Barth, P. (2000) Microanatomy and function of the spleen. Advances in Anatomy, Embryology and Cell Biology 151: 1–101.
4. Barone R (1997). Chapitre VII-Pancréas, Splanchnologie I, 560-575 p. In: Anatomie comparée des mammifères domestiques. Tome troisième, Troisième édition, Ed Vigot, Paris.
5. Bancroft, J. D., & Cook, H. C. (1984). *Manual of histological techniques* (pp. vii+-274pp).
6. Cesta M (2006). Normal structure, function, and histology of the spleen. Toxic Pathol 34(5):455-465.
7. Dimitrov,R.S(2012). Comparative Ultrasonographic, Anatomotopographic and Macromorphometric Study of the Spleen and Pancreas in Rabbit (*Oryctolagus cuniculus*) , Not Sci Biol, 4(3):14-20.
8. Hiba H. Qasem Farhan O. Rabee Ahmed S. Al-A'araji(2015). A Comparative Anatomical and Morphological Study of Spleen in Rabbit (*OryctologusCuniculus*) and Guinea pig (*Caviaporcellus*). Journal of Kerbala University , Vol. 13 No.4 Scientific .
9. Merchant, H. A.; mcconnel, E.L.; LIU, F.; ramaswamy, C.; kulkarni, r. p.; basit, a. w. and murdan, s. ( 2011) .Assessment of gastrointestinal pH, fluid and lymphoid tissue in the guinea pig, rabbit and pig, and implications for their use in drug development. European Journal of

- Pharmaceutical Science, Amsterdam, v. 42, n. 1-2, p. 3-10.
10. Steiniger, B. and Barth, P. (2000) Microanatomy and function of the spleen. *Advances in Anatomy, Embryology and Cell Biology* 151: 1–101.
11. ØSTA. M. (2006). Normal Structure, Function, and Histology of the Spleen. *Toxicologic Pathology*, 34:455–465.
12. Losco, P. (1992). Normal Development, Growth, and Aging of the Spleen. In: *Pathobiology of the Aging Rat* (U. Mohr, D. L. Dungworth and C. C. Capen, eds.), Vol. 1, pp. 75–94. ILSI Press, Washington, D.C.
13. Saito, H., Yokoi, Y., Watanabe, S., Tajima, J., Kuroda, H., and Namihisa, T. (1988). Reticular meshwork of the spleen in rats studied by electron microscopy. *Am J Anat* 181, 235–52.
14. Van Rees, E. P., Sminia, T., and Dijkstra, C. D. (1996). Structure and Development of the Lymphoid Organs. In: *Pathobiology of the Aging Mouse* (U. Mohr, D. L. Dungworth, C. C. Capen, W. W. Carlton, J. P. Sundberg and J. M. Ward, eds.), Vol. 1, pp. 173–187. ILSI Press, Washington, D.C.