



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP1: 994-996

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Histological studies on the kidney of *Marwari* Sheep (*Ovis aries*)

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Abstract

The microscopic studies of kidneys of 6 *Marwari* sheep showed that the thick fibrous capsule consisted of two layers. The outer layer of dense collagenous fibres with a few elastic fibres. Fibroblast and some smooth muscle cell were also present in outer layer. The inner layer consisted predominantly of reticular fibres with collagenous fibres and had a distinct thick smooth muscle layer. Interstitial tissue contained network reticular fibres which extended from the capsule to the apex of papilla. The juxtglomerular structure and basement membranes were P.A.S. positive. The papillary duct lined with simple columnar epithelium which become transitional before opening into the papilla.

Keywords: *Marwari* sheep, Kidney, Histology, Capsule, Epithelium

Introduction

Marwari sheep constitutes a major portion of the sheep population in western part of Rajasthan which has 14.31 million sheep (about 40%) and plays an important role in the economy of arid and semi-arid tract. The present investigation has been planned to study the histological structure of the kidney to justify its importance and essentiality in the body. In mammals the kidneys are the chief excretory organs of the body. They have a major role in the maintenance of fluid and electrolyte balance and in control of the blood pressure.

Materials and Methods

For the histological examination the small pieces of tissues (2 mm size) were collected from 12 kidneys (6 right and 6 left). From each kidney, the tissues were collected from six fixed anatomical regions to explore regional differences if any. The tissues were preserved in 10% formal saline for 48 hrs, Bouin's fluid for 12 hrs, and Zenker's fluid for 18 hrs. Fixed tissue was latter washed in running tap water for 6-10 hours followed by dehydration in ascending grade of alcohol, clearing, embedding in paraffin wax of melting point of 58-60°C, preparation of blocks, section cutting (5-6 µm thick), and mounting of section on albuminized slides, drying of sections and finally stained with the H. & E. and special staining methods to demonstrate different components of kidney.

Results and discussion**The capsule and connective tissue stroma**

The kidneys were invested by a thick fibrous capsule which consisted of two layers Fig. (1). which simulate to the reports by Wille (1968)^[14] in bovine, Dellmann (1993)^[1] in ruminants and Halder *et al* (2002b)^[4] in spotted deer. Trautmann and Fiebiger (1957)^[13] and Yadva and Calhoun (1958)^[15] found that the kidney capsule was composed of two distinct layers in horse, ox, Sheep and Goat. In the present study the outer layer was heavily laden with collagen fibres and fibroblasts were also seen between the collagen fibres. There oval nuclei were surrounded by a small amount of lightly acidophilic cytoplasm and cells had few short processes. Elastic fibres were very few between the collagenous fibres.

The inner thin layer consisted predominantly of reticular fibres with collagenous fibres. The reticular fibres were arranged parallel to the collagenous fibres and transversely dipped into the cortex of kidney. The inner layer had a distinct thick smooth muscle layer. Numerous smooth muscle cells were entangled between the loose collagenous and reticular fibres. Similar findings were reported by Gupta and Sharma (1991)^[3] in yak and Zade *et al* (2007)^[16] in panther. Whereas Malik *et al* (2001)^[7] reported that thin renal capsule was composed of loose superficial and compact deep layers with inconspicuous smooth muscle fibres in Asian elephant.

The interstitial space contained reticular fibres, which extended from the capsule to the apex of papilla. Its branching fibres formed a network in narrow spaces between the tubules of the kidney. The collagenous fibres surrounded the large blood vessels and a few fine collagenous fibres invested the tubules and Bowman's capsule. Similar findings have been reported by Yadva and Calhoun (1958) [15] for domestic animals, Omer and Mariappa (1970) [9] for Indian buffalo.

The uriniferous Tubules

The nephron and collecting tubules were entirely enveloped by basement membrane which was thickest in the parietal layer of Bowman's capsule and in the thin limb of loop of Henle in the present study. Similar observations were recorded by Dellmann (1993) [1] in domestic animals.

The Renal Corpuscles

The Renal Corpuscles of *Marwari* sheep were spheroidal bodies. The juxtamedullary renal corpuscles were larger than the cortical corpuscles. This was in agreement with the findings of Yadava and Calhoun (1958) [15] in horse, pig, dog and cat and Sarmad-Rehan and Qureshi (2006) [10] in one-humped camel. Whereas Yadva and Calhoun (1958) [15], Ommer and Mariappa (1970) [9] and Tiwari and Swarup (1977) [12] found that cortical corpuscles were larger than the juxtamedullary renal corpuscles in buffalo.

Both the parietal and visceral layers of the Bowman's capsule had a flattened squamous epithelium enclosing considerable capsular space, which is in consonance with the findings of Langham *et al* (1942) [5] in bovine, Omar and Mariappa (1970) [9] in Indian buffalo, Trautmann and Fiebiger (1957) [13], Yadva and Calhoun (1958) [15] and Dellmann (1993) [1] in domestic animals, while Malik *et al* (2001) [7] reported that capsular space was narrow in the Asian elephant.

The Proximal Convoluted Tubule

The proximal convoluted tubule was lined by simple truncated pyramidal cells with brush border, which was similar to the finding of Dellmann (1993) [1] in domestic animals, Shang-Jian Ke *et al* (2008) [11] in *Panther*.

The Thin Segment of Henle's Loop

The thin segment of Henle's loop was lined by flattened epithelial cells, which was similar to the finding of Dellmann (1993) [1] in domestic animals.

The Thick Segment of Henle's Loop

In present investigation the thick Segment of Henle's Loop was lined by cuboidal epithelium which was similar to the finding of Dellmann (1993) [1] in domestic animals.

The Distal Convoluted Tubule

The distal convoluted tubule was lined by cuboidal epithelium and had visible clear lumen which was similar to the finding of Dellmann (1993) [1] in domestic animals, Shang-Jian Ke *et al* (2008) [11] in *Panther*.

The arched collecting Tubule

The lumen of arched collecting tubules was more regular and

wider than that of the distal tubule. It was lined by a simple cuboidal epithelium. It was in agreement with the findings of Dellmann (1993) [1] and Yadava and Calhoun (1958) [15] in domestic animals.

The Straight collecting Tubule

The straight collecting tubule was lined by simple cuboidal epithelium which became wider and taller towards the papillary duct.

The papillary duct

The papillary duct was lined by simple columnar epithelium. Transitional epithelium present at the opening of the ducts. Similar observation was made by Langham *et al* (1942) [5] in the bovine kidney. While Gupta and Sharma (1991) [3] brought forward the opinion that in the kidney of yak, the papillary ducts were lined with stratified cuboidal epithelium. The 2-3 cell layered transitional epithelium occurred at the papillae only.

The Papilla

The renal papilla was lined by transitional epithelium which was also observed by Langham *et al* (1942) [5] in the bovine kidney and Yadava and Calhoun (1958) [15] in domestic animals. On the angle of reflection low transitional epithelium lined the side of papilla as observed in the present investigation.

The juxtaglomerular Apparatus

1. The juxtaglomerular cells

The nuclei of the juxtaglomerular cells, were spherical and stained deeply with hematoxylin, Fig (2). The cytoplasm of these myoepithelial cells contains few P.A.S. positive granules. This was similar to the findings of Ommer and Mariappa (1970) [9] in Indian buffalo. Dellmann (1993) [1] stated that at the point where the afferent arteriole entered the renal corpuscle, the muscle cells in the tunica media were modified in domestic animals. The nuclei were spherical and the cytoplasm contained many secretory granules and few myofilaments. These modified smooth muscle cells were the juxtaglomerular cells. These observations have already been made by Mussa (1982) [8] in goat and Gupta and Sharma (1991) [3] in yak. Tiwari and Swarup (1977) [12] In Indian buffalo stated that the juxtaglomerular cells were present with in the tunica media of the preglomerular portion of afferent and efferent arteriole which was similar to the present study.

2. The Macula Densa

Dellmann (1993) [1] mentioned in domestic animals, that at the point where the wall of distal tubule was in close contact with the wall of the afferent arteriole the tubular epithelium was taller, consequently the nuclei are closer together and the epithelium appeared denser forming the macula densa, Fig (2). Tiwari and Swarup (1977) [12] In Indian buffalo found that the cells forming macula densa were stratified with occasional single layer. While in present study the cells forming the macula densa were single layered having faintly stained cytoplasm.

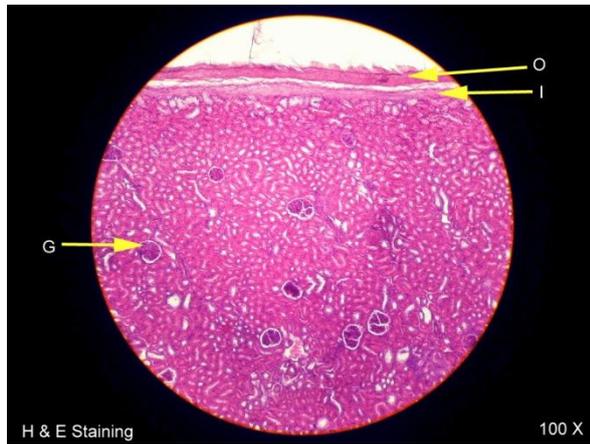


Fig 1: Section of the kidney through cortex showing (G) Glomeruli, (C) Convoluted tubules, (O) outer and (I) inner layer of capsule.

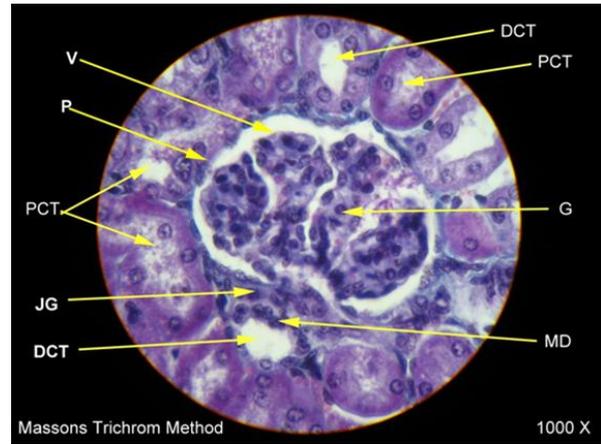


Fig 2: Section of kidney showing (a) Parietal and (V) visceral layers of Bowman's capsule, (MD) Macula densa, (JG) Juxtaglomerular cells, PCT and DCT

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