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# Comparative histological studies on the renal cortex in broiler chicken and broiler duck

**Deepa KP, Sreeranjini AR and Soumya CB**

**Abstract**
The present study was conducted on the kidneys of six each of adult broiler chicken and broiler ducks. Histologically, the kidneys of all studied birds consisted of two zones, the cortex and medulla. In both species, the cortex made up majority of the area of the kidney. Three types of nephrons were noticed in the cortex of chicken *viz.* small reptilian type nephrons towards the surface of cortex, large mammalian type nephrons near the medulla and intermediate type nephrons in the deeper parts of cortex while in duck the first two types only were seen. Proximal and distal convoluted tubules were present within the cortex. In the case of duck, cortex presented numerous small cortical nephrons and only a few large mammalian type nephrons. These results revealed that histologically the renal cortex in broiler chicken and broiler duck showed difference in the pattern of arrangement and in the size of various components.

**Keywords:** Kidney, cortex, broiler chicken, broiler duck, histology

## 1. Introduction
In birds the homeostasis of fluid and ions needs the proper functioning of several organ systems and is a more complex phenomenon than in other vertebrates. Kidneys in birds are very important organs that help to maintain water and electrolyte balance. Histologically, each kidney is composed of cortex and medulla. Kidneys are comprised of structural and functional units called nephrons. Nephrons filter the blood plasma to eliminate waste products and at the same time conserve materials like glucose and water. The cortex presents renal corpuscles of nephrons, proximal and distal convoluted tubules, loops of Henle of intermediate nephrons, cortical collecting ducts, ureteral branches and blood vessels. Literatures pertaining to the comparative anatomy of renal cortex in broiler chicken and broiler duck are meagre. Hence, the present study was undertaken to investigate the comparative histology of renal cortex in broiler chicken and broiler duck in detail.

## 2. Materials and Methods
The present programme of study was conducted on the kidneys of six each of adult broiler chicken and broiler ducks, slaughtered at the Meat Technology Unit, Mannuthy of Kerala Veterinary and Animal Sciences University. After opening the abdomen of cadavers, kidneys of broiler chicken and broiler duck were carefully dissected out of the renal fossa. Renal tissue samples were fixed in 10% neutral buffered formalin, processed for paraffin embedding and sectioned using rotary microtome. The sections with 5µm thickness were stained with haematoxylin and eosin (H&E) technique (Luna, 1968) [6]. The histological features of kidney in broiler chicken and broiler duck were studied in detail and digital images were stored in Leica DM 2000 LED microscope.

## 3. Results and Discussion
Kidneys of all birds in the present study comprised two zones *viz.* the cortex and medulla. The cortex made up majority of the area of the kidney with medulla occupying only a small portion. Similarly, Michalek *et al*. (2016) [7] noticed that in the kidneys of emu *(Dromaius novaehollandiae)* the cortex constituted the majority of the kidney, while the medulla formed only a small portion of the organ.

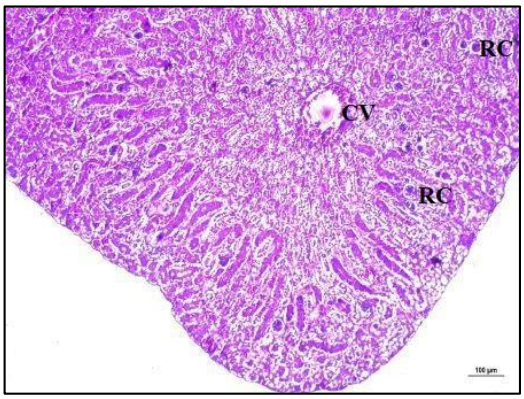


**Fig 1:** Section of kidney, Duck.CV- Central vein, RC- Renal corpuscle H&E. x 100

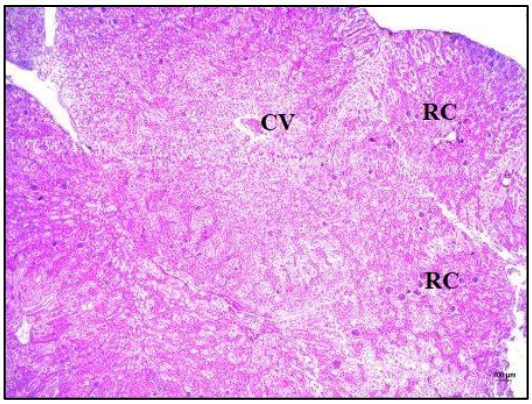


**Fig 2:** Section of kidney, Chicken. CV- Central vein, RC- Renal corpuscle H&E. x 40

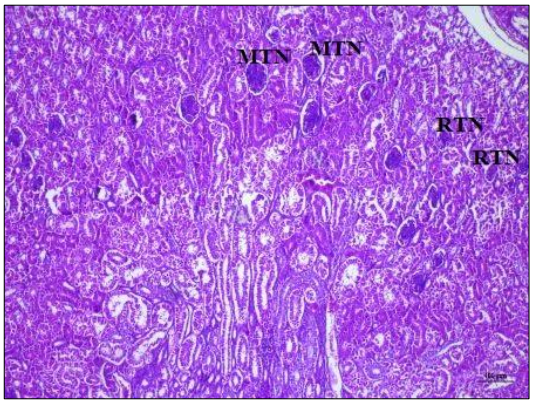


**Fig 3:** Section of kidney, Chicken. RTN- Reptilian type nephron, MTN- Mammalian type nephron H&E. x 100

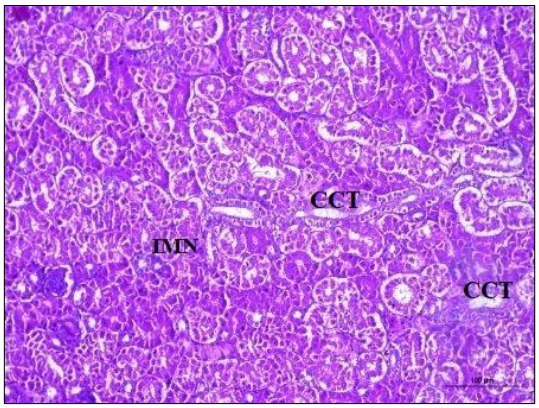


**Fig 4:** Section of kidney, Chicken. IMN- Intermediate nephron, CCT- cortical collecting tubules H&E. x 200

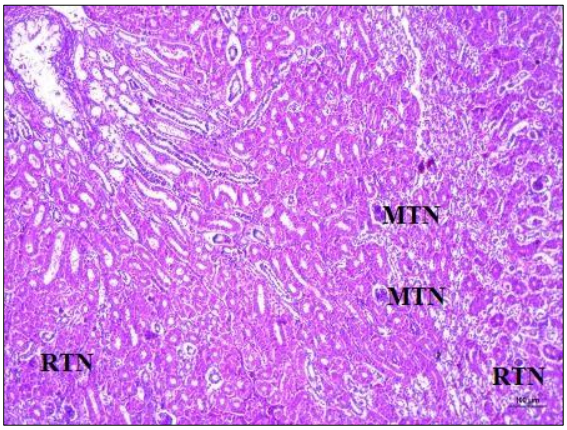


**Fig 5:** Section of kidney, Duck. RTN- Reptilian type nephron, MTN- Mammalian type nephron H&E. x 100

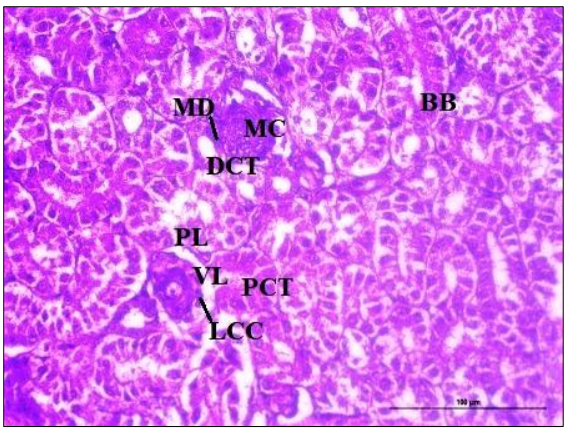


**Fig 6:** Section of kidney, Chicken. PL- Parietal layer, VL- Visceral layer, LCC- Large cuboidal cells, PCT-Proximal convoluted tubule, DCT- Distal convoluted tubule, MD- Macula densa, MC- Mesangial cells , BB- Brush border H&E. x 400

### 3.1 Cortex

The renal cortex in both the broiler chicken and duck were composed of several cortical lobules. The centre of each cortical lobule showed a central vein. In the broiler duck, renal corpuscles were almost circularly arranged around the central vein and were seen more towards the periphery of cortical lobules (Fig. 1) while in chicken they were randomly distributed in the cortical lobules (Fig. 2). Periphery of cortical lobules showed interlobular veins. In both chicken and duck, the renal cortex presented renal corpuscles of nephrons, proximal and distal convoluted tubules, loops of Henle of intermediate nephrons, cortical collecting ducts, ureteral branches and blood vessels.

#### 3.1.1 Nephrons

In the case of chicken, three types of nephrons were noticed in cortical lobules *viz.* small reptilian type (RT) nephrons towards the surface of cortex, large mammalian type (MT) nephrons near the medulla (Fig. 3) and intermediate type (IT) nephrons in the deeper parts of cortex (Fig. 4). In addition to the two types of nephrons, an intermediate type without true loop of Henle, but part of which entered medulla were described by King (1975) [4], Nicholson (1982) [8] and Abood *et al.* (2014) [1] in the kidney of fowl. In the case of duck, cortex presented numerous small cortical nephrons and only a few large MT nephrons (Fig. 5). In both species, the nephrons were composed of Bowman's capsule that enclosed endothelium-lined capillary loops called glomerulus.

Bowman's capsule had a parietal layer of simple squamous epithelium and a visceral layer composed of large cuboidal cells (Fig. 6) which was similar to the findings of Sreeranjini *et al.* (2008) [10] in the kidney of Japanese quail. These two layers enclosed the urinary space (capsular space). Glomerulus enclosed groups of cells called mesangial cells (Fig. 6). A few extra glomerular mesangial cells were also noticed outside the mesangium. Blood entered the renal corpuscles through afferent arteriole and left from the former through efferent arteriole.

### 3.1.2 Proximal Convoluted Tubules (PCT)

In both broiler chicken and duck, PCT originated from the urinary pole of Bowman's capsule and occupied major part of the cortical region (Fig. 6). In chicken they were having an average diameter of 46.489µm and while in duck it had 52.525µm diameter. They were lined by simple pyramidal cells with eosinophilic cytoplasm and basally located spherical nucleus having well-developed nucleoli. The luminal surface of the lining cells of PCT in chicken and duck furnished brush border (Fig. 6) similar to the observations made by Warui and King (1985) [11] and Reshag *et al.* (2017) [2] in avian kidney and Sreeranjini *et al.* (2000) [9] in the kidney of Japanese quail.

### 3.1.3 Distal Convoluted Tubules (DCT)

DCT were lined by simple cuboidal epithelial cells with centrally placed spherical nucleus and well-developed nucleolus. It lacked brush border in the luminal surface which was similar to the findings of Warui and King (1985) [11] in fowl kidney. In chicken it had an average diameter of 34.647µm while in duck it measured 39.155µm. The portion of distal convoluted tubule adjacent to the vascular pole of Bowman's capsule presented the macula densa (Fig. 6). Compared to proximal convoluted tubules, the area occupied by distal convoluted tubules in the cortex was less in both species.

### 3.1.4 Macula Densa and Juxtaglomerular Apparatus

In both broiler chicken and duck distinct macula densa was present in the wall of distal convoluted tubules (Fig. 6) near glomerulus similar to the finding of Batah (2012) [3] in the coot kidney. Cells of macula densa region were crowded together and were shorter with less amount of cytoplasm compared to other cells of DCT. This finding was similar to that of Kon *et al.* (1984) [5] in avian kidney who noticed that the macula densa cells were with their nuclei closer to each other than elsewhere in the distal tubule. Juxtaglomerular cells and peripolar cells contributing to distinct juxtaglomerular apparatus were noticed adjacent to the macula densa. At the periphery of cortical lobules, cortical collecting tubules (Fig. 4) composed of simple columnar epithelial cells were noticed.

## 4. Conclusion

In the present study, the renal cortex in both broiler chicken and duck made up majority of the area of the kidney with medulla occupying only a small portion. In the broiler duck, renal corpuscles were almost circularly arranged around the central vein and more towards the periphery of cortical lobules while in chicken they were randomly distributed in the cortical lobules. In the case of chicken, three types of nephrons were noticed *viz.* small RT nephrons towards the surface of cortex, large MT nephrons near the medulla and IT nephrons in the deeper parts of cortex. In the case of duck, cortex presented numerous small cortical nephrons and only a few large mammalian type nephrons. So, it was concluded that the renal cortex in broiler chicken and broiler duck showed difference in the pattern of arrangement and in the size of various components. Less mammalian type nephrons in ducks might be due to its aquatic habitat which does not need much reabsorption of water.

## 5. References


1. Abood DA, Reshag AF, Azhar SK, Ahmed MA. Comparative anatomical and histological features of the kidney in Harrier *(Circus aueroginosus)*, Chicken *(Gallus domesticus)* and Mallard duck *(Anas platyrhynchos).* Iraqi Journal of Veterinary Medicine. 2014; 38:107-113.
2. Reshag AF, Abood DA, Ektiffa SK Histological and histochemical characteristics of the kidneys in different avian species. Australian Journal of Basic and Applied Science. 2017; 11(16):36-44.
3. Batah AL. Morphological and histological study for the kidneys of coot bird *(Fulica atra).* Basrah Journal of Veterinary Research 2012; 11:128-136
4. King AS. Aves urogenital system. In: Getty, R. (ed.) Sisson and Grossman's the Anatomy of Domestic Animals. (5th Ed.). Saunders, Philadelphia, London 1975, 1919-1926.
5. Kon Y, Hashimoto Y, Kitagawa H, Kudo N. Morphology and quantification of juxtaglomerular cells of the chicken kidney. Japanese Journal of Veterinary Science 1984; 46:189-196.
6. Luna LG. Manual of histological staining methods of armed force Institute of pathology.3rd edition. New York USA. 1968, 39-110.
7. Michalek K, Szczerbińska D, Grabowska M, Majewska D, Laszczyńska M. Anatomical and morphological study of the kidneys of the breeding Emu (Dromaius Novaehollandiae). Turkish Journal of Zoology. 2016; 40(1):314-319.
8. Nicholson JK. The micrometry of the distal tubules, collecting tubules and collecting ducts in starling kidney. Journal of Anatomy 1982; 134:11-23.
9. Sreeranjini AR, Iyyangar MP, Gopinath S. Histological and histochemical studies in kidney of Japanese quail *(Coturnix coturnix japonica).* Indian journal of veterinary anatomy 2000; 12:169-173.
10. Sreeranjini AR, Iyyangar MP, Pramodkumar D. Histological study of renal corpuscles and juxta glomerular apparatus in Japanese quail *(Coturnix coturnix japonica).* Indian Journal of Animal Sciences 2008; 78:1365-1367.
11. Warui CN, King AS. Stereological observation on the kidney of the domestic fowl. Journal of anatomy. 1985; 142:129-139.