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

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### Abstract

Kidneys of six each of adult broiler chicken and broiler ducks were used in the present study. In the histological studies, the kidneys of all studied birds showed two zones, the cortex and medulla. The medulla occupied only a small portion of the kidney. In chicken a greater number of distinct cone-shaped medullary lobules were seen among cortical lobules while in duck they were lesser in number, more rounded in outline and were not cone shaped as in chicken. In the case of chicken more than one cortical lobule drained into a medullary lobule. Mammalian type of nephrons that occupied the juxta medullary region presented loop of Henle that was located within the medullary cone. Collecting ducts from different medullary lobules united together to form several large collecting ducts within the medulla which in turn united to form ureteral branches.

**Keywords:** Broiler chicken, broiler duck, renal medulla, loop of henle, collecting ducts, histology

### 1. Introduction

Kidneys in birds are very important organs that help in water and electrolyte balance and consist of two zones in the histological studies; cortex and medulla. Nephrons are regarded as the structural and functional units of the kidneys. It helps to eliminate waste products and at the same time conserve materials like glucose and water. Broiler chicken and broiler duck inhabit a broad range of environments and ecological habitats. Hence their kidneys do not follow a similar pattern. Therefore, the present study was undertaken to investigate the comparative histology of the renal medulla in broiler chicken and broiler duck.

### 2. Materials and Methods

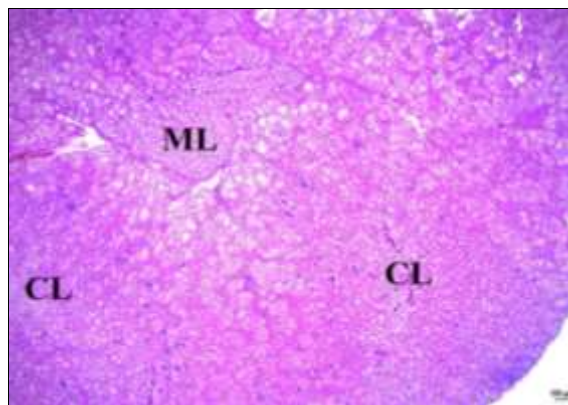
Kidneys of six each of adult broiler chicken and broiler ducks, slaughtered at the Meat Technology Unit, Mannuthy of Kerala Veterinary and Animal Sciences University were used to conduct the present study.

Kidneys of broiler chicken and broiler duck were carefully dissected out of the renal fossa and tissue samples were fixed at 10% neutral buffered formalin. Later they were processed for paraffin embedding and sectioned using rotary microtome. 5µm thick sections were stained with haematoxylin and eosin (H & E). The histological features of kidney in broiler chicken and broiler duck were studied in detail and were recorded. Digital images were stored in Leica DM 2000 LED microscope.

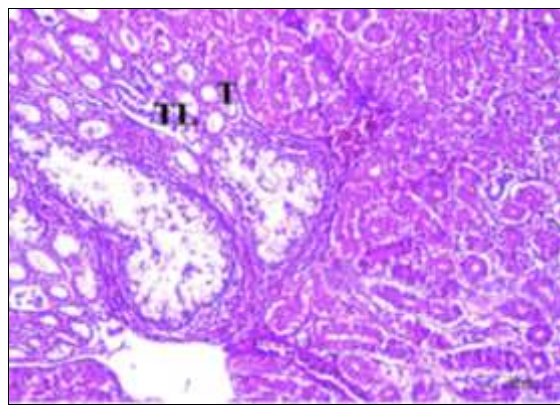
### 3. Results and discussion

In the present study, kidneys of all birds comprised two zones viz. the cortex and medulla. The medulla occupied only a small portion of the kidney. Similarly, Michalek *et al.* (2016) [8] noticed that the cortex constituted the majority, while the medulla formed only a small portion in the kidneys of emu (*Dromaius novaehollandiae*)

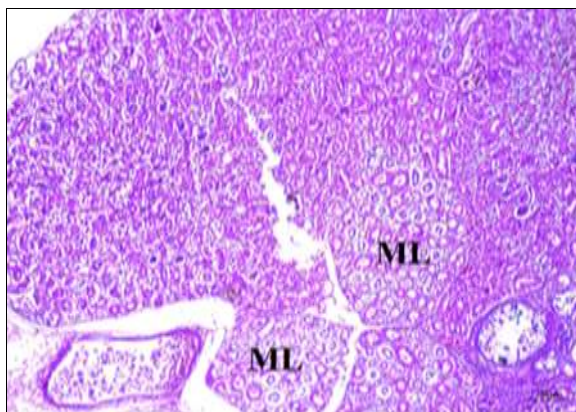




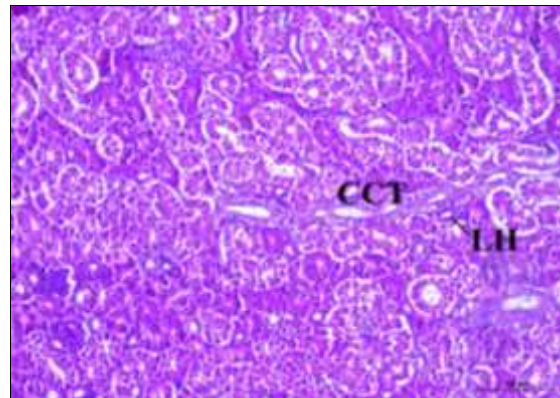
**Fig 1:** Section of kidney, Chicken. ML- Medullary lobule, CL- Cortical lobule. H&E. x 40



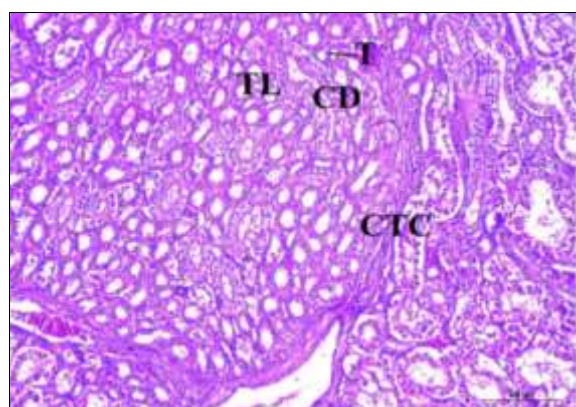
**Fig 5:** Section of kidney, Duck. T- Thin limb, TL- Thick limb. H&E. x 200



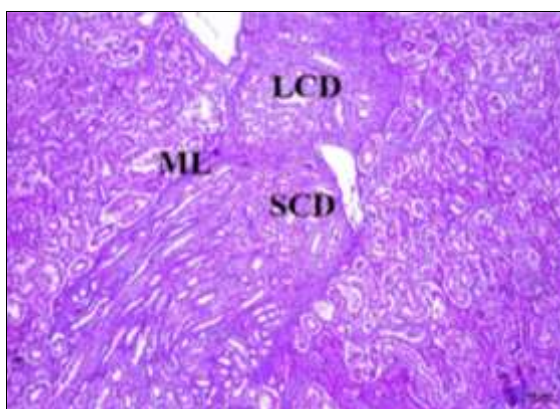
**Fig 2:** Section of kidney, Duck. ML- Medullary lobule. H&E. x 100



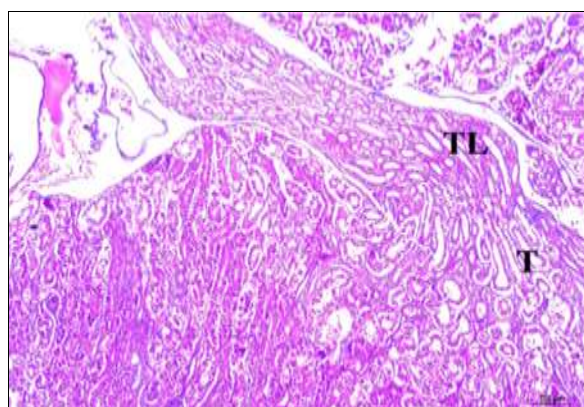
**Fig 6:** Section of kidney, Chicken. LH- Loop of Henle, CCT- Cortical collecting duct. H&E. x 200



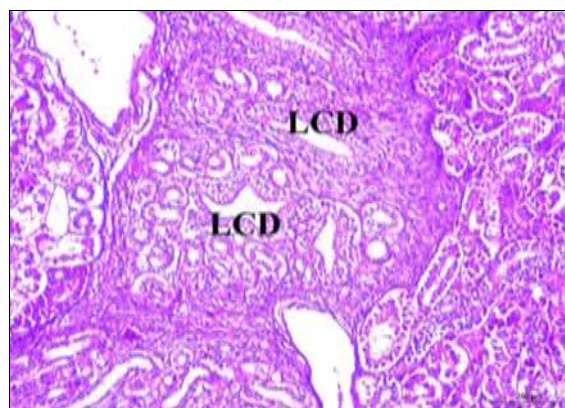
**Fig 3:** Section of kidney, Chicken. T- Thin limb, TL- Thick limb, CD- Collecting duct, CTC- Connective tissue covering of medullary lobule. H&E. x 200



**Fig 7:** Section of kidney, Chicken. ML- Medullary lobule, SCD- Small collecting duct, LCD- Large collecting duct. H&E. x 100

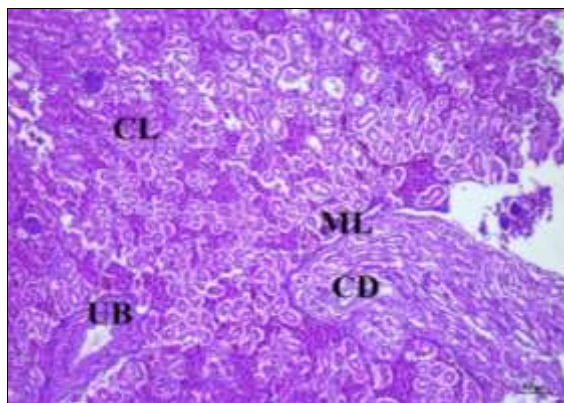


**Fig 4:** Section of kidney, Chicken. T- Thin limb, TL- Thick limb. H&E. x 100

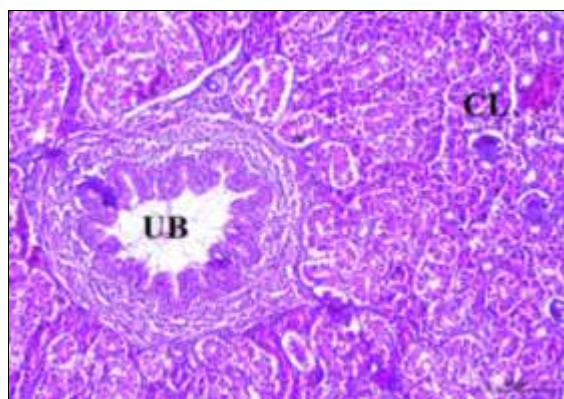


**Fig 8:** Section of kidney, Chicken. LCD- Large collecting duct. H&E. x 200





**Fig 9:** Section of kidney, Chicken. CL- Cortical lobule, ML- Medullary lobule, CD- Collecting duct, UB- Ureteric branch H&E. x 100



**Fig 10:** Section of kidney, Chicken. UB- Ureteric branch, CL- Cortical lobule. H&E. x 200

### 3.1 Medulla

In broiler chicken a greater number of distinct cone-shaped medullary lobules were seen among cortical lobules and more than one cortical lobule drained into single medullary lobule (Fig. 1). Similar observations were made by Sreeranjini (2000) <sup>[9]</sup> in the kidney of Japanese quail. In duck medullary lobules were lesser in number (Fig. 2), more rounded in outline and were not cone shaped as in chicken. Casotti *et al.* (2000) who reported that the avian medullary cones were structurally similar to the outer medulla of the mammalian kidney.

In the present study medullary lobules showed a distinct connective tissue covering and contained loops of Henle of juxtamedullary nephrons, vasa recta and collecting ducts of varying size (Fig. 3) identical to the findings of Sreeranjini *et al.* (2010) <sup>[10]</sup> who found that the renal medulla in Japanese quail was in the form of cone-shaped medullary lobules with the loop of Henle of juxtamedullary nephrons, collecting ducts and vasa recta.

### 3.2 Loop of Henle

Reptilian type of small nephrons in the cortical region was lacking in the loop of Henle while the mammalian type of nephrons that occupied the juxtamedullary region presented loop of Henle that was located within the medulla. Abood *et al.* (2014) <sup>[1]</sup> reported that, in mallard duck there were numerous both mammalian and reptilian types of nephrons.

Thick limb of loop of Henle was lined by cuboidal cells with spherical nucleus and distinct nucleolus but in thin limb, the epithelium was lined by flattened cells with elliptical nucleus (Fig. 3 & 4) which was similar to the findings of Batah (2012) <sup>[3]</sup> who noted that thick and thin segments of the loop of Henle

in the kidney of coot birds were lined by simple cuboidal epithelium. In duck, both thick and thin limbs of the loop of Henle were lined by simple cuboidal cells (Fig. 5).

### 3.3 Collecting tubules

In the present study the cortical collecting tubules that were mostly seen in the periphery of cortical lobules were lined by simple columnar epithelial cells (Fig. 6). Hodges (1974) <sup>[5]</sup> found that in the kidney of fowl, collecting tubules were lined by cuboidal or low columnar epithelium with large, round, vesicular, basal nuclei that contained one or two nucleoli.

Within medulla also the collecting ducts were lined by simple columnar epithelial cells (Fig. 3). They contained basal, spherical nuclei with distinct nucleolus and clear cytoplasm. Smaller collecting ducts united within the medullary cone to form larger collecting ducts (Figs. 7 and 8). Similar findings were made by Kurihara and Yasuda (1978) <sup>[6]</sup> in the kidney of fowl. They reported that cross section of medullary lobules showed clump or rosette like arrangement of medullary collecting ducts that was formed by the union of several perilobular or cortical collecting ducts. Several large collecting ducts within the medulla united together to form ureteral branches (Fig. 9). They were seen in cortical region also (Fig.10) which in turn joined and formed the ureter. Similarly, Akester (1983) <sup>[2]</sup> stated that in avian kidney cortical collecting ducts drained into peripheral collecting ducts which entered into the medulla and united to form a single large duct, the tertiary branch of the ureter.

### 4. Conclusion

In the present study, histological studies revealed that the renal medulla in both broiler chicken and duck occupied only a small portion. In chicken a greater number of distinct cones shaped medullary lobules were seen among cortical lobules while in the duck medullary lobules were lesser in number and more rounded in outline. The presence of a smaller number of mammalian type nephrons and medullary lobules in the kidney of broiler duck could be due to the aquatic habitat and feeding habit of the bird which enables it to consume more water through food. Due to higher access to water, these birds do not need to concentrate the urine as in the case of broiler chicken which are terrestrial birds. So, it was concluded that the renal medulla in broiler chicken and broiler duck showed differences in the pattern of arrangement of the various components.

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