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Anatomical and histological study of the kidneys in golden eagles, racing pigeon and common bulbul

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Abstract--The present study was carried on Thirty apparently healthy birds (ten Golden Eagles, ten Racing pigeon and ten Common Bulbul),a tool for determining the anatomy significant variations in the kidneys' histology Histological research (5-7) μ m. paraffin section stained with Hematoxylin and Eosin stain were prepared .In both birds, the kidneys were, dorso-ventrally flattened, extended from the caudal end of the lungs to the synsacrum bone's end, as well as the kidneys' dorsal half were sink deep in the synsacrum fosse and divided into three incomplete parts. In adult racing pigeon, the kidney was red to red brown in color flattened retroperitoneal fragile organs embedded in ventral surface of synsacrum bone. It has three lobes (cranial, middle and caudal), the caudal lobe was the largest and wider than the other two lobes. In golden eagles, had paired kidneys. Each kidney was flattened and extra-peritoneal organs. Also each kidney in Common Bulbul consists of three lobes were cranial, middle and caudal. The cranial lobe was longer and broader than the other two lobes, whereas the caudal lobe was similar in shape but smaller in size than the middle lobe. Histologically, in each species (Golden Eagles, Racing pigeon and Common Bulbul), Each kidney consisted of many renal tissue masses (lobules) there are no demarcation between

the cortex and medulla. Each lobule characterized by outer cortex and inner medulla was medullary cone. The cortex contain two types of nephrons, with two types of renal corpuscles, numerous large corpuscles were mammalian type, which characterized by presence of Henle loop and few of small corpuscles were reptilian type in which the loop Henle is absent. Both types of corpuscles were concentrated in the middle of cortex. Each renal corpuscle has composed of central core of mesangial cells those surrounded by podocyte surrounded with Bowman's capsule.

Keywords---Kidneys, Aves, Anatomy, Histology.

Introduction

Aves' urinary system consists of paired kidneys and ureters, which carry urine to the cloacae's urodeum. The urine bladder and renal pelvis were missing.(King,1975) The avian kidneys were extended from the lungs' caudal boundary to the synsacrum's caudal end and buried in the fossa. (Batah,2012;(Abood*et al.*,2014).The avian kidney is made up of three lobes that aren't totally separated. (Nabipour and Sadian.,2009;(Sreanjinietal.,2010;(Al-AJeely and Fadhil.,2012; (Michalek*et al.*,2016;(Mohammed,2021)each lobe is made up of multiple lobules that drain into many ureter branches. (Reshag*et al.*,2017;(Abood*et al.*,2014).The kidneys control the composition of bodily fluids and minerals, therefore they are required to maintain homeostasis and remove metabolic waste, as well as excess water and electrolytes (Nabipourandsadianm.,2009;(Wideman,1988)Urine released in the kidneys was refluxed into the cloacae-rectum, where it was changed before being eliminated. Because uric acid was the end result of nitrogen metabolism, avian urine was less concentrated than mammalian urine (Braun,2003;Braun and Pacelli.,1991;(Bataille*et al.*,2008).The Golden Eagles, Racing pigeon and Common Bulbul live in terrestrial(non aquatic birds) (Warui,1989).Birds' kidney lobes were split into many lobules, each of which contained the central vein and was separated into two regions: cortex and medulla. Renal corpuscles (reptilian and mammalian types), proximal renal tubules, distal renal tubules, and collecting ducts were all found in the cortical area. Henle loop segments were narrow and thick in the medulla region. The cortex was significantly larger than the medulla. (Abood *et al.*,2014;Reshag and Abood.,2017;Harikesh*et al.*,2018;Mohammed,2021)).The mammalian corpuscles are distinguished by the existence of a Henley's loop and a big corpuscle, whereas the reptile corpuscle is tiny and lacks a Henley's loop. (Abood *et al.*,2014).The goal of this study was to evaluate the morphological and histological characteristics of the kidneys of Golden Eagles, Racing Pigeons, and local Bulbuls.

Materials and Methods

1-Experimental Animals:-

The present study was carried on Thirty apparently healthy birds with no respect to sex, (ten Golden Eagles(*Aquila chrysaetos*), ten Racing pigeon(*Columba Livia Domestica*) and ten Common Bulbul(*Pycnonotus barbatus*), were pouch from the

local markets of Basra provinces and Al-Gazelle markets. Used for determinate the anatomy and histological differences in the kidneys.

2-Kidneys in birds Removing Procedure:

- 1- The movement of birds were restricted by using sticker tape.
- 2- The birds were generally anesthetized by chloroform inhalation.
- 3- The feathers of subjected area were detached carefully.
- 4- Simple vertically incision was made by using surgical blade in the top of the abdomen, the skin adducted then the organs were exposed then removed from both side(Mohammed,2021).

3-Sampling Methods for Anatomical study:

All birds were sacrificed by decapitation after used generally anesthetized. Then the abdomen walls were opened then the viscera were removed carefully. Both left and right kidneys were quickly removed from the synsacral fossa.

4-Sampling Methods for Histological Study:

The kidneys samples washed with normal saline fixed with 10% formalin for 48 hours in two changes. Paraffin section of kidneys at (5-7) μm thickness were prepared and stained with Hematoxylin and Eosin stain (Suvarna *et al.*, 2013). The stained sections were examined by compound light microscope. The microscopic images were captured using the digital camera with high characteristics.

Results and Discussion

The general anatomical characteristics of kidneys in three species were red to brown red in color, flattened dorso-ventrally organs extending from the caudal border of the lungs to the end of the synsacrum bone, and the dorsal half of the kidneys were embedded deep in the ventral synsacral fosse, according to the current study. Each kidney had three lobes (cranial, middle, and caudal) that were not totally divided (Fig.1,2,3). This evidence corroborated what many others had reported in many bird species, such as what was said by (Batah,2012)in common coot bird, (Michalek *et al.*,2016) in Emu ,(Nabipour *et al.*,2009) in dove and owl, (Al-AJeely and Fadhil,2012)in dove, racing pigeon,(Mohammed, A. Ali and Ali, F. Reshag.,2020)in ducks,(Mohammed,2021)in ducks.

Anatomical Results

The two red to red brown, flattened, three-lobed metanephric kidneys located postero-dorsally in the body cavity of pigeons (birds) are the major excretory organs, and are inserted in the pelvic girdles' hollows. Peritoneum covers their ventral surface. The renal portal veins give venous blood, whereas the renal arteries furnish arterial blood.

In adult racing pigeon, the kidney was red to red brown in color flattened retroperitoneal fragile organs embedded in ventral surface of synsacrum bone. It has three lobes (cranial, middle and caudal), the caudal lobe was the largest and wider than the other two lobes(Fig.1). This results were the similar to the results of (Nabipour *et al.* (2009), they found that the kidneys of doves and owl were also consisted of three lobes which the cranial lobe appeared larger than the small

middle one and a large caudal lobe, also (Abood *et al.* (2014) found that there were many differences between the Harrier, which had elongated cranial and middle lobes while the caudal lobe was triangular in shape. Whereas in mallard ducks, the cranial lobe is small rounded, the middle one is elongated and the caudal lobe is large with elongated appearance, (Reshag *et al.* (2014), Mohammed, A. Ali and Ali, F. Reshag.(2020). The same fact was recorded by Reshag *et al.* (2016) in great flamingos they reported that there were differences between the size and shape of the three lobes in kidneys, the cranial lobe was small round-oval in shape, the middle was elongated and the caudal lobe was large elongated.

In golden eagles, had paired kidneys. Each kidney was flattened and extra-peritoneal organs(Fig.2). This results were the similar to the results of (Al-AJeely, 2012), they found that the kidneys of golden eagles, had a paired kidneys and ureters, the renal pelvis and urinary bladder were absent. Each kidney was flattened and extra-peritoneal organs. The bird kidney consists of three lobes were cranial, middle and caudal. The cranial lobe was larger and wider than the other two lobes and the caudal lobe was similar to middle lobe in shape but smaller in size.

In Common Bulbul, each kidney consists of three divisions, a large cranial, a small caudal and a middle division. The dorsal half of the kidneys were embedded deeply in ventral synsacral fossa(Fig.3).This results were the similar to the results of (El-Bakary *et al.*, 2015, Mohammed, A. Ali and Ali, F. Reshag.,2020, Mohammed,2021). they found that the kidneys of squacco heron, each kidney consists of three divisions, a large cranial, a small caudal and a middle division. The dorsal half of the kidneys were embedded deeply in the synsacral fossa. And each kidney was completely separated from each other. And each kidney was completely separated from each other. The cranial lobe was larger and wider than the other two lobes and the caudal lobe was similar to middle lobe in shape but smaller in size.

Histological Results

The main histological structures in kidneys from three different species were discovered to be the same there were several renal lobules in the kidney lobes, each lobule featured a tiny medulla in the center, surrounded by a broad zone of cortex. (Fig.4,5,6,8,9,12 and 13), It consisted of two types of nephrons, a significant number of mammalian glomeruli and a small number of reptile glomeruli, as well as a lake of Henley's loop (Fig. 4, 9 ,11 and 13).This finding was consistent with the findings of (Nabipouretal.,2009);(2)Al-AJeely and Fadhils,2012);(Al-AJeely,2012,(Mohammed,2021) The outcomes of dove, racing pigeon, and gold eagle (Abood *et al.*,2014)Harriers, Mallards, and Chickens, Mohammed, A. Ali and Ali, F. Reshag.,2020)in ducks. The kidney lobes in all of these avian species were made up of multiple lobules that were made up of a big cortex and a tiny medulla. The renal nephrons were divided into two categories based on the size of the renal corpuscles and the presence of Henley's loop. The organization and distribution of renal nephron segments were the same in both groups of birds in this investigation. Renal corpuscles of both kinds, mammalian and reptilian renal corpuscles, are found in the cortical zone (MC,RC), were found at various levels, as were the (proximal and distal) convoluted tubules and

cortical collecting duct in the medullary region, as well as the thin and thick segments of Henley's loop and collecting duct (Fig. 5, 9 and 15). Previous investigations in other bird species have mentioned this histological characteristic. (Batah, 2012) in common coot, (Michalek *et al.*, 2016) in emu bird, (Reshag *et al.*, 2017) in great flamingos, Mohammed, A. Ali and Ali, F. Reshag, 2020) in ducks. The cortex had convoluted tubules and a cortical collecting duct, whereas the medulla had the thin and thick segments of Henley's loop, as well as a collecting duct.



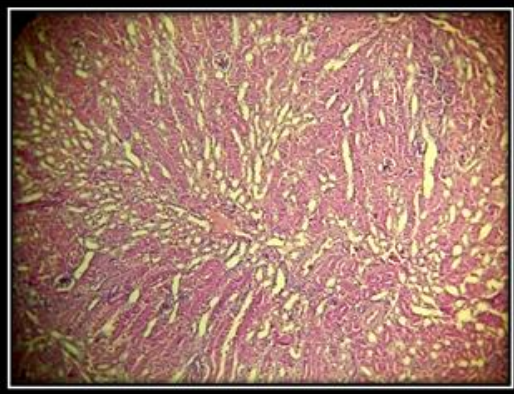
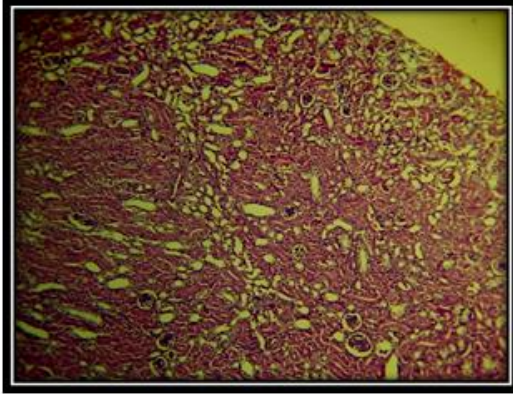
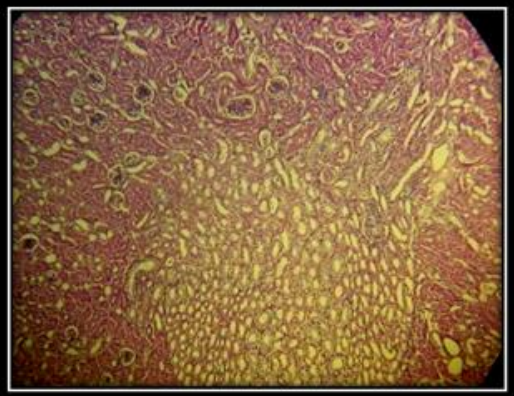
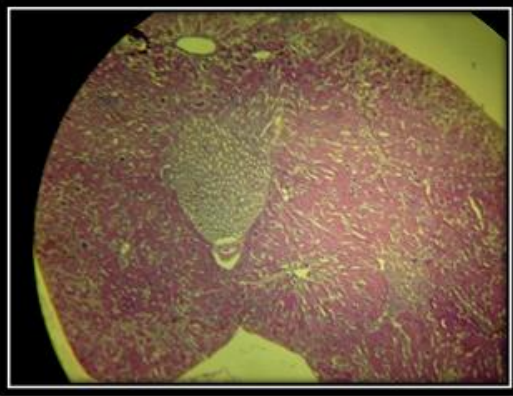
Figure (1) Macrograph of Golden eagle kidney, cranial lobe, m-middle lobe, caudal lobe



Figure (2) Macrograph of pigeon kidney, cranial lobe, Middle lobe, caudal lobe



Figure (3) Macrograph of Common Bulbul kidney, cranial lobe, Middle lobe, caudal lobe



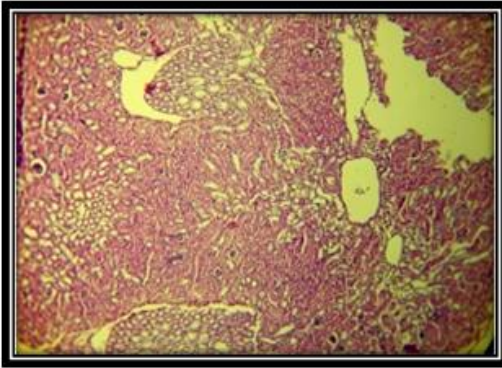


Figure (6) Common Bulbul kidney section through the cortex showing, Bowman's capsule, Glomerulus 100x H&E

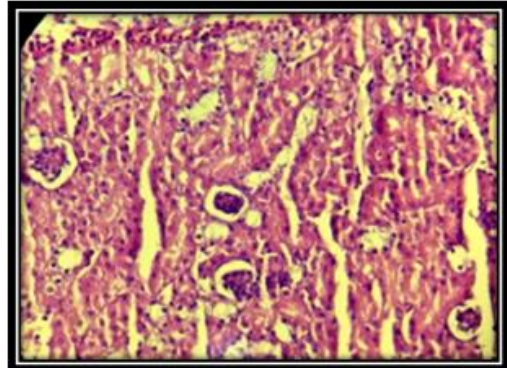


Figure (7) Common Bulbul kidney section through medulla. 100X H & E

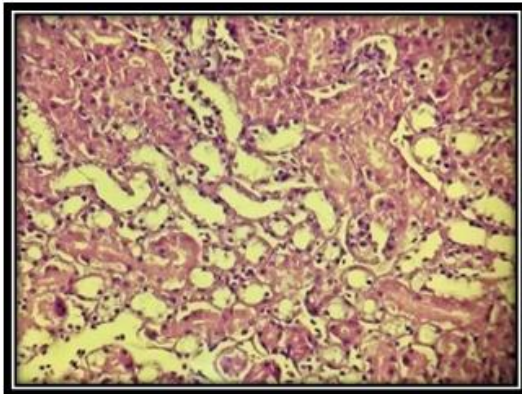


Figure (8) Golden eagle kidney section through the. Cortex ,medullary cone,Central vein. 40x H&E.

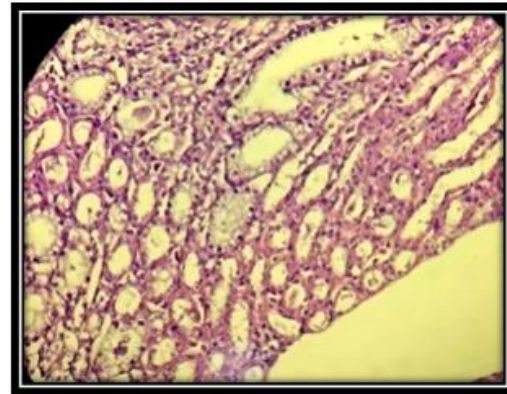


Figure (9) Golden eagle kidney section through the cortex showing ,Bowman's capsule ,glomerulus. 100x H&E

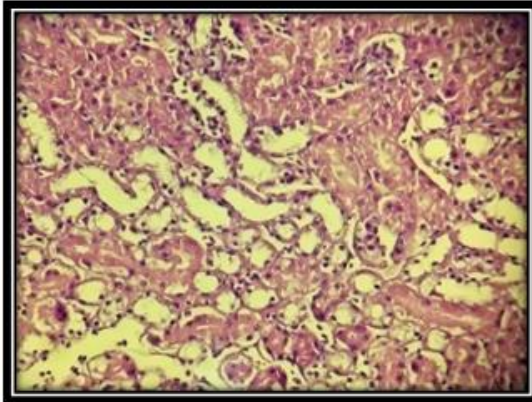


Figure (10) Golden eagle kidney section through the cortex medulla showing A-Bowman's capsule. B-glomerulus. D-distal convoluted tubule. Proximal convoluted tubule 200x H&E

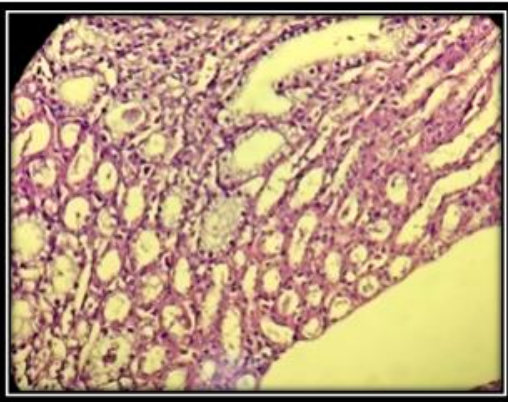


Figure (11) Golden eagle kidney section through medulla, A. Thick segment of handles loop, B. thin segment of Henley loop, D. collecting duct, E. papillary duct. 200X H & E

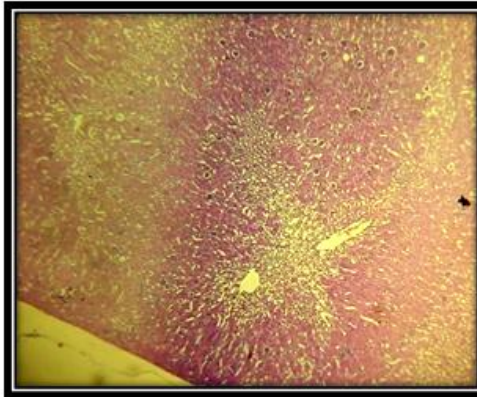


Figure (12) Racing pigeon kidney section through the. Cortex, Medullary cone, Central vein 40x H&E

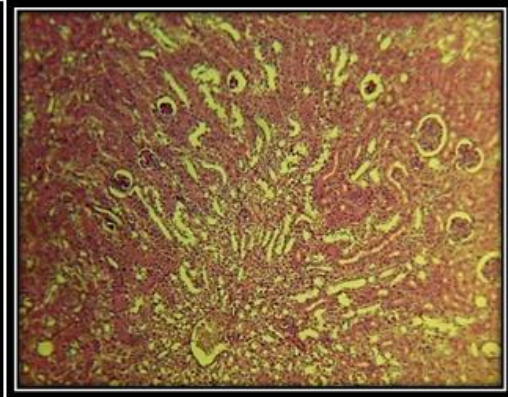


Figure (13) Racing pigeon kidney section through the cortex showing, Bowman's capsule, B- glomerulus. 100x H&E

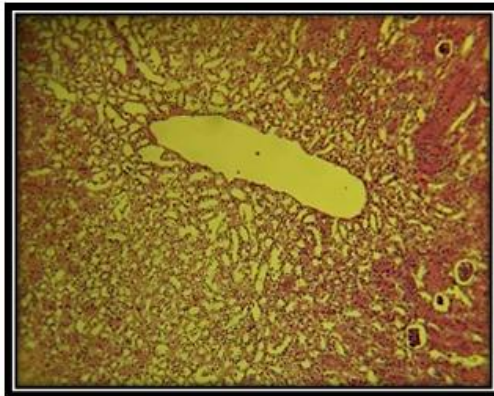


Figure (14) Racing pigeon kidney section through the cortex showing central vein, Bowman's capsule, Glomerulus. 200x H&E

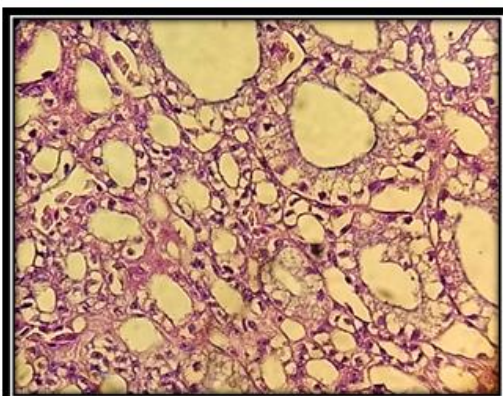


Figure (15) Racing pigeon kidney section through medulla, Thick segment of Henles loop, Thin segment of Henles loop, Collecting duct, distal convoluted, Proximal convoluted tubule, papillary duct. 200X H & E

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