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Anatomical and histological study of the kidney of *Caracus caracus* (Linnaeus, 1758)

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Abstract :

The results of the present study showed that the kidneys in the *Carassius auratus* fish are in the form of a hard structure which is located at the dorsal position on both sides of the vertebral column they are stripe-shaped with a dark red colour tissue color surrounded by a thin capsule of connective tissue the kidney consisting of three main parts : head , middle , and tail .

The head region is invaded by bloody tissue with a few renal corpuscles and urinary tubules , while the middle region which represents a transition zone where the blood tissue is reduced the number of glomeruli increases to side with urinary tubules and collecting tubules whereas the tail region has an excretory function where glomeruli are concentrated which appear as single , double , or triple . The proximal convoluted tubules that are lined with simple columnar epithelial tissue their cells are based on a basement membrane containing dark-colored nuclei from the free surface of its cells protruding long microvilli form what is known brush border , there are also distal convoluted tubules that are lined with a simple cuboidul epithelial tissue the nucleus of cells oval and with no brush border the collecting tubules is lined with a simple columnar epithelial tissue and cells with sepherical nuclei that take a position closer to the base than the center and have a dark color .

Key words : Morphological description , Histological structure , kidney , *Carassius caracus* .

INTRODUCTION :

Each organism organizes the internal content of the inorganic salts and exposes the waste released by the biological processes that take place in its body by various means . Kidney forms the organ that creates state from a balance in the exchange between the internal and external environment , it regulates concentrations of different salt ions and water in the blood regulates the concentration of glucose in it , and nitrogen wastes are discharged as urea , ammonia and creatinine , which represents the waste resulting from muscle activity , and the material is expelled which take their way into the body through the intestines and the respiratory system , where the above functions are accomplished through three operations represent by the precise filtration of blood and the re-uptake of part of the filter material and the specific secretion of certain substances that are directly excreted into the filter material (1, 2) .

The kidneys in the vertebrates including the fish show a similar construction plan they are generally composed of a crowded group of tubules forming a mass that takes a dorsal position within the body cavity and on both sides of the vertebral column despite the appearance their formation similarity there are differences in the details of the anatomical builder within different vertebrate groups , and represent this variation is the difference in the number and arrangement of glomeruli and the complexities of renal tubules in their different parts (3) , that variation comes due to ability of fish to live in differentiated salinity aquatic environments , thus facing the problem of maintaining the water and salt balance , which in turn is linked to the occurrence of adaptations of tissue and functional in its entirety , which earns the associated events osmoregulation particular importance in these organisms and perhaps the most prominent members are which contributing to this process are kidneys (4) .

The kidneys studied in vertebrates that inhabit the Iraqi aquatic environment were by many researchers, such as the study of the embryonic composition of the kidney in the *Cyprinus carpio* (5) , embryonic composition and histological structure of the front and back kidneys of the *Gambusia affinis* (*Gambosia hollobrolli* according to Coad , 2010) (6) , comparative study of the kidneys in two species of bone fish iide tolerance to salinity they *Heteropneustes fossilis* and *Gambusia affinis* (7) .

Most previous studies of kidneys in fish have indicated that they are not histological subdivided into a medulla and cortex region , they are thus not identical to kidneys in most of the higher vertebrates in terms of histological structure but in spite of that difference , they are functionally similar in that they represent an output unit .

The present study aimed to investigate the morphological description and histological structure of carcium carp (*Carassius caracus*) from Iraqi habitat .

MATERIALS AND METHODS OF WORK :

A total of (10) were obtained by cast nets from the AL-Hindyiah river within the geographical area of the city of Karbala (8) , the fish transferred to the laboratory by cork containers filled with ice to keep fish fresh , then washed and distributed on white marked papers and dried using filter paper . The measurements were taken total length to least (1 mm) by the measurement board , and the weight of the body to the (0.1 g) by a sensitive . Kidneys were removed and fixed in Bowns fluid and the paraffin wax method were used for histological study according to the method (9) (Fig 1 and 2) .

Figure (1) The external appearance of *C. auratus* .

Figure (2) Kidneys in *C. auratus* .

RESULTS :

1. Morphological Description of Kidney

The results of the gross anatomy showed that the kidneys in the studied fish are in a solid mass with a stripe-shaped structure consisting of two dark-red lobes that connect with each other at the back end . The right and left kidneys take a symmetrical position on both sides of the spine .

The results of the present study showed that the mean length of the kidneys in the fish under investigation was (0.1 ± 2.4 cm) , with range of (2-3 cm), the average body length (2.1 ± 20.4 cm) with range of (17 - 22 cm) , while the ratio of length of kidney to body length (0.12%) , While the weight average of the kidney reached (0.02 ± 0.341 g) and the range (0.25-0.36 g) , the

average body weight (6.7 ± 148.87 g) and the range of (164.59 - 135.51 g) , while the percentage of kidney weight to body weight (0.0023%) (Table 1) .

2. Histological structure of kidney

The results of the histological study showed that the kidneys in the studied fish were surrounded by a thin connective tissue capsule and were typologically distinguished into three regions : head , middle , and tail . The head region invades a large amount of hemato-poietic-tissue , which is permeated by very few areas containing urinary tubules and renal corpuscles , this structure changes in the middle part as the blood tissue is reduced in some regions of the renal tissue in a controlled and become the renal corpuscles and urinary tracts more distributed in those areas, while in the part of the tail disappears blood tissue almost disappear with the remnants of a very small amount between the renal corpuscles which is large and accompanied by increasing numbers of urinary tubules of various types (Fig 3) .

Renal corpuscles are made up of glumerulus, which have a diameter rate (0.3 ± 90.4 µm), and the rate of the number (0.1 ± 4.1) per square millimeter, it is surrounded by the bowman s capsule , the glomerulus is a mass of capillaries that are formed in a spherical shape or an oval shape , it is introduced by the afferent arteriole at the vascular pole and is left by the efferent arteriole at the urinary pole, the bowman capsule is connected to the urinary tubule and is bipolar , the layer that lies outside is called visceral layers, and the layer that lies inside is called Parietal layers (Table 1) , (Fig 4 and 5) .

The results of the present study showed that the anterior part of the urinary tubule is represented proximal convoluted tubule is connected to the urinary pole of the glomerulus and is scattered in the tissue of the kidney . It is lined with a simple columnar epithelial tissue rested on the basement membrane . The free surface of cells , bear long microvilli forming the brush border , the external diameter of the tubule is about (0.5 ± 20.1µm) (Table 1) , (Fig 6) .

The results of the histological examination showed that the distal convoluted tubule is short , which is less visible in the tissue sections, and is lined in a simple columnar epithelial tissue . The lining cells of distal convoluted tubule can be distinguished from the proximal convoluted tubules because the free surface of the cells is lack of the brush border and therefore the cavity is larger and the number of cells is greater , the outer diameter is (0.1 ± 23.4 µm) (Table 1) , (Fig 7) .

The results of the present study showed that the diameter of the collecting tubules was greater than the diameter of the proximal and distal urinary tubules the rate of external collecting tubule diameter was (0.2 µm ± 24.2 µm) , its epithelial lining consists of a low simple columnar epithelial tissue (Table 1) , (Fig 8) .

DISCUSSION :

The results of the current study showed that the kidneys in the studying fish they are in the form of a stripe that takes a dorsal position on both sides of the vertebral column which is dark red colored this is agree with the findings of several researchers studied the kidneys in fish , including (10), on the similarity of kidneys in most fish species as it is a solid structure surrounded by a thin capsule made of connective tissue and taking a dorsal position on both sides of the vertebral column and a reddish color .

The results of the present study showed that the kidneys consist of three main region : head , middle , and tail , and this is a confirmation the previous researcher (11) in his study on the kidney *Huso huso* that it consists of three main parts : head , middle , and tail .

The results of the histological study showed that the head part consists of a blood tissue with very few excretory units and urinary tubules , and these results are relatively similar to that indicated by (12) .

The results of the present study showed that the tail and middle part of the kidney suffers from a significant decrease in the proportion of blood tissue and an increase in the number of glomeruli and sections of urinary tubules , which appear largely in the part of the tail and it appears to be related to the activity of the functional part of the tail , these results confirmea the results of many researchers who studied the structure of the kidneys in the fish (13) in his study on the tissue of the kidney in *Cyprinus carpio* and *Carassius auratus* , the tail portion of the kidney consists of a large number of nephrons, along with a small amount of blood tissue that occupies the areas between those nephrons , this is agree with the results of (14) who pointed out in his study that the proportion of the presence of blood tissue in the kidneys of fish corresponds to the distribution of glomeruli and urinary tubules in addition to vascular spaces within the renal tissue, where the head area consists of a high proportion of the blood tissue accompanied by a lack or absence of glomeruli and urinary tubules , while it is reflected in the tail region of where the level of blood tissue is low and increase the concentration of glomeruli and urinary tubules .

The results of the present study showed that the different areas of the kidney (head , middle , and tail) differ in the distribution of glomeruli from their presence and numbers , where it was observed that the head region is almost free of glomeruli and the middle region has a small number of them , the tail region is rich in glomeruli this is related to the nature of the function performed by each part of the kidney, which is often referred to as the function of the front or head of the kidney is linked to the process of blood formation and thus is rich in blood tissue , this is agreed with the findings of the researcher (15) in his study on the kidneys , pointing to the occurrence of change in the function of the front of the kidney in many bony fish for the performance of function non-execratory absence of glomeruli in them and contribute to the construction of blood as in the *Pterophyllum scalare* , the front part contains a lymphatic tissue composed of blood vessels and capillaries , while the function of the concentrated in the back of the kidneys in those fish , as confirmed by (16) .

On the other hand , the results of the present study regarding the glomerular and its components have been agreed with several previous studies , the glomerulus is composed of a cluster of the capillaries that surround the bowman capsule from by outside with a wall of vascular and paricta layers this description is shared by kidneys in all bony fish living in fresh water as well as bony fish of marine habitats (17).

The results of the present study showed that the proximal convoluted tubules are lined with a simple column epithelial tissue with brush border at their free surface of cells ,and these results are agree with the findings of many researchers who indicated that the cells are lining of the proximal convoluted tubules in fish are often columnar (18) , while disagree with the findings of the researcher (19) in his study where he pointed out that the cells epithelial lining of the proximal convoluted tubule is a squamous and central nucleus site . The results of the current study have been agreed with respect to the lining epithelial tissue of the distal convoluted tubules , where it appears to be lining with a simple cuboidal epithelial tissue brush border and the diameter is more extensive than the proximal convoluted tubules (14) .

The results of the current study showed that the collecting tubules are larger diameter than both the proximal and distant convoluted tubules where they are lined with a simple columnar epithelial tissue (17, 18) .

Table (1) Measurements of kidneys in *C. auratus* .

Diameter Of distal convoluted tubule (µm)	Diameter Of proximal convoluted tubule (µm)	No. Glomeruli (mm^2)	Glomeruli Diameter (µm)	Kidney Length (cm)	Kidney Weight (gm)	Total Body (cm)	Body Weight (g)	Studied Parameters
23.4±0.2	20.1±0.5	4.1±0.1	90.4±0.3	2.4±0.1	0.341±0.2	20.4±2.1	148±6.7	Mean
12 - 10	15 – 10	8 – 4	12-23	3 – 2	0.36 - 0.25	17 -22	164.59 - 135.51	Range

± ..... Standard error

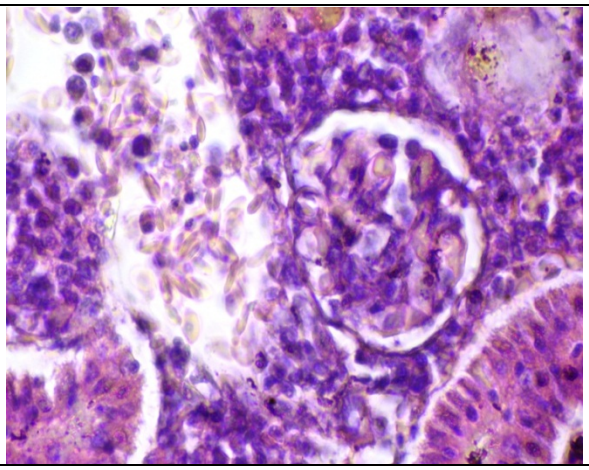

Figure (4) Cross section in kidney shows Glomeruli appear within the kidney tissue *C. auratus* (H & E stain) (1000 ×) .

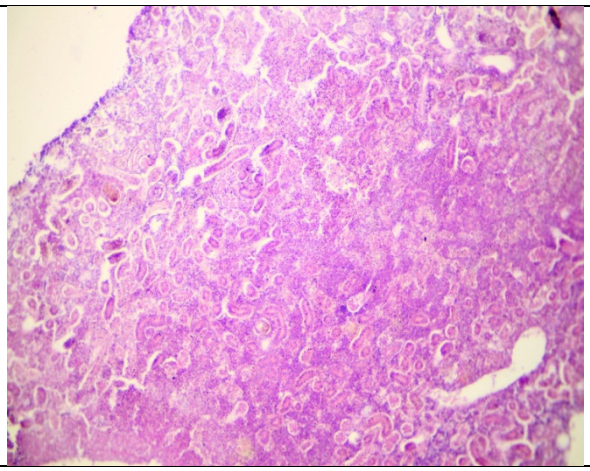

Figure (3) Cross section in kidney shows head region of the kidneys *C. auratus* (H & E stain) (100 ×) .

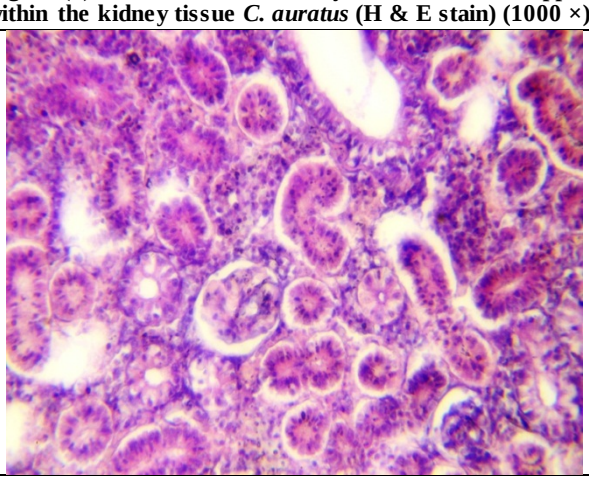

Figure (6 Cross section in kidney shows proximal convoluted tubule *C. auratus* (H & E stain) (400 x) .

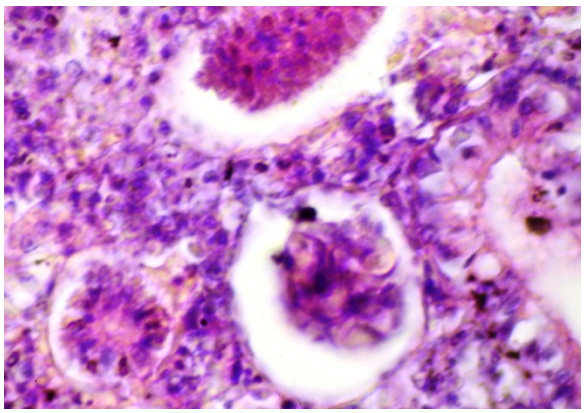

Figure (5) Cross section in kidney shows structure of the glomeruli *C. auratus* (H & E stain) (400 x) .

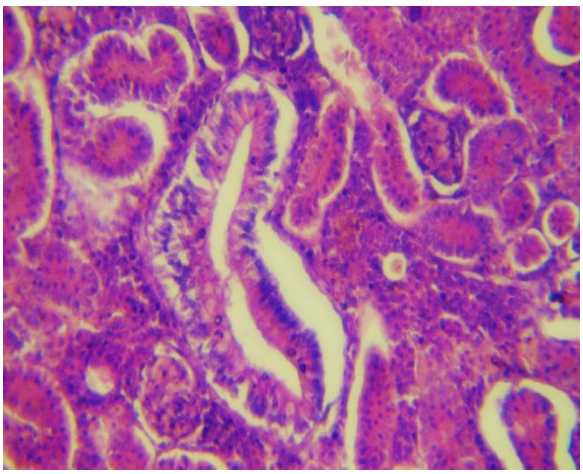

Figure (8) Cross section in kidney shows collect tubules *C. Auratus* (H & E stain) (1000 ×) .

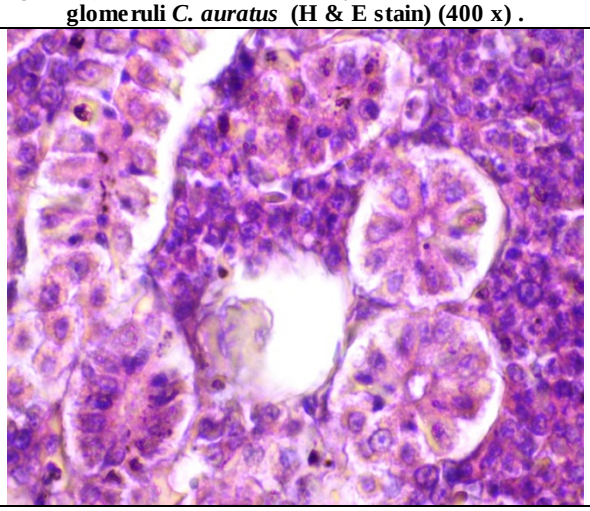

Figure (7) Cross section in kidney shows distant convoluted tubular *C. auratus* (H & E stain) (400 x) .

CONCLUSION :

This study conclude that striking anatomy and histology of kidney in fish gives an indication that the change of the histological structure and morphological appearance in comparison with higher vertebrates related with the adaptation to the habitat and the metabolic activities

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