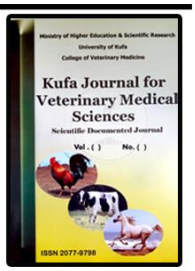
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Morpho-Histological Investigation of the Kidney of Iraqi Black-Tailed bull Gazelle (*Gazella Subgutturosa*)

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Abstract

Morphological and histological characteristics of the kidneys in the Iraqi black-tailed gazelle were investigated by using the morphological and histological methods. The two kidneys in the gazelle contributed about 0.6% of the body weight. The ratio of thickness of the renal medulla to the cortex was 4:1, which indicated that Henle's loops in gazelle's kidneys were very long. In cortex, there were more mid-cortical than the juxtamedullary nephrons which had longer Henle's loops. In the outer medulla, the vase recta were grouped obviously into specific vascular bundles which distributed within the bundles of Henle's loops and collecting tubules. The inner medulla was thicker than the outer one. Specialized cup like structures were formed by projecting of the pelvis and extended to fit the apex of the (8-10) renal pyramids. The characteristics above showed that black-tailed gazelle kidneys possessed a strong reabsorption and hence promoting the production of high concentrated urine.

Key words: black-tailed gazelle, high concentrated urine, histology, kidney, cortex, medulla

دراسة الصفات الشكلية والنسيجية في كلى الغزل العراقي ذو الذيل الاسود (*Gazella Subgutturosa*)

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الخلاصة:

تهدف الدراسة الحالية الى معرفة المميزات الشكلية و النسجية في كلى الغزال العراقي ذو الذيل الاسود الذكر ,اذ تم اجراء هذا البحث بالطرائق العيانية و النسيجية. اظهرت النتائج أن كليتا الغزال كانتا تمثل 0.6% من الوزن الكلي للجسم. النسبة بين سمك اللب الي القشرة كانت 4:1 مما يدل الى ان عروة هنلي في الغزال كان طويل جدا. في القشرة كان هناك عدد الكليونات اكثر من المنطقة المجاورة للب والتي كانت تملك طول اكبر لعروة هنلي .

في اللب الخارجي كان هناك تجمع لحزم الأوعية الدموية ما بين عروة هنلي و النبيبات الجامعة. اللب الداخلي كان اكثر سماكة من الخارجي.

وجد ايضا تراكيب متخصصة كأسية الشكل تكون بروزات ممتدة من الحوض يبلغ عددها8-10 تراكيب.

من اهم خصائص هذا النوع من الغزلان ان له القدرة العالية على اعادة امتصاص الماء ومما يؤدي الى انتاج بول بتركيز عال جدا

Introduction

The renal parenchyma of kidney in all mammalian species contains cortex and medulla. Cortex is reddish brown in color with granular appearance, the medulla is pale and striated (1).

The general histological structure of renal tissue is similar. The main histological functional units are the nephrons and the renal blood vessels; the stroma consists of very thin interstitial connective tissue.

The kidney is protected by fibrous connective tissue capsule (2). The kidneys have many physiological functions play great role in body homeostasis (3). In some animals which live in arid environment, the water conservation is the most important for the survival of these animals (4).

In addition, the thickness of medulla area with the long loop of Henle is the best adaptative features in the kidneys of mammals (5), therefore the aim of this study was to provide morphological and histological information about the nephrons and their distribution within the kidney of Iraqi black-tailed gazelle.

Materials and Methods

1- Six adult healthy male Iraqi black-tailed gazelle (*Gazella Subgutturosa*) from governmental reserve in Kusaybah city were used in this study. The mean weight of live animals was 19Kg. The individuals were scarified.

2-Their kidneys were weighed and fixed by intra-renal artery infusion10% of formaldehyde solution for histological observations. Many slides were papered from the upper, middle and deeper sections of cortex, and the medulla from the centre of the kidney. The size of these pieces was 8mm×4mm×1mm. Paraffin sections were then stained with Haematoxlin and Eosin and Massons Trichrome. Olympus microscope was used to observe and photograph the slides, and the data were measured by ocular-meter.

Results

Morphological observations

The findings of the present study revealed that the kidneys of the male Iraqi black-tailed gazelle were bean shape organ. Moreover, the mean weight of both kidneys was 120 gm, whereas the live body weight was (19.5-20) Kg. The ratio of kidneys weight to body weight was 0.6% in the gross longitudinal section.

Each half showed that the renal capsule had outer dark cortex and inner pale medulla. The medulla had two zones which were the outer narrow medulla and inner thicker white color medulla. In gazelle the medulla was thicker than the cortex; the cortical medulla index was 1/4. Eight to ten renal pyramids were noticed. The medullary rays were limited and each pyramid was extended to the cortex tissue. The data also showed that the renal pelvis was narrow and many cups like structures were projected to formed minor calices, each cup fit with the apex of the renal pyramid apex (Fig. 1).

Histological observations

The histological findings of the current study revealed that the renal capsule was composed of dense collagenous connective tissue. In its deep layer, few smooth muscle fibers were noticed (Fig. 2). The renal cortex was composed of cortical labyrinth and medullary rays. The cross-section quantity of the proximal convoluted tubule in cortical labyrinth was further than the distal convoluted tubule (5:1) in X100 magnification microscopic field (Fig. 3). Moreover the brush border of the proximal convoluted tubule was well developed. The renal corpuscles were distributed in the middle of cortex section and cortico-medullary junction, but below the capsule no renal corpuscles were found (Fig. 4). In

cortex, the density of the renal corpuscle was 5/microscope field, so it was sparser. There were differences in diameters of the renal corpuscles of nephrons which located at the middle of cortex (106) µm than the juxtamedullary ones (130) µm. Medullary rays were Located at the lateral border of each renal pyramid. In cortex, the blood capillaries runs close to the renal tubules and the distribution was very rich among them, and it occupied the most of renal interstitial connective tissue. The medulla was divided into outer and inner medulla. The vasa rectae in the outer medulla was well grown. The changes of the simple cuboidal epithelium lining the descending limb into simple squamous epithelium lining the thin segment of the descending limb of Henle's loop was observed (Fig. 4). The tubule bundles of the cortical medullary rays. The width of the vascular bundle is nearly equal to that of the uriniferous tubule bundle. Inside the vascular bundle, the thin segment of the renal tubule was not seen (Fig. 5). The wall of the collecting tubule is built of regular simple cuboidal epithelium. Its cell cytoplasm was bright and the boundary was clear. The tubal wall of pars recta was formed of low simple cuboidal epithelium (Fig. 6).

Discussions

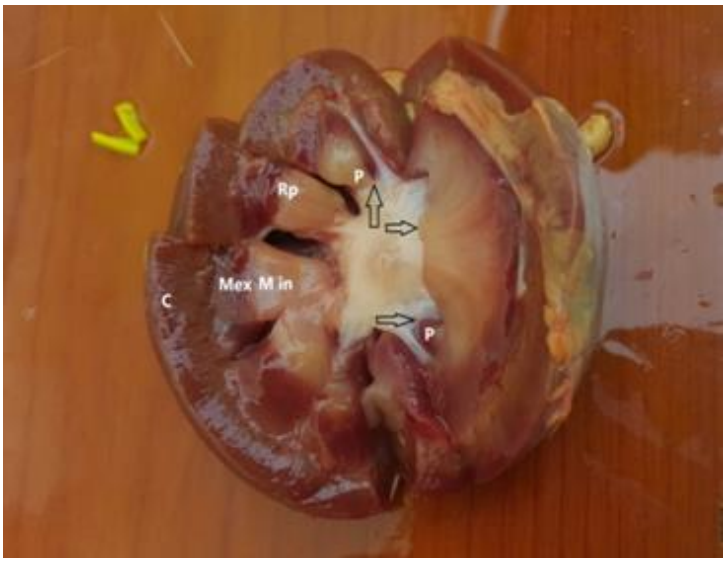
In the current study the weight of both gazelle kidneys was 120 gm and its ratio to the body was 0.6%. In corporation with finding of other research the kidney weight and its ratio to the body weight were different with species. (6) Reported that the weight of dog kidneys was 25 gm. The ratio was 0.2%; the weight of goat kidneys was 32.08 gm as mention by (7). In ox (8) found that the weight of both kidneys was 632gm and the ratio was 0.35%, while (9) recorded that both kidneys of one humped camel weighted 2467 gm. And the ratio was 0.6%, the same ratio reported by (4) in two humped camel, the weight of kidneys was 3000 gm. The ratio of kidneys weight to body weight in camel was similar to that reported in present study in gazelle. This was in agreement with the results of (4) they concluded that the animals with body metabolic and which adaptive arid area needed large kidneys. (10) Found that the ratio in African giant rat was low, it was 0.4%, and such animals' kidney had less ability to conserve water and excreted concentrated urine.

The cortex medulla index was 1/4.The index value in gazelle was equal to that of camels, which were measured by (11) and (4) .The thickness of medullary area gives a good indicator for the ability of gazelle's kidney to reabsorbed water.

According to the current the stained histological section showed, that the renal capsule of gazelles kidney formed of collagen fibers with smooth muscle fibers distributed deeply. This result was similar to what mentioned by (12) who stated that renal capsule of pig consist mainly of dense fibrous connective tissue and distinctive smooth muscle fiber present mainly in the inner layer, fibrocyte was observed in the outer layer, and the structure capsule in camel studied by (4). In contrast the renal capsule of dog was different; it was thick consisted of collagen fiber devoid of smooth muscle fiber. (13) Reported that the renal capsule in fat sand rodent was lack of smooth muscle fibers, that was disagree with the present result. The presence of dense irregular arranged collagenous fiber give the kidney of gazelle the ability to withstand the forces the high pressure results from the great blood flow reach the organ, while the smooth muscles fibers gave the kidney limited stretching capacity, this was in agreement with (14), they claimed that the collagen fibers can stretched five percent of their length. In addition to that the fibrous renal capsule

controls the filtration and plays an important role in protection for the renal tissue from the damage. The renal capsule was consisted mainly of collagen fibers bundles, this finding was in parallel with what was mentioned by (15, 16 and 17), they found that the decapsulated kidney lost their ability to filtrate blood and the renal parenchyma was easily to be damaged.

The renal corpuscles small diameter was distributed in the middle region of the cortex; this finding was parallel with the finding of (4) in the kidney of camel. Such renal corpuscles had longer loop of Henle and high number(5) proximal convoluted tubules with micro-villi which increased the water re absorption from the lumen of PCT to the blood in desert animals, as was mention by (18,19 and 20) how enumerated many renal modifications which helped the animals to adapt with water shortage. In the medulla there was a close attachment between the loop of Henle and collecting ducts and blood vessels. The flat lining epithelia facilitated the transport of water and electrolytes, leads to excrete a very concentrated urine and plays a great role in water economy .These facts were explained by (21) who concluded that the endothelia thickness fenestrated blood capillaries and the intrarenal veins are capable of sustaining passive transport between plasma and the renal interstitial connective tissue.(22) stated that the extreme urine-concentrating ability of kidney depended on the extensive length of the inner and outer medulla. All what was mention proved that the gazelle kidneys had good ability to conserve water and produce concentrated urine.



Figure(1) Gross longitudinal section shows, C-renal cortex, Mex- medulla external Min-Medulla internal, p- renal pyramid, P-papilla, Black arrows- pelvis recess (minor calyx)

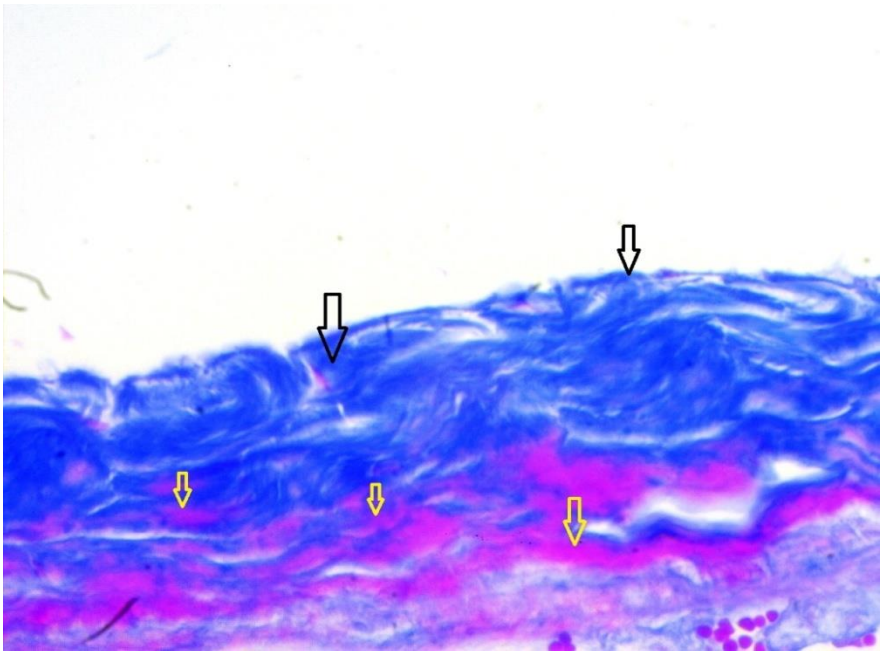


Figure (2) Histological section renal capsule shows:Collagen fibers bundles (black arrows), Smooth muscle fibers (yellow arrows),Masson Trichrome stain X100

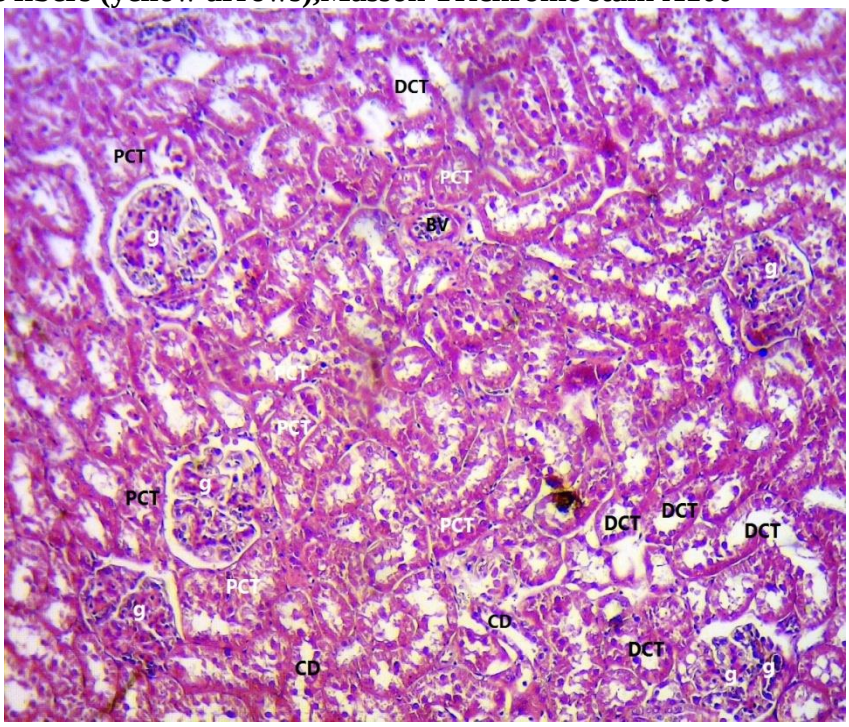


Figure (3) Histological section shows, g-the renal corpuscles, PCT-proximal convoluted tubule. DCT-distal convoluted tubule. CD- collecting duct (H&E stainX100)

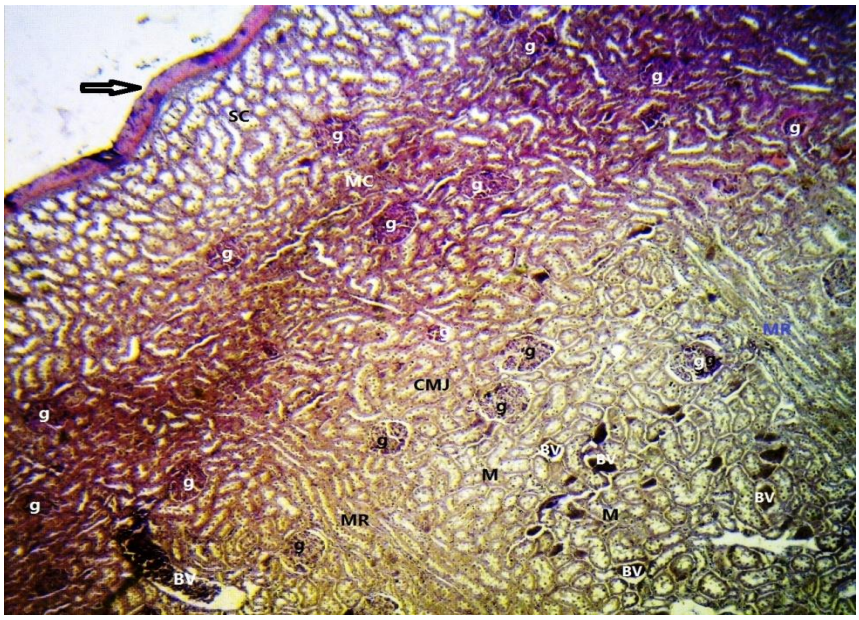


Figure (4) Histological section shows: renal capsule (black arrow) SC-sub capsular cortex, MC-middle cortex, MR- CMJ-cortex-medulla junction, M-medulla, g-renal corpuscle, medulla ray, Bv-blood vessel (Weigert Hematoxyline stainX40)

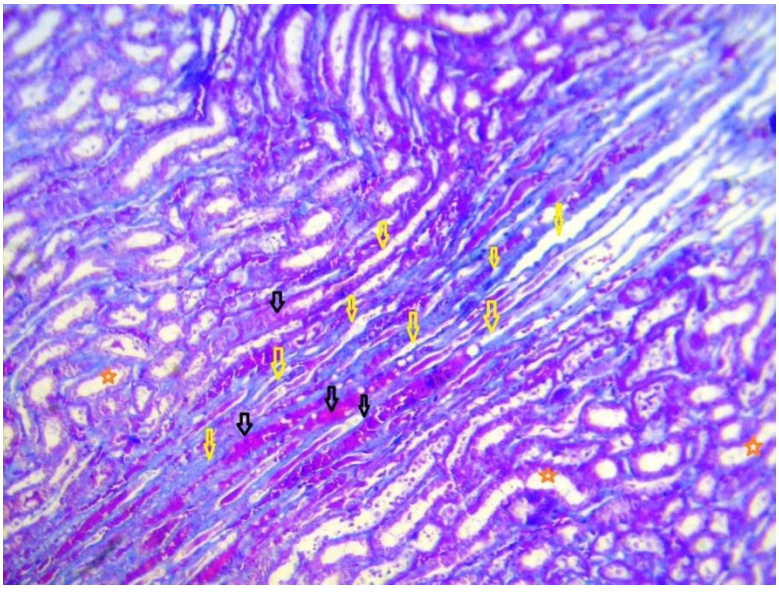


Figure (5) Histological section shows: blood vessels (black arrows) Henle loop segments (yellow arrows), collecting ducts (red stars) (massons Trichrome stain X100

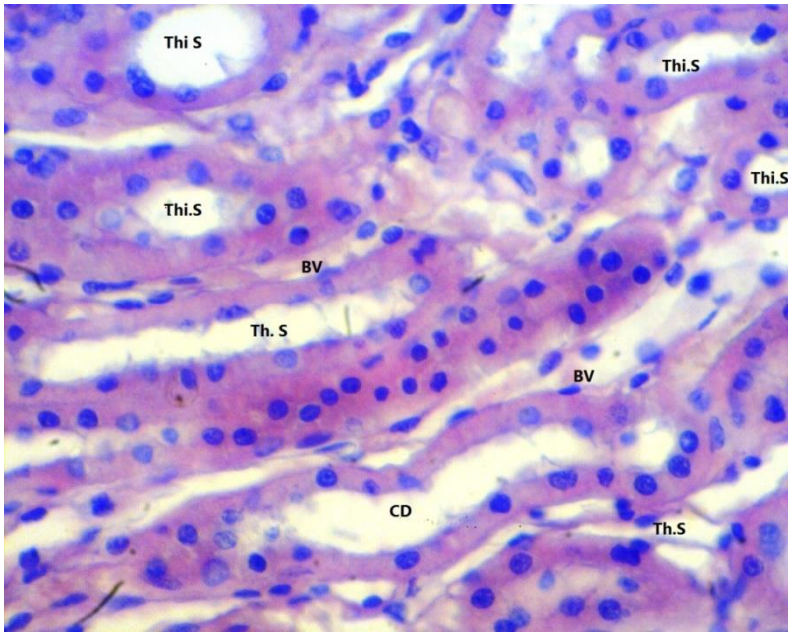


Figure (6) Histological section of renal medulla shows: ThiS-thick segment of Henle loop, ThS- thin segment of Henle loop, CD-collecting duct (H&E stainX400)

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