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Histomorphological and histochemical studies of the healthy liver and pancreas of local Adult homing pigeon (*Columba livia domestica*)

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summary

The purpose of study was to describe some the grossly and histological structure and histochemical features of the liver and pancreas of indigenous adult pigeons, The present study was conducted on twenty local adult homing pigeons divided into two groups ten for morphological study and ten for histological and histochemical study). The morphological result appears that the liver lies in the right and left hepatoperitoneal cavities, it has the red brown to brown in color the weight of the liver was 1.59 ± 0.21 in relation with the body weight. The liver is divided into two undivided lobes left lobe and right. the right lobe of pigeon is larger than left lobe mean length weight and thickness of wall of left and right lobe were 32.1 ± 0.41 mm, 22.6 ± 0.23 gm. and 3.5 ± 0.02 mm; 43.7 ± 0.25 mm, 46.6 ± 0.16 gram, 4.2 ± 0.03 mm respectively. the pancreas was long gland is on the lower side of abdominal wall between the arm of the duodenum, The mean length and weight of pancreas was 97.5 ± 2.20 mm, 3.12 ± 0.26 gm respectively. Histological examination reveals that the liver consisted of several lobules separate from each other by thin trabeculae of connective tissues extend from delicate capsule that enclose the liver, The basic unit of the parenchyma of liver is hepatocytes which arrange in plates or cord like that radiate around the central vein. and between these cords there is sinusoids lined by a layer of fenestrated endothelial cells and Kupffer cells. In the boundary of each lobule shows portal area which consisted of hepatic artery hepatic vein and bile duct lined by cuboidal cells The mean thickness of capsule diameter of central vein., portal vein, hepatic artery and hepatic duct were 145 ± 12.6 , 624 ± 32.4 , 523 ± 90.0 , 190 ± 20.4 and 325 ± 12.1 μ m respectively. The pancreas was serous tubuloacinar gland which covered by a thin connective tissue capsule consisted of collagenous, elastic and reticular fibers, The mean thickness was 47 ± 2.2 μ m. The parenchyma was consisted of exocrine portions and islets. The pancreatic islets were composed of large A cells and small B cells, The duct system composed of intercalated duct, intralobular duct interlobular duct and main excretory duct. The histochemical study the hepatic cells were positive to periodic acid Schiff stain, The pancreatic islets were composed of large A cells and small B cells.

Keyword: Homing pigeon, liver, pancreas Histochemical Histological.

Introduction

Birds have a single body chamber and do not have separation of abdomen and thorax as in mammalian (1). In the avian species the liver has two lobed organ that lies in the mid coelomic cavity of the body ventrally and posteriorly to heart associated with proventriculus and spleen (2-4). In most the avian species the left lobe of liver is slightly smaller than that right lobe of liver. The liver is largest gland of body it is dark brown or red brown in colour and the liver is both endocrine and exocrine gland releasing several substances directly into blood stream and secreted bile into duct system (5), Embryologically, it derived from endoderm (hepatocyte and biliary epithelium) and mesoderm (stroma cells, satellite cells, kupffer cells and blood vessels (6,7). Histologically, the liver of avian similar to that in mammalian but there is some differences such as absent connective tissue septa between lobules except in

portal area (8), duck liver consists of several lobules separated from each other by thin trabeculae of connective tissue extend from delicate capsule that enclose the liver (9). In turkey, the hepatocytes are usually arranged as two cell thickness between the liver sinusoids. The portal area contained a branch of portal vein, branch of hepatic artery and 2 to 3 interlobular bile ducts (10), the liver is most important organ in the body. It has numerous functions, including digestive functions, metabolism of protein, fats, and carbohydrates, detoxification, synthesis and secretion of bile (11,12). The avian pancreas is located on the right side of the abdominal cavity in all birds, the pancreas of the avian is considered to have four lobes ventral, dorsal, third and splenic with the three ducts ventral, dorsal and third, as described in chicken and quail, it consists of an endocrine portion or pancreatic islet and an exocrine portion (13-14). The pancreatic islets are responsible for the control of blood sugar concentration and consist of isolated groups of pale staining islet cells called islets of Langerhans. The exocrine portion releases many essential electrolytes and digestive enzymes (15,16).

Material and method

For morphological study ten adult healthy local birds (5 male and 5 female) were collected from local market in Muthana city during March 2019, the birds were killed after anesthesia by intramuscular injection of a mixture of ketamine and diazepam at dose 25 mg/kg and 5 mg/kg of bird body weight (17). The body cavity was opened through a midventral incision the liver and pancreas were immediately dissected out, measurement the mean length, weights and thickness of pancreas and measurement the mean length weights and thickness of the liver left lobe and right lobe of the liver by digital electronic vernier, measurement tape and ruler.

For histological and histochemical study the present studies were carried out on (10) specimens of the liver and pancreas of adult healthy local birds, 5 specimens from different regions of each lobe of the liver were taken and fixed by 10% formalin 24 hours at room temperature, and then treated by routine histological processing (18), embedding with paraffin wax (58 to 60°C) and sectioning to 5-7µm. The stains used, Hematoxylin and Eosin for demonstrating the general histological components, Periodic Acid Schiff for distinguishing carbohydrates, and Van Gieson stains for connective tissues (19). The slides are then dipped in xylene and mounted with cover slip using mounted medium. The slides are examined under light microscope to study the general histology and histochemistry features of liver and pancreas. The mean thickness of the capsule, diameter of hepatocytes, central vein, portal vein, hepatic artery and hepatic duct, the mean and the standard error were calculated for five slides for each lobe of liver and five slides of pancreas (19).

Result

The liver in present study proved that it was larger and bilobed organ, lie in the right and left hepatoperitoneal cavity (Fig.1) and it has red brown to dark brown in color, the weight of the liver is 1.59 ± 0.21 in relation with the body weight and it consisted of left and right lobe that are joined cranially at the midline by an interlobar portion. There was no gall bladder, The left liver lobe has a concavity in its top where the heart is stabilized and it is not divided into secondary lobe (Fig.1), and mean length weight and thickness of wall of left lobes of liver were (32.1 ± 0.41) mm, (22.6 ± 0.23) gm., (3.5 ± 0.02) mm respectively (Table 1), while the right liver lobes

has coenacavity from its ventral side where the gizzard was stabilized, and it didn't contain the incisions that divide it into secondary lobes (Fig.1), mean length, weight and thickness of wall of right lobe are 43.7 ± 0.25 mm, (46.6 ± 0.16) gram., (4.2 ± 0.03) mm (Table 1), the pancreas was long gland, is on the lower right side of the abdominal wall between the arms of the duodenum (Fig.1), The mean length and weight of pancreas was (97.5 ± 2.20) mm, (3.12 ± 0.26) gm respectively.

The histological examination of this study revealed that the liver of pigeon was composed of a parenchyma covered by capsule which is composed of regular dense connective tissue that contains collagen reticular and elastic fibers. This capsule also contains lymphatic vessels, collagen fibers and fibroblasts (Fig. 2,3). The parenchyma of the liver consists of hepatocytes which are arranged in plates, its thickness was either one cell or two cells around sinusoids. The hepatocytes constitute parallel cords to the capsule whereas it was arranged radially inward composing small lobules and acini, hepatocytes radiated around the central vein and between these cords there is sinusoids lined by a layer of fenestrated endothelial cells. Lumen of sinusoids contained mainly erythrocytes and macrophages. In the boundary of each lobule showed portal area which consists of hepatic artery; hepatic vein and bile duct lined by cuboidal cells (Fig.3). The mean thickness of capsule diameter of hepatic central vein portal vein, hepatic artery and hepatic duct in each left and right lobes of liver were (145 ± 12.6) μ m, (624 ± 32.4) μ m, (523 ± 90.0) μ m, (190 ± 20.4) μ m and (325 ± 12.1) μ m respectively (Table 1). The pancreas was serous tubuloacinar gland which was covered by a thin connective tissue capsule consisting of collagenous, elastic and reticular fibers (Fig.4). The glandular parenchyma was composed of exocrine portion and pancreatic islets. The mean thickness of pancreas capsule in this study was (47 ± 2.2) μ m. The duct system composed of intercalated duct, intralobular duct, interlobular duct and main excretory duct (Fig.4).

Histochemically, The hepatic cells were positive to periodic acid schiff stain (Fig.3). The pancreatic islets were composed of large Alpha and small Beta islets, The epithelial cells take the red color by Van Gieson stain (Fig.4). The acinar cells of the pancreas contain red granules with PAS - AB (Fig. 4).

Table (1): Measurement of thickness of capsule, diameter of central vein, portal vein, hepatic artery and hepatic duct of the liver and pancreas of homing pigeon (μ m) ($X \pm S.E$).

Part Measure	Left lobe of liver	Right lobe of liver
Thickness of capsule	145 ± 12.6	145 ± 12.6
Diameter of central vein	624 ± 32.4	624 ± 32.4
Diameter of portal vein	523 ± 90.0	523 ± 90.0
Diameter of hepatic artery	190 ± 20.4	190 ± 20.4
Diameter of hepatic duct	325 ± 12.1	325 ± 12.1

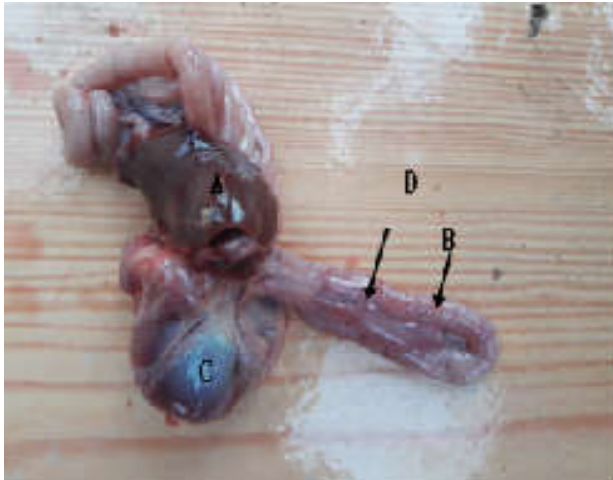


Fig. (1): Macroscopic section of liver and pancreas in pigeon, showing : no gall bladder, (A). liver, (B). duodenum, (C). gizzard.

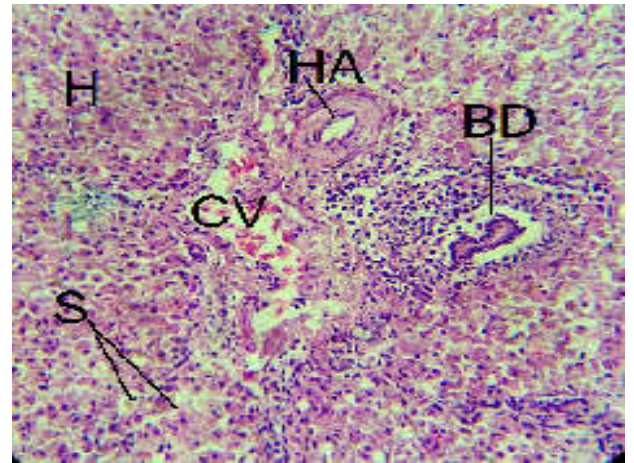


Fig. (2): Gross microscopic section of liver in pigeon BD. Bile duct, HA. Hepatic artery, CV. Central vein, H. hepatocyte, S. blood sinusoid, H & E stain (X400).

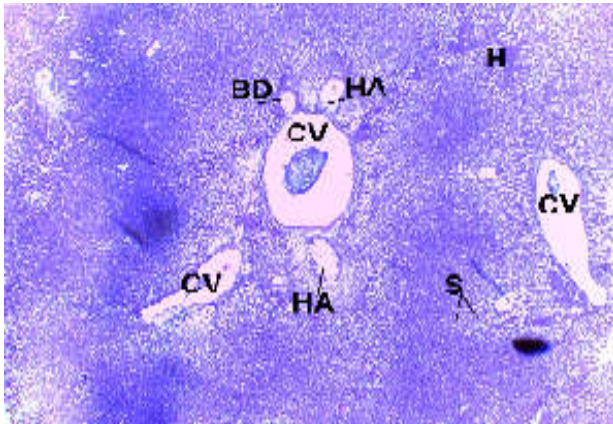


Fig. (3): Gross microscopic section from liver in pigeon : B.D. bile duct, C.V. Central vein, H. hepatocyte, S. blood sinusoid, H.A. Hepatic artery PAS stain (X400).

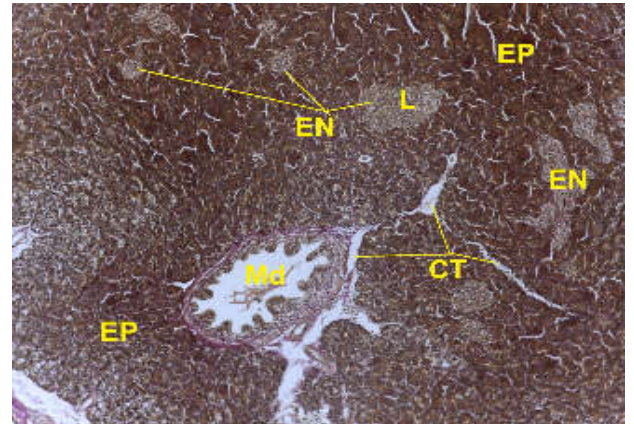


Fig. (4) Gross section from pancreas in pigeon : C.T. connective tissue, E.P. Exocrine, EN. endocrine, M.d. Main duct, F.B. Fibroblast, L. islets of Langerhans, Van Gesion stain (X400).

Discussion

The liver of pigeon lie in the right and left hepatoperiatoneal cavity, it has red brown to dark brown color. This result agreed with (12) who said the normal color of the adult male geese was red brown to dark brown and disagree with (2) who remained that the normal color of the avian liver depended on the nutritional state of the bird and it is red brown or it may be light brown but it is yellow if the bird is on a high fat diet. A gross examination of the present

study showed that the liver was a bilobed, these results are accompanied with the description of other birds such as captive bustards (20), ostrich (8) *Odoinus niger* (21), *Struthio camelus* (22) and other avian (23). The size of weight and color of the liver are dependent on the breed and the age and nutritional status of the individual bird (20). The pancreas was long gland, is on the lower right side of the abdominal wall between arms of the duodenum, This finding is in agreement with the result (24) and (25).

The parenchyma of the liver lobule is composed of hepatocyte arranged in branching plates and this separated by blood sinusoids and arranged in radiation the result was similar to those observed in turkey and pintail duck in (26). Numerous granules of glycogen in the cytoplasm, this agrees with (1) in chicken. The pancreas gland is covered by a thin capsule which concurs with the findings (16) in geese. In contrast, the capsules of pancreas were more thickening in the turkey (27). The capsules of pancreas are made of collagenous, elastic and reticular fibers, which correlate to the findings of (26) in ducks and (16) in geese. (16) stated the features of the mucous of the epithelium of the pancreatic duct are found to be different depending on the type of digestion. The duct system of pigeon pancreas composed of intercalated duct, intralobular duct, interlobular duct and main excretory duct. This finding is in agreement with the result (27). The hepatic cells were positive to periodic acid schiff and alcian blue reaction, The pancreatic islets are composed of large Alpha and the small Beta islets, these similar to (1) in chicken. These pancreatic islets which consisted of various shapes of large Alpha and small Beta islet were in agreement with the previous findings (15).

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