Histological Study of Exocrine Pancreas in Kestrel (*Falco tinnuclulus*)

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Abstract:- The purpose of this investigation was to study the histologicalcal structure of exocrine pancreas on ten healthy adult male of kestrels (*Falco tinnuclulus*). After anesthesia, tissues pieces were dissected from the lobes, samples were fixed in formalin processed and stained by H&E ,PAS and Masson trichrome stains for light microscopic study .The pancreas is located on the right side of the abdomen between the ascending and descending loop of the duodenum ,it consists of dorsal, middle and ventral lobe ,it was hard to recognize between the three lobes .Microscopic examination showed that the pancreas covered with a very thin layer of connective tissue with flattened mesothelium cells .The exocrine unit (tubuloacinar glands) comprised of pancreatic acini were pear, spherical to ovoid in shape and ducts .The acini unit lined by single layer of pyramidal cells had dark circular nucleus in the central part of the cell. The duct system were arranged as intercalated ducts, intra lobular ducts, inter lobular ducts and main pancreatic ducts. In conclusion ,it has been discovered with the exception of a few secondary characteristics, the exocrine histological structure of the Kestrel *(Falco tinnuclulus*) pancreas is identical to that of other bird species.

Keywords: Histological, Pancreas , Exocrine , ,Kestrels .

1-Introduction

Kestrel is a characterized member of the falcon family , and one of the most popular birds of prey , it is numerous and wide spread of the world , have much or varied colors , feed on different insects types or tiny mammals such as mice , young ground squirrels and sometime feeds even small birds [1]. Accessory organs of digestive system includes (liver and pancreases), the pancreas of birds is the largest accessory gland connected with alimentary tract; it is consist of exocrine and endocrine compartments [2] and [3]. The exocrine tissue consists of the bulk of the pancreatic mass; it secretes digestive enzymes that pass through the duct system to be delivered to the duodenum [4] . The pancreas consists of serous acini lobules. The secretory unit acinus appeared as a single globular mass consisting of many serous

cells surrounding the narrow lumen [5] and [6]. The acinar cell was large pyramidal, with a large rounded vesicular nucleus. Its apical part had fine deeply stained zymogenic granules [7] .The ductal system in the pancreas of birds consists of intercalateed ,intralobular, interlobular and the main excretory duct, and the epithelium lining the ducts varies from simple cuboidal in the intercalated and intralobular duct to the tall columnar in the interlobular duct [8]. In birds, the main excretory ducts which opened into the duodenum were reported to be the dorsal and ventral pancreatic ducts, and a third duct in certain other bird species [9]. The main duct wall consisted of mucosal, muscular and adventitial layers. In addition to dark principal, light and basal cells were observed in a simple columnar epithelium layer lining the duct. Glands, including centroacinar cells, are detected in all layers of duct. Furthermore, lymphoid follicles are observed in the connective tissue of the mucosa. Sulfated and carboxylated mucosubstance-secreting cells are found in the duct as well as neutral, acidic, and mixed mucosubstance-secreting cells [10]. This type of bird was chosen, which is characterized by its meaty nutrition that differed from other birds that previously studied and there was little information available concerning histological details of pancreas in kestrels. Therefore, the objective of this study was to investigate the histologicalcal structure of exocrine pancreas in adult kestrels.

2-Materials and Methods

A total of ten healthy adult male specimens of kestrels , every kestrel was anesthetized then the abdominal feathers were removed and the body cavity was opened through amid ventral incision ,then pancreas was removed from the duodenum and washed by 0.9% normal saline ,samples were fixed in 10% formalin for 24 hours, then rinsed in tap water for 4-5 hours and then transferred to various histological procedures :samples preserved in 70% ethyl alcohol hydrated in a graded series of alcohol, purified in xylene and embedded in paraffin wax as usual. Then sections 4-6 µm thick were mounted on clean glass slides .The specimens were stained with hemotoxylin and eosin (H&E) ,PAS stain and Masson trichrome stain. General histological observation included description of the structure of the pancreas plus several miocromorphometric parameters which achieved by using ocular micrometer the parameters included the thickness of capsule ,diameters of acini unit and the height of acini cells .

3-Results and Discussions

The current investigation in male adult kestrels revealed that the pancreas of kestrels consists of three lobes, dorsal lobe, ventral lobe, and middle lobe, It was hard to recognize between the three lobes as showen in (Figure 1) this result is similar to the finding of [11] in Pancreras of (*Falco tinnunculus)* and [12] in the European starling (*Sturnusvulgaris)* in contrast with[13], which confirmed in the comparative study of the pancreas of (*Columba livia Gmelin*) pigeons and (*Accipiter nisus Linnaeus*) sparrows ,the pancreas in both species of birds consists of three lobes: the dorsal lobe, the ventral lobe, and the splenic lobe ,while [14] in pancreas of hovering hawk (*Buteo buteo*), [15] in *Rhea americana* and [16] in white - eared bulbul

(*Pycnonotus leucotis*) whom confirmed that it consists of only two lobes, the dorsal lobe and the ventral lobe. Microscopic examination of the pancreas showed that it was covered with a very thin layer of connective tissue composed mainly of collagen and reticulur fibers in addition to fibroblasts , this capsule was covered with flattened mesothelium cells as shown in (Figure 2), this result is in agreement with [17],in Japanese Quail (*Coturnix coturnix japonica*) , [18] on the pancreatic capsule in Golden Eagles (*Aquila Chrysaetos)* , [19] in mature pigeon (*Columba Livia*) , [20] in goose (*Anser anser*) , [11] in kestrel (*Falco tinnunculus*) and [6] in Quail (*Coturnix coturnix japonica*) but in contrast with [7] in Ostrich (*Struthio camelus*) and [21] in turkeys ,whom reported that the pancreas was covered by a thick double-layer capsule with a fibrous inner lining of tissue , the average thickness of these capsule in kestrels were (10.07± 1.55 µm) as showed in (Table 1).

Table (1): Measurements of the thickness of capsule, diameter of acini and height of the acini cells in male adult kestrels (Mean ± Standard deviation).

Pancreatic Measurements	**(Mean ± SD)**
Thickness of capsule	10.07 ± 0.55 µm
Diameter of acini	21.26 ± 2.31 µm
Height of the acini cells	10.05±0.23 µm

Microscopic examination of the pancreas showed that the exocrine unit (tubuloacinar glands) comprised of pancreatic acini were pear, spherical to ovoid in shape and ducts of different orders between the lobes and lobules as showed in (Figure 3), this is in line with [22] in pancreas of Homing Pigeon (*Columba Livia Domestica*) and [6] in Quail (*Coturnix coturnix japonica*) and Cattle Egret (*Bubulcus ibis*) . This results disagreement with the results of [21] whom mentioned that the acinar unit in pancreas of native turkeys was cup-shaped , the microscopic investigation revealed that the acini unit lined by single layer of pyramidal cells have a dark circular nucleus in the central part of the cell and one or more nucleoli may be observed, acidophilic granules (zymogen granules) found in the apices of cells as showed in (Figure 4). This result enhanced by[5] in duck (*Anas boscas*) and pigeon (*Columba livia*); [11] in adult Kestrel and [23] in duck and pigeon. These cells characterized by bizonal cytoplasm referred to the presence of acidophilic granules in the apical portion and rich in ER in the basal portion, which in agreement with [18] in golden eagle, who found that the bizonal character of acinar cells could be attributed to the presence of mitochondria and zymogenic granules in the basal and apical part and showed cytoplasm with eosinophilic zymogenic granules and small centroacinar cells without granules projected into the acinus lumen. The average height of these acini cells were (10.05±0.23µm) , the average diameter of acini unit were (21.26 ± 2.31µm) as noted in (Table 1) .The present study demonstrated that there were darkly stained flattened centro acinar cells are located in the lumen of the acini unit.

These cells were flattened in shape, relatively smaller and brighter had prominent round nuclei with pale cytoplasm without granules than the acinar cells as showed in(Figure 4) this result agreed with[24] and [25]in dove; [26] in goose, [27] and [23] in the pigeon. But the centro-acinar cell is not observed in Mynah [28], in Guineafowl and Common gull [29] and [30] in Mynah.

The current study found that the duct system were arranged as intercalated ducts, intra lobular ducts, inter lobular ducts and main pancreatic ducts. The lumen of each acinus continues with the narrow lumen of the intercalated duct. The intercalated ducts had an intra-acinar portion. This portion was lined with centro-acinar cells which were relatively smaller cells, had a pale cytoplasm, which is represented by a single layer of simple squamous epithelium as illustrated in (Figure 5) .This result were similar to that described in goose by[4], in pigeon by [19] and in Quail (*Coturnix coturnix japonica*) and Cattle Egret (*Bubulcus ibis*) by [6] .This result disagreed with the finding of [8] in common quail, [27] in pigeon, and [26] in goose whom found that the intercalated duct was lined with simple cuboidal cells. On the other hand [11] in adult Kestrel (*Falco tinnunculus*), who confirmed that the intercalated duct was absent. The intra lobular ducts which lined with simple cuboidal cells with rounded nuclei, scanty connective tissue fibers are found surrounding these channels as illustrated in (Figure 6). This results are in line with those by [8] in common quail ,[31] in Japanese quail; [32] in duck; [27] in pigeon; [33] in Abu Ghra bird, [5] in goose and [6] in Quail (*Coturnix coturnix japonica*) and Cattle Egret (*Bubulcus ibis*). The current results in contrast with [34] who found that the intra lobular ducts in falcon lined with simple squamous epithelium and with [4]who found that the intra lobular ducts in goose lined with tall columnar epithelium.

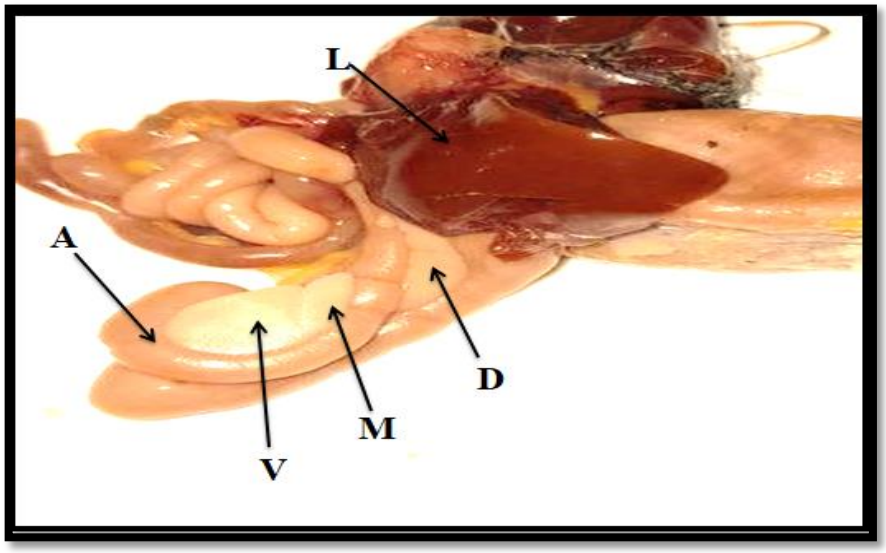
The histological results indicated that the interlobular duct was located in the connective tissue between the lobules of the pancreas and lined by a simple columnar to the low columnar epithelium abundant connective tissue was surrounding these ducts as illustrated in (Figure 7). These findings were in agreement with many other researchers such as [17] in quail; [32] in duck; [35] and [11] in adult Kestrel (*Falco tinnunculus*).

Our results revealed that the wall of the interlobular duct did not contain serous glands .This result agreed with the findings of [31] in Japanese Quail, [19] in the pigeon and [30] in Myna. As the same time our results differs with many researchers such as [4] and [26] in goose and [6] in Cattle egret, whom mentioned that the wall of the interlobular duct contained serous glands in the connective tissue.

The histological examination showed the interlobular duct carry pancreatic secretions into larger ducts (main ducts) to drain into the duodenum, the main excretory ducts were lined by a simple columnar cell with rounded nucleus, longitudinal folds are found in the mucous membrane, and its wall consists of a thick layer of connective tissue as showed in (Figure8) .These results were in agreement with many other researchers such as [6] in quail (*Coturnix coturnix japonica*) and Cattle Egret, [36] in *Coturnix coturnix* and and *Pterocles alchata*. The current results in contrast with [20] in goose described that the main duct was lined by simple to stratified columnar cells while [5] in goose and [30] in Mynah whom described that the main duct

was lined by stratified cuboidal to stratified columnar epithelium. Moreover, the connective tissue around the main ducts contains thick layers of smooth muscle fibers which is in accordance with [10] in goose.[23] confirmed that the variation or similarity between the duct system of avian species may be related to inhabitant environment, nature of diet and feeding habits.

In conclusion, it has been discovered with the exception of a few secondary characteristics, the exocrine histological structure of the Kestrel *(Falco tinnuclulus*) pancreas is identical to that of other bird species.



Figure(1): illustrated the pancreas of kestrel :**D-** dorsal lobe .**M-** middle lobe .**V-** ventral lobe . **A-** the duodenum . **L-** liver .

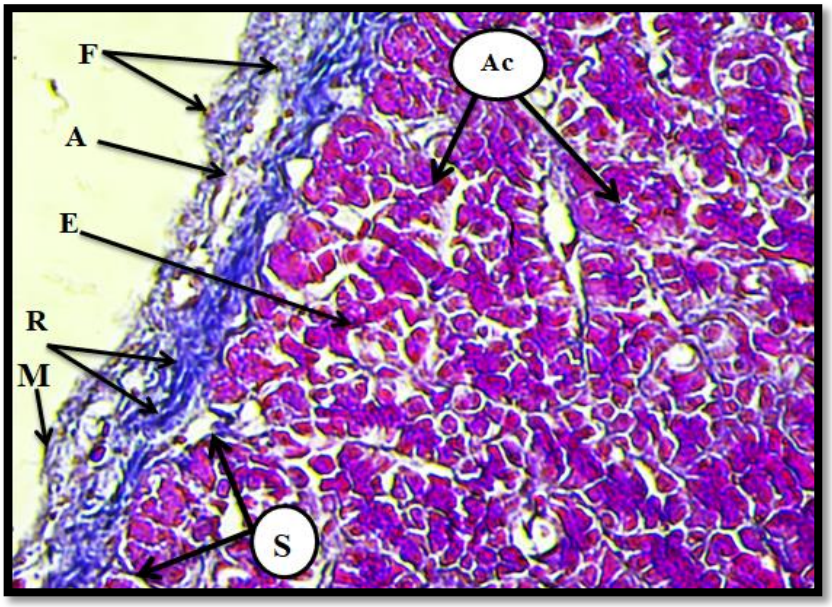
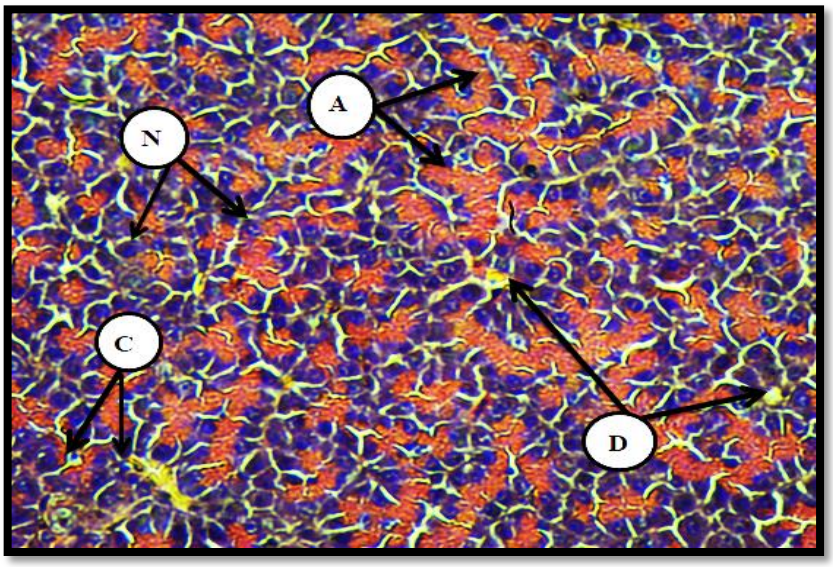
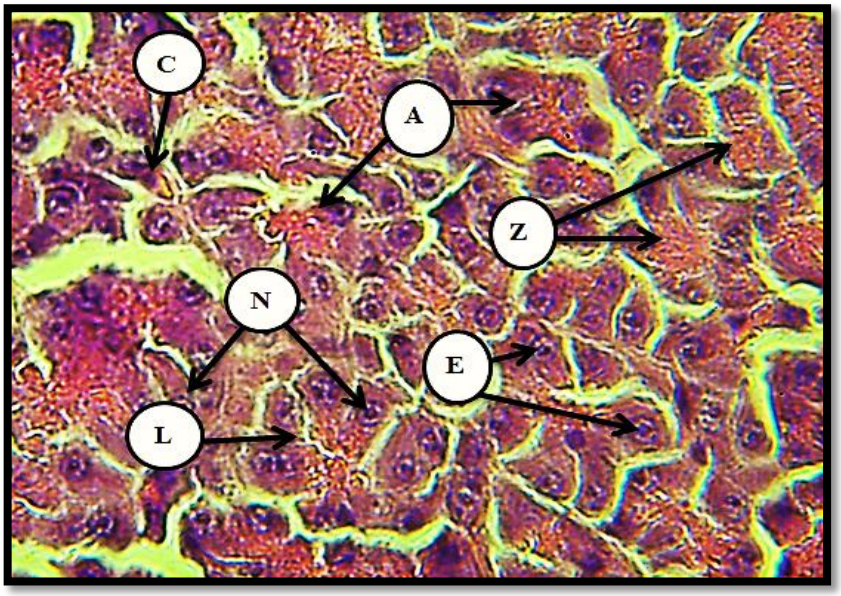


Figure (2): Show the capsule surrounded the pancreas of adult male kestrel .**A**- Capsule .**R**- Connective fibers .**E**- Parenchyma .**M**- mesothelium layer .**F**- Fibroblast **Ac**- acini cell . **S**- connective tissue septa .Masson trichrom .stain (200 X).



Figure(3): Light micrograph of kestrel pancreas showed exocrine unit **A**- (tubule acinar glands **N** -Nucleus cells of glandular epithelium. **C**- Centeroacinar cells & **D**- Intercalated duct .PAS stain (100 X)



Figure(4): Light micrograph of kestrel pancreas showed :**A** -Acinus .**N** -Nucleus cells of glandular epithelium .**E** -Nucleolus of acinar cell. **Z**-Zymogen granules . **L**- Acinus lumen. **C**-Centero acinar cells . H& E (400 X).

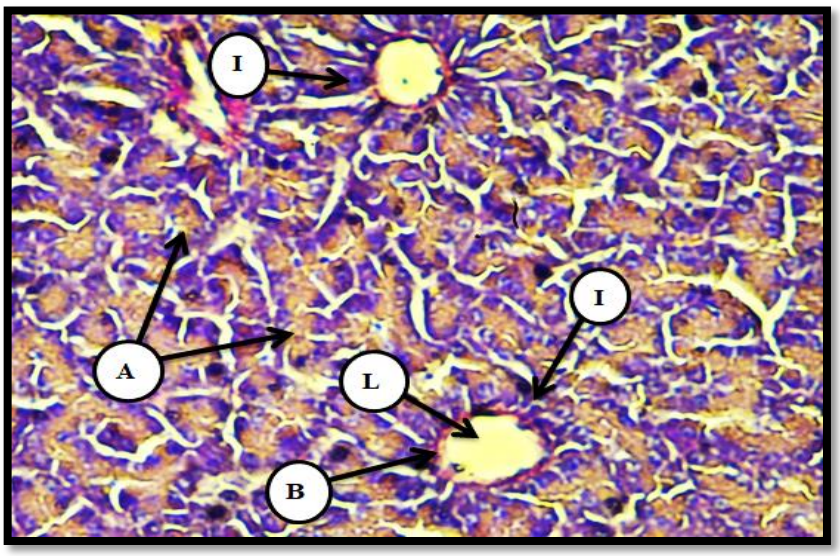


Figure (5): Light micrograph of kestrel pancreas showed : **A**- Intercalated ducts. **B**-Intercalated duct epithelium. **L**- Lumen of intercalated ducts .**Ac**-Acinar tissue . PAS stain (200X)

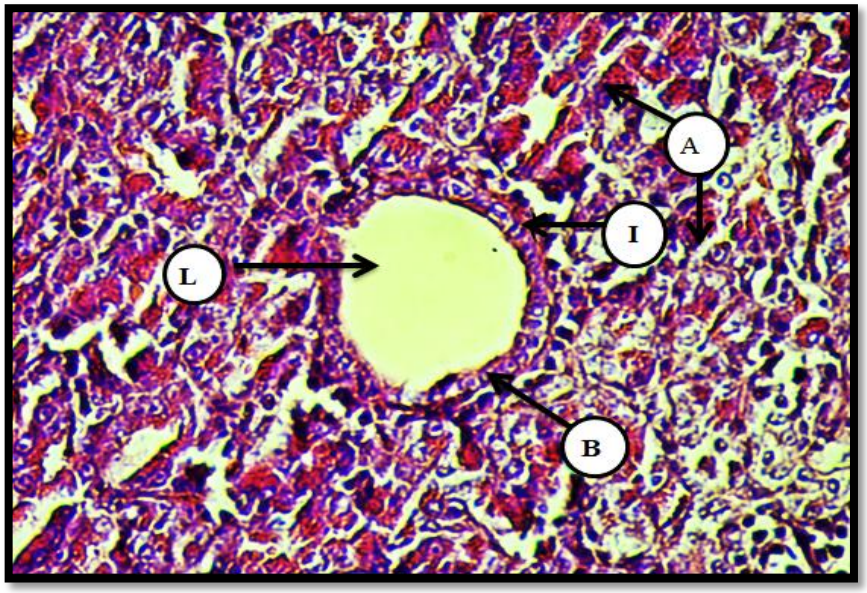


Figure (6): Light micrograph of kestrel pancreas showed: **A**- Intra lobular ducts .**L**- Lumen of intra lobular ducts. **B**-Intra lobular duct epithelium .**Ac**-Acinar tissue . H& E stain (100 X)

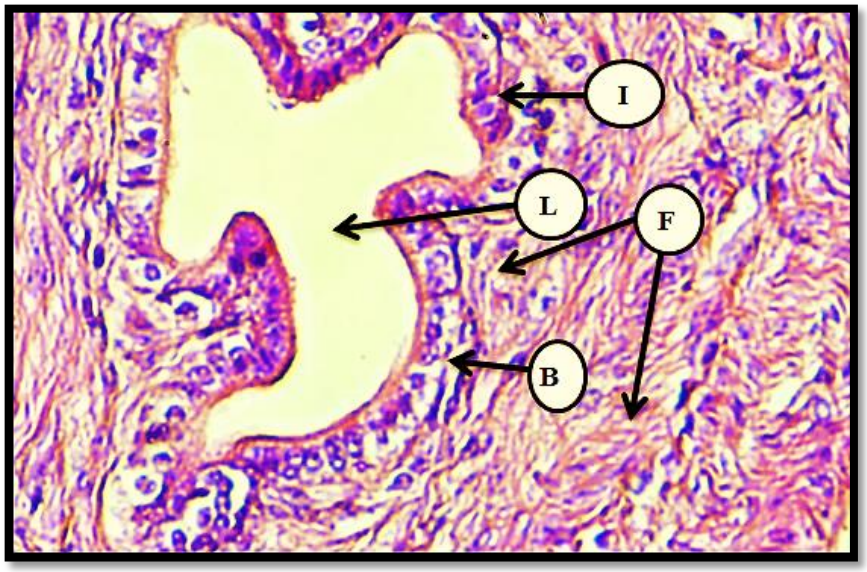


Figure (7): Light micrograph of kestrel pancreas showed: **A**- Interlobular ducts .**L**-Lumen of intra lobular ducts. **B**- Intre lobular duct epithelium .**F**-connective tissue fibers .PAS stain (100X)

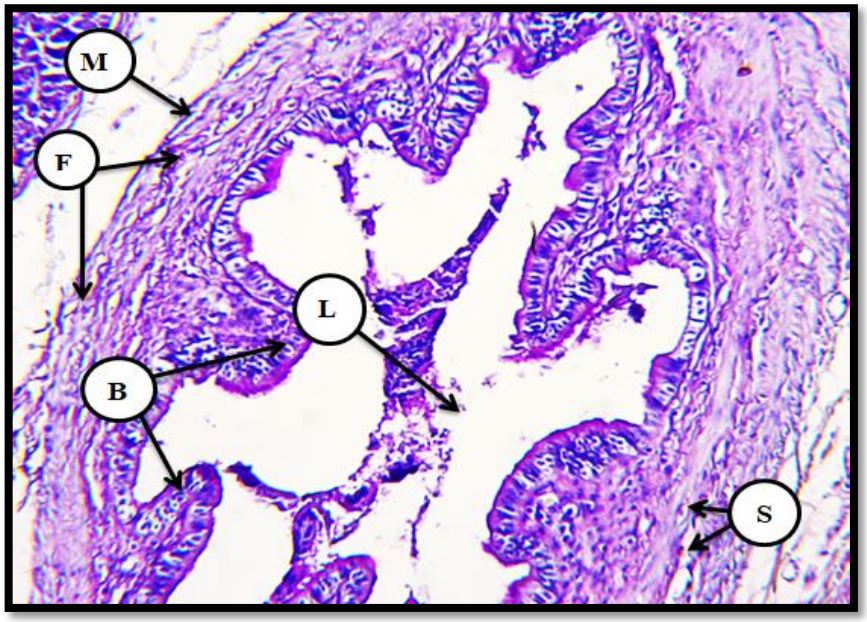


Figure (8): Light micrograph of kestrel pancreas showed: **M**-Main ducts .**L**-Lumen of the main ducts . **B**-Epithelium of main duct. **F**-Connective tissue fibers , **S**-Smooth muscle .PAS stain (100X)

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