

Histological Study of Exocrine Portion of Pancreas in Guinea fowl (*Numida meleagris*)

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ABSTRACT: Due to the importance of the pancreas gland and its important role of the digestion process, as well as the economic importance of guinea fowl (*Numida meleagris*). The present study was conducted to study the pancreas histologically in guinea fowl. Samples were taken from the pancreas of (15) healthy adult males of guinea fowl after slaughtering them and separating the pancreas from its appendages. All samples were subjected to histological techniques. In the current study, four types of stains were used when conducting the histological study, which are the Masson trichrome stain, Hematoxylin and eosin stain, Gomori's stain and Periodic Acid-Schiff stain. This current study discovered that the pancreas of guinea fowl was parenchymal tissue surrounded by a thin connective tissue capsule. The microscopic examination exhibited the parenchyma tissue of the pancreas was composed of an exocrine portion and an endocrine portion. The exocrine portion forms the largest area of pancreas and consisted of acini and ducting system. The secretory acini vary in shapes and size as globoid, oval, elongated and amorphous, while the exocrine ducts system consisted of intercalated, intralobular, interlobular, and the two major pancreatic ducts, the current study detected that the guinea fowl (*Numida meleagris*) exhibits the identical structure as other bird species.

Keyword: Histology, Pancreas, Exocrine, Guinea fowl.

1. Introduction

Guinea fowl or “helmeted guinea fowl” is a poultry species native to Africa. Its name from the coast of Guinea in West Africa, where it is believed to have originated [1]. Guinea fowl contributes to providing animal protein (meat and eggs), in addition to

income generation from the sale of birds and eggs [2]. The pancreas is a significant mixed gland linked with the digestive tract [3]. It was a serous tubuloacinar gland that was encased in a thin capsule of loose connective tissue [4]. The pancreas is positioned on the right side of the abdominal cavity in all birds, and it is bonded together by blood vessels and the mesentery situated between the descending and ascending duodenal loops hold it together [5]. The pancreas is generally understood to be divided into two regions: an exocrine portion, and endocrine portion [6]. The exocrine pancreas is made up of the acinus, that produces pancreatic juice, and the pancreatic duct, that carries pancreatic juice [7]. Acinus is composed of conical serous gland cells that are largely responsible for the creation, storage, and secretion of digesting enzymes [8]. Most birds have centroacinar cells, a unique type of cells, are also present in central pancreatic acini that produce salt and bicarbonate-rich fluid. These cells may have two nuclei but lack granules [9],[10]. The ducts system of avian composed of intercalated, intralobular, interlobular, and main ducts. The duct epithelium ranged from basic squamous to stratified columnar cells [11]. In poultry, the wall of pancreatic ducts comprised of three layers: from inside the mucosa, is consisted of epithelial cells, and the lamina propria, this is surrounded by a muscular layer and the last one, the adventitial layer covers the duct from the outside [12]. The current study was investigated histologically of guinea fowl pancreas to provide the base line information.

2. Materials and Methods

In this study were used fifteen healthy adult male guinea fowl samples. These birds were slaughtered and the pancreas was immediately eliminated from the right-side bird's abdominal cavity after a longitudinal fissure. The lobes of pancreas were detached and cleaned in 0.9% normal saline. The pancreatic specimens were fixed in 10% formalin for 24 hours before being washed and dehydrated with alcohol gradients and cleared with xylene. All specimens were soaked in paraffin wax before being embedded. The specimens were then cut to 5mm lengths. H&E stain, PAS stain, Masson trichrome stain, and Gomori's technique for Langerhans islets were used to stain these specimens. An ocular micrometer was used to measure the thickness of the capsule, the diameter of the acini, and the height of the acinar cells. The slides were then viewed under a light microscope, and microphotographs were made of the sections using a digital camera.

3. Results and Discussions

The microscopic examination of pancreas of male adult guinea fowl is covered with a thin layer of loose connective tissue capsule, as shown in (Figure1). The current study's findings are consistent with [10] in Kestrel (*Falco tinnunculus*), [34] in native ducks (*Anas Platyrhynchos*), [31] in Quail (*Coturnix coturnix japonica*) and [35] in See see (*Ammoperdix griseogularis*). Whereas, in contrary, [32] in Ostrich, [30] in Turkey and

[37] in hen, whom found that the pancreas was coated with a dense, bilayer connective tissue capsule lined with a fibrous layer of tissue. In guinea fowl, the capsule composed of elastic, collagen a reticular fiber as well as fibroblasts, blood vessels, and nerves that were primarily parallel to the mesothelial lining, as shown in (Figures 1,2,3), this finding noticed in the pancreatic capsule by [16] in Caspian gull, [6] in Common gull and [3] in chabro chicken. The current study of the pancreas in male adult guinea fowl showed that the exocrine portion is formed from a serous compound tubuloacinar gland and occupied a larger area of the parenchyma of pancreas and it's associated with duct system. The current study detected the exocrine unite composed of pancreatic acini (tubuloacinar glands) and ducts of different orders as shown in (Figures 3,4). The results of these finding agree with Prior investigations as [25] in Duck (*Anas platyrhynchos*) and Turkey (*Meleagris gallopavo*), [29] in goose (*Anser anser*) and [3] in chabro chicken.

4. Pancreatic Acini

The secretory acini vary in shapes and size as globoid, oval, elongated and amorphous. The pancreatic acini composed of one layer of changeable number of a pyramid to quadrate or long columnar cells. The nucleus was big, spherical to oval, and positioned near the base of the pyramidal cell, with noticeable dark nucleoli. It comprises a basophilic base and a large number of terminal acidophilic zymogen granules, as shown in (Figure 4). The present study accordance with findings, [13] in white-eared bulbul (*Pycnonotus leucotis*), [36] in chick and [14] in Turkey. Whereas, [33] in Palam dove (*Streptoplia selegalensis*) and [16] in Caspian gull, whose, founded oval shaped of exocrine acini. In guinea fowl, the centroacinar cell is missing from the middle of the acinus lumen. These results of the current study are in similar with [15] in Mynah, [6] in common gull and [16] in Caspian gull. On the other hands, these study disagreement with [17] in Kestrel (*Falco tinnuclulus*), [18] in falcon (*Falco peregrinus*) and [38] in turkey (*Meleagris gallopava*), which reported the centroacinar cells were found in the center of the acinus lumen. The basal cytoplasm of pancreatic acini is rich in rough endoplasmic (ER), and the apical cytoplasm is packed with zymogene secretory granules. Therefore, it appears basophilic on their bases and acidophilic on their apical. The average diameter of acini in guinea fowl were ($30.12 \pm 1.05 \mu$), as showed in (Table 1). Whereas, the average height of the acinar cells were ($12.65 \pm 0.28 \mu$), as showed in (Table 1).

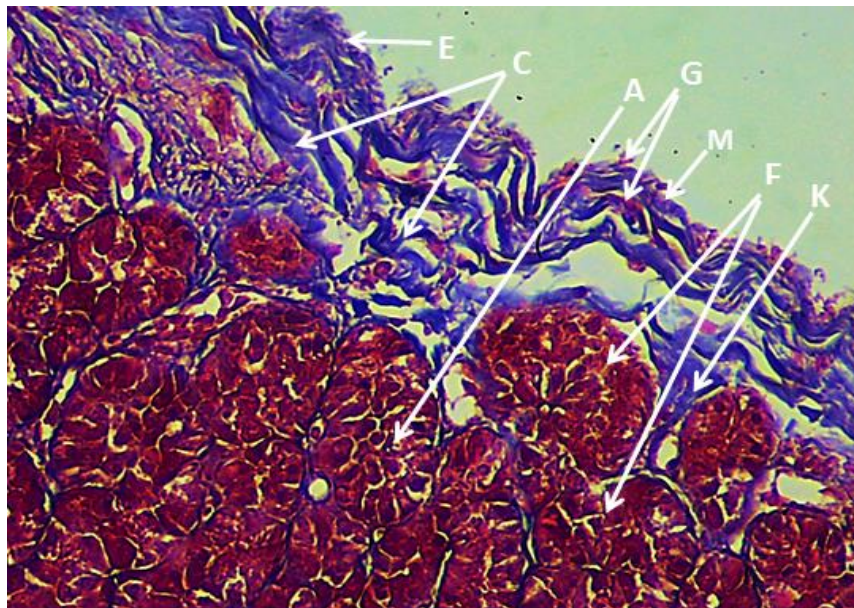
5. Pancreatic Ductal System

The current study on the guinea fowl pancreas noticed the exocrine ducts system were intercalated ducts, intralobular ducts, interlobular ducts, and the major pancreatic ducts (main ducts), as notice in (Figures 5, 6). The ductal system extends from the acinus lumens to the very small lumens of intercalated ducts. Circular intercalated ducts are bordered by simple squamous epithelium. as shown in (Figure 4). The current study is

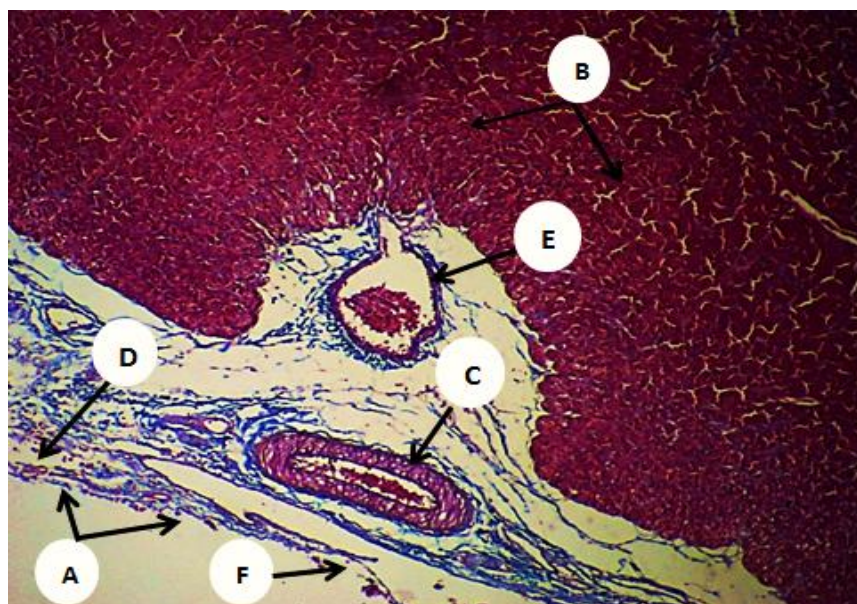
findings with [19] in goose and [17] in kestrel. But contrast with [5] in goose and [20] in the pancreas of pigeon whom found that intercalated ducts consisted of simple cuboidal cells. The intralobular ducts stretched from intercalated ducts and are dispersed during the pancreas parenchyma without defined arrangement and lined with the identical epithelial cell that covered the intercalated ducts and they are bordered with glandular acini, and they are surrounded by secretory acini, as illustrated in (Figure 6). The results of present study are similar in findings with [6] in Common gull and [21] in falcons (*Falco Anaumanni*). Furthermore, these current study disagreement with [22] in goose and [23] in duck, those were found the intralobular ducts lined by one layer of cuboidal epithelium. Intralobular ducts lead to interlobular ducts, which are made up of an epithelium that ranges from simple squamous to cuboidal epithelium and connective tissue enclosing the ducts. Interlobular ducts, on the other hand, contain thin muscle layers around the connective tissue as shown in (Figures 6,7). These results of present study is in concord with [6] in common gull and [13] in white-eared bulbul (*Pycnonotus leucotis*). Whereas, in contrary to [24] in golden eagle, [25] in Duck (*Anas platyrhynchos*) and Turkey (*Meleagris gallopavo*) and [26] in red jungle, those researchers reported that interlobular ducts composed of simple columnar cells. The results of histological study revealed that interlobular ducts in guinea fowl to flow into a large duct, which were pancreatic ducts (main ducts). The main ducts were lined with a single layer of simple cuboidal epithelium before changing to simple columnar epithelium. The mucosa of a wall of pancreatic duct contained connective tissue. Inner longitudinal and outer circular muscle fibers encircled the lamina propria in an equal proportion. Tunica adventitia was observed, as were collagen fibers at the mucosa and tunica adventitia as show in (Figures 8,9), this study agree with [21] in falcon and [6] in common gull .Whereas, disagreement with [27] in goose that founded simple to stratified layers of columnar epithelium lined the major ducts, and contrast with [28] in Japanese quail, [23] in ducks and [25] in ducks (*Anas platyrhynchos*) and Turkey (*Meleagris gallopavo*), those reported simple columnar epithelium covered the major ducts.

Table (1): Measurements of density of capsule, diameter of acini and height of the acini cells in male adult guinea fowl (Mean $\pm$ Standard deviation).

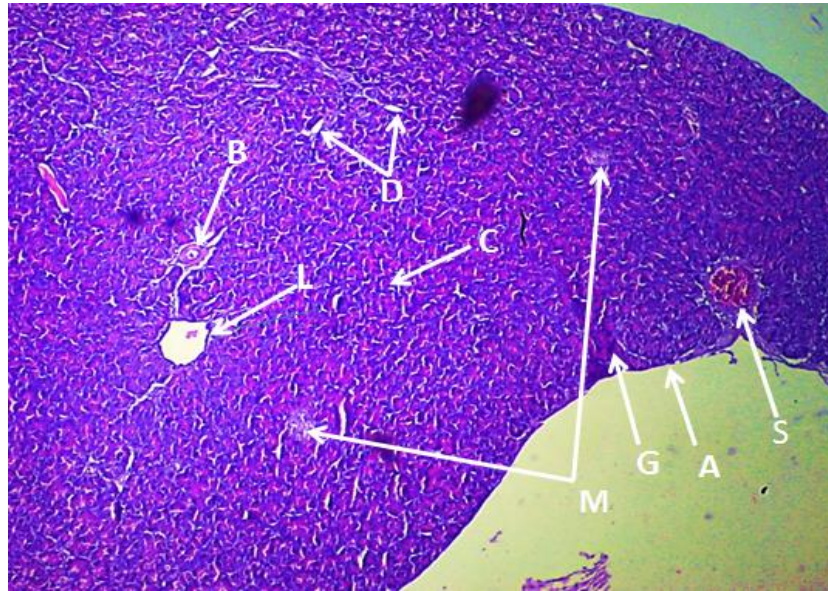
Pancreas measurement / μm (Mean $\pm$ SD)	Guinea fowl
Capsule	11.04 $\pm$ 1.67 μ
Diameter of acini	30.12 $\pm$ 1.05 μ
Height of acini cells	12.65 $\pm$ 0.28 μ



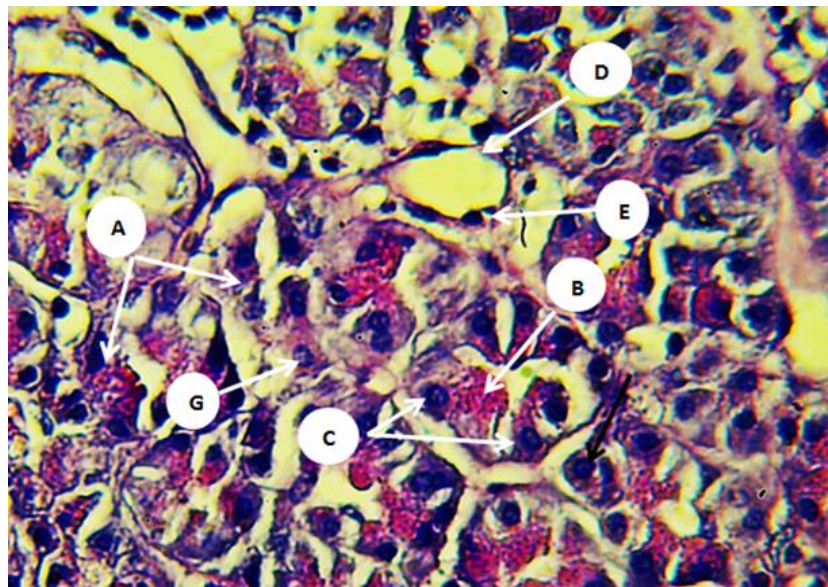
Figure(1): Photomicroscope of a cross section of guinea fowl pancreas. A- Parenchyma. F-Acini cell. M- Capsule. C- Connective Fibers. E- Mesothelium layer. G- Fibroblast. K-Septa. (Masson tichrom stain, X200)



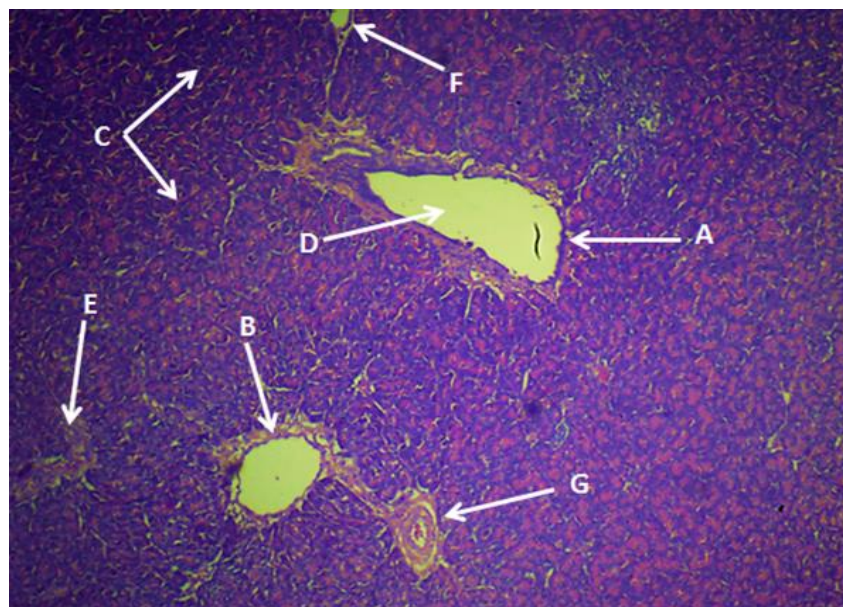
Figure(2): Photomicroscope illustrate. A- Capsule. B- Pancreatic peranchyma. C-Blood vessel (Artery). D- Connective tissue septa. E- Blood vessel (Vein). F- Mesothelium layer. (Masson tichrom stain, X200)



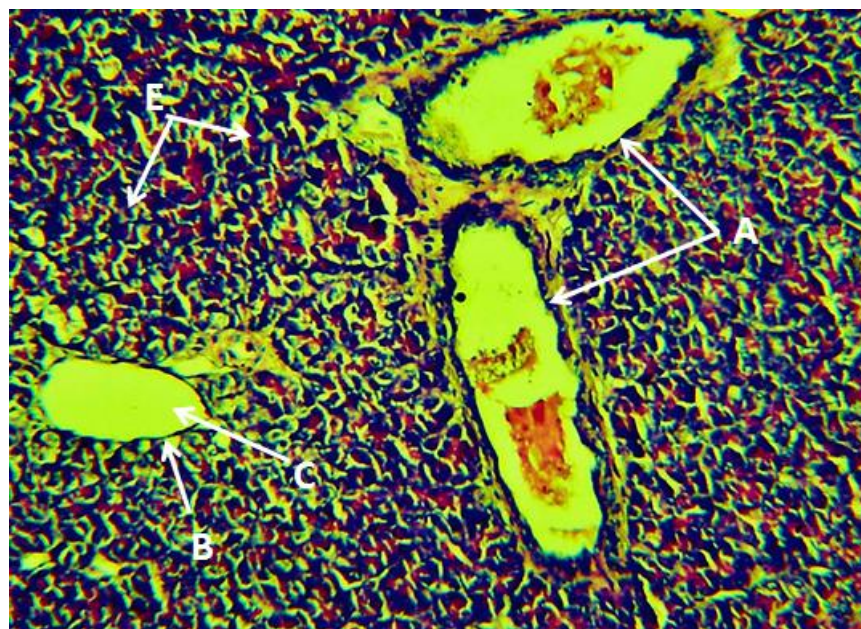
Figure(3): Photomicrograph illustrate guinea fowl pancreas. A- Capsule. S- Ganglia. C- Acinar tissue. L- Intercalated duct. D-Intralobular ducts. B- Blood vessels. M- Islets of Langerhans. (BAS, X40).



Figure(4): Photomicroscope show the structure of pancreas of guinea fowl. A- Acinar cells. B- Zymogen granules. C- Nucleus of acinar cell. D- Intercalated duct. E- Simple squamous epithelium of intercalated duct. G- Nucleolus. (PAS, X400)



Figure(5): Light micrograph of guinea fowl pancreas showed. A-Main ducts. B-Interlobular duct. C. Acinar tissue D- Lumen of the main duct. F- Intercalated duct. E- Islets of Langerhans. G- Blood vessels. (H&E, X40)



Figure(6): Photomicroscope of guinea fowl pancreas illustrate: A- Interlobular duct. B-Intralobular duct. C-Lumen of Intralobular duct. E-Acinar tissue. (H&E, X100)

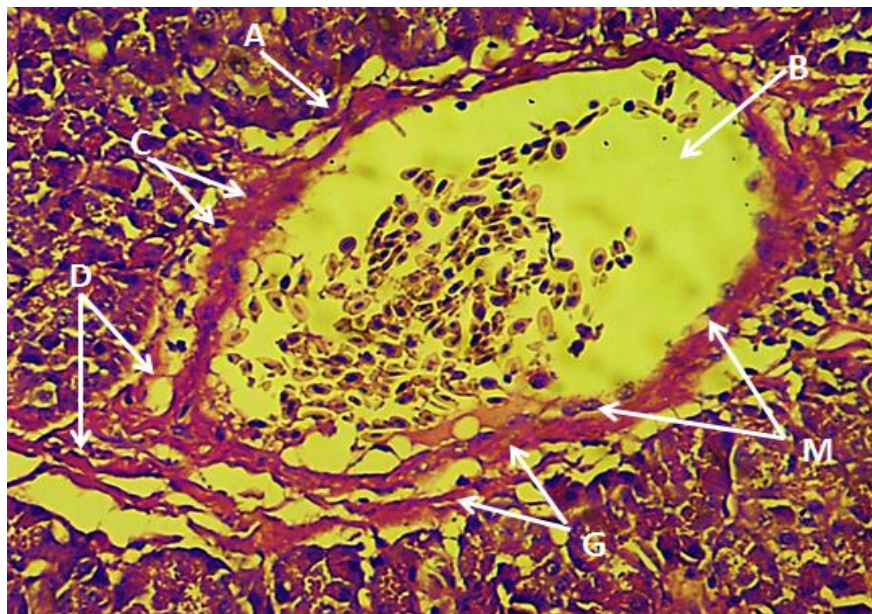


Figure (7): Photomicroscope illustrate. A-Interlobular duct. B-Lumen of interlobular duct. C-Fibroblast. D-Connective tissue fiber. M-Simple squamous tissue. G-Smooth muscle. (PAS, X200)

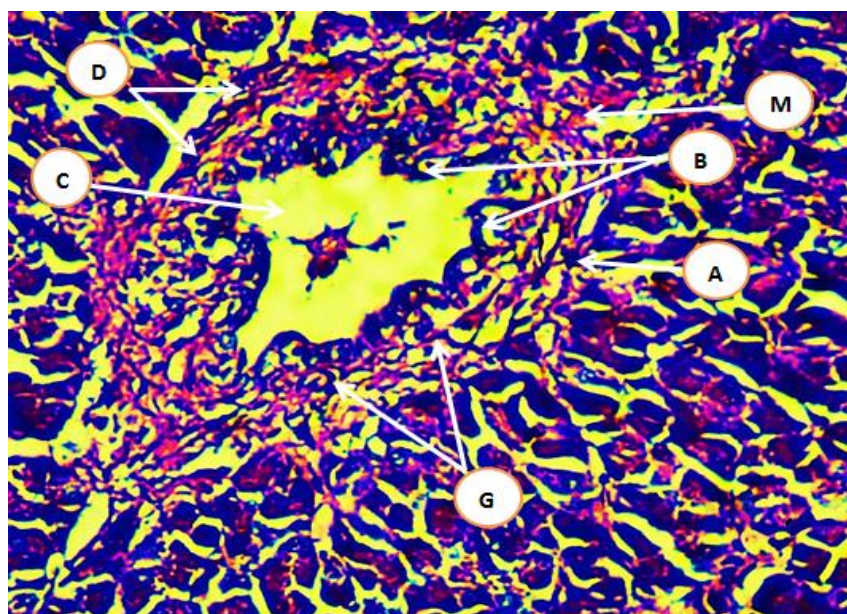


Figure (8): Photomicroscope illustrate. A-Main duct. B-Simple cuboidal epithelium. C-Lumen of main duct. D-Smooth muscle fibers. M-Connective tissue fibers. G-Fibroblast. (H&E, X200)

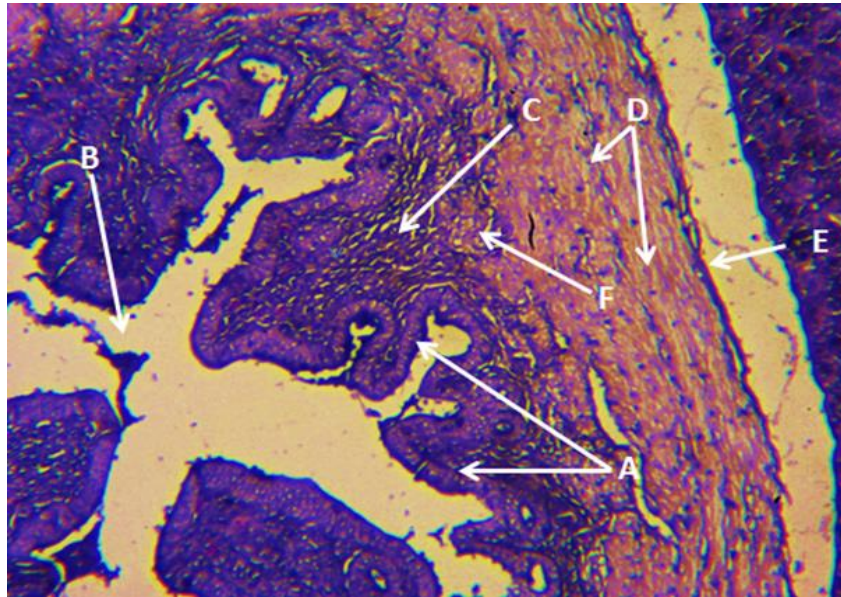


Figure (9): Photomicroscope illustrate section of main duct. A-Simple columnar epithelium. B-Lumen of main duct. C-Smooth muscles. D-Fibroblast. E-Main duct. F-Connective tissue fibers. (Gomori's, X200)

6. Conclusions

The pancreas of male adult guinea fowl is covered with a thin layer of loose connective tissue capsule. The capsule composed of elastic, collagen and reticular fibers as well as fibroblasts, blood vessels, and nerves that were primarily parallel to the mesothelial lining. The pancreatic parenchyma contains both an exocrine portion and an endocrine portion. The exocrine portion made up of pancreatic acini and a ductal system. Secretory acini varied in form and were covered a single layer of cells with pyramid shapes. Intercalated ducts, intralobular ducts, interlobular ducts, and major ducts comprised the ductal system. The epithelial of the ductal system starts from squamous epithelium and progresses to simple cuboidal or simple columnar epithelium in the main ducts. The relatively large diameter of the acini, as well as the rising height of acinar cells, reflect pancreatic enzyme activity in guinea fowl.

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