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Histomorphology of exocrine pancreas of large white Yorkshire pigs (*Sus scrofa*)

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Abstract

The present study provides a baseline data on histology of exocrine part of the pancreas of large white Yorkshire pigs. Histological study revealed that the gland was covered by a thick connective tissue capsule in splenic lobe and a thin capsule in duodenal and connecting lobes. The capsule of all the pancreatic lobes consisted of collagen, elastic, reticular fibres, adipose tissue, blood vessels and nerves. The interlobular and intersublobular septa divided the gland into lobules and sublobules. Each sublobule consisted of exocrine pancreatic acini and endocrine islets of Langerhans. The exocrine portion of pancreas consisted of many serous acini which were lined by pyramidal cells. At the basal portion of pyramidal acinar cells, spherical shaped condensed and vesicular types of nuclei were noticed. Numerous zymogen granules were observed in the apical cytoplasm of all the acinar cells. Centroacinar cells were also observed in the lumen of pancreatic acini. The duct system of exocrine pancreas was consisted of intercalated duct lined by squamous cells, intralobular duct lined by cuboidal epithelium, interlobular and main ducts lined by columnar epithelium. Numerous goblet cells among the columnar epithelial cells and small serous glands in the lamina propria were observed in the main duct.

Keywords: Histology, pancreas, exocrine, pig

Introduction

The pancreas is part of the gastrointestinal system which synthesise digestive enzymes into the intestine and hormones into the blood to control energy metabolism and storage throughout the body. Exocrine pancreas is the portion of the pancreas that includes acinar and duct cells with associated connective tissue, vessels and nerves. The exocrine pancreas comprises more than 95% of the pancreatic mass. The exocrine pancreas has two major physiologic functions: it supplies the enzymes and enzyme precursors (zymogens) that are needed for digesting dietary lipids, carbohydrates and proteins and secretes a bicarbonate-rich fluid that neutralizes acidic gastric secretions, providing the correct pH for duodenal digestion by pancreatic enzymes [1]. Rufus Epheus, a well known anatomist named the organ pancreas (from the Greek word *pan*: all and *kreas*: flesh or meat) and Andreas Vesalius gave a threadbare description of the pancreas as a glandulous organ. Johann George Wirsung, the prosecutor to Vesalius in Padua described the main duct of the human pancreas which bears his name. Santorini, an anatomist in Venice demonstrated the accessory pancreatic duct which also bears his name [2]. Although an extensive work on the structure of the pancreas has been carried out in various mammals and birds, the structural details of exocrine pancreas in large white Yorkshire pigs are limited. Hence, the present work has been undertaken with an aim to study the histomorphology of the exocrine pancreas of large white Yorkshire pigs in different age groups and to correlate the structures with the functional aspects.

Materials and methods

The Pancreas for the study was collected from healthy large white Yorkshire pigs which were slaughtered at local slaughter house, Namakkal and at the Department of Meat science, Veterinary College and Research Institute, Namakkal. The pancreas was collected from five age groups viz., four, six, eight, ten months and adult. Each group comprised of six samples of either sex. The tissues from splenic, duodenal and connecting lobes of pancreas were collected, washed and fixed in various standard fixatives such as 10% neutral buffered formalin, Bouin's fluid and formal calcium. Fixed tissues were dehydrated through ascending grades of alcohol, cleared in xylene and embedded in paraffin wax at 58-60 °C [3]. Sections of 3-5 µm thickness were made by using Leica Rotary microtome and used for routine and special histological

staining techniques. The stained pancreatic slides were studied and photographed with the help of Leica Image Analyzer.

Results and Discussion

a. Pancreatic capsule

Histological study revealed that the splenic lobe of pancreas was covered by a thick connective tissue capsule (Fig. 1) which was similar to the findings of Ali and Masaad [4] who stated that the pancreas of camel was covered by a thick connective capsule. The duodenal and connecting lobes were enclosed by a thin capsule as stated by Dhoolappa *et al.* [5] in Indian donkey. In contrast to these findings, Singh [6] reported that there was no definite capsule around pancreas in domestic animals except in dog which had only a layer of mesodermal cells at the outer surface of the capsule. Similarly, Bloom and Fawcett [7] also stated that the human pancreas was covered by a thin layer of connective tissue that does not form a definite capsule.

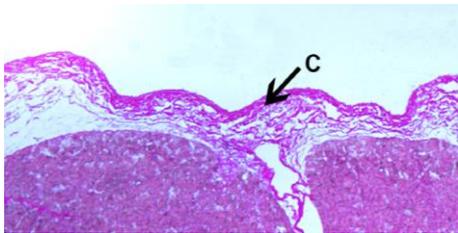


Fig 1: Photomicrograph showing the connective tissue capsule (C) in splenic lobe of pancreas of 6 months old large white Yorkshire pigs. Haematoxylin and Eosin X 40

In concurrence to the findings of Ali and Masaad [4] in camel, Singh and Gupta [8] in buffalo, Madhavi *et al.* [9] in duck and Mobini [10] in pigeon, the capsule of all the pancreatic lobes consisted of collagen, reticular, a few elastic fibres, adipose tissue, blood vessels and nerves. In the sub capsular space, cluster of adipocytes were noticed as stated by Ikpegbu *et al.* [11] in African giant pouched rat.

b. Stroma and Parenchyma

The interlobular septa from the connective tissue capsule entered the gland parenchyma and divided it into variable sized lobules as mentioned by Dhoolappa *et al.* [5] in Indian donkey.

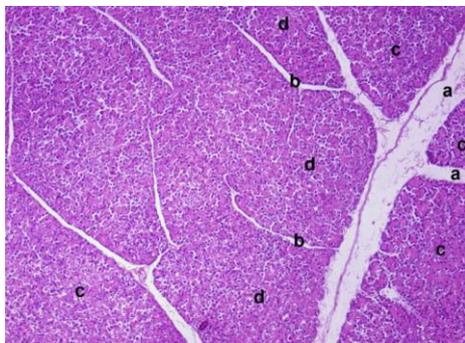


Fig 2: Photomicrograph showing interlobular septa (a) and intersublobular septa (b) dividing the gland into lobules (c) and sublobules (d) in 10 months old large white Yorkshire pigs. Haematoxylin and Eosin X 100

The lobules were again subdivided by intersublobular septa into indistinct sublobules (Fig. 2) as reported by Singh and

Gupta [8] who also stated that the pancreatic lobules were subdivided by interlobular septa into incomplete sublobules in buffalo. In contrast to these findings, the gland was not divided into lobules as there were no connective tissue septa in duck [9]. In each pancreatic sublobule, exocrine acini and endocrine islets of Langerhans were observed as reported in pigeon [10] and guinea fowl [12] respectively.

The connective tissue components of septa were composed of large amount of collagen (Fig. 3), reticular and a few elastic fibres which is in concordance with the findings of Singh and Gupta [8] in buffalo. Adipose tissue, arteries, veins, nerves and ducts were also noticed both in the interlobular and intersublobular septa in all age groups of pigs as reported by Dhoolappa *et al.* [5] in Indian donkey.

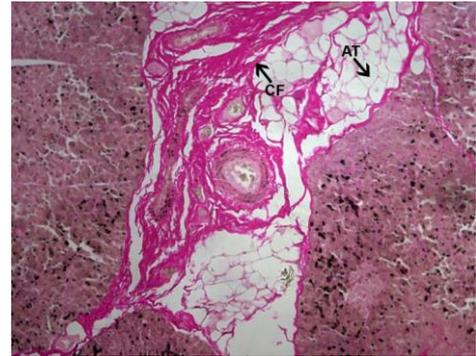


Fig 3: Photomicrograph showing Collagen Fibres (CF) and Adipose Tissue (AT) in the interlobular septa of 4 months old large white Yorkshire pigs. Van Gieson X 100

c. Exocrine pancreatic acini

In large white Yorkshire pigs, exocrine portion of the pancreas consisted of many serous acini with well distinguished duct system as described by Hamodi *et al.* [12] in guinea fowl. The enzymes are synthesized and secreted from the exocrine acinar cells, whereas bicarbonate is secreted from the epithelial cells lining small pancreatic ducts. In each sublobule, varying sized and shaped acini were noticed and all the acini were lined by pyramidal cells as stated by Eurell and Frappier [13] and Mobini [10] in domestic animals and pigeon respectively.

The pyramidal acinar cells had spherical shaped condensed and vesicular types of nuclei (Fig. 4) at their base and numerous zymogen granules in the apical cytoplasm which is in agreement with the findings of Eurell and Frappier [13] in domestic animals. The apical eosinophilic and basal basophilic cytoplasm showed gradient staining pattern in all the acinar cells as observed by Mobini [14] in goose.

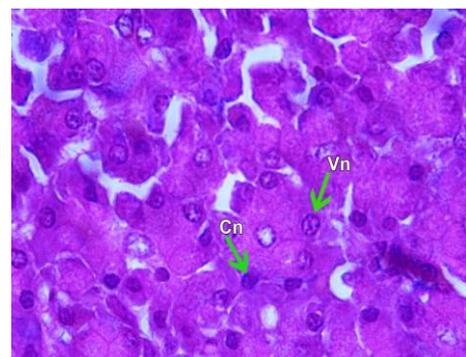


Fig 4: Photomicrograph showing pancreatic acini with Vesicular nucleus (Vn) and Condensed nucleus (Cn) in adult large white Yorkshire pigs. Haematoxylin and Eosin X 1000

The acini which were located near the islets were large and those located away from the islets were small as denoted by Bendayan and Ito ^[15] in rats. Each pancreatic acinus was surrounded by reticular fibres which is similar to the findings of Singh and Gupta ^[8] in buffalo.

The cell boundaries of acinar cells were indistinct and the lumen of the acini was narrow and small as described by Eurell and Frappier ^[13] in domestic animals. Centroacinar cells were observed in the lumen of pancreatic acini as stated by Kuehnel ^[16] in human pancreas.

d. Exocrine duct system

The duct system of exocrine pancreas was consisted of intercalated, intralobular, interlobular and main duct as noticed in domestic animals by Bloom and Fawcett ^[7] and in quail by Simsek and Alabay ^[17]

In concordance to the findings of Eurell and Frappier ^[13] in domestic animals, the intercalated ducts began with the flattened cells which were extended into the lumen of acinus as centroacinar cells. In contrast to these findings, Saadatfar and Asadian ^[18] and Hamodi *et al.* ^[12] reported that the centroacinar cells were not found in the pancreas of mynah and guinea fowl respectively.

The intralobular ducts (Fig. 5) noticed in the sublobules were lined by cuboidal epithelium as mentioned by Simsek and Alabay ^[17] in quail. But this is not in concordance with the findings of Gulmez ^[19] and Hamodi *et al.* ^[12] who stated that the intralobular ducts were lined by columnar and flattened squamous epithelium in goose and guinea fowl respectively.

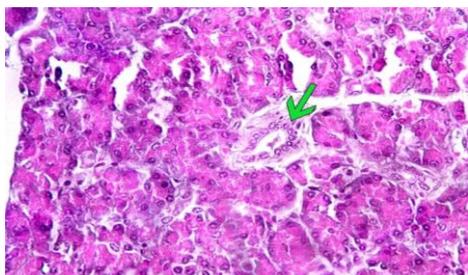


Fig 5: Photomicrograph showing intralobular duct in pancreas of 8 months old large white Yorkshire pigs. Chrome alum Haematoxylin – Phloxine X 400

As reported by Dellmann ^[20] in domestic animals and Simsek and Alabay ^[17] in quail, the interlobular and main ducts were lined by columnar epithelium. Numerous goblet cells were observed among columnar epithelial cells of main duct as observed by Singh and Parihar ^[21] in pig.

Small serous glands (Fig. 6) were noticed in the lamina propria of main ducts as noted by Gulmez ^[19] in goose and McMinn and Kugler ^[20] in rat, mouse and guinea pig.

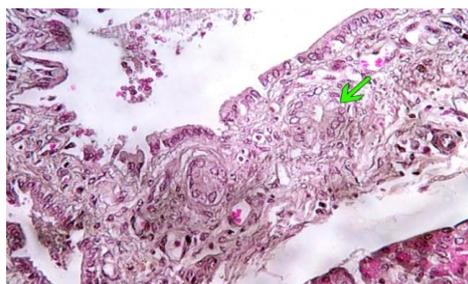


Fig 6: Photomicrograph showing serous glands in the main duct of 10 months old large white Yorkshire pigs. Chrome alum Haematoxylin – Phloxine X 400

The interlobular and main ducts were seen in the interlobular septa and were surrounded by thick layer of collagen, reticular and a few elastic fibres as in rat pancreas ^[22].

Conclusion

The present study concluded that the pancreas of large white Yorkshire pigs was covered by a connective tissue capsule which was thick in splenic lobe and thin in the duodenal and connecting lobes. The gland parenchyma was divided into lobules and sublobules by the interlobular and intersublobular septa. Each sublobule consisted of exocrine pancreatic acini and endocrine islets of Langerhans. The exocrine pancreas consisted of many serous acini with well distinguished duct system. In each sublobule, varying sized and shaped acini lined by pyramidal cells with basal nuclei were observed. In the apical cytoplasm of acinar cells numerous zymogen granules were noticed. The duct system of exocrine pancreas was consisted of intercalated duct lined by squamous cells, intralobular duct lined by cuboidal epithelium, interlobular and main ducts lined by columnar epithelium.

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