SOME HISTOLOGICAL STUDIES ON THE EXOCRINE PANCREAS OF BUFFALO
(BUBALUS BUBALIS)

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ABSTRACT

In the present study, ten healthy mature buffaloes of both sexes and of age ranged from 3-5 years old were used. The pancreas was removed just after slaughter of the animals. Tissue samples were obtained from the right lobe, left lobe, body and uncinate process of the pancreas. The specimens were immediately fixed in 10% buffered neutral formalin and processed for paraffin technique. Sections of 5μm thickness were obtained and stained with haematoxylin & eosin stain, crossmon's trichrome stain, Mallory's trichrome stain, combination of Weigert's elastic & Van gieson's stains and Gomori's reticulin method. The results showed that the capsule and interlobular connective tissue septa contained a high amount of collagen, elastic and reticular fibers. Ampullated blood spaces were encountered intra and inter-lobularly. The exocrine pancreas of buffalo was a tubuloalveolar gland that made the bulk of the pancreatic tissue. The acini were made of a single layer of pyramidal cells arranged around a narrow lumen. The acinar cells showed two distinct regions: the apical part filled with refractile zymogen granules that were acidophilic, orangophilic and argyrophilic and the basal part was intensely basophilic. Centroacinar cells were prominent in the lumen of pancreatic acini. Dark and light angular cells filled with coarse orangophilic cytoplasmic granules were present in association with the secretory units both intralobular and intratubular.

Key words: Buffalo, Exocrine pancreas

INTRODUCTION

The Egyptian water buffalo represents an important part of animal production in Egypt. The estimated herd number exceeds 3.6 million heads (FAO, 2002). It is economically a very important farm animal and genetic improvement of these animals is of economic importance, especially in reproductive
performance and quantity of meat and milk as well as diseases and parasite resistance.

There are large amounts of information available on pancreas in many aspects of both humans and animals (Takahashi et al., 1977; Furuoka et al., 1989; Furuzawa et al., 1992; Hiratsuka et al., 1996; Endo et al., 1997; Kara, 2005), yet morphological investigations into the pancreas of Egyptian water buffalo were limited.

Pancreas is one of the unique internal organs. Pancreas is a soft, lobulated gland with irregular shape (Liem et al., 2001).

The buffalo pancreas was divided into 2 lobes, left and right, which are connected by the body, similar to other mammals (Sisson, 1975a; Konig and Liebich, 2007). Nomenclature of the pancreatic lobe has been reported by many researchers in the different species with the terms of splenic, gastric and duodenal lobes which correlate to the left lobe, body and right lobe, respectively (Takahashi et al., 1977; Furuoka et al., 1989; Endo et al., 1997). In addition to these three regions, a process projected laterally from the right lobe adjacent to the body was observed which could be compared to the uncinate process of human pancreas (U) (Rung, R. T. and Klomkleaw W., 2014).

The aims of this study is to clarify the histological features of exocrine part of the pancreas of buffalo.

MATERIALS AND METHODS

Pancreas of 10 clinically healthy adult mature buffaloes of both ages and sexes were collected during the winter season of the year from Giza slaughter house. Four pieces were taken from each pancreas as follows: one from the left lobe (head), the second from the right lobe (tail), the third from its middle part (body) and finally from the uncinate process. The aforesaid parts were taken from the pancreas of slaughtered animals as fresh as possible and then were immediately fixed in buffered 10% neutral formalin.

The fixed specimens were then subjected to routine histological techniques. Sections of 5 micrometers thick were prepared and stained by: Harri’s hematoxylin and eosin stain (H&E) for general histological structures, Crossmon’s trichrome & Mallory’s trichrome stains for identification of collagen fibers and smooth muscle cells, combination of Weigert's elastic and Van Gieson's stains for identification of both elastic and collagen fibers and Gomori's reticulin stain for identification of reticular fibers.

The aforementioned stains were conducted as outlined by Drury and Wallington (1980).

RESULTS AND DISCUSSION

The micromorphology and histochemistry of all regions of the pancreas of buffalo were quite similar to each other.

The pancreas of the buffalo was found to be an irregularly lobulated gland formed of an exocrine and an endocrine portions. It was
invested by a thin connective tissue capsule. From the capsule, septa penetrate into the substance of the pancreas, dividing it into a number of lobules. Both the capsule and the interlobular septa were thin, and were made mainly of fine collagenic and reticular fibers together with few elastic ones. Fibroblasts, fibrocytes and few lymphocytes were also encountered.

The exocrine pancreas made the bulk of the pancreatic tissue as tubules and acini closely packed together within the pancreatic lobules of the buffalo (Fig.1).

The buffalo pancreas was compound tubuloalveolar. These results were in line with Johnson (1991) and Treating et al. (2012) in humans and Banks (1993) in domestic animals but disagree with Pinheiro et al. (1981) in Brazilian Sloth and Nada (1983) in sheep who mentioned that the secretory acini were tubular and tortuous.

The present work showed that the pancreatic acini were formed of a single layer of pyramidal cells with their apices directed toward a very narrow central lumen and their broad base were resting on basement membrane (Fig.2). The acini or tubules were enclosed by a fine layer of collagen, elastic (Fig.3, 4) and reticular fibers. The basal parts of the acinar cells were intensely basophilic, while the apical part contained refractile acidophilic zymogen granules. These granules were often argyrophilic and orangophilic (Fig.5). They accumulated in the apical pat of the acinar cells. Some cells appeared exhausted and devoid of zymogen granules. The boundaries between the acinar cells were not clear. The nuclei of the acinar cells were spherical and vesicular, located near the base. These results were in accordance with Elkeshawy (1981) in guinea pigs; Pinheiro et al. (1981) in Brazilian Sloth; Mythili et al. (2005); Dellmann and Eurell (2006) in domestic animals; Elbakary and Bayomy (2011) and Abdul-Hamid and Mostafa, (2013) in rats; Bosco et al. (2013) in degus and Pandiri (2014) in humans.

The current investigation showed that some sections of pancreatic acini were exhausted and contained few zymogen granules. Banks (1993) in domestic animals and Mescher (2010) in humans mentioned that the number of zymogen granules present in each cell varies according to the digestive phase and attains its maximum in animals that have fasted so if the animals were recently fed before sample collection the acini consequently contain less zymogen granules.

In contrary to Nada (1983) in sheep and Banks (1993) in domestic animals, no basal striation was observed in the basal part of acinar cells of the pancreas of buffalo.

The present work showed that, the pancreatic acini lumen contained one or two centrally located cells, the centroacinar cells, which contained little lightly acidophilic cytoplasm.
(Fig.2). Some centroacinar cells appeared elongated with elongated lightly stained nuclei when cut longitudinally. The centroacinar cells were continued with the intercalated ducts which were supported by fine collagenous connective tissue (Fig.2).

In the present investigation, the interlobular ducts were located in the interlobular connective tissue between the pancreatic lobules and possessed wide lumen. They were lined with low columnar cells, with large, oval and lightly stained nuclei. The interlobular ducts were supported by moderate amount of collagenous, elastic (Fig.6) and reticular fibers. Similar results recorded by Nada (1983) in sheep, Grapin-Botton (2005) and Young et al. (2006) in humans.

The present work revealed the presence of ampullated blood spaces lined by endothelial cells both inter and intralobularly in all regions of the pancreas of buffalo (Fig.1 and 7). Many venules could be observed intralobularly in addition to the capillary network surrounding the pancreatic acini. Similar results recorded by Nada (1983) in sheep pancreas and Leeson and leeson (1986) in rat pancreas.

Nada (1983) explained the presence of numerous intralobular ampullated venules as they may act as reservoirs for the pancreatic hormones that could pass to the circulation when needed. The current work showed the presence of angular dark and light cells with coarse oragngophilic granules that filled the whole cytoplasm. They showed themselves either singly or in groups inbetween the secretory end-pieces (Fig.8). Some of these cells were lodged in between the tubular cells. These cells possessed numerous cytoplasmic processes and their spherical nuclei were darkly stained. The irregularity of the angular orangophilic cells might indicate migrating movement of these cells (Nada, 1983). The last author added that, the different forms of angular cells might be regarded as either different stages of secretory activity or different stages of transitional cells between the exocrine pancreatic cells and the islet cells of the pancreas of sheep. These orangophilic cells were frequently found in close association with the ampullated blood spaces (Fig.9).
Fig. 1: Photomicrograph of section of the pancreas of buffalo showing that the tubules and acini closely packed together within the pancreatic lobules. Presence of ampullated blood spaces both inter and intralobularly in all regions (black arrows) (H&E X 40).

Fig. 2: Photomicrograph of section of the pancreas of buffalo showing that the pancreatic acini formed of a single layer of pyramidal cells. The pancreatic acini lumen contained one or two centrally located cells, the centroacinar cells (black arrows). The centroacinar cells continued with the intercalated ducts (white arrow) (H&E X 400).

Fig. 3: Photomicrograph of section of the pancreas of buffalo showing that the acini or tubules were enclosed by a fine layer of collagen fibers (Mallory’s Trichrome X40).

Fig. 4: Photomicrograph of section of the pancreas of buffalo showing that the acini or tubules were enclosed by a fine layer of elastic fibers (Combination of Weigert elastic & Van gison X 100).

Fig. 5: Photomicrograph of section of the pancreas of buffalo showing that the basal parts of the acinar cells were intensely basophilic, while the apical part contained refractile acidophilic zymogen granules which were often argyrophilic and orangophilic (Mallory’s Trichrome X 400).

Fig. 6: Photomicrograph of section of the pancreas of buffalo showing that the interlobular ducts lined with low columnar cells and supported by moderate amount of collagenous fibers (H&E X 100).

Fig. 7: Photomicrograph of section of the pancreas of buffalo showing that the presence of ampullated blood spaces lined by endothelial cells both inter and intralobularly in all regions (H&E X 400).

Fig. 8: Photomicrograph of section of the pancreas of buffalo showing that the presence of angular dark and light cells with coarse orangophilic granules either singly or in groups inbetween the secretory end-pieces (Crossmon’s trichrome X 400).

Fig. 9: Photomicrograph of section of the pancreas of buffalo showing that the orangophilic cells found in close association with the ampullated blood spaces (black arrow) (Crossmon’s trichrome X100).

REFERENCES


