



# HISTOCHEMICAL STUDIES ON THE PANCREAS AND INTRA AND EXTRAPANCREATIC DUCTS IN GOAT KIDS\*

A. R. Sreeranjini<sup>1</sup>, N. Ashok<sup>2</sup>, S. Maya<sup>3</sup>,  
K. M. Lucy<sup>4</sup> and J. J. Chungath<sup>5</sup>

Department of Veterinary Anatomy and Histology,  
College of Veterinary and Animal Sciences,  
Mannuthy -680 651, Thrissur, Kerala.

Received: 12.01.2015

Accepted: 16.05.2015

## Abstract

The present study was conducted on the pancreas collected from 36 male kids of one to six months of age. The basement membrane of pancreatic acini and interlobular and pancreatic duct epithelium, interlobular connective tissue, connective tissue covering and capillary loops in islets, goblet cells and globule cells in ducts and luminal contents of ducts showed strong PAS-positive reaction. Luminal border of surface epithelium of the hepato-pancreatic duct and its glands also showed intense PAS-positive reaction. Some cells located in the periphery of islets, some among the acinar cells and lining cells of large interlobular and hepato-pancreatic ducts showed a strong reaction for glycogen with Best's carmine while the cytoplasm of most of the secretory acini and duct glands showed a moderately positive reaction. In the PAS-Alcian blue method, globular cells located in the lining epithelium of large interlobular ducts and submucosal glands of hepato-pancreatic duct showed a mild to moderate reaction for neutral polysaccharides. Some of the goblet cells in the surface epithelium contained acid mucopolysaccharides, some others showed

the presence of neutral mucopolysaccharides and a third group contained both acid and neutral mucopolysaccharides. Presence of lipids was noticed in acini and in intralobular and pancreatic ducts. The luminal border of intralobular ducts showed a moderately positive reaction for acid phosphatase while a weak reaction was noticed in the islets of Langerhans. Positive reaction for alkaline phosphatase was observed in the endothelium of larger blood vessels and capillaries and in the surface epithelium of intralobular ducts.

**Key words:** Histochemistry, pancreas, goat kids, pancreatic ducts

The mammalian pancreas is a unique gland composed of anatomically and functionally closely related exocrine and endocrine components. Impairment of endocrine function as in diabetes, severely affects the exocrine component of the gland and dysfunction of the exocrine gland as in chronic pancreatitis, progressively disturbs the function of islet cell hormones (Gyr *et al.*, 1985). The exocrine part synthesizes and stores various digestive

\*Part of Ph. D thesis submitted by the first author to Kerala Veterinary and Animal Sciences University, Pookode, Wayanad, Kerala.

Corresponding author email ID: sreeranjini@kvasu.ac.in

1 Assistant Professor

2 Professor and Head

3 Professor and Head, Dept. of Veterinary Anatomy and Histology, CVAS, Pookode

4 Professor

5 Professor and Head, (Retd.)

enzymes such as amylase, protease and lipase for the digestion of carbohydrates, proteins and lipids. The islets of Langerhans contain four major types of endocrine cells that synthesize and secrete insulin, glucagon, somatostatin and pancreatic polypeptide. Literature pertaining to the histochemical studies on the pancreas in goat is scanty. Hence, the present study was undertaken.

### Materials and Methods

The present study was conducted on the pancreas, collected from 36 male kids of one to six months of age that were divided into six groups of six animals each at monthly intervals. Tissue samples were fixed in various fixatives such as chilled 10% neutral buffered formalin (NBF), Carnoy's fluid and Formol Calcium (4°C) and were processed for histochemical studies. Various histochemical staining methods such as Mc Manus's periodic acid Schiff's reagent (PAS) method for glycogen (Singh and Sulochana, 1997), Best's carmine method for glycogen (Luna, 1968), PAS-Alcian blue method for mucosubstances- pH 2.5 (Singh and Sulochana, 1997), Gomori's Lead method for acid phosphatase (Singh and Sulochana, 1997), Azo dye coupling method using  $\alpha$ -naphthyl phosphate for alkaline phosphatase (Bancroft and Gamble, 2003) and Oil red O in Propylene Glycol method for fat (Singh and Sulochana, 1997) were employed and the slides were examined under light microscope.

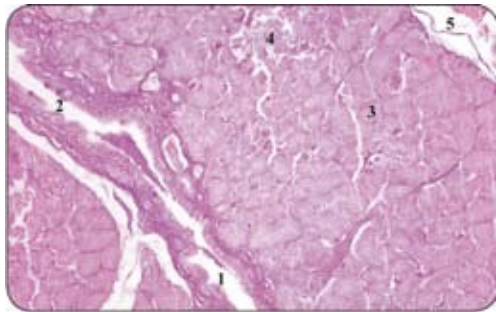
### Results and Discussion

The basement membrane of pancreatic acinar cells and interlobular duct epithelium showed strong PAS-positive reaction. Interlobular connective tissue, connective tissue covering of islets, the capillary loops seen inside islets and luminal contents of ducts were also PAS- positive (Fig. 1). These findings are in agreement with that of Singh and Gupta (1999) in buffaloes. The globule cells in large interlobular ducts also showed PAS-positive reaction indicating the presence of mucopolysaccharides. Some cells located in the periphery of islets, a few cells among the secretory acinar cells and some among the large interlobular duct cells showed the presence of glycogen with Best's carmine while the cytoplasm of most of the secretory

acini showed a moderately positive reaction. Contrary to these findings, Singh and Gupta (1999) reported a weak reaction for glycogen with Best's carmine in the centroacinar cells only.

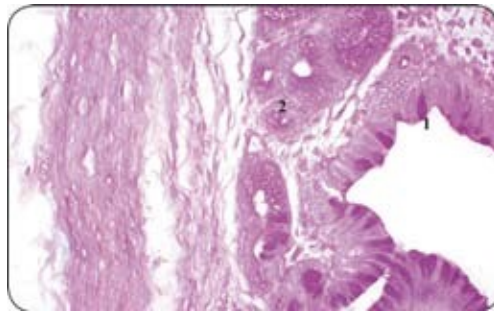
The basement membrane of pseudo stratified columnar epithelium that lined the pancreatic duct and the goblet cells were strongly positive for PAS reaction. Luminal border of surface epithelial cells and all goblet cells including globule cells in the surface epithelium of hepato-pancreatic duct showed intense PAS-positive reaction (Fig. 2). The luminal border of duct glands located in the submucosa of hepato-pancreatic duct and occasional goblet cells present among the lining cells of these duct glands also showed intense PAS-positive reaction. However, their cytoplasm exhibited only a moderate reaction. With Best's carmine, the lining epithelium of hepato-pancreatic duct appeared to contain more amount of glycogen compared to the duct glands (Fig. 3). These findings are in agreement with that of Mc Minn and Kugler (1961) in the epithelial cells and glands in pancreatic ducts of mouse in the duct glands of pancreatic and common bile ducts in sheep (Gemmell and Heath, 1973).

In PAS-Alcian blue method, occasional globular cells located in the lining epithelium of large interlobular and hepato-pancreatic ducts showed a light magenta colour indicating mild reaction for neutral mucopolysaccharides (Figs. 4 and 6). Some of the goblet cells in the surface epithelium of hepato-pancreatic duct were deep blue in colour indicating the presence of acid mucopolysaccharides while some others stained magenta due to the presence of neutral mucopolysaccharides. However, a few cells showed a mixture of blue and magenta colour indicating the presence of both acid and neutral mucopolysaccharides within the same cell (Fig. 5). Mild reaction in interlobular ducts was indicative of the beginning of the secretory activity in the goblet or globular cells while the strong reaction in hepato-pancreatic duct showed that the amount of mucopolysaccharides secreted and stored in the goblet cells of this region is very high. Most of the submucosal glands were moderately positive for neutral mucopolysaccharides (Fig. 6).



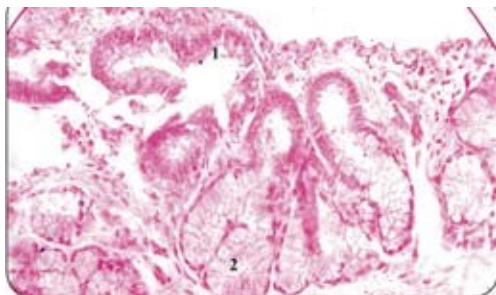
**Fig. 1.** Section of pancreas showing PAS- positive reaction (five months - postnatal). Mc Manus's PAS method x 200

1. Large interlobular duct
2. Globular cell
3. Acini
4. Islet of Langerhans
5. Interlobular connective tissue



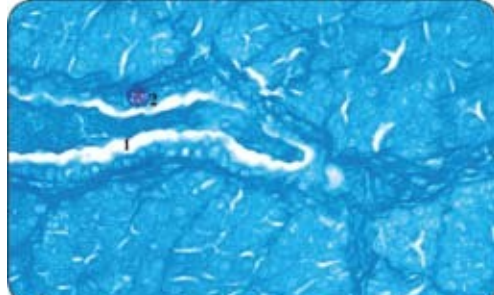
**Fig. 2.** L. S. of hepato pancreatic duct showing PAS- positive reaction (six months - postnatal). Mc Manus's PAS method x 400

1. Goblet cell
2. Duct gland



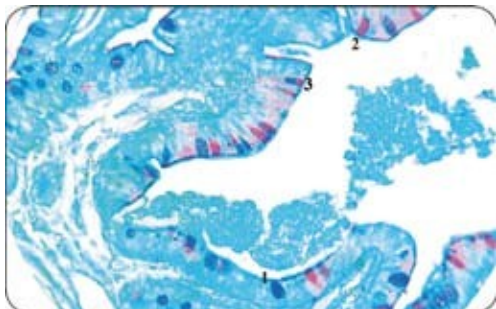
**Fig. 3.** C. S. of hepato pancreatic duct showing presence of glycogen (six months - postnatal). Best's carmine method x 400

1. Epithelium
2. Duct glands



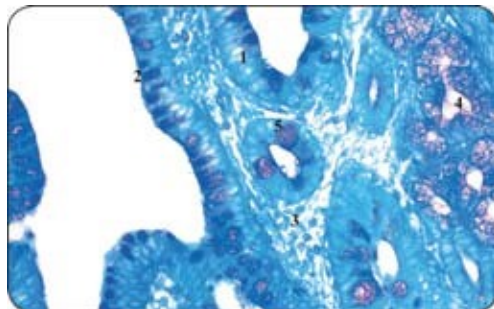
**Fig. 4.** Section of pancreas showing PAS-positive reaction in globular cell (six months - postnatal). PAS- Alcian blue method x 400

1. Large interlobular duct
2. Globular cell



**Fig. 5.** C. S. of hepato pancreatic duct showing positive reaction for mucopolysaccharides (six months - postnatal). PAS- Alcian blue method x 400

1. Goblet cell with acid mucopolysaccharides
2. Goblet cell with neutral mucopolysaccharides
3. Goblet cell with acid and neutral mucopolysaccharides



**Fig. 6.** C. S. of hepato- pancreatic duct (six months - postnatal). PAS-Alcian blue method x 400

1. Principal cell
2. Goblet cell
3. Lamina propria submucosa
4. Duct gland
5. Globular cell

The luminal border of intra lobular ducts showed a moderately positive reaction for acid phosphatase similar to the findings of Singh and Gupta (1999) in the pancreas of buffaloes. The positive reaction noticed in the islets of Langerhans was as observed by Petkov (1970) in the islets of Langerhans in

cattle. Contrary to this, in horses Bjorkman *et al.* (1963) did not observe any positive reaction for acid phosphatase in the islets of Langerhans. The acinar cells in the present study did not show any positive reaction for acid phosphatase activity. Contrary to this, Laitio *et al.* (1974) observed a positive reaction

for acid phosphatase in the apical half of acinar cells and stromal mononuclear cells of human foetal pancreas.

In the present study, no alkaline phosphatase activity was observed in the acini as reported by Githens (1983) in the pancreas of dogs. The surface epithelium of intralobular duct showed positive reaction which tallies with the findings of Githens (1983) in the pancreas of dogs. Jacoby (1946) also reported that in dogs, from the centroacinar cells to the epithelium of large ducts showed a strong positive reaction for alkaline phosphatase, whereas in guinea pig and rat, the reaction was negative. In this study, the endothelium of larger blood vessels and capillaries showed a positive reaction as seen in the pancreas of dogs (Githens, 1983). However, the observations of Laitio *et al.* (1974) in human foetal pancreas and Petkov (1970) in hamster were only in partial agreement with the above findings. Some of the islets in the present study showed a positive reaction for alkaline phosphatase which agrees with the findings of Petkov (1970) in hamster. Contrary to this, Bjorkman *et al.* (1963) observed that the islets of Langerhans in horses did not show any positive reaction for alkaline phosphatase. In the present study also no reaction was noticed in the pancreatic ducts similar to the findings in the foetal pancreas of human beings (Laitio *et al.*, 1974) and dogs (Githens, 1983).

Presence of lipids noticed in the acini and in the intralobular and pancreatic ducts is similar to the findings of Petkov (1970) in rats and Prasad and Sinha (1984) in buffaloes. Some of the islets of Langerhans showed the presence of trace amounts of lipids. Petkov (1970) also have observed traces of lipids in the islets of Langerhans in cattle.

## References

- Bancroft, J.D. and Gamble, M. 2003. *Theory and Practice of Histological Techniques*. (5<sup>th</sup> Ed.). Churchill Livingstone, Edinburgh, 796p.
- Bjorkman, N., Hellerstorm, C., Hellman, B. and Rothman, U. 1963. Ultrastructure and enzyme histochemistry of the pancreatic islets in the horse. *Zeits. Zellf.* **59**: 535-554.
- Gemmel, R.T. and Heath, T. 1973. Structure and function of the biliary and pancreatic tracts of the sheep. *J. Anat.* **115**: 221-236.
- Githens, S. 1983. Localization of alkaline phosphatase and adenosine triphosphatase in the mammalian pancreas. *J. Histochem. Cytochem.* **31**: 697-705.
- Gyr, K, Begliner, C. and Stalder, G.A. 1985. Interaction of the endo- and exocrine pancreas. *Schweiz. Med. Wochenschr.* **115**: 1299-1306.
- Jacoby, F. 1946. The pancreas and alkaline phosphatase. *Nature*: **158**: 268-269.
- Laitio, M., Lev, R. and Orlic, D. 1974. The developing human foetal pancreas: an ultrastructural and histochemical study with special reference to exocrine cells. *J. Anat.* **117**: 619-634.
- Luna, L.G. 1968. *Manual of Histologic Staining Methods of the Armed Forces institute of Pathology*. (3<sup>rd</sup> Ed.). Mc Graw-Hill Book Company, New York, 258p.
- Mc Minn, R.M.H. and Kugler, J.H. 1961. The glands of the bile and pancreatic ducts: autoradiographic and histochemical studies. *J. Anat.* **95**: 1-11.
- Petkov, P.E. 1970. Comparative histochemical studies of mammalian pancreatic islet cells. In: Falkmer, S., Hellman, B. and Taljedal, I.B (ed.), *The Structure and Metabolism of Pancreatic Islets. A Centennial of Paul Langerhan's Discovery*. Pergamon Press Ltd., pp. 213-222.
- Prasad, J. and Sinha, R.D. 1984. Histological and histochemical studies on the pancreatic duct of buffalo. *Indian J. Anim. Sci.* **54**: 121-123.
- Singh, D. and Gupta, A.N. 1999. Histomorphology of pancreatic ducts in buffalo (*Bubalus bubalis*). *Indian J. Vet. Anat.* **11**: 40-48.
- Singh, U.B. and Sulochana, S. 1997. *Handbook of Histological and Histochemical Techniques*. Premier Publishing House, Hyderabad, 111p. ■