FIBROARCHITECTURE OF DEVELOPING PANCREAS IN KUTTANAD DUCKS (*Anas platyrhynchos domesticus*)*

Patki, H.S.[1], Ashok, N.[2], Chungath, J.J.[3], Lucy, K.M.[4], Sreekumar, K.P.[5] and Kuttinarayanan, P.[6]
Dept. of Veterinary Anatomy and Histology,
College of Veterinary and Animal Sciences,
Mannuthy - 68051, Thrissur, Kerala.

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Abstract

A study was undertaken to trace the fibroarchitecture of pancreas during prehatch and posthatch periods in Kuttanad ducks using 18 embryos and 78 female ducklings from the day of hatch to 24 weeks of age. On seventh day of incubation, fine trabeculae were seen separating the developing tubules in the proximal region of pancreatic primordia. However, the distal part was devoid of any trabeculation. By 14th day blood vessels proliferated within the trabeculae and by 21st day rapid proliferation of parenchymal tissue outpaced the growth of trabecular network. Throughout the posthatch period the interlobular connective tissue was observed to be ill-developed which in turn resulted in absence of any lobulation. Endocrine islets were separated from exocrine tissue by a delicate layer of connective tissue composed of collagen, reticular and a few elastic fibres.

Key words: *Kuttanad ducks, pancreas, development, fibroarchitecture*

Compared to mammalian pancreas, avian pancreas is reported to have more distinct lobation and meagre lobulation (Norris and Carr, 2013). The extent of lobulation depends upon the complexity of trabecular network of connective tissue. Generally in birds, this trabecular network is poorly developed compared to mammals (Hodges, 1974). The literature on the fibroarchitecture of pancreas in Kuttanad ducks during development appears to be scanty. Hence, the present work was undertaken to establish a baseline data on the fibroarchitecture of pancreas during prehatch and posthatch developmental periods in Kuttanad ducks.

Materials and Methods

Fibroarchitecture of pancreas was studied in Kuttanad ducks during prehatch and posthatch periods using 18 embryos at seven days interval and 78 apparently healthy female ducks at fortnightly interval, from day of hatch to 24th week of age. These birds were selected at random from a single hatch and reared at the University Poultry and Duck Farm, Mannuthy under semi-intensive system of management. After recording body weight, the ducklings were anaesthetized and bled to death. Serial sections of embryos were taken till 21st day of incubation and were subjected to routine

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1. *Assistant Professor, Dept. of Veterinary Anatomy & Histology, CVAS, Pookode (Corresponding author) Email ID:* ***hpatki@gmail.com***
2. *Professor and Head*
3. *Professor and Head (Retd.).*
4. *Professor*
5. *Director (International Cooperation and initiation),Professor (RC), CVAS, Mannuthy*
6. *Professor and Head, (Retd.). Dept. of Livestock Products Technology, CVAS, Mannuthy*

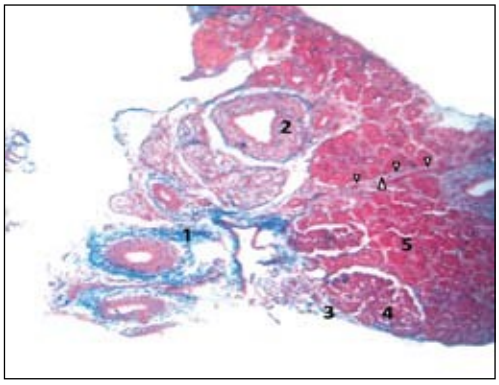

Fig. 1. Pancreas showing presence of trabeculae (21st day of incubation)

1. Collagen fibres surrounding an artery
2. Pancreatic duct
3. Capsule
4. Developing islet
5. Exocrine acini Arrow heads- trabeculae

H&E staining, Gomori's one step trichrome staining for connective tissue (Luna, 1968), Lillie's allochrome staining for connective tissue (Luna, 1968), Verhoeff's staining for elastic fibres (Luna, 1968) and Gridley's method for reticular fibres (Luna, 1968). Micrometry was done using an ocular micrometer.

Apart from this, a few samples were fixed in 2.5 per cent glutaraldehyde in phosphate buffer saline followed by gold sputtering with an automated sputter-coater (Model- JEOL JFC-1600) for three minutes. These samples were then scanned under Scanning Electron Microscope (SEM Model- JEOL JSM-5600) as per the standard procedures (Bozzola and Russell, 1998) at Ruska labs, College of Veterinary Science, SVVU, Rajendranagar, Hyderabad, Andhra Pradesh.

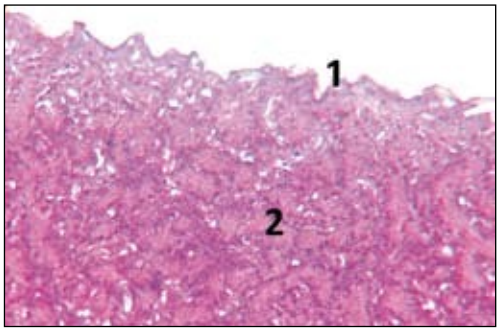

Fig. 2. Capsule of pancreas (18 weeks) (H&E x 100)

1. Capsule
2. Exocrine acini

Results and Discussion

The present study in Kuttanad ducks revealed the appearance of pancreatic primordia on third day of incubation. In domestic fowl (Ziswiler and Farner, 1972; Patten, 1973; Freeman and Vince, 1974) and Japanese quails (Sivakumar *et al.,* 1999) also the primordia were reported to appear on the third day of incubation. Both dorsal and ventral primordia showed thick walls consisting of actively proliferating tissue. These observations are in accordance with those of Romanoff (1960) in chicken and ducks and Sivakumar *et al.* (1999) in Japanese quails.

On seventh day of incubation, the pancreas was histologically divisible into two distinct regions, *viz*., proximal and distal. The proximal region was composed of cellular

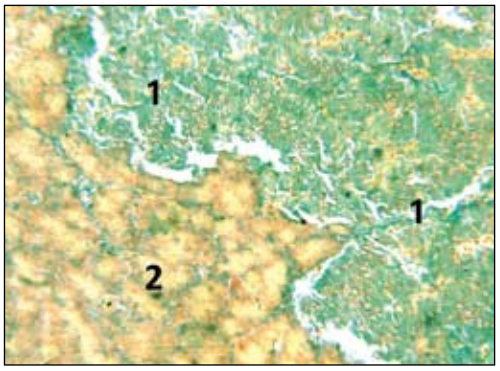

Fig. 3. Delineation of endocrine islets from exocrine acini (24 weeks) (Lillie's allochrome method x 400)

1. Endocrine islet
2. Exocrine acini

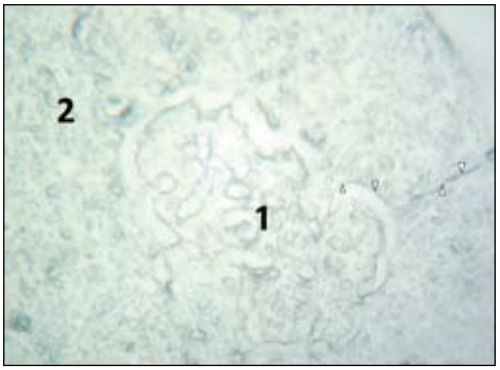

Fig. 4. Reticular fibres within parenchyma of pancreas (21st day of incubation) (Gridley's staining method x 400)

1. Developing islet
2. Exocrine parenchyma.
   Arrow heads – Reticular fibres

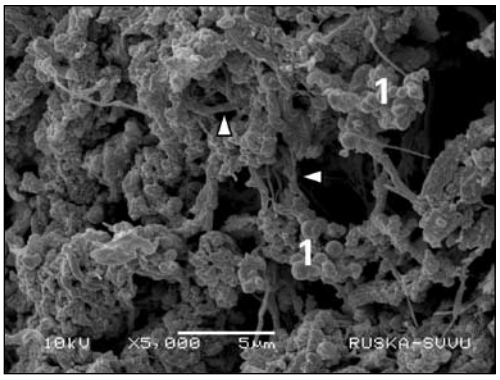

Fig. 5. Pancreatic islet cells supported by connective tissue fibres (SEM x 5000)

1. Pancreatic islet cells.
   Arrow heads- Collagen fibres

cords separated by fine trabeculae and started acquiring lumina. The distal region of pancreas was a compact mass of tissue without any trabeculation and started to differentiate into glandular tissue. By 14th day of incubation, the blood vessels started proliferating between the trabeculae and tubules. By 21st day of incubation, rapid proliferation of parenchymal tissue outpaced the development of trabecular network (Fig.1). These observations are in agreement with those made by Romanoff (1960) in fowl.

During the posthatch period, the pancreas was covered by a delicate fibrous connective tissue capsule with an investment of visceral layer of peritoneum (Fig. 2). The visceral layer of peritoneum was composed of mesothelial cells with an acidophilic cytoplasm and centrally located spherical nucleus. Similar histoarchitecture of the pancreatic capsule was reported in several species of birds including ducks by Hodges (1974).

On the day of hatch the capsule measured 4.00 ± 0.035µm in thickness. Histologically, the capsule did not show much changes during the posthatch period and measured 4.5 ± 0.020µm in thickness at the age of 24 weeks.

In all age groups, due to the absence of interlobular connective tissue, the lobulation was not as distinct as that of the mammalian gland. No smooth muscle fibres were detected in the capsule and stroma of pancreas throughout the study period. These observations tally with those made in goose (Mobini, 2011) and in pigeons (Faris, 2012; Mobini, 2013). However, in native turkey of Iran, Mobini (2009) reported presence of a very thick capsule covering the gland.

Histologically each lobe presented both exocrine acini and endocrine Islets of Langerhans. The exocrine acini were supported mainly by fine network of collagen and reticular fibres. Endocrine islets were delineated from the exocrine part by fine connective tissue fibres (Fig. 3, 4 and 5). The present observations agree with the findings of Ziswiler and Farner (1972), McLelland (1975) and Nickel *et al.* (1977) in several avian species including ducks and other waterfowls. However, Madhavi *et al.* (2000) reported that in local ducks (*Anas boscas domesticus*) of Andhra Pradesh, interacinar connective tissue was composed of reticular fibres alone.

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