



## Histo-morphometrical Studies on the Pancreas of Local Poultry of Poonch Region of Jammu and Kashmir

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### ABSTRACT

Present study was carried on six pancreas samples from apparently healthy local poultry of Poonch region. Pancreas was lobulated gland located between the descending and ascending parts of the duodenum. Histologically, the pancreas was covered by thick connective tissue capsule comprising mainly collagen fibers which sends fine septae dividing the gland into indistinct lobes. Parenchyma of pancreas consisted of both exocrine and endocrine portion. Exocrine part consisted of numerous secretory acini varying from spherical, oval to elongated. Acini consisted of single layer of pyramidal cells with round, large, basally situated nucleus. Cytoplasm contained acidophilic zymogen granules located mainly towards the apical portion of the cell. Centro-acinar cells were not observed in the present study. Average longer diameter was  $44.02 \pm 7.71 \mu$  whereas the smaller diameter was  $33.92 \pm 7.80 \mu$ . Average height of acinar cell was  $12.54 \pm 0.69 \mu$  with nuclear size of  $5.90 \pm 0.33 \mu$ . Endocrine part constituted only a small portion of parenchyma and appeared as lightly stained pale areas in between the acini. Occurrence of islets varied and were unevenly distributed. The shape of the Islets of Langerhans varied from spherical, oval to elongated. Most of the islets were lightly stained and cells had rounded basally located nucleus with prominent nucleolus. Few of the islets were mixed type in this local poultry of Poonch region having both light and few dark cells. Mean number of islets per field at 40x was  $4.17 \pm 0.70$ . Average longer diameter was  $184.62 \pm 19.77 \mu$  whereas the smaller diameter was  $114.82 \pm 10.14 \mu$ .

### HIGHLIGHTS

- Pancreas was covered by thick connective tissue capsule comprising mainly collagen fibers.
- Shape of secretory acini varying from spherical, oval to elongated.
- Centro-acinar cells were not observed.

**Keywords:** Acinar cells, histology, Islets of Langerhans, pancreas, zymogen granules

The Union Territory of J&K belongs to the greater Himalayan mountain range which exerts significant influence on its agro- climatic conditions. Poonch has a humid subtropical climate which is much cooler than rest of India due to its moderately high elevation and northerly position. Winters are cool with short day time and characterized by rainfall due to western disturbances. Snowfall is quite common during the months of January and February. Average temperature in January is  $2.5^{\circ}\text{C}$  ( $36.5^{\circ}\text{F}$ ) and temperature is below freezing point at night. Summers are short and usually pleasant. Indigenous poultry of Poonch region can survive in minus degree temperature and its rearing provides sustainability to the

local population. The local Poonchi bird weighs about 2.1-2.5 kg (cock) and 1.6-1.8 kg (hen). Females are combless whereas males present red coloured comb (Fig. 1).

Pancreas of birds is located on the right side of abdominal cavity between ascending and descending loops of duodenum. It is an important mixed gland consisting of both exocrine and endocrine part (Beheiry *et al.*, 2018).

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The exocrine part consists of acinar cells and excretory ducts (Pieler and Chen, 2006) which secretes digestive enzymes to help digestion of the food (Denbow, 2015). The endocrine part produces hormones such as insulin, glucagon and somatostatin to control the level of blood glucose (Mescher, 2010). Anatomical studies have been done on the pancreas in different bird species i.e. duck (Das *et al.*, 2003), ostrich (Stornelli *et al.*, 2006), quail (Simsek *et al.*, 2008), falcon (Simsek *et al.*, 2009), goose (Mobini, 2011), eagle (Al-Agele and Mohammed, 2012), pigeon (Mobini, 2013), chabro chicken (Yadav *et al.*, 2018) and turkey (Suri *et al.*, 2022). But no work on indigenous bird has been done yet. So, due to paucity of scientific literature on the histology and micrometry of pancreas of this species, the present study has been planned.

## MATERIALS AND METHODS

Carcasses of 06 birds were obtained from Division of Animal Genetics and Breeding, F.V.Sc & A.H., SKUAST-Jammu. Immediately after collection, digestive tracts were examined grossly and tissue samples of pancreas were taken and fixed in 10% Neutral Buffered Formalin for 24 hours and paraffin blocks were prepared (Luna, 1968). 5 micron thick sections were obtained and stained with Hematoxylin and Eosin (H&E) for general histomorphology. Different morphometrical parameters recorded mention below:

1. Thickness of capsule ( $\mu$ )
2. Diameter of longer and smaller acini ( $\mu$ )
3. Height of acinar cell ( $\mu$ )
4. Nuclear diameter ( $\mu$ ) of acinar cells
5. Longer and smaller diameter ( $\mu$ ) of Islets of Langerhans
6. Number of Islets of Langerhans per field at 40x

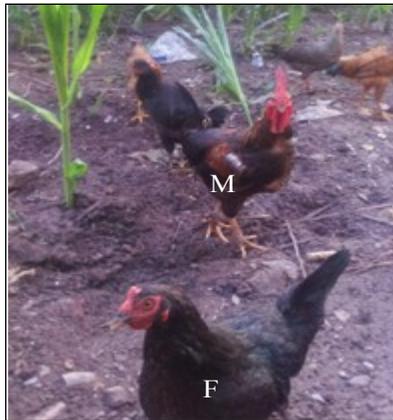
## RESULTS AND DISCUSSION

The pancreas of local poultry of Poonch region was lobulated gland located between the descending and ascending parts of the duodenum (Fig. 2) similar to the observations recorded in goose (Deprem *et al.*, 2015) and turkey (Suri *et al.*, 2022).

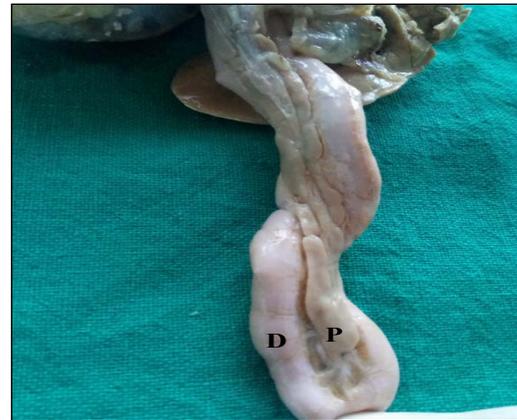
Histologically, the pancreas was covered by connective tissue capsule with varying thickness of 40.25 – 71.48  $\mu$  and mean thickness of  $54.66 \pm 5.39 \mu$ . Al-Haak (2019) recorded the thickness of capsule as  $11.71 \pm 0.2 \mu$  in kestrel. Mobini (2013) also observed thin capsule over the pancreas of pigeon whereas Helmy *et al.* (2018) reported thick capsule over the pancreas of ostrich. In present study, the capsule was comparatively much thicker. The connective tissue capsule comprising mainly collagen fibers (Fig. 4) sends various fine septae which penetrated into the parenchyma of the gland dividing it into indistinct lobes (Fig. 3). Collagen, elastic and very fine reticular fibers were also seen in capsule, septae and inter-lobular connective tissue.

The parenchyma of pancreas consisted of both exocrine and endocrine portion (Fig. 3) as also seen in common gull and Guinea fowl (Hamodi *et al.*, 2013) and turkey (Suri *et al.*, 2022). The exocrine part was composed of tubulo-acinar serous glands that occupied a larger area of pancreas as earlier reported by Suri *et al.* (2022) in turkey. In present study, pancreas consisted of numerous secretory acini along with duct system similar to the findings of Das *et al.* (2003) in duck, Gulmez (2003) in goose, Mobini (2013) in mature pigeon and Suri *et al.* (2022) in turkey. The shape of secretory acini varied from spherical, oval to elongated (Fig. 5). Saadatfar *et al.* (2011) reported oval shaped acini in Palam dove whereas Hamodi *et al.* (2013) reported globoid, oval elongated acini in Guinea fowl. In turkey, acini varied from spherical to oval and elongated in outline (Suri *et al.*, 2022). The acini consisted of single layer of variable number of pyramidal cells with round, large, basally situated nucleus (Fig. 6). Gulmez (2003) in goose reported columnar shaped secretory acini whereas Suri *et al.* (2022) in turkey observed single layer of pyramidal to tall columnar to rectangular cells with round basally located nucleus.

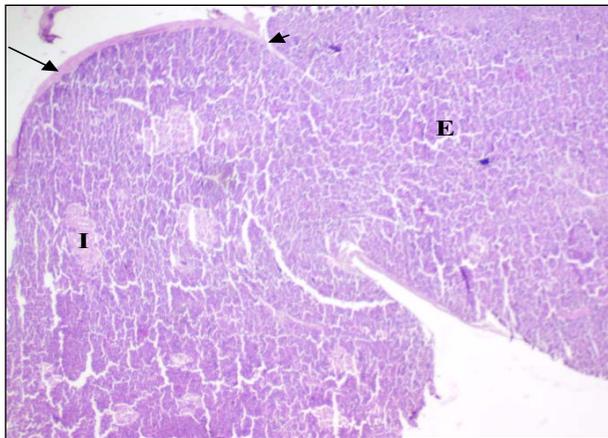
The cytoplasm contained acidophilic zymogen granules located mainly towards the apical portion of the cell (Fig. 6). The acinar lumen was indistinguishable as also observed by Helmy *et al.* (2018) in ostrich. Das *et al.* (2003) reported bizonal character of acinar cells that could be attributed to the presence of mitochondria in basal part and zymogen granules in apical part. Centro-acinar cells were also not observed in the present study similar to the observation of Hamodi *et al.* (2013) in Guinea fowl and in



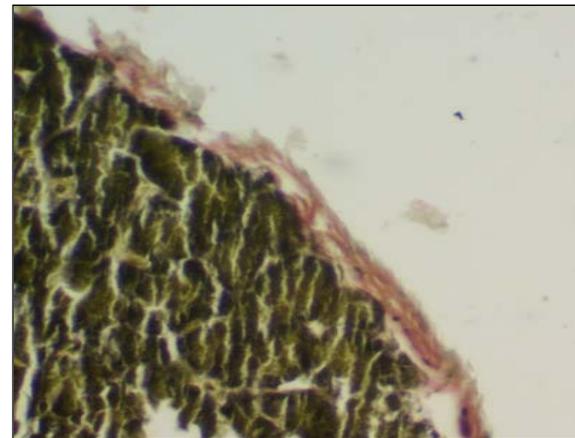
**Fig. 1:** Photograph showing female (F) and male (M) local poultry of Poonch region. Females are combless and males presents red colored comb.



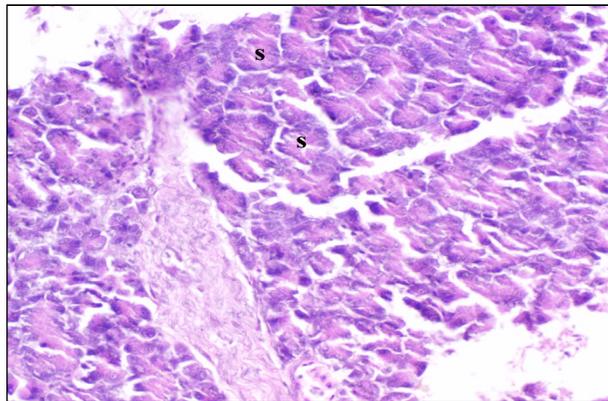
**Fig. 2:** Photograph showing pancreas (P) between the loops of duodenum (D) in local poultry of Poonch region



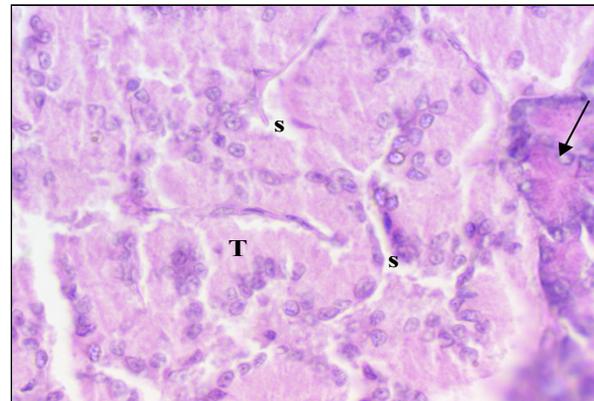
**Fig. 3:** Photomicrograph of pancreas of local poultry of Poonch region showing capsule (arrow), exocrine part (E) and Islets of Langerhans (I). Fine septae (arrow head) separating gland into indistinct lobules. H&E stain, 40x



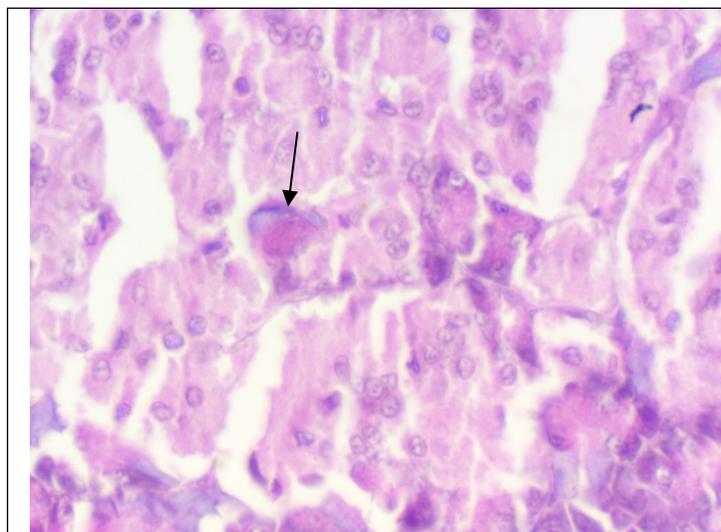
**Fig. 4:** Photomicrograph of pancreas of local poultry of Poonch region showing presence of collagen fibers (pink colour) in septa. Von Gieson & Verhoeff's stain, 400x



**Fig. 5:** Photomicrograph of pancreas of local poultry of Poonch region showing capsule spherical (s) shaped serous acini. H&E stain, 400x



**Fig. 6:** Photomicrograph of pancreas of local poultry of Poonch region showing Islets of Langerhans having tall columnar cells (T) surrounded by sinusoids (s). Serous acini have basally located round nucleus (arrow). H&E stain, 1000x



**Fig. 7:** Photomicrograph of pancreas of local poultry of Poonch region showing Islets of Langerhans having few dark cells (arrow) among the light cells of the pancreas. H&E stain, 1000x

contrast to the findings of Suri *et al.* (2022) in turkey. Al-Haaik, (2019) observed one or two nuclei in the centre of pancreatic acini in kestrel.

**Table 1:** Micrometrical parameters of pancreas of local poultry of Poonch region

Parameter	Range (in $\mu$ )	Mean Value (in $\mu$ )
Thickness of capsule	40.25 – 71.48	54.66 $\pm$ 5.39
Longer diameter of acini	26.42 – 80.08	44.02 $\pm$ 7.71
Shorter diameter of acini	22.17 – 71.65	33.92 $\pm$ 7.80
Height of acinar cell	11.27 – 15.82	12.54 $\pm$ 0.69
Nuclear diameter of acinar cells	5.19 – 7.14	5.90 $\pm$ 0.33
Longer diameter of Islets of Langerhans	143.63 – 276.07	184.62 $\pm$ 19.77
Shorter diameter of Islets of Langerhans	89.09 – 155.40	114.82 $\pm$ 10.14
Number of Islets of Langerhans per field	2 – 6	4.17 $\pm$ 0.70

Both longer and smaller diameters of serous acini were calculated (Table 1). The average longer diameter was 44.02 $\pm$ 7.71  $\mu$  whereas the smaller diameter was 33.92 $\pm$ 7.80  $\mu$ . In turkey, the longer and smaller diameter were 50.73 $\pm$ 5.59  $\mu$  and 35.08 $\pm$ 3.80  $\mu$ , respectively (Suri *et al.*, 2022). The difference in the average diameter may be due to species difference. The average height of

acinar cell was 12.54 $\pm$ 0.69  $\mu$  with average nuclear size of 5.90 $\pm$ 0.33  $\mu$ . In Guinea fowl, the average nuclear diameter was 3.415 $\pm$ 0.21  $\mu$  and the same was 4.268 $\pm$ 0.27  $\mu$  in Common gull (Hamodi *et al.*, 2013). In pancreas of turkey, the average height of acinar cell was 15.63 $\pm$ 1.59  $\mu$  with average nuclear diameter of 6.87 $\pm$ 0.35  $\mu$  (Suri *et al.*, 2022). In Guinea fowl, the secretory acini had average thickness of 46.588 $\pm$ 6.18  $\mu$  and it was 29.754 $\pm$ 4.72  $\mu$  in Common gull (Hamodi *et al.*, 2013).

The endocrine part or Islets of Langerhans varied in shape and size and were scattered within the exocrine part (Fig. 3). It constituted only a small portion of parenchyma. The endocrine part appeared as lightly stained pale areas in between the acini. Islets of Langerhans showed uneven distribution as seen in Fig. 3. The shape of the Islets of Langerhans varied from spherical, oval to elongated (Fig. 3). However, Simsek *et al.* (2009) reported round to irregular islets in falcon, oval or circular islets in golden eagle (Al-Agele and Mohammed, 2012) and oval, rounded, irregular, elongated and rectangular shape in chabro chicken (Yadav *et al.*, 2018). Yadav *et al.* (2018) reported light colored oval, triangular, irregular, elongated and polyhedral cells in chabro chicken.

In present study, most of the islets were lightly stained and cells had rounded basally located nucleus with prominent nucleolus (Fig. 7). The endocrine cells were polygonal to tall columnar arranged in irregular rows surrounded by

sinusoids (Fig. 6). Few of the islets were mixed type in this local poultry of Poonch region having both light and few dark cells. Dark cells had dark eosinophilic cytoplasm and were irregular in shape but smaller than the light cells (Fig. 7). Light islets occurred more commonly than the mixed islets. These findings corroborate with the findings of Yadav *et al.* (2018) in chabro chicken who also reported two types of islets namely light islets and mixed islets with light islets occurring more commonly than the mixed islets. They described dark cells as alpha cells and light cells as beta cells. Mobini (2011) in pancreas of goose also described alpha and beta islets. Alpha cells of islets were larger than beta cells of islets. Rawdon (1998) in chicken and Gulmez (2003) in goose mentioned that most islets were formed by beta cells. Mixed islets were also reported in Japanese quail (Sivakumar *et al.*, 2000) and pigeon (Faris, 2012).

The islets do not had any distinct borders within the exocrine part and lacked the fibrous connective tissue capsule which was similar to the observations made by Gulmez *et al.* (2004) in goose, Abou-Zaid *et al.* (2010) in pigeon, Hamodi *et al.* (2013) in common gull and Guinea fowl, Yadav *et al.* (2018) in chabro chicken and Suri *et al.* (2022) in turkey.

Number of islets per field (at 40x), longer and smaller diameter of Islets of Langerhans was recorded and given in Table 1. Mean number of islets per field at 40x was  $4.17 \pm 0.70$ . In this study, the average longer diameter was  $184.62 \pm 19.77 \mu$  whereas the smaller diameter was  $114.82 \pm 10.14 \mu$ . The mean values for longer and smaller diameter was comparatively much higher as earlier recorded in pancreas of kestrel where the smaller islets had mean diameter of  $40.02 \pm 0.9 \mu$  and larger islets had diameter of  $126.3 \pm 3.8 \mu$  (Al-Haaik, 2019). In turkey, the average longer diameter was  $49.26 \pm 1.41 \mu$  whereas the smaller diameter was  $43.61 \pm 1.23 \mu$  (Suri *et al.*, 2022).

## CONCLUSION

Pancreas was located between the descending and ascending parts of the duodenum. Histologically, the pancreas was covered by thick connective tissue capsule comprising mainly collagen fibers which sends fine septae dividing the gland into indistinct lobes. Parenchyma of pancreas consisted of both exocrine and endocrine portion. Exocrine part consisted of numerous secretory

acini varying from spherical, oval to elongated. Acini consisted of single layer of pyramidal cells with round, large, basally situated nucleus. Cytoplasm contained acidophilic zymogen granules located mainly towards the apical portion of the cell. Centro-acinar cells were not observed in the present study. Endocrine part constituted only a small portion of parenchyma and appeared as lightly stained pale areas in between the acini. Occurrence of islets varied and were unevenly distributed. The shape of the Islets of Langerhans varied from spherical, oval to elongated. Most of the islets were lightly stained and cells had rounded basally located nucleus with prominent nucleolus. Few of the islets were mixed type in this local poultry of Poonch region having both light and few dark cells.

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