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Research Article

MORPHOLOGICAL ANALYSIS OF PAROTID SALIVARY GLAND OF PIG (*SUS SCROFA*)

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ABSTRACT

The present study was conducted on six healthy young pigs of local mixed breed of either sex to study the histology and histochemistry of the parotid salivary gland. The glandular parenchyma was found to be of compound tubuloacinar type consisting of purely serous secretory end pieces along with several orders of ducts distributed in the stroma. The myoepithelial cells appeared as flattened basal cells around the secretory acinar cells and formed the incomplete layer enclosed by a basement membrane. The interstitial tissue contained scattered plasma cells and sparse lymphocytes in addition to the connective tissue fibres, numerous small blood vessels and nerves. The duct system comprised of intralobular, interlobular and large excretory ducts. The intercalated, as well as striated ducts, were of intralobular type which first opened into interlobular ducts and finally emptied into the large excretory duct lined by stratified columnar epithelium. The interlobular ducts converged to form the main parotid duct, which opened into the oral cavity. Histochemical studies revealed the absence of neutral mucopolysaccharides, weakly acidic sulfated mucosubstances, sialomucins and hyaluronic acid in the secretory units; however, goblet cells showed the presence of all these substances in the interlobular ducts of the parotid gland.

Keywords: Histomorphology, Histochemistry, Parotid gland, Pig

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The salivary glands are invaginations from the buccal epithelium into the lamina propria-submucosa (Singh and Singh, 2017a). These develop at different sites and they have very different architectures and produce different types of saliva. The salivary glands are known as multifunctional organs as they perform many important digestive, protective, excretory and endocrine functions. The secretion (saliva) of the parotid gland plays an important role in the moistening and swallowing of newly ingested food and the maintenance of oral hygiene. The saliva is mostly serous containing various enzymes, water, mucopolysaccarides and lubricating glycoproteins (Singh and Singh, 2017b). The broader distributions of the salivary glands are advantageous for the protection of the oral cavity against pathogens. Dysfunction of salivary secretion (hyposalivation) causes xerostomia (dry mouth) and sequentially leads to severe dental caries as well as oral mucosal disorders (Featherstone, 2000).

In the literature, the structure of the parotid salivary gland of the prenatal pig (Zhou *et al.*, 2010), rabbit (Al-Saffar, 2014), sheep (Singh *et al.*, 2015) and neonatal buffalo (Singh and Singh, 2017c) has been studied at both macroscopic as well as microscopic levels, but the parotid salivary gland of the postnatal pig has received little attention, especially from the histomorphochemical point of view. Keeping in view the importance of parotid gland, the present study describes light microscopic details of the gland in postnatal pig and its comparison with other domestic animals.

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MATERIALS AND METHODS

The present study was conducted on the parotid salivary gland of six healthy young pigs of local mixed breed of either sex. The heads were procured from the local slaughter house immediately after decapitation and the tissues were fixed in a 10% neutral buffered formalin solution for 48 hours, subjected to routine tissue processing for light microscopic examination and embedded in paraffin blocks. The paraffin sections (5-6µ) were made through the entire gland and stained with routine Harris' hematoxylin and eosin stain for general histomorphological examination, Gomori's stain for reticular fibres, Weigert's method for elastic fibres (Luna, 1968) and Crossman's trichrome stain for collagen fibres (Crossman, 1937). In addition, selected sections were processed for the histochemical demonstration of mucopolysaccharides using Periodic-Acid-Schiff-Alcian blue (PAS-AB), Alcian blue (AB) at pH 2.5, McManus' method, Colloidal iron method and Mayer's mucicarmine method (Luna, 1968).

RESULTS AND DISCUSSION

The parotid gland of pig was found to be of compound tubulo-acinar type as observed earlier in camel (Mansouri and Atri, 1994), sheep (Singh *et al.*, 2015) and neonatal buffalo (Singh and Singh, 2017c); however, the gland has been reported compound tubulo-alveolar type by Elewa *et al.* (2010) in goat. The gland was enclosed in a thick layer of fibrous connective tissue known as capsule. The dense septa primarily composed of collagen fibres along with few reticular fibres, arose from the capsule and passed into

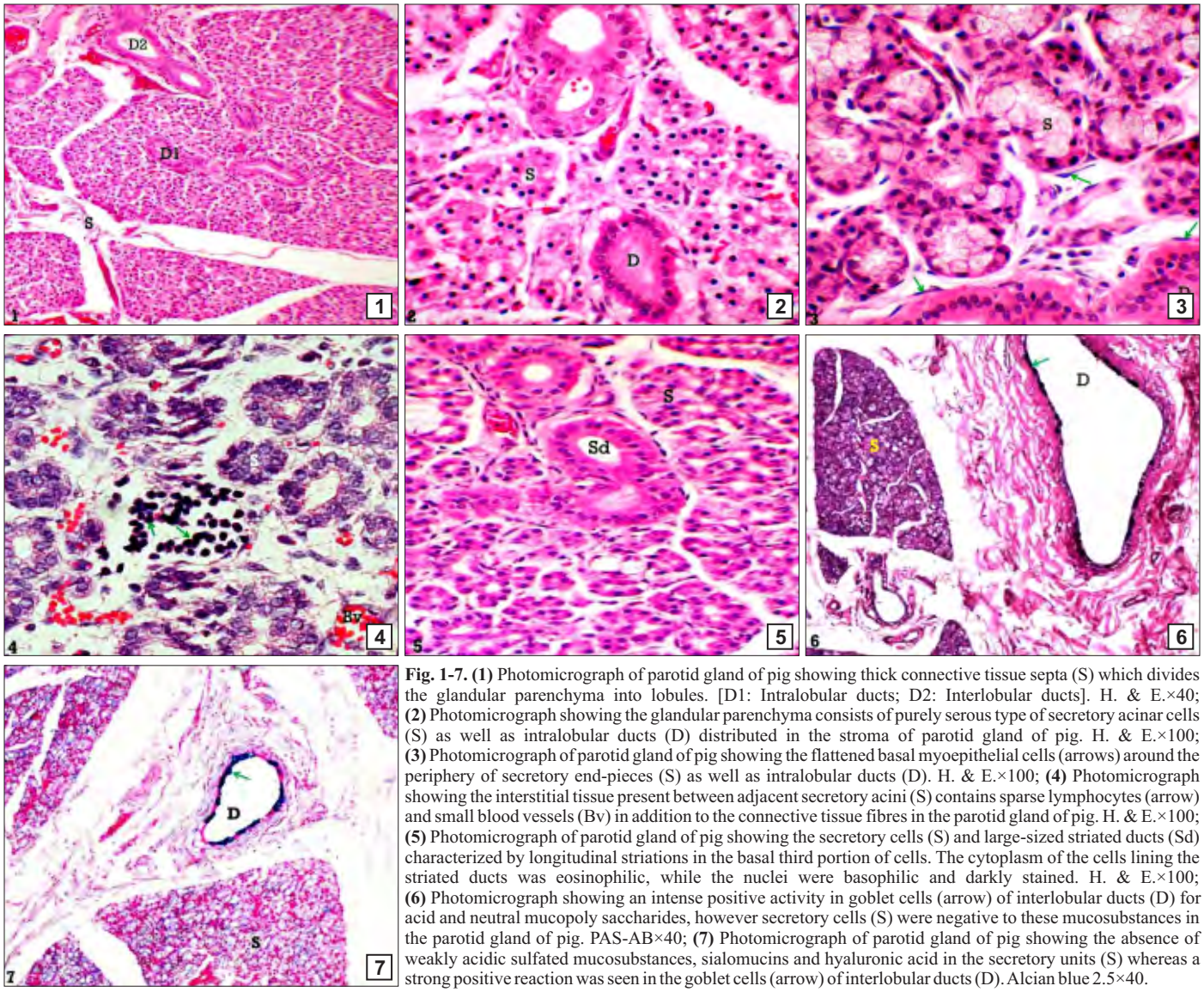

Fig. 1-7. (1) Photomicrograph of parotid gland of pig showing thick connective tissue septa (S) which divides the glandular parenchyma into lobules. [D1: Intralobular ducts; D2: Interlobular ducts]. H. & E.×40; **(2)** Photomicrograph showing the glandular parenchyma consists of purely serous type of secretory acinar cells (S) as well as intralobular ducts (D) distributed in the stroma of parotid gland of pig. H. & E.×100; **(3)** Photomicrograph of parotid gland of pig showing the flattened basal myoepithelial cells (arrows) around the periphery of secretory end-pieces (S) as well as intralobular ducts (D). H. & E.×100; **(4)** Photomicrograph showing the interstitial tissue present between adjacent secretory acini (S) contains sparse lymphocytes (arrow) and small blood vessels (Bv) in addition to the connective tissue fibres in the parotid gland of pig. H. & E.×100; **(5)** Photomicrograph of parotid gland of pig showing the secretory cells (S) and large-sized striated ducts (Sd) characterized by longitudinal striations in the basal third portion of cells. The cytoplasm of the cells lining the striated ducts was eosinophilic, while the nuclei were basophilic and darkly stained. H. & E.×100; **(6)** Photomicrograph showing an intense positive activity in goblet cells (arrow) of interlobular ducts (D) for acid and neutral mucopoly saccharides, however secretory cells (S) were negative to these mucosubstances in the parotid gland of pig. PAS-AB×40; **(7)** Photomicrograph of parotid gland of pig showing the absence of weakly acidic sulfated mucosubstances, sialomucins and hyaluronic acid in the secretory units (S) whereas a strong positive reaction was seen in the goblet cells (arrow) of interlobular ducts (D). Alcian blue 2.5×40.

the gland to divide it into lobes and lobules (Fig. 1). The size of lobules varied without a definite pattern. A similar type of arrangement was observed in the horse (Dellmann and Eurell, 1998), goat (Muthukrishnan *et al.*, 2013), sheep (Singh *et al.*, 2015) and neonatal buffalo (Singh and Singh, 2017c). Each lobule consists of a purely serous type of secretory cells known as acini along with the several orders of ducts distributed in the stroma (Fig. 2). However, the gland was reported to be of mixed type in young puppies and lambs (Dellmann and Eurell, 1998). The gland in camel was reported to be seromucous in nature (Mansouri and Atri, 1994). Vignoli and Nogueira (2007) found that the parotid gland of Zebus (*Bos indicus*) was entirely serous in older animals, but mucous end pieces were seen in younger animals.

Furthermore, a few mucous cells were present in carnivores (Banks, 1992). The gland was found to be of purely serous type in sheep (Singh *et al.*, 2015) and neonatal buffalo (Singh and Singh, 2017c). These pyramidal shaped acinar cells were arranged around a narrow lumen and characterized by the presence of spherical nucleus located near the basal-third of the cell. These findings are in agreement with those of Elewa *et al.* (2010) in goat and Singh *et al.* (2015) in sheep.

Flattened basal cells, known as myoepithelial cells, were seen around the secretory end-pieces as well as intercalated and striated ducts of the parotid gland, which results in the formation the incomplete layer, enclosed by a basement membrane (Fig. 3). Stellate-shaped myoepithelial cells were located between the secretory cells and the basement membrane as reported by Muthukrishnan *et al.* (2013) in goat.

The interstitial tissue comprised of sparse lymphocytes and scattered plasma cells in addition to the connective tissue fibres, numerous small blood vessels and nerves (Fig. 4). However, Elewa *et al.* (2010) stated that the

presence of myoepithelial cells surrounding the intercalated duct was considered as a distinguishing feature to identify these ducts in parotid gland of goat. The secretory units were followed by a duct system. The duct system comprised of intercalated, striated, interlobular and large excretory ducts. The secretory cells first opened into small intercalated ducts, lined by simple cuboidal epithelium as reported in parotid gland of sheep (Singh *et al.*, 2015). These intercalated ducts then emptied into the large striated ducts, lined by simple columnar epithelium. These large striated ducts with a wide lumen were characterized by longitudinal striations in the basal third portion of cells, extending from the base of cells to the level of the nucleus. The cytoplasm of the cells lining the striated ducts was eosinophilic, while the nuclei were basophilic and darkly stained (Fig. 5). Lemmon (2008) reported that the striated ducts occurred in groups and lacked distinct striations in buffalo calves. These ducts then opened into the interlobular ducts and finally emptied into the large excretory duct lined by stratified columnar epithelium. The interlobular ducts converged to form the main parotid duct, which opened into the oral cavity. This duct system had also been noticed in the parotid gland of horse (Dellman and Eurell, 1998), camel (Mansouri and Atri, 1994), goat (Elewa *et al.*, 2010) and sheep (Singh *et al.*, 2015). Goblet cells were present among the epithelium of interlobular and large excretory ducts with their varied numbers.

Histochemical studies revealed the absence of neutral mucopolysaccharides, weakly acidic sulfated muco-substances, sialomucins and hyaluronic acid in the secretory end-pieces and the stroma of the gland (Fig. 6). A strong to intense Periodic-Acid-Schiff (PAS) positive reaction was seen in the goblet cells of epithelium of interlobular and large excretory ducts; however, strong Alcian blue (AB) reaction was noticed in these goblet cells (Fig. 7). A similar type of activity was observed in parotid gland of sheep (Singh *et al.*, 2015). Localization of neutral mucopolysaccharides in acinar cells of bovine parotid gland was observed, whereas these cells lacked acidic mucopolysaccharide content (Lemmon, 2008). Mayer's mucicarmine and Colloidal iron methods also showed absence of mucosubstances in the secretory acinar cells.

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