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Research Article

HISTOMORPHOLOGICAL AND HISTOCHEMICAL STUDIES ON THE DUCT SYSTEM OF THE BUCCAL AND LABIAL GLANDS IN BUFFALO (BUBALUS BUBALIS)

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ABSTRACT

The tissues from the buccal and labial glands of ten healthy buffalo calves (1-1½ years of age) were collected and processed for paraffin and frozen sectioning techniques. The duct system of these glands was comprised of intercalated, intralobular, interlobular, interlobar and excretory ducts. The intercalated duct emerged from the alveolar lumen of mucous alveoli but through intercellular canaliculi from serous alveoli and terminated by opening into the next duct. The epithelium changed progressively from simple squamous lining the intercalated duct to stratified columnar with goblet cells in the interlobar ducts with the difference that goblet cells were not seen in the epithelium lining the interlobar duct of labial glands. The epithelial cells were filled with homogeneous acidophilic cytoplasm and were negative to all types of carbohydrates, lipids and enzymes studied during the present study except the goblet cells which contained neutral and acidic mucopolysaccharides and orthochromatically reactive mucin.

Key words: Buccal gland, labial gland, duct system, buffalo

The minor salivary glands contribute to the secretion of saliva which plays an important role in keeping the ruminants healthy by fascilitating mastication and deglutition, helping in restoration of normal ruminal pH and microbial protein synthesis to be used as dietary proteins. The literature revealed that most of the research work is confined to major salivary glands whereas the research conducted on minor salivary glands is sparse and scanty. Though some of the studies have been conducted on the secretory adenomeres of the minor salivary glands in buffalo (Gupta *et al.*, 2000, 2004, 2005, 2007) but still their duct system remained unexplained in detail. Hence the present study was aimed at to give emphasis on the duct system of the minor (buccal and labial) salivary glands in buffalo.

MATERIALS AND METHODS

Small pieces of tissues buccal and labial glands from ten healthy buffalo calves (1-1½ years of age) of either sex were collected and processed for paraffin and frozen sectioning techniques. The sections were stained with routine Harri's haematoxylin and eosin stain for general histomorphology, Weigert's method for elastic fibers, Gomori's method for reticular fibers (Luna, 1968) and Crossman's trichrome stain for collagen and muscular fibers (Crossman, 1937). Frozen sections were stained with periodic acid Schiff's (PAS) stain with and without saliva (diastase) treatment for mucopolysaccharides. Best's carmine stain for glycogen (Luna, 1968). Alcian blue with metanil yellow for acid mucopolysaccharides (Drury and Wallington, 1967), Mayer's mucicarmine stain for mucin (Thompson and Hunt, 1966), Sudan black-B method for fat (Luna, 1968), Nile blue sulphate method for acidic and neutral lipids (Bancroft and Stevens, 1977), Azo-dye for acid phosphatase enzyme (Barka, 1960) and Azo-dye technique for alkaline phosphatase enzyme (Burstone, 1958). Micrometry was done with the help of a linear calibrated ocular micrometer.

RESULTS AND DISCUSSION

The parenchyma of buccal and labial glands in buffalo was composed of the secretory units (adenomeres) and duct system. The secretory part was made up of serous, mucous and mixed alveoli with serous demilunes while the duct system formed by the various types of ducts classified as intercalated,

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intralobular, interlobular, interlobar and excretory duct depending upon type of epithelium lining the ducts and connective tissue thickness surrounding them.

The intercalated ducts originated from the lumen of the mucous alveoli while from serous alveoli these ducts originated through intercellular canaliculi and terminated by opening into the next duct. The epithelial height increased progressively from intercalated to interlobar ducts (Table). The lining epithelium was simple squamous to simple low cuboidal in the intercalated ducts (Fig 1), simple cuboidal to simple low columnar in the intralobular ducts (Fig 2) and simple columnar to pseudostratified columnar lining the interlobular ducts (Fig 3).The folded mucosa of interlobar ducts was made up of pseudostratified columnar to stratified columnar epithelium with abundance of goblet cells lining the interlobar ducts (Fig 4) while the goblet cells were not seen in the epithelium lining the interlobar ducts of labial glands as reported in sheep and cattle (Kay, 1960). The excretory ducts were lined with stratified columnar epithelium at their beginning which changed to stratified squamous near their opening of the ducts in oral cavity. The same pattern of duct system with epithelium lining has been described by Parida and Das (1991) in domestic ruminants. Contrary to present findings, the intercellular canaliculi were associated with serous as well as mucous components (Shackleford and Klapper, 1962) in major salivary glands of mammals. Young and VanLennep (1978) reported that the excretory units of ventral buccal glands in ruminants consisted of intercalated, striated and excretory ducts. Kay (1960) in cattle and sheep reported that the intralobular ducts of buccal glands were lined with flat epithelial cells. Contrary to our findings Stinson and Calhoun (1993) in domestic animals divided the duct system of buccal glands consisting of simple cuboidal epithelium within the lobule and two layered cuboidal epithelium in the larger interlobular ducts. They further mentioned that stratification of duct epithelium increased towards the oral cavity where it changed to stratified squamous type. The stratification of the epithelium and occurrence of goblet cells towards the excretory ducts was also reported in domestic ruminants (Parida and Das, 1991), in cattle and sheep (Kay, 1960) and in ruminants (Young and Van Lennep, 1978). The luminal border of the epithelial cells lining the ducts of buccal glands in buffalo presented secretory blebs giving an appearance of streamer formation. It was hypothesized that something may be contributed by the ductal cells to the secretory products of the glands during its passage through the ducts.

The basement membrane binding the ducts was surrounded by lamina of collagenous and reticular

Table

Micrometry of various types of ducts in buccal and labial glands of buffalo

Parameter (μ)	Intercalated duct	Intralobular duct	Interlobular duct	Interlobar duct
Dorsal buccal gland				
Ductal diameter	31.08±14	60.68±2.41	110.88±3.28	212.47±4.46
Luminal diameter	14.06±1.07	34.04±1.64	80.29±2.05	*
Epithelial height	7.00±0.46	12.57±0.40	16.09±0.39	22.50±1.08
Middle buccal gland				
Ductal diameter	26.64±1.35	56.08±1.97	73.63±2.25	121.89±3.04
Luminal diameter	9.99±0.83	34.41±1.75	46.25±1.82	*
Epithelial height	8.51±0.33	11.28±0.77	14.98±0.96	20.40±1.37
Ventral buccal gland				
Ductal diameter	26.27±1.03	41.43±2.73	95.83±2.71	203.59±4.15
Luminal diameter	10.54±1.00	21.82±1.49	69.56±1.03	*
Epithelial height	7.77±0.39	10.73±0.62	14.61±0.37	24.25±1.82
Labial gland				
Ductal diameter	51.28±1.85	77.33±2.50	101.34±3.25	169.48±3.81
Luminal diameter	22.94±0.66	37.93±1.95	75.85±1.62	*
Epithelial height	14.06±0.48	16.83±0.51	19.79±0.97	28.60±1.96

*Obliterated with folded mucosa

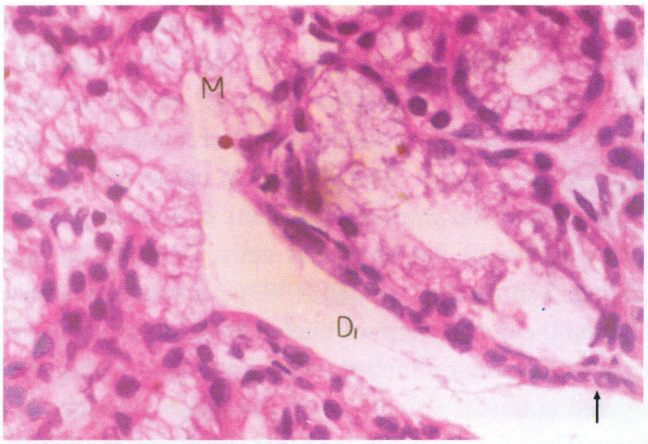

Fig 1. Dorsal buccal gland showing origin of intercalated duct (D1) from the lumen of mucus alveoli (M). The epithelium lining the duct is simple squamous to low cuboidal (arrow). (H. & E. x 200).

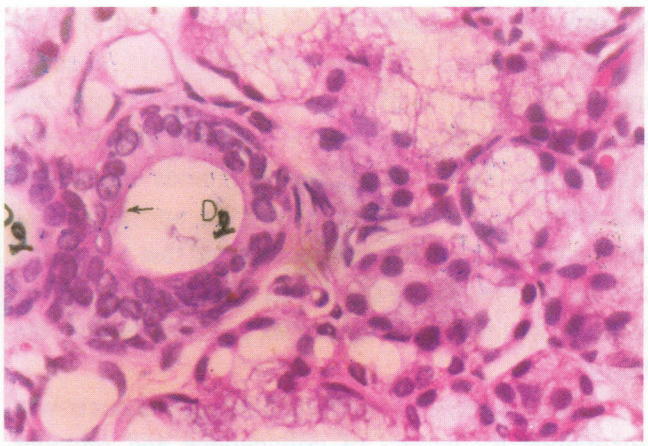

Fig 2. Dorsal buccal gland showing intralobular duct (D2). The epithelial lining is typical simple cuboidal to simple low columnar with secretory streamers towards free surface (arrow). (H. & E. x 200)

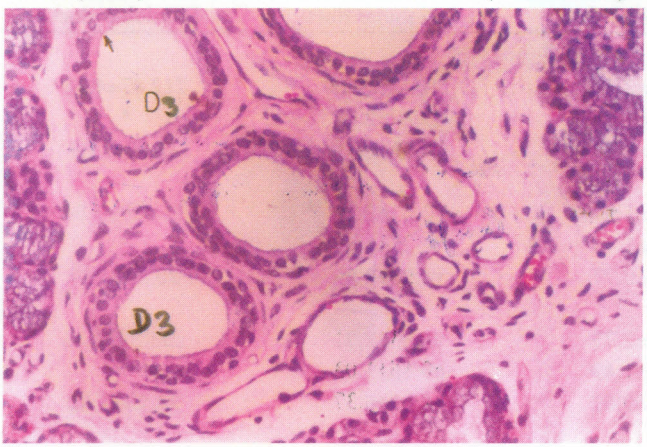

Fig 3. Dorsal buccal gland showing interlobular duct (D3). The epithelial lining is simple columnar to pseudostratified columnar with scretory streamers towards free surface (arrow). (H. & E. x 100)

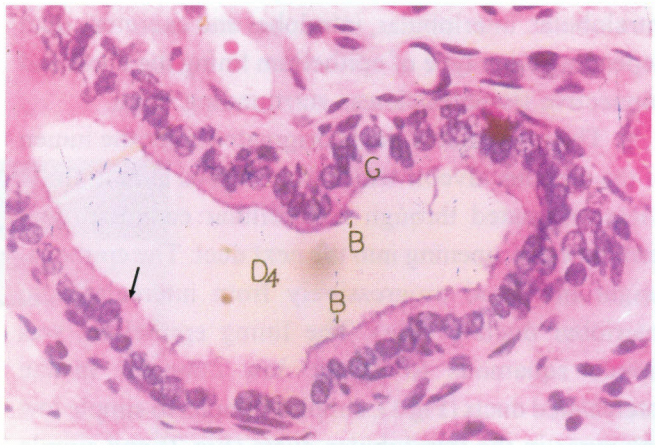

Fig 4. Dorsal buccal gland showing interlobar duct (D4). The epithelial lining is pseudostratified columnar with goblet cells (G). Scretory blebs (B) and streamers (arrow) can also be seen. (H. & E. x 200)

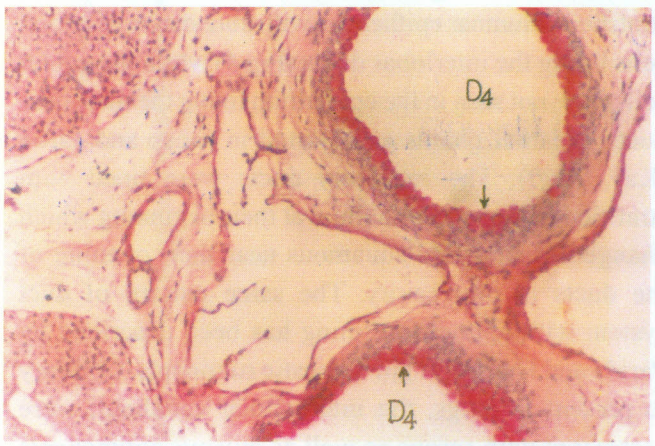

Fig 5. Ventral buccal gland showing PAS-positive material in goblet cells (arrow) lining the interlobar duct (D4). (PAS x 50)

fibers. The tunica adventitia around the ducts recorded a progressive increase in thickness from a thin lamina around the intercalated duct to a large amount of collagenous and reticular fibers surrounding the interlobar ducts. But the absence of elastic fibers in the parenchyma and tunica adventitia of ducts proved that these glands are continuously discharging their secretions in the oral cavity (Eversole, 1972, Parida and Das, 1991). The ductal and luminal diameter showed a progressive increase from intercalated to interlobar ducts of buccal and labial glands in buffalo (Table). Micrometry of excretory duct could not be done in the present investigation.

The epithelial cells lining the ducts of buccal gland in buffalo were filled with acidophilic cytoplasm (Figs 1, 2, 3, 4) and were negative to all types of

carbohydrates, mucopolysaccharides, lipids and enzymes studied during the present investigation. Only the goblet cells lining the duct epithelium reacted positively with PAS (Fig 5) and alcian blue (Fig 6) stains while these were negative to mucicarmine stain . It can be concluded that the goblet cells of the ducts contained neutral and acidic mucopolysaccharides, whereas the mucins containing prosthetic groups (highly complex sulphuric acid) found in mucous cells of the secretory units may not be present in these cells. It supported that the mucopolysaccharides in the form of mucin reacting orthochromatically is being added to the secretory product during its passage through the ducts. Whereas, the cells lining the ducts of labial glands in buffalo were negative for all histochemical stains used during the present study except a strong Alcian blue positive reaction at the luminal border of the interlobar ducts. It can be opined that the absence of secretory blebs or streamers on the luminal border of the epithelial cells and presence of Alcian blue reaction near the luminal border reflected that nothing significant was being added from the ductal cells to the secretory products of the labial glands except a small amount of orthochromatically reacting mucin during its passage through the ducts.

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