HISTOLOGICAL STUDIES ON THE NASAL CAVITY OF SHEEP (OVIS ARIES)

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ABSTRACT

The histological studies conducted on nasal cavity of sheep revealed vestibular, respiratory and olfactory regions. The smallest vestibular region was lined by stratified squamous epithelium and its propria submucosa contained hair follicles, sebaceous glands, sweat glands, venous caverns, mucous and serous glands. The respiratory region was lined by pseudostratified columnar ciliated epithelium and its propria submucosa had mucous glands which were strongly PAS positive especially for mucopolysaccharides, hyaluronic acid and sialomucins. Vascularity increased rostro-caudally. The olfactory region was lined with the olfactory epithelium and contained mucous type of Bowman's glands and increased number of nerve bundles.

Key words: Nasal cavity, nasal turbinates, vestibular, respiratory, olfactory, sheep

The nasal cavity plays an important role in preparation of the inspired air, olfaction and removal of foreign dust particles. The histology of nasal cavity had been studied in cattle (Pass et al., 1971, Adams, 1986), buffalo (Gupta et al., 1994), goat (Kumar et al., 1992, 1993), dog (Kumar et al., 1994), camel (Badawi and Bab, 1974, Zguigal et al., 1994, Suman et al., 1998) and horse (Kumar et al., 2000). The present communication describes histomorphological features of different structures of nasal cavity in sheep and its comparison with other domestic animals.

MATERIALS AND METHODS

The present study was conducted on six young sheep (Ovis aries) of local mixed breed of either sex. The heads were procured from local slaughter house. The mid sagittal section of each head was made to collect the tissues from the straight and alar fold, rostral, middle and caudal parts of the dorsal, middle and ventral nasal turbinates and ethmoturbinates. The tissues fixed in 10% neutral buffered formalin were decalcified by formic acid-sodium citrate method (Luna, 1968) and processed for paraffin technique of light microscopy. Sections of 5-6 μ were stained with routine Harris’ hematoxylin and eosin stain, Gomori’s method for reticulum, Weigert’s method for elastic fibers, Bielschowsky’s method for axis cylinder and olfactory dendrites, PAS-Alcian blue method for mucosubstances (pH 2.5), Alcian blue method for mucosubstances (pH 2.5), McManus’ method for glycogen (PAS) (Luna, 1968) and Crossman’s trichrome stain for collagen fibers (Crossman, 1937).

RESULTS AND DISCUSSION

The nasal cavity of sheep was categorized into vestibular, respiratory and olfactory regions on the basis of epithelial lining of nasal mucosa which were previously described as alar fold region, upper first premolar region and last molar region (Khamas and Ghoshal, 1982). Vestibular region constituted small portion of the rostral part of nasal cavity lining the alar and straight fold having stratified squamous non-keratinised epithelium (Fig 1) as reported earlier in domestic animals (Zguigal et al., 1994, Suman et al., 1998, Kumar et al., 2000). The deeper surface of lining epithelium was very irregular due to the presence of papillary pegs as reported in sheep (Khamas and Ghoshal, 1982), goat (Kumar et al., 1992), camel (Badawi and Bab, 1974), and dog (Kumar et al., 1994). However, stratified cuboidal epithelium lined the vestibular region in bovines (Adams, 1986). The
Fig 1. Straight fold showing stratified squamous epithelium (E), collagen fibres (F) in between interpapillary pegs (P) surrounding sebaceous glands (S) and hair follicles (H). (Crossman's trichrome stain x 50)

Fig 2. Propria submucosa of mid portion of dorsal nasal turbinate showing strong PAS positive activity in epithelial goblet cells (C), duct opening on to the surface of the epithelium (D) and glandular acini (G). (McManus' PAS x 50)

Fig 3. Mid level of ventral nasal turbinate showing respiratory region having thicker outer propria submucosa (O) than inner surface (I) divided by the osseous plate (P). Note respiratory epithelium (E) of the surfaces. (H. & E. x 20)

Fig 4. Rostral part of middle nasal turbinate showing positive reaction for mucopolysaccharides in goblet cells (C) and mucus acini (A). Ducts (D) showing weak positive reaction. (PAS-Alcian blue x 50)

Fig 5. Caudal portion of dorsal nasal turbinate showing pseudostratified columnar epithelium with olfactory dendrites (E), Bowman’s glands (B), Nerve bundles (N), hyaline cartilage (C) and increased vascularity (V). (H. & E. x 20)

Fig 6. Pseudostratified columnar epithelium with olfactory dendrites (E) lining the caudal portion of ethmoturbinates. Note basal (b), supporting (s) and olfactory (o) cells and Bowman's glands (B) in propria submucosa. (H. & E. x 100)
subepithelial part of propria submucosa had loose irregular connective tissue having fine reticular and dense collagen fibers bundle and sebaceous glands. The deeper part of propria submucosa had a large number of small blood vessels, venous caverns, fine blood capillaries and seromucous glands. The propria submucosa was well supported by a hyaline cartilage. The respiratory zone was localized to rostral and middle parts of dorsal, middle and ventral nasal turbinates, and a major portion of ethmoturbinates. The respiratory region was lined with pseudostratified columnar ciliated epithelium with PAS positive goblet cells (Fig 2) as reported in camel (Badawi and Bab, 1974), buffalo (Gupta et al., 1994), bovine (Adams, 1986) and horse (Kumar et al., 2000). The mucosa of respiratory region was divided into an outer and an inner surface by an irregular osseous plate. Both the surfaces were lined with respiratory epithelium (Fig 3) as reported in goat (Kumar et al., 1992), buffalo (Gupta et al., 1994), dog (Kumar et al., 1994), camel (Suman et al., 1998) and horse (Kumar et al., 2000). The epithelium of outer surface had round to oval shaped nuclei of basal cells placed in a linear row towards the basement membrane. The most superficial layer of nuclei was more basophilic. The cytoplasm of goblet cells showed strong PAS positive activity (Fig 2) for acidic and neutral mucopolysaccharides. A few vacuolated areas and lymphocytes were also observed in the epithelium.

The outer propria submucosa was more in thickness and had loose connective tissue along with a few connective tissue cells, clusters of mucus acini, fine blood capillaries, large number of venous caverns and small to medium sized blood vessels. The similar type of the glandular acini had been reported in goat (Kumar et al., 1992), buffalo (Gupta et al., 1994), camel (Suman et al., 1998) and horse (Kumar et al., 2000). However, Badawi and Bab, (1974) observed a few seromucous glands in camel. The mucous glands and their ducts showed strong PAS positive activity (Fig 2) for glycogen. The acini showed weak reaction for the acidic and neutral mucopolysaccharides and a moderately positive activity for hyaluronic acid and sialomucins (Fig 4). The deeper half of propria submucosa had mainly venous caverns, which presented valvular arrangement due to constriction and dilatation.

In addition, a large number of the blood capillaries and medium sized blood vessels and nerve bundles were also present.

The epithelium of the inner surface had basal cells and a few sustentacular cells and more abundance of strongly PAS positive goblet cells as compared to the outer surface. However, Badawi and Bab (1974) observed more number of goblet cells towards the outer surface in camel. The goblet cells showed predominance of neutral mucopolysaccharide. The propria submucosa towards inner surface had comparatively denser arrangement of connective tissue cells but the concentration of mucus glandular acini and venous caverns was drastically reduced (Fig 3) as reported in goat (Kumar et al., 1993) and camel (Suman et al., 1998). The majority of acini with strong PAS positive activity showed predominance of acidic mucopolysaccharides towards luminal surface (Fig 4). The distribution of the collagen fibers was more in the vicinity of the glandular acini and blood vessels.

The olfactory region was localized in the caudal most portion of the dorsal nasal turbinate and ethmoturbinates adjacent to the cribriform plate of the ethmoid bone. This region was lined with pseudostratified columnar epithelium with olfactory dendrites (Figs 5, 6) as reported earlier in goat (Kumar et al., 1993), buffalo (Gupta et al., 1994), camel (Badawi and Bab, 1974, Zguigal et al., 1994, Suman et al., 1998) and dog (Kumar et al., 1994) and horse (Kumar et al., 2000). The height of the epithelium was drastically increased as compared to respiratory epithelium and was constituted by 8-14 rows of nuclei oriented at varying heights. The basal cells had round to oval shaped nuclei. The lightly stained round to oval shape nuclei of olfactory cells were mainly localized towards lower half of the epithelium. The oval to elongated nuclei of supporting cells was densely stained and mainly occupied superficial part of the epithelium (Fig 6). The cytoplasm of these cells was eosinophilic and finely granular. The free surface of the epithelium presented olfactory dendrites. The outer propria submucosa had loose irregular connective tissue, clusters of mucus type Bowman’s glands, blood capillaries and a few venous caverns (Fig 6). The mucous acini showed moderate PAS positive activity as reported in camel (Zguigal et
The glandular acini were serous in nature in buffalo (Gupta et al., 1994), camel (Suman et al., 1998) and goat (Kumar et al., 1993). However, the concentration of nerve bundles was drastically increased in olfactory portion (Fig 5) as reported in buffalo (Gupta et al., 1994), camel (Suman et al. 1998) and goat (Kumar et al., 1993). The inner propria submucosa was comparatively smaller but it had cellular characteristics like those of the outer surface. However, Suman et al. (1998) reported absence of the Bowman's glands towards inner surface in camel.

REFERENCES


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