

## Original Research Article

# Histoarchitectural Studies on the Organs of Upper Respiratory Tract from Nostril to Larynx in Garole Sheep

Manoj Kumar Sinha<sup>1\*</sup>, Sanjay Ray<sup>2</sup> and Avnish Kumar Gautam<sup>3</sup>

<sup>1</sup>Department of Veterinary Anatomy, Bihar Veterinary College,  
Bihar Animal Science University, Patna-14, India

<sup>2</sup>Bihar Veterinary College, Patna, India

<sup>3</sup>WBUAFS, Kolkata, India

*\*Corresponding author*

## ABSTRACT

For present study tissue samples were collected from external nares, nasal cavity, nasopharynx and larynx of six healthy adult Garole Sheep. The samples were routinely prepared for routine histological observation. The external nares, and nasopharynx were lined by stratified squamous epithelium, and nasal cavity was ciliated pseudostratified columnar epithelium. Nasal epithelium showed several cell types including ciliated cell, secreting cell, brush cell and basal cell. The nasal glands were serous and mucous type and solitary lymph nodes were identified in the propria. Epiglottis was made up of elastic cartilage where as others was made up of hyaline cartilage. Test buds were observed in all laryngeal cartilage except in the cricoid cartilage. The cricoid cartilage appeared in the form of continuous plate in others. A smaller nodular projection was found at the base of epiglottis and arytenoid cartilage.

### Keywords

Respiratory tract,  
Garole sheep,  
Histology

## Introduction

Garole sheep is a popular breed of sheep, mainly found in the eastern region of India. This is known for its high prolificacy, good meat quality and disease resistant power particularly to foot rot and capable of grazing in knee-deep water. All economies of rural people are dependent on small ruminants farming, but major losses of sheep farmer are due to respiratory disease of sheep.

Respiratory disorders are mainly cause due to air born diseases, and pathological changes of the respiratory system. Respiratory tract is exposed to large quantities of foreign materials and inhaled

with air. The large particles are usually trapped in the upper respiratory tract and only the very smallest particle inter to the lung. Respiratory tract contains lymphoid tissue in the form of nodules within the mucosa in the walls of the air ways, which is maintained the respiratory system immunity.

The histological details of upper respiratory tract of some mammals, like goat and equine, are available in literature, but information regarding Garole sheep upper respiratory tract is scanty. Therefore, in present study structure of normal upper respiratory tract, from nostril to larynx, in garole sheep has been discussed here.

## **Materials and Methods**

The samples were collected from six (3 male and 3 female) adult Garole Sheep. All the organs of the upper respiratory tract of goat are taken from Tangra slaughter house, Kolkata, India. The samples are harvested from External nares, Nasal cavity, Nasopharynx and Larynx. The samples were fixed in 10% neutral buffer formalin. The tissues were then routinely processed to prepare the paraffin blocks. Then sections of 5-6 microns thickness were cut and stained with hematoxylin and eosine Luna (1968), for collagen, elastic and glycogen, Massom (1929), Mallory (1961) and McManus (1946) techniques were applied. Sections were photographed by using Leica Qwin Image Analyser software in Leica DM2000 Microscope.

## **Results and Discussion**

### **Anterior naris**

From the histological observation of anterior naris of sheep it was revealed that the outer most surface was lined by stratified squamous epithelium and the epidermal thickness were  $342.24 \pm 24.16 \mu\text{m}$  in sheep. The no of epidermal strata was counted and recorded  $28.7 \pm 4.1$  cells/ $100 \mu\text{m}^2$  in sheep (Fig.1). From the recorded it was revealed that the number of septa were numerous. However no literature was in found in support of our findings. Donald R. Adams and Dieter Dellmann (1998) mentioned that the skin around the external opening (naris) of the nasal cavity was slightly modified in each species.

Numerous hair follicles were identified at the outer most layer of the anterior naris in sheep. There was no hair follicle in the internal surface of the anterior naris. Sebaceous and sweat gland were enormous

and frequencies were as per with the hair follicle population. Distribution of mesocrine glands within the dermal component was similar in sheep. In these regarded no literature was found in support in our finding.

The allar cartilage was found in the form of a continuous plate like structure with in the dermal component in sheep. The section specially treated from collagen fiber revealed irregular distributions of collagen fiber within the dermal component in sheep the fibers were regularly oriented in and around the allar cartilage, again in case of sheep around the allar cartilage solitary lymph node were also found. But no literature was available in agreement of our findings.

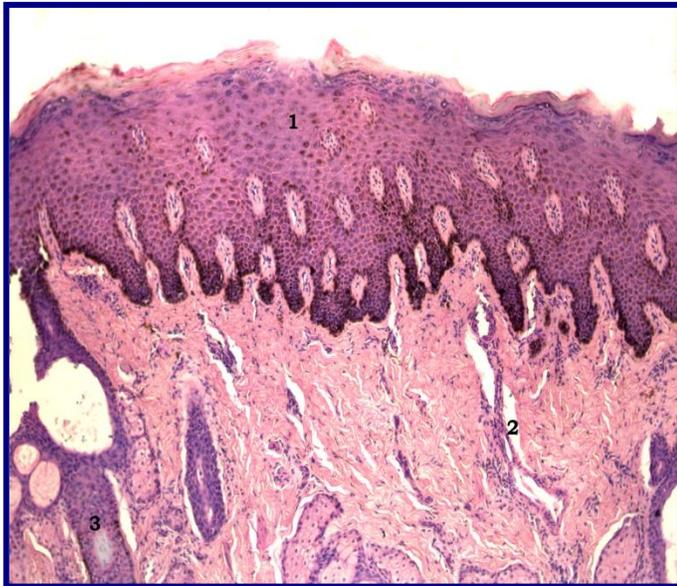
Elastic fibers were abundantly distributed around the hair follicles and within the dermal component in sheep. But there is no literature in this regard.

### **Respiratory nasal cavity**

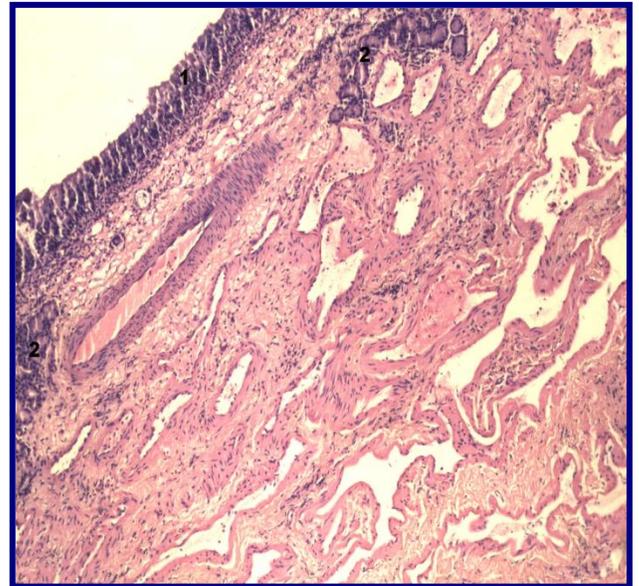
It was revealed from the histological sections of respiratory region of nasal cavity of sheep that the epithelium was lined by ciliated psudostratified columnar epithelium around the middle nasal meatus.

The ciliated stratified epithelium of nasal cavity showed several cell type including ciliated cells, secretary cells, basal cells and brush cells. The nasal gland mostly serous and mixed types were identified with in the lamina propria part of the nasal concha. Aggregation of lymphocytes in the form of lymph node was revealed with in the nasal mucosa of both the species.

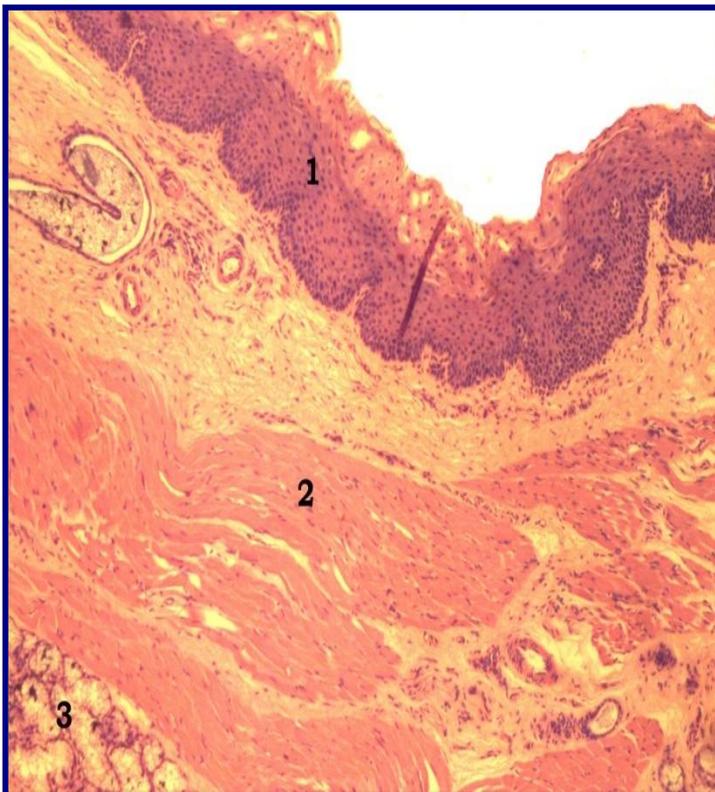
These findings are in full agreement with the statement recorded by Banks (1993) and Delman brown (1998).



**Fig.1** Photomicrograph showing Anterior naris of sheep, Epithelium (1) Sweat gland (2) Sebaceous gland (3) H&E, X 100



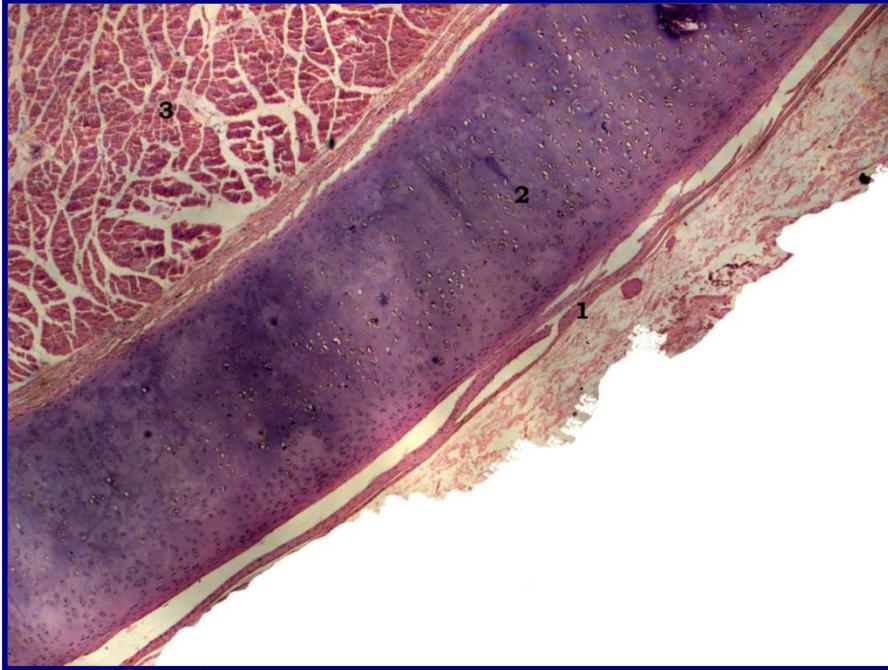
**Fig.2** Photomicrograph showing Nasal mucous membrane of sheep Epithelium (1), gland (2), H&E, X 100



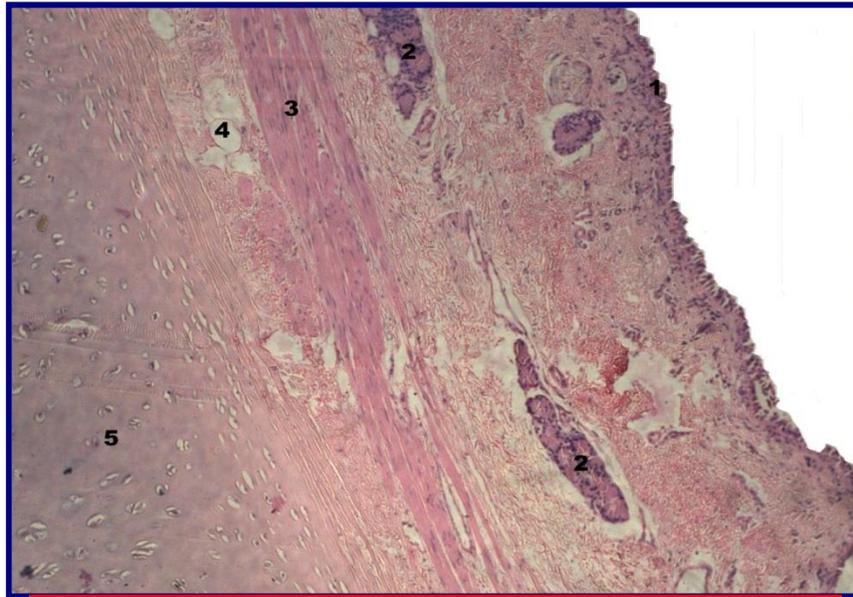
**Fig.3** Photomicrograph showing Pharynx of sheep Epithelium (1), skeletal muscle (2), H&E, X 100



**Fig.4** Photomicrograph showing (arrow) collagen fibers in epiglottis of goat M&T X 50



**Fig.5** Photomicrograph showing Thyroid Cartilage of Sheep Epithelium (1), Cartilage (2) Muscle (3) H&E, X 50



**Fig.6** Photomicrograph showing Cricoid cartilage of Sheep Epithelium (1) gland(2) Adipose tissue(4)Muscle (3) Cartilage (5) H&E, X 100

However Khawa and Purton (1996) reported similar observation in kashmeri goat where they observed pseudostratified ciliated

columnar epithelium in the nasal mucous membrane. In case of the sheep the glands were located in the deeper layer and very

few were superficial. The number of goblet cell in the epithelial lining was also more and lymphatic nodules were more frequent than in goat (Fig.2).

Moussa and Mokhtar (2004) reported that the lining mucosa of the one humped camel, the nasal cavity was similar to that of other mammals, but there were some differences like the respiratory epithelium showed a small number of goblet cell and there were a mixture of acidic and neutral mucins inside the epithelial and glandular mucous cell which is in agreement with our finding.

### **Nasopharynx**

The epithelial lining was composed of squamous epithelial in sheep. Transitional zone of respiratory epithelium was not identified in this sample. Goblet cells were not detected, few areolar tissue were detected. Few areolar tissues were detected underneath in the form of cluster and connected by connective tissue septa. The lamina propria and tunica submucosa was abundantly distributed with connective tissue fibers and cells a large aggregated tonsil.

Khawa and Putton (1996) reported similar epithelialization of the nasopharynx in case of Cashmere goat. Bacha (1990) and Banks (1993) stated the presence of the goblet cell in esophageal tissue of the nasopharynx which was not found in our present investigation. However he has narrated that lamina propria contains tubular mixed glands in the nasopharynx and mucous gland in the oropharynx which is in agreement without present finding.

Dellmann Brown (1998) and Banks (1993) stated similar glandular deposition in lamina propria and also stated the presence of prominent lymphatic nodules in the dorsal

portion of the nasopharynx were aggregated as the pharyngeal tonsil.

The average epithelium thickness was recorded as  $887.79 \pm 67.35 \mu\text{m}$  in sheep. In sheep the stratum corneum was thick and it was associated with lamina lucidum (Fig.3). But in support of our finding no literature was available.

### **Larynx**

Larynx of sheep was made up of four distinct cartilages, like thyroid, arytenoid, epiglottis and cricoid. Histological study was conducted on all the cartilages and it was revealed that the general plan of histoarchitecture of thyroid, arytenoid, epiglottis were almost similar. Cricoid cartilage revealed few special histological characteristic. The epithelial lining of thyroid, arytenoid and epiglottis was lined by stratified squamous epithelium.

Taste bud population was more in case of epiglottis than arytenoid and in thyroid and in case of arytenoid, the test buds were more as compare to thyroid but less than epiglottis. Solitary lymph nodes were identified in all these cartilages. The glandular disposition within the lamina propria and in the muscular tissue were almost similar in all these three cartilages in sheep. The glands were mostly mucous in nature but serous and mixed types of glands were noticed. The core component of these cartilages were made up of hyaline cartilage but the cartilage was not distributed continuously none of these three cartilage rather they were found in the form of small and large plates. The transverse section of three cartilages revealed presence of mucous and mixed types of glands within the hyaline cartilaginous plate in sheep. (Fig.5) In support of these findings Banks (1993) stated that the lamina epithelialis was lined

by stratified squamous epithelium. Test buds were present in the epiglottic region of ruminants but we have observed presence of test buds in all the three types of cartilages in sheep. Diffuse and nodular lymphatic tissues were present. Branched tubulo alveolar glands were found out of that mucous glands were predominant but serous and mixed glands were also present. This was in agreement with our findings. Eroschenko (1994) stated similar observation in case of the epiglottic cartilage. Spicer *et al.*, (1982) reported that epiglottal glands consisted of many mucous tubule, a few serous element and are occasional mucous duct. This is in agreement in our present finding.

In case of the epiglottis, thyroid and arytenoid cartilage of sheep revealed presence of solitary lymph node with in the propria and submucosa.

A small nodular projection was found at the base of epiglottis and arytenoid cartilage histologically it was composed of connective tissue fibers with glandular disposition covered by stratified squamous epithelium in case of sheep (Fig.4). Dellmann Brown (1998) stated that in pig and small ruminant a paraepiglottic tonsil was present on either side of the base of the epiglottis. But we have observed this nodular paraepiglottis in case of sheep was not a lymphoid tissue. In support of this finding Christophe *et al.*, (2008) reported that histological examination of lymphoid tissue of cattle clearly demonstrated the presence of isolated primary and secondary lymphoid follicles and diffuse aggregation of lymphocytes in the subepithelial lamina propria of the mucosa at the base of epiglottis.

The cricoid cartilage of the sheep revealed some peculiar characteristics in comparison

to other three cartilages on histological examination. The lining epithelium was made by pseudostratified ciliated epithelial tissue. The distributions of glands were infrequent as compared to other cartilage and they were mostly restricted within the lamina propria (Fig.6). Taste buds were absent in the surface area rather goblet cells were found in the epithelial tissue. Dellmann Brown (1998), and Banks (1993) stated presence of pseudostratified ciliated columnar epithelium in the lamina epithelialis of the larynx but no information was available about the presence of this epithelial tissue in the cricoid cartilage in our finding. However Eroschenko (1994) narrated that the epithelium of the larynx changes to pseudostratified ciliated columnar epithelium and the under lining lamina propria contains mixed gland. The cricoid cartilage was the lower most cartilage in case of mammals.

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