

MACROSCOPIC AND MICROSCOPIC STUDY OF THE MANDIBULAR SALIVARY GLAND OF BLACK BENGAL GOATS

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ABSTRACT

The gross anatomy and microscopic structures of the mandibular salivary gland of 15 Black Bengal goats of either sex and different ages were carried out during the period from January 1999 to December 2000. The mandibular salivary gland was irregularly triangular in shape and was situated ventral and caudal part of the angle of the mandible and partly covered by the ventral part of the parotid gland. The gland was cream colored in fresh condition and the lobules were coarser and less compact in texture. The mandibular duct left the gland near the middle of the cranio-dorsal border and opened into the caruncula sublingualis with the sublingual duct in common. The average length of the duct was 11 cm. The branches of external carotid, lingual and occipital arteries supplied the mandibular salivary gland. The mandibular gland was drained by the lingofacial and lingual veins and occasionally by the laryngeal vein. It was mixed tubulo-alveolar gland and consisted to numerous lobes and lobules supported by connective tissue capsule. The mixed alveoli were more than the isolated serous and mucous alveoli.

Key words: Mandibular salivary gland, macroscopic, microscopic, Black Bengal goats

INTRODUCTION

Salivary gland is very important organ of goat which secretes clear, tasteless fluid called saliva. The saliva provides a fluid medium for the formation of bolus and serves as a lubricant for swallowing, mechanical transport of ingesta in deglutition, regurgitation and passage through the small inter compartmental opening in the stomach. It also serve to dilute or dissolve the food, to make it possible to taste the food and when an enzyme is present, to hydrolyze the higher carbohydrates (Trautmann and Fiebiger, 1952; Habel, 1975; Copenhaver *et al.*, 1975). The ruminant saliva lack of digestive enzymes, it maintains a favorable liquid medium with adequate phosphate for bacterial digestion of cellulose in the forestomach and acts as a buffer to neutralize the fatty acids produced. Saliva provides a means where by the mouth may be washed clear of cellular and food debris which otherwise might provide an excellent cellular medium for bacteria (Ham and Leeson, 1961). It helps in water balance of the body. Informations regarding these glands are very limited and are confined in adult goat only, but there are no available literature regarding young goats. There are three pairs of salivary glands in goat e.g., parotid, mandibular and sublingual those are commonly referred to as major salivary glands. The present work has been carried out to study of topography, color, blood supply and microscopic structure of the mandibular salivary gland of Black Bengal goats of different ages in order to detect a variation of normal and abnormal conditions of the gland.

MATERIALS AND METHODS

Fifteen Black Bengal goats of different ages and sexes were used for the gross and microscopic study which were purchased from the villages close to the Bangladesh Agricultural University campus, Mymensingh and reared in the departmental goat house. Goats were divided into three age groups: 1 day old, 180 day old and 2 years old. After proper anaesthesia the goats were killed and 0.9% saline was injected through the common carotid artery to flush the blood vessels. Then the goats were preserved by injecting the fixing solution containing 10% formalin, 1 % phenol and 0.05% glycerin.

After 24 hours of preservation latex was injected through common carotid artery, then dissection was carried out. Reflecting the skin, the topography, shape, color and weight of the mandibular salivary glands were studied. Dissecting microscope and magnifying glass were used to study the finer branches of blood vessels. For microscopic studies fresh glandular tissues from 15 goats were collected from one side. The tissues were immediately fixed in Labdowsky's mixture (Guyer, 1949). After fixing, the tissues were embedded in paraffin following the technique of Gurr (1962). Using Rotary Microtome thin sections were cut at 7 μ and then the sections were stained following the Harris Haematoxylin and Eosin technique and Verhoeff's stain.

RESULTS AND DISCUSSION

Gross anatomy

The mandibular salivary gland of Black Bengal goat was situated ventral and caudal part of the angle of the mandible. It was irregularly triangular in shape (Fig. 1).

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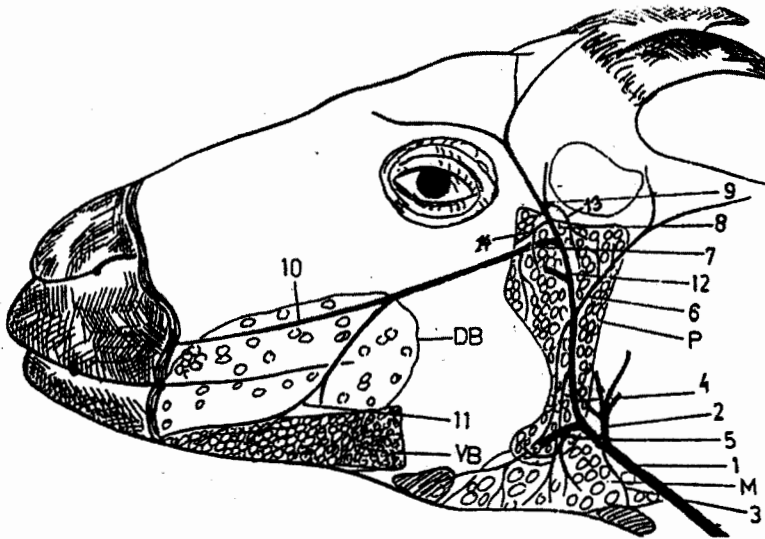


Fig. 1. The schematic diagram showing irregular triangular shaped mandibular salivary gland (M) with arterial blood supply of Black Bengal goat. P = Parotid salivary gland, DB = Dorsal buccal gland, VB = Ventral buccal gland, 1 = Common carotid artery, 2 = Occipital artery, 3 = Branch of the occipital artery, 4 = External carotid artery, 5 = Lingual artery, 6 = Caudal auricular artery, 7 = Transverse facial artery, 8 = Superficial temporal artery, 9 = Cranial auricular artery, 10 = Artery labialis maxillaries, 11 = Artery labialis mandibularis, 12 = Maxillary artery, 13 = Branch of cranial auricular artery and 14 = Branch of superficial temporal artery.

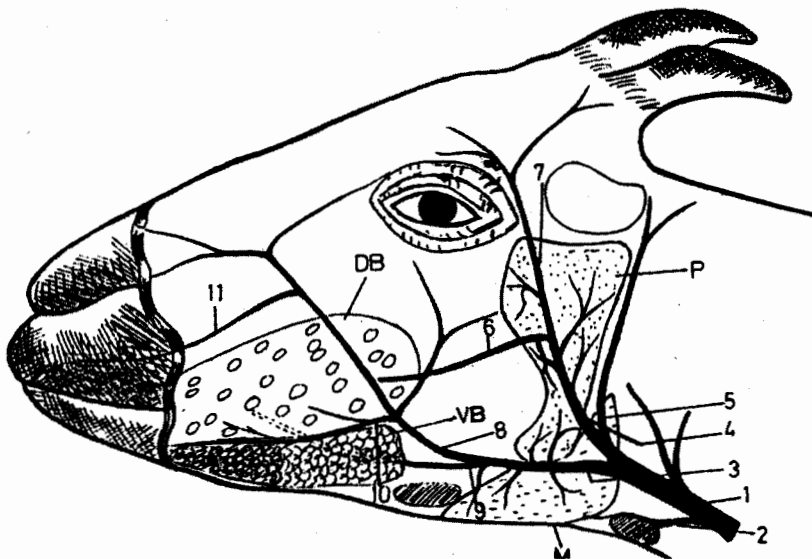


Fig. 2. Venous drainage of the mandibular salivary gland of Black Bengal goat. P = Parotid salivary gland, M = Mandibular salivary gland, DB = Dorsal buccal gland, VB = Ventral buccal gland, 1 = Jugular vein, 2 = Laryngeal vein, 3 = Linguofacial vein, 4 = Maxillary vein, 5 = Caudal auricular vein, 6 = Transverse facial vein, 7 = Superficial temporal vein, 8 = Facial vein, 9 = Lingual vein, 10 = Vein labialis mandibularis and 11 = Vein labialis maxillaris.

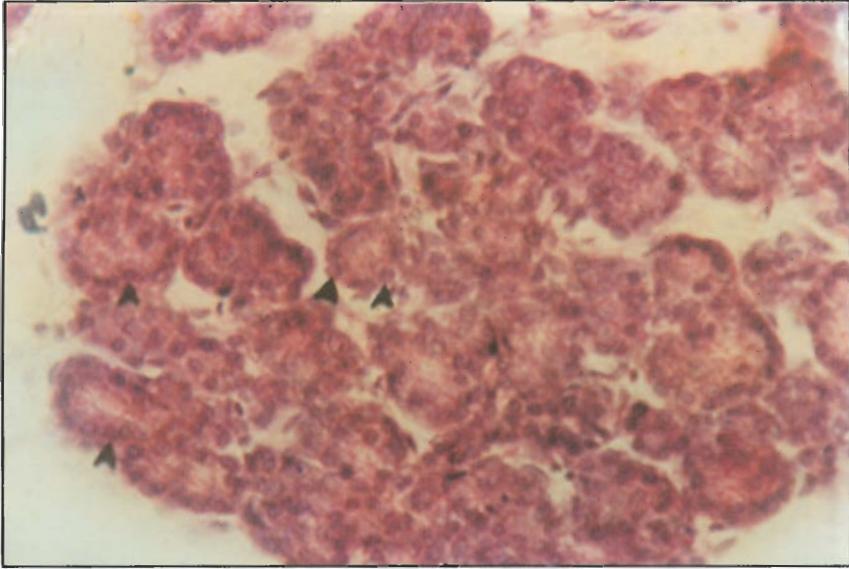


Fig. 3. Microscopic structure of a mandibular salivary gland of day-old kid, showing small mucous alveoli lined by a single layer of pyramidal cells surrounded by a basement membrane (arrowheads). H & E stain X 400.

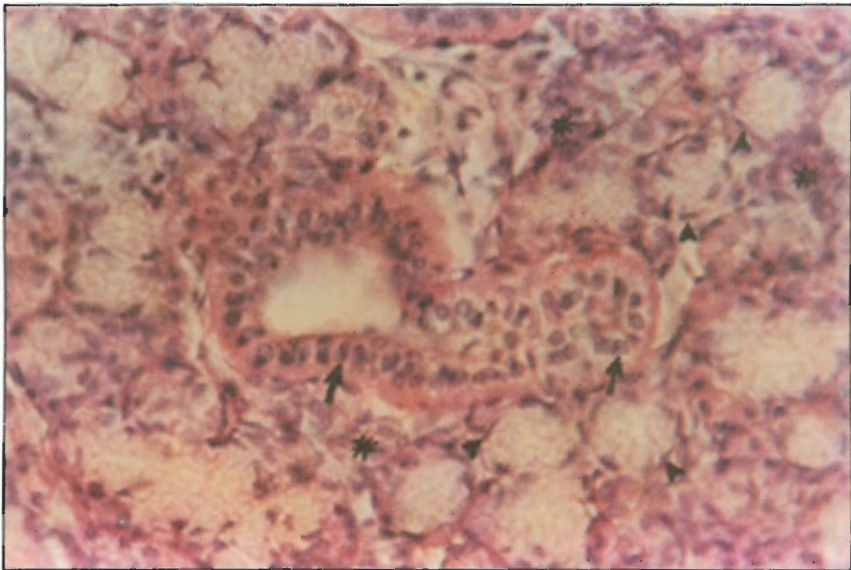


Fig. 4. Microscopic structure of mandibular salivary gland of an adult goat showing larger mucous alveoli lined by larger cells with flattened nuclei and situated against the basal part of the cells (arrowheads). The serous alveoli were smaller than the mucous alveoli, the lumens were also narrower, the lining cells were pyramidal in shape with rounded nuclei (asterisks). The excretory ducts were lined by simple columnar epithelium (arrows). H & E stain X 400.

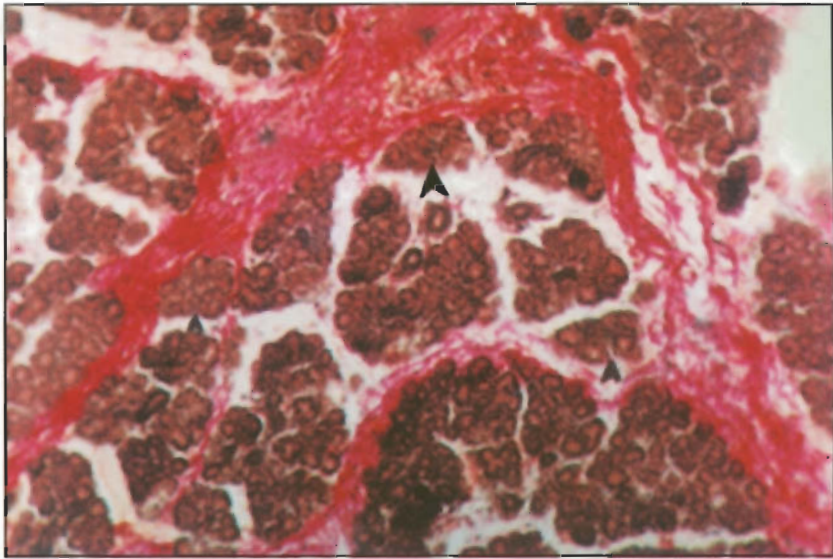


Fig. 5a

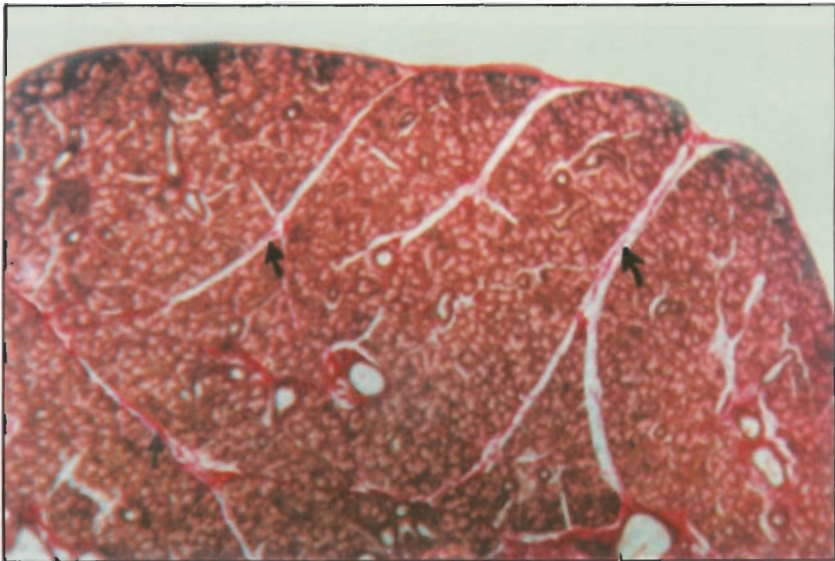


Fig. 5b

Fig. 5ab. The interlobular connective tissues were more and loosely arranged in the mandibular salivary gland of day-old kid (asterisks) and the lobules were smaller in size like fragment of the lobule (arrowheads) (Fig. 5a) whereas the connective tissue decreased along with the advancement of age and in adult animal existed as thin partition (arrows) (Fig. 5b). H & E stain X 400.

The gland has three angles, two surfaces and three borders. The lateral surface was covered partly by the ventral part of the parotid gland, the sternomandibularis muscle and its tendon, the external maxillary vein and the pterygoideus medialis muscle. The medial surface was related to retropharyngeal lymphnode, the pharynx, the larynx, the lingual artery, the digastric muscle and the stylohyoid muscle. The relations of these surfaces in general agreed with the reports of Habel (1975) in bovine and in goat (Islam, 1981). In adult goat the craniodorsal border was thin and about 5 cm in length. It was related to the pterygoideus medialis muscle. The mandibular duct left the gland at the middle of this border. The caudal border was straight, 3 cm in length and was thicker than the preceding one. It was related to the retropharyngeal lymphnode. The ventral border was almost straight and 3.5 cm in length and was related to the sternothyrohyoideus muscle.

The mandibular salivary gland was cream colored in fresh condition. The color of this gland was reported as pale yellow in goat (Islam, 1981) and in bovine (McLeod *et al.*, 1964). The coarse lobulations of the gland were visible through the capsule and were less compact in texture. The mandibular salivary gland in adult goat was measured 5.33 cm in length, 1.6 cm in breadth, 0.86 cm in thickness, 5.22 g weight and 5.16 ml in volume on average. The weight of the mandibular salivary gland has been reported to be 10.3 g by Islam (1981). In day-old kid, the salivary gland was elongated, narrow and was measured 1.5 cm in length, 0.5 cm in breadth, 0.2 cm in thickness and was 0.23 mg in weight. In young goat of 180 days of age, the mandibular salivary gland was irregularly triangular with rounded ends and was measured 2.7 cm in length, 1.5 cm in breadth, 0.8 cm in thickness and 3.0 g in weight (Table 1). It was not reported previously.

Table 1. The morphometric measurement of the mandibular salivary gland of Black Bengal goats at different ages of development

Parameters	Age of goats		
	1 day (n = 5)	180 days (n = 5)	2 years (n = 5)
Length (cm)	1.50 ± 0.241	2.7 ± 0.380	5.33 ± 0.524
Breadth (cm)	0.50 ± 0.074	1.5 ± 0.241	1.60 ± 0.241
Thickness (cm)	0.20 ± 0.000	0.8 ± 0.230	0.86 ± 0.342
Weight (cm)	0.23 ± 0.000	3.0 ± 0.381	5.22 ± 0.524

Arterial supply

The branches of the external carotid, lingual and occipital arteries supply the mandibular salivary gland (Fig. 1). A small artery was originated from the external carotid artery about 1 cm away from the root of the lingual artery. It passed caudally and divided into branches after entering into the mandibular salivary gland. Another artery originated from the external carotid artery near the caudal auricular artery gave branches to the parotid and mandibular salivary glands. These were not reported by any of the previous authors.

The mandibular gland received its major portion of blood from two glandular branches of the lingual artery (Fig. 1). A small glandular branch, shortly after its origin from the lingual, the artery passed backward to reach the cranio-lateral border of the digastric muscle. Here the arteries gave of 3 or 4 branches and supplied the gland. Another branch originated from the lingual artery about 1 cm away from the preceding branch. It is then passed upward and slightly forward and entered into the gland on its dorso-lateral aspect. In 50% cases the occipital artery was observed to give a branch to the gland (Fig. 1). This observation supports the report of Hossain (1975) in goat.

Venous drainage

Two branches of the lingofacial vein drained the mandibular salivary gland. One branch into the lingual vein and occasionally by the laryngeal vein (Fig. 2). Shortly after the origin of the lingofacial vein, from the external maxillary vein it received a branch from the mandibular gland (Fig. 2). Another larger branch drained into the lingofacial veins about 1.5 cm away from its root. The lingual vein received a branch from the mandibular gland at level of its bifurcation from the facial vein. In ruminant, the veins of the mandibular gland joined the lingofacial and facial vein that was reported by Habel (1975). In buffalo, the vein from the gland was drained into the facial vein only reported by Barnwal and Sinha (1981)

Microscopic anatomy

The mandibular salivary gland of Black Bengal goat was a compound tubuloalveolar gland. A thin connective tissue capsule covered the gland and the gland was divided into lobes and lobules by the connective tissue septa. These connective tissue septa contained ducts, blood vessels, lymphatic and nerves. The mandibular gland was composed of serous, mucous and mixed alveoli. The mixed alveoli were more than the isolated serous and mucous alveoli. The duct system of the gland was consisted of intercalated, striated and excretory ducts. These were similar to the observation of Islam (1981) in goat, and Trautmann and Fiebiger (1952) in domestic animals.

In day-old kid, the mucous alveoli were small and lined by a single layer of pyramidal cells surrounded by a basement membrane and myoepithelial cells. The nuclei of the cells were rounded and located in the basal half of the cells (Fig. 3). In young and adult animals, the mucous alveoli were larger. The lining cells were also larger and the nuclei were flattened and situated against the basal part of the cells (Fig. 4). The mucous alveoli were light bluish purple in color in hematoxylin and eosin stain.

The serous alveoli of the mandibular salivary gland of Black Bengal goat were comparatively smaller than the mucous alveoli and the lumen were also narrower and the lining cells were pyramidal in shape with rounded nuclei lying at the basal half of the cells. The serous alveoli were reddish purple with hematoxylin and eosin stain. In the mixed alveoli, the ends of the mucous alveoli were capped by outer groups of serous cells. These parietal complexes were crescent shaped and were called serous demilunes. The branches of the lumen extended between the mucous cells to the secretory canaliculi of demilunes. The cells of the serous demilunes stained reddish purple and mucous alveoli stained bluish purple with haematoxylin and eosin. These findings support the earlier reports of Islam (1981) in adult goats.

The capsule and the connective tissue septa consisted of collagen bundles. In day-old kid, interlobular connective tissue were more and loosely arranged (Fig. 5a). The lobules were smaller in size like fragment of the lobule. The connective tissue decreased along with the advancement of age and in adult animal existed as thin partition (Fig. 5b). The intercalated ducts were lined by simple cuboidal epithelium. The striated ducts were numerous and lined by simple columnar epithelium with basal striation. The excretory ducts were lined by simple columnar epithelium (Fig. 4).

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