

ANATOMY AND HISTOLOGY OF THE MAJOR SALIVARY GLANDS IN ONE HUMPED CAMEL (*Camelus dromedarius*)

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ABSTRACT

This study was carried out to investigate anatomy and histology of major salivary glands of 25 one-humped adult camels. The parotid salivary gland was the largest in camel. It was situated at the base of ear. The colour of the gland was dark red and the mean weight about 145 gm. It was purely serous and a compound tubulo-alveolar gland. The intercalated and striated ducts were located within the lobule and lined by low cuboidal and simple columnar epithelium, respectively. The interlobular and main excretory ducts were lined by stratified columnar epithelium that changed to stratified squamous epithelium where the main parotid duct opens into the oral cavity.

The mandibular salivary gland was oval in camel and placed ventral to the parotid salivary gland. It's colour was light brown and weight about 48 gm. It was a compound tubulo-acinar gland composed of both mucous and serous acini. The duct system was like that of the parotid salivary gland.

The sublingual salivary gland was thin and long that lied under the mucosa of the tongue. It's colour was light yellow. It was a compound acinar gland with predominant mucous acini. The intercalated ducts were not prominent. The striated and interlobular ducts were lined by low cuboidal and simple columnar epithelium, respectively. The epithelium lining of the main excretory ducts changed from stratified cuboidal to stratified squamous.

Key words: Anatomy, camel, histology, salivary glands

Major salivary glands are important components of upper digestive system in dromedary camel and need to be studied. Few researchers have attempted to study these histologically (Taha *et al*, 1999; Al-Asgah *et al*, 1990; Duhan *et al*, 1996; Abdalla, 1977; Nawar and Khaligi, 1975). However, there is a paucity of information in available literature on these glands. Present study was therefore done to study the anatomy and histology of major salivary glands in one humped camel.

Materials and Methods

The anatomical location, weight and colour of the major salivary glands (parotid, mandibular and sublingual) were determined in 25 slaughtered male camels. Histological structure of these glands was studied by using routine histological techniques. Sections at 5 µm thickness were cut and stained with the methods

of Haematoxylin and Eosin, Masson Trichrome and Periodic Acid Schiff (Luna, 1968).

Results

The parotid glands of the camel was situated at the base of ear and between the mandible and the wing of the atlas. The colour of the gland was dark red. The dimensions of the gland were 14 cm long, 5.3 to 8.5 cm wide, about 2.5 cm thick and weighed 145 gm. The parotid duct ran first on the medial surface of the mandible after leaving the gland, and it then wound around the ventral border of the mandible to join the lateral surface of the face. It passed rostr dorsally in the cheek to open in the buccal vestibule.

Histologically, the parotid salivary gland was a compound tubulo-alveolar gland composed of purely serous units. The interlobular connective tissue was consisted of vessels and nerves. The secretory units of the glands were formed by low

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cuboidal epithelial cells. Myoepithelial cells were present around the secretory units. The lumen of the secretory units opened into a short intercalated duct lined by low cuboidal epithelium (Fig 1).

The intercalated duct joined a large striated duct lined by simple columnar epithelium (Fig 2). The interlobular ducts were located in the connective tissue septa between lobule. The epithelium of these ducts changed from stratified cuboidal to stratified columnar.

The mandibular salivary gland was present in the caudal part of mandible, cranial to the wing of atlas and above the pharynx and the larynx and was partly covered by the parotid gland. It was light brown in colour. The dimensions of gland were 7 cm long, 1.4 cm thick, 4.5 cm wide and weighed 48 gm. Histologically, the mandibular salivary gland was a compound tubulo-acinar gland composed of both mucous and serous secretory units with the seromucous acini as the predominant acini. Also, there were a few pure serous and mucous acini. The pure serous acini were more than mucous acini. The intercalated duct was lined by low cuboidal epithelium. Myoepithelial cells were also present around the secretory units (Fig 3).

The striated duct was larger than the intercalated duct and there were many striated ducts within the lobule. It was lined by simple columnar epithelium. The interlobular duct was lined by stratified columnar epithelium. In this duct the goblet cells were dispersed among the epithelial cells (Fig 4).

The interlobular duct converged to form the main mandibular duct. Its epithelium was stratified columnar with goblet cells and the epithelium changed to stratified squamous where the main mandibular duct opened into the oral cavity.

The sublingual salivary gland in camel was thin and elongated and cream in colour. It was located under the mucosa of the lateral sublingual recess. The gland extended from the level of canine tooth to root of the tongue.

Histologically, the sublingual gland was a compound acinar gland. In addition to the pure mucous acini and serous demilunes, the gland contained a few pure serous acini also (Fig 5).

The intercalated ducts were present, but not prominent in camel. The striated and the

interlobular ducts were lined by low cuboidal and low columnar epithelium, respectively. The epithelium lining of the main excretory ducts changed from stratified cuboidal to stratified squamous.

Discussion

The parotid salivary gland was the largest major salivary gland in camel. The dimensions of the gland were 14 cm long, 5.3 - 8.5 cm wide and 2.5 cm thick. The parotid gland of horse is 20-26 cm long, 5-10 cm wide and about 2 cm thick (Nickel *et al*, 1979). The mean weight of the gland in camel was 145 gm. It is 220-225 gm in horse (Nickel *et al*, 1979), 115 gm in ox (Getty, 1975), 7 gm in dog (Nickel *et al*, 1979) and 11 gm in sheep (Getty, 1975). The colour of the parotid gland in camel was dark red. It is yellowish gray in horse (Getty, 1975), yellow in human being and dog (Nickel *et al*, 1979) and light red-brown in ox (Getty, 1975) and yellowish in pig (Nickel *et al*, 1979). The parotid gland of the camel was compound tubulo-alveolar gland composed of purely serous units. But in the other domestic animals and human being the gland consists of acinar secretory units (Dellmann, 1993 and Junqueira *et al*, 1986). It is usually serous in domestic animals, human being and rodents. A few mucous cells or adenomeres present in carnivores and may be mixed in young puppies and lambs (Banks, 1993). The mandibular salivary gland was oval in camel. Its colour was light brown and weight about 48 gm. The mandibular gland of the ox is much larger than the parotid gland, it 18-20 cm long, 8-10 cm wide and 2-4 cm thick (Nickel *et al*, 1979). The mandibular gland of the horse is smaller than the parotid. Its length is 20-25 cm, width 2.5 to 3.0 cm, and thickness about 1 cm. It weighs about 45 to 60 (Getty, 1975). It is globular in carnivores and often larger and lighter in colour than the parotid gland (Nickel *et al*, 1979). The mandibular gland of the pig is reddish in colour and is much smaller than the parotid gland. It is more or less globular in shape, but presents a short rostromedial angle (Nickel *et al*, 1979). The mandibular salivary gland of the camel was a compound tubuloacinar gland composed of both mucous and serous acini. It was similar to that of human being (Junqueira *et al*, 1986) and other animals (Dellman, 1993). It was a mixed gland in camel with predominant seromucous

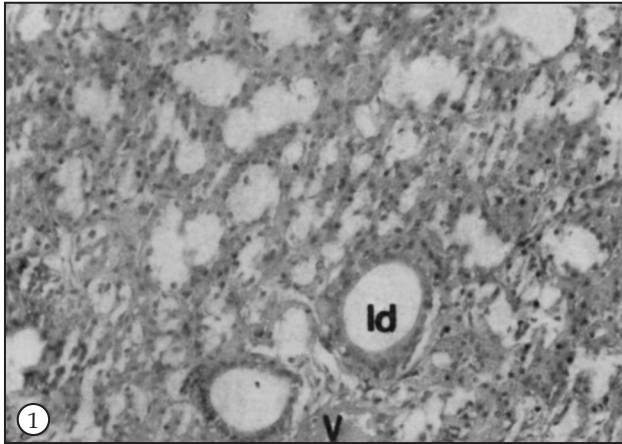


Fig 1. Microphotograph of the parotid salivary gland in the camel showing the secretory units and intercalated duct (ld); Vessels (V), (Haematoxylin and Eosin staining x 320).

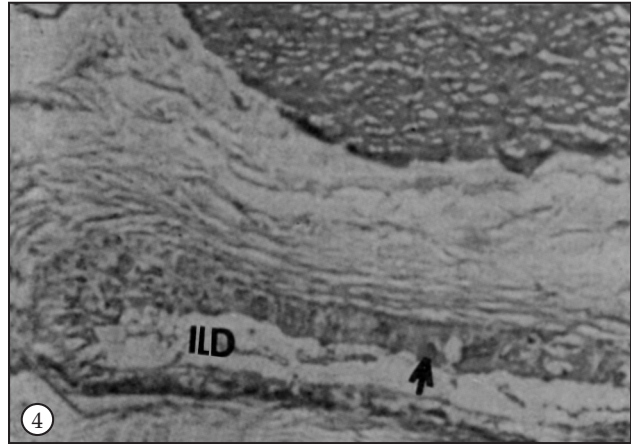


Fig 4. The interlobular duct (ILD) of the mandibular gland of camel with goblet cells (arrow), (Periodic Acid Schiff staining x 320).



Fig 2. The striated ducts of the parotid salivary gland of camel (Masson Trichrome staining x 640).

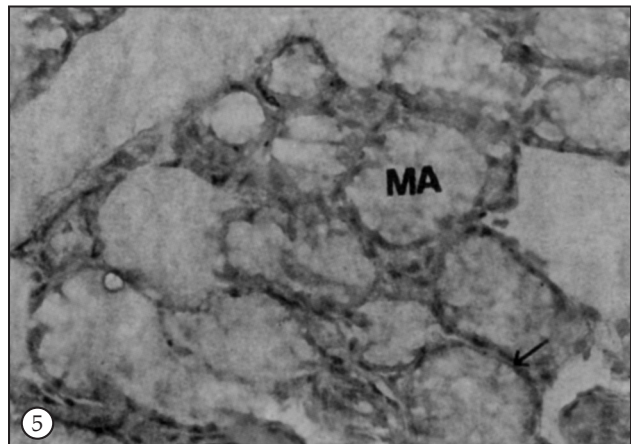


Fig 5. Microphotograph of the sublingual salivary gland in the camel showing the secretory units; mucous secretory unit (MA); nucleus of the mucous cell (arrow), (Haematoxylin and Eosin staining x 640).

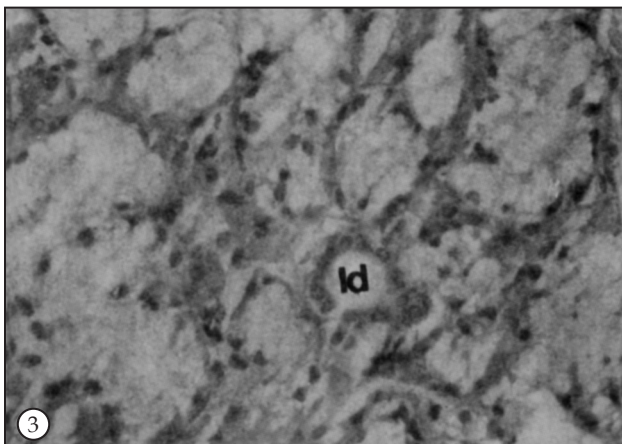


Fig 3. Microphotograph of the mandibular salivary gland in the camel showing the secretory units and intercalated duct (ld), (Haematoxylin and Eosin staining x 640).

acini. The gland is usually mucous in dogs and cats, serous in rodents, mixed in horses, human being and ruminants (Banks, 1993).

Of the two types of sublingual salivary glands, only the polystomatic sublingual gland was found in camel. It was similar to that of horse (Getty, 1975), but in the ruminants, carnivores and pig there are monostomatic and polystomatic sublingual salivary glands (Nickel *et al*, 1979). The sublingual gland of camel was a compound acinar gland with predominant mucous acini. Also, there were a few serous acini. The gland is predominant mucous in ruminants, swine and rodents. It is mixed in small carnivores, human and horses (Banks, 1993).

In present study the sublingual salivary glands were cream in colour whereas Taha *et al*

(1999) found these as pinkish lobules and Van Lennep (1957), Smuts and Bezuidenhout (1987) and Al-Asgah *et al* (1990) described these as pale yellow and located along the lateral surface of the root of the tongue.

In present study these glands were found to be compound acinar glands whereas Van Lennep (1957) and Fahmy and Dellman (1968) have described these to be purely mucous. Taha *et al* (1999), Hoppe *et al* (1974) and Al-Asgah *et al* (1990) opined that sublingual glands of the one humped camel are mixed glands.

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References

- Abdalla AB (1979). Structure of the secretory cells of the salivary glands of the dromedary camel. *Sudan Journal of Veterinary Science and Animal Husbandry* 20(2):65-76.
- Al-Asgah NA, Jarr BM and Taib NT (1990). Structure and histochemistry of the sublingual salivary glands of the one-humped camel (*Camelus dromedarius*). *Revue Elev. Med. Veterinary Pays Trop.* 43(4):519-527.
- Banks WJ (1993). *Applied Veterinary Histology*. 3rd Ed. London: Mosby Year Book, London. p 360.
- Dellman HD (1993). *Textbook of Veterinary Histology*. 4th Ed. Lea and Febiger, Philadelphia. pp 161-162.
- Duhan SS, Nagpal SK and Jain RK (1996). Topographic anatomy, histology and histochemistry of sublingual gland of camel (*Camelus dromedarius*). *Journal of Camel Practice and Research*. pp 115-118.
- Fahmy MF and Dellman HD (1968). Studies on the microscopic anatomy of the oral cavity of *Camelus dromedarius*. *Journal of Veterinary Science*. U.A.R. 5:45-51.
- Getty R (1975). *Sisson and Grossman: The Anatomy of the Domestic Animals*. 5th Ed. W.B.Saunders Company, Philadelphia, U.S.A.
- Hoppe P, Kay RN and Maloij CO (1974). Salivary secretion in the camel. *Journal of Physiology, London*, 244(1):32-33.
- Junqueira LC, Carneiro J and Long JA (1986). *Basic Histology*. 5th Ed. Lange Medical Publications, Los Altos. pp 358-359.
- Luna LG (1968). *Manual of Histological Staining Methods of the Armed Forces Institutes of Pathology*. McGraw-Hill Book Company, New York. pp 51-52, 94-95, 158-159.
- Nawar SM and Khaligi GE (1975). Morphological, micromorphological and histochemical studies of the parotid salivary glands of the one-humped camel (*Camelus dromedarius*), *Gegenbaurs Morphology Jahrb.* Leipzig 121:430-499.
- Nickel R, Shummer A, Seiferle E and Sack WO (1979). *The Viscera of the Domestic Mammals*. 2nd Ed. Verlag Paul Parey, Berlin. pp 44, 59, 62, 67, 71.
- Smuts MMS and Bezuidenhout AJ (1987). *Anatomy of the Dromedary*. Clarendon Press, Oxford. pp 105-141.
- Taha AAM, Mohammed MK and Abdel-Magied EM (1999). Anatomy of the sublingual salivary glands of the dromedary. *Journal of Camel Practice and Research* 6(2):323-328.
- Van Lennep (1957). The glands of the digestive system in the one-humped camel, *Camelus dromedarius* I. The salivary glands. *Acta Morphologia Neerland Scandinavia* 1:286-299.