DOI : 10.5958/2277-8934.2021.00017.5 *Vol 28 No 1, p 107-109*

# SCANNING ELECTRON MICROSCOPY OF THE THYROID GLAND OF CAMEL (*Camelus dromedarius*)

**Devendra Singh, Sanjeev Joshi, Pankaj Kumar Thanvi, Mahendra Kumar Saini and Om Prakash Choudhary[1]**

Department of Veterinary Anatomy and Histology, College of Veterinary and Animal Sciences, Rajasthan University of Veterinary and Animal Sciences, Bikaner-334001, Rajasthan, India

[1]Department of Veterinary Anatomy and Histology, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University (I), Selesih, Aizawl-796015, Mizoram, India

## ABSTRACT

The scanning electron microscopy of the thyroid gland was done in 16 naturally dead camels (n=16) of both sexes at Veterinary Clinical Complex, RAJUVAS, Bikaner, Rajasthan. The scanning electron microscopy (SEM) of collected thyroid gland was done at Department of Veterinary Microbiology, College of Veterinary and Animal Science, Bikaner. The thyroid gland was covered by a thick fibrous connective tissue capsule and the parenchyma was made up of numerous follicles. The external forms of the follicles were mostly oval and elliptical. Some irregular follicles were observed. The size of the thyroid follicle ranged between 550-800 µm in summer and 80-350 µm in the winter season. The interfollicular or interstitial connective tissue separated the follicles. The parafollicular or "C" cells were also seen in between the thyroid follicles. The thyroid follicles were filled with gel-like round substances called colloid substances. The follicular epithelium cells of the thyroid gland were squamous to low cuboidal in shape.

**Key words:** Camel, colloid, follicle, SEM, thyroid gland

The thyroid gland is one of the endocrine glands that influences many organs of the body and plays an important role in the metabolism of animals (Ahmadpanahi and Yousefi, 2012). Marked variations in location, gross and histological features of the thyroid gland have been observed in different vertebrates (Dyce *et al,* 2002). The gross and histological characteristics of the thyroid gland of the dromedary camel have been described previously (Kausar and Shahid 2006; Rejeb *et al,* 2011; Ahmadpanahi and Yousefi, 2012). The functional unit of the thyroid gland is its follicle which are filled with colloid, produced by the follicular cells. The follicles are connected by interfollicular connective tissues that contain blood vessels. In the interfollicular area, there are a large number of cells, such as fibroblast and parafollicular cells (C cells), which produce calcitonin (Santos *et al,* 2013). The follicular cells produce thyroid hormones (triiodothyronine, T3, and tetraiodothyronine, T4), which have important effects on cell proliferation, differentiation, and migration as well as general growth and metabolism of embryos (Kress *et al,* 2009). A scanning electron microscope provides detailed surface information by tracing a sample in a raster pattern with an electron beam (Choudhary and Priyanka, 2017). The transmission electron microscopy of the thyroid gland of the dromedary camel has already been studied (Singh *et al,* 2021).

However, in present study scanning electron microscopic study of the thyroid gland in the dromedary camel is done.

## Materials and Methods

The thyroid glands were collected from freshly dead camels (n=16) of both sexes from Veterinary Clinical Complex, College of Veterinary and Animal Sciences, Bikaner, Rajasthan. These animals were free from any pathological condition of the thyroid gland.

### *Processing of the samples for SEM*

The scanning electron microscopy of the thyroid gland was done at the department of Veterinary Microbiology, College of Veterinary and animal Science, RAJUVAS, Bikaner. The standard protocol of AIIMS, New Delhi, was followed for scanning electron microscopy (Anonymous, 2015). For the scanning electron microscopy, 5-6 $mm^2$ size tissue was taken from representative areas and primarily preserved in Karnovsky's fixative (a mixture of 4% paraformaldehyde and 1% glutaraldehyde in 0.1M phosphate buffer) followed by post-fixation in 1%

SEND REPRINT REQUEST TO PANKAJ KUMAR THANVI email: drpankajthanvi@gmail.com

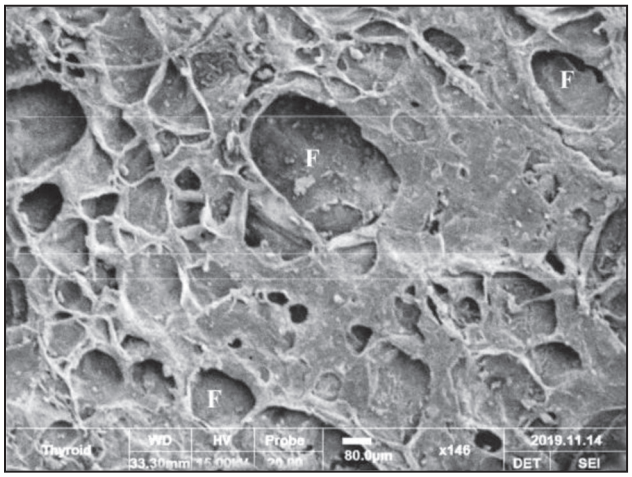


**Fig 1.** Scanning electron micrograph showing oval and elliptical follicles (F) in the thyroid gland of the camel (X146).

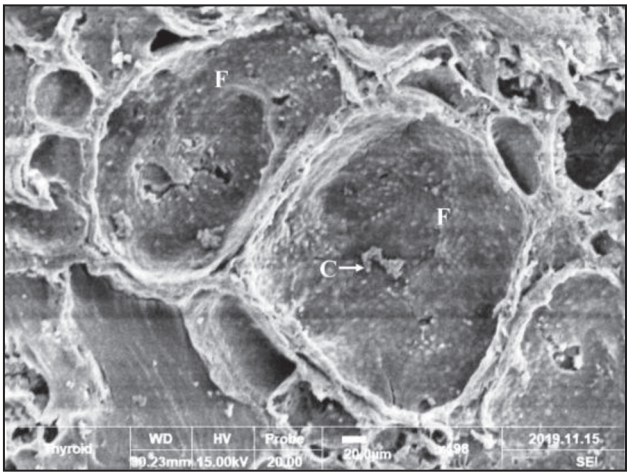


**Fig 2.** Scanning electron micrograph showing the internal surface of thyroid follicles (F) filled with the colloid particles (C) in the thyroid gland of the camel (X498).

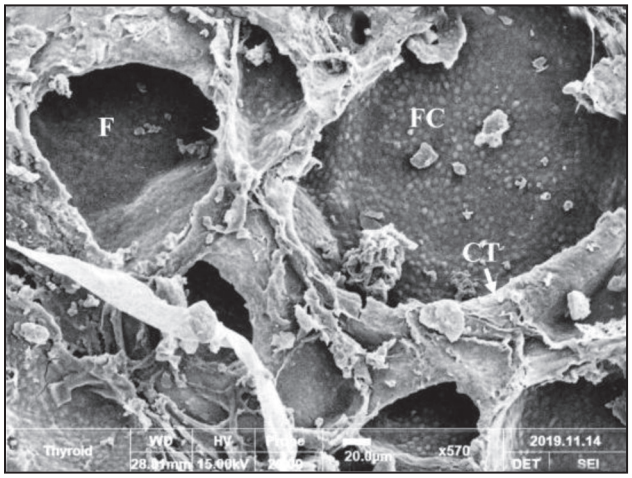


**Fig 3.** Scanning electron micrograph showing follicles (F), follicular cells on the internal surface of thyroid follicles (FC) and connective tissue (CT) in the thyroid gland of the camel (X570).

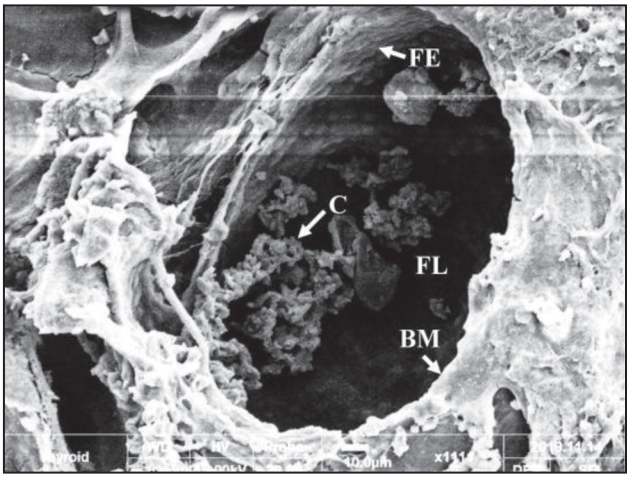


**Fig 4.** Scanning electron micrograph showing lumen of the follicle (F), follicular epithelium (FE), basement membrane (BM) and clumps of colloid particles (C). (X111).

solution of osmium tetraoxide and then chemical drying. All steps up to chemical drying were carried out at 4°C. Then it was followed by critical point drying (Biostag, New Delhi), mounting, metal sputter coating (Polalis, South Korea), and viewed by SEM (Genesis – 1100, Emcraft, South Korea) equipped with digital imaging and photography system.

## Results and Discussion

The thyroid is an endocrine gland that secretes hormones, including thyroglobulin, triiodothyronine and thyroxin. The thyroxin hormone secreted by this gland plays an essential role in the metabolism of the body (Turner, 1966; Choudhary and Doley, 2016).

In the present study, the thyroid gland of the camel (Fig 1-4) was covered by a thick fibrous connective tissue capsule as reported previously in camel (Igwenagu *et al,* 2016). The parenchyma of the thyroid gland was made up of numerous follicles as reported in Bakerwali goat (Dar *et al,* 2018). The follicles of the thyroid gland were vascularised while these were poorly vascularised in hagfish (Suzuki and Kawabata, 1988), Jamunapari goat (Choudhary and Doley, 2016) and goat (Joshi, 2016). The external forms of the follicles were mostly oval and elliptical; however, the thyroid follicles were spherical in the thyroid gland of Muscovy (Luo and Lin, 1992). In the present study, there were some irregular follicles observed that can be due to the plane of the section of the follicles or tissue shrinkage. In another study, Rajeb *et al* (2011) reported that the activity of the thyroid gland of the dromedary was variable

according to age, sex, and season. In the present study, the size of the thyroid follicle ranged between 550-800 µm, in summer and 80-350 µm in the winter season, whereas the follicle size was 300X180 µm in hagfish (Suzuki and Kawabata, 1988) and 20-90 µm in Jamunapari goat (Choudhary and Doley, 2016). The follicles were covered with membranous connective tissue (Fig 3) as reported in Jamunapari goat (Choudhary and Doley, 2016).

The large follicles were usually surrounded by smooth-surfaced cells with a large apical diameter, while the smaller follicles were surrounded by smaller cells with numerous and large microvilli, as reported in Jamunapari goat (Choudhary and Doley, 2016). The interfollicular or interstitial connective tissue separated the follicles and fibroblast and parafollicular or "C" cells were present as reported in cattle and buffaloes (Miyandad, 1973).

The lumen of the thyroid gland follicles was filled with gel-like round substances called colloid (Fig 4) as reported earlier by Kausar and Shahid (2006). The colloid particles were uniform and homogenous and size of particles was as mentioned for Jamunapari goats (Choudhary and Doley, 2016). The follicular epithelium cells of the thyroid gland were squamous to low cuboidal in shape as reported for Jamunapari goat (Choudhary and Doley, 2016), hagfish (Suzuki and Kawabata, 1988), however, the epithelium was squamous too high cuboidal in Bakerwali goat (Dar *et al,* 2018).

In conclusion, the scanning electron microscopic studies of the thyroid gland of camel did not differ from that of other studied mammalian species.

**Acknowledgement**

The authors are thankful to the Dean, College of Veterinary and Animal Sciences, Bikaner, RAJUVAS, Bikaner, Rajasthan for providing all the necessary facilities to carry out research work.

## References

Ahmadpanahi SJ and Yousefi MH (2012). Anatomical and histological study on thyroid gland in one humped camel (*Camelus dromedarious*). Journal of Veterinary Research 67:273-278.

Anonymous (2015). Handbook in Electron Microscopy. All India Institute of Medical Sciences (AIIMS), New Delhi, India.

Choudhary OP and Doley PJ (2016). Histomorphological and scanning electron microscopic studies of thyroid gland in Jamunapari goats. Indian Journal of Small Ruminants 23(1):120-122.

Choudhary OP and Priyanka (2017). Scanning electron microscope: advantages and disadvantages in imaging components. International Journal of Current Microbiology and Applied Sciences 6(5):1877-1882.

Dar Y, Suri S, Sarma K and Sasan JS (2018). Ultrastructure of the thyroid gland in Bakerwali goat (*Capra hircus*). Journal of Animal Research 8(1):111-116.

Dyce KM, Sack WO and Wensing CJG (2002) Textbook of Veterinary Anatomy, 5th Edn., Elsevier, London, UK.

Igwenagu E, Usende IL, Maina MM, Saidu AM, Aina OO, Waziri A, Monguno MB, Omeh IJ and Aji TG (2016). Gross, histological and histomorphometric studies on the thyroid gland of one humped camel (*Camelus dromedarius*) found in the semi-arid region of North Eastern Nigeria. Nigerian Veterinary Journal 37(2):64-71

Joshi S (2016). Gross and histological studies on the thyroid gland of goat (*Capra hircus*). Ph.D. thesis submitted to the Rajasthan University of Veterinary and Animal Sciences (RAJUVAS), Bikaner, Rajasthan, India.

Kausar R and Shahid RU (2006). Gross and microscopic anatomy of thyroid gland of one-humped camel (*Camelus dromedarius*). Pakistan Veterinary Journal 26(2): 88-90.

Kress E, Samarut J and Plateroti M (2009). Thyroid hormones and the control of cell proliferation or cell differentiation: paradox or duality? Molecular and Cellular Endocrinology 313:36-49.

Luo K and Lin SG (1992). The microstructure and ultrastructure of the thyroid gland of Muscovy (*Cairina moschata*). Journal of Fujian Agriculture and Forestry University 21(2):194-197.

Miyandad P (1973). Anatomical studies of the thyroid gland of buffalo. M.Sc. thesis submitted to the University of Agriculture, Faisalabad, Pakistan.

Rejeb A, Amara A, Rekik M, Rezeigui H, Crespeau F (2011). Histomorphometry and hormone secretion of the thyroid gland of the dromedary (*Camelus dromedarius*). Journal of Camelid Science 4:10-22.

Santos CM, Teixeira MJ, Sales A and Figeueiredo MA (2013). Histological and immunohistochemical study of the thyroid gland of the broad snouted caiman (*Caiman latirostris*). Acta Scientiarum. Biological Sciences 35(4): 585-589.

Singh D, Joshi S, Thanvi PK and Choudhary OP (2021). Ultrastructural studies on the thyroid gland of dromedary camel (*Camelus dromedarius*). Indian Journal of Animal Research DOI:10.18805/IJAR.B-4363.

Suzuki S and Kawabata I (1988) A scanning electron microscopic studies on the thyroid follicle of Hagfish Eptatretus burger. Acta Zoologica 69:253-258.

Turner CD (1966). General Endocrinology, 4th edn., W.B. Saunders Company, London, UK.