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Histological studies on the thyroid gland of sheep (*ovis aries*)

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Abstract
In Group I, the parenchyma of gland was not divided into lobes and lobules. Majority of follicles had eosinophilic colloid and lined by flattened follicular cells. In group II, follicles were lined by low cuboidal cells. The mean follicular size of large and medium sized follicles was decreased compared to Group I. In group III, colloid of the follicles was separated from the surrounding follicular epithelium by a space. A small space was noticed between the colloid and follicular epithelium.

Keywords: Development, histology, thyroid gland, sheep, follicular epithelium, parenchyma

Introduction
Thyroid hormones are essential for normal development, neural differentiation and metabolic regulation in mammals. They play an important role in endochondral ossification and are essential for skeletal development, linear growth, maintenance of bone mass and efficient fracture healing. They are also essential for fetal and post-natal nervous system development and play a key role in the maintenance of adult brain function.

Materials and Methods
The thyroid glands were collected from slaughtered animals, rinsed in normal saline, tissue pieces of 5mm thickness were cut and were placed in neutral buffered formalin and Bouin's fluid. The fixed tissues were processed as per the methods described by Luna (1968) [7]. Paraffin sections of 3-5µm thickness were cut and subjected to Harri's Haematoxylin and Eosin (H&E) method for the routine histological study (Bancroft and Stevens, 1996) [2] and Van Gieson's method for collagen fibres. The age was ascertained based on the eruption of teeth as described by Dyce *et al*. (1996) [3]. Research material for present study was collected from six different age groups with 6 animals in each group. The groups are classified as follows.

Table 1: Age groups

Group I	Group II	Group III
Birth to 3 months (Prepubertal)	7-9 months (Pubertal)	2 years and above (Adult)

Results and Discussion
In group I, the thyroid gland of sheep upto three months of age, was covered by a capsule which consisted of connective tissue fibres, connective tissue cells and a few blood vessels. At this age, parenchyma of the gland was not divided into lobes and lobules. These observations were in disagreement with the findings of Abdel-Magied *et al.* (2000) [1] in camel, in camel, Onwuaso and Nwagbo (2014) [9] in rat, Khaleel and Salih (2017) [6] in sheep and gazelle who reported that the trabeculae from capsule divided the glandular parenchyma into irregular lobules.

The gland parenchyma consisted of numerous tightly packed follicles of different sizes and shapes. Large, medium and small follicles were found intermingled with each other (Fig 1). This was in contrary with the observations of Rejeb *et al.* (2011) [10] who observed that in thyroid gland of camel the follicles on the periphery were larger than central ones. This variation might be due to species difference.

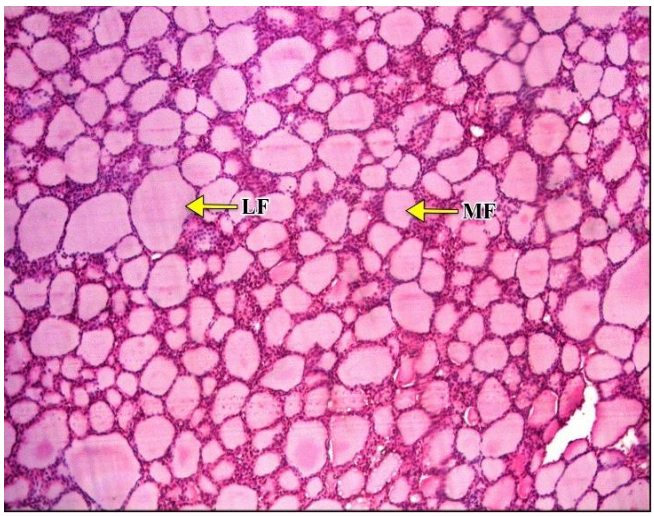

Fig 1: Photomicrograph showing thyroid gland in 2 months old sheep LF-Large Follicle, MF-Medium Follicle, H&E X 100

Majority of follicles were completely filled with basophilic colloid and were lined by flattened follicular cells with compact basophilic nucleus, while few follicles were lined by cuboidal follicular cells with round nucleus and had an eosinophilic colloid (Figure 2). Similarly, Shelke *et al.* (2009) [12] observed that in the thyroid gland of buffaloes, follicles of various sizes were lined by cuboidal or flat epithelium and filled with colloid.

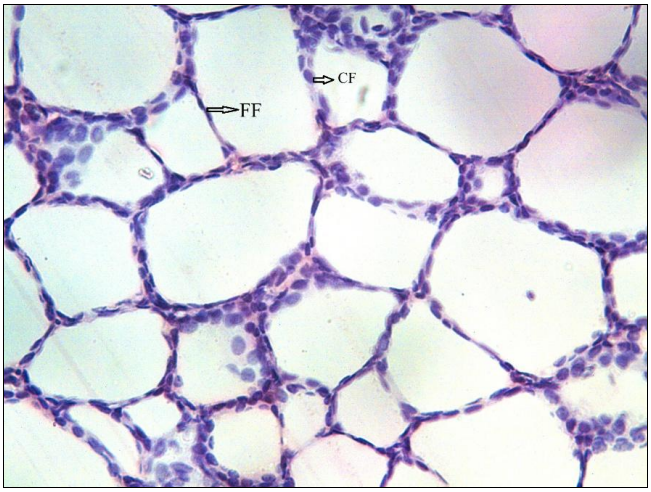

Fig 2: Photomicrograph showing thyroid gland in 3 months old sheep, LF-Large Follicle, MF-Medium Follicle, H&E X 400

Few follicles showed presence of peripheral vacuoles which was in agreement with the findings of Abdel-Magied *et al.* (2000) [1] in camel. In between the follicles, groups of round to oval parafollicular cells with centrally placed large nucleus and eosinophilic cytoplasm were observed. Follicles were surrounded by myoepithelial cells (Figure 3). These findings were in accordance with the findings of Khaleel and Salih (2017) [6] in sheep and gazelle.

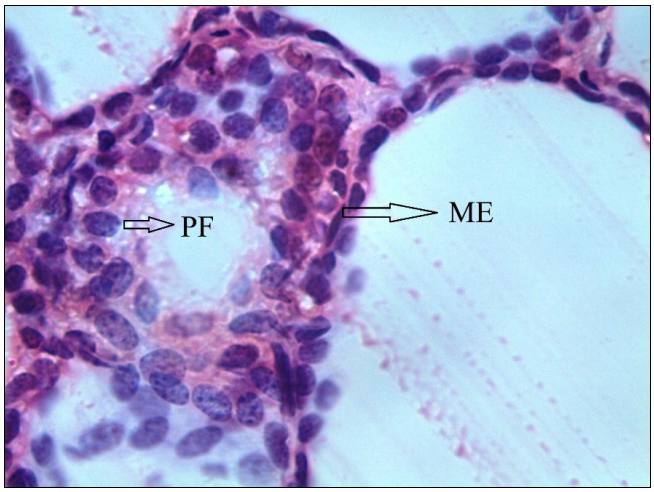

Fig 3: Photomicrograph showing thyroid gland in 2 months old sheep, PF-Para Follicular cell, ME-Myoepithelial Cell, H&E X 1000

In group II, thyroid follicles in thyroid gland of sheep between seven and nine months of age were lined by low cuboidal cells with round nucleus which was in concurrence with the findings of Igwenagu *et al.* (2016) [4] in one humped camel. They were completely filled with colloid. Peripheral vacuoles were not observed in these follicles. All the follicles were almost spherical shaped. On contrary, Igbokwe and Ezeasor (2017) [5] reported presence of colloid droplets in the follicles situated at the periphery in thyroid gland of West African dwarf goat.

The mean follicular size of large and medium sized follicles was decreased compared to Group I (Table 1). The mean height of the follicular epithelial cells was increased compared to Group I. But, Roy *et al.* (1978) [11] observed that in thyroid gland of goats, the follicles became irregular in outline and their diameter was increased with advancing age. It is believed that the follicles are at different stages of secretion.

Table 6: Mean (± SE) values of histometrical parameters of thyroid gland in pre and postnatal age groups of sheep

Group	Mean diameter of the follicle (µm)		
	Large follicle	Medium follicle	Small follicle
I	-	-	-
II	50.47±2.45	28.09±1.40	18.47±0.65
III	82.10±3.45	49.09±0.93	28.70±3.24
IV	141.65±7.75	74.48±8.08	33.08±3.17
V	130.46±5.46	79.62±2.91	31.58±4.20
VI	120.49±5.85	69.30±5.91	29.89±2.80

In group III, sheep above 2 years of age showed thyroid follicles of different diameters were found intermingled with each other. They were filled with eosinophilic colloid. These findings were in disagreement with the observations of Igbokwe and Ezeasor (2015) [5] who observed that in the thyroid of pigs, larger follicles were seen beneath the capsule and the medium and smaller were seen in the middle of the gland.

A small space was noticed between the colloid and follicular epithelium which simulated the findings of Onwuaso *et al.* (2014) [8] in white Fulani cattle who reported that by 225-260 days of gestation, all the follicles contained colloid was contracted and irregular at periphery and Shelke *et al.* (2009) [12] who reported shred or mobbing type of follicles leaving clear areas in the thyroid gland of buffaloes.

The follicles were lined by cuboidal cells with round nucleus which was in contrast with the observations of Igbokwe and Ezeasor (2017) [5] who reported that in the thyroid gland of West African dwarf goat above 3 years of age large follicles were lined by squamous epithelium.

The mean follicular size was reduced when compared to group I and group II. The mean height of the follicular epithelial cells was increased when compared to group I and group II. Whereas, Roy *et al.* (1978) [11] observed that in thyroid gland of goats, the follicles became irregular in outline and their diameter was increased with advancing age.

Conclusion

With advancing age, the mean follicular size was reduced while mean height of the follicular epithelial cells was increased. The follicular colloid turns from basophilic to eosinophilic. Colloid contracted and a space was observed at the periphery of the follicles.

Conflict of Interest

Not available

Financial Support

Not available

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