

International Journal of Agriculture Extension and Social Development

Volume 9; SP-Issue 3; March 2026; Page No. 04-07

Received: 12-12-2025
Accepted: 17-01-2026

Indexed Journal
Peer Reviewed Journal

Comparative Morphohistological studies of thyroid glands in lactating and non lactating Kosali Cow

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DOI: <https://doi.org/10.33545/26180723.2026.v9.i3Sa.3282>

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Abstract

Experiment was designed in 12 Kosali cow to study morphohistology of thyroid gland in lactating and nonlactating stage. The thyroid gland of Kosali cow consisted of two lobes; right and left connected by isthmus at the level of 1st or 2nd tracheal ring. The topographic position, shape and external appearance of thyroid gland did not show any distinguishable differences in lactating and non lactating Kosali cow. The weight of right lobes of the thyroid gland was comparatively higher in lactating and non lactating Kosali cow. The mean weight and volume of both the lobes of thyroid gland was higher and non significant in lactating stage than in non lactating stage. Craniomiddle and midcentral thickness in left thyroid lobe was significantly higher in lactating group. The weight, volume, length, width and thickness of isthmus were more in lactating stage than nonlactating. In lactating stage, apparently 75 percent follicles were smaller in size, whereas, in non lactating stage the percentage of medium sized follicles is 50percent. Height of thyrocytes were more in lactating stage than non lactating stage.

Keywords: Gross anatomy, histoarchitecture, Kosali cow, lactating stage, non lactating stage, thyroid gland

Introduction

The thyroid gland shows a marked variation in structural components according to the functional status of the gland and in response to environmental influence. This alteration is related to the number of cells, morphology and hormone storage in the cells. Thyroid hormone regulates the basal metabolic rate and important in the regulation of growth of tissues as well as indirectly play role in milk synthesis. Serum thyroid hormone concentration increased as the stage of lactation progressed, the values at the late stage of lactation being significantly higher as compared to the early stage of lactation (Tiirats, 1997) ^[1]. In view of important role of thyroid hormone in lactation and meager literature availability regarding gross and histoarchitectural organization of thyroid gland at lactating and dry stage with special reference to Kosali cow, present experiment was designed

Materials and Methods

The present study was conducted on thyroid glands of twelve Kosali cows. Samples were collected immediately after death of 6 lactating and 6 non lactating Kosali cows from Rajnandgaon, Durg and Balod, districts of Chhattisgarh. The thyroid glands were studied for their topography in situ and glands were collected in 10% neutral buffered formalin. Morphometrical observations were recorded with the help of Vernier caliper, thread and scale method and volume were recorded by water displacement method. The tissue samples were processed and stained (Singh and Sulochana, 1997) ^[2]. Micrometry of stained sections was done with Labovision KXi2000 photomicroscope. The data obtained for different parameters was statistically analyzed.

Results and Discussion

The thyroid gland of Kosali cow consisted of two lobes;

right and left lobes, these were connected by isthmus. The lobes were present on dorsolateral aspect of trachea. In contrast to present findings Kumar *et al.* (2018)^[3] in ox and Poonia *et al.* (2021)^[4] in buffalo, sheep and goat observed that glands were present in ventrolateral aspect of trachea. Glands were extended in the cranio-caudal direction from the level of caudal part of the cricoid cartilage of larynx up to the 3rd or 4th tracheal cartilage and covered about fifty percent of tracheal surface. The isthmus was directed ventrocranially from the ventral aspect of the trachea at the level of 1st or 2nd tracheal cartilage. The dorsal part of thyroid lobes were related to the common carotid artery and other structures of carotid sheath of respective side, whereas ventrolateral part was covered by cephalic ends of sterno-cephalicus and sterno-thyro-hyoideus muscles and fascia (Fig.1). Dorsomedially, left lobes of thyroid glands were related with ventrolateral aspect of oesophagus. Similar topographical findings were reported by Poonia *et al.* (2021)^[4] and Sharma *et al.* (2020)^[5] in buffalo. The shape of the right and left lobes of thyroid gland was roughly quadrilateral (Fig.2). While Konig and Liebich (2004)^[6] reported irregular shaped thyroid lobes in cattle. The surface of the gland was irregular in appearance with granular texture due to presence of many enclosed follicles. The consistency of gland was firm as mentioned by Dyce and Sack (2010)^[7]. Firm consistency, size and location; enable the lobes to be identified in cattle by palpation caudal to the larynx. The topographic position, shape and external appearance of thyroid gland did not show any distinguishable differences in lactating and non lactating Kosali cow.

The recorded weight of right lobe of thyroid gland was higher in both lactating and non lactating Kosali cow. The mean weight of both the lobes of thyroid gland in Kosali cows was higher and non significant in lactating stage than in non lactating stage. The ratio of volume of right and left lobe of thyroid gland in lactating and non lactating Kosali cow was 7.0:5.0 and 5.0:4.0 was higher and non significant in lactating stage. Poonia *et al.* (2021)^[4] recoded the volume of whole thyroid gland, left lobe of thyroid gland and right lobe of thyroid gland was 19.81 ± 2.02 cc, 9.87 ± 0.76 cc and 8.29 ± 1.13 cc, respectively in buffalo, sheep and goat. The recorded volume of left and right lobe of thyroid gland in non lactating and lactating Kosali cows were lower than previous findings of Poonia *et al.* (2021)^[4] in buffalo.

The length of thyroid gland in lactating and non lactating stage was in between 3 and 4 centimeters in both the lobe of thyroid gland and was non significantly higher in decimal values in lactating than non lactating stage. In present study, left lobe of thyroid gland was slightly longer than right lobe in Kosali cow justify the conclusion of Poonia *et al.* (2021)^[4] that left lobe was longer than the right lobe in buffalo, sheep and goat.

The gland was widest in middle part in both the lobes of thyroid gland in both the group. Maximum middle width was more in right lobe of thyroid gland than left and did not show significant differences between lactating and non lactating stage. In left lobe of thyroid; middle and caudal width were significantly different ($p < 0.05$) in lactating group. Length of cranial border, caudal border, dorsal border and ventral border was comparatively more in lactating stage than in the non lactating stage both in right and left lobe of thyroid gland. Perimeter and cross sectional

area (Fig. 3) of right and left lobe of thyroid glands were more in lactating stage and was non significant. The recorded width of right and left lobe of thyroid glands were less than previous findings of Roy (1971)^[8] who reported the average width of the left and right thyroid lobe in the adult animals as 3.61 cm and 3.45 cm, respectively.

The thickness was comparatively higher in lactating stage than nonlactating stage. Thickness was significantly higher at craniomiddle, craniodorsal, midventral and midcentral region of right lobe of thyroid and craniomiddle and midcentral region of left lobe of thyroid in lactating stage than non lactating stage.

The weight, volume, length, width and thickness of isthmus were more in lactating stage than non lactating and were non significant, which could be attributed to the decrease in parenchyma in non lactating stage to tune with physiological demand of the body.

Histoarchitectural organization of thyroid gland consisted of lobes surrounded by thin capsule and trabeculae of varied thickness divided the gland into lobules. Trabeculae contained numerous sinusoids. Within lobule, follicles were separated by inter follicular connective tissue. Varied size colloid filled follicles were present (Fig. 4). Similar histoarchitectural organization was observed by Hullinger and Andrisani (2006)^[9] in cattle. Parafollicular cells were present between the thyrocytes and basement membrane and in between the adjacent thyroid follicles. In non lactating stage, inter follicular connective tissue was more than in lactating stage.

The thyroid follicles were categorized into three types on the basis of diameter. Diameter of large sized follicle was ranged between 100 -150 μ m, medium sized between 50- 99 μ m and small sized between 1- 49 μ m for all the observed slides. In lactating stage, ratio of percentage of small, medium and large sized follicles were 75:20:5, while it was 30:50:20 in non lactating stage (Fig.4). In lactating stage percent of small follicles were highest which corroborates the previous finding of Peksa *et al.* (2011)^[10] who reported presence of very small and small follicles during high metabolic activity.

The diameter of large, medium and small follicles were more in non lactating stage in right and left lobes of thyroid gland and was nonsignificant. Follicular epithelium was apparently cuboidal in shape. Height of thyrocytes was more in lactating stage and less in non lactating stage and it was similar to findings of Jelinek *et al.* (2003)^[11] and Peksa *et al.* (2011)^[10] in cow. In lactating stage colloid was lighter with vacuolated appearance. Whereas, in non lactating stage follicles were darkly stained and uniformly solid in appearance.

Parafollicular cells were large and vesicular and found in lactating and non lactating thyroid gland as well as in isthmus. These were present either singly or in groups. However, in isthmus parafollicular cells were apparently seen in groups. Similar findings were reported by Kumar *et al.* (2018)^[3].

Isthmus was more parenchymatous in lactating stage the ratio was about 60.00 percent 40.00 percent between parenchyma and connective tissue. In non lactating stage fibrous tissue was more and ratio between fibrous and parenchyma was 70.0-95.0 percent and 5.0- 30, further in two cases of non lactating stage the isthmus was completely fibrous. Similar findings were reported by Sharma (2019)^[12] in isthmus of the thyroid gland of Jaffarabadi buffaloes.

Table 1: Mean $\pm$ SE of gross parameters of right and left lobes of thyroid gland of lactating and non lactating Kosali cow

S. No.	Parameters	Right non lactating	Right lactating	Left non lactating	Left lactating
1	Weight (g)	5.08 $\pm$ 0.48	8.00 $\pm$ 1.06	4.64 $\pm$ 0.41	5.99 $\pm$ 0.74
2	Volume (cc)	5.25 $\pm$ 0.57	7.50 $\pm$ 0.99	4.75 $\pm$ 0.44	6.00 $\pm$ 0.66
3	Length (cm)	3.50 $\pm$ 0.06	3.61 $\pm$ 0.28	3.56 $\pm$ 0.12	3.88 $\pm$ 0.22
4	Cranial width (cm)	2.44 $\pm$ 0.21	2.25 $\pm$ 0.16	2.32 $\pm$ 0.13	2.59 $\pm$ 0.21
5	Middle width (cm)	2.75 $\pm$ 0.18	3.14 $\pm$ 0.23	2.58 $\pm$ 0.07	2.92 $\pm$ 0.22*
6	Caudal width (cm)	1.77 $\pm$ 0.17	2.04 $\pm$ 0.18	1.58 $\pm$ 0.05	1.98 $\pm$ 0.16*
7	Cranial border (cm)	2.79 $\pm$ 0.26	2.97 $\pm$ 0.19	2.52 $\pm$ 0.12	2.87 $\pm$ 0.25
8	Caudal border (cm)	2.03 $\pm$ 0.18	2.10 $\pm$ 0.15	1.88 $\pm$ 0.09	2.12 $\pm$ 0.15
9	Dorsal border (cm)	3.36 $\pm$ 0.15	3.88 $\pm$ 0.29	2.74 $\pm$ 0.12	3.18 $\pm$ 0.21
10	Ventral border (cm)	2.97 $\pm$ 0.21	3.38 $\pm$ 0.21	2.82 $\pm$ 0.13	3.28 $\pm$ 0.13
11	Perimeter (cm)	11.20 $\pm$ 0.42	12.06 $\pm$ 0.74	9.95 $\pm$ 0.26	11.54 $\pm$ 0.63
12	Cross sectional area (mm ²)	186.00 $\pm$ 12.54	212.67 $\pm$ 39.64	184.83 $\pm$ 12.98	214.33 $\pm$ 29.50
13	Cranioventral thickness (cm)	0.49 $\pm$ 0.05	0.51 $\pm$ 0.02	0.49 $\pm$ 0.04	0.54 $\pm$ 0.02
14	Craniomiddle thickness (cm)	0.58 $\pm$ 0.06	0.61 $\pm$ 0.01*	0.38 $\pm$ 0.01	0.65 $\pm$ 0.07*
15	Craniodorsal thickness (cm)	0.42 $\pm$ 0.05	0.43 $\pm$ 0.015*	0.36 $\pm$ 0.02	0.43 $\pm$ 0.03
16	Mid ventral thickness (cm)	0.54 $\pm$ 0.026	0.57 $\pm$ 0.05*	0.50 $\pm$ 0.03	0.57 $\pm$ 0.03
17	Mid central thickness (cm)	0.79 $\pm$ 0.03	1.09 $\pm$ 0.09*	0.70 $\pm$ 0.03	1.02 $\pm$ 0.12*
18	Mid dorsal thickness (cm)	0.49 $\pm$ 0.02	0.57 $\pm$ 0.05	0.47 $\pm$ 0.02	0.55 $\pm$ 0.04
19	Caudoventral thickness (cm)	0.47 $\pm$ 0.05	0.48 $\pm$ 0.03	0.48 $\pm$ 0.02	0.50 $\pm$ 0.03
20	Caudomiddle thickness (cm)	0.59 $\pm$ 0.05	0.59 $\pm$ 0.03	0.64 $\pm$ 0.04	0.65 $\pm$ 0.03
21	Caudodorsal thickness (cm)	0.42 $\pm$ 0.02	0.54 $\pm$ 0.02	0.48 $\pm$ 0.02	0.52 $\pm$ 0.02

Mean values with (*) superscripts show significant different ($p < 0.05$)

Legends of photograph



Fig 1: Photograph showing position of thyroid gland in Kosali cow, cricoids cartilage (CC), right thyroid gland (RT), ventral surface of trachea (VST), isthmus (I), left thyroid gland (LT), sternothyrohyoid muscle (STH), sternocephalic muscle (SC) of non lactating Kosali cow.

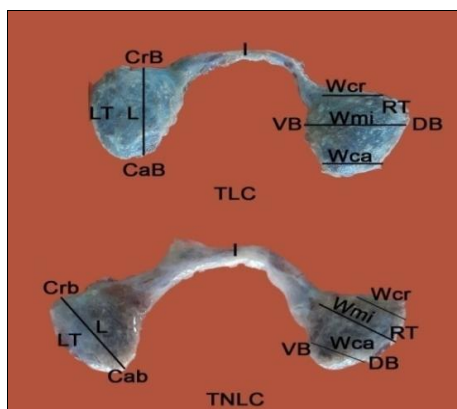


Fig 2: Photograph of thyroid gland, showing medial surface of right lobe of thyroid (RT), isthmus (I), medial surface of left lobe of thyroid gland (LT), cranial border (CrB), caudal border (CaB), dorsal border (DB), ventral border (VB), Length (L), cranial width (Wcr), middle width (Wmi), caudal border (Wca) in lactating (TLC) and non lactating (TNLC) Kosali cow.

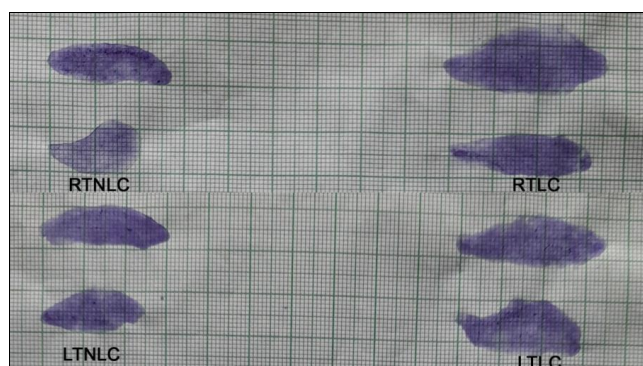


Fig 3: Photograph showing cross sectional area of right and left lobe of thyroid gland in non lactating (RTNLC and LTNLC) and right and left thyroid in lactating (RTL and RLNLC) in Kosali cow

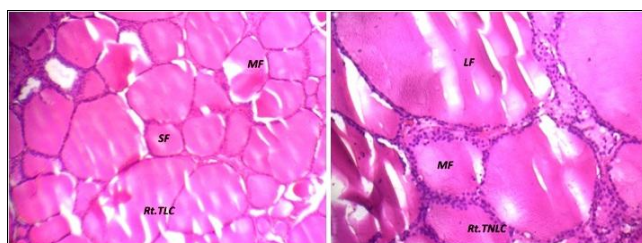


Fig 4: Photomicrograph of right lobe of thyroid gland in lactating Kosali cow (Rt.TLC) and right lobe of thyroid gland in non lactating Kosali cow (Rt.TNLC) showing large follicles (LF), medium follicles (MF) and small follicles (SF) (H&E, 200X)

Conclusion

The present study describes the gross anatomical and histological features of the thyroid gland in lactating and non-lactating Kosali cows. The gland consisted of right and left lobes connected by an isthmus and was located on the dorsolateral aspect of the trachea. The lobes were quadrilateral in shape with a firm consistency and granular

surface due to numerous follicles. Morphometric observations showed that most measurements were slightly higher in lactating cows, though differences were largely non-significant. Histologically, the gland contained colloid-filled follicles lined by cuboidal epithelium. Lactating cows showed a higher proportion of small follicles and increased thyrocyte height, indicating greater metabolic activity compared to non-lactating animals.

References

1. Tiirats T. Thyroxin, triiodothyronine and reverse-triiodothyronine concentrations in blood plasma in relation to lactational stage, milk yield, energy and dietary protein intake in Estonian dairy cows. *Acta Vet Scand.* 1997;38:339-348.
2. Singh UB, Sulochana S. *Handbook of histological and histochemical techniques*. 2nd ed. Hyderabad: Premier Publishing House Kothi. 1997. p. 42-63.
3. Kumar D, Vaish R, Pandey Y, Gupta N, Umeel, Kumar P. Thyroid gland: An anatomical perspective. *Journal of Entomology and Zoology Studies.* 2018;6(4):1400-1405.
4. Poonia A, Gupta A, Uppal V. Comparative gross anatomical and biometrical studies on thyroid gland of buffalo, sheep and goat. *Indian Journal of Animal Research.* 2021;B-4419:1-9.
5. Sharma A, Vyas YL, Kumar V, Tank PH, Talekar SH. Gross morphometric studies on thyroid and adrenal glands of Jaffarabadi buffalo during different seasons of the year. *Indian Journal of Veterinary Anatomy.* 2020;32(1):19-22.
6. König HE, Liebich HG. Endocrine glands. In: *Veterinary anatomy of domestic mammals: Textbook and colour atlas*. 4th ed. 2004. p. 537-545.
7. Dyce KM, Sack WO, Wensing CJG. *Textbook of veterinary anatomy*. 4th ed. St. Louis, Missouri: Saunders Elsevier. 2010. p. 213-222.
8. Roy MK. Histological and certain histochemical observations on endocrine glands of buffalo. M.Sc. Vet. Thesis. Agra: Agra University; c1971.
9. Hullinger RL, Andrisani OM. Endocrine system. In: *Dellmann's textbook of veterinary histology*. 6th ed. Oxford: Blackwell Publishing Ltd. 2006. p. 298-319.
10. Peksa Z, Travnicek J, Dusova H, Konecny R, Hasonova L. Morphological and histometric parameters of the thyroid gland in slaughter cattle. *Journal of Agrobiology.* 2011;28(1):79-84.
11. Jelinek F, Krabaaova I, Kroupova V. Assessment of functional activity of the bovine thyroid gland using morphometry and two markers of cellular proliferation. *Acta Veterinaria Brunensis.* 2003;72:11-16.
12. Sharma A. Gross morphological, histological and histochemical studies on pineal, pituitary, thyroid and adrenal glands of Jaffarabadi buffalo during different seasons of the year. Junagadh: Junagadh Agricultural University; 2019.