



## Postnatal Gross Morphological and Histoenzymic Studies on the Thyroid Gland of Assam Goat

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### ABSTRACT

The thyroid gland was composed of right and left lateral lobes connected by a narrow isthmus. The location of the isthmus over the trachea varied in male goats which ranged from 4<sup>th</sup> to 9<sup>th</sup> tracheal rings. Various biometrical parameters *viz.* length, width, thickness and weight of the thyroid gland showed a highly significant ( $P < 0.01$ ) increase between various age groups as well as between the thyroids of right and left sides of the body in Assam goats. Accessory thyroid tissue was not observed in any of the male goats. Different biometrical parameters of the isthmus showed an increasing trend with the advancement of age and the variations were found to be highly significant ( $P < 0.01$ ) between various age groups, except in respect of their weight. The activity of LDH in the follicular epithelium of the thyroid gland varied from weak to intense from 4 to 10 months of age (groups-III to VI). However, MDH showed a strong activity in these cells at birth (group-I), which was reduced to moderate in 4 month old kids (group-III) and again elevated in older goats. The enzymic activity of G-6-PDH was variable from mild to moderate in the male goats. The intertubular stroma of the thyroid gland showed no activity for MDH and G-6-PDH in all the age groups. But a mild activity of LDH enzyme was seen in goats from 6 month of age (group-IV) onwards.

**Keywords:** Morphology, histoenzymology, thyroid gland, goat

The thyroid gland develops from the floor of the primitive pharynx and begins to synthesize and secrete thyroid hormones by 17 days of gestation (Said *et al.*, 2007). The most numerous cell populations in the gland is the thyroid follicular cells which are responsible for development, growth and metabolism of the organ systems (Cabello and Wrutniak, 1989).

It is also essential to observe the activity of various enzymes like oxidoreductases,  $\Delta^5$ -3- $\beta$ -HSD and 17- $\beta$ -HSD in the tissues during the study of growth process of the thyroid gland towards maturity. Among the different animals in which investigations pertaining to the anatomical study of the thyroid gland was made by various workers included goat (Agarwal and Bhattacharya, 1981; Baishya *et al.*, 1986), Asiatic water buffalo (Mathur, 1971), sheep (Roy and Saigal, 1987), cattle (Sanap *et al.*, 1998) and pig (Sekulic and Lovern, 1995).

Pursuance these literatures revealed that meager detailed systematic study on thyroid gland was conducted considering the sequence of morphological changes that takes place during postnatal development from birth to post pubertal period in animals and particularly in Assam goat. Therefore this present study was aimed to elucidate the development of the thyroid gland in terms of its gross morphology and histoenzymology in Assam goat from birth to 10 months of age.

### MATERIALS AND METHODS

A total of 18 male Assam goats varying in age from 0-day to 10 months were used in the present study. The animals were divided into six age groups *viz.* group-I (0-day), group-II (2 months), group-III (4 months), group-IV (6 months), group-V (8 months) and group-VI (10 months) consisting of three animals in each group. The age of the

goats were estimated from birth records. Each animal was weighed using Spring Balance to record the body weight. The animals were sedated by giving intramuscular injection of Siquil @ 1 mg/Kg body weight and subsequently anaesthetized by administering intravenous injection of Intravel Sodium @ 15 mg/Kg body weight (Hall *et al.*, 2000). After induction of proper level of anesthesia, the animals were sacrificed. The whole procedure for sample collection has been approved by the Institutional Animal ethics Committee.

The topographical positions, gross morphological features and biometrical parameters (length breadth, thickness, weight) of the of the thyroid gland were recorded for each animal. All the data were put to statistical analysis (Snedecor and Cochran, 2004) and the means along with their standard errors were calculated. Variations of different parameters among different age groups were estimated by ANOVA and the probable variations between individual age groups were calculated by Critical Difference Test. All the above calculations were carried out by using SPSS software version 11.5.

For histoenzymic studies, representative tissue samples from and thyroid glands of the animals of various age groups were collected and sectioned at 10  $\mu$  thicknesses using a cryostat (Leica, U.K.). The cryostat sections were incubated for the histoenzymic demonstration of various enzymes *viz.* Glucose-6-Phosphate dehydrogenase (G-6-PDH), Lactate Dehydrogenase (LDH) and Malate Dehydrogenase (MDH) as per Nitro - BT method (Pearse, 1980).

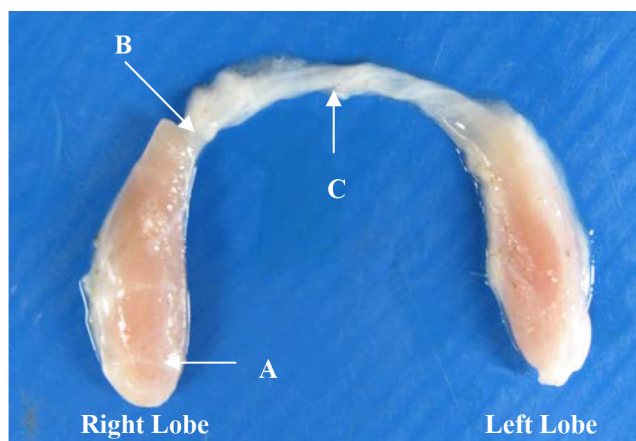
## RESULTS AND DISCUSSION

The thyroid gland was composed of right and left lateral lobes connected by a narrow isthmus in all the male goats under study. The lobes were reddish-brown in colour and elliptical in outline. The cranial pole was enlarged, thick and rounded, whereas the caudal pole was relatively pointed and thinned out forming a blunt tapering end to meet the isthmus (Fig. 1). The location of the isthmus over the trachea varied in male goats under study and ranged from 4<sup>th</sup> to 9<sup>th</sup> tracheal rings (Fig. 2). Similar findings were recorded about the locations of isthmus in early post natal goat between 0 to 90 days of age by Baishya *et al.* (1985). Roy *et al.* (1975) observed the shape of both the lobes of the thyroids to be elongated elliptical in outline in goats.

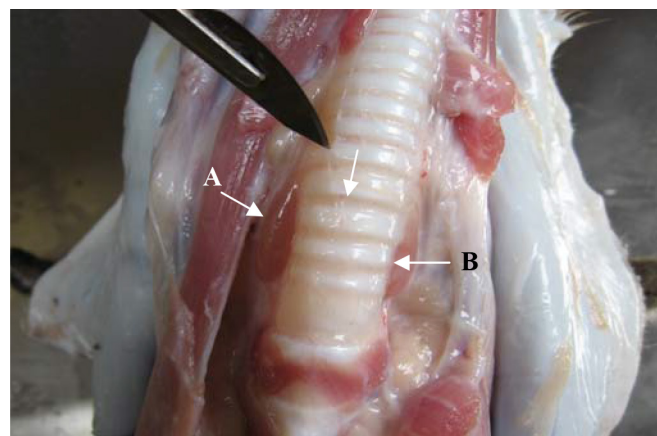
However, Bhardwaj *et al.* (2006) reported that the thyroid gland was almost almond shaped and the posterior margin of the thyroid was pointed and long in Gaddi goats.

The length of the thyroid gland increased from 1.14  $\pm$  0.03 cm in day-old kids (group-I) to 2.35  $\pm$  0.03 cm in 10 months old bucks (group-VI) and the variation of values in respect of length of the thyroid gland was highly significant ( $P < 0.01$ ) between right and left sides as well as between different age groups. The width of the thyroid gland were recorded as 0.52  $\pm$  0.01 cm and 1.39  $\pm$  0.01 cm in day-old kids (group-I) and at 10 months of age (group-VI), respectively. The values pertaining to width of the thyroid gland had significant ( $P < 0.05$ ) differences between the thyroids of right and left sides and a highly significant ( $P < 0.01$ ) difference between the various age groups, respectively. Similarly, the thickness of the thyroid gland was varied from 0.37  $\pm$  0.01 cm at birth (group-I) to 0.81  $\pm$  0.02 cm in 10 months old goats (group-VI). A highly significant ( $P < 0.01$ ) variation in thickness of thyroid gland persisted between body sides and different age groups. Perhaps, the thickness of thyroid gland was found to differ significantly ( $P < 0.05$ ) between 2 and 4 months of age in the male kids (groups-II & III). The weight of the thyroid gland increased from 0.13  $\pm$  0.0 g in day-old kids (group-I) to 1.21  $\pm$  0.02 g in 10 months old bucks (group-VI). The variation of values in respect of weight of the thyroid gland was also highly significant ( $P < 0.01$ ) between right and left sides as well as between different age groups.

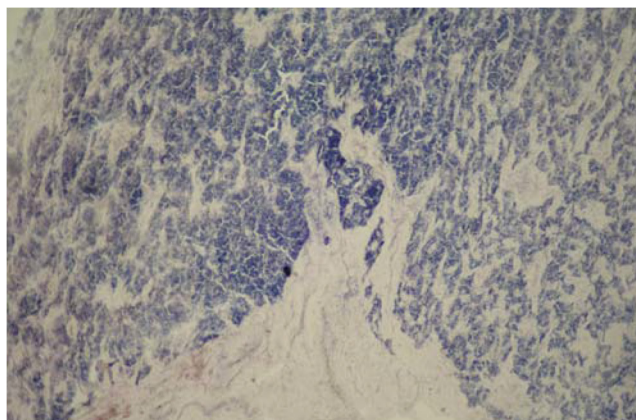
It was seen that various biometrical parameters *viz.* length, width, thickness and weight of the thyroid gland showed a highly significant ( $P < 0.01$ ) increase between various age groups as well as between the thyroids of right and left sides of the body in Assam goats. These findings were in agreement with the reports of Baishya (1984) in Assam goats at an early post natal age of 0 to 90 days. On the contrary, Roy *et al.* (1975) reported that the lateral lobes of the same thyroid gland did not show marked variations in measurements in goats. The various biometrical parameters pertaining to the thyroid gland recorded in the present study in day-old (group-I) and 2 months old kids (group-II) were comparable to that observed at the same age in Assam goats by Baishya (1984). In the present investigation, accessory thyroid tissue and parathyroids were not observed in any of the male goats. Getty (1975) remarked that, accessory thyroid tissue and parathyroids



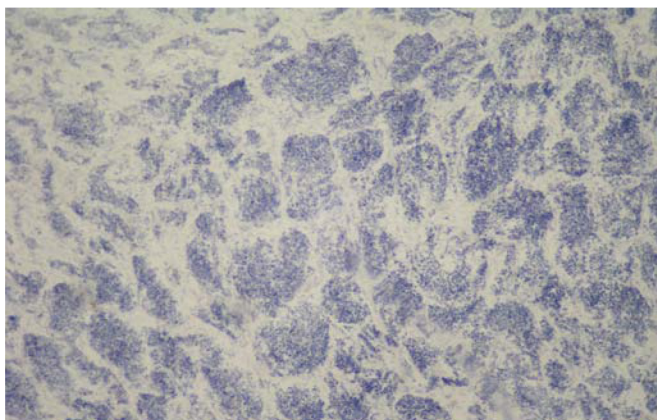
**Fig. 1:** Photograph showing the anterior pole (A), caudal pole (B) and the isthmus (C) of the thyroid gland of a four months old male kid



**Fig. 2:** Photograph of the topographical location of the thyroid gland showing the isthmus (arrow), right lobe and (A) left lobe (B) in a four months old male kid



**Fig. 3:** Photomicrograph of the thyroid gland in a four months old kid showing the activity of LDH enzyme. 100 X



**Fig. 4:** Photomicrograph of the thyroid gland in a four months old kid showing the localization of MDH enzyme. 100 X

were inconstant in caprine species. However, Roy *et al.* (1976) recorded the presence of extra thyroid tissue embedded within or in close vicinity of the thyroid gland in 26.9 per cent of the goats they studied. Breed difference might play a role in occurrence of these structures in goats.

Various biometrical parameters of the isthmus of the thyroid gland showed an increasing trend with the advancement of age and the variations were found to be highly significant ( $P < 0.01$ ) between various age groups except in respect of their weight. Length and width of the isthmus differed significantly ( $P < 0.05$ ) between first two groups of kids.

The activity of LDH in the follicular epithelium of the thyroid gland was mild up to 4 month of age (group-III). However, the activity rose to moderate to strong at 6 months (group-IV) (Fig. 3) and strong to intense at 8 and 10 months of age (groups-V & VI), respectively. The activity of LDH was diffused granular type and observed mainly at the basal portion of the cells. No activity of LDH was seen in the intertubular stroma of the thyroid gland up to 6 months of age (group-IV). However, a mild activity of LDH was noticed in the interfollicular stroma in older goats.

A strong activity of MDH enzyme was found in the follicular epithelium of the thyroid gland in day-old kids

(group-I). However, a variable activity of weak to moderate intensity was noticed in 2 and 4 months old kids (groups II & III) (Fig. 4), which raised to moderate to strong in 6 months old goats (group-IV) and strong in older animals. The interfollicular stroma did not reveal any activity of MDH in all the male goats under study. On the contrary, Thomas *et al.* (2005) reported that the intensity of activity of LDH in the follicular epithelium of the thyroid gland did not show any change with age in human.

On the other hand, G-6-PDH had variable activities in the follicular epithelium of the thyroid gland ranging from mild in the younger kids to moderate in older ones in the present study. Tsuchiya *et al.* (1983) observed that the follicular cells of the thyroid gland reacted intensely with G-6-PD and LDH in common dolphin.

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