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Histological changes in the thyroid gland during the female reproductive cycle in *Hipposideros lankadiva (kelaart)*

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Abstract : The present investigation was undertaken to compare the histological changes in thyroid gland of female reproductive cycle of *Hipposideros lankadiva (kelaart).*Thyroid gland showed marked seasonal variation in weight, quantity of colloid and follicular epithelial height, suggesting that the thyroid gland remains inactive during quiescence and winter dormancy and it became active during the time of recrudescence and the remaining breeding behavior is similarly to the testicular cycle. Plasma thyroxin (T4) concentration showed a significant seasonal change with high concentration during the breeding and post-breeding period and low concentration during quiescence.

The observations confirm that during diapauses the thyroid gland show hypothyroid condition. Probably the stored colloid material is used by bat after the arousal from torpor as embryonic development gains momentum. It is suggested that the increase in the consumption of colloid material after arousal from torpor is due to hyper-metabolism which might be the requirement of feto-placental unit in the pregnant animal. Although, the hypothyroidism is associated with infertility, sterility and abnormal in bats. The present study records that it may also be related to embryonic diapause and slow growth of embryo in *H. lankadiva*.

Key words: *H. Lankadiva*, Thyroid gland, Embryonic diapause, Reproductive cycle.

Introduction

Hipposideros lankadiva (kelaart) is the tropical, non-hibernating, monoestrus, monotocous, hipposiderid bat. These bats are indigenous to the southwestern subcontinent of India. This is the only bat in this vast subcontinent representing the phenomenon of delayed development or embryonic diapause and also suggests a slow rate of embryonic differentiation after implantation resulting prolonged gestation period of 260 days (8.5 month) with the body weight of just 55gm as reported by Sapkal and Bhandarker (1984). Seraphim (2009 a &b) studied the endocrine interaction during different phases of the female reproductive cycle in *H. lankadiva (kelaart).* She noticed changes, both light and electron microscopic, in diapause stage. According to her, thyroid gland plays an important role in the maintenance of growth and reproduction. The hypothyroidism is believed to be closely associated with sterility, infertility and abortion (Mayant, 1964). In cattle, T3 deficiency results in silent estrous in female. Singh *et al.(2002)* reported seasonal changes in thyroid activity in the female sheath-tailed bat, *Taphozous longimanus* (Chiroptera: Emballonuridae). They found that thyroid gland showed marked seasonal variation in weight and secretory activities. It was inactive in quiescence from early to mid-winter dormancy and active during recrudescence and breeding period during late winter dormancy. They also reported that serum 3, 5,3'-triiodothyronine (T3) and thyroxine (T4) concentrations showed significant variation and closely coincide with thyroid activity. In the present study an attempt has been made to know endocrine interaction during different phases of the female reproductive cycle in bat, *Hipposideros lankadiva (kelaart).*

Materials and methods

Mature female *H. lankadiva* were collected from there roosting places in Chandrapur and Ballarshah (Maharastra) and Mandu (M.P.) from August up to May in such a way that all the important reproductive periods were represented. Live animals were brought to laboratory with minimum stress, anesthetized and killed by decapitation. Thyroid glands were dissected outweighed and fixed in alcoholic Bouins. After 24 hrs the glands were washed with 70% ethanol, dehydrated through graded series of ethanol, cleared in xylene and embedded in paraffin wax. The sections were cut at 5µ-75µ thick. The sections were stained with Ehrlick's hematoxylin and counter stained with eosin. The weight of the thyroid gland during different phases of the reproductive cycle was measured. Necessary statistical techniques were used.

Results

Thyroid gland of *H. lankadiva* is a bilobed structure. Measurement of the wt of thyroid glands during different phases of the reproductive cycle has been shown in the table 1. The present observations

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Table 1. Weight of the thyroid gland during different phases of the reproductive cycle

Reproductive state	Month	Weight of sample no			Mean Weight ± SEM
		I	II	III	
Estrus	August	5.6	7.8	7.2	6.80 ± 0.6582
Implant	Sept.	5.9	5.1	7.2	6.00 ± 0.6137
Diapause	Nov.	4.5	5.7	6.2	5.40 ± 0.5066
Arousal	Feb.	7.6	4.8	5.6	6.00 ± 0.8326
Lactation	June	5.4	5.0	6.6	5.60 ± 0.4830
Anestrus	July	5.8	6.4	5.9	6.00 ± 0.1870

suggest that the weight of the thyroid gland reaches its peak (6.80 ± 0.6582) during estrus the weight reduces during implantation (6.00 ± 0.6137) it is further reduced to (5.40 ± 0.5066) during in diapause period of the reproductive cycle. Again there is an increase in the wt of the gland during later part of pregnancy and lactation.

The follicles and parafollicular cells of the thyroid are embedded in the parenchyma. The histology of the thyroid gland during different phases of reproductive cycle is presented below.

Thyroid gland during estrus:

It is oval and triangular in shaped during this phase and contains follicles of varying sizes and shapes can be distinguished into 3 types depending upon their size and the type of epithelial cells lining.

1. A type follicle: (diameter 100µ - 150µ)

The thyroid comprised large numbers of follicles whose diameter ranges from 100µ - 150µ and is mainly located towards the periphery of the gland. The follicles are lined by sqamous epithelium. The follicles contain homogenous colloid. The cells cytoplasm is eosinophilic in nature, the nuclei are flattened. The follicles are less inquantity during estrous period.

2. B type follicles: (diameter 60µ - 100µ)

B type follicles have diameter ranging from 60µ - 100µ. These are medium sized and situated mainly in the inner portion of the gland and are lined by cuboidal epithelium. They are round in shape with centrally placed nuclei and the cytoplasm is basophilic in nature. The colloid material is homogenous.These are present in large numbers.

3. C type follicles: (diameter 30µ - 60µ)

Another type of follicles is designated as C type follicles. The diameter ranges from 30µ - 60µ. These follicles are small with narrow lumen occupying the interior portion of the gland and are lined by cuboidal and columnar epithelium that the nuclei take dark blue stain with hematoxylin thus showing basophilic nature. The colloid is homogenous and is also basophilic. These follicles became abundant during estrus phase.

Parafollicular cells:

These are arranged either singly or in group of 2 to 3 cells within the follicle and in the interfollicular connective tissue. These are close to the base of the epithelium and do not extend to the follicular cavity. These cells have large nuclei with faintly stained cytoplasm.

Thyroid gland during pregnancy:

In *H. lankadiva* after implantation female animal enters into torpor with less body activity and foraging movement is in the embryonic diapause stage. It start late August to early September. The pregnant females showed retarded growth of implanted blastocyst till the end of January. The thyroid gland during diapause presents following histological feature.

There is a large number of A type follicles and six to ten have acquired a diameter of about 167µ. These are situated at the periphery of the gland and are not observed in any of the previous stage. There large lumen is filled with homogenous eosinophilic colloid material. The B type which are medium size follicles are less in no as compared to A type and are lined by cuboidal epithelium. The C type follicles are less in number but are distributed throughout the gland. Parafollicular cells are found scattered in the interfollicular region.

Diapause state ends in the first week of February in *H. lankadiva* and thyroid gland of aroused animal shows interesting features. The oval gland shows presence of a minimum number of A type follicle while B and C types of follicles are abundant in no in aroused animals. During arousal stage the homogenous

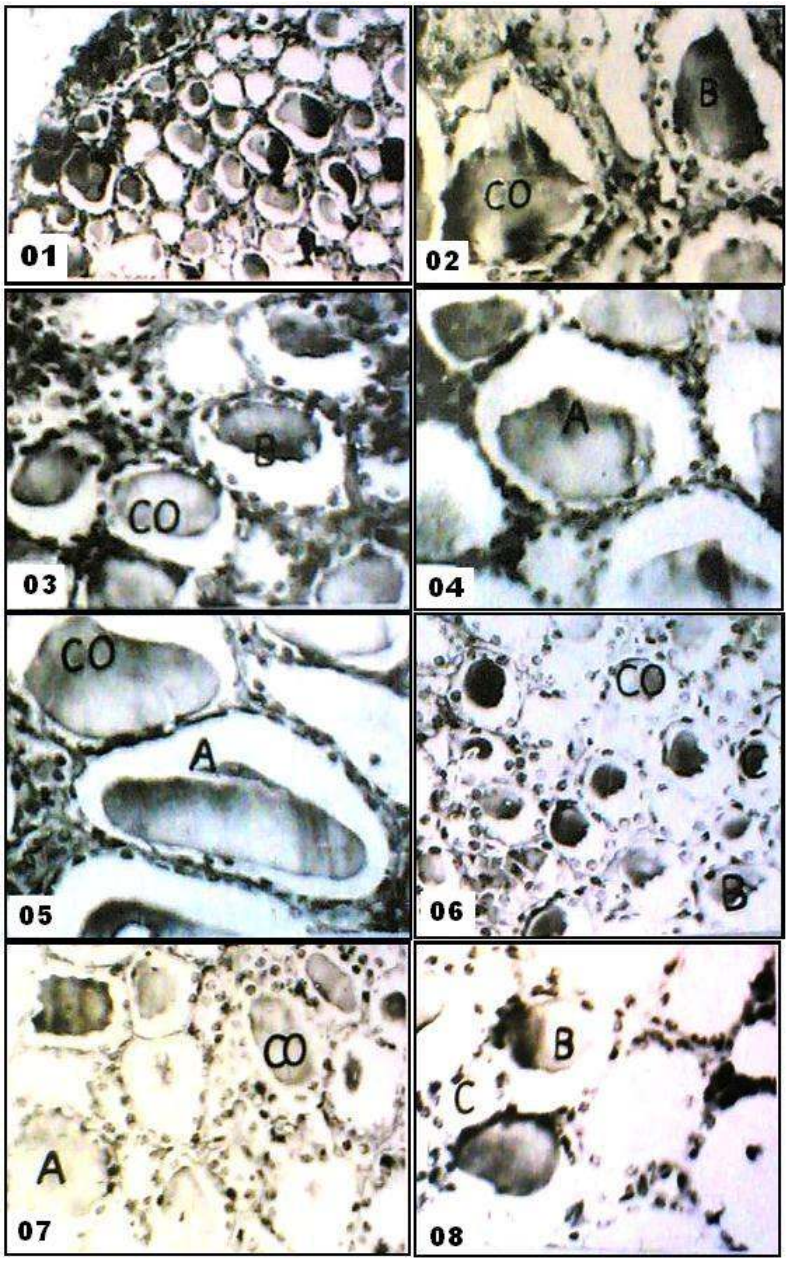

Fig. 1. Transverse section of thyroid gland of female *H. lankadiva* during estrus phase showing B and C type follicles. X 160.

Fig. 2. TS of thyroid gland of female *H. Lankadiva* during estrus phase showing B type follicles with cuboidal epithelium and homogenous colloid material. X450

Fig. 3. TS of thyroid gland of female *H. Lankadiva* during estrus phase during diapause showing B type follicles. X450

Fig 4. TS of thyroid gland of female H. Lankadiva during estrus phase during diapause showing A type follicles with low cuboidal follicular epithelium. X450.

Fig. 5. TS of thyroid gland of female *H. Lankadiva* during diapause showing A type follicles with largest diameter and homogenous colloid material (CO). X450.

Fig. 6. TS of thyroid gland of female during arousal phase showing B and C type follicles with cuboidal epithelium and vacuoilization in the colloid material (CO). X450.

Fig. 7. TS of thyroid gland of female *H. Lankadiva* during arousal showing A type follicles with cuboidal follicular epithelium vacuoles in the colloid. X450.

Fig. 8. TS of thyroid gland of female *H. Lankadiva* during lactation phase showing B type follicles with low cuboidal epithelium.X450.

follicular colloidal material shows vacuolation. The follicular epithelium is cuboidal in nature in B and C type follicules. Some of the follicles show depleted colloid material in their lumen. During late pregnancy there is further decrease in the number of very large follicles.

Thyroid gland during lactation:

Adult female *H. lankadiva* were observed in a state of lactation phase from June to July. During the oval shaped thyroid gland shows A type follicles with reduced number B and C type follicles are abundant.

Discussion

The insignificant variation in the wt. of the gland of *H. lankadiva* throughout the reproductive cycle is confirmation to the observation in bats as reported by earlier investigators (Burns *et al*., 1972; SINGH. & KRISHNA,1995 & 1966). Decrease in the wt. of the gland and the presence of the follicles of largest diameter is observed during torpor in pregnant female, *H.lankadiva*. This is due to the inactive state of the thyroid gland in which the stored colloid l has been consumed by the animal. Once it arouses from the torpor or at the end of the embryonic diapause the blastocyst starts developing. Chatefield and Lyman, (1950) and Holland *et al.* (1967) suggested that from arousal to hibernation or torpor is characterized by a transient period in which there is sharp rise in the rate of oxygen consumption and basal metabolic rate. Lardy and Kent (1963) stated that the thyroid hormones T -3 and T-4 regulate the cellular oxidation and metabolism. There is decrease in plasma thyroxin level (T-4) in *Macrotus californicus* after implantation and its lowest level is noticed in diapause (Burrow, 1972). A sharp rise after arousal is maintained till lactation.

An increase in the wt of the gland of *H. lankadiva* during arousal is observed. Histological, the aroused animals show medium and small sized follicles which contain with homogenous colloid material. Most of the follicles show vacuolization in the colloid material but some show complete depletion of the colloid material which indicates the active phase of the thyroid gland which continued till lactation.

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