ORIGINAL RESEARCH PAPER

Zoology

SEASONAL CHANGES IN THE PARATHYROID GLAND OF THE SNAKE, ENHYDRIS ENHYDRIS (SCHNEIDER) IN RELATION TO SERUM CALCIUM AND INORGANIC PHOSPHORUS LEVELS

KEY WORDS: Parathyroid gland, Enhydris enhydris.

Dr. Mrinalini Kagwade

Department of Zoology, Elphinstone College Dr. Homi Bhabha State University.

ABSTRACT

Adult snakes of E. enhydris were collected from the coast around Mumbai. They were maintained in tanks and acclimatized to laboratory conditions. Five males and five females were sacrificed under Nembutal anaesthesia on the same day and time every month throughout the year. The parathyroids were excised, fixed, processed in graded series of alcohol and paraffin embedding, sections cut at 6μ and stained with haematoxylin-phloxin.

The parathyroid glands show seasonal histological changes. The glands are more active in the months of November-December reflected by an increase in serum calcium and inorganic phosphorus levels. In the month of July and the gland showed partial degeneration suggesting hypoactivity.

INTRODUCTION

Parathyroid gland is an important endocrine gland concerned with calcium metabolism. In a water snake like *E. enhydris* it is interesting to understand the histopathological behaviour of parathyroid which generally has a correlation with the environmental temperature, seasonal fluctuations of calcium in lake water and also breeding season. The reptiles have a low metabolic rate and remain inactive for long periods except for feeding and breeding. The parathyroids of these animals show marked seasonal histological (Sidky, 1965; Dubewar and Suryawanshi, 1978a; Akbarsha, 1983; Singh and Kar, 1984; Swarup and Pandey, 1990b; Warbhuwan and Padgaonkar, 1996a), histometric (Akbarsha, 1985b) and ultrastructural (Isono et al., 1979) changes. Any changes in the histology of the gland should reflect on the levels of circulating calcium and inorganic phosphorus levels.

The parathyroid glands of many lizards show seasonal histological changes. Peters (1941) has reported changes in the parathyroid gland of *Lacerta viridis* during winter. In *Uromastix hardwickii* (Dubewar and Suryawanshi, 1978a) the parathyroid gland is hyperactive during summer and shows degenerative changes during winter. An elevation in plasma calcium and inorganic phosphorus levels accompany this in summer and low levels in winter. Similar observations were also made in *Calotes versicolor* (Akbarsha, 1985b) and *Varanus flavescens* (Swarup and Pandey, 1990b). In the snake, *Natrix piscator*, there is no significant seasonal variation in the physiological function of the gland (Singh and Kar, 1983b), while in another snake, *Eryx johnii*, the parathyroid gland is hyperactive in late summer and rainy season (Singh and Kar, 1983a). In *Acrochordus granulatus*, the parathyroid gland showed maximum activity in November and minimum in the month of July (Warbhuwan and Padgaonkar, 1996a).

Apparently, the parathyroid glands of different species respond differently to changes in season. This study attempts to corelate the changes, if any, in the histology of the parathyroid glands with the serum levels of calcium and inorganic phosphorus in the snake, *Enhydris enhydris*.

MATERIALS AND METHODS

Adult snakes were collected from the nearby sea coast around Mumbai. The snakes were available between July and January, for seven months. Repeated attempts to procure the snakes between February and June were unsuccessful. The snakes after collection were kept in tanks containing seawater at room temperature (27-28° C) for 48 hours for acclimatization. Five male snakes and five female snakes were sacrificed under Nembutal anaesthesia 2.5mg/100g body weight) on the same day and time every month throughout the year. Blood samples from each snake were collected from the aortic arch, sera separated and analysed for serum calcium and inorganic phosphorus according to methods described by Trinder (1960) and Gomorri (1942) respectively. The rostral parathyroids and the thymus glands were excised and fixed in Bouins fluid. After routine processing in graded series of alcohol and paraffin embedding, sections were cut at 6μm and stained with hematoxylin-phloxin method.

RESULTS

E. enhydris exhibits seasonal and sexual differences in the serum levels of calcium and inorganic phosphorus. The females have higher values of serum calcium annual mean (14.94 ± 1.71mg%) and inorganic phosphorus annual mean (5.2 ± 0.75mg%) as compared to those of males annual serum calcium mean (12.40 ± 0.63mg%) and inorganic phosphorus (4.32 ± 0.47 mg%). During the breeding season, from October to December, the females have significantly high values of serum calcium with the peak values in the month of December (Table 1). The minimum values are recorded in the month of July. As compared to females, the seasonal changes in the serum calcium and phosphorus levels are less significant (Table1).

TABLE 1: Seasonal changes in the serum calcium and inorganic phosphorus levels in the female and male snake, *Enhydris enhydris*

MONTH	SERUM CALCIUM mg%		SERUM INORGANIC PHOSPHORUS mg%	
	Female	Male	Female	Male
JULY	10.98 ± 0.25	10.48 ± 0.25	3.66 ±0.17	3.01 ±0.16
AUGUST	11.27 ± 0.22	10.96 ± 0.63	3.70 ± 0.28	3.51 ± 0.12
SEPTEMBER	12.66 ± 0.27	11.23 ± 0.22	4.03 ± 0.20	3.53 ± 0.12
OCTOBER	12.30 ± 0.80	11.38 ± 0.36	4.48 ± 0.19	4.22 ± 0.31
NOVEMBER	17.45 ± 0.39	13.39 ± 0.25	7.94 ± 0.50	6.25 ± 0.11
DECEMBER	24.74 ± 1.13	14.86 ± 0.53	8.71 ± 0.77	6.34 ± 0.28
JANUARY	15.18 ± 0.41	14.55 ± 0.36	3.91 ± 0.17	3.78 ± 0.22
ANNUAL MEAN	14.94 ± 1.71	12.40 ± 0.63	5.20 ± 0.75	4.32 ± 0.47

The parathyroid gland is composed of glandular parenchyma with a cord- like arrangement of cells separated by thin stroma of connective tissue (Fig1). These cells have inconspicuous cell boundaries with very little cytoplasm and oval or round nuclei.

The parathyroid gland of both sexes shows partial degenerative changes in the month of July (Figure 2 and Figure 3). The degenerative changes are conspicuous in the central part of the gland. The arrangement of the cells situated near the degenerating area is disturbed and they migrate towards the central space where they degenerate. The centre of the gland appears to be sparsely filled with a few cells in different stages of degeneration. The histology of the parathyroid during the other months of the year is normal.

FIGURE 1: Photomicrograph of the parathyroid gland showing cord like arrangement of cells. 250X

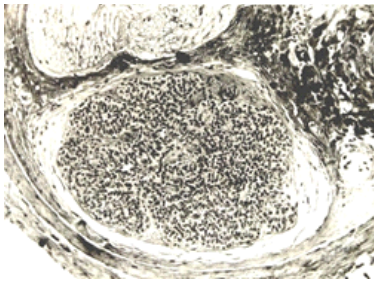


FIGURE 2: Photomicrograph of the parathyroid gland of the male snake showing partial degeneration in the month of July. 250X.

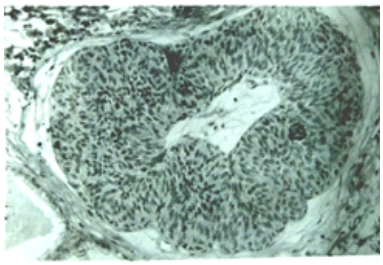
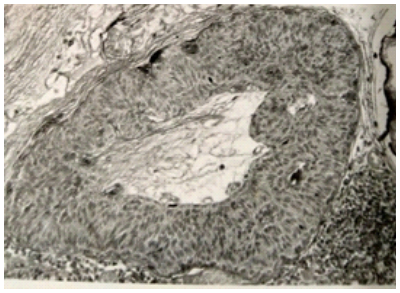


FIGURE 3: Photomicrograph of the parathyroid gland of the female snake showing partial degeneration in the month of July. 250X.



DISCUSSION

In E. enhydris, significantly high serum calcium and inorganic phosphorus values were recorded in the month of December. Similar observations were made in the snake Acrochordus granulatus (Warbhuwan and Padgaonkar,1996a). Further, the increase in serum calcium and inorganic phosphorus levels were more significant in females than males. Similar observations were made in Uromastix hardwickii (Dubewar and Suryawanshi, 1978a), Calotes versicolor (Akbarsha,1985b) and Varanus flavescens (Swarup and Pandey, 1990b). During the breeding season the serum calcium and inorganic phosphorus levels in the females are higher as compared to males. The rise in the females during the months of November to December (breeding season) can be attributed to the endogenous secretion of estrogen. Other researchers have also drawn similar conclusions in other reptilian species (Dessauer et al., 1956; Dessauer and Fox, 1959; Clark, 1967b; Oguro and Uchiyama, 1972; Dubewar and Suryawanshi,1978a; Akbarsha,1983,1985; Alcobendas,1988; Swarup and Pandey,1990b). Similar observations were made in the snake Acrochordus granulatus (Warbhuwan and Padgaonkar,1996a).

The parathyroid glands in many reptiles showed hyperactivity during summer when the environmental temperature is high and hypoactivity in winter when the temperature is low (Dubewar and Suryawanshi, 1978a; Akbarsha,1985). In E. enhydris, higher activity of the parathyroid gland was observed during winter i.e., November through December which is also the breeding season. Further in July, during monsoon when the temperature is moderately high, the parathyroid gland showed signs of hypoactivity and low levels of serum calcium and inorganic phosphorus. It can thus be concluded that the activity of parathyroid gland in E. enhydris does not depend on environmental temperature.

Partial degeneration of the parathyroid gland in E.enhydris is similar to that observed in the lizard, Uromastix hardwickii (Dubewar and Suryawanshi,1978a). Parts of the gland appeared to be normal, suggesting that the gland is not completely degenerated. The serum calcium and inorganic phosphorus levels was at the minimum suggesting that the parathyroids are hypoactive.

Thus, it can be concluded that in the snake E. enhydris the levels of serum calcium and inorganic phosphorus are related to the activity of the parathyroid gland as well as the reproductive cycle.

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