

CORRELATION BETWEEN SEASONAL CHANGES IN THE ACTIVITY OF THYROID GLAND AND GONAD IN ANABAS TESTUDINEUS (BLOCH)

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ABSTRACT

Cyclic activity of thyroid glands and gonad were studied in an air breathing fish, *Anabas testudineus* to establish, if a relationship exists between them. These glands showed parallelism in their activity. Bilateral ovariectomized animals ($P < 0.05$). Correlation coefficient and coefficient of determination were high showing interrelationship of these two glands in this fish.

Keywords : Cyclic, activity, fish, gonad, thyroid.

INTRODUCTION

Cycle activities of thyroid gland and gland have been studied in a number of teleostean species but the relationship between the cyclic activity of thyroid and gonad in air breathing fishes has not been studied in details so far. The thyroid glands seems to influence the development of gonads and spawning in teleostean fishes. The retardation of gonad development after the treatment with thiourea (an anti- thyroidal drug) has been observed in teleostes a significant increase in thyroid activity after the treatment of Methyl testosterone. Thus it seems that the activities of gonad and thyroid are really influenced by each other in fishes. In the present study and attempt has been made to establish a direct correlation between the cyclic activity of these glands in *Anabas testudineus*.

MATERIALS AND METHODS

Fresh specimens of adult female. Female *A. testudineus* (approximately 40-50g body weight) were procured from a local fish market at Darbhanga in the first week of every month during the period October-2019 to September – 2019. They were kept in large aquaria for acclimatization and were fed daily with pieces of goat liver.

THYROID ACTIVITY :-

Serial sections of the thyroid cut at 5-6 μm were stained in eosin haematoxylin. Histometry has been taken as a criterion for assessing the activity of the thyroid. The cell height of thyroid follicles (ten sections from each fish) were measured directly by using a calibrated ocular micrometer.

GONADAL ACTIVITY :-

The gonadas of each of ten animals were taken out and weighed separately. A mean value for gonad weight was obtained every month and after extrapolation of the data the relative weight of the gonad (g/100g body weight) were calculated.

METHOD OF BILATERAL OVARIECTOMY

During the breeding period (June) forty adult females (55-56g) were anaesthetized in a 1: 2000 solution of Ms- 222 (tricane methane sulphonate). The abdomen of each fish was opened using a sterilized knife and both ovaries were removed (bilateral ovariectomy). The wound in the abdomen was stitched with silk thread. Forty control females (55-56g) were operated on similarly except that the ovaries were not removed (sham operated). Ten fish from each group was sacrificed at monthly intervals (July, August, September) and thyroid gland activity was assessed histometrically.

The cell height of the thyroid follicles in different months of a year were compared with ovary weight of the corresponding month to establish a relationship between them. The relationship was established by using the general equation $y = a+bx$. Here y and x are dependent and independent variables respectively, a = intercept and b = regression coefficient. The significance of difference was calculated by student's t-test at the level of 5%.

OBSERVATION

Thyroid- Gonad Axis:

The thyroid of *A. testudineus* is compact being situated in the sub-pharyngeal region. The thyroid and gonad both showed parallelism (Table 1) in their activity. The increase in mean epithelial cell height of thyroid follicle with increasing mean ovarian weight and vice-versa showed good relationships which may be represented as follows:

Mean ovarian weight (g) Vs. mean cell height of thyroid follicle (μm);

$$Y = 4.1400+0.3235 x$$

Here y stands for epithelial cell height and x for mean ovarian weight.

Table 1

Showing average water temperature ($^{\circ}\text{c}$), mean epithelial cell height of thyroid follicle (μm), ovarian weight (g) and relative gonad weight of *Anabas testudineus* in different months of a year, $n = 10$.

Months	Mean body weight (g)	Average temperature $^{\circ}\text{c}$	Cell height thyroid (μm)	Mean follicular diameter of thyroid (μm)	Ovary height (g)	Relative weight of gonad
October-2018	42.0	27.0	4.32	50.64	1.14	2.71
November	43.0	24.0	4.23	65.52	0.75	1.74

December	46.0	18.0	3.69	84.00	0.29	0.63
January-2019	42.0	20.0	4.01	78.96	0.29	0.69
February	43.0	23.0	4.20	53.76	0.30	0.69
March	44.0	26.5	4.56	49.42	0.39	0.88
April	42.0	30.0	5.05	43.68	0.62	1.47
May	43.0	32.5	5.40	35.68	1.99	4.62
June	44.0	33.0	6.36	24.00	4.56	10.36
July	42.0	30.0	5.93	23.76	3.66	8.71
August	42.0	30.0	4.20	29.76	3.53	8.40
September	43.4	30.0	4.40	37.24	3.20	7.44

Epithelial cell height of thyroid (μm) Vs. Ovary weight (g);

$$Y = 4.411 + 1.3128.x$$

Here y stands for mean Ovarian weight and x for mean weight and x for mean epithelial cell height of thyroid follicle.

It was marked that with unit increase in mean epithelial cell height of the thyroid follicle the mean weight of the ovaries increases by a power of 1.3128 where as with unit increase in mean ovarian weight the mean epithelial cell height increases by a power of only 0.3235 where as with unit increase in mean ovarian cell height increases by a power of only 0.3235. The correlation coefficient was 0.6514. further it was found that in 80.7% (coefficient of determination) cases increase in mean cell height with increasing mean ovarian weight and vice versa are associated and only in 19.3% (coefficient of non-determination) cases such relationship is non-associated.

Table -2

Showing epithelial cell height of thyroid (μm) of ovariectomized (OD) and sham operated (c) *Anabas testudineus* in different months n=10;+ S.E.M. (Body weight 55.0-66.0g)

S= Significant

<u>Month</u>		<u>Cell Height</u>	<u>Value of P</u>	
July 2019	OD	4.32+0.10	P<0.05	S
	C	4.92+0.22		
August 2019	OD	4.17+0.18	P<0.05	S
	C	4.85+0.17		
September 2019	OD	4.01+0.12	P<0.01	S
	C	4.73+0.15		

Effect of Ovariectomy on Thyroid

Activity:

Ovariectomy produced marked changes in the activity of thyroid in this fish. The cell height of thyroid follicles ovariectomized animals were significantly less (Table 2) in the first ((P<0.05) second (p<0.05) and third (p<0.05) months following the operation in comparison to shamoperated animal i.e, throughout the spawning period.

DISCUSSION

Attempts have been made by many investigators from time to time in different species of fishes to correlate the thyroid activity with the animals' reproductive cycles. In increase in the activity of thyroid glands has been reported during the development of gonads in *Phoxinus* (fortune, 1955) and *Salmo trutta* (Swift, 1959), Matty (1960) in *Sparisoma squalidum*, Singh (1969) in *Mystics vittatus* and Singh (2007) in *H. fossils* have demonstrated a significant increase in thyroid activity after androgen treatment. Bullough (1941) has shown that there is an increase in gonad size in *Phoxinus* twice during the year, one in September/October and next in spring. The peak of thyroid activity precede the increase in gonad size and it may be assumed that there is same relationship between the two. Fortune (1955) found that *Phoxinus* shows a seasonal variation

in thyroid activity, correlated with its breeding period but in lebistes this correlation is absent. Berg et al, (1959) found that during the spawning period of fundulus heteroclitus, thyroxine output reached a peak after which it decreased to a constant level. Thus general activity in teleosts might influence thyroid physiology as it has also been shown that the thyroid is stimulated with methyl-testosterone (Malty, 1960; Singh, 1969). Singh (1969) has observed that in *Mystus vittatus* the decreased thyroid activity after hypophysectomy was brought back to the normal level when treated with gonadal steroids. An inhibition of maturation of gonads was observed in different species of teleosts when treated with antithyroidal drugs (Barrington and Matly, 1952 Pandey, 1970).

In the present study in *A. testudineus* good correlation and parallelism of activity was observed between relative gonad weight and histological conditions of the thyroid follicles (Table.1). This is in agreement with the works of Berg et al; (1959); Fortune (1955) and Matly (1960) in different species of fishes. These findings were further supported by the experimental data. In gonadectomized animals *A. testudineus* the thyroid activity decreased to a significant level (Table 2). Rao and Mukherjee (1972) have reported that prolonged treatment with thiourea extending over 60-110 days has prevented vitellogenesis and a fall in the percent of mature ova in *H. fossilis* and thus above findings prove the interdependence of thyroid and gonads though from the regression analysis it was observed that the effect of thyroid is more pronounced on the gonad than the effect of gonads which it has on thyroid.

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