AROMATASE ACTIVITY OF BRAIN AND OVARY IN RELATION TO ANNUAL REPRODUCTIVE CYCLE OF THE INDIAN CATFISH, *HETEROPNEUSTES FOSSILIS*

Aggarwal, N., Goswami, S.V., Sehgal, N.

Department of Zoology, University of Delhi, Delhi 110 007, India
E-mail address : neerja.agg@gmail.com

Introduction:

Aromatization of androgens by cytochrome P450 aromatase is the key step for the synthesis of estrogens. Although cytochrome P450 aromatase is predominantly expressed in brain and ovary, some other tissues such as liver, kidney, adipose tissue and skin of fish also show its presence. It occurs mainly in two isoforms, ovarian and brain types, encoded by *cyp*19a and *cyp*19b, respectively. Expression and activity of aromatase *cyp*19a in the ovary regulates ovarian production of E_2 during reproductive cycle of fish. In addition, developmental or seasonal fluctuations in brain aromatase activity are also observed in several teleosts, suggesting its involvement in the control of reproductive cycle. Moreover, the aromatase activity is maximum in the brain areas associated with reproductive functions. Estrogen synthesized from circulating substrate in these areas binds to nuclear receptors and is therefore physiologically important. In the present study an attempt has been made to investigate changes in aromatase activity in ovary and brain and their relationship with circulating levels of E_2 and T at different stages of reproductive cycle in the annually reproducing Indian catfish, *Heteropneustes fossilis*.

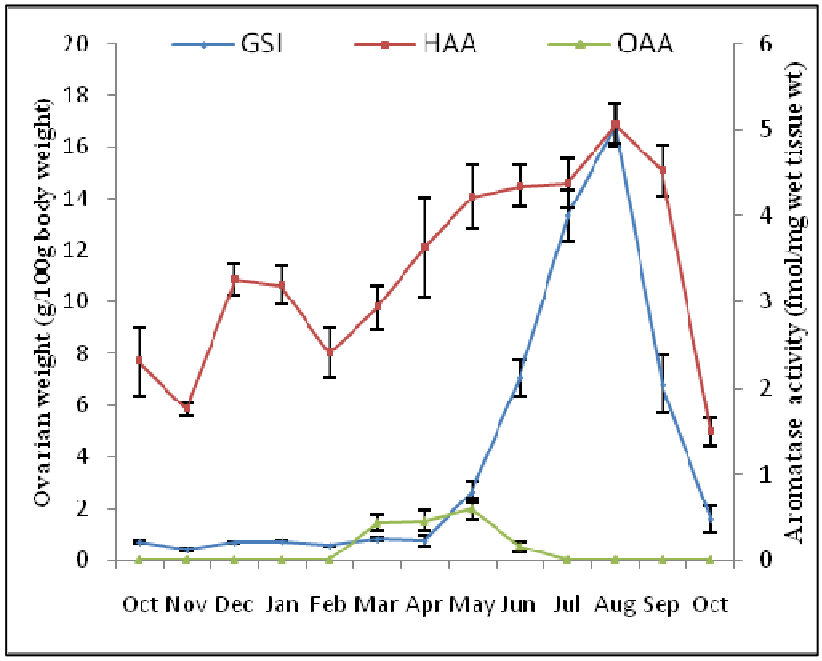
Methods:

The catfish, *Heteropneustes fossilis* were collected every month from backwaters of river Yamuna and acclimated to laboratory conditions (25ºC; L:D::12:12) for at least 7 days. At the time of sampling, female fishes were anaesthetized and weighed to the nearest 0.5 gm. Blood samples were collected from caudal artery and processed for estimation of vitellogenin by alkali-labile phosphorus method and steroid hormones (E_2 and T) by radioimmunoassay [2]. The fishes were decapitated, ovaries were removed and weighed for calculating GSI. The brain was exposed and the hypothalamic region was excised. A piece of ovarian tissue and brain (hypothalamic region) were weighed to the nearest 0.1 mg and processed for estimation of aromatase activity [1].

Results and Discussion:

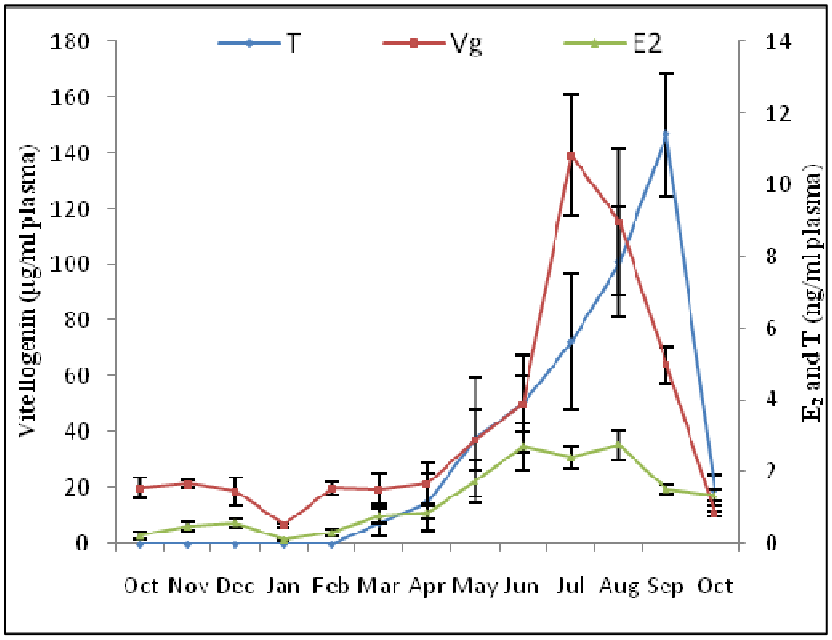
Aromatase activity in hypothalamus of the female catfish was detectable throughout the year and registered two peaks during the annual ovarian cycle. The hypothalamic aromatase activity starts increasing during the preparatory period, along with increase in ovarian weights. The increase in enzyme activity continues till the spawning period; the activity declines immediately after spawning in September and October. The second peak of smaller magnitude was recorded in late post spawning period (December-January) when the photoperiod and temperature are low and the fish is sexually quiescent. Aromatase activity in the ovary was detectable only during the preparatory and prespawning periods, the time of the year when the production of ovarian estrogen is needed in order to promote hepatic synthesis of vitellogenin and its incorporation in the growing oocytes. At the completion of vitellogenesis, ovarian aromatase activity declined sharply resulting in elevation of plasma testosterone levels, which in turn could be utilized as substrate by the hypothalamic aromatase whose activity was highest in the postvitellogenic catfish. The ovaries at this stage are maintained in a viable state by a tonic release of gonadotropins. Also at this stage of reproductive cycle, the pituitary stores

Fig.1. Seasonal variations in ovarian aromatase activity (OAA), hypothalamic aromatase activity (HAA) and gonadosomatic index (GSI) in the catfish *H. fossilis.*



gonadotropin for subsequent release as a surge at the onset of the maturational phase. It is reasonable to assume that the extremely high levels of circulating testosterone observed in the female catfish in the present study, coupled with elevated aromatase activity in the hypothalamus are responsible for promoting storage of gonadotropins in the pituitary.

Fig.2. Seasonal variation in plasma vitellogenin (Vg), estradiol-17β (E_2) and testosterone (T) in the catfish *H.fossilis*



Conclusion:

The present study establishes the existence of seasonally related variations in plasma sex steroids and aromatase activity in the brain and the ovaries of the catfish, *H. fossilis*. Furthermore, changes in circulating steroids are responsible for the changes in both brain and ovarian aromatase activity. Marked seasonal variations in hypothalamic aromatase activity suggest that estrogen synthesis in central nervous system plays a pivotal role in reproduction.

References:

[1]CALLARD, G.V., PETRO, Z. AND RYAN, K.J. 1981. Estrogen synthesis *in vitro* and *in vivo* in the brain of a marine teleost (Myoxocephalus). Gen. Comp. Endocrinol., 43: 243-255.

[2]LAMBA, V.J., GOSWAMI, S.V. AND SUNDARARAJ, B.I. 1982. Radioimmunoassay for plasma cortisol, testosterone, estradiol-17β and estrone in the catfish, *Heteropneustes fossilis* (Bloch): Development and validation. Gen. Comp. Endocrinol., 47: 170-181.