Indian J. Applied & Pure Bio. Vol. 29(1), 121-124 (2014).

Timed daily administration of Neurotransmitter Precursor Drugs Influences Thyroid-Gonad Relationship of Domestic Pigeon, *Columba livia domestica*

Taj N. Qureshi and H. S. Rathore

School of Studies in Zoology and Biotechnology
Vikram University Ujjain (M.P.)-456001 (India)
(Email: drtajnqureshi2009@rediffmail.com)

ABSTRACT

Present study is undertaken to know whether the temporal synergism of dopamine and serotonin can affect the thyroid–gonad inter- relationship in the female domestic pigeon *Columba livia domestica*. The thyroidectomised groups of birds receiving neurotransmitter precursor drugs (dopamine and serotonin) at 12 hr interval showed inhibitory responses in special reference to body weight, crop gland weight and plasma prolactin level. The results show significantly reduction in comparison to control at the level of $P<0.05$. it is noticed that the administration of dopamine and serotonin at 12 hr phase relationship as well as hyperthyroidism inhibit the neuroendocrine-gonadal axis and body growth in *Columba livia domestica*. Possibly inverse thyroid – gonad relationship in this species may be related to seasonal changes in phase relationship between daily rhythm in serotonergic and dopaminergic activity of the central nervous system.

Key words: serotonin, dopamine, thyroid, gonad, pigeon.

In a pioneer study the seasonality was altered experimentally by daily injections of corticosterone and prolactin in white-throated sparrow[8] hence it was proposed that hormone rhythms are the expressions of two circadian neuroendocrine oscillations that change seasonally in their phase relations and thereby regulate seasonality[9]. It was hypothesized that hormone injections may reset two circadian neuroendocrine oscillations and temporal interaction of these oscillations determine the complex of physiological conditions. Dopamine and serotonin may play an important role in the control of seasonal reproduction and their phase relation may determine appropriate seasonal conditions.Seasonal wave of reproductive activity is common in many vertebrate species[2,6,7].

In view of interrelationship/ interdependence of neural oscillators and overt rhythms and seasonal variation in circadian rhythms and their phase relationship of serotonergic and

dopaminergic activity may influence seasonal reproductive condition, present study was designed in such type of avian species which is monogamous and produces crop milk during brooding. In the present study the effect of hour relationship were tested on thyroid-gonad interrelationship in domestic pigeon, *Columba livia domestica*.

During the quiescent period (late April) 24 male pigeon were selected from bulk and divided into four groups of six birds in each. Group Ist and IVth were fed at normal diet and water *ad libitum* while *G*roup IInd and IIIrd were fed at normal diet but drinking water mixed with thyiouracil.

Administration of Thyiouracil: Thyiouracil dissolved in distillled water by the addition of 40% NaOH drop wise to adjust the pH to 8.0 to 8.5. The solution was filtered through glass wool and administrered to birds along with the drinking water at the concentration of 0.1% for 3 weeks. After 3 weeks birds were weighed, and used for administration of the neurotransmitter precursor drugs.

Administration of Neurotransmitter Precursor Drugs: Group I (Normal control) and group II (thyroidectomised control) birds received two daily injections of normal saline. Group III (thyroidectomised 12hr.) and group IV (12 hr) birds received injection of 5-HTP (5-Hydroxytryptophan, a serotonin precursor) at 8:00 AM and L-DOPA (L-Dihydroxyphenylalanin, a dopamine precursor) at 8:00 PM and considered as 12 hr for 13 days. The doses of 5-HTP and L-DOPA were 5mg/100gm body weight. During the course of the study the birds were provided with food grains and drinking water *ad libitum*. Birds were anesthetized and observations were made at 45 days post treatment (after 45 days of last injections). Body weight was taken by single pan balance. Crop gland was removed and weighed. Plasma prolactin (PRL) level was measured. For the assay of prolactin blood collected directly from the left ventricle of heart. Hormones were assayed by RIA kit (ACS 180, USA). Observations were expressed in terms of Mean ± SE. Statistical analysis was done by student's't' test[1]. Experiment was conducted in triplicate and only consistent results were taken in consideration. Experiments on the animals were conducted in accordance with institutional practice and within the framework of revised animals (scientific procedures) Act of 2002 of government of India on animal welfare.

Results showed that the thyriodectomised group receiving normal saline was found significantly increased ($p<0.05$) body weight, (Fig. 1) crop gland weight (Fig. 2) and plasma prolactin level (Fig. 3) in comparison to normal control while the thyriodectomised group receiving 5-HTP and L-DOPA 12 hr apart showed significantly decreased ($p<0.05$) results in all respects. Similarly the group received these precursor drugs 12 hr apart was found also significantly low ($p<0.05$) values. The studies hypothesized that seasonality is the result of temporal interaction between circadian neural oscillations/rhythms. The administration of serotonin and dopamine precursors (5-hydroxytryptophan, 5-HTP and L-dihydroxyphenylalanine, L-DOPA respectively) at the interval of 12 hours (12-hr relation) is reported to induce the breeding condition while that of 8 hours (8-hr relation) leads to a non-breeding condition in many seasonally breeding birds as well as in

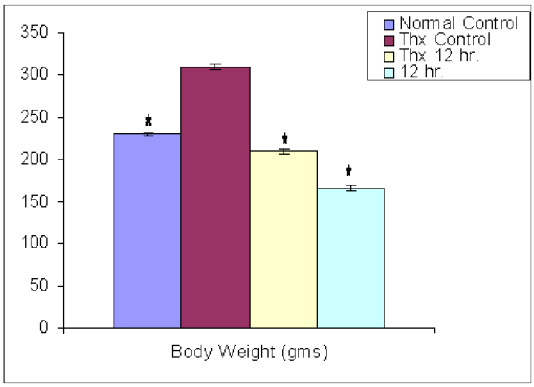

Fig. 1

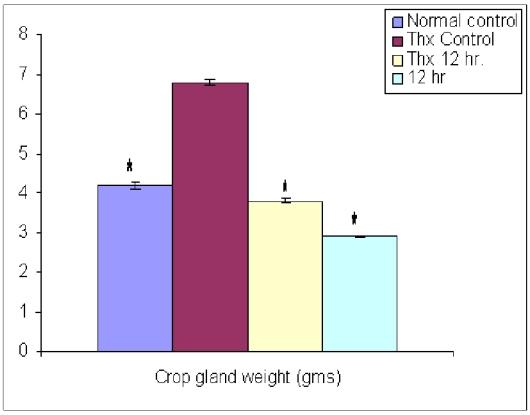

Fig. 2

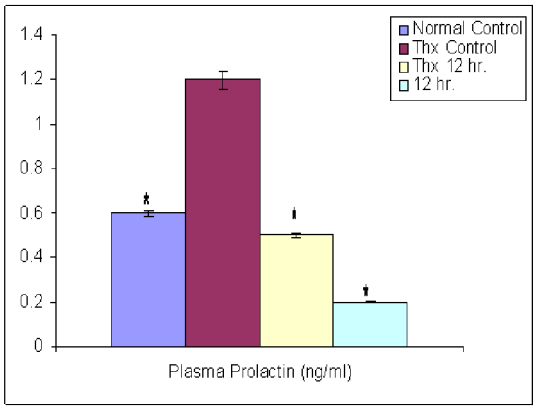

Fig. 3

Japanese Quail[4,10]. Similar studies have been carried out in two mammalian species, Syrian hamster,[11] and Palm Squirrel[3] and in one species of fish, Gulf killifish[5]. It is obvious that Thx lead to gonadal stimulation and increase in body weight even during regressive phase of reproductive cycle and 12-hr phase relation of 5-HTP and L-DOPA lead to inhibitory effect. Hence, it may be suggested that gonadal decrease following 12-hr relation was due to decreased activity of neuroendocrine axis. It is concluded that the hyperthyroidism as well as administration of serotonergic and dopaminergic drugs at the 12hr interval inhibit the neuroendocrine-gonadal axis and body growth of *Columba livia domestica*. Possibly inverse thyroid-gonad relationship in this species may be related to the seasonal changes in phase relationship between daily rhythm in serotonergic and dopaminergic activity of the central nervous system, but this pure speculation, till further study.

Financial support from UGC, Govt. of India for the first author in the form of Post Doctoral fellowship for women and departmental facilities are gratefully acknowledged.

References:

1. Bruning, J. L. and B. L. Kintz (1977). Computational handbook of statistics; II Ed. Scott, Foresman, Glenview, California.
2. Bullough, W.S. (1961). *Vertebrate reproductive cycles*. Publishers, Kjohm Wiley and Co; New York, Methen and Co. Ltd., London.
3. Chaturvedi, C.M. and R. Jaiwal (1990). *J. Neural. Transm., 81:* 31-40.
4. Chaturvedi, C.M., A.C. Tiwari and P. Kumar (2006). Effect of temporal synergism

of neural oscillations on photorefractoriness in Japanese quail (*Coturnix coturnix japonica*). *J. Exp. Zool., 305A(1):* 3-12.

5. Emata, A.C., A.H. Meier and R.E. Spieler (1985). *J. Exp. Zool., 233:* 29-34.
6. Marshall, F.H.A. (1956). The breeding season. In: Marshall's Physiology of reproduction, III[rd] edition, A.S. Parkes, ed. Longmanas, Vol.I, Pt. 1-London, 1-42.
7. Marshall, A.J. (1961). Breeding season and migration. In: Biology and comparative physiology of birds (ed. Marshall, A.J.), *2:* 307-335. Academic Press, New York and London.
8. Meier A.H., D.D. Martin and Mac, Gregor R. III (1971). *Science, 173:* 1240-1242.
9. Meier, A.H., B.R. Ferrell and L.J. Miller (1981). Circadian components of the circannual mechanism in the white-throated sparrow. In: *Proceedings of XVII, International Ornithological congress. Deutsche, Ornithology-Gesellschoft.* 458-462.
10. Miller, L.J. and A.H. Meier (1983b). *J. Interdiscipl. Cycle Res., 14:* 85-95.
11. Wilson, J. M. and A. H. Meier (1989). *Chronobiol. Intern., 6:* 113-121.