

PINEAL GONAD RELATIONSHIP WITH SPECIAL REFERENCE TO TEMPORAL SYNERGISM OF NEUROTRANSMITTER PRECURSOR DRUGS IN DOMESTIC PIGEON
Columba livia domestica

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ABSTRACT

Pineal gonadal hypothalamo hypophyseal axis was tested using two neurotransmitter precursor drugs (5-HTP and L-DOPA) at different time intervals in monogamous bird domestic pigeon *Columba livia domestica*. Male birds were divided in to three groups, each with eight individuals. Group I was vehicle treated (control) group. Group II (8 hr) group received 5-HTP and L-DOPA at 8 hr interval. Group III, (8 hr+mlt) group which received single dose of melatonin along with two daily injection of 5-HTP and L-DOPA per day at 8 hr interval. Administration of 5-HTP, L-DOPA and melatonin conducted for 13 days and results were obtained at 46th day. 8 hr group showed significantly stimulatory ($P < 0.05$) responses in body weight, plasma testosterone and plasma prolactin levels, while 8 hr+mlt group showed significantly inhibitory ($P < 0.05$) effect in comparison to control. Similar results were obtained in the testicular size in both groups (II and III). Regressive stages of reproductive state by administration of neurotransmitter precursor drugs along with melatonin suggest possibility of changes in temporal synergism between pineal-gonadal axis of hypothalamus under laboratory conditions.

KEYWORDS: 5-HTP, L-DOPA, Pineal Gland, Domestic Pigeon

The relationship of the hypothalamo-hypophyseal system with several endocrine glands is well established for mammals, however the role of the pineal, in these systems is not as much clear. In mammals, pineal has been considered to be an endocrine organ whose function is influenced by the photoperiod (Wurtman *et al.*, 1968). A pituitary-pineal interaction has been suggested by several investigators. Hypophysectomised rats showed morphological and ultrastructural changes in the pineal (Ito and Matsushima, 1970; Satodate, 1970). Available information suggests that synchronization of the annual gonadal cycle with annual photocycle is made by an endogenous circadian oscillator system (Wada, 1984). Among avian species this circadian oscillator system is located in the pineal body (Cassone *et al.*, 1993), in turn among which the pineal gland is considered as the most important component for its responsiveness mechanism with the changes in environmental light and darkness (Quay, 1963; Wurtman *et al.*, 1963)

Interrelationship/ interdependence of neural oscillators and unconcealed rhythms and seasonal variation in circadian rhythms and their phase relationship of serotonergic and dopaminergic activity may modulate seasonal reproductive conditions. Current study was designed in such type of avian species which is monogamous and produces crop milk for the period of brooding. The effect of hour relationship was tested on pineal-gonad interrelationship in male domestic pigeon, *Columba livia domestica*.

MATERIALS AND METHODS

A colony of birds is maintained in the departmental aviary where they breed successfully. Time to time adult birds are selected for study. During the progressive phase of reproduction (December) 24 male pigeons were selected out by lateral laparotomy from the group of acclimatized birds. They were divided into three groups of 8 birds each. Group I was the control group and received two daily injections of normal saline. Group II was 8 hr group in which birds received daily injections of 5-HTP (5-Hydroxytryptophan, a precursor of serotonin) and L-DOPA (L-Dihydroxyphenylalanine, a dopamine precursor) 8 hr apart i.e. 5-HTP at 6:00AM and L-DOPA 8 hr later i.e. at 2:00 PM. Group III was 8 hr+ melatonin group, where bird received daily injections of 5-HTP (5-Hydroxytryptophan, a precursor of serotonin) at 6:00AM and L-DOPA (L-Dihydroxyphenylalanine, a dopamine precursor) 8 hr later i.e. at 2:00 PM. And a single injection of melatonin was given late afternoon at 5.00 PM. The neurotransmitters were administered at the dose of 5mg / 100 gm body weight in 1 ml normal saline. The melatonin was administered at the quantity of 125 ug/100 gm body weight in 0.1ml normal saline/ animal. Doses were administered for 13 days. After 45 days at termination of experiment body weight was recorded. Blood was obtained directly from left ventricle of heart for hormone assay (Plasma Testosterone and Plasma Prolactin) were done in a private pathology laboratory following standard techniques using RIA kit (ACS 180, USA). Testes were removed for

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the measurement of testicular volume by using formula $4/3 \pi ab^2$. Experiments were performed thrice and only consistent results were taken in consideration. Data were statistically analyzed by student 't' test (Bruning and Kintz, 1977). The work is in the knowledge of departmental ethical committee. Birds were handled gently causing no cruelty.

RESULTS AND DISCUSSION

Results revealed that body weight of 8 hr group significantly increased while 8 hr+mlt group significantly reduced ($P < 0.05$) in comparison to control (Fig.1). Plasma testosterone and plasma prolactin also revealed the same patterns i.e. 8 hr group had significantly higher ($P < 0.05$) level while in 8 hr.+mlt group significantly lower ($P < 0.05$) level (Fig.2). Testicular volume was found significantly higher ($P < 0.05$) in 8 hr. group and lower in 8 hr.+mlt group in comparison to control.(Fig.3).

Most of the free-living birds are periodic breeders. Therefore, one of the very common approach towards unraveling the mystery of pineal-gonadal interrelationship in birds was to study the activity of pineal in relation to the gonadal functions during the annual cycles. The house sparrow (*Passer domesticus*) was considered for this purpose by several workers, but the results were not complementary to each other. A clear inverse relationship between the activity of pineal and gonad was observed in Indian weaver bird *Ploceus philippinus* (Saxena et al., 1979). The pineal activity in this bird was lower during the breeding phase than the non-breeding phase. Annual gravimetric variation in testes and changes in nuclear population of pineal indicated that the values were low during the breeding season (long day regimen) and were high at non-breeding phase, corresponding to the short day regimen, in Indian crow *Corvus splendens* (Chauhan and Ambadkar, 1984). Similar inverse relationship between the activities of pineal and gonad was reported in both male and female tree pie *Dendrocitta vagabunda* (Chaudhuri and Haiti, 1989). John and Georget 1989 observed that in migratory Canada goose *Branta canadensis* interior, the ratio of nuclear size to cell size of the pinealocytes was highest in the breeding phase. The weight of the pineal was reported to be inversely related with that of the testis throughout the annual cycle in Indian jungle bush quail *Perdica asiatica*, as well as in Indian spotted owl, *Athene brama* (Halder and Ghosh, 1990). From the findings of the present experiments and earlier work it can be argued that melatonin, shows an antigonadotrophic effect by

working directly on hypophysial-gonadal axis. The seasonal changes in reproductive and hormonal conditions of *Columba livia* might be related to daily rhythm in serotonergic and dopaminergic activities of the brain and melatonin secreted from the pineal gland, however, this is mere speculation and further detailed study is needed to know the actual factors.

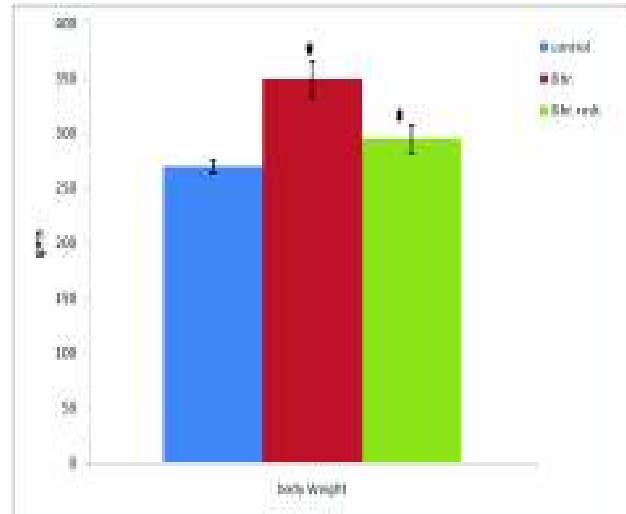


Figure 1: Effect of 8 hr and 8 hr+mlt temporal relationships of 5-HTP and L-DOPA on the body weight level of Domestic pigeon. (n=8, mean ±SEM, $P < 0.05$)

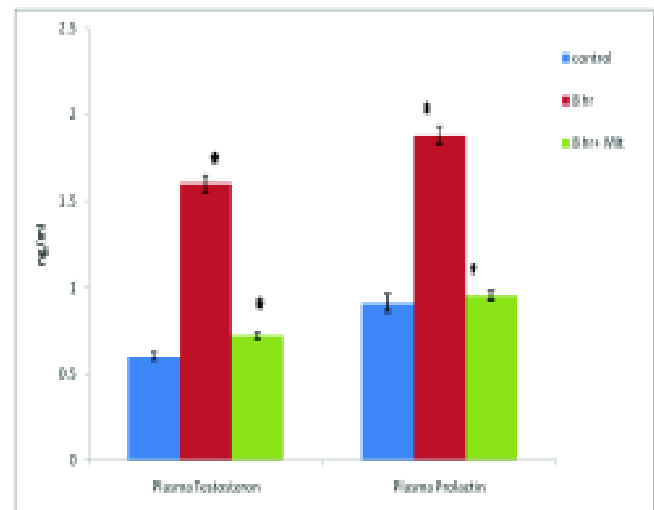


Figure 2: Effect of 8 hr and 8 hr+mlt temporal relationships of 5-HTP and L-DOPA on the Plasma Testosterone and Plasma Prolactin level of Domestic pigeon. (n=8, mean ±SEM, $P < 0.05$)

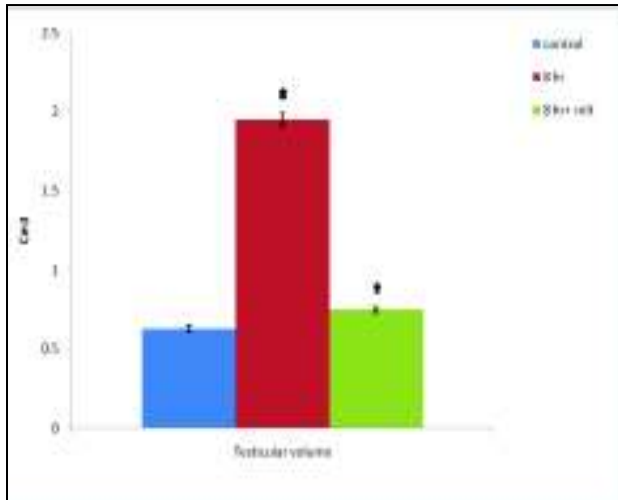


Figure 3: Effect of 8 hr and 8 hr+mlt temporal relationships of 5-HTP and L-DOPA on the Testicular volume of Domestic pigeon. (n=8, mean \pm SEM, P<0.05)

ACKNOWLEDGEMENT

Financial support from UGC Government of India for the first author in the form of Post Doctoral fellowship for women is gratefully acknowledged. Departmental facilities are also acknowledged.

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