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Interference of Propylthiouracil in the Activity of some Endocrines in Male White-throated Munia, *Lonchura malabarica*

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Male white-throated munia (*Lonchura malabarica*) in their different sexual stages treated with propylthiouracil intramuscularly at two different doses (1mg and 2mg/kg body weight/day) for 10 days, revealed decline in body weight with the indication of hypertrophy and hyperplasia of the thyroid gland. The elevation of hypothalamic neurosecretory cell activity and retardation of pinealocyte physiological function suggest the stimulatory effect of PTU to hypothalamus and inhibition to pinealocytes.

Key Words : Propylthiouracil, Hypothalamus, Pineal, Thyroid

Introduction

There are many reports about the enlargement of thyroid glands in birds after the treatment of antithyroid compounds (Raheja & Snedecor 1970, Some & Sarkar 1993). Beside the increment of weight, the gland showed typical hyperemia, hyperplasia, heightened follicular epithelium, vacuolization and release of colloid. So far no attempt has been made to investigate the effect of chemical thyroidectomy on other related glands barring thyroid and gonad particularly in avian species. Therefore the present study was undertaken to examine the effect of a goitrogen (propylthiouracil) induced hypothyroidism on body weight, hypothalamus and pineal in different sexual stages of a wild finch white-throated munia, *Lonchura malabarica*, in which the sexual cycle is well studied (Maji et al. 1992).

Materials and Methods

The experiments were designed in three different sexual stages of male white-throated munia (*Lonchura malabarica*): non-breeding (April), pre-breeding (August) and breeding (November) and the adult birds were collected from the bird dealer accordingly. For each experiment the birds were divided separately into three groups. The first group of birds (T_1) received 1 mg/kg body weight of propylthiouracil (PTU) manufactured by Sigma Chemical Co., USA in 0.1ml saline

whereas the second group of birds (T_2) were injected with PTU at a dose of 2mg/kg body weight. The third group (C) served as control receiving the same amount of normal saline (vehicle of the drug). All the birds were injected intramuscularly between 11 AM to 12 noon for consecutive 10 days. The birds were sacrificed by cervical dislocation on 11th day of the experimentation.

After recording the weights (body and thyroid), the tissues (hypothalamus, pineal and thyroid) were fixed in Bouin's fluid. Hypothalamus sections were stained with Bargmann's chrome alum — haematoxylin (Bargmann et al. 1950). Pineal sections were stained with chrome alum-haematoxylin/ phloxine and gallocyanine/phloxine (Quay 1965). Thyroid gland sections were stained with Masson's trichrome technique.

At least 50 follicular cells both mitotic and non mitotic were measured from random sections of the thyroid gland for each specimen by ocular micrometer. The epithelial height was recorded. Hypothalamic nuclei (SON and PVN) diameter for each bird was calculated from 50 nuclei. For calculating the nuclear volume the method as described by Srebro (1970) following the formula $V = 11/6\ LB^2$ (where L, is the long and b the short dimensions of the nucleus) was adopted. Both the ependymal and hypendymal cellular nuclei of the pineal gland parenchyma (excluding stalk) were measured considering oval or nearly rounded of 50 such from each bird. Statistical analysis was done using student's 't' test (Snedecor 1961).

Results

Administration of propylthiouracil declined the body weight but increased the thyroidal weight. In all sexual phases the experiments caused the decrease of follicular diameter in thyroid and colloid in the lumen. The height of the epithelium recorded a significant increment in both treated groups (table 1). Cellular multiplication was noted in thyroidal epithelial cells of treated groups.

The antithyroid drug treatment caused hypertrophied of supraoptic nucleus (SON) and paraventricular nucleus (PVN) in hypothalamus of the experimental birds (table 2). This characteristic feature was observable in all the sexual stages of the bird with increased accumulation of stainable neurosecretory materials (NSM).

The pinealocytes in the pineal gland showed vacuolation and appeared disintegrated with the reduction of cell nuclei diameter in all sexual stages of the bird after PTU treatment (table 2).

Discussion

The depletion in body weight caused by PTU may be due to the decreased food consumption was noted during the experimentation. Such an extrathyroidal effect of PTU was also suggested by Raheja and Snedecor (1970) in chick. An opposite effect of PTU in bird was reported by Gupta and Thapliyal (1986).

The 2-3 fold increase in thyroid weight after the administration of goitrogen with the significant elevation of epithelial cell height and hyperplastic condition of the gland signify the inhibition of thyroxine synthesis from the gland, which is a well established fact (Takayama et al. 1986, Weiss & Burns 1988). The enhancement of hypothalamic nuclear volume and diameter after the drug treatment with the increment of Gomori-positive neurosecretory materials (NSM) surrounding the neurosecretory cell nuclei were noticed in this experiment. These NSM

Table 1 *Gravimetric and histological studies on thyroid in white-throated munia (**Lonchura malabarica**) after propylthiouracil treatment (Values are mean ± SE)*

Sexual stage	Group	Body wt (g)	Paired Thyroid wt (mg)	Diameter of round follicle(μm)	Height of epithelium (μm)	Colloid accumulation
	C* (20)	13.20 ± 0.26	3.84 ± 0.04	25.73 ± 0.52	3.61 ± 0.08	2+
Non-breeding	T_1 (20)	12.25 ± 0.45^z	4.60 ± 0.19^y	16.91 ± 0.45^x	8.34 ± 0.16^x	±
	T_2 (20)	12.20 ± 0.30^y	5.84 ± 0.29^x	14.19 ± 0.45^x	10.96±0.19^x	±
	C (15)	12.90 ± 0.41	2.36 ± 0.08	28.52 ± 0.59	3.68 ± 0.07	3+
Pre-breeding	T_1 (15)	12.20 ± 0.18^z	5.90 ± 0.10^x	22.45 ± 0.54^x	7.03 ± 0.15^x	±
	T_2 (15)	12.00 ± .0.10^y	6.80 ± 0.12^x	16.36 ± 0.65^x	9.10 ± 0.15^x	±
	C (15)	13.92 ± 0.15	2.40 ± 0.03	19.12 ± 0.39	3.01 ± 0.05	3+
Breeding	T_1 (15)	12.94 ± 0.28^y	3.20 ± 0.21^y	18.16 ± 0.45^z	4.32 ± 0.13^z	±
	T_2 (15)	12.56 ± 0.44^y	4.32 ± 0.23^x	16.69 ± 0.30^z	4.37 ± 0.16^z	-

*C, control; T_1, received 1mg/kg B.Wt.; T_2, received 2mg/kg B.Wt. Number in parentheses are used birds

x = $p < 0.001$; y = $p < 0.005$; z = $p < 0.05$

Table 2 *Karyometric studies of hypothalamic neurosecretory nuclei and pinealocytes in white-throated munia after propylthiouracil treatment (Values are mean ± SE)*

Sexual stage	Group	Volume (μm^3)		Diameter (μm)		
		SON*	PVN	SON	PVN	Pinealocyte
	C(20)**	360.51 ± 7.65	271.65 ± 5.56	8.90 ± 0.09	8.00 ± 0.07	5.53 ± 0.02
NB	T_1 (20)	410.22 ± 5.15*	456.74 ± 6.87^x	9.94 ± 0.04^x	9.85 ± 0.04^x	4.77 ± 0.03^x
	T_2 (20)	462 .14 ± 5.75^x	478.68 ± 5.33^x	10.15 ± 0.08^x	10.04 ± 0.04^x	4.63 ± 0.02^x
	C (15)	420.29 ± 6.12	390.11 ± 8.89	9.50 ± 0.78	8.80 ± 0.61	5.00 ± 0.03
PB	T_1 (15)	489.52 ± 7.27^x	432.59 ± 6.97^y	10.50 ± 0.61^x	9.20 ± 0.06^x	4.44 ± 0.04^x
	T_2 (15)	500.10 ± 9.81^x	450.73 ± 7.74^x	10.67 ± 0.07^x	9.61 ± 0.05^x	4.25 ± 0.03^x
	C (15)	400.68 ± 7.75	338.27 ± 6.66	9.22 ± 0.05	8.66 ± 0.91	4.80 ± 0.04
BR	T_1 (15)	515.45 ± 7.81^x	400.04 ± 5.62^x	10.05 ± 0.07^x	0.09 ± 0.04^y	4.33 ± 0.05^x
	T_2 (15)	545.19 ± 5.99^x	420.89 ± 5.08^x	10.29 ± 0.05^x	9.29 ± 0.04^x	4.10 ± 0.02^x

**SON*, Supraoptic nucleus; *PVN*, Paraventricular nucleus; *NB*, Non-breeding; *PB*, Pre-breeding; *BR*, Breeding; *C*, Control; T_1, 1mg/kg body weight; T_2, 2mg/kg body weight

**Number in parentheses are used birds.

x = $P < 0.001$; y = $P < 0.005$

are probably TSHRF which stimulate the thyroid gland *via* hypophysis to produce thyroxine (Lloyd & Mailloux 1987, Sanchez-Franco et al. 1989, Some & Sarkar 1993). As PTU has the capacity to block iodination during thyroxine synthesis (Kobayashi & Gorbman 1960) so this insufficiency compels the thyroid for enlargement with its associated hypertrophy and hyperplasia. This probability is also supported by the other evidence from the significant depletion of pinealocyte nuclear diameter after the treatment causing its inhibition.

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