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Effect of Thyroxine and Testosterone on Body Weight and Gonad of Gonadectomized and Chemically Thyroidectomized Male Rain Quail, C*oturnix coromandelica*

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ABSTRACT
The role of thyroid may vary with species sex and phase of the annual cycle. We investigated in the present work the effects of thyroxine and testosterone on body weight and gonad in gonadectomized and chemically thyroidectomized male Rain quails (*Coturnix coromandelica*) for a period of ten days. Body weight decreased significant in chemically thyroidectomized birds treated with testosterone. In intact and chemically thyroidectomized groups significant reduction in testis weight was found in sub-group B and C when compared to control sub-group.

Keywords: Testosterone, Rain Quail, Body weight, Thyroxine

INTRODUCTION

In birds despite variations in the thyroid gonad relationship in different species, very little is known about the relative roles of the gonads and the thyroid in reproduction (Assenmacher, 1973; Thapliyal, 1981). In fowl and duck, a certain minimum level of thyroid hormone is necessary for the growth of the body, maturation of the juvenile gonad and even for the normal functioning of the adult gonad (Turner, 1959; Hohn, 1961),

The role of thyroid may vary with species sex and phase of the annual cycle. Thyroidectomy inhibited or delayed gonadal regression in the European starling (Woitkewitsch, 1940; Wieselthier and Van Tienhoven, 1972; Nicholas, *et al*., 1984) and in several tropical species (Thapliyal, 1969; Chaturvedi and Thapliyal, 1983) provided that the operations were carried out prior to photostimulation on long day-lengths.

It is quite likely that the increasing day length of spring prepares the birds physiologically bringing them into a ready state from where they can migrate as soon as appropriate temperature is reached. Such integration of envi-

ronmental cues has been shown in tropical birds e.g. of photoperiod and rainfall in baya weaver (Chandola Saklaini *et al.,* 1990).

In few species, the annual testosterone and thyroid cycles have been observed to exhibit almost opposite patterns, with thyroid hormone cycles occurring at their lowest levels during the annual reproductive phase and at their peak levels during hibernaton, as in the Richardson ground squirel, Spermophilus richardsonil (Demeniex and Henderson, 1978; Winston and Henderson, 1981) and the ground squirrel Citellus tridecemlineatus (Berges, 1981). On the other hand, thyroid and testosterone cycles have also been shown to follow strictly parallel patterns with an annual peak for plasma thyroxine during the reproductive season in the edible dormouse Glis glis (Jallageas and Assenmacher, 1983).

In many seasonally breeding temperate zone birds, the annual increase in day length (photoperiod) is the primary proximate factor used to initiate reproductive development (Dawson et al., 2001; Ramenofsky *et al*., 1992) studying the foraging ecology, harmonal and metabolic aspects of migration in dark eyed juncos (Junco hyemales) also suggested the possibility of diverse mechanisms for spring and autumn migration. In redheaded buntings artificial photostomulation enhanced monoidination of T_4 (Pant and Chandola Saklani, 1993).

However, while the influence of short and long term thyroidectomy on gonads and body weight of a number of birds is known (Henrick and Turner, 1966; Thapliyal, 1969, 1980, 1981; Thapliyal, *et al.,* 1968; Wieselthier and Van Tienhoven, 1972; Chandola, et al., 1973, 1974; Thapliyal and Chaturvedi, 1976; Chaturvedi and Thapliyal, 1979), information on the effects of thyroxine and testosterone on quails is still scanty, therefore, it is of interest to examine more closely the nature of thyroid-gondal interactions, we investigated in the present work the effects of thyroxine and testosterone on body weight and gonad in gonadectomized and chemically thyroidectomized male Rain quails (Coturnix coromandel ica) for a period of ten days.

MATERIAL AND METHODS

Male Rain quails were procured locally and were accustomed in an aviary for about a fortnight. After the period of acclimatization forty-five birds of birds of approximately same body weight wee sorted

out from the stock, tagged and divided into three groups of fifteen birds each according to the experimental schedule. First group was kept as intact group. Birds of group 11 were castrated. Birds of group III were treated with antithyroid drug Neomercazole and a tablet (5 mg.) was implanted subcutaneously in the nape region of neck near thyroid gland. Birds of all three main groups were subdivided into three subgroups of five birds each.

Sub group A which served as control was treated with 0.1 ml vehicle (0.1% normal saline). The other sub-group was injected intramuscularly with tghyroxine (Thyroxine T_2 sigma T-2257) in a dosage of 0.1 mg/bird/day in 0.1 ml. normal saline. Sub-group C was treated with testosterone (Aquavieron) in a dosage of 0.3 mg/bird/day. Each bird received a total dose of 3 mg. testosterone in ten days.

The injections were given around 8:00 a.m. - 9:00 a.m. for ten days. All birds were examined at the beginning and the end of the experiment. At each observation all birds were weighed individually to the narest gm. and by exploratory laparatomy size of the left testis was measured in situ. The birds were sacrificed the day following the last injection. After measuring the testis size in situ (Group I and III), testes were carefully separated and weighted to the nearest mg. The weight of the testis of control and experimental groups, were analyzed by standard statistical methods ('t' test). Body weight and gonad volume were compared post treatment vs. pre-treatment in all the sub-groups.

RESULTS

Table-1 shows the tabular and graphical representation of mean body weight of different groups. Body weight decreased significantly ($P>0.005$) in chemically thyroidectomized birds treated with testosterone. Thyroxine and testosterone inhibited the increase in body weight following castration, chemical thyroidectomy and in normal intact birds (Table 1). Marginally significant ($P>0.025$) degrease was found in castrated birds treated weight vehicle and thyroxine. In other groups body weight was not altered significantly (Table 1)

Group – II

Thyroxine and Testosterone affects body weight (Pre and Post treatment) and testis volume (Pre and Post treatment) of male Rain quail, *Coturnix-coromandelica.* Vertical bars indicate . Vertical bars indicate $\pm$ SE of the mean values. Fig-

ures in parentheses denote number of birds in each group. Group II consist of castrated birds. Significance Pre Vs. Post treatment.

Testis Volume

In all the three sub-groups of intact and chemically thyroidectomized group highly significant ($P > 0.005$) decrease in the testis volume was found after treatment (Table 1) thyroxide was found to be most gonado-inhibitory. Birds treated with testosterone also showed inhibition but the extent of inhibition was much less than the thyroxine injected birds, although the dose of testosterone administered was thrice of thyroxine that has been administered to the experimental birds.

Testis Weight

In intact and chemically thyroidectomized groups significant reduction in testis weight was found in sub-group B ($P > 0.01$ and $P > 0.005$) and C ($P > 0.005$) when compared to control sub-group. In many species of birds, environmental information initiates reproductive development prior to the onset of optimal conditions for raising offspring while other environmental information regulates the specific timing of reproductive behaviour and the eventual termination of reproduction (Wingfield *et al.*, 2000).

In Rufous-Winged sparrows seasonal changes in photoperiod are not reflected in marked changes in plasma LH secretion (Deviche *et al.*, 2006).

DISCUSSION

One of the chief aims of the present study was to explore the possible occurrence of thyroid-testis interactions. Extensive experimentation in birds has certainly produced evidence that reciprocal inhibitory interaction between thyroid and testosterone secretion is a basic mechanism determining the timing of both the sexual and molting cycles (Assenmacher and Jallageas, 1980). Fairly similar testis-thyroid interaction appears to prevail in the European badger (Maurel, *et al*., 1977), the red fox (Maurel and Boissin, 1981) and the mink (Boissin-Agassee, *et al*., 1981), since they all exhibit testis and thyroid cycles with inversed phases.

Thyroid hormone administration causes gonadal collapse (Thapliyal, 1969, 1978, 1981) and gonadal stimulation (Assenmacher, 1973; Lal and Thapliyal 1982) in a number of avian species.

In common myna testicular development is inhibited by L-thyroxine

(Chaturvedi and Thapliyal, 1979). The similar inhibition of gonadal development by thyroidectomy and L-thyroxine has been reported in male weaver bird and domestic duck (Thapliyal) and Garg, 1969; Jallageas and Assenmacher, 1974).

Results obtained from the present experiment demonstrate that in male Rain quails thyroxine and testosterone had significant inhibitory effect on gonads. Both the hormones inhibited a increase in testis volume and weight. It was found that chemical thyroidectomy followed by thyroxine treatment leads to a marked decrease in gonad size and weight. Body weight decreased after treatments in all the sub-groups.

Administration of L-T_4 reduces body weight in wild bird (Thapliyal, 1980a, 1981). The body weight of chemically thyroidectomized jungle Bush qualis decreased in all the groups (Srivastava and Saxena, 1979). In common myna, Acridotheres tristis, House sparrow, passer domesticus and vented bulbul, Molopastes Cafer administration of L-T_4 decrease the body weight (Thapliyal, 1981). In Bunting mild hyperthyroidism exerts beneficial effects (Lal, 1982).

Thyroidectomy and thyroid hormones have no effect in the edible dormouse (Jallageas and Assenmacher, 1986). The effects of testosterone and L-thyroxine on the gonads and body weight of thyroidectomized and orchidectomized spotted munia have been reported in which thyroid-gonad relationship is inverse and thyroid activity is influenced neither by castration nor by administration of testosterone (Chandola and Thapliyal, 1973).

Non-photoperiodic environmental signals also influence the timing of reproduction in birds. These signals include temperature (Perfito *et al.,* 2005; Wingfield *et al.*, 2003) food availability humidity rain (Zann *et al.,* 1995).

Administration of L-thyroxine reversed the gonado-stimulatory effect of thyroidectomy and the gonads regressed as in normal birds. Unlike developing and developed gonads of intact and thyroidectomized birds (Thapliyal, 1969), regressing gonads did not respond to exogenous L-thyroxine. Similar results have also been obtained in lal Munia, Estrilda amandava (Thapliyal and Gupta, 1984). It seems that during the late regressive phase high levels of endogenous thyroid hormones (Thapliyal, 1969; Chandola and Thapliyal, 1974) were sufficient to

cause rapid regression of gonads and exogenous L-thyroxine become superflous. Thus it may be suggested that the antigonadal effect of L-thyroxine (Thapliyal, 1980a) in addition to other factors depends upon gonadal status and thyroid activity of the birds.

Testosterone, depending on the gonadal status of birds at the time of injection or implantation and the dose administered, may stimulate, inhibit or produce no effect on testicular activity (Lofts and Murton, 1973; Thapliyal, 1981). But so far the thyroid-gonad relationship and the level of thyroid activity have not been taken into account while considering the impact of testosterone treatment on gondal activity (Thapliyal, 1981). In the red headed bunting testosterone reversed completely the ill effect of thyroidectomy by acting directly at gonads (Thapliyal, *et al.*, 1983b).

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Table 1: Effect of Thyroxine and Testosterone on body weight and gonad of intact, chemically thyroidectomized (Neomeraceazole treated) and castrated male Rain quall, Coturnis coromandelica for a period of ten days

Groups	Status of bird	Sub-group	Dose Per Bird/day	Body weight in GMS		Testis Volume in MM^3		Testis weight in mg/100 gm body weight M±SE
				Before Treatment	After treatment	Before Treatment	After Treatment	
I	Intact	A	0.1 ml Vehicle	63.33±3.7	60.43±3.09	77.94±2.29	68.56±4.98***	220.37±13.05
		B	0.1mg Thyroxine	64.10±4.65	62.50±1.89 NS	134.71±4.93	54.74±3.64***	201.01±2.96***
		C	0.3mg Testos-terone	55.00±1.70	53.50±4.08 NS	66.26±1.75	43.39±3.67***	163.91±11.60***
II	Caponized	A	0.1ml Nor-mal Saline	65.27±1.76	60.77±3.53	-	-	-
		B	0.1mg Thyroxine	59.23±2.76	53.80±3.24	-	-	-
		C	0.3mg Tes-tosterone	61.73±2.64	60.00±3.47 NS	-	-	-
III	Chemically Thyrodectomized (Neomercazole Treated)	A	0.1ml Saline	61.00±2.01	50.83±3.19 NS	49.81±6.24	36.93±2.91***	145.65±17.83
		B	0.1mg Thyroxine	62.00±2.12	59.57±1.92 NS	74.25±2.50	17.13±4.66***	6.7±8.16***
		C	0.3mg Testos-terone	62.60±1.32	54.33±1.42***	43.50±4.56	23.27±1.40***	72.09±5.26***

Values expressed as Mean + SE. P > 0.0025, ***P>0.005, NS = Not Significant