STUDIES ON THE THYROID SECRETION RATE AND PLASMA PROTEIN BOUND IODINE LEVELS IN CROSSBRED (NEW HAMPSHIRE X WHITE CORNISH) CHICKENS*

By

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With the recognition of meat and eggs as high quality human food ; the poultry farmers have taken to crossbreeding since it has been proved that hybridisation resulting from crossbreeding increases the productive performances of this species. Since thyroid gland is the major regulator of productive and metabolic processes of the body, the study of the thyroid function of crossbred is not only important from the stand point of comparative physiology but also to exploit the economic traits of this species. Since estimation of thyroid secretion rate (TSR) and plasma protein bound iodine (PBI) level have been considered as fairly good indices of measuring quantitative and qualitative activity of the thyroid gland (16) it was proposed to find out the TSR and PBI of crossbred chicks (New Hampshire x White Cornish) about which no report seems to be available in literature.

Various methods have been used to determine TSR in poultry from time to time. In the absence of radiotracer facilities the goiter prevention assay method was followed, which had been recommended for TSR estimation in many species of small animals (4, 11). This method is based on the action of antithyroid compounds inhibiting endogenous formation of the thyroid hormones in the test subjects. This permits an increased output of TSH which causes a compensatory enlargement of the thyroid gland. If, however, thyroxine is given exogenously the TSH is held in check whereby thyroid enlargement is prevented to an extent in proportion to the amount of thyroxine given. The daily dose of thyroxine needed to give thyroid weight of goitrogen treated birds equal to the untreated control is taken as the adequate daily requirements of the hormone to maintain normal thyroid-pitutary balance and is considered as the secretion rate.

MATERIALS AND METHODS

A total number of 120 "Day old" crossbred (New Hampshire x White Cornish) chicks were procured from Haryana Agricultural University Poultry Farm. They were kept in the brooder batteries with temperature adjusted to 37°C for the first 15 days and thereafter the birds were maintained at room temperature. They were fed *ad. lib.*, the standard chick feed obtained from Haryana Agro-Industries. They were divided into six groups of 20 birds each (Group I to VI) : Group I served as "normal" control group while the groups II to VI were given daily methimazole (1-methyl-2 mercaptoemidazole) as 0.05 per cent solution in drinking water throughout the period of the assay to prevent the formation of endogenous thyroxine.

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Birds in groups II to V, in addition, received daily injection of L-thyroxine at the rate of 1 μg, 2 μg, 3 μg and 5 μg/100 *gm* body weight respectively for the duration of the experiment.

Group VI was not given thyroxine treatment and this served as a "Hypothyroid control". After 30 days of treatment the birds were sacrificed and the thyroids from each of the bird were dissected out. All the extraneous tissue adhering to the glands was carefully removed and the wet weights of the glands were recorded on a torsion balance. The wet weights were plotted against the dose of L-thyroxine and the TSR was determined by the dose of thyroxine, at which the thyroid weight of the thyroxine injected birds intercepted the normal thyroid weight line (Fig. I).

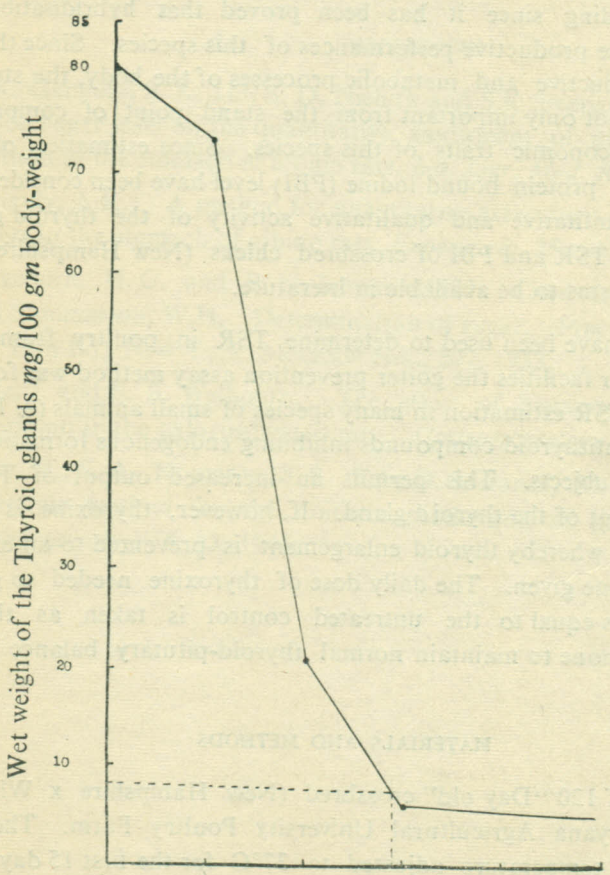

Fig 1

Graph showing thyroid secretion rate by Goiter Prevention Method

Drugs Used : Methimazole (as a 0.05 per cent in drinking water) was used as a goitrogen in view of its having minimum extrathyroidal action as it does not decrease the deiodinisation by

thyroxine as observed by the use of thiouracil (20, 8, 5). With the use of methimazole as goitrogen in the goitrogen prevention assay method, fairly repeatable results for TSR have been reported (19, 17).

L-Thyroxine : Stock solution of 100 $\mu g/ml$ of sodium-L-thyroxine was prepared at short intervals and stored in the refrigerator. To prepare the stock solution 10 *mg* of L-thyroxine were first dissolved with N/10 sodium hydroxide on a watch glass. It was then transferred to 100 *ml* Volumetric flask filled 3/4 of it with normal saline. Enough N/10 hydrochloric acid was then added to neutralise alkaly until the solution became slightly turbid. The volume of this suspension of thyroxine was made to 100 *ml*. Solutions for injections were prepared by diluting the stock solution.

For plasma protein bound iodine analysis the blood was collected at the time of sacrificing the birds in heparanised centrifuge tubes, which were previously washed thoroughly with glass redistilled water. The determinations were made by the method as followed by Faulkner *et al.* (6).

RESULTS AND DISCUSSION

Thyroid Weight : The weights of the thyroid gland per hundred gram body weight recorded in various groups of experimental birds have been presented in Table I. An average

TABLE 1

Thyroid weights and Protein Bound Iodine Levels in various groups of experimental chicks

Sr.No.	*Group*	*Thyroid weight in mg/100 gm body weight*	*PBI* ($\mu g/100ml$).
1.	Normal control (I)	8.11±0.40	2.87±0.02
2.	Hypothyroid + 1 $\mu g/100\,gm$ body weight thyroxine (II)	73.44±2.06	2.37±0.03
3.	Hypothyroid + 2 $\mu g/100\,gm$ body weight thyroxine (III)	20.92±0.60	2.51±0.05
4.	Hypothyroid + 3 $\mu g/100\,gm$ body weight thyroxine (IV)	6.21±0.17	2.92±0.03
5.	Hypothyroid + 5 $\mu g/100\,gm$ body weight thyroxine (V)	5.15±0.12	3.19±0.06
6.	Hypothyroid control (VI)	80.40±2.32	2.03±0.03

value of 8.11 *mg*/100 *gm* body weight was observed in birds of "normal control" group (Group I) while an average figure of 80.40 *mg*/100 *gm* body weight was recorded in the birds of "Hypothyroid control" group (Group VI). Astwood *et al.* (1) had reported an increase of

5-6 fold in thyroid weights of goitrogen treated birds as compared to normal bi Singh (16) have reported thyroid of 110 *mg* per hundred gram body weight hypothyroid control" group of chick in an assay run for 32 days using propylthiouracil goitrogen. Gradual decrease in thyroid weights was observed in the birds (Group II administered with increasing doses of L-thyroxine. In groug V which received the high of 5μg/100*g* body weight, the thyroid glands were found to be extremely small in size a lowest in weight. This decrease in the weight of thyroids in groups receiving exogen thyroxine may possibly be due to the inhibiting effect on the secretion of TSH from the pitui on account of the high titer of blood thyroxine.

Thyroid Secretion Rate (*TSR*) : The thyroid secretion rate as calculated from t thyroid curve was found to 2.9 μg/100 *g* body weight. The thyroid secretion rate of 1.65 μ 2.75 μg, 1.3 μg., and 2.3 μg per hundred gram body weight in White leghorn birds had be reported (15, 13, 9, 17). The values obtained in our studies with crossbred seem to be high than the figures reported by these workers. No report seems to be availale in the literature o TSR values of crossbred chicks. The higher value recorded may by attributed to the benefici effect of heterosis or hybrid vigour which is often the result of cross-breeding. These findin may find support in the results of Singh *et al.* (18) with their study on TSR of Zebu-Holste crossbred cattle which showed a higher secretion rate than either of the two pure breeds.

Protein Bound Iodine (*PBI*) : The values recorded on the protein bound iodine hav been presented in the Table I. The level in the normal control birds ranged from 2.8 μg t 3.0 μg/100 *ml* and in the hypothyroid control birds the range was from 1.9 to 2.2 μg pe hundred *ml*. These values indicate that the goitrogen treatment in birds significantly lowere the PBI values. The PBI levels of birds receiving 1 μg and 2 μg/100 *gm* of thyroxine wer not significanly different than those of hypothyroid control birds. But the birds receiving daily dose of 3 μg/100 *g* body weight showed a significantly higher PBI levels than th hypothyroid control and the mean value obtained in these birds (2.92 μg/100 *ml*) wer comparable to that of normal control birds (2.87 μg/100 *ml*). This finding indicates that thi might be the probable dose of exogenous thyroxine required by the hypothyroid birds t neutralise the effect of the goitrogen treatment. This finding further lends support to th accuracy of the assay, since goiter prevention assay method is based on the assumption tha estimated TSR is the dose of thyroxine required to suppress the output of TSH in goitroge treated birds to of control. The birds from the group receiving 5 μg/100 *g* body weigh L-thyroxine showed a significantly higher PBI levels than the normal control birds indicatin a larger iodine pool as a result of higher doses of exogenous thyroxine. The values of the PB recorded in the present study are higher than those already reported in white leghorn breed of poultry (3, 10, 14, 17). The higher PBI in crossbreds may be due to corresponding higher TSR in these birds. Such observations have also been reported by Gulati (7) who showed that a higher TSR in Desi breed of poultry was associated with corresponding higher values of PBI.

The PBI values of birds seems to be markedly lower as compared to these mammals in which it ranges between 3-6 μg/100 *ml* (12, 18). The absence of specific thyroxine binding alpha globulin in avian blood may be the factor contributing to this species differences.

SUMMARY

The thyroid status was measured in crossbred chicks (New Hampshire x White Cornish) by quantitative measurement in terms of thyroid secretion rate (TSR). Data was also recorded on thyroid weights and plasma protein bound iodine (PBI) of those birds to give a qualitative information about thyroid gland function. The mean value for the daily TSR by goiter prevention assay method was found to be 2.9 μg/100 *gm* body weight. The thyroid weights and PBI levels as observed in normal control, hypothyroid control and other groups of goitrogen treated birds receiving different daily doses of L-thyroxine have been presented and discussed.

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