

Comparison of Thyroxine Secretion Rate of Docile and Flighty Lines of Fowls.* (31734)

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In this laboratory a method for estimation of the thyroxine secretion rate (TSR) of fowls has been developed(1). Two strains of New Hampshire chickens which differed markedly in their mean TSR have been studied extensively since that time. Recently, 2 lines of chickens were obtained from the Hy-Line Poultry Farms of Johnston, Iowa, which were characterized as to temperament as "docile" and "flighty." It was of interest to determine whether the difference in temperament of these 2 strains indicated a variation in their TSR and the extent of the difference if one was shown. In addition, a comparison was made of the biological effectiveness of L-thyroxine (L-T₄) and L-triiodothyronine (L-T₃) in these lines.

Materials and methods. Two groups of cockerels were received in our laboratory when they were about 17 weeks of age. After several weeks in their new environment and feed (Purina laying ration) the first TSR determination was started on June 6, 1965, when the birds were about 19 weeks of age. The TSR's were determined a second time starting on June 25.

The cockerels were injected subcutaneously with 50 μ c of I¹³¹ and the uptake by the thyroid glands was measured after 24 hours. In the second trial 100 μ c of I¹³¹ was administered and the percentage uptake again observed.

During the period of the first TSR determination the highest daily temperatures ranged between a 70 and 80-85°F whereas in the second TSR determination, the high daily temperature ranged between 80 and 90-95°F. Following the completion of the TSR determinations, L-T₃ was substituted for L-T₄. The L-T₃ was injected on an equimolar basis with L-T₄ and the TSR was redeter-

mined as before to determine its biological effectiveness in blocking thyroidal-I¹³¹ release.

Results. The cockerels of the "flighty" strain in the first trial showed a range in TSR between 0.25 μ g L-T₄/100 g bw and 1.25 μ g with a mean TSR of 0.82 μ g/100 g bw (Table I). The mean uptake of I¹³¹ was 6.9%. The "docile" strain showed a range in TSR between 0.25 μ g and 1.0 μ g/100 g bw, with a mean of 0.49 μ g L-T₄/100 g bw. The difference in mean TSR of the two strains was 67.6% in favor of the "flighty" strain. The mean uptake of I¹³¹ in the "docile" strain was 9.7%, a difference of 40.5% in favor of the "docile" strain.

In the second trial in late June and early July, the temperature during the day reached the 90-95°F for a number of days. The range in TSR of the "flighty" strain was the same as in the first trial, but the mean was reduced to 0.58 μ g L-T₄/100 g bw. This reduction is believed to be due to the elevated temperature during the period the TSR estimations were conducted. The mean uptake of I¹³¹ was 11.2%. The range in TSR of the "docile" strain was 0.25 μ g to 1.25 μ g with a mean of 0.48 μ g L-T₄/100 g bw. In this trial, the difference in the mean TSR of the 2 strains was 22.7% in favor of the "flighty" strain. The mean uptake of I¹³¹ in the "docile" strain was 16.1%, a difference of 43.8% in favor of the "docile" strain.

When L-T₃ was substituted for L-T₄ on an equimolar basis, the flighty line required a mean of 0.38 μ g L-T₃/100 g body weight and the docile line required a mean of 0.23 μ g L-T₃/100 g body weight. In comparison with L-T₄, the L-T₃ was 2.16 and 2.13 times as biologically effective as L-T₄, respectively.

Discussion. The strain of New Hampshire chickens with the elevated thyroxine secretion rate showed a mean winter TSR of 2.97 ± 1.43 μ g/L-T₄/100 g bw and a summer mean TSR of 1.24 ± 0.47 μ g/100 g bw, a decline

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TABLE I. TSR and I^{131} Uptake in Two Strains of Fowls.

TSR ($\mu\text{g L-T}_4/100\text{ g body wt}$)	Flighty		Docile	
	Frequency distribution 1st trial	Frequency distribution 2nd trial	Frequency distribution 1st trial	Frequency distribution 2nd trial
.25	1	7	8	12
.50	2	1	6	3
.75	6	4	5	1
1.00	4	1	1	3
1.25	2	2	0	1
Total No. of birds	15	15	20	20
Mean, TSR	.82	.58	.49	.48
I^{131} uptake, % mean	6.9	11.2	9.7	16.1
Difference in TSR, %	67.6	22.7		
Difference in I^{131} uptake, %	40.5	43.8		

of 58.3% in TSR from the winter to the summer season(2). The mean TSR of the low strain during the winter season was $1.01 \pm .47 \mu\text{g}/100\text{ g bw}$, and during the summer season was $0.59 \pm 0.02 \mu\text{g}/100\text{ g bw}$, a decline of 41.6% from winter to summer.

Since the present study was conducted during June and early July, the TSR's observed would represent the summer secretion rate. The "flighty" strain with mean TSR of $0.82 \mu\text{g}/100\text{ g bw}$ is $0.42 \mu\text{g}$ lower than the strain with high secretion rate during the summer. On the basis of a 50% decline in TSR during the summer, the winter TSR of this strain might be elevated to $1.64 \mu\text{g}/100\text{ g bw}$.

The "docile" strain with a mean TSR of $0.49 \mu\text{g}/100\text{ g bw}$ is only $0.1 \mu\text{g}$ lower than the low strain summer TSR. The winter TSR of this strain might be estimated as about $1.0 \mu\text{g}/100\text{ g bw}$.

In repeating the TSR estimations during a period of elevated summer temperature low 90°F ($90\text{--}95^\circ\text{F}$) an interesting observation was made in regard to the two strains of birds. The "flighty" strain showed a decrease in TSR from a mean of $0.82 \mu\text{g}$ to $0.58 \mu\text{g}$ whereas the "docile" showed no decline.

It is suggested that the "docile" strain may be less subject to high environmental temperature than the "flighty" birds.

It is interesting to note that the "flighty" birds although secreting larger amounts of thyroxine had, in both trials, about a 40% lower uptake of I^{131} . Both groups were fed the same adequate iodine diet (Purine laying ration) and environmental conditions were

uniform during each TSR determination. It has been shown that animals on a low iodine diet will show a marked increase in I^{131} uptake but this cannot account for the present observation.

The rate of secretion of TSH, when other factors are constant, plays an important role in the uptake of I^{131} . A method for estimation of the TSH secretion rate (TSH-SR) in fowls(3) and calves(4) has been described. In fowls little relationship between TSR and TSH-SR was observed. In other words, some birds of low TSR secrete as much TSH as some birds of high TSR. However, in calves, the TSR was highly correlated with TSH-SR.

In a number of studies, it has been reported that the uptake of I^{131} is a poor criterion of thyroid function(5) and in studies of dairy cattle it has been shown also that I^{131} release rate was not significantly related to TSR.

The present study with fowls provides further evidence that the uptake of I^{131} by the thyroid gland is not a good index of the thyroid hormone secretion rate.

Shellabarger(6) and Newcomer(7) reported that L-T_3 was no more effective than L-T_4 in reducing goiter size in thiouracil-fed chicks. Mellen and Wentworth(8) reported that L-T_4 was more potent than L-T_3 on an equimolar basis in baby chicks by the goitrogen technique as well as by the blockage of thyroidal- I^{131} release.

In contrast to these observations, the present study indicates that L-T_3 is slightly over twice as active biologically as L-T_4 as measured by our TSR technique.

In other studies in our laboratory it was

TABLE II. Comparison of the Biological Activity of L-T₄ and L-T₃ by Subcutaneous Injection.

Hormone	Flighty		Docile	
	No. of birds	Mean TSR ($\mu\text{g}/100\text{ g body wt}$)	No. of birds	Mean TSR ($\mu\text{g}/100\text{ g body wt}$)
L-T ₄	15	.82	19	.49
L-T ₃	15	.38	19	.23
Ratio L-T ₄ to L-T ₃		2.16		2.13

shown that L-T₃ was 2.6 times as active as L-T₄ in male rats(9), and 2.14 times as active as L-T₄ in dairy cattle(10). In raccoons, L-T₃ was 1.92 times as active in adult male and 1.06 times as active in juveniles(11). In the opossum, L-T₃ was found to be only 1.1 times as active as L-T₄(12).

No explanation can be offered for our observation concerning the increased biological activity of L-T₃ in this study compared to the previous reports in fowls.

Summary. Two strains of chickens developed by the Hy-Line Poultry Farms which were characterized by the terms as "docile" and "flighty" as to temperament were studied in regard to their estimated thyroxine secretion rate (TSR) during the summer (June). The "flighty" strain had a mean TSR of 0.82 μg L-T₄/100 g bw/day whereas the "docile" strain had a mean TSR of 0.58 μg L-T₄/100 g bw/day, a difference of 67.6%. In a second trial about one month later, during a period of elevated temperature 90°F (90-95°F), the TSR of the "flighty" birds was reduced to 0.58 $\mu\text{g}/100\text{ g bw}$, but the "docile" birds were unaffected. The percentage uptake of I¹³¹ by the "docile" birds was about 40% greater than the "flighty" birds indicating that the percentage uptake of

I¹³¹ is not a good index of the functional activity of the thyroid gland. While previous studies indicated that L-T₃ and L-T₄ were approximately equal in biological activity in fowls, in this study, the two lines of birds showed L-T₃ to be slightly over twice as active as L-T₄.

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Effect of Hypophysectomy on Concentration of Intrinsic Factor In Rat Gastric Mucosa.* (31735)

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The purpose of this study was to observe the influence of hypophysectomy on the concentration of intrinsic factor (IF) in the gastric mucosa and, thereby, to throw light on two problems pertaining to the biology of

IF. First, the cellular origin of IF remains in

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