

## Influence of Thyroactive Iodocasein on Growth of Chicks.

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Koger, Hurst and Turner<sup>1</sup> have reported that thyroxin has a stimulating effect on the rate of growth of female albino mice; and more recently<sup>2</sup> that thyroactive iodocasein has a similar growth-stimulating property. This report presents data relative to the effect of such material\* on body and feather growth and on the efficiency of feed utilization of chicks to 12 weeks of age.

**Methods.** Five lots of Rhode Island Red chicks were started in a battery brooder on May 21, 1942, and when 8 weeks old were transferred to a finishing battery. Thyroactive iodocasein was added to the basal all-mash ration of 4 groups at levels varying from 0.025% to 0.2%. One group, the controls, received the basal mash only. All chicks were weighed individually in grams at 1 day and at 4, 8 and 12 weeks of age. The room in which the experiments were conducted was not air-conditioned, and the relatively high prevailing summer temperatures undoubtedly had a suppressing influence on the rate of growth of all groups. At 12 weeks the chicks were examined as to feather growth and placed in 3 grades, as follows: *Rapid*—Chicks well covered with feathers; *medium*—chicks fairly well covered, but not completely covered over backs and wing fronts, and with few pin feathers; and *slow*—poorly feathered chicks,

including "bare-backs" and those with many immature or "green" feathers.

**Results.** The results presented in Table I indicate that thyroactive iodocasein has a growth-stimulating effect on chicks to 12 weeks of age. At 4 weeks of age the mean weights of the 5 groups were about the same, but at 8 weeks the thyroactive iodocasein-fed chicks were consistently heavier. The chicks receiving the mash with the highest level of thyroactive iodocasein (0.2%) averaged 12% heavier than the controls. At 12 weeks, however, the chicks on the lowest level of thyroactive iodocasein (0.025%) weighed the most. The average gains made by the 5 groups from 4 to 8 and 8 to 12 weeks and from 1 day to 12 weeks are shown in Table II. The fact that the chicks in Lot 5 made the greatest gains from 4 to 8 weeks, whereas those in Lot 2 made the greatest gains from 8 to 12 weeks is of interest, and suggests that the levels of thyroactive iodocasein conducive to greatest gains change with the age or stage of development of the chick.

Although the differences in the amounts of feed required per gram gain in the 5 groups were not great (Table II), there is some indication that the 2 groups receiving the smallest amounts of thyroactive iodocasein required less feed per unit gain than did the controls or the chicks fed the higher levels. The fact that Lot 5 required more feed per unit gain than did the controls, and Lot 4 as much as the controls, whereas the average gains of both lots exceeded those of the controls, indicates that feeding the higher levels of thyroactive iodocasein tends to decrease the efficiency of feed utilization. Koger, Hurst and Turner observed that thyroxin treatment of mice increases the efficiency of gains only during the time that the rate of growth is more rapid than in non-treated animals. The data on gains and feed utilization shown in Table II

<sup>1</sup> Koger, M., Hurst, V., and Turner, C. W., *Endocrin.*, 1942, **31**, 237.

<sup>2</sup> Koger, M., Reineke, E. P., and Turner, C. W., *PROC. SOC. EXP. BIOL. AND MED.*, 1943, **52**, 236.

\* The thyroactive iodocasein was furnished by Drs. C. W. Turner and E. P. Reineke, Department of Dairy Husbandry, University of Missouri, and was prepared by the method described by Reineke *et al.*, *J. Biol. Chem.*, 1942, **143**, 285. The preparation used in this experiment showed approximately 5.4% of the response of thyroxine when assayed by injection into tadpoles. This is equivalent to an oral effect 2% that of thyroxine.

TABLE I.  
Influence of Thyroactive Iodocasein on Average Body Weights of Rhode Island Red Chicks to 12 Weeks of Age. Both Sexes.\*

| Lot No. | % of thyroactive iodocasein in ration, % | Chicks |       | Age     |         |         |          | 12-wk wt to control wt, % | P† value, % |
|---------|------------------------------------------|--------|-------|---------|---------|---------|----------|---------------------------|-------------|
|         |                                          | No.    | Sex ♀ | 1 day g | 4 wks g | 8 wks g | 12 wks g |                           |             |
| 1       | .000                                     | 23     | 13    | 41.8    | 141.1   | 423.1   | 789.4    | 100.0                     |             |
| 2       | .025                                     | 23     | 14    | 41.4    | 139.5   | 447.7   | 861.5    | 109.1                     | 5           |
| 3       | .050                                     | 24     | 14    | 40.8    | 149.6   | 445.6   | 836.2    | 105.9                     | 30          |
| 4       | .100                                     | 23     | 12    | 42.2    | 142.9   | 445.9   | 819.0    | 103.7                     | 60          |
| 5       | .200                                     | 22     | 12    | 42.6    | 148.9   | 474.8   | 841.9    | 106.7                     | 25          |

Avg wt males + avg wt females

\*Avg body weights for both sexes =

2

†Probability that the 12-wk wt of the group under consideration does not differ from that of controls in lot 1.

TABLE II.  
Influence of Thyroactive Iodocasein on Gains and Efficiency of Feed Utilization of Rhode Island Red Chicks. Both Sexes.

| Lot No. | % thyroactive iodocasein in ration, % | Gains and (amounts of feed per gram gain) |        |            |        |            |        |
|---------|---------------------------------------|-------------------------------------------|--------|------------|--------|------------|--------|
|         |                                       | 4-8 weeks                                 |        | 8-12 weeks |        | 0-12 weeks |        |
|         |                                       | g                                         | g      | g          | g      | g          | g      |
| 1       | .000                                  | 282.0                                     | (3.55) | 366.3      | (4.14) | 747.6      | (3.90) |
| 2       | .025                                  | 308.2                                     | (3.40) | 413.8      | (3.87) | 820.1      | (3.72) |
| 3       | .050                                  | 296.0                                     | (3.50) | 390.6      | (4.05) | 795.4      | (3.76) |
| 4       | .100                                  | 303.3                                     | (3.55) | 373.1      | (4.12) | 776.8      | (3.90) |
| 5       | .200                                  | 325.9                                     | (3.48) | 367.1      | (4.57) | 799.3      | (4.05) |

TABLE III.  
Influence of Thyroactive Iodocasein on Feathering of Rhode Island Red Chicks.

| Lot No. | % thyroactive iodocasein in ration % | Rate of feathering |        |      |         |        |      |            |        |      | Chi.* Square |
|---------|--------------------------------------|--------------------|--------|------|---------|--------|------|------------|--------|------|--------------|
|         |                                      | Cockerels          |        |      | Pullets |        |      | Both sexes |        |      |              |
|         |                                      | Rapid              | Medium | Slow | Rapid   | Medium | Slow | Rapid      | Medium | Slow |              |
|         |                                      | %                  | %      | %    | %       | %      | %    | %          | %      | %    |              |
| 1       | .000                                 | 0                  | 40     | 60   | 15      | 69     | 15   | 9          | 56     | 35   | 7.19         |
| 2       | .025                                 | 0                  | 0      | 100  | 29      | 50     | 21   | 17         | 30     | 52   | 4.49         |
| 3       | .050                                 | 0                  | 10     | 90   | 7       | 64     | 29   | 4          | 42     | 54   | 9.90         |
| 4       | .100                                 | 36                 | 55     | 9    | 83      | 8      | 8    | 61         | 30     | 9    | 6.54         |
| 5       | .200                                 | 90                 | 10     | 0    | 92      | 8      | 0    | 91         | 9      | 0    | 27.68        |

\*Total  $X^2 = 55.50$ ,  $df = 8$ ,  $P = < 1\%$ . The sexes were not treated separately since numbers were too small for a valid Chi-Square test. From observation, it is evident that thyroactive casein in large dosages caused a marked rapid feathering in both sexes.

show that a similar phenomenon exists when thyroactive iodocasein is fed to growing chicks.

Data presented in Table III show that levels of 0.1 and 0.2% of thyroactive iodocasein in the chick ration stimulate feather growth. Feather development in the 2 groups of chicks receiving the lower levels, 0.025 and 0.050%, was no better than that of the chicks in the control group, if as good. From a practical standpoint it is unfortunate that the chicks

which made the greatest and most economical gains did not feather more satisfactorily. It is possible that thyroactive iodocasein may be used to stimulate both body growth and feather growth by varying the amounts fed at different ages.

*Conclusions.* Rhode Island Red chicks were raised to 12 weeks of age on diets containing from 0.025 to 0.2% of thyroactive iodocasein. Chicks receiving the lower levels,

0.025 and 0.050%, made greater gains and required less feed per gram of gain than did the controls. Those fed diets with 0.1 and 0.2% thyroactive iodocasein gained more than the controls and were more fully feathered than either the controls or those receiving the lower levels. The thyroactive iodocasein-fed chicks utilized their feed more efficiently than the controls only during the periods when

they were gaining at a more rapid rate.

Statistical analysis showed the difference in rate of gain to be of doubtful significance although the data indicate that at the proper dosage level growth rate was above normal. The differences in the rate of feathering in favor of the treated birds on higher dosage levels were highly significant.

## 14101

### Influence on Growth of Thyroactive Iodocasein.\*

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We have shown recently that small amounts of synthetic thyroxine injected over a period of 5 weeks will cause an acceleration in the growth rate of immature mice.<sup>1</sup> With the discovery that a highly potent thyroactive iodoprotein<sup>†</sup> could be formed by combination of iodine with tyrosine-containing proteins under controlled conditions,<sup>2,3</sup> it was decided to test the effect of some of these products on the growth rate of mice and determine whether responses similar to these secured by giving small amounts of thyroxine would be obtained.

**Materials and Methods.** Virgin female mice weighing from 13 to 15 g at the beginning of

the trials were used as experimental animals. Three different trials were conducted over a period of 35 days each, different lots of thyroactive iodocasein being used for each trial. Suitable controls were kept for each experiment. The animals were numbered individually and their lengths determined under anesthesia at the beginning and at the end of the experimental period. Body weights were taken weekly. The dosages and methods of administration of the thyroactive iodocaseins as well as the grouping of animals in the experiments are indicated in Table I.

The thyroactive proteins used were prepared by iodination of casein at the optimal level as described in previous reports.<sup>2,3</sup>

The material used in Experiment 1 was a highly potent preparation containing 7.14% iodine. It possessed 10.3% of the potency of synthetic thyroxine-sodium (BDH) on a weight basis when injected into tadpoles, and 4% of the activity of thyroxine when assayed on guinea pigs, by oral administration of the test substance. The material was injected subcutaneously at the rate of 0.55 mg every 2 days. This dosage was calculated purposely to contain the same amount of iodine as 0.06 mg synthetic thyroxine—an amount of thyroxine that has proven to cause acceleration of growth rate in young mice.<sup>1</sup>

The material used in Experiment 2 was a less potent lot containing 1.8% the activity

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† The term thyroactive iodocasein is used to designate products formed by iodination of proteins in such a manner as to produce a substance with high thyroidal activity. It is necessary to distinguish between these preparations and compounds such as iodocasein and iodoalbumin which are used merely as carriers of organic iodine, and have little or no thyroidal effect.

<sup>1</sup> Koger, Marvin, Hurst, Victor, and Turner, C. W., *Endocrinology*, 1941, **29**, 667.

<sup>2</sup> Reineke, E. P., Williamson, M. B., and Turner, C. W., *J. Biol. Chem.*, 1942, **143**, 285; 1943, **147**, 115.

<sup>3</sup> Reineke, E. P., and Turner, C. W., *Mo. Agri. Exp. Sta. Bull.* 355, 1942.