EFFECTS OF FEEDING THYROACTIVE IODINATED CASEIN ON GROWTH AND FEATHERING OF RHODE ISLAND RED CHICKS

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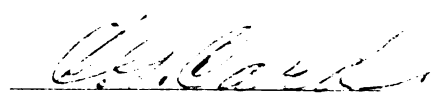

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by

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INTRODUCTION

"Thyroid secretion is absolutely necessary for the normal growth and development of young animals, and for maintaining the normal level of metabolism of animals of all ages. Magnus-Levy in 1895 demonstrated that thyroid deficiency was associated with a greatly reduced metabolism and that treatment with desiccated thyroid restored the metabolic rate to the normal level or above." (Best and Taylor, 1937). Many investigators, making use of this fact, have used raw or desiccated thyroid or thyroid-like materials such as thyroactive proteins, to determine their effect on various animals.

Crew and Huxley (1923), used desiccated thyroid to determine its effect on twelve chicks, six male and six female, F_1 generation of Rhode Island Red male X Light Sussex female cross. The chicks were fed wet mash daily, to which two grains of desiccated thyroid per individual was added. The activity of the thyroid preparation was tested by its power to induce metamorphosis in the axolotl. The feeding started at three months of age, and continued until sexual maturity was reached, or a little over seven months of age. No significant difference in weight between thyroid fed chicks and controls was noted.

When thyroactive iodocasein, with a potency of 3.1 per cent of dl-thyroxine mixed in a basal mash at the level of 45 grams per 100 pounds of mash was used, Turner, Irwin, and Reineke (1944) recorded a slight loss of weight in Barred Plymouth Rock chicks. The potency of this product was determined by guinea pig assay.

However, Parker (1943), feeding various lots of Rhode Island Red chicks, noted a gain in weight on all lots consuming iodocasein over the controls, although statistically, this gain was of doubtful significance. A basal all-mash ration containing .025 per cent to .20 per cent thyroactive iodocasein, showing a potency of approximately 5.4 per cent of thyroxine, as determined by tadpole assay, was fed to the chicks.

Irwin, Reineke, and Turner (1943) noticed an increase in weight, over controls, when White Rock chicks were placed on an all-mash ration containing 36 grams of thyroactive iodocasein per 100 pounds of mash for a period of twelve weeks. The iodocasein had a potency of 3.1 per cent of thyroxine by guinea pig assay. It was also noted that levels above 113 grams thyroactive iodocasein, testing 2.0 per cent potency on guinea pigs, per 100 pounds of all-mash depressed the body weight of chicks.

Several investigators have observed that thyroxine containing substances have an affect on the rate of feathering. Parker (1943) reported that as the level of thyroactive iodocasein in the all-mash was raised, there was a corresponding increase in rate of feathering. Irwin, Reineke, and Turner (1943) and Turner, Irwin and Reineke (1944), substantiated this claim.

PURPOSE

The present work was undertaken so as to observe the effect of iodinated casein on growth and rate of feathering. This study is being made under different seasonal and temperature conditions than reported by other investigators. For the purpose of this test, the college strain of slow feathering Rhode Island Red chicks were fed iodinated casein at a range of levels so as to note its effect on growth and feathering of this strain of birds.

MATERIALS AND METHODS

Three experiments, each twelve weeks in length, were conducted with Rhode Island Red chicks. At one day of age, the chicks were sorted into lots. Experiments A and C were started with 30 chicks in each lot. In experiment B, lot 6 contained 28 chicks, and the remaining lots had 27 chicks each. At this time the chicks were wing banded and individually weighed to the nearest gram. The average weight of any one lot did not vary more than three grams in comparison to the average weight of any other lot. At two week intervals thereafter, the chicks were weighed, scored for degree of feathering, and their feed consumption recorded.

The number of primary and secondary feathers on the wings were noted and scored as follows.

Feather Scoring

WING FEATHER SCORING METHOD
Experiment A

0 -- No primary - no secondary feathers
1 -- Few primary - no secondary feathers
2 -- Few primary - very few secondary feathers
3 -- Few primary - few secondary feathers
4 -- Many, and long primary - many and long secondary feathers

This method of scoring was apparently too general, and a system similar to that used by Darrow (1944), was employed for experiments B and C. This method was based on the total number of secondary and covert feathers visible at one day of age.

The revised scoring on wing feathers for experiments B and C for one day chicks was as follows.

WING FEATHER SCORING METHOD
Experiments B and C

0 -- No secondary or covert feathers visible.
1 -- 4 or less secondary and covert feathers visible.
2 -- 5 or 6 secondary and covert feathers visible.
3 -- 7 or 8 secondary and covert feathers visible.
4 -- 9 or 10 secondary and covert feathers visible.
5 -- Over 10 secondary and covert feathers visible.

At two weeks of age, the tail growth was recorded by the following scoring method, similar to Darrow and Warren (1944).

TAIL FEATHER SCORING METHOD

0 -- No tail.
1 -- Tail showing in sheath or just emerging.
2 -- Tail showing, some feathers developed.
3 -- Short feathers, well developed but webbing not well formed.
4 -- Long well developed feathers.

At four weeks of age and every two weeks thereafter until the close of the experiment, the feathering on the back was scored. See Figures 1 to 6.

BACK FEATHER SCORING METHOD

0 -- No pins or feathers visible.
1 -- Feathers on border of back feather tract.
2 -- Feathers half way up center of back.
3 -- Center of back fully feathered, bare area between center and outer ring.
4 -- Pins formed but feathers not fully developed.
5 -- Fully feathered.

BACK FEATHER SCORING METHOD

Figure 1

Score -- 0
No pins or feathers
visible

Figure 2

Score -- 1
Feathers on border
of back feather
tract

Figure 3

Score -- 2
Feathers half way up
center of back

Figure 4

Score -- 3
Center of back fully feathered, bare area between center and outer ring

Figure 5

Score -- 4
Pins formed but
feathers not fully
developed

Figure 6

Score -- 5
Fully feathered

(Photographs by E. N. Huby)

Rearing Equipment

The chicks were reared in starting batteries, five decks high, until eight weeks of age, at which time they were transferred to fattening batteries located in a room with a temperature of 60 to 70 degrees F. The position of the lot was changed every two weeks, off-setting to some extent, the advantage one lot might have over another due to the temperature difference between the top and bottom decks. The chick room was steam heated and thermostatically controlled for a temperature of 84 degrees F., but there was a variation in temperature of approximately four degrees above and below this point. The temperature under the back-warmers was approximately 100 degrees F. at all times. The back-warmers were removed at the end of four weeks.

Basal Ration -- Preparation and Analysis

The basal all-mash ration used in the three experiments is nearly the same as that which was used by Irwin et al (1943) and Turner et al (1944).

TABLE I Formula of Basal Ration

Ingredients	Pounds
Corn meal	45.0
Bran	5.0
Alfalfa, 17% dehydrated	10.0
Flour middlings	15.0
Soy bean oil meal (41%)	15.0
Animal feeding oil (35 D, 600 A)	1.0
Meat scraps (50%)	7.0
Salt	1.0
Steamed bone meal	.5
	99.5

The animal feeding oil was mixed with the soy bean oil meal before combining with the other feedstuffs.

Twenty per cent dehydrated alfalfa was used when seventeen per cent dehydrated alfalfa was no longer available.

The mash was mixed in fifty pound batches so that a relatively fresh mixture would be available at all times. A half pound sample was taken from each batch for analysis by the Agricultural Chemistry Department.

Table II shows the range of the feed constituents within each department. Some of the variation is undoubtedly due to the change in the alfalfa meals. Occasionally the samples were not analyzed immediately, and the dealy may have caused a variation of the moisture content.

TABLE II Range of Feed Analysis

Constituents	Experiment A		Experiment B		Experiment C	
	Low %	High %	Low %	High %	Low %	High %
Water	6.07	9.94	6.01	9.05	6.73	7.61
Protein	19.13	20.63	19.63	20.81	19.50	20.56
Calcium	.942	1.23	.909	1.13	.906	1.07
Phosphorus	.792	1.03	.796	.995	.795	.976
Crude fiber	5.83	7.98	6.22	6.80	5.63	7.28
Ash	6.82	7.54	6.90	7.86	6.99	7.74

The mash feeders were kept about half full so as to provide ample feed at all times, with minimum wastage.

Iodinated Casein

The thyroactive iodinated casein used in this experiment was distributed under the commercial name of Protamone, and produced

by the Cerophyl Laboratories (Kansas City, Missouri). This product was prepared by the method described by Reineke (1946). It had a potency of 3.04 per cent of thyroxine when assayed, quantitatively, by a method similar to that outlined by Reineke, Turner, Kholer, Hoover and Beezley (1945).

The iodinated casein was weighed for each lot on an analytical balance to the nearest .001 gram. It was combined with a small portion of the corn meal, and then mixed with the remaining corn meal before being placed in the feed mixer. This procedure was followed so as to more evenly distribute the small quantity throughout the basal ration.

Dosage Levels

The thyroactive iodinated casein was added to the basal ration as follows: Experimental lots 1, 2, 3, 4, and 5 were fed 0, 9, 18, 36, and 72 grams per 100 pounds of mash, respectively; lots 6, 7, 8, and 9 were fed 0, 36, 54, and 72 grams per 100 pounds of mash, respectively; and lots 10, 11, 12, and 13 were fed 0, 2.25, 4.5, and 9 grams per 100 pounds of mash, respectively.

The ration fed to the first lot, the control, in each experiment contained no iodinated casein.

At eight weeks of age, all lots in experiment B were taken off the mash containing iodinated casein, and placed on the control ration for the remaining four weeks.

Experiments A and C however, were carried through the full twelve weeks on mash containing iodinated casein.

The data was analyzed by the statistical method outlined by Baten (1938) on page (219) of Mathematical Statistics.

RESULTS

Growth

The mean weight in grams of each lot in experiments A, C, and B has been recorded at two week intervals in Tables III, IV, and V respectively. The lots are subdivided according to sex.

TABLE III Effect of Iodinated Casein on Weight
Experiment A

			Mean Weight in Grams						
			Age in Weeks						
Lot	Sex	No.	0	2	4	6	8	10	12
						Control			
1	M	17	39.7	114.5	242.6	453.2	746.4	947.9	1181.2
1	F	7	36.4	107.7	227.8	417.4	655.7	862.1	1023.1
						9g/100*			
2	M	17	38.4	104.6	232.3	422.6	666.5	888.0	1064.2
2	F	9	38.1	94.4	197.3	375.6	582.8	764.2	881.1
						18g/100			
3	M	12	39.3	103.1	231.2	459.3	702.9	922.3	1092.1
3	F	13	37.5	97.1	208.4	405.9	591.2	780.9	926.9
						36g/100			
4	M	14	38.9	90.7	218.6	417.1	620.8	801.2	957.8
4	F	12	39.2	90.3	217.8	396.1	583.3	760.5	862.7
						72g/100			
5	M	9	39.7	84.8	195.1	378.0	451.8	706.4	808.1
5	F	11	39.5	90.4	199.1	382.2	457.0	613.7	732.5

* Grams of iodinated casein added per 100 pounds mash.

Experiment A

With the exception of the males in lot 3 which received 13 grams of iodinated casein per 100 pounds of feed, there was a decrease in weight on all lots in experiment A at both six and twelve weeks when compared with the controls (Table III). At six weeks of age, lot 3 showed a 6.1 gram increase in weight over the control, lot 1. This increase was not significant (Table VI).

The only significant decrease in weight of the males was observed at the level of 72 grams of iodinated casein. The depression of weight in this lot was highly significant when compared with the controls at six weeks of age. The females of lot 2, as well as lot 5, showed a significant decrease in weight at this age (Table VI).

At twelve weeks of age, the males showed a significant decrease in weight in lots 2 and 5. The females showed a significant weight decrease in all lots when compared with the controls.

TABLE IV Effect of Iodinated Casein on Weight
Experiment C

			Mean Weight in Grams			
			Age in Weeks			
Lot	Sex	No.	0	2	4	6
				Control		
10	M	12	36.7	86.8	220.1	408.3
10	F	15	37.0	92.9	224.3	404.9
				2.25g/100*		
11	M	18	36.6	90.7	232.4	435.5
11	F	8	36.1	85.8	217.4	400.6
				4.5g/100		
12	M	12	38.3	92.8	239.5	434.3
12	F	16	37.0	86.9	207.8	375.0
				9g/100		
13	M	13	38.6	91.1	200.7	371.2
13	F	10	37.4	84.7	205.0	376.9

* Grams of iodinated casein added per 100 pounds mash

Experiment C

The males in lots 11 and 12 (Table VI) show an increase in weight over lot 10, the control. However, this increase is not statistically significant. The females show a depression in weight, with lot 12 showing a slightly significant decrease. In no instance did the mean weight equal the control.

TABLE V Effect of Iodinated Casein on Weight
Experiment B

			Mean Weight in Grams						
			Age in Weeks						
Lot	Sex	No.	0	2	4	6	8	10	12
					Control			Control	
6	M	7	38.4	78.9	192.9	337.1	543.0	784.7	982.1
6	F	16	36.0	90.1	212.6	341.9	550.4	739.8	934.4
					36g/100*			Control	
7	M	13	37.5	73.8	195.9	393.6	663.7	866.9	1063.8
7	F	7	35.6	72.6	185.6	340.0	571.0	763.1	928.1
					54g/100			Control	
8	M	11	37.3	79.3	176.6	370.7	543.0	756.3	982.5
8	F	13	36.1	81.7	183.5	377.4	565.6	730.9	901.4
					72g/100			Control	
9	M	10	36.4	80.1	193.7	364.1	563.7	770.2	975.2
9	F	5	34.8	73.8	179.6	327.6	522.2	675.8	833.6

* Grams of iodinated casein added per 100 pounds mash.

TABLE VI Effect of Iodinated Casein on Weight
Experiment A and C

Lot	Age in Weeks	Males No.	Males Standard Deviation	Males Significance	Females No.	Females Standard Deviation	Females Significance
			Experiment A				
			Control			Control	
1	6	17	51.4		7	21.2	
1	12	17	148.5		7	60.6	
			9g/100*			9g/100	
2	6	17	55.4	1.66	9	45.4	2.44
2	12	17	191.5	2.02	9	99.4	3.60
			18g/100			18g/100	
3	6	12	75.1	.244	13	40.9	.827
3	12	12	225.0	1.20	13	75.7	3.18
			36g/100			36g/100	
4	6	14	53.7	1.90	12	47.5	1.34
4	12	14	176.3	3.77	12	82.3	4.91
			72g/100			72g/100	
5	6	9	73.4	2.74	11	42.3	3.63
5	12	9	161.3	5.77	11	104.5	7.48
			Experiment C				
			Control			Control	
10	6	12	60.5		15	36.5	
			2.25g/100			2.25g/100	
11	6	18	50.2	1.29	8	33.0	.28
			4.5g/100			4.5g/100	
12	6	12	30.4	1.33	16	45.6	2.01
			9g/100			9g/100	
13	6	13	46.0	1.71	10	40.6	1.74

* Grams iodinated casein per 100 pounds mash

Experiment B

All lots of males at eight weeks of age in experiment B (Table VII), show an increase in weight over the control. The increase on lot 7, receiving 56 grams of iodinated casein per 100 pounds of mash, was highly significant. The remaining lots, 8 and 9, were not significant. At twelve weeks of age, lot 7 maintained a mean weight above the controls, but was barely significant. Lot 8 showed the same mean weight as the control and lot 9 a slight loss in weight, although not significant.

The females in lots 7 and 8 were heavier than the control at eight weeks, but slightly lighter at twelve weeks. The difference in any case was not significant. In lot 9 however, there was a slight decrease, though not significant, at both eight and twelve weeks.

TABLE VII Effect of Iodinated Casein on Weight
Experiment B

			Males			Females		
Lot	Age in wks	Grams Feed/ Gram Gain	No.	Standard Deviation	Signif-icance	No.	Standard Deviation	Signif-icance
6	8	3.23	7	Control 70.0		16	Control 60.1	
7	8	3.52	13	36g/100* 81.7	3.54	7	36g/100 67.4	.660
8	8	3.86	11	54g/100 148.9	.096	13	54g/100 77.7	.578
9	8	4.41	10	72g/100 78.9	.71	5	72g/100 81.1	.718
6	12	5.09	7	Control 154.5	.	16	Control 127.5	
7	12	5.92	13	156.3	2.07	7	133.6	.103
8	12	6.08	11	169.5	.005	13	131.1	.681
9	12	6.01	10	144.3	.09	5	161.2	1.279

* Grams iodinated casein added per 100 pounds mash

Feathering

Experiment A

The males of lots 2, 3, and 4, at six weeks of age show very significant increases in rate of feathering when compared with lot 1, the control (Table IX). Lot 5, however, showed no significant increase. All lots of females show significant increases in rate of feathering.

At twelve weeks of age all males show an increase in rate of feathering but only lots 4 and 5 show increases that are highly significant (Table IX). All lots of females show increases in rate of feathering. Birds in lot 4 were completely feathered with a mean score of 5. Lot 2 is the only group of females which did not show significance.

Experiment C

Neither a significant increase nor decrease in rate of feathering occurred between any lot and the control (Table IX).

TABLE VIII Effect of Iodinated Casein on Tail Feather Score

Lot	Wing Score 1 Day		Tail Score 2 Weeks	
	Male	Female	Male	Female
1	2.4	3.0	.7	2.0
2	2.8	2.6	1.3	1.3
3	2.3	2.5	1.1	2.4
4	2.5	2.8	1.9	1.9
5	3.0	2.9	1.8	2.7
6	3.1	2.7	0	.4
7	3.5	3.3	.46	1.6
8	2.9	2.9	.73	1.3
9	3.2	3.8	1.4	2.0
10	3.2	3.1	.58	1.5
11	2.7	3.0	.44	1.1
12	2.4	3.3	.75	1.2
13	2.8	3.4	.46	1.2

TABLE IX Effect of Iodinated Casein on Feather Score
Experiments A and C

Lot	Age in Wks	Males No.	Mean Feather Score	Standard Deviation	Significance	Females No.	Mean Feather Score	Standard Deviation	Significance
				Experiment A					
				Control				Control	
1	6	17	2.1	.373		7	2.7	.438	
1	12	17	3.1	.373		7	4.0	.535	
				9g/100*				9g/100	
2	6	17	2.9	.471	3.32	9	3.3	.473	2.62
2	12	17	3.5	1.09	1.18	9	4.4	.830	1.17
				18g/100				18g/100	
3	6	12	3.1	.64	3.56	13	3.5	.500	3.70
3	12	12	3.8	1.01	1.94	13	4.6	.625	2.26
				36g/100				36g/100	
4	6	14	3.0	.38	3.83	12	3.3	.723	2.25
4	12	14	4.5	.824	4.58	12	5.0	.000	4.95
				72g/100				72g/100	
5	6	9	2.9	1.10	1.88	11	3.5	.657	3.10
5	12	9	4.6	.687	4.81	11	4.9	.238	3.19
				Experiment C					
				Control				Control	
10	6	12	1.8	.830		15	2.4	.712	
				2.25g/100				2.25g/100	
11	6	18	1.7	.651	.351	3	2.5	.500	.392
				4.5g/100				4.5g/100	
12	6	12	1.8	1.18	0	16	2.3	.583	.425
				9g/100				9g/100	
13	6	13	1.5	.747	.946	10	2.2	.400	.397

* Grams iodinated casein added per 100 pounds mash

Experiment B

All lots showed highly significant increases over the control in rate of feathering (Table X). All females in lots 7 and 9 were completely feathered, having a mean score of five at twelve weeks.

TABLE X Effect of Iodinated Casein on Feather Score
Experiment B

		Males				Females			
Lot	Age in Wks	No.	Mean Feather Score	Standard Deviation	Signif-icance	No.	Mean Feather Score	Standard Deviation	Signif-icance
				Control				Control	
6	8	7	2.1	.352		16	2.9	.660	
				36g/100*				36g/100	
7	8	13	3.2	.697	4.66	7	3.9	.640	3.38
				54g/100				54g/100	
8	8	11	3.0	.852	6.44	13	4.2	.800	4.80
				72g/100				72g/100	
9	8	10	3.7	.731	5.69	5	4.4	.800	3.75
				Control				Control	
6	12	7	3.1	.640		16	4.2	.527	
7	12	13	4.4	.835	3.85	7	5.0	0	6.06
8	12	11	4.2	.716	3.36	13	4.9	.267	4.64
9	12	10	4.8	.600	5.47	5	5.0	0	6.06

* Grams iodinated casein added per 100 pounds mash

DISCUSSION

Growth

From the data shown in Tables III, IV, and V, it may be noted that each lot maintained its same relative position, with the other lots, throughout the entire experiment.

Darrow (1943) found that the period of greatest variability in degree of feathering was at six weeks of age. From his results, it was reasoned that critical evidence of rate of feathering in experiments A and C might be determined by observations at six and twelve weeks of age. Birds in experiment B were taken off the rations containing iodinated casein and put on the basal ration at eight weeks of age. Consequently, in this experiment data on growth and feathering at eight weeks and twelve weeks of age were used in analysis of the data.

Some variations may be noted when comparing two lots on the same ration. Lot 4 (Table III), on a ration containing 36 grams of iodinated casein, show a slight decrease in weight, at eight weeks of age when compared to the control, lot 1. But, lot 7, (Table V), on the same ration, show a highly significant increase.

Several levels show slight increases in weight over the control. Only the males on the 36 gram level in experiment B show a significant increase.

Significant decreases at six weeks of age in experiment A may be noted for both male and females on the 72 gram level, and also for the females in lots 2 and 12. At twelve weeks, significant

decreases may be noted for both males and females when iodinated casein is continued in the ration beyond six weeks. (Table VI).

Feathering

Since the chicks were sorted into lots by weight at one day of age, it was not possible to sort the birds accurately according to secondary wing feather score. Although there are some differences in the mean feather score, (Table VIII), an increase in rate of feathering was shown at two weeks of age. The most striking increases occurred in the mean feather score of the males in lots 3 and 8, and for the females in lots 3 and 5.

In most instances, at six weeks, there was an increase in the rate of feathering as the level of iodinated casein increased. All lots in experiments A and B (Tables IX and X), show an increase in degree of feathering when compared to the controls. At both eight and twelve weeks in experiment B, this increase is highly significant. In experiment A, the increased feathering was not significant on levels of 9 or 18 grams at twelve weeks. Birds on the low levels, 2.25 grams, 4.5 grams, and 9.0 grams used in experiment C, show no significant increase or decrease.

Mortality

Lots 5 and 9, when compared with the controls, showed an excessive number of deaths. Since this occurred on the 72 gram level of iodinated casein, and for both experiments A and B, the mortality may have been due to the iodinated casein.

Perosis and neural lymphmatosis were responsible for a number of the deaths. Mortality due to perosis may have been due to the lack of sufficient manganese in the ration.

Comparisons with Earlier Research

This work is in close agreement with Irwin, Reineke, and Turner (1943) in that a significant increase in weight of the male chicks on rations containing 36 grams of iodinated casein per 100 pounds of mash was found. On levels lower than this, the increase was not significant.

Parker (1943) noted slight increases in weight on rations containing as much as .2 per cent iodinated casein. The present work shows significant losses in weight at levels as high as .59 per cent (72 grams) of iodinated casein.

Irwin, Reineke, and Turner (1943) and Parker (1943), observed that feather growth increased as the level of thyroactive iodinated casein was increased. This also was definitely shown in this study.

SUMMARY

It has been definitely shown that feathering is greatly stimulated when chicks are fed a ration containing between 9 and 72 grams of iodinated casein per 100 pounds of mash.

No benefits are derived from feeding thyroactive iodinated casein at levels above 36 grams per 100 pounds of mash when the product contains 3.04 per cent of thyroxine.

Under the conditions of this experiment there was no advantage in using iodinated casein beyond the eighth week for increased weight. The rate of feathering is stimulated to twelve weeks and at levels higher than 36 grams per 100 pounds of mash. However, this stimulation is at the expense of body weight.

Mortality was exceedingly high on the 72 gram level of iodinated casein.

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