

Growth Relationships and Effect of Diet Energy Levels on Thyroxine Secretion Rates in Feeder Cattle

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INTRODUCTION

A preliminary investigation was initiated during the spring of 1966 to see if any relationship exists between the level of serum thyroxine and the performance of feeder cattle, and to determine if there is a relationship between energy uptake and thyroxine secretion. Serum thyroxine levels in two breeds of cattle also were compared.

MATERIALS AND METHODS

Thirty intact, unbred heifers (12 months of age at the beginning of the experiment) consisting of 15 Herefords and 15 Angus \times Hereford hybrids were used. They were divided into 3 groups according to diet energy level with 5 Herefords and 5 Angus \times Hereford hybrids in each group, making a total of 6 groups.

Group I consisted of Angus \times Herefords, and Group II consisted of Herefords. Each of these groups was placed on a sorghum ensilage diet of 10.5 lb. of dry matter per animal per day.

Group III consisted of Angus \times Herefords, and Group IV consisted of Herefords. These groups were placed on a corn ensilage diet of 10.5 lb. of dry matter per animal per day. This diet had a higher energy level than the sorghum ensilage diet because it contained a higher grain content.

Group V consisted of Angus \times Herefords, and Group VI consisted of Herefords. These animals were placed on a corn ensilage diet of 14.4 lb. of dry matter per animal per day.

All of the experimental animals received a 2-lb. mixture of cottonseed meal, minerals, and vitamin A daily. Water intake was unrestricted.

Blood samples were collected from each animal at 28-day intervals over a period of 112 days. The animals were weighed at each blood sampling.

Circulating thyroxine was measured by using a simplified Iiothyronine I^{125} uptake test which has been developed by Abbott Laboratories. Previously, a red-cell uptake test was employed, but it was limited by the difficulty in washing the red blood cells uniformly each time the test was performed. Abbott Laboratories have developed a Triosorb resin-sponge (polyurethane resin-embedded sponge) which is offered as a replacement for red blood cells in the uptake test.

The principle of this test is that circulating thyroxine is bound to several blood constituents, thyroxine-binding globulin being the most active. Smaller amounts of thyroxine are bound to albumin and to red blood cells. Iiothyronine is similarly but less firmly bound to the same sites. In hyperthyroidism, the primary thyroxine-binding sites are nearly saturated. Added Iiothyronine I^{125} is taken up by secondary binding sites (including red blood cells) or by an exogenous material such as a Triosorb resin-sponge. In hypothyroidism, the relatively unsaturated primary sites take up added Iiothyronine I^{125} . In short, the binding or uptake by a Triosorb resin-sponge is increased in hyperthyroidism and decreased in hypothyroidism. Thus, the level of serum thyroxine is directly proportional to the percentage of Triosorb uptake.

RESULTS

A summary of the results over the 112-day period is shown in Table I. Comparison of the animals on the two different corn ensilage diets showed that the heifers on the diet of 14.4 lb. per animal per day had a higher thyroxine level. There was a positive correlation between the diet energy levels in Groups III, IV, V, and VI, and circulating thyroxine levels. However, the results for Groups I and II did not agree with those for the last 4 groups. Group II (Herefords) gained more on the sorghum ensilage diet than either the Angus \times Herefords or the Herefords that were on the corn ensilage diet of 10.5 lb. per day. This was unexpected since the sorghum ensilage was of rather poor quality due to adverse conditions during ensiling.

TABLE I. AVERAGE GAIN AND AVERAGE PERCENTAGE TRIOSORB UPTAKE IN 112 DAYS.

Group	% Triosorb Uptake	Gain in Pounds
I	24.37	86
II	28.78	133
III	23.38	126
IV	26.89	120
V	24.36	162
VI	29.21	167

Upon checking individual performance records, it was found that two of the Angus \times Herefords in Group I gained no appreciable weight during the last 84 days of the experiment. These animals were not examined for any possible causes of poor performance, however. It was also noted that two heifers in Group II had abnormally high thyroxine levels on one of the testings. This was probably caused by improper technique during the measuring of the thyroxine level.

Figure 1 plots the average percentage of Triosorb uptake for each animal for the 112 days against its gain during that time. It also designates whether the animal was a Hereford or an Angus \times Hereford. It can be seen that the Herefords averaged a higher gain than did the Angus \times Herefords. The Herefords also had a higher average amount of circulating thyroxine. This is more plainly seen in Figure 2. The Herefords averaged approximately 4% higher than the Angus \times Herefords at every testing. Along with higher thyroxine levels, the Herefords averaged a gain of 140 lb. per animal as compared to 125 lb. of gain for each Angus \times Hereford. Therefore, those animals with a higher percentage Triosorb uptake had a higher average rate of gain.

DISCUSSION

It cannot definitely be stated at present that the diet energy level influenced the circulating thyroxine level, although two of the diets did show some evidence of this. Studies by Post (1965) indicated a correlation between thyroxine levels of steers on good pasture and of the same steers on poor pasture. A depression of feed intake was accompanied by a depression of the thyroxine level. However, Lundgren and Johnson (1964) placed more emphasis on the depression of the thyroxine level by body environment (temperature) than by the depression of feed intake. Post also reported that those animals with a higher thyroid activity were at an advantage on good pasture but were at a disadvantage on poor pasture.

We found a definite difference between the thyroxine levels of Herefords and Angus \times Herefords. This difference was almost a constant

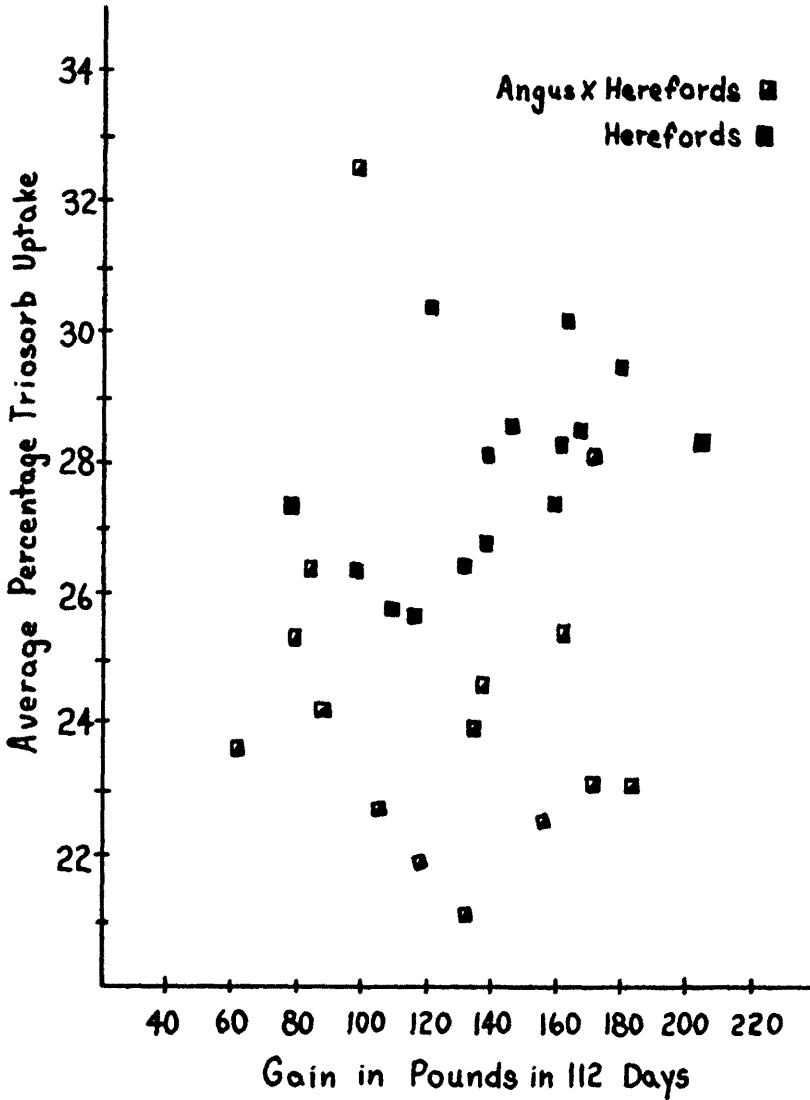


Figure 1. Average gain for each heifer over the 112 days plotted against the average percentage Triosorb uptake for the 112 days.

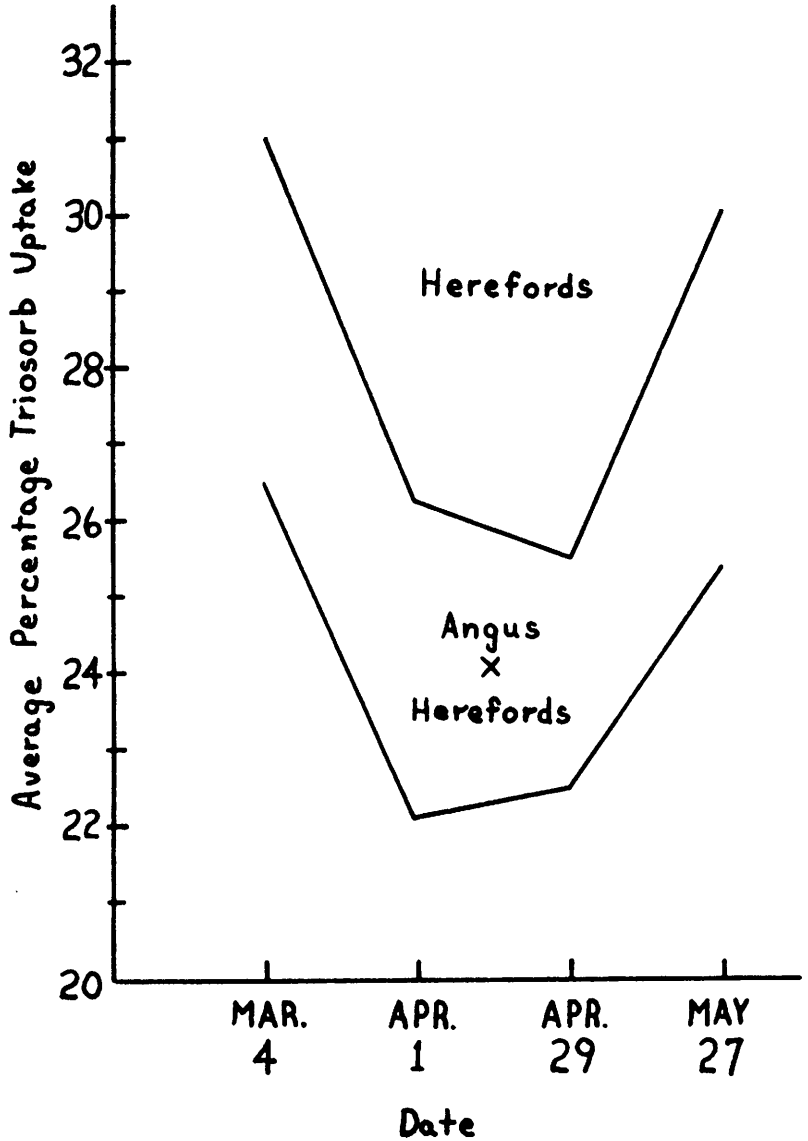


Figure 2. A comparison between the average thyroxine levels of the Angus x Herefords and Herefords at each of the four testing dates.

over the testing period. A study by Pipes et al. (1963) showed no correlation between breeds, when the determination method of Pipes and Turner (1956) was used.

Since this preliminary study has shown possible correlations, further investigation is in progress, with modifications employing greater variations in the diet energy level over a more extended period of time. Also, duplicate determinations will be run on each animal to avoid errors.

If future results are favorable, they may be helpful in developing an objective technique for forecasting potential gain in feeder cattle.

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