

In these rats the catecholamine content of the brain was unchanged, while that of the heart was reduced and the adrenal increased.

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Metabolism of Thyroxine in Hyperthyroidism in Cattle.*† (26486)

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Mean biological half-life of thyroxine ($t_{1/2}$) in a group of 16 normal dairy cows was observed to be 2.47 days and a turnover rate of 28.4% per day(1). The present study was concerned with influence of hyperthyroidism on $t_{1/2}$ of thyroxine. Hyperthyroidism was defined in cattle in terms of 50 and 100% increase above their estimated winter thyroxine secretion rate (TSR).

Methods and materials. TSR was determined in late winter in lactating cows of several breeds by replacement technique(2). All animals were maintained in dry lot with free access to iodized salt. In each experiment 300 μ c of carrier-free l-thyroxine- I^{131} was injected intravenously and blood samples taken from jugular vein each day following injection of hormone. Measurements of radioactivity of plasma were made in a National Radiac scintillation well counter (Mod-

el SA-2D) and conventional corrections were made for decay of isotope and for background. Disappearance of radioactivity in plasma from day to day followed an exponential course. In all experiments 4 g Tapa-zole/1000 lb body weight/day was administered to each animal to prevent recycling of I^{131} from thyroxine- I^{131} metabolism(3). Plot of disappearance of I^{131} from plasma was extrapolated back to zero time (time of injection) and biological half-time ($t_{1/2}$) of thyroxine was determined graphically or from slope of regression line(1). $t_{1/2}$ represents time required by animal body to eliminate one-half of I^{131} in blood.

Eight animals, after they had attained peak milk production, were injected for several months with 1-thyroxine (T_4) subcutaneously daily, 50% in excess of estimated winter TSR, and its effect on milk production noted. $t_{1/2}$ of 1-thyroxine- I^{131} was determined during this period of hyperthyroidism. In 2 animals, (a Guernsey and Jersey-Holstein cross) the level of T_4 injection was further raised to equal twice normal estimated TSR of animal. $t_{1/2}$ of 1-thyroxine- I^{131}

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TABLE I. Influence of Hyperthyroidism on Biological Half-Life of Thyroxine-I¹³¹ in Dairy Cattle.

Animal No. and breed	Estimated normal daily TSR (mg/100 lb body wt)	Biological half-life (T _{1/2}) of thyroxine-I ¹³¹	
		Normal animals	Hyperthyroid 50% above normal 100% above normal
24 (Brown Swiss)	.5	2.33 ± .05	1.07 ± .02 ^{(+)*}
25 (" ")	.4	2.25 ± .06	.85 ± .04 ⁽⁺⁾
869 (Holstein)	.6	2.10 ± .03	1.12 ± .03 ⁽⁺⁾
870 (")	.5	2.32 ± .07	1.08 ± .04 ⁽⁺⁾
873 (")	.4	2.29 ± .06	1.10 ± .02 ⁽⁺⁾
630 (Jersey)	.6	2.50 ± .09	1.00 ± .01 ⁽⁺⁾
38 (Guernsey)	.4	2.35 ± .07	1.10 ± .04 ⁽⁺⁾ .88 ± .21 ⁽⁺⁾
601 (Holstein-Jersey cross)	.5	2.40 ± .06	1.05 ± .03 ⁽⁺⁾ .89 ± .25 ⁽⁺⁾
Mean	.49	2.32	1.05

* Lactational response to thyroxine treatment was considered as positive (+) when an increase in milk production of at least 20% over pre-treatment level was obtained.

was again determined in these 2 animals. Effect on milk production was also noted.

Results. Half-life ($t_{1/2}$) of thyroxine-I¹³¹ for group of 8 normal cows was 2.32 days. When maintained in hyperthyroid state 50% above their estimated daily TSR by exogenous T₄, the $t_{1/2}$ was reduced to 1.05 days, a reduction of 54.3% (Table I). Two cows injected with T₄ 100% above TSR showed a further reduction ($t_{1/2}$ = 0.89 days). The range of $t_{1/2}$ in individual cows was minimal.

All cows showed increases in milk yield of 20% or more at 50% above normal T₄ level, but showed little or no further increase at 100% above normal level.

Discussion. When dairy cows were maintained in a hyperthyroid condition by injection of T₄ 50% above their winter TSR, it was observed that rate of disappearance of thyroxine-I¹³¹ from blood was doubled. Increasing T₄ injection to 100% above winter TSR further decreased $t_{1/2}$. Milk production in all cows at 50% above normal level of T₄ increased 20% or more and the increase was sustained for many weeks. Increase to 100%

above normal level of T₄ had little or no further influence upon lactation.

These data indicate that hyperthyroidism tends to increase rate of T₄ metabolism in somatic cells. While T₄ metabolism may occur by 3 pathways, (1) deiodination in cells and excretion of I¹³¹ in urine, (2) glycuconjugation in liver and excretion in bile, and (3) oxidative deamination, present method determines only total elimination of thyroxine-I¹³¹ from blood.

From these observations it would appear that body has a mechanism for protection against (in cases of) hyperthyroidism by decrease in $t_{1/2}$ of thyroxine. In study of induced hyperthyroidism a dose of T₄ would not be directly related to degree of hyperthyroidism since $t_{1/2}$ of thyroxine would gradually decline as level of T₄ increased.

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