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Effects of Morning vs Evening Feeding on T_3 and T_4 Concentrations in Feedlot Steers

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Story in Brief

Seventeen crossbred steers were used to determine if concentrations of triiodothyronine (T_3) and thryoxine (T_4) in plasma were altered by the time of day that cattle were fed and stage of finishing. Steers were fed either at 8:00 a.m. or 5:00 p.m. each day. Steers fed at 8:00 a.m. received either free choice access to feed (AL), 9 h/d of eating time restricted by closing a gate in front of the feedbunk (DG), or approximately 9 h/d of eating time restricted by attempting to have cattle consume each day's feed by 5:00 p.m. (DC). Steers fed at 5:00 p.m. received feed for 9 h/night restricted by closing a gate at 2:00 a.m. in front of the fcedbunk (NG) or approximately 15 h/night of eating time restricted by attempting to have cattle consume each day's feed by 8:00 a.m. the following morning (NC). Blood was drawn via tail venipuncture. Period I samples were obtained on September 18, 1997 prior to the 8:00 a.m. feeding and again on September 23, 1997 prior to the 5:00 p.m. feeding. Period 2 samples were taken on October 28, 1997 prior to the 8:00 a.m. feeding and again on November 7, 1997 prior to the 5:00 p.m. feeding. Feeding treatment did not influence concentration of T_3 or T_4 in plasma, although a period by time interaction was detected. In the first period, T_3 and T_4 concentrations were greater on the second sampling day than on the first sampling day. This may be related to a greater average ambient temperature (85 F) on the first day than on the second (65° F). In Period 2, concentration of T_3 and T_4 did not differ between the two sampling days. Thyroid function was not affected by feeding time or treatment in this trial. Even though thyroid function appeared to be related to ambient temperature in the first period of our trial, similar patterns were not observed in the second period.

(Key Words: Thyroid Hormones, Triiodothyronine, Thyroxine, Steers.)

Introduction

Thyroid hormones such as T_3 and T_4 in plasma of steers regulate metabolic rate of cattle (Richards et al., 1995). T_3 and T_4 are inversely related to ambient temperature (Pratt and Wettemann, 1986). As ambient temperature increases, release of thyroid hormones is decreased to help decrease metabolic rate and body temperature. In contrast with low ambient temperatures, concentrations of T_3 and T_4 increase to raise metabolic rate and heat production. It is unclear how these hormones respond to the time of day that cattle are fed. Feeding heat stressed cattle in the evening rather than the morning may improve efficiency by reducing die heat load on the cattle during the hottest part of the day. If feeding in the morning or the evening improves efficiency, metabolic rate may be involved and useful as a measurement to determine the mechanism for improved efficiency. The objective of our study was to determine if concentrations of T_3 and T_4 in plasma of steers were altered due to different times of the day that cattle are fed and by limiting the time cattle have access to feed.

Materials and Methods

Seventeen steers from a feeding trial were randomly chosen to evaluate concentration of T_3 and T_4 in plasma. Steers received a dry, whole corn based 87% concentrate diet in one of five ways: 1) steers were fed at 8:00 a.m. and allowed free choice access to feed (AL), 2) steers were fed at 8:00 a.m. and restricted to 9 li/day of eating time controlled by a closed gate in front of the feedbunk at 5:00 p.m. (DG), 3) steers were fed at 8:00 a.m. and restricted to 9 li/day of eating time controlled by restricted delivery of feed resulting from feed calls (DC), 4) steers were fed at 5:00 p.m. and restricted to 9 h/night of eating time controlled by a closed gate in front of the feedbunk at 2:00 a.m. the following morning (NG), or 5) steers were fed at 5:00 p.m. and restricted to 15 li/night of eating time controlled by restricted delivery of feed resulting from

feed calls (NC).

Blood was obtained from steers via tail venipuncture at two times during two different periods. Period I was prior to the 8:00 a.m. feeding on September 18, 1997 (Time 1) and prior to the 5:00 p.m. feeding on September 23, 1997 (Time 2). Period 2 was prior to the 8:00 a.m. feeding on October 28, 1997 (Time 3) and prior to the 5:00 p.m. feeding on November 7, 1997 (Time 4). Blood, collected in tubes that contained EDTA, was placed on ice and centrifuged within two hours of collection at 3,000 g for 15 min. Plasma was decanted and frozen at -8° F until T_3 and T_4 were analyzed.

Concentrations of T_3 and T_4 in plasma were determined in duplicate by radioimmunoassay using Total T_3 and T_4 kits. Addition of .5 ng/ml of T_3 to the plasma sample resulted in 72% recovery of mass. Addition of 30 ng/mI of T_4 to the plasma sample resulted in 95% recovery of mass. When different volumes of plasma, were quantified with either assay, the response was parallel to the standard cm-ve. All samples were measured in a single assay.

Data were analyzed by analysis of variance as a split-split-plot Feeding treatment was the main plot, period was the sub-plot, and time of feeding was the sub-sub-plot.

Results and Discussion

Concentrations of T_3 and T_4 were not affected by limiting access time to feed (Table 1). However, a period by time of feeding -interaction detected differences between the time of day that cattle were fed. In the first period, both T_3 and T_4 concentrations in the plasma of the animals were greater ($P<.05$) the second sampling (September 23) compared with the first sampling (September 18) (Table 2). This corresponds with a lower ambient temperature on the second date (83° F vs 65 F). This agrees with previous work done by Pratt and Wettemann (1986) who found that plasma concentration of T_3 and T_4 increased in steers subjected to cooler ambient temperatures and decreased in steers subjected to warmer ambient temperatures. However, in Period 2, concentrations of T_3 and T_4 in plasma were not different from the first (October 28) to the second sampling (November 7) although average ambient temperature continued a downward trend between the two times (50° F (28th) to 36° F (7th)). The reason for lack of similar thyroid concentrations between the two periods is unknown. However, body weight may have affected thyroid function as the second sampling period was approximately 35 to 42 d later so that cattle were heavier at this time (approximately 1020 vs 1100 lb).

Results from this trial indicate that thyroid function is related to ambient temperature to which cattle are exposed in helping to regulate body temperature and metabolic rate. However, degree of finish may provide an insulative effect for cattle the longer they remain on feed, and thyroid hormones may become less important in the regulation of body temperature and heat production of the animal.

Literature Cited

Pratt, B, R. and R. P. Wettemann. 1986. 1 Anim. Sci. 62:1346. Richards, M. W. et al. 1995. Anim. Reprod. Sci. 37:267.

Table 1. Effect of limit feeding treatment on T_3 and T_4 levels in feedlot steers.

	Time and exposure to feed				
	AL	DG	DC	NG	NC
Number of head	3	4	4	3	3
T3, ng/ml	1.52	1.60	1.42	1.36	1.41
T4, ng/ml	92.88	93.89	95.12	100.69	100.25

Table 2. Effect of period by time interaction on T_3 and T_4 levels in feedlot steers.				
	Period I		Period 2	
	8:00 a.m.	5:00 p.m.	8:00 a.m.	5:00 p.m.
Number of head	17	17	17	17
Max ambient temp, F	95	66	67	48
T3, ng/ml	1.28^{a}	1.58^{b}	1.54^{b}	1.44^{ab}
T4, ng/ml	99.91^{b}	108.87^{c}	91.18^{a}	86.3^{a}
^{a,b} Values within rows differ (P<.05).				

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