

by their respective price/cwt. and then calculating a weighted steer-heifer average.

The Holstein females weaned calves with the highest total value, although adjustment for land and supplement costs removed most of this advantage. On the basis of return above land and supplement costs, it would appear that cows on the Moderate level of supplement returned the most profit, \$221.95, \$218.78 and \$228.71 respectively for Moderate Hereford, Hereford x Holstein and Holstein females. In past years Holsteins have returned less profit due to increased feed requirements but the high value of calves in 1973 overcome the increased feed and land costs.

A more realistic profit picture is provided by adjusting for rebreeding performance. This was done by multiplying the return above feed cost per calf by percent conception of the cows as 4-year-olds. On this basis the Moderate Hereford x Holsteins were the most profitable with the Herefords, High Hereford x Holsteins and Very High Holsteins slightly behind. The low rebreeding performance of the Moderate and High Holsteins made them uncompetitive. It should be noted that in previous years when calf prices were lower the Very High Holsteins were also uncompetitive when compared to the Hereford and Hereford x Holstein cows.

The Influence of Ambient Temperature on Blood Serum Prolactin In Heifers

R. P. Wettemann, H. A. Tucker, W. Jackson and G. D. Adams

Story in Brief

Four heifers were exposed to 50°F and 80°F for 5 days after pre-conditioning to 70°F in a controlled environment chamber. Blood serum prolactin decreased from 13 to 4 ng/ml during the 4-hr. interval when ambient temperature was reduced from 70° to 50°. Prolactin increased from 8 to 22 ng/ml during the 3-hr. period when ambient temperature was increased from 70° to 80°. During 5 days of exposure to 50°, serum prolactin was 38 percent lower than during a control period

at 70°; and while at 80°, heifers had twice the concentration of serum prolactin as those at 70°. We conclude that ambient temperature influences serum prolactin in heifers.

Introduction

Prolactin is generally considered to be necessary for milk production in laboratory animals, and serum prolactin is correlated with average monthly milk production in cows. Stimuli associated with lactation can alter blood serum prolactin in cattle. For example, milking or washing the udder increase serum prolactin concentration. Furthermore, it has been demonstrated that serum prolactin concentration in lactating cows was greater during the warmer months of the year than during the winter months. However, the environmental factors which cause these changes in serum prolactin are not known. Knowledge of these factors will be essential before the role of prolactin during lactation will be clearly understood. Thus, the objective of this study was to examine the relationship of ambient temperature to serum prolactin in cattle.

Materials and Methods

Four Holstein heifers, 3 months of age, were paired randomly, and the two pairs were confined in two environmental chambers (I and II). A pair of heifers was stanchioned beside each other, but physical contact between calves was restricted. Relative humidity was maintained at 50 ± 10 percent, and animals were exposed to 12 hr. of light daily starting at 8 a.m. Water and a complete ground ration (grain concentrate plus roughage) were supplied *ad libitum*, and chambers were cleaned at 8:30 a.m. and 5:00 p.m.

After an initial 2-week adjustment period to the chambers (maintained at $70 \pm 1^\circ\text{F}$) and the day before blood sampling started, a cannula (Silastic, 40 in. length; .085 in. O.D., Dow Corning Corp.) was inserted into one jugular vein of each heifer. About 8 in. of cannula were placed in the vein and attached to the neck with adhesive tape. The remaining 32 in. of cannula were taped to the dorsal midline of the heifer to permit blood samples to be taken while standing at the rear of the animal.

The pair of heifers in chamber I was maintained at $70 \pm 1^\circ$ for 5 days, then the temperature was elevated to 80° at the rate of approximately 5° per hr. beginning at 10:00 a.m. Exposure to $80 \pm 1^\circ$ was continued for 5 days. On the fifth day at 10:00 a.m. the heifers were injected via the jugular cannula with $10 \mu\text{g}$ of synthetic thyrotropin-releasing hormone (pyro-glutamyl-histidyl-proline amide, TRH)¹. Previous work has demon-

stated that TRH elevates blood levels of prolactin. The TRH injection was used to evaluate the ability of the anterior pituitary to release prolactin at different ambient temperatures. The next day the temperature was returned to 70° for 5 days. After 5 days at 70° the temperature was reduced to 50° at the rate of about 5° per hr. beginning at 10:00 a.m. Exposure to 50±1° was maintained for 5 days, and on the fifth day the heifers were infused with 10 µg of TRH via jugular cannula. The pair of heifers in chamber II were treated similarly and concurrently with those in chamber I, except the order of the periods of exposure to 80° and 50° was reversed.

Blood serum samples were collected via cannulae twice daily at 8 a.m. and 8 p.m. On those days when temperature was altered from 70° 12 samples were taken at hourly intervals, starting one hour before the start of the temperature change. Prior to treatment of heifers with TRH, blood samples were taken and discarded at 15-min. intervals for 1.5 hr. in an effort to achieve stable baseline prolactin values. Thereafter, blood samples were collected 30, 20, 10 min and immediately before (0) TRH injection. After TRH infusion, blood samples were taken at 5, 10, 15, 20, 25, 30, 45 and 60 min. Sera were stored at 0° until prolactin was quantified by a double antibody radioimmunoassay.

¹ TRH kindly supplied by Dr. R. Rippel, Abbott Laboratories, North Chicago.

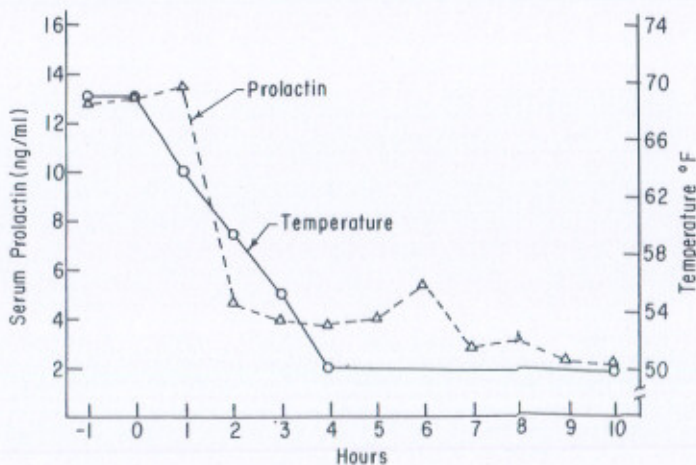


Figure 1. Serum Prolactin and Ambient Temperature During the Change From 70° to 50°.

Results

During the 4-hr. interval when ambient temperature was reduced from 70° to 50°, serum prolactin concentration decreased linearly (Figure 1). Prolactin averaged 13 ng/ml before the start of the temperature decline, and decreased to approximately 4 ng/ml. As ambient temperature was increased from 70° to 80°, serum prolactin increased linearly (Figure 2) from approximately 8 ng/ml to a maximum of 22 ng/ml.

Chronic exposure for 5 days of the heifers to either 50°, 70° or 80° altered serum prolactin. Since average serum prolactin concentrations were not significantly different between daily samples taken at 8 a.m. and 8 p.m. or between days within a given temperature, the values for all samples taken for each heifer were averaged (Table 1). When heifers were exposed to 50° after the adjustment period at 70°, serum prolactin was reduced (6.7 vs. 10.8 ng/ml, respectively; $P < .05$). Serum prolactin was twice as concentrated in heifers maintained at 80° as when they were at 70°.

Within 5 min. of TRH administration serum prolactin increased 9.7 fold in heifers at 50° and 7.4 fold in heifers at 80° (Figure 3). In comparison with heifers at 50°, absolute concentrations of serum prolactin were greater in the heifers at 80° before and after TRH. When the prolactin concentration during the first 20 min. after TRH was expressed as a percentage of the pretreatment concentration, heifers at both tem-

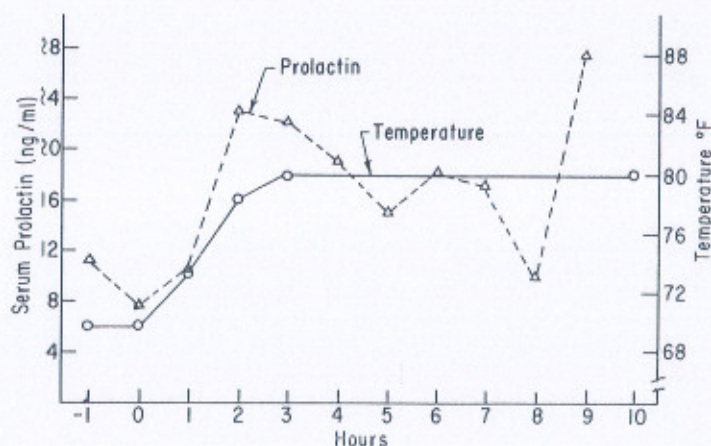


Figure 2. Serum Prolactin and Ambient Temperature During the Change From 70° to 80°.

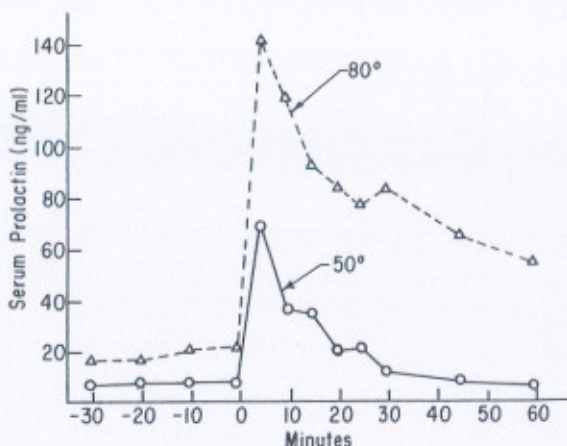


Figure 3. Serum Prolactin Response to Infusion of 10 μ g of TRH (at 0 Minutes) into Each of Four Heifers at 50° and 80°.

Table 1. Serum Prolactin (ng/ml) in Heifers During Exposure to 50°, 70° or 80° for 5 Days

Heifer number	Treatment		
	50°	70°	80°
1	8.0 ¹	12.0	24
2	3.4	9.0	16
3	5.7	9.9	25
4	9.6	12.3	27
\bar{X}	6.7	10.8	28

¹ Mean for 7 to 10 samples per heifer taken during a 5-day period.

peratures responded similarly to TRH. But during 25 to 60 min. after TRH, heifers at 80° had a greater serum concentration of prolactin percentage wise than heifers at 50°. In fact, within one hour after TRH infusion, prolactin concentration had decreased to pretreatment values in heifers at 50°, but in heifers at 80° serum prolactin concentration was still elevated about 2.5 times above pretreatment values.

Discussion

Alteration of blood serum prolactin by changes in environment temperature has been suggested previously. Michigan workers observed in lactating cows that serum prolactin concentration was greatest in summer and lowest in winter, but the temperature effect was confounded with changes in day length and diet. The rapid and consistent change in serum prolactin which occurred within 3-4 hr. during which time temperature was altered suggests the need to control temperature when studying relationships of prolactin to physiological functions.

Injection of TRH markedly increased serum prolactin similar to previous reports in cattle and sheep. When the data were expressed as a percentage of pretreatment values, ambient temperatures had no influence on the initial prolactin concentrations after TRH. However, the absolute concentrations of serum prolactin after TRH in heifers at 80° were at least twice as great as those for heifers at 50°, and serum prolactin response to TRH at higher temperatures remained above pretreatment concentrations for a longer period of time. The data clearly showed that environmental temperature markedly influenced the ability of the anterior pituitary to release prolactin within 5 min. after TRH injection.

Three Levels of Nitrogen Fertilization For Bermudagrass

J. P. Telford, F. P. Horn, D. F. Stephens, J. E. McCroskey,
J. V. Whiteman and Robert Totusek

Story in Brief

Three levels of N application (60, 180 and 300 lb./A) were applied to 130 acres of Midland bermudagrass (*Cynodon dactylon*) which was divided into 12 pastures. The N application was applied in equal split applications (May, July and September); P_2O_5 and K_2O were applied in accordance with soil analysis.

Monthly forage production was estimated with 4 ft. by 4 ft. wire cages (CC). Esophageal fistulated cows (12) and calves (12) were used to

In cooperation with USDA, Agricultural Research Service, Southern Region.