# FORAGE AND LIVESTOCK RESEARCH - 1988

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# RESPONSE TO ENVIRONMENTAL TEMPERATURE IN BRAHMAN CALVES DURING THE FIRST COMPARED TO THE SECOND DAY AFTER BIRTH: METABOLIC HORMONES AND METABOLITES

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## SUMMARY

The results of this study indicate that Brahman calves born in a cold environment cannot maintain body temperatures as well as calves born in a warm environment or 1-day-old calves. Energy compounds, glucose and tri- glycerides, were at higher levels in the blood of 1-day-old than newborn Brahman calves. In addition, adrenal release of cortisol and thyroid secretions were elevated in Brahman calves exposed to cold air temperatures. This stress response to chilling, combined with low energy metabolite levels, may be the reason newborn Brahman calves cannot maintain body temperature and lose viability when chilled.

## INTRODUCTION

Brahman calves born during the colder periods of the year, late fall to early spring, tend to be less viable than Brahman calves born during warmer months. The newborn Brahman calf appears to be unwilling to stand and nurse when exposed to cold environmental temperatures. It has been suggested that these symptoms are caused by an inability of newborn Brahman calves to utilize the energy components of the blood to regulate body temperature when stressed by cold. This study was designed to investigate the effect of chilling on newborn and 1-day-old Brahman calves, specifically to determine the 24 hour blood profiles of metabolic hormones and metabolites as related to body temperatures.

## PROCEDURES

Twenty-eight Brahman calves were utilized in this study. Calves were removed from their dams within 30 minutes of birth (0 h) prior to suckling, or at 20 hours of age. The 20 hour calves were fasted for 4 hours prior to treatment (24 h). All calves were placed in either a warm (77°F) or a cold (41°F) environment. Jugular blood samples were collected at 15 minute intervals for 3 hours and at hours 4, 5, 6, 8,

10, 12, 14, 18 and 24 after beginning treatments. Body temperature was recorded at each sample time. Following the 60 minute and 12 hour samples, each calf was given 2.5 pints of colostrum from its dam via stomach tube or nipple bottle. Immediately after the 120 minute blood sample, cold treated calves were placed in the warm environment for the remainder of the sampling period. Blood samples were analyzed for metabolic hormones (insulin, cortisol, triiodothyronine [T3], and thyroxine [T4] and metabolites (glucose, lactate, blood urea nitrogen, triglycerides and non-esterified fatty acids).

## RESULTS

Cold treated newborn Brahman calves had lower ($P<.05$) body temperatures than warm treated newborn or 1-day-old Brahman calves from 75 minutes through the 3 hour sampling (Figure 1). The cold newborn Brahman calves began recovery toward normal body temperature upon removal from the cold environment and recovery was complete within 3 hours. Plasma glucose was lower ($P<.0001$) in all newborn Brahman calves than in 1-day-old Brahman calves until the second feeding of colostrum (Figure 2). Newborn Brahman calves had elevated glucose concentrations after each colostrum feeding, with the greatest response observed in the cold treated newborn Brahman calves (Figure 2). No effect of age or temperature treatment was found on plasma lactate or blood urea nitrogen levels. One-day-old Brahman calves had higher ($P<.0002$; Figure 3) plasma triglyceride concentrations than newborn Brahman calves. Higher ($P<.05$) plasma non-esterified fatty acid concentrations were observed in cold treated calves than warm treated calves.

Newborn Brahman calves had higher ($P<.0001$; Figure 4) serum cortisol concentrations than 1-day-old Brahman calves and cold treated calves had greater ($P<.008$) concentrations of serum cortisol than warm treated calves. The highest serum cortisol concentrations ($P<.05$) occurred in cold newborn Brahman calves from 75 minutes through 3 hours (Figure 4) which corresponds with the time of depressed body temperature (Figure 1). Age or temperature treatment did not affect serum triiodothyronine concentrations, although an age x temperature interaction ($P<.02$) was observed. Higher ($P<.002$) serum thyroxine concentrations were found in newborn Brahman calves

than 1-day-old Brahman calves with cold newborn Brahman calves having the most elevated thyroxine concentrations from 135 minutes through 8 hours (Figure 5). There was no effect of sex of calf on body temperature, serum metabolic hormones or circulating metabolites. Birth weights were similar between all calves.

The conclusions from this experiment are that 1-day-old Brahman calves have adequate circulating energy compounds and are competent to maintain body temperatures when chilled. Newborn Brahman calves do not have adequate circulating energy compounds and cannot respond to chilling in a fashion which allows maintenance of body temperatures.

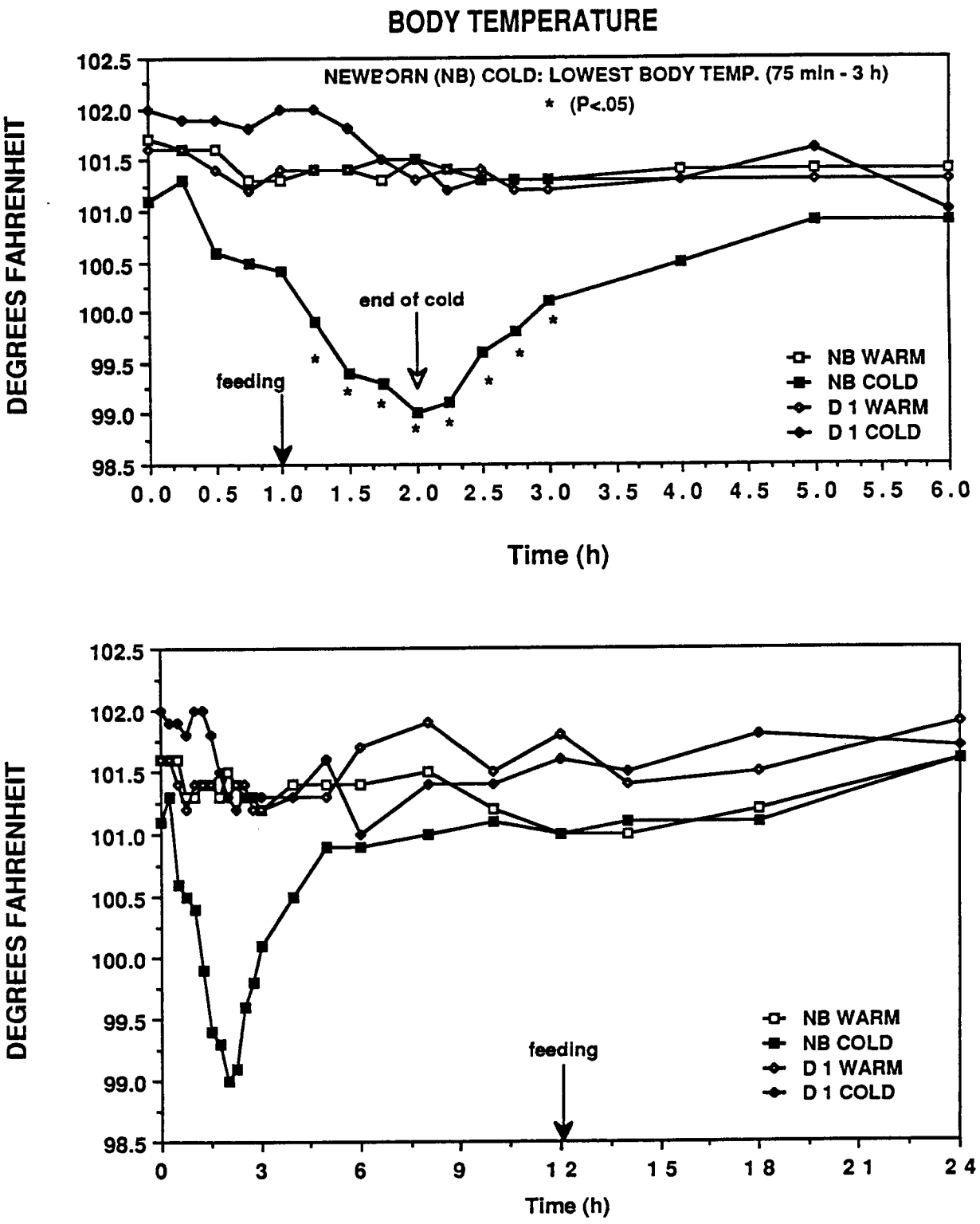
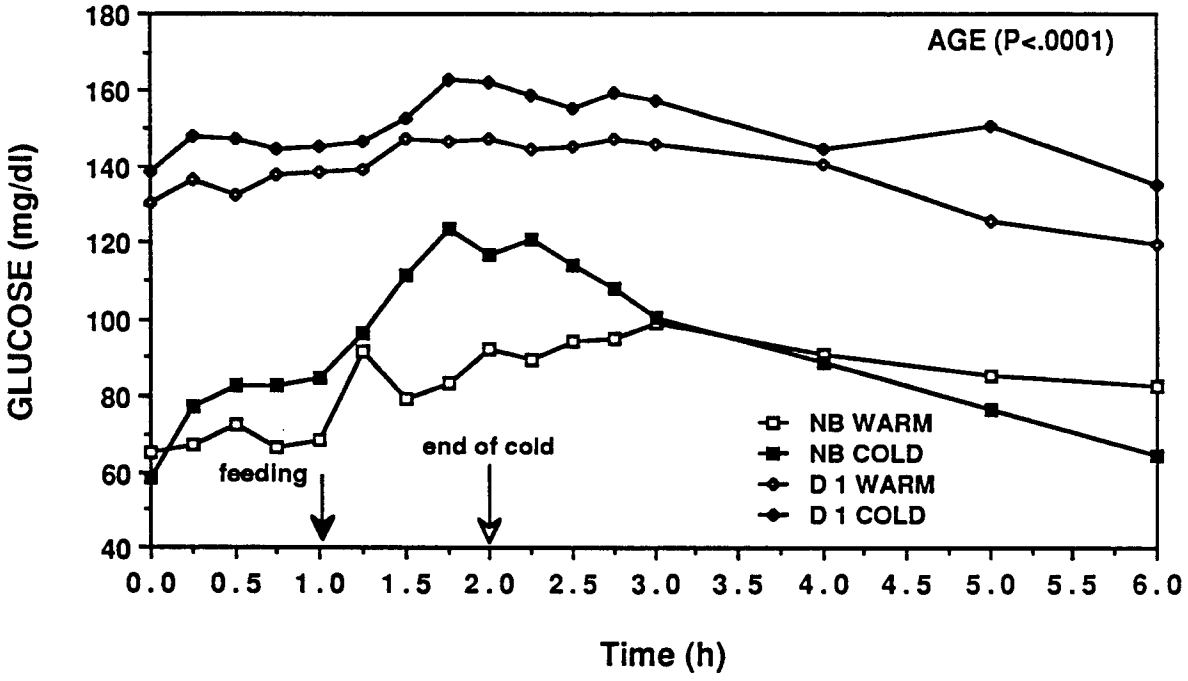



Figure 1. BODY TEMPERATURE OF BRAHMAN CALVES.



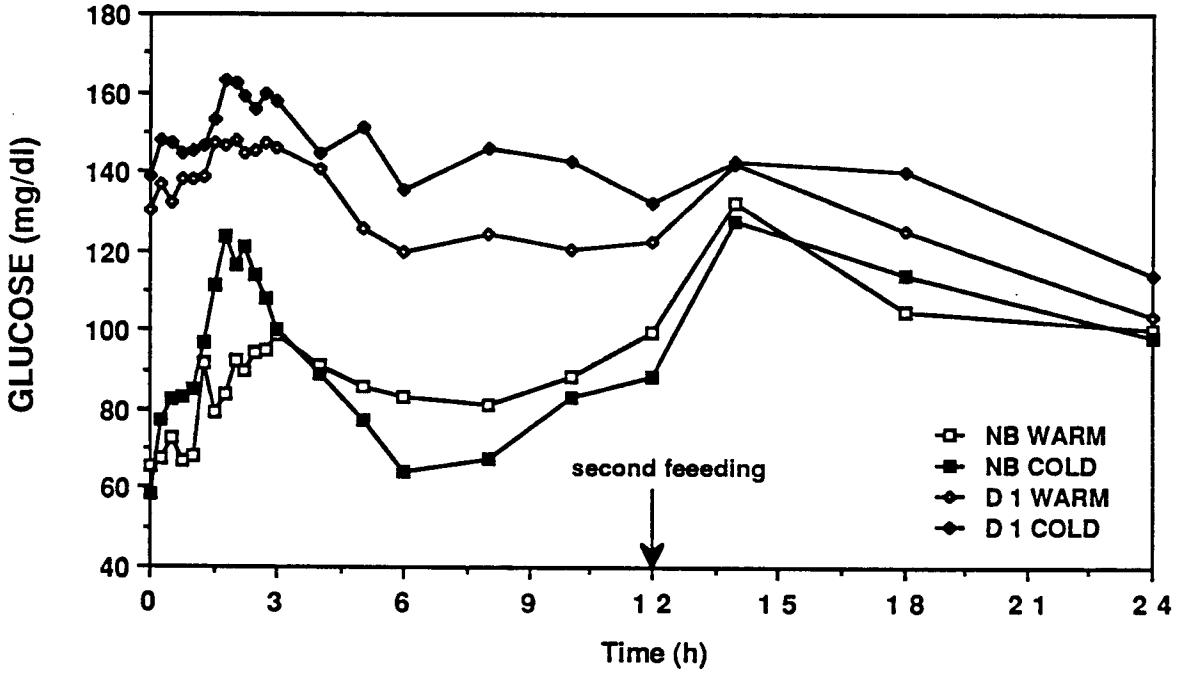




**Figure 2. BLOOD GLUCOSE CONCENTRATION OF BRAHMAN CALVES.**

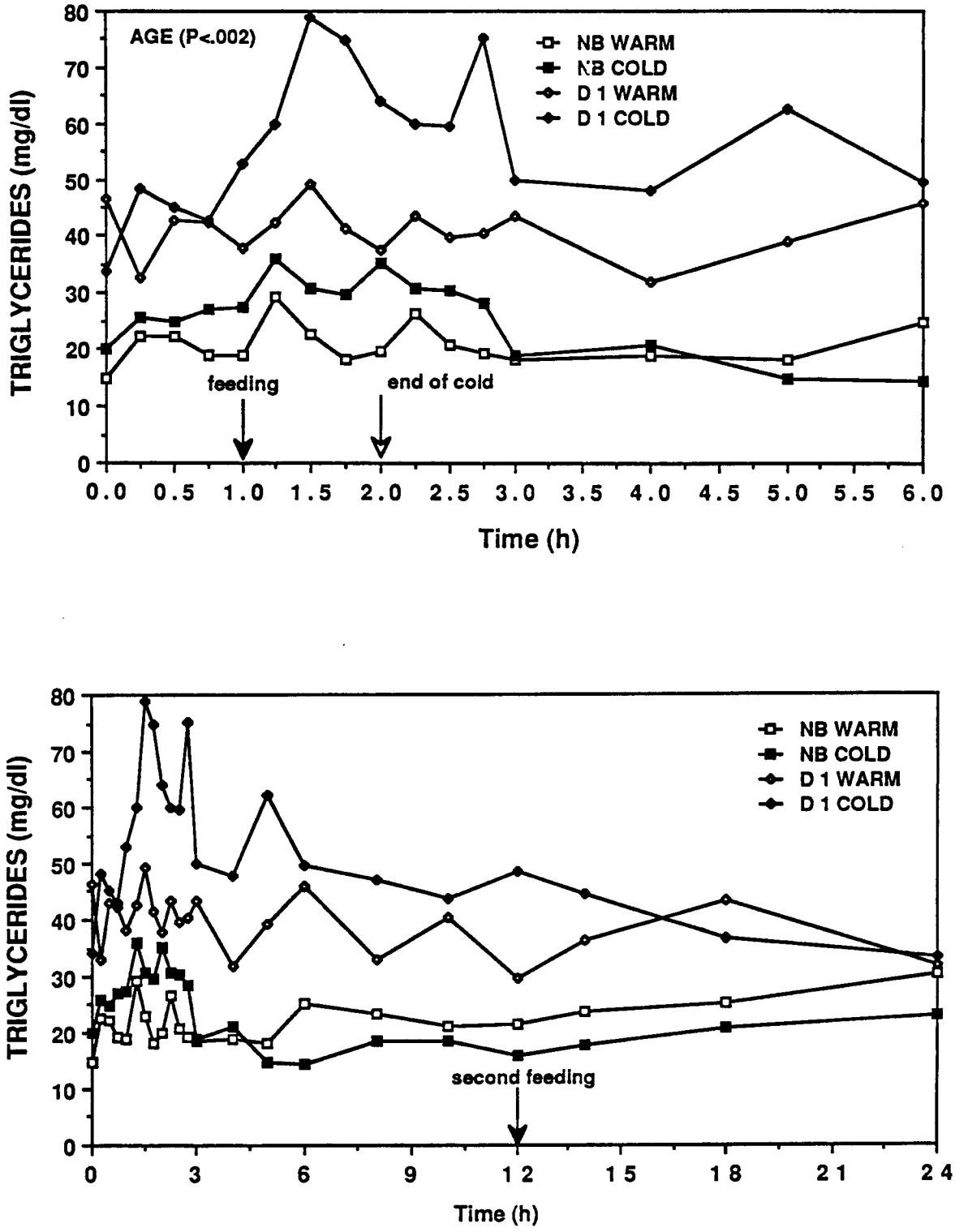



Figure 3. BLOOD TRIGLYCERIDE CONCENTRATION OF BRAHMAN CALVES.

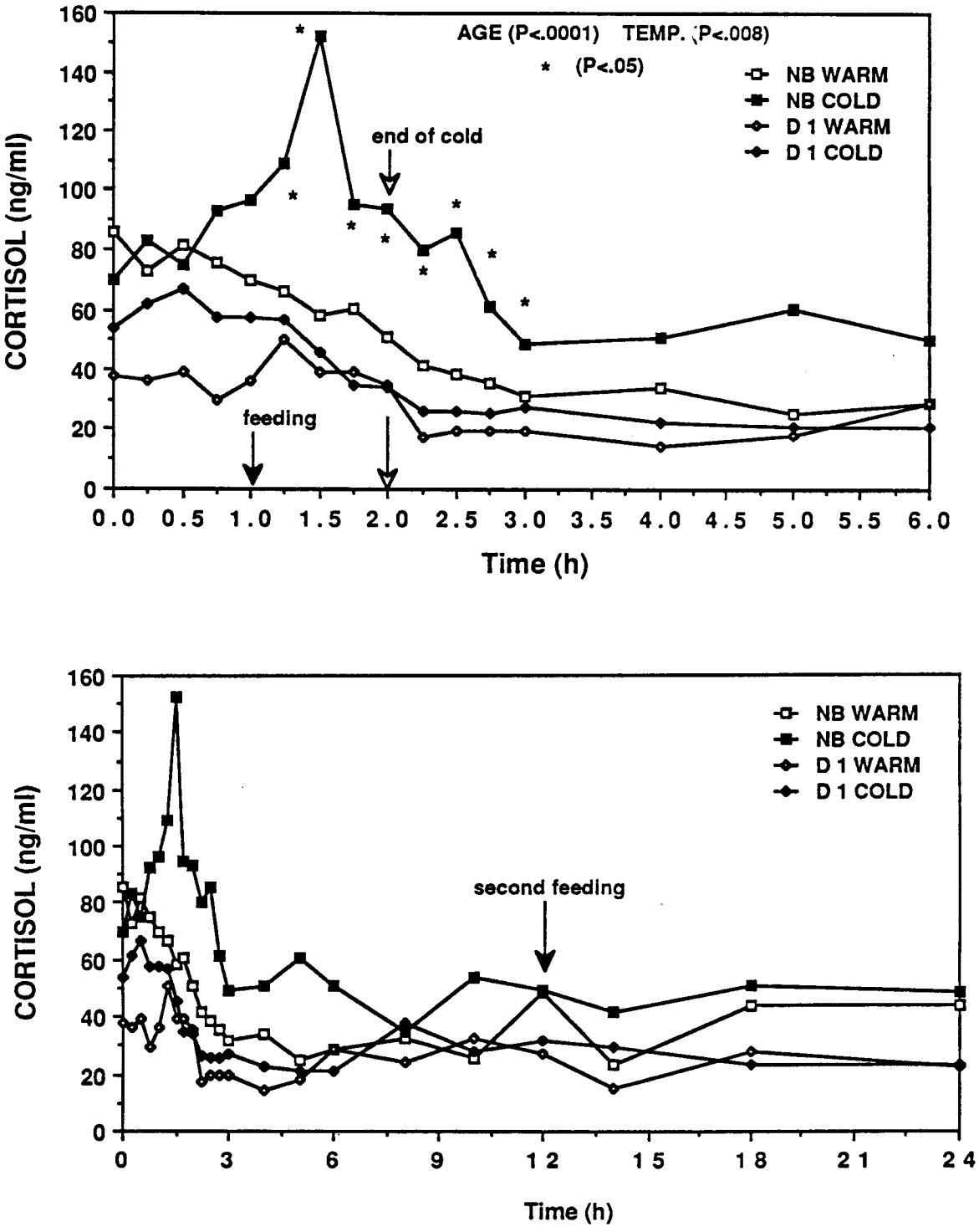
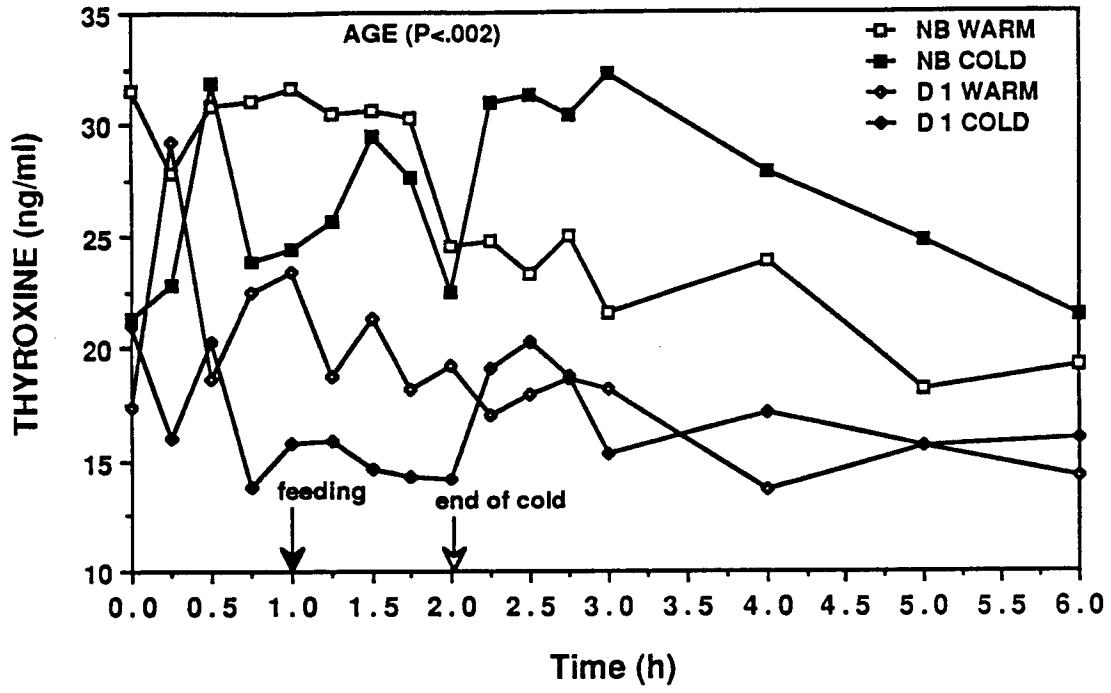



Figure 4. BLOOD CORTISOL CONCENTRATION OF BRAHMAN CALVES.



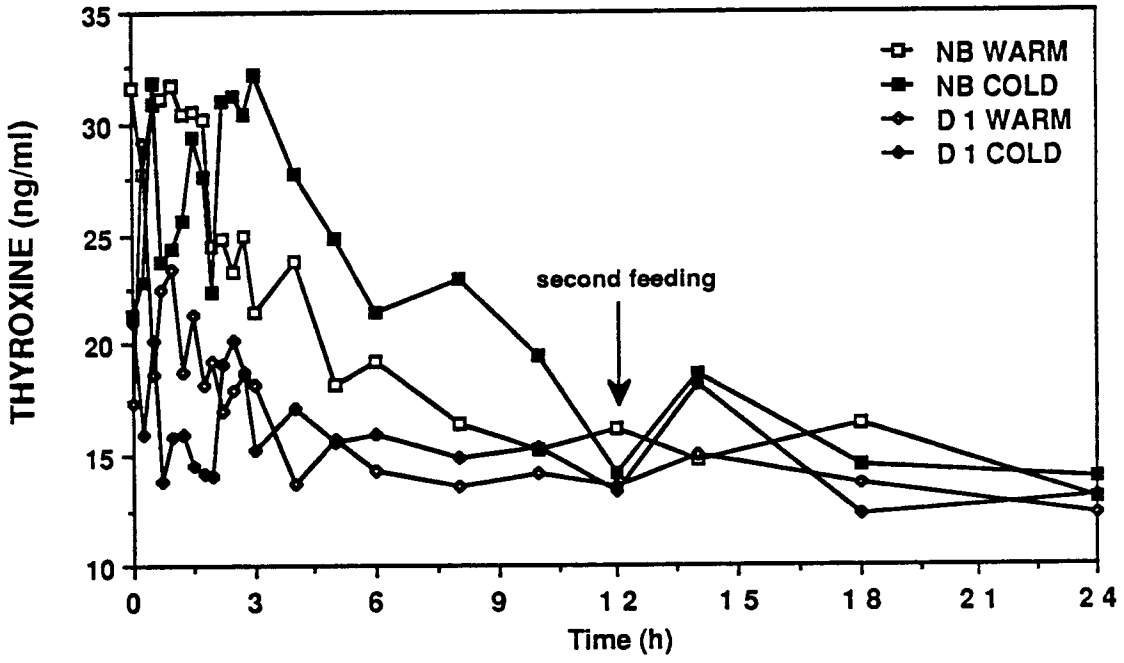




**Figure 5. BLOOD T4 CONCENTRATION OF BRAHMAN CALVES.**