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Evaluating Stress in Calves Weaned at Three Different Ages

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Calves weaned in October (210 days) exhibited less chronic stress, more prolonged endocrine responses, and greater weight gains than calves weaned in August (150 days) and December (270 days).

Summary

Trials were conducted to evaluate the effects of weaning calves at 150, 210 and 270 days of age (i.e. August, October and December, respectively). A total of 75 Angus x MARC II heifers calves were used in this study. Heifers were bled on the day of weaning and again at 2, 7, 14 and 28 days after weaning. Blood was analyzed for differential WBC, cortisol, T_3 *and glucose. Weight changes were recorded. The data suggests October weaned calves (210 days) had both greater blood cortisol and glucose at days 7, 14 and 28 post-weaning and greater weight gains when compared to calves weaned at 150 and 210 days of age.*

Introduction

Cattle, which are animals of habit, become stressed when they experience a novel or painful situation. Weaning can be one such stressful change. Weaning involves not only psychological

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stress due to separation, but also abrupt changes in the calf's environment, nutrition and social structure. Because of these variables, weaning could result in a considerable setback in a calf's performance.

Studies on cattle suggest the physiological effects of separating a calf from its mother may contribute to a performance decrease several days after weaning. Physiological effects may be classified into three general categories; gross clinical signs, blood composition changes and endocrine interposed changes.

The initial response to stress is a release of hormones from the adrenal gland. The adrenal hormone cortisol functions to increase gluconeogenesis resulting in increased blood glucose, decreased glucose uptake by the tissues, decreased protein synthesis and an increased immune-defense system (increase in WBC count).

Triiodothyronine (T_3) responds to stress by calibrating the metabolic state of the animal, which means body heat production is altered, allowing the stressed animal to adapt to the environment. Thus, both rapid defense systems (cortisol) and long-term adaptation mechanism (T_3) are effected by stress.

In this study, cortisol, T_3, glucose, differential WBC and weight changes were analyzed to determine the effects of weaning at 150, 210 and 260 days of age.

Procedure

Animals and management

This research was conducted using 75 Angus x MARC II crossbred heifer calves. All animals were managed at the University of Nebraska, Dalbey-Halleck Farm near Virginia, Nebraska. Calves were randomly allotted to one of three weaning groups based on age (150, 210 and 260 days; August, October and December weaning, respectively). In addition, control groups of non-weaned calves were assigned to August and October weaning groups. At weaning, all calves were separated from their dams and taken to a post-weaning pen with free access to grass hay and water. After three days they were fed corn and a protein supplement to gain 1.25 to 1.5 pounds per day. The non-weaned calves remained with their mother.

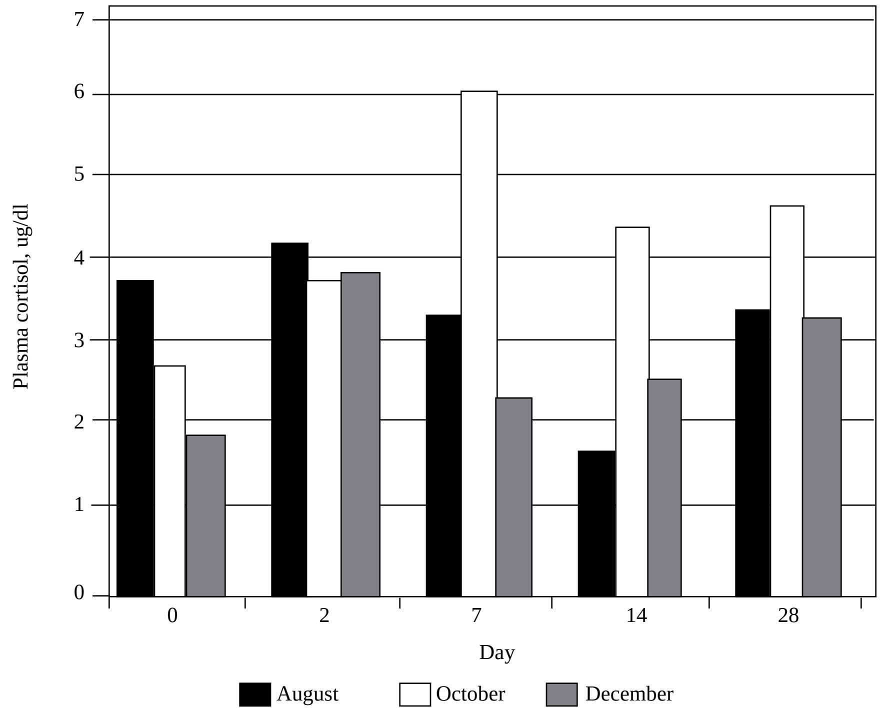

Figure 1. Plasma cortisol means observed in the calves at the day of weaning and at 2, 7, 14 and 28 days after weaning for August, October and December groups.

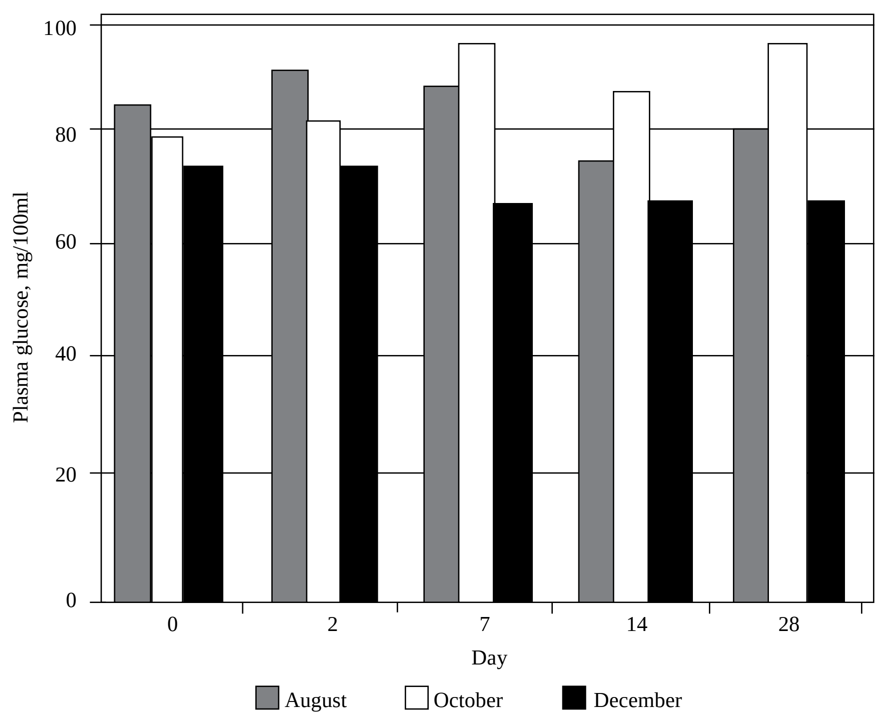

Figure 2. Plasma glucose means observed in the calves at day of weaning and at 2, 7, 14 and 28 days after weaning for August, October and December groups.

Blood sampling

Blood samples were collected via jugular venipuncture on the day of weaning (day 0) and days 2, 7, 14 and 28 after weaning from both weaned and non-weaned calves. Plasma samples were analyzed for T_3 and cortisol, using radioimmunoassay and glucose, and using automated, colorimetric determination (Auto Analyser I). Blood smears were

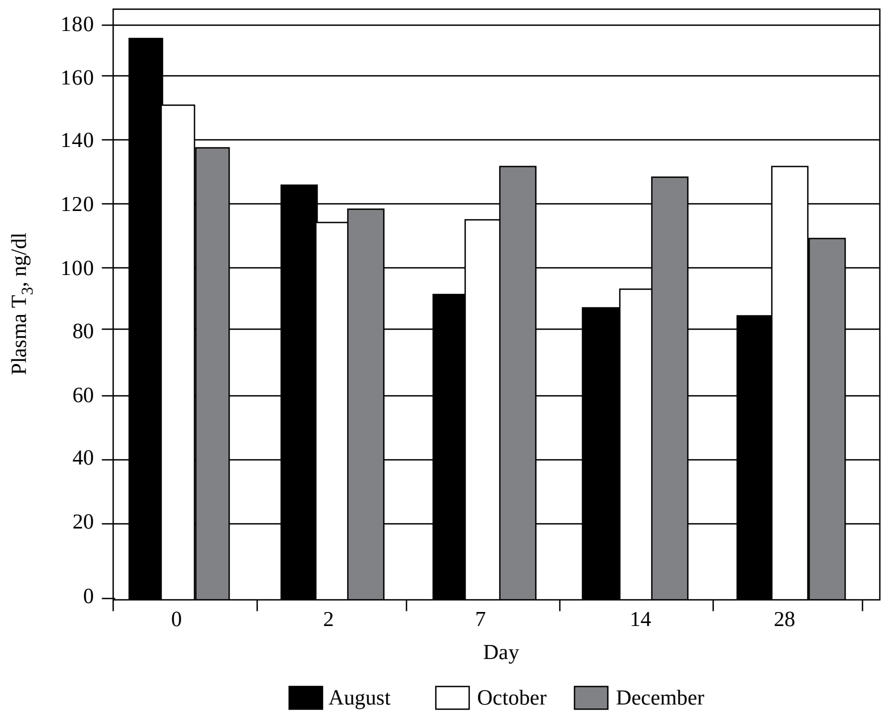

Figure 3. Plasma T_3 means observed in the calves at the day of weaning and at 2, 7, 14 and 28 days after weaning for August, October and December groups.

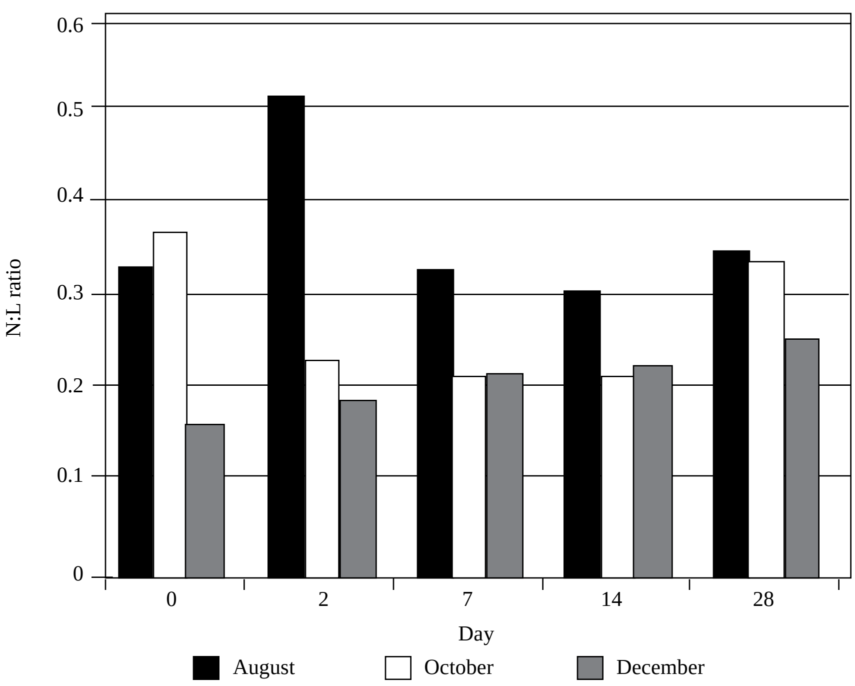

Figure 4. Neutrophil:Lymphocyte ratio means observed in the calves at the day of weaning, and at day 2, 7, 14 and 28 after weaning for August, October and December groups.

made from each sample to determine differential white blood cell counts.

Results and Discussion

Significant differences (P<0.01) existed for most blood parameters due to age of weaning. Mean values for each blood parameter are presented in Figures 1 through 4. Non-weaned calves presented no significant changes in the concentration of the blood parameters analyzed over the 28-day trial. Plasma cortisol increased for October and December weaned calves at day 2 post-weaning (P<0.001), but continued to increase and remain high only in October-weaned calves (P<0.01- Figure 1). Plasma cortisol values decreased at days 7 and 14 for the August weaned calves (P<0.05). Plasma glucose concentration changes were not as dramatic as those of cortisol (Figure 2). Blood glucose concentrations for October calves continued to increase and remain high throughout the post-weaning period, while concentrations for August and most noticeably December weaning decreased.

Concentrations of plasma T_3 were highest in the August and lowest in the December calves at the time of weaning (P<0.05 - Figure 3). Plasma T_3 decreased (P<0.05) in each age group, but were similar at day 2 post-weaning. Thereafter, post-weaning concentrations of T_3 were generally reflective of the environmental temperature during that post-weaning period. Calves weaned in the warm August days maintained the lower T_3; calves weaned in December exhibited higher T_3 concentrations.

Figure 4 presents the data for the Neutrophil: Lymphocyte ratio (WBC count). Calves weaned in August demonstrated the most dramatic increase in N: L ratio at day 2 post-weaning (P<0.05), and continued to maintain the higher ratio throughout the post-weaning period. The October and December weaned calves had similar, but lower, N: L ratio's during the post-weaning period.

Figure 5 illustrates the weight gain of the calves from weaning (day 0) to the completion of the trial (day 28) for each age group, as well as for the control (non-weaned) calves. Mean weight gains were greater (P<0.05) for October (67.5 lb) weaned calves compared to August (52.2 lb - P<0.1) and December (43.7 lb) weaned calves for the first 28 days post-weaning.

We know stress response increases the animals resistance to stress. The overall effects of stress can be favorable or not, depending on the animal's perceptions. In an acute stage, the stress response is, in general, beneficial. On

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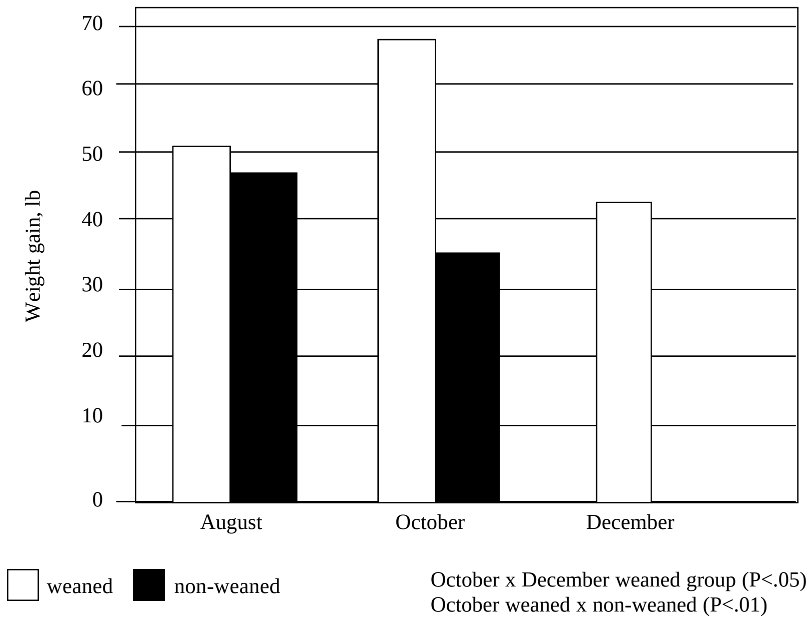

Figure 5. Changes in weight observed in weaned and non-weaned calves in August, October and December groups.

the other hand, if the stress is too intense, it may be harmful to the calves. In this study, calves weaned in October (210 days) had higher concentrations of cortisol and glucose on days 7, 14 and 28 after the weaning; however weight gain was significantly greater in this group of calves compared to calves weaned in August (150 days) and December (270 days). Therefore, for October-weaned calves, the stress was not severe enough to decrease animal performance and actually induced a favorable response increasing their weight gains as compared with the other two groups.

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