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EFFECT OF *IN UTERO* MATERNAL STRESS ON THE CALF'S RESPONSE TO LATER STRESSORS

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Background. It is well established that when livestock are stressed their immune function is impaired and they are, therefore, more apt to succumb to disease. However, stress during infancy has been shown to decrease emotional behavior and(or) increase the ability to cope with stressful situations in maturity for a variety of species. When the dam is stressed, the release of cortisol into her circulation readily crosses the placental membrane. This cortisol may affect the fetus by fine tuning the fetal brain to enable to cope more efficiently with stress in adulthood. The following study is being conducted to determine if *in utero* exposure to high levels of cortisol can enhance the ability of the calf to cope with stress in maturity.

Research Findings. Experiment 1 was conducted to determine how much cortisol is released into the maternal circulation in response to different doses of adrenocorticotropic hormone (ACTH). Twenty-five pregnant Brahman cows were given either: 0 (saline), 1.25, .25, .5 or 1 IU ACTH per kg body weight. Two base blood samples were taken followed by nine blood samples collected over 4.5 hours, after the ACTH injection. All doses of ACTH caused similar peak plasma cortisol concentrations (Figure 1); however, cows who received lower doses of ACTH had cortisol concentrations that returned to baseline earlier (P<.0002) than the cows that received a higher dose of ACTH. Experiment 2 was designed to create high concentrations of cortisol in maternal blood to determine if the cortisol would affect the developing calf. Seventy-seven cows were either transported 30 miles, injected with 1 IU ACTH per kg body weight, or acted as controls. Blood samples and body weight were taken both before and after treatments to calculate percent shrink and plasma cortisol concentrations. The cows that were transported lost more (P<.005) weight than either the ACTH or the control cows (Table 1). Cows injected with ACTH had the highest (P<.005) cortisol concentrations, followed by transport cows and then control cows (Table 1).

Transportation and ACTH treatments successfully established high concentrations of cortisol in the maternal blood and further experiments will continue. An antigen will be injected into 7 calves from each treatment at the start of weaning and blood samples will be taken for two weeks to measure antibody production to the antigen. Those calves that are better able to cope with weaning will have a quicker and more robust antibody response. Behavioral indicators of stress such as vocalizations, distance traveled, and time spent eating will also be quantified immediately after weaning.

Application. Cattle are regularly subjected to such unavoidable stressors as transportation and restraint. If a method of making cattle more resistant, or less reactive, to stressors can be developed, then losses can be dramatically decreased. With a decrease in stress, production will be improved (e.g., growth rate, conception rate).

Table 1. Percent weight loss and cortisol response at 5 different days of gestation.

	Day of Gestation				
Group	60	80	100	120	140
	Percent Shrinkage				
Control	2.0[a]	1.2[a]	0.7[a]	1.0[a]	0.4[a]
ACTH	2.1[a]	1.7[a]	1.1[a]	0.6[a]	0.7[a]
Transport	3.9[b]	3.6[b]	3.0[b]	2.3[b]	2.3[b]
	Cortisol Response Above Baseline (ng/ml)				
Control	2[a]	2[a]	1[a]	2[a]	1[a]
ACTH	43[b]	41[b]	44[b]	35[b]	41[b]
Transport	33[c]	33[c]	25[c]	24[c]	25[c]

[a,b,c]Values in columns of the parameter with different superscripts differ (P<.005).

Figure 1. Cortisol response to exogenous ACTH. The area created by the curve for each dose is different for each subsequent dose (P<.0002).