

Effects of Stress from Predation in Gestating Ewes—A Case Study

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In the early morning hours of February 26, 2015, two stray dogs entered the east sheep unit of the New Mexico State University (NMSU) campus farm and attacked the flock. Of the 48 ewes housed in this unit, four were killed on site and five later died or were euthanized due to their injuries. During the chaos of the morning, the faculty of the Departments of Animal and Range Sciences and Extension Animal Sciences and Natural Resources quickly decided that something important could be learned from this tragic event. It was a rare opportunity for researchers to document the physiological effects of predation on livestock so shortly after a real-world predatory attack.

Introduction

Predation of livestock can result in substantial economic loss due to death (Ashcroft et al., 2009). What is not clearly understood are the production losses due to stress of animals chronically exposed to predation. Cortisol is an adrenal hormone correlated with a physiological



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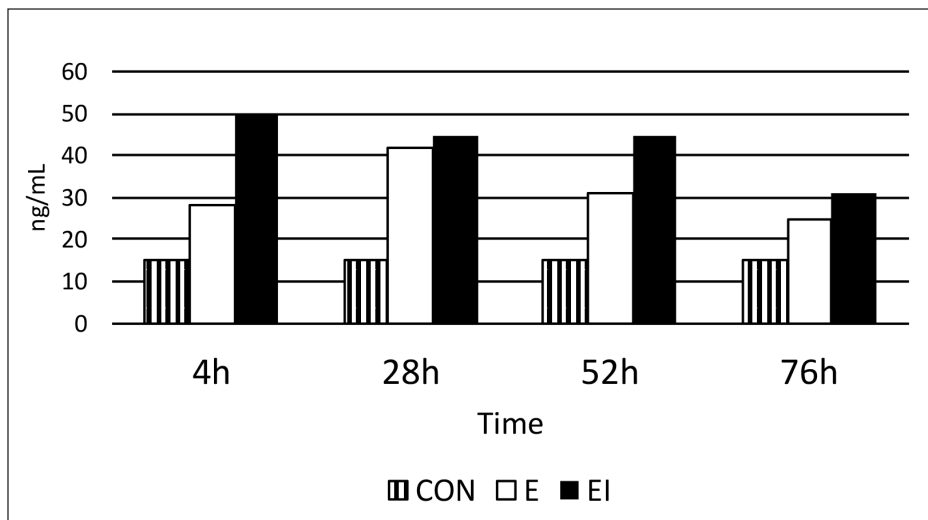


Figure 1. Circulating blood cortisol (P < .05).

response to stress (Hough et al., 2015). Sustained elevated cortisol levels can have a negative effect on circulating progesterone (hormone required for pregnancy maintenance) and glucose metabolism in pregnant animals (Keller-Wood et al., 2014). Currently, very little is known regarding actual pregnancy loss or dystocia (birthing difficulty) related to prolonged exposure to stress in a production setting.

Methods

The objective of this study was to measure stress parameters in pregnant ewes that were either injured by or exposed to a dog attack or not exposed. Though this study was impromptu in nature, the project was approved by the Institutional Animal Care and Use Committee before going forward. To better understand the impacts of predation on surviving animals, blood was collected via jugular venipuncture at 4, 28, 52, and 76 hours post-attack. Furthermore, a subset of ewes located at the west sheep unit, not exposed to the attack, was only bled at hour 4. This group served as our control group (CON). Ewes were classified into three treatments based on injury status and location: CON = no exposure, E = exposed to dog attack with no visible injuries, and EI = exposed to dog attack with visible injury. For the ewes involved in the dog attack, lambing observations were also made and categorized by level of difficulty, based

on a 3-point scale: 0 = no complications, 1 = some complications, and 2 = severe complications.

Results

Four hours after the attack, the EI ewes had greater cortisol levels than both CON and E. At 28 hours post-attack, both E and EI had greater circulating cortisol than CON. At 76 hours, the EI ewes still had higher levels of cortisol than CON; however, CON and E cortisol levels were similar (Figure 1).

These data demonstrate increased circulating concentrations of cortisol in EI ewes 4 hours after attack, whereas blood cortisol concentrations were not statistically greater than CON in the group that was merely exposed until the 28-hour sampling. The attack had no effect on progesterone (Figure 2). By hour 76, however, progesterone levels were lower in both E and EI. This response was likely due to the fact that the east sheep unit ewes were closer to lambing than the control group from the west sheep unit.

Although the dog attack occurred approximately 2 weeks prior to lambing, there was also no statistical difference in the number of ewes experiencing dystocia or the level of dystocia.

Conclusion

This was a unique opportunity to measure cortisol and progesterone in pregnant ewes so shortly after

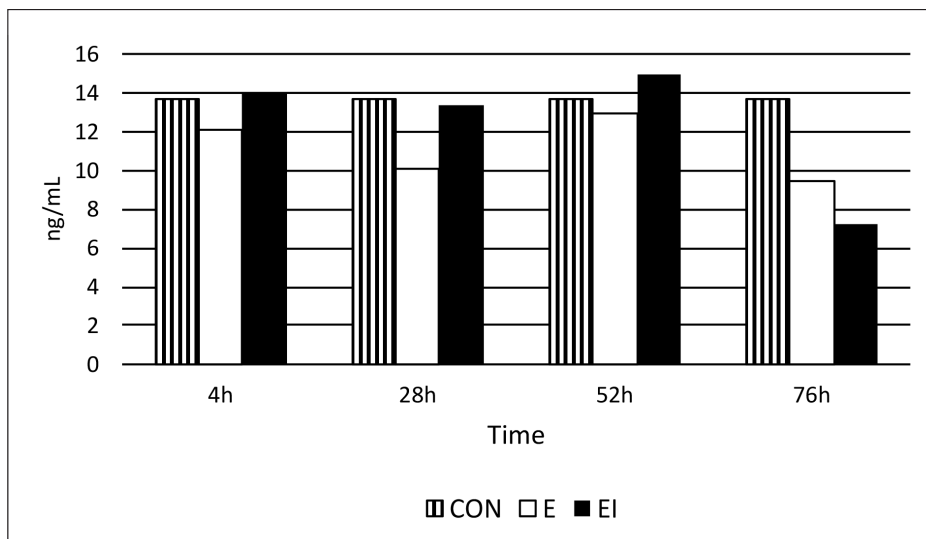


Figure 2. Circulating progesterone.

a violent attack by predators. As expected, circulating cortisol in EI ewes peaked 4 hours after the attack. Interestingly, cortisol levels did not peak until 28 hours post-attack in E ewes, indicating that these ewes may have been on high alert. Though cortisol levels began to decline in both E and EI ewes by hour 76, levels were still 10–15 ng/mL higher than CON.

NMSU experienced a loss of almost 20% of their production flock located on the main campus due to the attack of two dogs in February 2015. This group of ewes were within 2 weeks of lambing. Though not statistically significant, differences were seen in dystocia values, and student observation noted a decrease in milk production, more downer ewes, and a general increase in lambing issues compared to previous years.

Other studies have demonstrated significant increases in fetal and maternal mortality when animals are chronically exposed to elevated levels of cortisol (Keller-Woods et. al, 2014). It should be noted that the greatest circulating levels in that study were 18.5 ng/mL, sustained from day 115 of gestation to lambing. In our study, both the EI and E ewes continued to have on average 30 ng/mL circulating cortisol, up to 76 hours post-attack. These data suggest prolonged exposure to an intense predatory environment could result in indirect losses of production.

References

- Ashcroft, N.K., C.P. Mathis, S.T. Smallidge, J.M. Fowler, and T.T. Baker. 2009. Reestablishment of the Mexican gray wolf: The economics of depredation [Report 80]. Las Cruces: New Mexico State University, Range Improvement Task Force.
- Hough, D., K. Storbeck, S.W. Cloete, A.C. Swart, and P. Swart. 2015. Relative contribution of P450c17 towards the acute cortisol response: Lessons from sheep and goats. *Molecular and Cellular Endocrinology*, 408, 107–113.
- Keller-Wood, M., X. Feng, C.E. Wood, E. Richards, R.V. Anthony, G.E. Dahl, and S. Tao. 2014. Elevated maternal cortisol leads to relative maternal hyperglycemia and increased stillbirth in ovine pregnancy. *American Journal of Physiology – Regulatory, Integrative and Comparative Physiology*, 307, R405–R413.



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