IDENTIFYING POTENTIAL ENVIRONMENTAL AND BEHAVIORAL STRESSORS THROUGH BLOOD CORTISOL IN THE BLACK RHINOCEROS *(DICEROS BICORNIS)*

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ABSTRACT

Environmental and behavioral stressors have potentially negative effects on the captive management of the black rhinoceros. Overcrowding, pair incompatibility, and poor nutrition are just a few of the factors facing this species in a zoological setting. The black rhino is considered to be the most nervous and stress-susceptible of the 5 rhino species (Carlstead, 1999). There are several disease syndromes that are specific to the black rhinoceros including, hemolytic anemia, oral and skin lesions, IHVS, encephalomalacia, iron storage, and fungal pneumonia.

At the Denver Zoo, we have experienced each one of these syndromes, along with mortalities in our black rhino population. Stress has been implicated as one of the causal factors in these specific syndromes in the black rhino (Fouraker, Wagener, 1996). A research project was developed to identify and evaluate potential stressors that may initiate some disease factors, by comparing behavioral observations to blood cortisol levels before and after predefined events.

METHODS

Observations of each animal's reactions to different situations over many years were used to identify baseline data for focal sampling. These observations were then used to test the hypothesis that specific events might cause stress levels to increase in the animals. Potential stress events identified for evaluation were two adult males kept in close proximity to one another, the appearance of the veterinarian for medical management, and finally high exposure to the public. A behavioral checklist was developed to record behaviors before, during, and after each stressor test was performed. A scale was implemented to score the behavioral state of the animal during the collection process, from 1 (very calm) to 5 (very agitated). Baseline cortical values were determined by sampling at two set times during the day over the course of three days. Other data collected, included weather conditions and crowd size throughout the testing period. The method for obtaining the cortisol was through blood. The animals in this study had been trained through operant conditioning for the collection of blood via ear or caudal leg vein. Blood collection was performed on a regular basis, and was therefore a reliable means of sampling for cortisol. Blood samples, rectal temperatures, and time were recorded before the test occurred and 20 minutes after the event. Each event was recorded on video for accurate documentation of behavior before, during, and after the predefined event.

DISCUSSION

Stress can be defined as an event that produces an adaptive response. Animals respond to these challenges through various mechanisms including physiologically, biochemically, immunologically, and behaviorally (Tuck, 2000). Stress responses include increased heart rate, increased blood pressure, and secretion of the glucocorticoid hormone cortisol. The secretion of cortisol is controlled by the hypothalamus. The stressor or event transfers information in the chemical form of (corticotrophin) CRH releasing hormone. CRH travels to the pituitary gland, which releases (adrenocorticotrophic) ACTH hormone. This is circulated to the adrenal cortex where it stimulates the production of cortisol (Tuck, 2000). Six to fifteen percent of the cortisol is unbound and biologically active. It can be found in blood, sweat, tears, and saliva (Kirshbaum, 2000). Increase in cortisol levels effects glucose metabolism, and suppresses the immune system. It is known that stress can suppress reproduction, impair immune function, and result in aberrant behaviors (Carlstead, 2000).

Data collected thus far includes sixty-five cortisol samples from eight predefined stressor events. Preliminary data includes baseline cortisol levels for both male rhinos. Normal circadian changes in cortisol levels will peak in the early morning hours, and then gradually decline from late morning to midnight where they start to slightly increase towards the morning levels (Kirshbaum, Laudenslager 2000). Preliminary results on this project show a marked difference in each individual's reaction to certain stressors through three predefined events. Future goals of this project are; expanding data by collection of more biomaterials and assessment of behavioral and physiological parameters to accurately evaluate stressors in the captive environment.

LITERATURE CITED

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