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PSX-2 **Investigation of body condition and metabolic health and their role in the reproductive success of managed southern white rhinoceros.**

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Abstract: Challenges associated with reproduction in managed female southern white rhinoceros include acyclicity, difficulty in producing calves, and uterine pathologies. Excessive body fat also may negatively affect fertility in white rhinos; however, research in this area is limited. Our objective was to evaluate female white rhino (n=26) reproductive status associations with serum biomarkers of body condition and metabolic status, body condition score (BCS), and girth circumference. We hypothesized that over-conditioned females would have lower reproductive success, defined by not producing a live calf in the preceding five years despite access to a proven male. Insulin is a validated marker of metabolic status in white rhinos, but leptin and adiponectin, markers of body condition, have not been previously validated. We found significant positive associations between serum adiponectin and BCS and between serum leptin and body weight or heart girth (Spearman's correlation r >0.2, P< 0.05). Additionally, insulin-to-glucose ratio was significantly positively correlated to leptin, BCS, weight, heart girth, and umbilical girth (r >0.2, P< 0.05). Further analysis using mixed linear models found no relationship between adiponectin and measures of body condition (P >0.05),

but trends for leptin were positively associated with BCS (P=0.10). Although adiponectin and leptin data were promising for use as indicators of body condition in rhinos, the study population generally was skewed towards over-conditioned animals (76% >4/5 BCS). Clear associations between leptin and reproductive success were not evident; however, reproductively successful females had significantly lower BCS (Mann-Whitney P< 0.05), heart girth, weight, adiponectin, and insulin-to-glucose ratio (Mixed Linear Models P< 0.05) relative to unsuccessful females, supporting our hypothesis. Moreover, incorporating a size-corrective measure, such as height, strengthened the observed relationship between heart girth and reproductive success. This study suggests that non-breeding females were over-conditioned and had reduced insulin sensitivity. It also provides valuable insights into developing tools to evaluate body condition and metabolic health in white rhinoceroses, highlighting potential associations with reproduction in managed southern white rhinos. This project was funded by the Institute of Museum and Library Services National Leadership Grant #MG-249011-OMS-21.

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