
VETERINARY OBSERVATIONS OF WILD GREATER ONE-HORNED RHINOCEROS (*Rhinoceros unicornis*) IN THE ROYAL CHITWAN NATIONAL PARK: IMPLICATIONS FOR CAPTIVE MANAGEMENT

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Abstract

Recent health surveys of greater one-horned rhinoceros (*Rhinoceros unicornis*) held in zoological facilities in both North America and Europe highlight the prevalence of a significant medical condition, chronic pododermatitis (CP). CP, characterized by nail overgrowth, non-healing fissures and ulcers located between the sole of the central toe and the adjacent pad and by pad overgrowth, bruising and chronic infection, occurs predominantly in adult male rhinos. The condition has not been recorded in wild animals. This paper describes a study that has utilized field observations of wild *R. unicornis* in the Royal Chitwan National Park (RCNP), Nepal to further elucidate the causes of CP as they relate to captive management. Our observations indicate that unusually large body size of captive animals, particularly males, and suboptimal husbandry are likely to be the most influential etiologic factors in the development of CP. Treatment of advanced CP has been shown to be largely ineffective¹ and appropriate changes in our approach to the husbandry and management of this species in captivity are essential if we are to control or prevent this debilitating disease.

Introduction

As zoo veterinarians and animal managers we recognize our responsibility to ensure the best possible healthcare, housing, and husbandry conditions for the animals in our charge. In order to maximize sustainability of captive endangered species programs, improved knowledge of behavior, anatomy, physiology, nutrition and general health in normal individuals is desirable. In the authors' experience, the most effective way of accumulating this knowledge base is through the establishment of professional relationships with animal managers in the field, participation in *in situ* research programs and observation of the physiologic and anatomic features of free-ranging and recently captured wild animals.

The RCNP is located in south-central Nepal at 120-200 m above sea level and occupies an area of 932 km². A recently established buffer zone provides an additional 750 km². In 2002 the *R. unicornis* population in the park and surrounding area was estimated to be 544 animals. Eighty-seven animals have been captured from this park and translocated to other protected reserves in

western Nepal since 1986.^{2,4} The population of *R. unicornis* in RCNP is generally well protected, and has been comprehensively studied over the past 30 yr.

Due to thermoregulatory and nutritional requirements, the distribution of wild *R. unicornis* in RCNP tends to be limited to narrow strips of riverine habitat characterized by alluvial *Saccharum spontaneum* grassland, significant silt deposits and soft, sandy soils with a year-round average moisture content of 30-40%.⁴ Home ranges tend to be small (3.4 – 4.3 km²) and foraging on hard, rocky ground tends to be limited by the presence of non-palatable ‘sal’ forest (*Shorea robusta*), a habitat not considered to be suitable for grazing rhino.⁴ Animals have been frequently observed to utilize mud wallows and pools apparently as a means of thermoregulation. Wallowing frequency increases during periods of high humidity. It has been demonstrated that the extent and duration of wallowing correlates strongly with vapor pressure density, precipitation and mean maximum monthly temperature.⁴ Male dominance appears to be primarily determined by incisor length and intra-specific aggression and sparring is frequent, severe and occasionally fatal.⁴ Based on field observation and examination of weight records of animals captured for translocation, substantial size dimorphism between sexes is not seen in wild *R. unicornis*.

Conversely, captive male *R. unicornis* in North American and European zoos may be up to 1,500 kg heavier and 25 cm taller (shoulder height) than females.^{3,4,9} Primary flooring substrates tend to be concrete and access to pools and wallows is limited in most zoological facilities, particularly during the winter. Males tend to be maintained separately, especially once they reach maturity (6+ yr), have few opportunities for exercise and are fed diets high in energy and protein content.^{3,10} Growth rates are rapid and males frequently attain a massive body weight by an early age. For example, an adult male *R. unicornis* weighing 3,800 kg was recently transferred between zoological facilities in Europe. At another facility a 2-yr-old male weighed 1,500 kg. In contrast, the body weight of most adult males captured in RCNP seldom exceeds 2,000 kg. Males born in captivity may become much larger than captive-born females after only 4 yr; in contrast, 4-yr-old males in the wild are always substantially smaller than adult females.⁴ It has been observed that severe lesions of CP are primarily noted in adult animals.⁸⁻¹⁰

Observations to Date

Multiple etiologies and pathogenesis of CP as well as preventive, therapeutic and management options have been proposed.^{1,5,10} However, in order to better understand the specific changes occurring in the feet of affected *R. unicornis*, and to determine why adult males are predominantly affected, it is critical to gain a better understanding of what constitutes ‘normal’. Observation of wild *R. unicornis* in RCNP before, during and after capture/translocation,^{2,4,7} in conjunction with examination of relevant scientific literature and evaluation of historic data, has provided the authors an opportunity to assess size, condition and health status and visually examine and in some cases, measure, various parameters of foot anatomy from more than 30 individuals. This information has been compared to our observations of captive animals.

All adult rhinos examined in RCNP appear to exhibit similar podiatric features: each hoof (toe nail) has an oval to semi-circular shape; the central toe tends to be larger and longer with a more pronounced semi-circular shape than the medial and lateral toes; the palmar/plantar aspect of the sole of the central toe merges with the structures of the foot pad while the lateral and medial hooves remain more mobile with a more distinct dorsal edge and obvious inter-digital separation; the horn wall of all toes appears to be long, dense and structurally very hard and forms an elevated 'rim' distinct from the sole, which tends to be markedly concave; the foot pad is roughened and hard with multiple superficial cracks and fissures present in the horny tissue and the hard horn wall 'rim' serves as the major weight-bearing surface of the foot during ambulation. As a result, these animals have been classified as "toe walkers."¹⁰

The majority of captive *R. unicornis* feet examined in zoos in North America and Europe exhibit significantly different anatomic characteristics than those noted in their wild counterparts: thin, smooth and flattened footpads, pale coloration with frequent cracks, fissures and hematoma; short horn wall with indistinct dorsal edges; toes indistinct from the sole; soles flat (no longer concave) with even transition to the adjacent pad and hoof walls (particularly lateral toes) which are frequently abraded and have a pale colored, thin, flattened wall structure. These animals are classified as "pad walkers."¹⁰ Adult *R. unicornis* suffering from CP also exhibit nail overgrowth, non-healing fissures and ulcers located between the sole of the central toe and the adjacent pad and pad overgrowth, bruising and chronic infection.¹

Hypothesis and Discussion

Although there are exceptions, adult male and female *R. unicornis* tend to be of similar body size in the wild. Animals forage and maintain small home ranges in areas limited by their proximity to rivers. Local terrain is characterized by moist, soft, sandy substrates. Consistent with a dominance hierarchy, mature males interact with each other frequently, defending their home ranges vigorously and seeking out breeding opportunities. Dominance appears to be related to mandibular incisor length. (It is hypothesized that the size and condition of the tusks in breeding age *R. unicornis* help determine dominance, access to estrus females, and ultimately reproductive success.⁴) In captivity where sedentary young males receive large quantities of nutritious feed from an early age, extremely rapid growth rates seem to occur. These animals are protected from frequent intra-species aggression, are seldom exercised and are generally housed on concrete or a similar unforgiving substrate allowing abrasive damage to occur to the toes and feet, often leading to CP. This is likely to occur more frequently in males because they get comparatively much larger and heavier than similarly raised females. Infrequent access to ponds or wallows throughout the year, particularly during the winter months, limits thermoregulatory control, likely encourages skin desiccation and cracking and further exacerbates the traumatic effects of prolonged weight bearing on joints and feet.

Chronic pododermatitis is a severe, difficult to control but ultimately preventable disease of *R. unicornis* which has a very high incidence in the captive population. The husbandry implications for captive rhino managers and veterinarians are significant and readers are referred to the EEP 2002 *R. unicornis* Husbandry Manual where many of these concerns are addressed.⁶ In light of

extensive field observation and our experiences with maintaining this species in captivity, we recommend serious consideration of the following when developing management plans, preventive health protocols and new facilities:

- Dietary restriction to limit rapid growth, massive body size and obesity especially in young males.
- Flexible, shock-absorbent and non-abrasive flooring. Avoid concrete or sand as a primary surface, utilize rubberized/urethane surfaces or alternative substrates such as wood chips or clay-soils.
- Year-round access to a pond or mud wallow.

In light of the severity of chronic pododermatitis in this species and the apparent link to husbandry practices, it is important we remain aware of our management responsibilities when recommending importation of wild-caught animals to augment the captive population.

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