
MAINTANENCE OF WILD BORN WHITE RHINOCEROS (*Ceratotherium simum simum*) ON FORAGE-ONLY DIETS IN CAPTIVITY

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Abstract

Introduction

White rhinoceros are generally classified as hind-gut grazers. Wild diets typically consist of grasses with some low lying vegetation occasionally taken. In captivity, it is common to supplement commercially available hay with a pelleted concentrate. While generally hardy animals once acclimated to captivity, the lack of reproductive success prompted the staff at Busch Gardens Tampa Bay (BGT) to start investigating the possible role of nutrition in the lack of the F1 generation of white rhinoceros to breed successfully in captivity.

Methods and Materials

In May 2001, 1.2 white rhinoceros estimated at 5 yr of age, arrived at Busch Gardens Tampa Bay (BGT) from the Kruger National Park. After their capture they were held in bomas and adjusted to a diet of local grass hay for 6 mo prior to their arrival in Busch Gardens. Upon arrival to Florida they were housed together in a sand pen and fed a combination of timothy and alfalfa hays. The rhinoceros were trained within a few months for voluntary blood draws from the caudal surface of the ear and to stand on a platform for weights. A 5-day intake study was conducted in March 2003 prior to their relocation to a 15-acre mixed species display. Serum was stored and retrospectively analyzed for vitamin and mineral levels. Routine serum blood chemistries and complete blood cell counts were also examined periodically. Once moved, obtaining weights became routine. Two pregnancies have been confirmed and monitored. Milk was collected but was not analyzed for nutritional content as of this writing. A growth curve for the offspring has been established.

Results

The results of the intake study are summarized in Table 1. The three rhinoceros were treated as one individual and the totals summed per the protocol. Table 2 shows the weights of the adult rhinoceros. The first weight in October 2000 was at capture in Kruger National Park. Figure 1 shows the growth curve of the first calf born to female 61409. This calf averaged approximately

1.5 kg per day growth during the first year of life. Table 3 shows the most recent vitamin and mineral serum analysis of the four rhinoceros on the forage-only diet.

Discussion

Alfalfa hay was limit fed and the rhinoceros always consumed it all. It was fed at the same time and is a preferred item over the timothy hay. The intake of 1.2% should be a good estimate as the rhinoceros still had plenty of palatable hay to consume if they chose. This figure represents a combination of timothy and alfalfa hay intake. Foose reports separate intake for grass hay (1.03%) and alfalfa hay (1.19%).³ Feeding 100% alfalfa is not advisable and was not looked at in this project. The combination hays fed here led to a similar intake of alfalfa by Foose and avoided the potential complications of feeding alfalfa exclusively to herbivores. The weight gains by the adults appeared reasonable and their overall condition is excellent (M. Hoftmyer, 2006. pers. comm.). The growth curve of the young female calf, 62638, shows a steady weight gain. This provides good evidence that the energy status of the dam was adequate. This female did lose some weight during this lactation period but her condition remained good and she has already conceived again. It can also be inferred that the protein level was adequate in this growing calf.

The only complications encountered so far have involved minerals. Table 3 compares the most recent serum vitamin and mineral analysis to published levels in free-ranging white rhinoceros. The zinc level was low in all animals and especially in 61409, the female with the calf. While lactating, this female developed a depigmentation of the skin on the withers. Biopsy revealed hyperplastic lesions consistent with zinc deficiency in domestic cattle.⁴ The zinc level at this time was 0.57 µg/dl with a reference level of 1.39 ± 0.2 µg/dl.¹ Several browse and forages were looked at for zinc content and Spanish moss (*Tillandsia usneoides*) was chosen as a supplement. It is highly palatable and has a high level of zinc. High calcium diets also may lower zinc by competitive binding in the gastrointestinal tract.⁴ The amount of alfalfa was reduced to its current level and is now used only for husbandry and medical procedures. The serum zinc level improved as did the skin condition over several weeks. The reduction in calcium intake is believed to have been more useful as the supply of Spanish moss was exhausted soon. Other vitamin and minerals were within the range reported in wild rhinoceros with the exception of the iron in the calf 62638. The iron level at 12 mo of age was 1.59 µg/dl, well within the reference range. At 16 mo of age it had dropped to 0.89 µg/dl. This calf has no other health problems at this point but this aspect will be closely followed on the premise that this drop in iron is due to weaning.

With the notable exception of zinc, it appears that white rhinoceros can be successfully maintained and propagate on a forage-only diet. If this trend holds true it is hoped the F1 generation produced will be fed the same way. The addition of concentrates and commercial feed stuffs may be affecting reproduction possibly as an antigenic source and will be investigated. Close attention should be paid to all nutrients when conducting such trials. The emphasis on operant conditioning can not be underestimated in this trail.

LITERATURE CITED

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Table 1. Five-day intake study of one male and two female white rhinoceros at Busch Gardens Tampa Bay. All weights are in pounds.

Study Day	Feed	Fed	Remaining	Consumed	Total Hay Consumption
1	Timothy	105	30	75	130
	Alfalfa	55	0	55	
2	Timothy	90	30	60	110
	Alfalfa	50	0	50	
3	Timothy	100	15	85	145
	Alfalfa	60	0	60	
4	Timothy	95	20	75	125
	Alfalfa	50	0	50	
5	Timothy	95	30	65	120
	Alfalfa	55	0	55	
Average Timothy Intake			72		
Average Daily Alfalfa Offered			54		
Average Daily Hay Consumption			126		
Total Body Weight			10487		
Hay Intake %BW/day			1.2		

Table 2. Weights (kg) of three adult white rhinoceros managed on forage-only diets at Busch Gardens Tampa Bay.

Date	Animal ID		
	61407	61408	61409
Oct-00	1329	1160	1150
Mar-03	1735	1588	1434
Nov-04	1729	1656	1563
Jan-05	1733	1661	1540
Apr-05	1801	1658	1534
Jun-05	1792	1695	1504
Aug-05	1810	1720	1529
Nov-05	1853	1785	1581
Jan-06	1851	1776	1593
Mar-06	1885	1783	1606

Table 3. Representative vitamin and mineral profile of white rhinoceros at Busch Gardens Tampa Bay on forage diets.

	Animal ID				Average (n=5) Wild Rhinoceros
	61407	61408	61409	62638	
Retinol	25	31	25	23	7±4
alpha-tocopherol	0.56	0.42	0.25	0.66	0.62±0.48
25-OH D ₃ ng/ml	45.67	70.51	88.14	58.98	55.7
Calcium µg/ml	113	117	123	112	105.6±15.5
Copper µg/ml	1.23	1.03	1.5	1.23	1.16±0.15
Iron µg/ml	1.45	1.05	1.28	0.81	1.77±0.66
Magnesium µg/ml	22.5	24.4	26.1	22.8	20.6±4.1
Phosphorus µg/ml	37	44	29	52	35.5±8.7
Zinc µg/ml	0.88	0.8	0.7	0.81	1.39±0.20

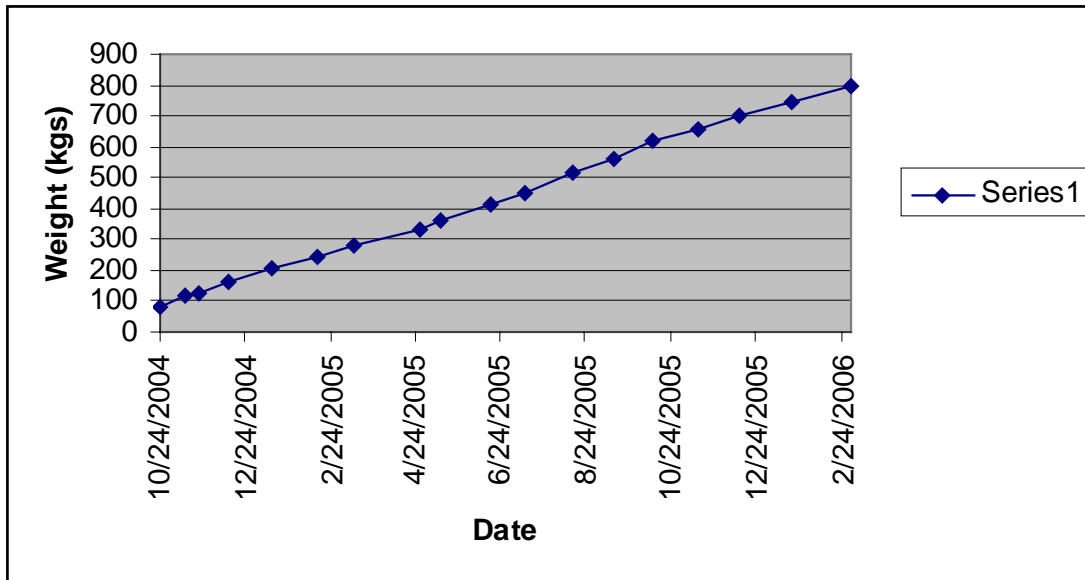


Figure 1. Growth curve of female calf, 62638. Date of Birth: 12 October 2004.