BASELINE LABORATORY DATA FOR THE WHITE RHINOCEROS *(CERATOTHERIUM SIMUM SIMUM)*

U.S. Seal, Ph. D.*
R. Barton, D.V.M.**
L. Mather**
C.W. Gray, D.V.M.***

INTRODUCTION

The family Rhinocerotidae of the order Perissodactyla contains five living species in four genera. Two of these species, the Sumatran and Javan rhinoceros, are nearly extinct if not extinct and are not represented in North American collections. Statistics from the ISIS inventory indicate that there are about 15 Indian rhinoceros *(Rhinoceros unicornis)*, 75 black rhinoceros *(Diceros bicornis)* and 150 white rhinoceros *(Ceratotherium simum)* in zoo collections in North America. Monographs on the biology of two of these species have been published in recent years. The white rhinoceros is currently divided into two subspecies, the southern race *C. s. simum* and the northern race *C. s. cottoni* (1). Only three members of the northern race are in North American zoo collections. This subspecies is considered endangered. The southern subspecies, once on the endangered list, has been successfully re-established and large numbers of this race have been exported to zoos around the world. However, there does not appear to be any information available on blood constituents for any species of rhinoceros. We collected blood samples from 16 animals in a single collection over a 2-day period and present some of the results of studies on these samples here.

*Veterans Administration Hospital, Minneapolis, Minn. 55714, and Department of Biochemistry, University of Minnesota, Minneapolis, Minn. 55455

**Kings Dominion, Doswell, Va. 23005

***National Zoological Park, Washington, D.C. 20009

Supported in part by NIAMDD 5RO1AM11376-14

MATERIALS AND METHODS

The analytical methods employed in our laboratory have been described in other publications (5). Essentially, red and white blood cells are determined with a Coulter counter model B, hematocrit by a micro method microhematocrit, and hemoglobin by a cyanmethemoglobin method. Differentials are counted on 200 cells. Serum protein fractions are measured by cellulose acetate electrophoresis. Total protein is determined by an ultraviolet method. Enzymes, glucose, BUN and bilirubin are measured using the kits and machine of Abbott Laboratories - the ABA 100. Calcium, phosphorus, electrolytes, cholesterol and triglycerides are determined with special methods and the specific instruments of Technicon Corporation. Cortisol and thyroxine are determined by competetive protein binding and testosterone by radioimmunoassay. Blood samples were collected from the ear vein of drug immobilized animals. The hematology samples were drawn into EDTA and samples for the other assays were drawn as serum. The serum was separated within two to three hours of drawing the blood and stored frozen. Hematology was determined 24-48 hours after drawing the blood. The 16 animals from whom samples were obtained are located at Lion County Safari, Kings Dominion, Doswell, Virginia. There are eight males and eight females. The ares are not known precisely but would appear to range between three and five years. None appear full grown. The blood samples were collected on November 12th and 13th. The animals were immobilized with 1.5 mg of M-99. The time required for the animals to become manageable was 28.3 $\pm$ 9.3

minutes (mean ± standard deviation). Most animals went into sternal recumbency with this dose. The drug was administered by dart gun. Blood samples were drawn, temperature taken, measurements made, and each animal was tattooed in an ear for future identification. Except for two animals, M-50/50 in a dose of 3 mg was administered as an antidote when the work was complete. The average time required for recovery and active moving of the animal was 10.6 ± 4.1 minutes. The antidote was administered intravenously to an ear vein. The rectal body temperature was 37.5 ± .45°C or 99.6 ± .82°F. All of the laboratory data are presented as mean with standard deviations, and standard error and the 95% range of expected values in the tables. The 95% range is defined as the mean ± two standard deviations. Values falling outside of this range may tentatively be regarded as abnormal depending in part upon the magnitude of the deviation.

RESULTS AND DISCUSSION

The hematology data are presented in table 1. The results of every test were examined for possible significant sex differences. In those cases where significant differences were found, the data are presented separately in the respective tables. The females averaged more white blood cells than males, but there is a considerable overlap in the range. The bulk of this difference in white blood cells was contributed by the segmenters or neutrophils. These animals have a relatively high level of eosinophils and with some scatter of the data, possibly reflecting the presence of intestinal parasites in greater densities in some animals than in others. Two of the animals with the highest eosinophils also had the lowest hemoglobin levels, and so some physiological effects of the intestinal parasites may be present.

Serum chemistry data are presented in table 2. The actual range of blood glucose values was 35-137 mg%. It is possible that for reliable values in this species it will be necessary to draw blood into fluoride-containing tubes, as is essential for lions in our experience. This point will be reinvestigated in further studies. Serum calcium levels had a mean of 11.9 mg/100 ml and thus average higher than is found in many other mammals. However, the several collections of zebra data that were reported by us several years ago (Baseline Laboratory Data for Captive Native and Exotic Species; Seal, U.S., Makey, D.G. and SEAMAK Systems) indicate comparable levels of calcium in these species so that this may be a characteristic of the Perissodactyla. This remains to be established with further studies. It is also possible that the average levels will decline with increasing age of the animals, as happens with many mamalian species.

Serum sodium and chloride levels are similar to those observed for the zebras. Potassium and total bicarbonate levels fall within the usual range. Serum lipid levels were quite low. The levels of triglycerides actually varied between 0-25 mg/100 ml. The levels of cholesterol averaged 10-30 mg% lower than has been reported for the zebras. Triglyceride levels have not been reported for the equids.

The values for serum protein fractions determined by electrophoresis are shown in table 3. The total serum protein value of 7.6 gm/100 ml is in the characteristic range for mammals. However, the fraction attributable to albumin (2.6 mg/100 ml) is lower than is usually seen in mammals with the result that all of these animals show what would be considered a reversed A/G ration of about 0.5. This would appear to be normal for this species. The low serum albumin and the slightly lower levels of serum electrolytes suggest osmotic pressure adjustments in these animals. It would be of interest to determine the blood pressure of this species and the effects of posture. Blood volume and body water measurements would also be of interest. Fibrinogen levels averaging 520 mg/100 ml were unremarkable but indicated that none of these animals had any severe trauma or infection.

Serum hormone levels are shown in table 4. Serum thyroxine levels were in the same range as seen with the zebras. However, serum cortisol levels were very low, averaging less than 1 μg/100 ml. It is possible that cortisol is not the predominant adrenal corticosteroid in the rhinoceros. They should be examined for the presence of corticosterone. Serum testosterone levels were low in both males and females but the differences between the groups were significant.

Table 1. Hematology of the White Rhinoceros (Ceratotherium s. simum)

	$\bar{X}$	SD	SE	95% Range
Red Blood Cells ($10^6/mm^3$)	6.99	.56	.14	5.87 - 8.11
Hemoglobin (g/dl)	16.3	1.6	.40	13.1 - 19.5
Hematocrit (%)	43.1	3.2	.81	36.7 - 49.5
MCV	61.4	3.1	.79	55.2 - 67.6
MCHC	37.6	2.5	.62	32.6 - 42.6
MCH	23.3	1.9	.48	19.5 - 27.1
White Blood Cells ($10^3/mm^3$)				
Males	9.7	1.8	.65	6.1 - 13.3
Females	12.2	1.7	.59	8.8 - 15.6
Lymphocytes ($10^3/mm^3$)	4.0	.65	.16	2.7 - 5.3
Neutrophils ($10^3/mm^3$)				
Males	4.7	1.34	.47	2.0 - 7.4
Females	6.7	1.18	.42	4.3 - 9.1
Bands (mm^3)	210	200	50	0 - 600
Monocytes (mm^3)	300	140	40	20 - 600
Eosinophils (mm^3)	780	390	100	?
Basophils (mm^3)	0	0	0	0 - 1

SUMMARY

Hematology and serum chemistries have been measured on blood samples obtained from eight male and eight female white rhinoceros immobilized with M-99. Tentative baseline ranges for each of the tests have been calculated from these data. Since we have not located any other data on rhinoceros in the literature, it is not possible to make further comparisons of these data. Although comparisons can be drawn with the equids or tapirs, it would be of far greater interest to obtain similar data on the black and Indian rhinoceros. It is our intention to gather further data on this group of white rhinoceros during the next year and to explore some of the questions raised by the data already obtained.

Table 2. Serum Chemistry of the White Rhinoceros (*Ceratotherium s. simum*)

	$\bar{X}$	SD	SE	95% Range
Glucose (mg/dl)	84	28	7	28 - 140
Urea Nitrogen (mg/dl)	13	2.0	.5	9 - 17
Calcium (mg/dl)	11.9	.7	.18	10.5 - 13.4
Phosphorus (mg/dl)	5.2	.52	.13	4.2 - 6.2
Sodium (meq/l)	139	5.0	1.24	129 - 149
Potassium (meq/l)	5.1	.39	.10	4.3 - 5.9
Chloride (meq/l)	95	3.0	.75	89 - 101
Total CO_2 (meq/l)	27.8	1.6	.41	24.6 - 31.0
Cholesterol (mg/dl)	89	21	5.3	47 - 131
Triglyceride (mg/dl)	6.8	7.9	2.0	0 - 25
Bilirubin (mg/dl)	.21	.10	.03	0 - 0.4
Alkaline Phosphatase (IU)	100	27	7	46 - 154
LDH (IU)	270	58	15	154 - 386
SGOT (IU)	47	8	2	31 - 63
SGPT (IU)	8.9	1.0	.26	6.9 - 10.9
CPK (IU)	93	33	9	27 - 159

Table 3. Plasma Proteins of the White Rhinoceros (*Ceratotherium s. simum*)

	$\bar{X}$	SD	SE	95% Range
Serum Protein (g/dl)	7.6	.74	.19	6.1 - 9.1
Albumin (g/dl)	2.6	.25	.06	2.1 - 3.1
Alpha-1 (g/dl)	.14	.04	.01	.06 - .22
Alpha-2 (g/dl)	.35	.09	.02	.17 - .53
Betas (g/dl)	1.93	.29	.07	1.35 - 2.51
Gamma globulin (g/dl)	2.47	.36	.09	1.75 - 3.19
Fibrinogen (mg/dl)	520	53	13	414 - 626

Table 4. Serum Hormones of the White Rhinoceros (*Ceratotherium s. simum*)

	$\bar{X}$	SD	SE	95% Range
Thyroxine (µg/dl)	2.8	.71	.18	1.4 - 4.2
Cortisol (µg/dl)	.8	.56	.14	0 - 2
Testosterone (ng/dl)				
Males	81	32	11	17 - 145
Females	41	18	6	5 - 77

ACKNOWLEDGEMENTS

The authors wish to express their sincere appreciation for the expert technical assistance of Mary D. Lewis.

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PECTINOTOMY IN AN AFRICAN LIONESS

M .E. Mainster, D.V.M.*
M.L. Matthews, D.V.M.**
S.G. Stoops, D.V.M.***

An eleven month old African lioness *(Panthera leo)* had exhibited difficulty in walking since six months of age. Conservative treatment with vitamins and steroids did not result in any permanent reversal of the symptoms.

When the animal was seven and one-half months of age it was sedated with Ketamine(a) and examined. The right coxo-femoral joint felt loose and slightly crepitus. Radiography demonstrated osteoarthritic changes with some loss of acetabular structure present in the right coxo-femoral joint. No changes were evident on the left side but the lioness was limping on both hind legs. A complete blood count and chemistry profile was done, but all results were in normal range. The lioness continued to have problems ambulating. Based on physical signs and radiographic changes a bilateral pectineous myotomy was recommended.[1,3].

When eleven months of age the 84 pound lioness was immobilized with 860mg Ketamine. An intravenous drip was instituted and additional sedation was given using 4% Surital(b). The lioness was positioned in dorsal recumbency with her femurs abducted so that their long axis was perpendicular to the animal's body. This makes the pectineus muscle more prominent and surgically accessible. The animal was then prepped in a routine manner using Nolvasan(c) and Betadine(d).

Initial incisions were made in each thigh directly over the proximal caudal femoral artery. The superficial medial femoral fascia was divid-

*Consulting Veterinarian, San Antonio Zoo, San Antonio, Texas

**Former Veterinarian, San Antonio Zoo, San Antonio, Texas

***Former Veterinarian, San Antonio Zoo, San Antonio, Texas