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SOME HEMATOLOGICAL VALUES OF FREE-RANGING AFRICAN ELEPHANTS[1]

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Abstract: Blood samples were collected from 23 free-ranging African elephants (*Loxodonta africana*) in Tanzania. Red and white blood cell counts, white blood cell differential, hemoglobin, blood copper, and blood inorganic phosphate were determined. No correlation of any of these measurements with age and sex was discernible, except that the total white count was significantly higher in females than in males in all age groups. The findings are compared with those previously reported for captive and free-ranging African elephants.

INTRODUCTION

An opportunity arose in March 1968 to obtain blood samples from African elephants cropped in a herd reduction scheme in Mkomasi Game Reserve, Tanzania. The limited published information on blood values for African elephants,[1,7,8] especially free-ranging elephants, prompted this report.

MATERIALS AND METHODS

Free-flowing blood from a jugular vein puncture was collected in heparin within 10 min after the elephant was shot. Erythrocytes (RBC) and leukocytes (WBC) were counted in an "improved Neubauer" chamber within 6 h of collection. The RBC diluent was 0.9% physiologic saline solution; the WBC diluent, 2% glacial acetic acid with 1% gentian-violet. The differential blood count was determined by counting 100 leukocytes on thin Giemsa-stained blood smears. Hemoglobin levels were determined by the alkaline hematin method,[9] copper by the modified method[2] of Eden and Green,[3] and inorganic phosphate by the method of Fiske and Subbarow.[4] The last three tests were performed in the laboratory within 48 h of collection of the blood in vials containing an anticoagulant consisting of 6 mg of sodium fluoride and 1 mg of "Merthiolate" per ml of blood.[5] The copper and inorganic phosphate determinations were selected because of the sandy, heavily weathered soil in the area inhabited by the elephants.

The age of the elephants was determined by dental criteria established by Laws.[6]

RESULTS

Table 1 gives the results obtained. It is important to remember that the normal sedimentation rate (PCV) of elephant blood is very high (29 mm/h)[10] in comparison with that of other living animals. For this reason samples were obtained only from animals that could be bled within 10 min of death.

The average RBC counts for males ($3.78 \pm 0.48 \times 10^6$) and females ($3.75 \pm 0.17 \times 10^6$) did not differ appreciably

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TABLE 1. Some Hematological Values of Blood from Free-Ranging African Elephants (**Loxodonta africana**).

Elephant No. (Sex, age in yrs.)	Red blood cells (10^6/mm^3)	White blood cells (mm^3)	Lymphocytes (%)	Nonsegmented neutrophils (%)	Segmented neutrophils (%)	Monocytes (%)	Eosinophils (%)	Basophils (%)	Hemoglobin (g/100ml)	Copper (ppm)	Inorganic phosphate (mg/100ml)
120 (M, 2-1/4)	3.76	12,000	79	2	11	8	0	0			
124 (M, 3-1/2)	2.20	8,600	56	5	22	16	1	0			
212 (M, 24)	1.92	8,200	85	2	7	5	1	0			
214 (M, 7)	6.74	8,200	72	0	21	6	1	0	5.2	12.8	1.13
218 (M, 1/2)	3.21	7,150	69	2	11	17	1	0	9.1	11.8	1.05
223 (M, 5)	3.11	5,950	69	2	18	7	4	0			
228 (M, 14)	4.32	13,450	63	1	27	12	1	1			
229 (M, 8)	4.10	9,700	76	0	18	6	0	0			
231 (M, 7-1/2)	4.66	5,700	81	1	10	6	2	0			
108 (F, 48)	4.39	7,850	58	0	31	10	1	0			
110 (F, 9)	3.58	21,200	66	1	24	6	3	0			
112 (F, 4)	3.76	12,000									
118 (F, 23)	4.28	7,950									
121 (F, 24)	3.12	13,000									
123 (F, 2-1/2)	4.01	15,300									
126 (F, 7-1/2)	3.32	15,500	65	0	33	2	0	0			
216 (F, 30)	3.11	16,000	70	1	17	11	1	0	6.3	10.4	0.89
217 (F, 1)	4.22	10,300	60	1	31	5	2	1			
206 (F, 8)			68	0	21	10	1	0	8.0	9.4	1.11
211 (F, 26)									7.5	7.1	0.86
215 (F, 23)			62	1	32	3	2	0	7.3	11.1	
221 (F, 3-1/2)			76	1	12	9	2	0	7.3	11.4	1.19
226 ((F, 17)			68	1	22	8	1	0	5.9	10.1	1.08
Sample size	23	18	18	18	18	18	18	18	8	8	7
Mean	12.6	3.77 ± 0.25*	11,000 ± 975	69.1 ± 1.89	1.17 ± 0.03	20.17 ± 0.61	8.17 ± 0.03	1.33 ± 0.25	0.11 ± 0.08	7.08 ± 0.44	10.51 ± 0.06	1.04 ± 0.05
Range		1.92-6.74	5,700-21,200	56-85	0-5	7-33	2-17	0-4	0-1	5.2-9.1	7.1-12.8	0.86-1.19

* Standard deviation.

($P < 0.05$). However, there was a significant difference ($P > 0.05$) in WBC count by sex, with the average for males being 8,700 ± 860/mm³ and for females, 13,230 ± 1142/mm³. The remaining values in the table are self-explanatory, with no discernible ($P < 0.05$) correlation between age and sex.

DISCUSSION

This study was conducted under less than ideal conditions. The red and white blood counts were performed up to 6 h after collection, which may bias the determined values. Moreover, all the elephants in this study were found infected with the bile duct hookworm *Grammocephalus* sp., and the presence of these and other parasites could have a bearing on the blood values obtained. However, the data may be useful until true norms can be determined.

Young and Lombard[10] found the RBC count for 11 male elephants averaged 5.02 x 10^6, which is much higher than our results. Since their samples were from immobilized elephants, the speed of sedimentation of the RBC might explain the discrepancy, although one might expect the opposite effect, namely a decrease in erythrocyte count and PCV, as described in reports which compare the effects of drugs and physical restraint in white-tailed deer.[7,8] Bartels *et al.*[1] quote 3.20 x 10^6 as the RBC count for one African elephant in captivity while Schmitt[9] cites 4.64 x 10^6 for four elephants, of which only one was African.

WBC determinations for elephant blood have been reported to range from 10,000 to 14,400/mm³ and hemoglobin from 12 to 14 g/100 ml. Our results agree for WBC but are lower for hemoglobin. However, we made only eight hemoglobin determinations.

Previously published results on the differential blood count of elephants are minimal. Our finding of 69% lymphocytes is high compared to Young and Lombard's 58%, but more striking is our finding of 8% monocytes and 1% nonsegmented neutrophils compared with 1.5% and 13%, respectively, reported by Young and Lombard.[10] Each of two elephants had 1% basophils (three cells actually seen) indicating that elephants do have basophils, a fact not previously reported. The low percentage of eosinophils is surprising considering the large number of tissue eosinophils observed to be associated with the bile duct lesions of *Grammocephalus* sp.

Determinations of copper and inorganic phosphate in elephant blood appear not to have been previously published. Although our sample size is small, there is close correlation between samples. The average for blood inorganic phosphate (7.08 ± 0.44 mg/100 ml) is higher than the 4.5 mg/100 ml seen in mature cattle blood. The average for copper corresponds with results in cattle.[5]

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