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HAEMATOLOGICAL AND BIOCHEMICAL VALUES IN THE PERIPHERAL BLOOD OF CAPE HUNTING DOGS KEPT IN THE EAST-BOHEMIAN ZOOLOGICAL GARDEN AT DVŮR KRÁLOVÉ NAD LABEM

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Abstract

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Thirteen clinically healthy cape hunting dogs (*Lycaon pictus*) kept in the East-Bohemian Zoological Garden at Dvůr Králové nad Labem were subjected to haematological and biochemical examination of the peripheral blood. The report gives the results of their haematological examination covering erythrocyte count, haemoglobin content, haematocrit, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, mean corpuscular volume, leukocyte count and differential leukocyte count and those of biochemical examination of their blood sera covering total protein, glucose, creatinine, urea, triglyceride, cholesterol, magnesium, calcium, phosphorus, chloride, sodium, potassium, copper, zinc and iron level and alkaline phosphatase and AST and ALT aminotransferase activity, all expressed as mean values. The values were compared with those reported in the literature for the peripheral blood of the dog (*Canis familiaris*).

Lycaon pictus, haematology, blood serum, biochemistry.

Systematic examination of haematological and biochemical values in the peripheral blood of clinically healthy animals kept in the East-Bohemian Zoological Garden at Dvůr Králové nad Labem has been carried out for several years (P o s p í š i l et al. 1984 abcd; 1985ab). The present study is concerned with haematological and biochemical values in the peripheral blood of cape hunting dogs (*Lycaon pictus*) reared successfuly in this zoo for a number of years. To our knowledge, no published data are available on biochemical values in the peripheral blood of this animal species and only H a w k e y (1975) reported haemotological values obtained in two cape hunting dogs.

Materials and Methods

Cape hunting dogs (*Lycaon pictus*) kept in the East-Bohemian Zoological Garden at Dvůr Králové nad Labem were housed in a house designed for this animal species. Heating was provided in winter and the animals had access to an open-air enclosure throughout the year. In summer they spent most of the time in the open-air enclosure. They were fed beef or veal three times a week, a mixture consisting of minced meat, oat flakes, carrot, milk-powder, yeast, minerals- and vitamins-containing concentrate and vegetable oil twice a week, living feed (rabbit, coypu, hen) once a week and were offered no feed once a week.

The animals were in good health, the only problem being occasional injury to the skin or limbs.

Before blood collection the animals were immobilized by i.m. administration of ketamin (NARCAMON SPOFA) (80 - 160 mg per animal) given concurrently with xylazine (ROMPUN BAYER) (70 - 140 mg per animal) and then blood-sampled from the vena saphena. A total of 7 male and 6 female cape hunting dogs were examined. Their age and the season of examination are shown in Table 1.

Table 1. Age of cape hunting dogs (Lycaon pictus) examined and the season of examination

Sex	No. animals	Month when animal examined / No. blood collections	Age in years / No. animals
males	7	II/3, VI/2, VII/1, IX/1	1/2, 2/2, 3/1, 4/1, 5/1
females	6	II/6	2/4, 5/2

All haematological values were determined by standard techniques as used in clinical practice (J a n e l e et al. 1981). Their detailed description was presented in our previous reports (P o s p í š i l et al. 1984a, 1985a).

For exploratory assessment of the effects of the immobilizing procedure on haemotological values in the peripheral blood, three cape hunting dogs were examined at three intervals after injection of the immobilizing agents.

Biochemical values were determined in the blood serum. The methods used can be divided into two groups. One group comprised techniques using kits supplied by LACHEMA, Brno, and carried out according to the producer's instructions. In this way total protein and glucose, creatine, urea, triglyceride, cholesterol, chloride and phosphorus level and alkaline phosphatase and ALT and AST aminotransferase activity were determined. Spectrophotometric measurements were made with a PM2K OPTION spectrophotometer. The other group of the methods comprised techniques based on atomic absorption spectrophotometry. This approach was chosen for the determination of calcium, magnesium, potassium, sodium, iron, copper and zinc level. The spectrophotometer used was a PERKIN-ELMER 2380 and the determinations were made according to the producer's instructions. The validity of the results obtained with the two methods was checked by including samples of control sera (CALIBRATE, LABORDIAGNOSTICA, Gödecke, GFR).

Means (X) and standard deviations (S.D.) were computed separately for male and female animals. The significance of the difference of the means between males and females was analysed using Student's t-test.

Results

The results of haematological examination of the peripheral blood are presented in Table 2 and those of biochemical examination of the blood serum are presented in Tables 3 and 4. The difference of the means of the haematological and biochemical values between males and females were not significant except for erythrocyte count and sodium level where at the 3.1% and 4.4% levels of significance, respectively. The difference between males and females in all the other values were not significant (at the 5% level).

The results of exploratory examination of the effects of the immobilizing procedure on haematological values of the peripheral blood in three cape hunting dogs are presented in Table 5. It can be seen that the immobilizing agents exerted no marked effects on haematological values of the peripheral blood at the post-administration intervals under study.

Discussion

For comparison with the haematological values in te peripheral blood of cape hunting dogs obtained in the present study only the data presented by H a w k e y (1975) were available. Our findings (Table 2) differed from those presented by the aforementioned writer particularly in erythrocyte count and haemoglobin content. In these two instances the values obtained by us were higher, whereas our haematocrit value was lower than that reported by H a w k e y (1975). These differences in basic erythrocyte values are then responsible for considerable differences in the values computed from them (mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration and mean corpuscular volume). Moreover, the leukocyte count (based on examination of one cape hunting dog) in Hawkey's monograph (1975) is lower than our result, although only little difference was found in the differential leukocyte count. The reasons for the differences in individual haematological values of the peripheral blood of the cape hunting dog are difficult to assess. In both cases the number of cape hunting dogs examined were small (2 in H a w k e y ' s (1975) study and 13 in our report), the animals used in the two studies were kept under different husbandry conditions and the results of examination were influenced by both biological and analytical factors. Furthermore, the peripheral blood values under study may also have been affected, to a certain extent, by age of the animals as was reported for the dog (*Canis familiaris*) by S c h a l m (1975) and K i r k (1980). However, the number of cape hunting dogs of differing age within the range of 1- to 5-year old animals in our study was too small to permit classification into age groups where such assessment could have been made.

Comparison of the haematological values found by us in the peripheral blood of cape hunting dogs with those reported for the dog (*Canis familiaris*) is possible, although not fully justified considering that such comparison is made between two different species of the dog family, the latter of which is kept under quite different conditions and is blood-sampled without previous administration of any immobilizing agents. In spite of these and some other differences haematological findings in the dog will probably continue to be used for comparison in such cases because of their availability. The question was which out of a number of haematological findings in the dog by various investigations as reported by S c h a l m (1975) and summarized in a

Table 2. Haematological values in the peripheral blood of cape hunting dogs (Lycaon pictus)

Haematological value	females (N=6)				males (N=7)			
	$\bar{X}$	S.D.	min.	max.	$\bar{X}$	S.D.	min.	max.
Erythrocyte count (10^{12}/l)	9.86	0.80	8.86	11.24	8.45	1.18	6.48	9.90
Haematocrit (l/l)	0.437	0.023	0.40	0.47	0.433	0.047	0.37	0.50
Haemoglobin content (g/l)	185.2	12.3	173	206	173.4	16.9	159	203
Mean corpuscular haemoglobin (pg)	18.56	1.72	14.9	20.4	20.45	2.35	17.3	24.5
Mean corpuscular haemoglobin concentration (nmol/l)	26.24	1.05	24.94	28.41	25.00	2.23	22.21	27.05
Mean corpuscular volume (fl)	44.86	3.12	40.9	49.7	50.95	8.20	45.1	67.3
Leukocyte count (10^{9}/l)	13.03	4.67	7.2	19.2	12.88	2.56	8.4	16.2
neutrophil granulocytes (segments)	0.781	0.052	0.69	0.88	0.720	0.115	0.50	0.82
neutrophil granulocytes (rods)	0.016	0.005	0.01	0.02	0.021	0.019	0.01	0.06
eosinophil granulocytes	0.028	0.005	0.01	0.05	0.040	0.029	0.01	0.09
basophil granulocytes	0.003	0.005	0.00	0.01	0.008	0.016	0.00	0.04
lymphocytes	0.141	0.053	0.04	0.23	0.156	0.132	0.07	0.41
monocytes	0.028	0.012	0.01	0.05	0.036	0.008	0.03	0.05

N = No. animals examined
$\bar{X}$ = Mean
S.D. = Standard deviation
min., max. = Minimal and maximal value

Table 3. Changes of haematological values in the peripheral blood of cape hunting dogs (Lycaon pictus) after i.m. administration of KETAMIN and XYLAZINE

(N = 3)

Haematological value	time of administration		
	8-12 min.	20-21 min.	30-31 min.
Erythrocyte count (10^{12}/l)	9.08 ±0.39	8.99 ±0.13	8.80 ±0.14
Haemoglobin content (g/l)	172.6 ±4.16	175.3 ±6.8	171.3 ±5.5
Haematocrit (1/1)	0.413 ±0.011	0.410 ±0.026	0.406 ±0.030
Mean corpuscular haemoglobin (pg)	18.74 ±1.15	19.46 ±0.76	18.50 ±0.96
Mean corpuscular haemoglobin concentration (nmol/l)	25.87 ±1.05	26.92 ±0.49	26.18 ±1.48
Mean corpuscular volume (fl)	44.9 ±2.5	44.8 ±1.9	46.2 ±4.2
Leukocyte count (10^9/l)	11.7 ±1.5	11.7 ±2.29	14.2 ±1.04
neutrophil granulocytes (segments)	0.766 ±0.020	0.725 ±0.077	0.766 ±0.032
neutrophil granulocytes (rods)	0.010 ±0.00	0.020 ±0.00	0.016 ±0.005
eosinophil granulocytes	0.026 ±0.015	0.033 ±0.005	0.036 ±0.011
basophil granulocytes	±0.000	±0.000	±0.000
lymphocytes	0.170 ±0.000	0.163 ±0.066	0.116 ±0.011
monocytes	0.026 ±0.011	0.036 ±0.005	0.036 ±0.011

previous study by one of us (P o s p í š i l and K o m á r e k 1963) were to be chosen for this comparison. In the light of our previous studies (P o s p í š i l et al. 1984 abcd; 1985 ab) we chose those of S c h a l m (1975) and S o v a (1979) regarding such values as markedly different that did not overlap in terms of standard deviations or range. The results of this comparison are shown in Table 7.

Table 4. Biochemical values in the blood serum of cape hunting dogs (Lycaon pictus) (males)

Biochemical value		N	$\bar{X}$	S.D.	min. - max.
Protein	g/l	6	65.16	11.08	54.0 - 80.0
Glucose	mmol/l	6	9.20	1.16	8.4 - 10.9
Creatinine	µmol/l	6	115.0	22.9	74.0 - 135.0
Urea	mmol/l	7	11.92	4.2	3.7 - 16.6
Triglycerides	mmol/l	6	2.52	0.53	1.64 - 2.99
Cholesterol	mmol/l	7	5.12	0.96	4.0 - 6.9
Alkaline phosphatase	µkat/l	5	0.476	0.522	0.16 - 1.40
AST	µkat/l	7	0.368	0.132	0.20 - 0.54
ALT	µkat/l	7	0.412	0.214	0.15 - 0.72
Magnesium	mmol/l	7	0.931	0.088	0.74 - 1.01
Calcium	mmol/l	7	2.141	0.207	1.78 - 2.32
Phosphorus	mmol/l	7	1.262	0.531	1.09 - 1.75
Chlorides	mmol/l	7	113.3	7.9	97.0 - 119.0
Sodium	mmol/l	7	148.1	6.9	139.0 - 157.0
Potassium	mmol/l	7	4.560	0.496	3.95 - 5.19
Copper	µmol/l	5	10.12	9.93	2.4 - 21.4
Zinc	µmol/l	5	25.58	12.08	13.8 - 45.4
Iron	µmol/l	4	14.02	9.90	7.9 - 28.8

For explanation of the symbols see Table 2.

As to biochemical values in the blood serum of cape hunting dogs, no published data were available to us for comparison. Therefore we compared our findings only with those obtained for the dog (*Canis familiaris*), using the data reported by S o v a (1979), J a g o š and B o u d a (1981 and K i r k (1980) and adhering to the same criteria as were used by us in comparing the haematological values. The biochemical values in the blood serum of the dog quoted by K i r k (1980) are those used by N.Y.S. Veterinary College, Cornell University. The results of the comparison are shown in Table 8.

As can be seen from Table 7 and 8 the largest differences between the peripheral blood values of cape hunting dogs and those reported for the dog (*Canis familiaris*) were found in erythrocyte count and glucose level. To

Table 5. Biochemical values in the blood serum of cape hunting dogs (Lycaon pictus) (females)

Biochemical value		N	$\bar{x}$	S.D.	min. - max.
Protein	g/l	6	73.83	7.57	65.0 - 84.0
Glucose	mmol/l	6	8.53	2.18	6.3 - 12.5
Creatinine	µmol/l	6	141.1	28.3	112.0 - 182.0
Urea	mmol/l	6	10.13	5.46	4.8 - 17.3
Triglycerides	mmol/l	6	2.63	0.60	1.84 - 3.37
Cholesterol	mmol/l	6	5.26	0.67	4.6 - 6.1
Alkaline phosphatase	Sµkat/l	6	0.456	0.415	0.13 - 1.24
AST	Sµkat/l	6	0.500	0.078	0.43 - 0.65
ALT	S kat/l	6	0.271	0.075	0.18 - 0.38
Magnesium	mmol/l	6	0.915	0.056	0.86 - 0.99
Calcium	mmol/l	6	2.155	0.116	1.95 - 2.30
Phosphorus	mmol/l	6	1.125	0.361	0.92 - 1.56
Chlorides	mmol/l	6	115.5	2.8	112.0 - 119.0
Sodium	mmol/l	6	148.5	12.4	126.0 - 160.0
Potassium	mmol/l	6	4.06	0.223	3.77 - 4.36
Copper	µmol/l	4	5.12	3.57	2.0 - 9.3
Zinc	µmol/l	4	20.85	4.09	15.3 - 26.2
Iron	µmol/l	4	9.40	4.48	4.7 - 13.9

For explanation of the symbols see Table 2.

which extent the higher blood serum glucose level found in cape hunting dogs is a consequence of intervention into the neuroendocrine control at blood collection or is species-specific is difficult to decide. In our view a response to non-specific load (S c h r e i b e r 1985) produced by handling and treatment of the animals before blood collection is more probable. As to the higher erythrocyte count, however, the foregoing explanations is, to a certain extent, at variance with our exploratory studies on haematological changes in three cape hunting dogs at various intervals after administration of KETAMIN and XYLAZINE.

The objective of our systematic studies of haematological and biochemical values in the peripheral blood of clinically healthy animals kept in the East-Bohemian Zoological Garden at Dvůr Králové nad Labem is to provide information that would be of help in diagnosing disease on the basis of

Table 6. Haematological values in the peripheral blood of cape hunting dogs (Lycaon pictus) as reported by Hawkey (1975)

Haematological value	N	$\bar{x}$	Range
Erythrocyte count (10^{12}/l)	2	7.17	6.74 - 7.60
Haematocrit (1/1)	2	0.485	0.480 - 0.490
Haemoglobin (g/l)	2	158	149 -168
Mean corpuscular haemoglobin (pg)	2	22.2	19.5 - 24.9
Mean corpuscular haemoglobin concentration (mmol/l)	2	20.94	19.18 - 22.76
Mean corpuscular volume (fl)	2	68.2	65.0 - 71.5
Leukocytes (10^9/l)	1	4.1	
neutrophil granulocytes	1	0.760	
eosinophil granulocytes	1	0.035	
basophil granulocytes	1	0.000	
lymphocytes	1	0.150	
monocytes	1	0.055	

For explanation of the symbols see Table 2.
The values reported by Hawkey (1975) are expressed here in terms of S.I. units for the sake of comparison.

clinical and laboratory examination. Moreover, our studies along this line in a number of animal species are a contribution to comparative animal physiology in general.

Hematologické a biochemické hodnoty periferní krve psů hyenových (*Lycaon pictus*) chovaných ve Východočeské zoologické zahradě Dvůr Králové nad Labem

V práci je referováno o výsledcích hematologického a biochemického vyšetření periferní krve 13 klinicky zdravých psů hyenových (*Lycaon Pictus*) chovaných ve Východočeské zoologické zahradě Dvůr Králové nad Labem. Byly stanoveny průměrné hodnoty počtu červených krvinek, obsahu hemoglobinu, hematokritu, středního množství hemoglobinu červené krvinky, střední koncentrace hemoglobinu červené krvinky, středního objemu červené krvinky, počtu bílých krvinek, zastoupení jednotlivých druhů bílých krvinek. V krevním séru byly stanoveny průměrné hodnoty hladiny bílkovin, glukózy, kreatininu, močoviny, triglyceridů, cholesterolu, hořčíku, vápníku, fosforu, chloridů, sodíku, draslíku, mědi, zinku, železa a aktivity alkalické forfatázy, aminotransferázy AST a ALT. Dosažené hodnoty byly porovnány s hodnotami udávanými v periferní krvi psa (*Canis familiaris*).

Table. 7. Comparison of haematological values in the peripheral blood of cape hunting dogs (Lycaon pictus) with those reported for the dog (Canis familiaris)

Value compared	SCHALM et al. 1975	SOVA 197
Erythrocyte count	Δ	Δ
Haematocrit	o	∇
Haemoglobin content	o	o
Mean corpuscular haemoglobin	∇	∇
Mean corpuscular haemoglobin concentration	Δ	Δ
Mean corpuscular volume	∇	∇
Leukocyte count	o	o
neutrophil granulocytes (segments)	o	Δ
neutrophil granulocytes (rods)	o	Not mentioned
eosinophil granulocytes	o	o
basophil granulocytes	o	o
lymphocytes	o	o
monocytes	o	o

Δ = Peripheral blood value found in cape hunting dogs is higher that that reported for the dog.

o = Peripheral blood value found in cape hunting dogs shows little difference from that reported for the dog.

∇ = Peripheral blood value found in cape hunting dogs is lower than that reported for the dog.

Гематологические и биоцхимические величины периферической крови гиенообразных собак (*Lycaon pictus*), содержащихся в Восточночешском зоопарке Двур-Кралове над Лабой

В работе приводятся результаты гематологического и биохимического исследований периферической крови 13 клинически здоровых собак (*Lycaon pictus* , содержимых в Восточночешском зоопарке Двур-Кралове над Лабой. Определяли средние величины красных кровяных телей, содержания гемоглобина, гематокрита, среднего количества гемоглобина, красные тельца, средней концентрации гемоглобина красные тельца, среднего объема красных телец, числа белых телец, представительства отдельных видов белых кробяных телец. В кровяной сыворотке определяли средние величины уровня белков, глюкозы, креатинина, мочевины, триглицеринов, холестери-

Table 8. Comparison of biochemical values in the blood serum of cape hunting dogs (Lycaon pictus) with those reported for the dog (Canis familiaris)

a = males b = females

Value compared	SOVA 1975		JAGOŠ BOUDA 1981		KIRK 1980	
	a	b	a	b	a	b
Protein	o	o	o	o	o	o
Glucose	Δ	Δ	Δ	Δ	Δ	Δ
Creatinine	o	o	o	o	o	o
Urea	o	o	Δ	Δ	Δ	Δ
Triglycerides	Not mentioned		Δ	Δ	+)o	o
Cholesterol	o	o	o	o	o	o
Alkaline phosphatase	Not mentioned		o	o	o	o
AST	Not mentioned		o	Δ	o	o
ALT	Not mentioned		o	o	o	o
Magnesium	Δ	Δ	o	o	o	o
Calcium	o	o	o	o	o	o
Phosphorus	o	o	o	o	o	o
Chlorides	o	Δ	o	o	o	o
Sodium	Δ	o	o	o	o	o
Potassium	o	∇	o	∇	o	o
Copper	Not mentioned		Not mentioned		Not mentioned	
Zinc	Not mentioned		Not mentioned		Not mentioned	
Iron	∇	∇	o	∇	o	∇

Symbols are the same as used in Table 7.

+ Kirk (1980) using data of N.Y.S. Veterinary College, Cornell University, did not mention the value, but this was presented in the relevant chapter by Bentinck-Smith (1980).

на, магния, калия, фосфора, хлоридов, натрия, кальция, меди, цинка, железа и активность щелочной фосфатазы, аминотрансферазы AST и ALT. Полученные величины сопоставляли с величинамикрови собаки (*Canis familiaris*).

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