

HAEMATOLOGICAL AND BIOCHEMICAL VALUES IN THE PERIPHERAL BLOOD OF STRIPED HYENAS (*HYAENA HYAENA*) KEPT IN THE EAST-BOHEMIAN ZOOLOGICAL GARDEN AT DVŮR KRÁLOVÉ NAD LABEM

J. POSPÍŠIL, J. VÁHALA, P. ŠPÁLA and F. KAŠE

East-Bohemian Zoological Garden, 554 01 Dvůr Králové nad Labem

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Abstract

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Six clinically healthy striped hyenas (*Hyaena hyaena*) kept in the East-Bohemian Zoological Garden at Dvůr Králové nad Labem were subjected to haematological and biochemical examinations of the peripheral blood. The haematological examination of the peripheral blood covered erythrocyte count, haematocrit, haemoglobin content, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, mean corpuscular volume, leukocyte count and differential leukocyte picture. In the blood serum, determination was made of total bilirubin, protein, glucose, creatinine, urea, lipids, triglycerides, cholesterol, magnesium, calcium, phosphorus, chlorides, potassium, sodium, copper and iron levels and of alkaline phosphatase, ALT and AST aminotransferase and lactate dehydrogenase activities.

Hyena, haematology, blood serum enzymes.

The haematological and biochemical values in the peripheral blood of striped hyenas (*Hyaena hyaena*) reported in the present study are part of systematic examination of the peripheral blood of clinically healthy animals kept in the East-Bohemian Zoological Garden at Dvůr Králové nad Labem (Pospíšil et al. 1984a,b,c,d, 1985a,b). To our knowledge, no published information exists on biochemical values of the peripheral blood of this animal species and relevant haematological values were reported by Hawkey (1975) who examined three striped hyenas and by Schalm et al. (1975) who published only incomplete values based on examination of one animal.

Materials and Methods

Striped hyenas (*Hyaena hyaena*) in the East-Bohemian Zoological Garden at Dvůr Králové nad Labem are kept separate from one another because of mutual scuffles and frequent injuries which occurred when they were left together in the past. In winter they are kept in a heated house, in summer mostly in open-air enclosures with the possibility of shutting them in the house. They are 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 left without feed once a week.

Once separated from one another, the hyenas were in good health.

Before being blood-sampled, the hyenas were immobilized by i.m. administration of KETAMIN (Narcamon SPOFA) (100-130 mg per animal) given concurrently with XYLAZINE (Rompun Bayer) (100 mg per animal) and then blood-sampled from the vena saphena. A total of 6 striped hyenas were examined. Their age, sex and the season of examination are shown in Table 1.

Table 1
Age of striped hyenas (*Hyaena hyaena*) examined
and the season of examination

Sex	N	Month/No. animals examined	Age in years/No. animals
Males	3	VIII/3	3/2, 7/1
Females	3	II/2, IX/1	3/2, 4/1

Haematological and biochemical values of the peripheral blood and blood serum respectively were determined by routine techniques as used in clinical practice and described in detail in our previous reports (Pospíšil et al. 1984a, 1985b, 1986).

Means \bar{X} and standard deviations SD were computed and are tabulated together with the values obtained in individual animals.

Results

The haematological values found in the peripheral blood of 6 striped hyenas are presented in Table 2 and the biochemical values are shown in Table 3.

Discussion

Compared with the haematological parameters reported by Hawkey (1975), our examination of the peripheral blood of striped hyenas (Table 2) showed higher values for haemoglobin content,

Table 2
Haematological values in the peripheral blood of striped hyenas
(Hyaena hyaena)

Haematological value	Individual values						\bar{X}	SD
	b	a	a	a	b	b		
Erythrocyte count ($10^{12}/l$)	8.46	7.36	9.14	6.90	9.62	7.22	8.11	1.12
Haematocrit (l/l)	0.42	0.46	0.56	0.42	0.44	0.37	0.445	0.069
Haemoglobin content (g/l)	169	190	215	180	171	142	178.0	24.5
Mean corpuscular haemoglobin (pg)	20.0	25.8	23.6	26.0	17.8	19.7	20.49	6.78
Mean corpuscular haemoglobin concentration (mmol/l)	24.94	25.62	23.83	25.55	24.07	23.82	24.82	1.05
Mean corpuscular volume (fl)	49.6	62.5	61.2	60.8	45.7	51.2	55.18	7.21
Leukocyte count ($10^9/l$)	13.8	11.5	13.6	17.4	13.6	13.8	13.95	1.90
Differential count								
Neutrophil granulocytes (segments)	0.66	0.77	0.55	0.53	0.67	0.66	0.640	0.088
Neutrophil granulocytes (rods)	0.01	0.01	0.01	0.00	0.05	0.01	0.015	0.016
Eosinophil granulocytes	0.02	0.01	0.02	0.01	0.02	0.02	0.016	0.005
Basophil granulocytes	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000
Lymphocytes	0.28	0.17	0.30	0.40	0.22	0.28	0.275	0.077
Monocytes	0.03	0.04	0.12	0.06	0.03	0.03	0.051	0.035

a = male; b = female

 \bar{X} = mean value

SD = standard deviation

Table 3
 Biochemical values in the blood serum of striped hyenas (*Hyaena hyaena*)
 (a = male; b = female).

Biochemical value	Individual values						\bar{X}	SD
	a	a	a	b	b	b		
Total bilirubin	1.61	-	-	1.93	1.30	-	1.613	0.315
Protein	89.0	84.0	68.0	64.0	72.0	56.0	72.16	12.40
Glucose	5.55	11.0	8.60	10.93	9.40	10.50	9.33	2.07
Creatinine	159.3	-	152.0	150.5	106.0	139.0	141.3	21.0
Urea	8.82	9.66	9.60	9.32	10.31	7.10	9.14	1.10
Lipids	10.8	13.8	-	10.1	9.60	-	11.07	1.88
Triglycerides	-	-	2.35	-	2.84	2.97	2.72	0.32
Cholesterol	6.7	-	4.9	6.0	5.8	5.5	5.78	0.66
Alkaline phosphatase	-	-	0.28	-	0.74	0.24	0.420	0.277
A S T	1.79	0.69	0.40	0.51	0.53	0.43	0.725	0.531
A L T	1.23	1.04	0.52	0.89	0.26	0.53	0.745	0.367
L D H	-	-	2.38	-	5.84	1.92	3.38	2.14
Magnesium	0.90	1.03	0.80	0.95	-	0.82	0.900	0.094
Calcium	2.38	2.35	2.17	2.11	-	2.15	2.232	0.123
Phosphorus	1.97	1.80	-	1.49	3.74	1.50	2.100	0.939
Chlorides	98.0	160.0	98.0	109.0	115.6	100.0	104.4	7.0
Potassium	-	-	4.4	-	-	4.12	4.26	0.19
Sodium	-	-	144.0	-	-	156.0	150.0	8.48
Copper	-	-	8.1	-	33.5	36.9	26.16	15.73
Iron	-	-	11.9	23.3	20.0	25.4	20.15	5.93

\bar{X} = mean value SD = standard deviation

mean corpuscular haemoglobin and mean corpuscular haemoglobin concentration, lower leukocyte count, a smaller proportion of neutrophil granulocytes and a higher proportion of lymphocytes (Table 4). Little difference was found from the findings of Schalm et al. (1979) who published incomplete results of examination of one animal.

Table 4

Haematological values in the peripheral blood of striped hyenas (*Hyaena hyaena*) reported by Hawkey /1975/ (converted to SI units)

Haematological value	N	\bar{X}	Range
Erythrocyte count ($10^{12}/l$)	3	7.4	6.8-8.5
Haematocrit (l/l)	3	0.450	0.420-0.490
Haemoglobin content (g/l)	3	134.0	125.0-151.0
Mean corpuscular haemoglobin (pg)	3	18.1	17.8-18.2
Mean corpuscular haemoglobin concentration (nmol/l)	3	18.42	18.05-18.92
Mean corpuscular volume (fl)	3	60.8	58.0-63.0
Leukocyte count ($10^9/l$)	3	16.6	16.1-17.3
Neutrophil granulocytes	3	0.78	0.71-0.82
Eosinophil granulocytes	3	0.016	0.000-0.035
Basophil granulocytes	3	0.012	0.000-0.020
Lymphocytes	3	0.136	0.080-0.165
Monocytes	3	0.056	0.040-0.075

N = No. animals examined

\bar{X} = mean value

Where a need for rough information on normal haematological and biochemical values of the peripheral blood and blood serum, respectively, of striped hyenas arises in practice, one is likely to resort to the parameters reported for the dog (*Canis familiaris*) although this means comparison between animals of two different families - Hyaenidae and Canidae. This approach was also adopted in the present study. As in our previous report (Pospíšil et al. 1986) we compared the haematological values of the peripheral blood of striped hyenas with those reported for dogs by Schalm et al. (1975) and Sova (1979), and the biochemical values with those obtained in dogs by Kirk (1980), Sova (1979) and Jagoš and Bouda (1981). As marked differences were regarded such instances where standard deviations of the corresponding values or their ranges did not overlap. As can be seen from Table 5, marked differences in haematological values between striped hyenas and dogs were recorded only for mean corpuscular haemoglobin and mean corpuscular haemoglobin concentration. In biochemical values (Table 6) marked differences from those reported for dogs by three different investigators (Sova 1979; Kirk 1980; Jagoš and Bouda 1981) were found only in glucose level. The higher glucose level in our study was presumably due to a nonspecific reaction to the load produced by handling of the animals before blood collection.

Table 5

Comparison of haematological values in the peripheral blood of striped hyenas (*Hyaena hyaena*) with those reported for the dog (*Canis familiaris*)

Haematological value compared	SCHALM et al. 1975	SOVA 1979
Erythrocyte count	●	▲
Haematocrit	●	▼
Haemoglobin content	●	●
Mean corpuscular haemoglobin	●	▼
Mean corpuscular haemoglobin concentration	▲	▲
Mean corpuscular volume	▼	▼
Leukocyte count	●	●
Neutrophil granulocytes (segments)	●	●
Neutrophil granulocytes (rods)	●	not reported
Eosinophil granulocytes	●	●
Basophil granulocytes	●	▲
Lymphocytes	●	●
Monocytes	●	●

- ▲ = the value of the peripheral blood found in striped hyenas is higher than that reported for the dog,
 ● = the value of the peripheral blood found in striped hyenas shows little difference from that found in the dog,
 ▼ = the value of the peripheral blood found in striped hyenas is lower than that reported for the dog.

Being obtained in a relatively small number of animals kept under the specified conditions, the haematological and biochemical findings in the peripheral blood and blood serum, respectively, of striped hyenas reported in the present study are only of tentative value: Nevertheless, they may prove of some help on examination of diseased striped hyenas, providing rough information which, in our view, is more relevant than that obtained in other animal species.

Table 6

Comparison of biochemical values in the blood serum of striped hyenas (*Hyaena hyaena*) with those reported for the dog (*Canis familiaris*)

Biochemical value	SOVA	JAGOŠ BOUDA	KIRK
	1979	1981	1980
Total bilirubin	▼	●	●
Protein	●	●	●
Glucose	▲	▲	▲
Creatinine	●	●	●
Urea	●	▲	▲
Lipids	not re- ported	▲	not re- ported
Triglycerides	not re- ported	▲	+)●
Cholesterol	●	●	●
Alkaline phosphatase	not re- ported	●	●
A S T	not re- ported	●	●
A L T	not re- ported	▲	●
L D H	not re- ported	▲	●
Magnesium	▲	●	●
Calcium	●	●	●
Phosphorus	●	●	●
Chlorides	●	●	●
Potassium	●	●	●
Sodium	●	●	●
Copper	not re- ported	not re- ported	not re- ported
Iron	not re- ported	●	●

+) = compared with the value reported by Bentinck-Smith /1980/.
For explanation of the symbols see Table 5.

Hematologické a biochemické hodnoty periferní krve
hyen žíhaných (*Hyaena Hyaena*) chovaných ve Východočeské
zoologické zahradě Dvůr Králové nad Labem

V článku je referováno o výsledcích hematologického a biochemického vyšetření periferní krve 6 klinicky zdravých hyen žíhaných (*Hyaena Hyaena*) chovaných ve Východočeské zoologické zahradě Dvůr Králové nad Labem. Z hematologických hodnot periferní krve byl určen počet červených krvinek, hodnota hematokritu, obsah hemoglobinu, střední množství hemoglobinu červené krvinky, střední koncentrace hemoglobinu červené krvinky, střední objem červené krvinky, počet bílých krvinek, zastoupení jednotlivých druhů bí-

lých krvinek. Z biochemických hodnot krevního séra byla stanovena hladina celkového bilirubinu, bílkovin, glukózy, kreatininu, močoviny, lipidů, triglyceridů, cholesterolu, hořčíku, vápníku, fosforu, chloridů, draslíku, sodíku, mědi a železa, aktivita alkalické fosfatázy, aminotransferázy ALT a AST a laktátdehydrogenázy.

Гематологические и биохимические величины периферической крови гиен полосатых (*hyaena hyaena*), содержащихся в Восточночешском зоопарке Двур-Кралове над Лабой

В статье приведены результаты гематологического и биохимического исследований периферической крови 6 клинически здоровых полосатых гиен (*hyaena hyaena*), содержащихся в Восточночешском зоопарке Двур-Кралове над Лабой. Из гематологических величин периферической крови определяли численность красных телец, величину гематокрита, содержание гемоглобина, среднее количество гемоглобина красные тельца, среднюю концентрацию гемоглобина красные тельца, средний объем красные тельца, численность белых телец, представительство отдельных видов белых телец. Из биохимических величин кровяной сыворотки определяли уровень общего билирубина, белков, глюкозы, креатинина, мочевины, липидов, триглицеридов, холестерина, магния, кальция, фосфора, хлоридов, калия, натрия, меди и железа, активность щелочной фосфатазы, аминотрансферазы ALT и AST и лактатдегидрогеназы.

References

- BENTINCK-SMITH, J.: A Roster of Normal Values for Dogs and Cats. pp. 1321-1330 in: KIRK, R. W.: Current Veterinary Therapy VII. Small Animal Practice. W. B. Saunders Comp. Philadelphia, London, Toronto, 1980. 1360 p.
- HAWKEY, C. M.: Comparative Mammalian Haematology-Cellular Components and Blood Coagulation of Captive Wild Animals. William Heinemann Medical Books LTD, London, 1975, 310 p.
- JAGOŠ, P. - BOUDA, J.: Základní biochemické a hematologické hodnoty u domácích zvířat a nové způsoby vyjadřování výsledků laboratorního vyšetření. Klub přátel Vysoké školy veterinární, Brno, 1981, 29 p.
- KIRK, R. W.: Current Veterinary Therapy VII. Small Animal Practice. W. B. Saunders Comp. Philadelphia, London, Toronto, 1980, 1360 p.
- POSPÍŠIL, J. - KAŠE, F. - VÁHALA, J. - MOUCHOVÁ, I.: Basic haematological values in Antelopes I. Comp. Biochem. Physiol., 78 A, 1984a: 347-351.
- POSPÍŠIL, J. - KAŠE, F. - VÁHALA, J. - MOUCHOVÁ, I.: Basic haematological values in Antelopes II. Comp. Biochem. Physiol., 78 A, 1984b: 799-807.
- POSPÍŠIL, J. - KAŠE, F. - VÁHALA, J. - MOUCHOVÁ, I.: Basic haematological values in Antelopes III. Comp. Biochem. Physiol., 78 A, 1984c: 809-813.

- POSPÍŠIL, J. - KAŠE, F. - VÁHALA, J. - MOUCHOVÁ, I.: Basic haematological values in Antelopes IV. *Comp. Biochem. Physiol.*, 78 A, 1984d: 815-821.
- POSPÍŠIL, J. - KAŠE, F. - VÁHALA, J.: Basic haematological values in the African Buffalo (*Syncerus caffer caffer*) and in the Red Buffalo (*Syncerus caffer nanus*). *Comp. Biochem. Physiol.*, 82 A, 1985a: 495-498.
- POSPÍŠIL, J. - VÁHALA, J. - KAŠE, F. - FRAISOVÁ, L.: Haematological values in the Peripheral Blood of Zebras Kept in the East Bohemian Zoological Garden at Dvůr Králové. *Acta vet. Brno*, 54, 1985b: 129-140.
- POSPÍŠIL, J. - VÁHALA, J. - ŠPÁLA, P. - KAŠE, F.: Haematological and Biochemical Values in the Peripheral Blood of Cape Hunting Dogs (*Lycan pictus*) Kept in the East-Bohemian Zoological Garden at Dvůr Králové nad Labem. *Acta vet. Brno*, 56, 1987: 195-205.
- SCHALM, O. W. - JAIN, N. C. - CARROLL, E. J.: *Veterinary Hematology*, 3rd edition. Lea and Febiger, Philadelphia, 1975: 807 p.
- SOVA, Z.: Používání SI jednotek v zootechnice a veterinární medicíně. *Biologizace a chemizace živočišné výroby-Veterinaria*, 15 (21), 1979: 295-301.