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SOME BLOOD VALUES IN CAPTIVE AND FREE-LIVING COMMON SEALS *(PHOCA VITULINA)*

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Abstract

Blood samples were collected from 12 captive and 15 free-living, apparently healthy, young common seals. A range of haematological and biochemical values were determined. Captive animals had consistently lower levels for red blood cells, haemoglobin, packed cell volume, creatinine and alkaline phosphatase. A range of 'normal' values are suggested and the possible effects of captivity on these values are discussed.

Introduction

The haematology and blood chemistry of mammals can provide much information on the physiological well being of the animal. The need for a range of 'normal' values for the veterinary care of captive seals has already been identified by HUBBARD (1968) but, apart from RIDGWAY (1972), relatively little has been published on the common seal. In this paper we report the physical and chemical properties of blood from a population of common seals in the UK and give the range of values found in apparently healthy seals.

Materials and methods

During 1978-1980 thirteen common seal pups and two yearlings were sampled on sandbanks in the Wash, and twelve pups were examined at Skegness Natureland, Lincolnshire. The captive animals were found as starvelings washed up along the Lincolnshire coast, and were sampled several times over the course of a year to detect any changes in blood values that might occur with age.

In all cases blood was taken from the extradural intervertebral vein, using the technique described by HARRISON and TOMLINSON (1956) and by GERACI and SMITH (1975), into a series of 15 ml Vacutainer tubes (Becton and Dickinson UK Ltd) containing (1) no additive (NA), (2) Lithium heparin (LH) and (3) Ethylenediaminetetracetic acid (EDTA). The sampling procedure could be completed in less than 5 minutes, thus minimising stress to the animal.

Table 1. Haematology and blood chemistry parameters - comparison between young free-living and captive common seals.

	CAPTIVE			FREE-LIVING		
PARAMETER	N	MEAN ± SD	MIN - MAX	N	MEAN ± SD	MIN - MAX
White blood cells $x10^9$/l	10	9.7 ± 1.2	8.0 - 12.2	13	7.5 ± 1.4	4.6 - 9.4
Red Blood cells $x10^{12}$/l	10	5.0 ± 0.25	4.6 - 5.2	13	6.1 ± 0.3	5.4 - 6.55
Haemoglobin g/dl	10	17.9 ± 1.15	16.5 - 19.3	13	21.5 ± 1.2	19.4 - 23.2
Packed cell volume %	10	51.3 ± 9.4	46.3 - 57.1	13	64.7 ± 3.7	56.1 - 71.1
Mean cell volume µ3	10	100.0 ± 2.9	97.0 - 108.0	13	104.0 ± 2.6	101.0 - 110.0
Mean cell haemoglobin pg	10	35.6 ± 0.87	34.1 - 37.2	13	34.3 ± 3.3	24.8 - 39.6
MCH concentration g/dl	10	35.3 ± 0.49	34.6 - 36.1	13	33.3 ± 1.6	29.3 - 36.1
Reticulocytes %	10	1.1 ± 0.2	<1.0 - 1.6	13	2.4 ± 0.48	2.0 - 3.0
Sodium mmol/l	12	150.0 ± 1.2	148.0 - 152.0	11	151.0 ± 1.4	150.0 - 154.0
Potassium mmol/l	12	3.9 ± 0.3	3.3 - 4.3	11	4.3 ± 0.38	3.4 - 4.9
Bicarbonate mmol/l	12	27.5 ± 1.9	24.0 - 31.0	11	24.3 ± 3.2	20.0 - 29.0
Glucose mmol/l	12	6.1 ± 1.2	4.3 - 8.3	11	6.4 ± 1.5	3.8 - 9.1
Urea mmol/l	12	11.3 ± 1.4	9.9 - 14.9	11	15.4 ± 1.87	12.4 - 18.3
Creatinine mol/l	12	49.1 ± 7.4	36.0 - 60.0	11	78.9 ± 6.4	67.0 - 85.0
Protein g/l	12	67.0 ± 2.5	63.0 - 71.0	11	66.5 ± 8.6	58.0 - 69.0
Albumin g/l	12	41.0 ± 1.8	38.0 - 45.0	11	38.0 ± 3.8	34.0 - 47.0
Calcium mmol/l	12	2.5 ± 0.14	2.2 - 2.8	11	2.6 ± 0.08	2.5 - 2.8
Phosphate mmol/l	12	2.1 ± 0.32	1.4 - 2.56	11	2.3 ± 0.16	2.0 - 2.53
Total bilirubin mol/l	12	4.2 ± 1.19	3.0 - 7.0	11	5.6 ± 3.4	3.0 - 6.0
Alkaline Phosphatase U/l	12	137.1 ± 28.8	90.0 - 196.0	11	161.0 ± 52.6	112.0 - 279.0
SGPT U/l	12	51.0 ± 12.2	36.0 - 69.0	9	53.3 ± 26.9	31.0 - 100.0
Uric acid mmol/l	6	0.13 ± 0.013	0.11 - 0.15	8	0.11 ± 0.02	0.09 - 017
Cholesterol mmol/l	6	6.7 ± 0.76	5.5 - 7.8	9	8.0 ± 0.9	6.7 - 9.5

Analysis were carried out at Addenbrookes Hospital, Cambridge within 24 hours of collection. Samples were kept at approx 4°C while in transit from the field to the hospital. The EDTA sample went to the Haematology Department where red blood cell, white blood cell, haemaglobin, packed cell volume and reticulocyte values were determined using a Coulter counter model S-Plus. Mean cell volume, mean cell haemoglobin and mean cell haemoglobin concentration were calculated from these results. The NA and LH tubes were centrifuged within 6 hours of collection at 2000 rpm for 10 minutes, and the serum and plasma pipetted into clean dry tubes. These samples were sent to the hospital Clinical Biochemistry Department where sodium, potassium, bilirubin, alkaline phosphatase, SGPT, bicarbonate, glucose, urea, creatinine, protein, albumin, calcium, phosphate, uric acid and cholesterol were determined using standard automated methods. The effects of storing serum and plasma were also investigated be freezing duplicate blood samples for up to 8 weeks at - 20°C before analysis.

Results and discussion

The physical and chemical blood parameters of the free-living and captive common seals are shown in Table 1. The captive seals were all bled at approximately the same time of day, normally immediately after feeding and the free-living seals during a low tide period on the sand bank. There was little change with increasing age (Table 2), although bilirubin levels were considerably higher in neonatal pups. We suggest that this is caused by the liver not becoming

Table 2. Effects of age on some blood parameters.

Values shown are means.

		WBC	RBC	Hb	Protein	Bilirubin	Alkaline
	N	$X10^9/l$	$X10^{12}/l$	g/dl	g/l	µmol/l	Phosphatase
Newborn	4	8.6	5.4	20.1	65	87	281
3 month	11	7.5	6.1	21.5	66	5.6	161
1 year	2	9.4	5.5	22.1	89	4	112
Adult*	2	9.8	4.6	23.0	88	5	110

*

Values taken from results obtained by J. Cooper MRCVS during investigation on captive adults at Skegness Natureland.

fully functional until a few days after birth, and by the rapid turnover and breakdown of foetal haemoglobin. Alkaline phosphatase levels were also higher in newborn pups (Table 2), probably as a result of rapid bone growth during the first few months of life. LEE *et al* (1978) found this in polar bear cubs *(Ursus maritimus)* as did SEAL *et al* (1975) in wolf pups *(Canis lupus)*. The greatest differences seen between captive and free-living seals were in the red blood cell and haemoglobin levels. Captive animals had lower values for both; this was probably due to the decreased activity of the animal in captivity caused by the relative lack of space and water depth. We have observed the same effect in grey seal *(Halichoerus grypus)* pups (McCONNELL, in pr.), their red blood cell and haemoglobin levels slowly decrease after birth, while they are inactive on land, and these levels do not start to increase until they become more

active when they go to sea after weaning. RIDGWAY *et al* (1970) noticed a drop in the red blood cell and haemoglobin levels during captivity in small Cetacea and suggested that the higher levels found in wild animals could indicate an adaption to deeper diving capabilities. The free-living seals had a higher reticulocyte count than the captive animal indicating a higher turnover of red blood cells. This may also be a function of a more active life in the open sea.

Differing creatinine levels are probably due to the breakdown of creatinine in the muscles. With increased activity more creatinine is produced, therefore an active animal might be expected to have higher levels. Captive seals have little excercise, whereas the free-living seals that were sampled would have been swimming over the whole of the previous high water period prior to sampling. The narrower ranges noticed in the captive animals compared to the free-living animals is probably because captive animals are in an enclosed environment with regular meals and vitamin supplements. The free-living seals do not have a constant daily diet, their amount of exercise and energy expenditure each day would also be greater. All this would affect the blood parameters, but particularly glucose, alkaline phosphatase and creatinine levels. White blood cell values in the captive pups were considerably higher than in the free-living pups. This suggests that the captive animals are more susceptible to infections than free-living seals.

The higher urea levels found in free-living animals were probably due to the seals having fed some hours prior to sampling, we have no information available on the timing of feeding. This is one source of variation that could not be avoided in the free-living animals. Captive seals were all fed at 11 am every day, immediately prior to or after sampling.

Diet could also cause values of red blood cells, haemoglobin and urea to decrease in captivity. All of the captive seals were fed fish which had been frozen and re-thawed, a process which breaks down and destroys many vitamins (GERACI, 1975). It is therefore essential to supplement the diet of captive animals with vitamins.
Freezing had no significant effect on blood values (Table 3), although levels of alkaline phosphatase and SGPT were considerably decreased in the frozen samples, probably due to denaturing during freezing.

Table 3. Effects of frozen storage on blood samples from captive animals

		Frozen sample		Fresh sample
Parameter	N	Mean ± SD	Min-Max	Mean ± SD
Sodium mmol/l	5	148.0 ± 1.0	143.0 - 150.0	150.0 ± 1.2
Potassium mmol/l	5	3.4 ± 0.35	3.1 - 3.8	3.9 ± 0.3
Bicarbonate mmol/l	5	27.2 ± 2.3	23.0 - 32.0	27.5 ± 1.9
Glucose mmol/l	5	5.9 ± 1.9	4.5 - 8.1	6.1 ± 1.2
Urea mmol/l	5	11.1 ± 1.2	8.9 - 13.2	11.3 ± 1.4
Creatinine mol/l	5	52.3 ± 6.7	36.9 - 65.0	49.1 ± 7.4
Protein g/l	5	67.5 ± 2.3	64.0 - 69.0	67.0 ± 2.5
Albumin g/l	5	42.3 ± 2.2	37.0 - 48.0	41.0 ± 1.8
Alkaline phosphatase U/l	5	118.2 ± 17.2	86.0 - 152.0	137.0 ± 28.8
SGPT U/l	5	32.0 ± 8.3	15.0 - 41.0	51.0 ± 12.2

Captive seals live in an environment with little variation, a constant diet and little daily exercise. It should be easy to monitor any deviation from the 'normal' range of blood parameters. If an animal does deviate from the 'normal' then this should be a clear indication of ill health and prompt treatment can be given. Veterinarians should be careful, however, when consulting a 'normal' range that it is specifically for captive animals as this does differ from that of free-living animals.

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