

Stability of Hematological Parameters in Woodland Caribou (*Rangifer tarandus caribou*) Blood Stored at 4°C

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Abstract: Eighteen free-ranging female woodland caribou were captured in northern Alberta in January and February 1993. Blood was collected into ethylenediaminetetraacetate (EDTA) tubes which were packaged in coolers containing ice packs, and transported to the laboratory where they arrived within 48 hrs of collection. Complete blood counts (CBC) were performed on five consecutive days to assess the stability of hematological parameters. Average values of hematocrit (HCT), mean cell hemoglobin (MCH), mean cell volume (MCV), red cell distribution width (P.DW), white blood cell count (WBC), and red blood cell count (RBC) remained stable with no statistically significant changes occurring during 5 days of post-collection storage at 4°C. Mean P.BC values exhibited significant differences ($p < 0.05$) between geographic locations. Mean platelet volume (MPV) increased significantly ($p < 0.001$) with storage time, while platelet (PLT) values decreased ($p < 0.001$) over time and were significantly different ($p < 0.01$) between locations. For optimal hematological results, it is recommended that sample analysis be performed within 24 hours of blood collection; however, if caribou blood samples are properly stored at 4°C, useful information may be obtained from stable parameters up to 5 days following collection.

Key words: hematology, wildlife, temperature, changes, time

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Introduction

Hematological analysis, in conjunction with other screening procedures, provides valuable information when assessing animal health (Jain, 1986). For complete blood counts, it is generally agreed that blood constituents in EDTA remain stable for 24 hours at 4°C (Brittin *et al.*, 1969; Cohle *et al.*, 1981; Lampasso, 1968). However, when blood samples are collected from wild animals living in remote areas, transportation time to analytical laboratories may exceed 24 hours.

Because hematological values are often used for screening purposes, it is critical to determine their stability over time, under field conditions. Although the majority of hematological constituents in human blood remain stable for up to 5 days following collection (Cohle *et al.*, 1981), using these guidelines for wildlife blood could be misleading. The objective of this study was to determine the stability of hematological parameters in woodland caribou blood stored at 4°C.

Materials and method

Study area, blood collection and transportation

A total of eighteen female woodland caribou were captured by aerial net gun technique (Barret *et al.*, 1982) during January and February of 1993 in the following two northern Alberta areas: between 55°30'N and 56°15'N, and 111°15'W and 112°35'W (referred to as location 1); and between 55°10'N and 55°40'N, and 112°42'W and 113°30'W (referred to as location 2). The animals were physically restrained without the use of an anaesthetic. Blood was collected from the superficial digital veins directly into 7-mL tripotassium EDTA Vacutainer tubes (0.081 mL of a 15% solution of tripotassium EDTA, Becton Dickinson & Co., Rutherford, NJ, USA) using 18-gauge needles (Becton Dickinson & Co., Rutherford, NJ, USA). After collection, blood tubes were wrapped in paper towels (to insulate from freezing), packed in a styrofoam cooler containing ice packs, and transported by courier to the Animal Pathology

Laboratory at the Alberta Environmental Centre. The blood samples were received and analyzed within 24 to 48 hours of collection.

Hematological analysis

Prior to analysis, all samples were mixed at room temperature (22°C) for 10 to 15 minutes on a rocker (AMES Aliquot Mixer. Ames Division, Miles Laboratories Inc., Elkhart, IN, USA) which tilts back and forth at 18 cycles per minute. Hematological determinations including white blood cell count (WBC), red blood cell count (RBC), hemoglobin (HGB), hematocrit (HCT), mean cell hemoglobin (MCH), mean cell volume (MCV), mean cell hemoglobin concentration (MCHC), platelets (PLT), red cell distribution width (RDW), and mean platelet volume (MPV) were performed on a Coulter Counter S-Plus IV (Coulter Electronics, Inc. Hialeah, FL, USA) within 24 hours of collection (day 1). The samples were kept refrigerated at 4°C, and were reanalyzed every 24

hours for four consecutive days (days 2 to 5). All samples were analyzed in duplicate.

Statistical analysis

Least square mean estimates of location, time, and location-by-time were obtained by fitting blood data using a repeated measures analysis of variance model coded in SAS version 6.08 software (SAS Institute Inc., Cary, NC, USA). Time (days=1, 2, 3, 4 and 5) was the repeated factor in the model. "Animals within locations" was used as the error term to calculate F-values to test for location effect. The overall mean square error was used for testing time and location-by-time effects.

Results

The average values for WBC, HCT, MCH, MCV and P.DW. did not change significantly ($p < 0.05$) with storage time or between collection locations 1 and 2 (Table 1). The values for MPV did not differ between the two locations, but increased signifi-

Table 1. Mean \pm standard error of hematology parameters of female woodland caribou from two locations in northern Alberta, on day 1 through day 5 of blood storage at 4°C. (Values having no mean differences between locations).

Parameter	Storage time (days) following collection					Combined Means (day 1 through 5)
	1	2	3	4	5	
n	13	18	18	18	18	
HCT	0.57 \pm 0.002 Range 0.52-0.63	0.57 \pm 0.002	0.58 \pm 0.002	0.58 \pm 0.002	0.58 \pm 0.002	0.58 \pm 0.001
HGB g/L	202.8 \pm 0.44 Range 183-219	203.5 \pm 0.36	204.3 \pm 0.36	204.4 \pm 0.36	204.7* \pm 0.36	204.0 \pm 0.20
MCH pg	16.65 \pm 0.081 Range 15-18	16.64 \pm 0.067	16.80 \pm 0.067	16.70 \pm 0.067	16.80 \pm 0.067	16.67 \pm 0.037
MCV fL	47.47 \pm 0.103 Range 43-52	47.40 \pm 0.085	47.55 \pm 0.085	47.49 \pm 0.085	47.66 \pm 0.085	47.51 \pm 0.025
MPV fL	6.34 \pm 0.115 Range 43-52	7.16* \pm 0.095	7.36* \pm 0.095	7.53* \pm 0.095	7.65* \pm 0.100	7.31 \pm 0.053
RDW	9.50 \pm 0.435 Range 7.5-18.7	8.74 \pm 0.338	9.23 \pm 0.338	9.95 \pm 0.338	9.18 \pm 0.338	9.34 \pm 0.187
WBC 10 ⁹ /L	5.32 \pm 0.049 Range 2.8-7.2	5.35 \pm 0.040	5.39 \pm 0.040	5.34 \pm 0.040	5.41 \pm 0.040	5.36 \pm 0.022

Values with a superscript * are significantly different ($p < 0.05$) from the mean on day 1. Hematological determinations on day 1 were performed within 24 hours of blood collection.

candy ($p<0.001$) with storage time. Values for HGB on day 5 showed a small but statistically significant change ($p<0.001$). The RBC values showed differences between locations ($p<0.05$), but did not change with storage (Table 2). The PLT values differed between locations ($p<0.01$), and with storage time ($p<0.001$). Platelet values from location 1 decreased 26% between day 1 and day 5; those in location 2 decreased 11%. The values of MCHC on days 3 and 4 were significantly greater than on day 1 ($p<0.05$) for location 1. However, values on day 2 through day 5 were not different from day 1 for location 2.

Discussion and conclusion

This study found that HCT, RBC, WBC, MCV, MCH and RDW values remain stable in female woodland caribou blood stored at 4°C, for 5 days following collection; hemoglobin values remain stable for 4 days. Platelet numbers decreased and platelet size increased, suggesting that platelet aggregation occurred with storage. Cohle *et al.* (1981) found that platelet numbers in blood from healthy human donors were stable for 5 days following collection. The differences in RBC and PLT values between

locations suggest that there may be a location effect for some hematological parameters.

Results from this study indicate that caribou blood samples, when handled under our specified conditions of collection and storage, provide useful information for most hematological parameters up to 5 days following blood collection.

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Table 2. Mean \pm standard error of hematology parameters of female woodland caribou from two locations in northern Alberta, on days 1 through 5 of blood storage at 4°C. (Values having mean differences between locations)

Parameter	Location	n	Storage Time (days) following collection					Combined Means (day 1 through 5)
			1	2	3	4	5	
PLT 10 ⁹ /L	1	6	214.4 \pm 10.37 Range 132-269	154.1* \pm 8.71	147.1* \pm 8.71	162.0* \pm 8.71	157.3* \pm 9.45	167.0 \pm 15.89
	2	7	253.9 \pm 9.65 Range 197-317	239.6 \pm 7.79	211.6* \pm 7.79	221.5* \pm 7.79	225.9 \pm 7.79	230.5 \pm 14.08
RBC 10 ¹² /L	1	6	11.67 \pm 0.065 Range 11.05-12.41	11.65 \pm 0.055	11.68 \pm 0.055	11.71 \pm 0.055	11.75 \pm 0.055	11.69 \pm 0.214
	2	7	12.48 \pm 0.061 Range 11.60-13.09	12.51 \pm 0.049	12.63 \pm 0.049	12.59 \pm 0.049	12.60 \pm 0.049	12.56 \pm 0.192
MCHC g/L	1	6	352.1 \pm 1.72 Range 344-357	353.4 \pm 1.44	357.5* \pm 1.44	358.1* \pm 1.44	352.9 \pm 1.44	354.8 \pm 1.40
	2	7	350.1 \pm 1.60 Range 346-359	351.0 \pm 1.29	351.0 \pm 1.29	347.5 \pm 1.29	350.5 \pm 1.29	350.1 \pm 1.26

Values with a superscript * are significantly different ($p<0.05$) from the mean on day 1. Hematological determinations on day 1 were performed within 24 hours of blood collection.

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