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HEMATOLOGIC, SERUM CHEMISTRY AND SEROLOGIC VALUES OF DALL'S SHEEP (*OVIS DALLI DALLI*) IN ALASKA

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ABSTRACT: In June 1979, 73 Dall's sheep were captured near Tok, Alaska to determine selected hematologic and serum metabolite parameters and to determine the presence of antibodies to selected pathogens. Hematology and serum metabolite values were compared with values for domestic sheep and bighorn sheep (*Ovis canadensis*). Antibodies were detected against *Brucella* sp. (4%), *Campylobacter feti* (30%), contagious ecthyma virus (23%), and bovine parainfluenza type 3 virus (1%). Antibodies were not detected against *Anaplasma* sp., *Leptospira* sp., bovine virus diarrhea virus, bluetongue virus, infectious bovine rhinotracheitis virus, ovine progressive pneumonia, and *Toxoplasma* sp.

INTRODUCTION

Normal physiologic values of hematology and serum metabolites have been reported for domestic ruminants and many wild ruminants (Schalm et al., 1975). Such values have been published for Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*), Nelson's bighorn sheep (*O. c. nelsoni*) and Stone's sheep (*Ovis dalli stonei*) (Franzmann and Thorne, 1970; Woolf and Kradel, 1970; Franzmann, 1971a, b; McDonald et al., 1981), but information is lacking on wild Dall's sheep (*Ovis dalli dalli*). This report presents data from 73 wild Alaskan Dall's sheep to establish baseline data for this species. A serologic survey was also conducted to detect the presence of antibodies for specific disease organisms.

MATERIALS AND METHODS

Dall's sheep were captured using either a 18-m by 12-m nylon rocket net or an 18-m^2 nylon drop net at Sheep Creek in the Alaska Range, west of Tok, Alaska, during June 1979. Captured sheep were physically restrained and blindfolded and were aged by tooth eruption and by horn development. Adults, 2 yr of age or older were tranquilized with an intramuscular injection of 6 mg of acepromazine maleate (Ayerst Laboratories, New York, New York 10017, USA), and yearlings with 4 mg. Lambs were not tranquilized.

Following tranquilization, 60 ml of blood for serum and 3 ml of blood in anticoagulant (EDTA tubes) were collected by jugular venipuncture. The EDTA sample was used to determine total white blood cell count (Unopette #5856, Becton-Dickinson Co., Rutherford, New Jersey 07070, USA), total red blood cell count (RBC) (Unopette #5851), total hemoglobin (Spencer hemoglobinometer, American Optical, Buffalo, New York 14240, USA), packed cell volume (Clay Adams microhematocrit method, Clay Adams, Inc., Parsippany, New Jersey 07054, USA), and total plasma proteins (AO refractometer, American Optical, Buffalo, New York 14240, USA). A blood smear was fixed in methanol and stained with Wright's stain for a differential white cell count (WBC).

Whole blood in clot tubes was allowed to clot for 18–24 hr, centrifuged, and serum pipetted off. Serum was frozen in 2-ml Cryotubes (Vanguard International Inc., Neptune, New Jersey 07753, USA) and stored in a 30-liter liquid nitrogen tank. Serum chemistries were analyzed by a Technicon Sequential Multiple Analyzer Computer (SMAC) system (Treasure Valley Laboratories, Inc., Boise, Idaho 83707, USA). Tests for serum antibodies to *Anaplasma* sp., *Leptospira* sp., bovine parainfluenza type 3 virus (PI-3 virus), contagious ecthyma virus (CE virus), bovine virus diarrhea virus (BVD virus), bluetongue virus (BLU virus), *Toxoplasma* sp., infectious bovine rhinotracheitis virus (IBR virus) and ovine progressive pneumonia virus (OPP virus) were completed at the Washington Animal Disease Diagnostic Laboratory, Pullman, Washington. Specific tests used are listed in Table 1. Standardized methods according to Cottral (1978) were used.

RESULTS AND DISCUSSION

Forty-four sheep were captured by the rocket net method and 29 by the drop net method. The mean age of captured sheep was 3.7 yr, including the following age distribution: lambs (n = 2), yearlings (n = 14), 2 (n = 21), 3 (n = 8), 4 (n = 6), 5 and older (n = 22). Fifty-four sheep were females, 19 were males.

All samples were seronegative for *Anaplasma* sp., *Leptospira* sp., BVD virus, BLU virus,

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TABLE 1. Results of serologic tests for antibodies to selected animal pathogens in 73 wild Dall's sheep.

Disease agent	Test[a]	No. positive	Range of reciprocal titers (median)
Anaplasma sp.	CG	0	—
Brucella sp.	PG	3	50 (50)
Campylobacter feti	TG	22	100–200 (100)
Leptospira sp.	PG	0	—
Bovine virus diarrhea virus	SN	0	—
Bluetongue virus	AGID	0	—
Contagious ecthyma virus	SN	17	5–320 (10)
Infectious bovine rhinotracheitis virus	SN	0	—
Ovine progressive pneumonia	AGID	0	—
Parainfluenza 3 virus	SN	1	100
Toxoplasma sp.	IHA	0	—

[a] CG = Card agglutination, PG = plate agglutination, TG = tube agglutination, SN = serum neutralization, AGID = agar gel immunodiffusion, IHA = indirect hemagglutination.

Toxoplasma sp., IBR virus and OPP virus (Table 1). Antibody titers to four disease agents, *Campylobacter feti, Brucella* sp., PI-3 virus and CE virus, were demonstrated. Reactors to *C. feti* and CE virus were the most prevalent. Vibriosis is an abortive disease of domestic sheep caused by *Campylobacter feti intestinales* (Jensen and Swift, 1982), and could contribute to decreased herd productivity in Alaska Range sheep. Ovine brucellosis is a common disease of domestic sheep and results in lowered productivity. Infected ewes may abort, but more commonly, infected rams develop an epididymitis leading to abscessation and reduced fertility (Jensen and Swift, 1982). Bovine parainfluenza type 3 virus has been shown to be a pathogen in the upper respiratory tract of domestic sheep (Fishman, 1967) and Rocky Mountain bighorn sheep (Parks et al., 1972). The evidence indicated exposure to the PI-3 virus, but the importance of this virus as a respiratory pathogen of wild Dall's sheep is unknown. Serologic evidence suggested widespread exposure to CE virus. Contagious ecthyma is a common disease of domestic sheep and has been reported in wild Rocky Mountain bighorn sheep (Blood, 1971) and Dall's sheep in captivity (Dieterich et al., 1981). The virus has recently been isolated from a mammary gland lesion of a wild Dall's sheep ewe (Smith et al., 1982). The role of this pathogen in contributing to decreased productivity among Dall's sheep in Alaska deserves further study.

Hematologic data are summarized in Table 2. These results are compared with published

TABLE 2. Mean hematologic values for 73 Dall's sheep, compared with published data on Nelson's bighorn sheep and domestic sheep.

Hematologic value	Dall's sheep (mean ± SD) (n = 73)	Nelson's bighorn sheep[a] (mean ± SD) (n = 11)	Domestic sheep[b] (mean (range)) (n = 591)
Leukocytic series			
Total white blood cells ($\times 10^6/\mu l$)	7,600 ± 3,200	10,800 ± 1,400	8,000 (4,000–12,000)
Mature neutrophils (%)	49.6 ± 11.9	63 ± 13.6	30 (10–50)
Band neutrophils (%)	rare	—	rare
Lymphocytes (%)	33.9 ± 11.9	26 ± 10.5	62 (40–75)
Monocytes (%)	1.3 ± 1.3	5 ± 3.2	2.5 (0–6)
Eosinophils (%)	14.5 ± 7.5	2 ± 2.2	5 (0–10)
Basophils (%)	rare	—	1 (0–3)
Erythrocytic series			
Total red blood cells ($\times 10^6/\mu l$)	13.8 ± 2.8	—	12.0 (9–15)
Total hemoglobin (g/dl)	14.3 ± 1.6	—	11.5 (9–15)
Hematocrit (%)	46 ± 5.2	—	35 (27–45)
Total plasma protein (g/dl)	6.8 ± 0.1	6.6 ± 0.7	6.7 (6.0–7.5)
Mean corpuscular volume (μl)	33	—	34 (28–40)
Mean corpuscular hemoglobin (pg)	10.4[c]	—	10 (8–12)
Mean corpuscular hemoglobin concentration (g/dl)	31[c]	—	33 (31–34)

[a] From McDonald et al. (1981).
[b] From Schalm et al. (1975).
[c] Calculated from mean values for total red blood cells, total hemoglobin and hematocrit.

TABLE 3. Blood chemistry values for 73 Dall's sheep compared with published data on Nelson's bighorn sheep and domestic sheep.

Component	Dall's sheep (mean ± SD) (n = 73)	Nelson's bighorn sheep[a] (mean ± SD) (n = 11)	Domestic sheep[b] (mean (range)) (n variable[b])
Total plasma proteins (g/dl)	6.8 ± 0.8	6.6 ± 0.7	7.6 (6.7–9.1)
Albumin (g/dl)	3.3 ± 0.4	3.6 ± 0.1	3.0 (2.3–4.1)
Globulin (g/dl)	3.5 ± 0.7	3.0 ± 0.7	4.6 (3.5–5.7)
Ca (mg/dl)	9.6 ± 0.8	10.0 ± 0.4	11.8 (10.4–14.0)
P (mg/dl)	4.6 ± 1.6	5.5 ± 2.3	5.1 (4.0–7.0)
Na (mEq/liter)	140 ± 7.1	—	152 (140–164)
K (mEq/liter)	6.9 ± 1.9	—	5.0 (4.4–6.7)
Cl (mEq/liter)	100 ± 6.6	—	118 (115–121)
BUN (mg/dl)	24 ± 4.7	21.0 ± 5.1	26 (15–36)
Creatinine (mg/dl)	1.1 ± 0.2	1.9 ± 0.1	1.9 (0.7–3)
Glucose (mg/dl)	162 ± 56	226 ± 38	88 (55–131)
Cholesterol (mg/dl)	60 ± 15	61.0 ± 10.2	100.0 (50–140)
Lactic dehydrogenase (IU/liter)	762 ± 66.8	826 ± 231	77.5 (44–112)
Aspartate amino transferase (IU/liter)	160 ± 37	284 ± 110	82 (40–123)

[a] From McDonald et al. (1981).
[b] Compiled from several sources by Mitruka and Rawnsley (1981).

data for domestic sheep (Schalm et al., 1975) and bighorn sheep (Franzmann and Thorne, 1970; Woolf and Kradel, 1970; Franzmann, 1971b; McDonald et al., 1981). Serum metabolite concentrations are summarized in Table 3 and compared with published data for domestic sheep (Mitruka and Rawnsley, 1981).

The hematologic data obtained for Dall's sheep in this report were similar to normal values for domestic sheep (Table 2). The most outstanding difference in the leukogram is the high percentage of eosinophils. Eosinophilia is associated with endoparasitism and other conditions, but fecal samples of the captured sheep were not examined for parasite eggs.

These Dall's sheep had a greater concentration of red blood cells than values reported for domestic sheep (Table 2), but were similar to values reported for bighorn sheep (Woolf and Kradel, 1970; Franzmann, 1971b) and Stone's sheep (Franzmann, 1971a). Several environmental factors, including physical stress and elevation, can influence this parameter. The elevation at the capture site was approximately 1,075 m above sea level, but it is unlikely that this elevation would result in any significant difference in the RBC concentrations. Physical stress may have influenced the values observed in the sheep. Physical stress of capture can result in splenic contraction with subsequent release of red blood cells into the peripheral vasculature leading to an increased hematocrit.

The results of serum chemistry analyses showed most Dall's sheep values to be similar to published values for domestic sheep (Table 3). Glucose values of Dall's sheep were higher than those reported in domestic sheep, but were similar to or lower than values reported from bighorn sheep (Woolf and Kradel, 1970; Franzmann, 1971b) or Stone's sheep (Franzmann, 1971a). The elevated glucose may be a response to the stress of capture and the administration of acepromazine. Injection of chlorpromazine results in a marked increase in blood glucose in domestic sheep (Bruss, 1980) and it is likely that acepromazine also increases blood glucose in Dall's sheep.

Serum potassium values in Dall's sheep were higher than those reported for domestic sheep. Elevated serum potassium values can occur due to renal disease, hypoadrenocorticism, lactic acidosis, circulatory failure or from RBC's when serum is left in contact with the clot. It is unlikely that the captured Dall's sheep were suffering from renal disease or hypoadrenocorticism. Mild lactic acidosis and stress of capture could well have been present in the majority of these sheep. Tranquilization of captured sheep tended to lower the respiratory rates and could have contributed to the mild lactic acidosis and consequently to the observed elevated potassium values. However, the most likely cause was technical error as the result of the clot being allowed to remain in contact with the serum, resulting in elution of RBC potassium into the serum.

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LITERATURE CITED

BLOOD, D. A. 1971. Contagious ecthyma in Rocky Mountain bighorn sheep. J. Wildl. Manage. 35: 270–275.

BRUSS, M. L. 1980. Effects of chlorpromazine on plasma concentration of long chain fatty acids and glucose in sheep. J. Vet. Therap. 3: 35–44.

COLES, E. H. 1967. Veterinary Clinical Pathology. W. B. Saunders Co., Philadelphia, Pennsylvania, 455 pp.

COTTRAL, G. E. 1978. Manual of Standardized Methods for Veterinary Microbiology. Cornell University Press, Ithaca, New York, 731 pp.

DIETERICH, G. R., G. R. SPENCER, D. BURGER, A. M. GALLINA, AND J. VANDERSHALIE. 1981. Contagious ecthyma in Alaskan muskoxen (*Ovis moschatus*) and Dall sheep (*Ovis dalli*). J. Am. Vet. Med. Assoc. 179: 1140–1143.

FISHMAN, H. R. 1967. Epidemiology of parainfluenza$_3$ infection in sheep. Am. J. Epidemiol. 85: 272–281.

FRANZMANN, A. W. 1971a. Physiologic values of stone sheep. J. Wildl. Dis. 7: 139–141.

———. 1971b. Comparative physiologic values in captive and wild bighorn sheep. J. Wildl. Dis. 7: 105–108.

———, AND T. THORNE. 1970. Physiologic values in wild bighorn sheep (*Ovis canadensis canadensis*) at capture, after handling and after captivity. J. Am. Vet. Med. Assoc. 157: 647–650.

JENSEN, R., AND B. L. SWIFT. 1982. Diseases of Sheep, 2nd Ed. Lea & Febiger, Philadelphia, Pennsylvania, 330 pp.

MCDONALD, S. E., S. R. PAUL, AND T. O. BUNCH. 1981. Physiologic and hematologic values in Nelson desert bighorn sheep. J. Wildl. Dis. 17: 131–134.

MITRUKA, B. M., AND H. M. RAWNSLEY. 1981. Clinical Biochemical and Hematological Reference Values in Normal Experimental Animals and Normal Humans, 2nd Ed. Masson Publishing USA, New York, New York, 413 pp.

PARKS, J. B., G. POST, T. THORNE, AND P. NASH. 1972. Parainfluenza$_3$ virus infection in Rocky Mountain bighorn sheep. J. Am. Vet. Med. Assoc. 161: 669–672.

SCHALM, O. W., N. C. JAIN, AND E. J. CARROLL. 1975. Veterinary Hematology, 3rd Ed. Lea & Febiger, Philadelphia, Pennsylvania, 807 pp.

SMITH, T. C., W. E. HEIMER, AND W. J. FOREYT. 1982. Contagious ecthyma in an adult Dall sheep (*Ovis dalli dalli*) in Alaska. J. Wildl. Dis. 18: 111–112.

WOOLF, A., AND D. C. KRADEL. 1970. Hematologic values of captive Rocky Mountain bighorns. J. Wildl. Dis. 6: 67–68.