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PHYSIOLOGIC AND HEMATOLOGIC VALUES IN NELSON DESERT BIGHORN SHEEP[1,2]

SCOTT E. McDONALD,[3] STEPHAN R. PAUL,[3] and THOMAS D. BUNCH[4]

Abstract: Physiologic and hematologic values were established for two groups of free ranging Nelson desert bighorn sheep *(Ovis canadensis nelsoni).* Eleven sheep (Group I) were captured with a drop net, 16 sheep (Group II) were immobilized with Etorphine introduced in projectile syringes. The mean glucose level, respiration rate and leucocyte count values for Group I sheep were more than twice those observed in Group II sheep. There were no differences between the groups in the other values. Data obtained were compared to values previously established for free ranging and captive Rocky Mountain bighorn sheep *(O. c. canadensis),* California bighorn sheep *(O. c. californiana)* and domestic sheep *(O. aries).*

INTRODUCTION

Physiologic values are an important tool when diagnosing disease. Values have been established for most domestic animals and for some wild species. Since wild sheep are both difficult and costly to capture, information on their physiologic parameters is limited. Values have been reported for Rocky Mountain bighorn sheep *(Ovis canadensis canadensis),*[5,7,9] California bighorn sheep *(O. c. californiana),*[5] and stone sheep *(O. dalli stonei).*[6] This paper presents physiologic values for two groups of Nelson desert bighorn sheep *(O. c. nelsoni)* that were restrained by two different methods.

MATERIALS AND METHODS

Two groups of Nelson desert bighorn sheep from different locations and restrained by two different techniques were sampled. Group I consisted of 11 sheep captured with a drop net in a 36 ha enclosure at Zion National Park, Springdale, Utah. Each sheep was restrained by hobbling all four feet and then blindfolding. The physical examinations included recording rectal temperatures, pulse rates and respiratory rates. Blood samples were taken from the external jugular vein.

Group II consisted of 16 sheep chemically immobilized from a helicopter at Canyonlands National Park, Moab, Utah. Etorphine [5] at dosages of 2.5 mg for medium-sized sheep (44-55 kg) and 3.5 mg for larger sheep (70 kg) was used. Upon completion of the physical examination of each sheep, immediately following the collection of a blood sample, diprenorphine [6] was given intravenously to each sheep at twice the dose of Etorphine to reverse immobilization effects.

Serum chemistry profiles were obtained using a Technicon 12/60 Micro

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[5] M-99, American Cyanamid Company, Princeton, New Jersey, 08540, USA.

[6] M 50-50, American Cyanamid Company, Princeton, New Jersey 08540, USA.

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Analyzer.[7] Hemograms in Group I were established using a Coulter Counter Model Fn [8] and Group II with a Coulter Counter Model S.[8]

RESULTS

Blood serum chemistry data and physiologic and hematologic values were similar for Groups I and II except for glucose levels, respiration rates, leucocyte counts and differential counts (Tables 1 and 2). The glucose levels, respiration rates, and leucocyte counts of animals that were not tranquilized (Group I) were double those of the Etorphine-immobilized sheep (Group II).

DISCUSSION

Values established in Nelson desert bighorn sheep were similar to those reported in wild and captive Rocky Mountain bighorn sheep and California bighorn sheep.[5,7,9] Total protein, albumin, cholesterol, total bilirubin, blood urea nitrogen and creatine values were within the range established for domestic sheep.[3] Values that appeared to be affected by stress included rectal temperature, pulse, respiration, glucose, lactic dehydrogenase, serum glutamic oxalacetic transaminase, leucocytes and differentials.

Significant stress-related differences were observed between Groups I and II in glucose levels, respiration rates and leucocyte counts. These differences are attributed to sheep in Group I being alert throughout processing, whereas sheep in Group II were chemically immobilized.

The mean erythrocyte counts, packed cell volumes and hemoglobin values of Nelson bighorn sheep differ from the means established for domestic sheep but were within the same range.[3,5,7,9] Differences in mean values between Nelson bighorn sheep and domestic sheep that could not be associated with stress during restraint were calcium and alkaline phosphatase levels.[3]

Elevated levels of lactic dehydrogenase and serum glutamic oxalacetic transaminase in both groups of Nelson bighorn sheep were indicative of stress and cell damage. Lactic dehydrogenase and serum glutamic oxalacetic transaminase levels have been shown to rise in domestic sheep following cell damage

TABLE 1. Physiologic and hematologic values for Nelson bighorn sheep and domestic sheep.

	Group I (mean ± S.D.)	Group II (mean ± S.D.)
Temperature	104.9± 1.1	105.9± 1.6
Pulse (min)	132 ±46.6	115 ±24.3
Respiration (min)	83 ±19.0	32 ± 6.7
Erythrocytes (10^6/ml)	—	9.0± .9
Leucocytes ($10^3/\mu$l)	10.8± 1.4	4.7± 1.1
Packed cell volume %	—	35 ± 3.9
Hemoglobin (g/dl)	—	12.3± 1.6
Bands %	3.0± 2.7	0
Neutrophils %	63 ±13.6	62 ±18.7
Lymphocytes %	26 ±10.5	34 ±17.8
Monocytes %	5 ± 3.2	1 ± 1.9
Eosinophils %	2 ± 2.2	2 ± 2.9

[7] Technicon Corporation, Tarrytown, New York 10591, USA.

[8] Coulter Electronics, Inc., Hialeah, Florida 33010, USA.

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TABLE 2. Blood serum chemistry values from Nelson bighorn sheep.

	Group I (mean±S.D.)	Group II (mean±S.D.)
Calcium (mg/dl)	10.0± 0.4	9.8± 0.9
Phosphorous (mg/dl)	5.5± 2.3	3.6± 0.8
Glucose (mg/dl)	226 ±38.2	98 ±28.5
BUN* (mg/dl)	21 ± 5.1	16 ± 5.2
Cholesterol (mg/dl)	61 ±10.2	70 ±20.4
Total protein (gm/dl)	6.6± 0.7	6.5± 0.9
Albumin (gm/dl)	3.6± 0.1	2.9± 0.5
Total bilirubin (mg/dl)	0.9± 0.3	0.3± 0.2
Alk. phosphatase (mU/ml)	372 ±204.2	191 ± 77.3
LDH** (mU/ml)	826 ±230.8	789 ±539.9
SGOT*** (mU/ml)	284 ±110.0	328 ±280.7
Creatinine (mg/dl)	1.9± 0.1	1.9± 0.3

*Blood urea nitrogen
**Lactic dehydrogenase
***Serum glutamic oxalacetic transaminase

to a wide variety of tissues and specifically as a result of muscle damage.[2,3]

Physiologic leucocytosis was observed in sheep from Group I. This was no surprise since physiologic leucytosis is associated with exercise, excitement, fear, apprehension or pain.[2] Sheep in Group I underwent most of these clinical signs while being hobbled and blindfolded. Physiologic leukocytosis in domestic sheep often is due to neutrophilia occurring as a response to the destruction or sequestration of lymphocytes.[2] The relative neutrophil counts in Group I and Group II of the Nelson bighorn sheep were 63% and 62% respectively. The normal levels for domestic sheep range from 10-50%.

Neutrophilia and lymphopenia exist in both groups of Nelson desert bighorn sheep based on the mean leucocyte and differential counts for domestic sheep. Upon converting percentages of these cell types to absolute numbers, the neutrophil count was 6,791 and 2,917 for Groups I and II, respectively, and 2,100 for domestic sheep. The absolute lymphocyte count was 2,802 and 1,600 for Groups I and II, respectively, and 4,200 for domestic sheep. The significance of these variations from the normal parameters in domestic sheep is unknown.

Mean values for calcium were substantially lower in both groups of Nelson bighorn sheep than in domestic sheep.[2] The mean phosphorous level for sheep in Group II was lower than values established in domestic sheep.[2] The reduced levels of calcium and phosphorus may be related to diet. This possibility is particularly evident in the phosphorous level differences between sheep in Groups I and II, since Group I animals had been supplementally fed a ration of alfalfa hay and grain concentrate. Phosphorous deficiency occasionally is observed in domestic livestock maintained on the desert ranges of southwestern United States.

Higher levels of alkaline phosphatase are associated with osteoblastic activity in young growing animals.[2] This partially explains the higher level in Group I as compared to Group II. Six of 11 sheep in Group I were approximately six months of age, whereas all in Group II were two years or older.

The data presented in this paper are meant to establish baseline values for Nelson desert bighorn sheep.

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Physiologic data obtained from Nelson desert bighorn sheep correspond closely to published values for Rocky Mountain and California bighorn sheep, even when the variables of excitability and stress are taken into account. Although similarities exist among values established for North American wild sheep and domestic sheep, more complete data needs to be accumulated from all genotypes of free-living and captive wild sheep and further assessed to accurately establish physiologic and hematologic profiles.

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