HEMATOLOGIC AND SERUM CHEMICAL VALUES OF ADULT FEMALE ROCKY MOUNTAIN ELK FROM NEW MEXICO AND OKLAHOMA

Authors: WOLFE, GARY, KOCAN, A. ALAN, THEDFORD, THOMAS R., and BARRON, SELWYN J.

Source: Journal of Wildlife Diseases, 18(2) : 223-227

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-18.2.223

HEMATOLOGIC AND SERUM CHEMICAL VALUES OF ADULT FEMALE ROCKY MOUNTAIN ELK FROM NEW MEXICO AND OKLAHOMA

GARY WOLFE, Vermejo Park, P.O. Drawer E, Raton, New Mexico 87420, USA.
A. ALAN KOCAN, THOMAS R. THEDFORD AND SELWYN J. BARRON, College of Veterinary Medicine, Oklahoma State University, Stillwater, Oklahoma 74078, USA.

Abstract: Hematologic and serum chemical values were determined for two groups of adult female Rocky Mountain elk *(Cervus elaphus nelsoni)* from New Mexico and Oklahoma. Although considerable variation in values was observed between elk from the same group, the mean values for 16 of the 20 blood parameters tested were significantly different between the two groups. Of these, the most significant variations were observed in values which were likely to be influenced by nutritional condition and health status. The results of this study indicate that when evaluating the health status of different herds kept under known conditions, hematologic and serum chemical values are of optimal significance when the mean values of the herds are compared.

INTRODUCTION

Hematologic and serum chemistry values are important aids in diagnosing disease conditions and in evaluating health status. Although values for wild ungulates are becoming more available, the maximum utilization of this information will not be achieved until sufficient data are accumulated from a number of different populations under a variety of known environmental conditions. Hematologic and serum chemistry values are available for Rocky Mountain elk from Oregon (Pedersen and Pedersen, 1975), Idaho (Vaughn et al., 1973), Colorado (Herin, 1968), Montana (Knight, 1969), and Utah (Follis, 1972), and for Roosevelt Elk *(C.e. roosevelti)* from Oregon (Weber and Bliss, 1972). This report presents hematologic and serum chemistry values for two groups of adult female Rocky Mountain elk *(Cervus elaphus nelsoni)* from locations in New Mexico and Oklahoma.

MATERIALS AND METHODS

Group I animals were from a private collection of 52 elk maintained on a 1,415 ha wildlife preserve with a game-proof parameter fence in northeastern Oklahoma. Elevation of the property is approximately 207 m and the major vegetation type is oak-hickory parkland. Major competitors for forage include 300 bison *(Bison bison)*, 36 exotic cattle and over 700 exotic deer including sika *(Cervus nippon)* and fallow deer *(Dama dama)*.

The original herd was purchased from a private collection in Nebraska in 1930. Subsequently the collection was maintained as a closed female herd until the introduction of three bulls in 1973. The reproductive rate (number of calves observed on fall feeding grounds) for cows over 2 years of age was 2% and 35% respectively for the previous 2 years. Additionally, births were recorded at sporadic times and occurred as late in the year as July. All animals were free-ranging within the confines of the preserve and foraged on native vegetation most of the year. Supplemental feeding of elk began in October and continued through March. Supplementation began at 0.5 kg per head/day and increased to 1.8 kg per head/day

resulting in an average of 1.4 kg per head/day for the 6 month feeding period. Supplementation consisted of 20% natural protein cattle cubes. At feeding time, both elk and free-ranging deer competed for available feed.

All animals in Group I were in apparently good health, although their condition, as determined by visual examination and physical palpation, was judged to be only fair as evidenced by prominent dorsal processes of the spine and lack of flesh cover over the ribs. The elk in this group were immobilized with etorphine (1-3 mg)[1] introduced by projectile syringe.[2] Blood samples were taken from the jugular vein when the animals were completely immobilized. Sampling occurred between October and January. Serologic testing indicated no reactors to *Brucella abortus*, three animals with low titers (1:100) to *Leptospira pomona* and two reactors (1:20) to bluetongue virus. Microscopic examination of semen, collected by electroejaculation from each herd bull revealed live, viable sperm. Internal parasite levels as determined by fecal flotation appeared to be low as were external parasite levels determined visually.

Group II animals were from a population of 4,000-6,000 elk at Vermejo Park, a 198,000 ha ranch in northeastern New Mexico. This elk herd is completely wild and free-ranging; the property is not enclosed by a game-proof fence, nor is supplemental feeding practiced. Elevation on the property ranged from 1,830 to 3,960 m. Major vegetation types included grama-buffalo grasslands, pinyon-juniper woodlands, ponderosa pine-Douglas fir forests, southwestern spruce-fir forests, and subalpine and alpine meadows. Major competitors for rangeland forage included a moderate population of mule deer *(Odocoileus hemionus)* and approximately 3,000 Hereford cattle. Elk were captured in Clover traps (Clover, 1956) from January through March. Blood samples were collected by jugular venipuncture while the animals were physically restrained. Ages were estimated by tooth wear and replacement (Quimbly and Gaab, 1975). The physical condition of elk in Group II as determined by visual inspection and physical palpation, was judged to be superior to that of the animals in Group I. The conception rate for adult cows (≥2 years old) in the Vermejo herd averaged 78% for the previous two years (Wolfe, 1980). Serology results were negative for bluetongue virus and epizootic hemorrhagic disease virus. One animal had a titer (1:256) to bovine virus diarrhea virus.

Hematologic values were determined by means of standard clinical laboratory methods. Serum chemical values were determined on an automated Coulter Chemistry.[3] Differences between means were compared using Student's t-test (P=0.05).

RESULTS AND DISCUSSION

Values for the two groups of elk showed notable differences in a variety of tests (Table 1). All mean hematologic values were significantly different between groups except leucocytes and neutrophils. Packed cell volume (PCV) values were lower in the Group I elk than the Group II elk. The Group II PCV-values were similar to those reported for elk from Colorado (Herin, 1968), but were not as high as those reported for elk from Oregon (Pedersen and Pedersen, 1975). Hemoglobin values showed a similar pattern, being higher in Group II elk. Group II values were again comparable with those of elk from Colorado (Herin,

[1] D-M Pharmaceutical, Inc., Rockville, Maryland 20859, USA.

[2] Cap-Chur Gun, Palmer Chemical Co., Atlanta, Georgia 30134, USA.

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

TABLE 1. Hematology and serum chemical values for adult female Rocky Mountain elk.

Value	Group I (N=16)		Group II (N=25)	
A/G Ratio	1.57	(1.00)[a]	0.85	(0.22)*
Albumin (gm/dl)	4.03	(0.67)	3.30	(0.38)*
Blood urea nitrogen (mg/dl)	20.40	(5.96)	16.41	(3.96)
Calcium (mg/dl)	8.72	(1.18)	10.14	(0.91)*
Cholesterol (mg/dl)	111.53	(27.87)	89.44	(13.00)*
Creatine Phosphokinase (IU/L)	727.00	(1,304.00)	61.52	(42.52)*
Creatinine (mg/dl)	2.74	(0.66)	3.35	(0.45)*
Glucose (mg/dl)	62.53	(34.07)	226.21	(43.88)*
Magnesium (mg/dl)	2.28	(0.59)	ND[b]	
Phosphorus (mg/dl)	5.10	(2.18)	4.43	(1.38)
Potassium (mEq/L)	8.09	(1.34)	4.58	(1.28)*
Serum Protein (g/dl)	6.61	(0.52)	7.23	(0.86)*
Aspartate amino-transferase (IU/l)	91.31	(60.14)	134.64	(100.13)*
Sodium (mEq/L)	139.95	(3.24)	146.88	(5.11)*
Leucocytes (μl)	8,705.55	(13,644.00)	6,877.60	(1,442.90)
Hemoglobin (g/dl)	15.78	(2.12)	18.56	(3.15)*
Packed cell volume (%)	40.62	(4.06)	47.21	(4.34)*
Neutrophils (%)	49.88	(21.16)	54.50	(17.97)
Lymphocytes (%)	28.33	(12.28)	41.29	(18.74)*
Monocytes (%)	3.17	(3.35)	1.17	(1.55)*
Eosinophils (%)	16.24	(11.29)	1.08	(1.55)*

[a] = Average value followed by standard deviation in parentheses
[b] = Not determined
* = Means with asterisk are significantly different at the P = 0.05 level.

1963), but were not as high as those from Oregon (Pedersen and Pedersen, 1975). Although the difference in nutritional levels between the two groups could contribute to the higher values seen in Group II animals, many other factors such as altitude or stress due to the method of capture may have influenced these values. Total leucocyte values did not vary significantly between the two groups but were higher in Group I elk. Leucocyte values from both Groups I and II animals were, however, higher than values from elk from Colorado (Herin, 1968). The lymphocyte values observed in Groups I and II were 28% and 41% respectively. Most notable was the 16% eosinophil count observed in Group I. The exact cause for this increased value was not readily apparent. Indications of infection or parasite diseases which are normally associated with increased eosinophil levels were not detected.

Eleven of 13 mean serum chemistry values varied significantly between the two groups (Table 1). Only BUN and phosphorus levels did not vary significantly. BUN levels, which have been shown to reflect the quality of the diet, were higher in Group I animals but showed more variability between animals. These results are consistent with other studies on elk which compare captive and wild animals although the levels for both groups of animals in this study were not as high as those reported previously (Vaughn et al., 1973; Weber and Bliss, 1972). Since BUN levels are known to vary directly with the protein content of the diet an explanation for the higher levels observed in the semi-

captive Group I animals may be that supplemental feeding was occurring at the time of sampling. Although differences between the values in the two groups was not significant at the 0.05 level, they were at the 0.07 level. The lower levels in the Group II animals was probably a reflection of the time of sampling and the protein content of the available forage during winter. Although we have no evidence to support it, it is possible that the increased BUN levels in Group I animals were related to renal damage or disease. This may be a more likely possibility than the aforementioned association with diet since both serum protein levels and BUN should be elevated in the animals with the higher protein intake. In this study, the BUN level was elevated in the Group I animals and the serum protein levels were higher in the Group II animals.

Blood glucose values differed markedly between the two groups, being much higher in Group II. A similar relationship was reported for blood glucose values in two groups of elk from Oregon where free-ranging elk had much higher blood glucose values than elk maintained in a zoo (Weber and Bliss, 1972). In the present study, Group I animals were not in a typical zoo situation but were partially confined. They competed with many other animals for available natural food and the supplemental diet. Glucose values for Group I were also much lower than those reported for free-ranging elk in other studies (Follis, 1972; Pedersen and Pedersen, 1975; Vaughn et al., 1973), and were even lower than the glucose values reported for the zoo elk in Oregon (Weber and Bliss, 1972). We postulate that the differences in glucose levels observed in the two groups of elk were related to nutritional status although factors such as stress due to capture could have also contributed to the high glucose levels for Group II animals.

The albumin values in the two groups in the present study also parallel the observations of the Oregon study (Weber and Bliss, 1972), the albumin values being lower in the free-ranging elk when compared with elk which were confined. Potassium, creatine phosphokinase and A/G ratio were all greater in Group I animals. Most values for Group II animals were comparable with available information from other studies (Follis, 1972; Pedersen and Pedersen, 1975; Weber and Bliss, 1972). Group II values were greater than those seen in Group I for creatinine, glucose, serum protein, SGOT and sodium.

We feel that the values provided in this report are as close to "normal" as it is possible to obtain for both free-ranging elk whose diet was not supplemented and semi-captive elk whose diet was supplemented. Although information on the effects of differing capture methods on hematologic and serum chemistry values for elk is not available, comparable studies on white-tailed deer *(Odocoileus virginianus)* show that if blood samples are drawn immediately after the animal is immobilized, variations are not necessarily related to the method of capture (Kocan et al., 1981; Mautz et al., 1980; Wesson et al., 1979). Based on these data, we do not feel that the differences in restraint procedures used for the two groups significantly influenced the values observed.

The individual variation between elk from the same group for a specific blood parameter was considerable (Table 1). However, the mean values for 16 of 20 blood parameters compared was significantly different between the two groups. Although many factors such as altitude, genetics, immune status and method of capture could have influenced the values tested for in this study, the authors believe that the major influencing factor was the poorer nutritional condition of the Group I animals. Although Group I animals received supplemental feeding for part of the year, the available forage during the time of non-feeding and the competition for food

with other species on the preserve resulted in a less than adequate nutritional level, as evidenced by the poor body condition observed.

These results suggest that group mean hematologic and serum chemistry values from animals maintained under known conditions are of more value in comparing the health status of different herds than when comparing values from individuals within or between herds. The data presented in this report should serve as a useful reference for future studies in which hematologic and serum chemical values are used as indicators of the health status of an elk herd.

LITERATURE CITED

CLOVER, M.R. 1956. Single-gate deer trap. Calif. Fish and Game. 42: 199-201.

FOLLIS, T.B. 1972. Reproduction and hematology of the Cache elk herd. Utah State Div. Wildl. Resour. Publ. 72-8, 132 pp.

HERIN, R.A. 1968. Physiological studies in the Rocky Mountain elk. J. Mammal. 49: 762-764.

KNIGHT, R.R. 1969. Some chemical characteristics of elk blood. Bull. Wildl. Dis. Assoc. 5: 8-10.

KOCAN, A.A., B.L. GLENN, T.R. THEDFORD, R. DOYLE, K.A. WALDRUP, G. KUBAT and M.G. SHAW. 1981. Effects of chemical immobilization on hematologic and serum chemical values in captive white-tailed deer. J. Am. Vet. Med. Assoc. 179: 1153-1156.

MAUTZ, W.W., U.S. SEAL and C.B. BOARDMAN. 1980. Blood serum analysis of chemically restrained white-tailed deer. J. Wildl. Manage. 44: 343-351.

PEDERSEN, R.J. and A.A. PEDERSEN. 1975. Blood chemistry and hematology of elk. J. Wildl. Manage. 39: 617-620.

QUIMBLY, D.C. and J.E. GAAB. 1975. Mandibular dentition as an age indicator in Rocky Mountain elk. J. Wildl. Manage. 21: 435-451.

VAUGHN, H.W., R.R. KNIGHT and F.W. FRANK. 1973. A study of reproduction, disease and physiological blood and serum values in Idaho elk. J. Wildl. Dis. 9: 296-301.

WEBER, Y.B. and M.L. BLISS. 1972. Blood chemistry of Roosevelt elk. Comp. Biochem. Physiol. 43A: 649-653.

WESSON, J.A. III, P.F. SANLON, R.L. KIRKPATRICK and H.S. MOSBY. 1979. Influence of chemical immobilization and physical restraint on packed cell volume, total protein, glucose, and blood urea nitrogen in blood in white-tailed deer. Can. J. Zool. 57: 756-767.

WOLFE, G.J. 1980. Elk management on a New Mexico ranch. Proceedings of the western states elk workshop. British Columbia Fish and Wildlife Branch, Victoria, pp. 26-32.

Received for publication 12 June 1981