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A STUDY OF REPRODUCTION, DISEASE AND PHYSIOLOGICAL BLOOD AND SERUM VALUES IN IDAHO ELK^{III}

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Abstract: A study was conducted on elk (Cervus canadensis nelsoni) in the Selway-Bitterroot Wilderness and adjoining primitive area of the Clearwater drainage of Idaho over a 3 year period, 1969-1972.

Midwinter examination of cows in this herd indicated the pregnancy rate was high, but game counts showed only 15 to 20 calves per 100 cows indicating that the losses occurred around or after calving.

A serologic survey did not indicate the presence of antibodies to the agents of brucellosis, leptospirosis, vibriosis, bluetongue, infectious bovine rhinotracheitis or bovine virus diarrhea. Positive complement fixation reactions for anaplasmosis were present in nearly 50% of the animals tested; however, many of the serums were anticomplementary.

Blood chemistry determinations were made on all elk and compared with the values obtained from captive elk. Similar values were noted in the captive and wild elk in calcium phosphorous ratio, glucose and total protein. Dissimilarity occurred with cholesterol, blood urea nitrogen, albumen, bilirubin, alkaline phosphatase and serum oxalacetic transaminase values.

INTRODUCTION

The elk herds in north central Idaho are some of the largest in the world. After the extensive forest fires of 1910, 1919, 1929, and 1934, the herds built up to a peak in the late 1940's. The winter of 1949-1950 was very severe with deep snows and an extended period of -18 C weather accompanied by a die-off of elk. There have been two more severe winters, 1958 and 1965, with die-offs since the 1949-1950 catastrophe. The elk have continued to decrease since that time.

This decline has been attributed to a decrease in elk habitat and food supply due to the decrease of elk forage as the result of natural plant succession of forest regrowth. For several years calf production has been poor; about 20% of the cow herd. Because of this poor repro-

duction or poor calf survival rate, the present research was initiated.

Physiological values are necessary criteria for disease and clinical health studies of a species. These values are available in published material on domestic species and to a limited extent on other wild species.^{1,3,1,3} Very little has been published on elk.^{2,5,7,9} The need for additional information in studying the health and reproductive ability in elk was recognized.

MATERIALS AND METHODS

The Lochsa drainage of the Clearwater River was selected for this study because the Idaho Fish & Game Department and the Idaho Cooperative Wildlife Research Unit were operating elk traps in that

① Approved by the Director of the Idaho Agricultural Experiment Station as Publication No. 937.

area. Both dead (road kills and illegal hunter kills) and trapped cows were examined for pregnancy. Trapped cows were examined by rectal palpation.

Serum was collected by random sampling from seven traps located throughout the area. Sampling was done by jugular bleeding into 10 ml vacuum vials. Restraint was in a wooden head gate chute without sedatives or tranquilizing drugs. Blood from serum was held at room temperature until clotted, then centrifuged and the serum transferred to screwcapped vials and preserved by freezing at --- 4 C.

abnormalities that may have been asso-

The elk in the area were observed for

ciated with calf losses beginning in early January and continuing through the period of calving into late June. Tests applied to the serum to detect the presence of circulating antibodies were those employed in domestic ruminant disease serology (Table 1).

The blood samples from wild elk were subjected to blood serum chemistry. Since the literature gives little reference to normal physiological values for elk blood and blood serum, captive elk were purchased for additional data to be used in assessing these parameters. Three healthy elk were purchased from the Okanagan Game Farm, Penticton, British Columbia (one mature 6 year old

TABLE 1. Results of Serologic Tests 1 on Lochsa Elk.

Disease	No. of Samples	Negative	Reactors	Suspect	Anti- Complimentary
Bacterial					
Brucellosis	54	54	0	0	NT*
Leptospirosis					
pomona	50	50	0	0	*
icterohemorrhagiae	39	39	0	0	*
canicola	39	39	0	0	*
grippotyphosa	39	39	0	0	*
hardjo	39	39	0	0	*
Vibriosis	54	54	0	0	*
Viral					
Bluetongue	54	54	0	0	*
Infectious Bovine Rhinotracheitis (IBR)	50	50	0	0	*
Bovine Virus Diarrhea (BVD)	50	50	0	0	*
Rickettsial					
Anaplasmosis	50	2	21	9	18

* NT (Not Tested)

1 Test procedures:

Brucellosis: Plate agglutination test. U.S.D.A. Strain 19 antigen

- Leptospirosis: Macroagglutination test. Commercial antigens
 - Vibriosis: Serum agglutination test. V. fetus var. venerealis commercial antigen Bluetongue: Agar gel precipitin test

 - IBR and BVD: Serum neutralization test
 - Anaplasmosis: Complement fixation test

pregnant cow and two bull calves). These elk were placed in an enclosure and were maintained on the ration they had been fed at the Okanagan Game Farm^[2] which consisted of high quality alfalfa pellets and a supplemental ration of high quality mixed grains and oil meals. This ration and amount (5.5 kg per animal) was fed in feeders with the calves fed in a creep. Calves were fed all they would eat. The cow, which was fed once a day, would have eaten more. They were subjected to the stresses of weather and handling.

At 2 week intervals these elk were immobilized with the central nervous system depressing drug Etorphine or M-99^[3] used with Cap-Chur^[4] equipment. Temperatures were recorded; oxylated blood samples were taken for the determination of red and white blood cell counts, hematocrit and hemoglobin values. A blood smear was made for a differential count of white cells. Serums obtained from the penned and trapped elk were sent to the Pathologist, Regional Laboratory, Lewiston, Idaho and subjected to an automated multiphasic screening analysis for twelve components of blood serum.

RESULTS

In the winter of 1969 and spring of 1970, 37 mature female elk were examined for pregnancy by palpation or necropsy. Of this number, 36 were pregnant. The number sampled was small, but animals examined were of random selection, indicating a high pregnancy rate. No evidence of abortion was found during the late gestation period. No dead, weak or sick newborn calves were found in the areas where elk were observed.

Due to the rugged topography of the area and the habits of elk with newborn calves to be extremely secretive, it was difficult to observe enough newborn

TABLE 2. Mean Hematology and Temperature Values of the Penned Elk*.

	Co	Bul (14	Bulls	
No. of Samples	Mean	\$.D.	Mean	<u></u>
Av. Hematocrit Volume %	53.9	1.24	50.2	3.74
Hemoglobin g/100 ml	17.0	0.42	16.0	1.59
Erythrocytes (x10 ⁶)	6.85	0.71	4.79	1.99
Leukocytes (x10 ³)	4.0	0.51	3.9	0.78
Monocytes %	21.0	15.29	23.0	10.85
Lymphocytes %	28.0	12.95	36.0	12.16
Neutrophils %	39.0	10.26	28.0	7.10
Eosinophils %	11.0	3.89	12.0	6.40
Basophils %	0.4	0.54	9.0	0.36
Rectal Temp. C	39.0	1.40	38.6	0.40

* Seven samples each from two yearling males and five samples from one 7 year-old pregnant female at 14 day intervals.

3 American Cyanamid Company, Princeton, New Jersey, U.S.A.

² Daily ration: Rolled oats .45 kg, rolled barley .45 kg, wheat middling .45 kg, alfalfa pellets 2.75 kg, Purina Calf Manna .7 kg, Purina Show Chow .7 kg, Total 5.5 kg.

⁴ Palmer Chemical and Equipment Co., Atlanta, Georgia, U.S.A.

calves to determine the health and condition of this age group. All calves found were visibly in excellent health. animals.

The results of the various serologic tests performed are shown in Table 1. There was little evidence of disease that would interfere with reproduction. There were 21 positive complement fixation (CF) reaction to anaplasma testing. No signs of disease were noted in any of the Hematology values (Table 2) were obtained for two captive yearling bulls and one cow. Field facilities were inadequate to obtain these data for wild elk. Comparable data are those of Follis² and Herin⁵. Mean rectal temperature was 38.6 C for the two penned males and 39 C for the female. Serum chemistry values are given in Table 3.

TABLE 3. See	um Chemistry	Mean	Values	for	Captive	and	Wild	Elk.
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	Pen Males 1		Pen Fer	nale1	Wild F	females	
Sample Size	Mean	S.D.	Mean	S.D.	Mean	s.D.	
Calcium mg/100 ml	9.22	0.17	9.76	0.18	7.29	0.93	
Phosphorous mg/100 ml	7.39	0.31	7.50	0.20	4.80	1.80	
Glucose mg/100 ml	141.19	19.51	160.00	20.73	170.57	51.73	
BUN ² mg/100 ml	32.28	3.10	38.60	2.87	24.55	7.31	
Uric Acid mg/100 ml	0.17	0.04	0.20	0.00	0.27	0.22	
Cholesterol mg/100 ml	49.07	6.60	60.40	6.15	72.38	13.59	
Total Protein g/100 ml	6.15	0.14	7.44	0.29	6.26	0.77	
Albumin g/100 ml	1.05	0.10	1.46	0.23	0.97	0.20	
Total Bilirubin mg/100 ml	0.52	0.05	0.50	0.06	1.24	0.52	
Alkaline Phosphatase mg/100 ml	175.07	20.54	188.60	3.77	215.80	121.91	
LDH ³ mg/100 ml	342.86	63.48	600+		373.00	91.00	
SGOT mg∕100 ml	59.28	13.65	106.40	19.33	110.92	42.00	
CALCIUM PHOSPHOROUS			1.3	0	1.50		

[] Seven samples each from two yearlings and five samples from one 7 year old pregnant female at 14 day intervals.

2 Blood Urea Nitrogen.

3 Lactose Dehydrogenase.

A Serum glutamic oxalacetic transaminase.

DISCUSSION

Mean values of hemoglobin and total white blood cells were slightly lower than reported by Herin. Herin apparently combined monocytes and lymphocytes under lymphocytes and reported a lower value (36%) than found in this investigation (49%). We also found fewer neutrophils and eosinophils although the latter still appeared to be abnormally high compared to values for cattle and sheep. Herin attributed high eosinophil counts to a heavy infestation of ticks but these were not present on elk that we examined.

Mean rectal temperature values are lower than those reported by Herin but most of the difference is probably attributable to the state of excitability when the samples were taken, or to the immobilizing drug employed in these elk.

Howe et al.⁶ showed that the high frequency of anticomplimentary reaction to the CF test for anaplasmosis is indicative of the inadequacy of this test when employed on elk serum. They also found that false positive and non-specific reactions were common with serum samples from elk (56%). Blood inoculums from the false reactors failed to transmit anaplasmosis to calves.

Blood urea nitrogen (BUN) determinations appear to be of value in determining the quality of the diet. BUN varied directly with the protein content of the diet^{2.0} and a difference between mature elk and calves was found with mature elk having a higher BUN. Wild elk had a wide BUN range of 13.8 to 37.0 mg/%, zoo elk on alfalfa hay have a range of 16.2 to 22.9 mg/% and elk on grass hay, grain and mineral supplement show a mean of 23.77 Sigma units.

In our research with captive elk on a ration of alfalfa pellets and a grain supplement, total protein was slightly higher and the BUN values were higher than reported elsewhere.^{2,9} There was agreement that total protein and BUN values were higher in mature animals than in young animals. Total protein was not greatly increased but BUN showed a significant increase on a ration of alfalfa and grains.

Wild elk had a wide range of total protein and BUN values indicating that

their natural selection of available forage is reflected both in the total protein and BUN. This parameter of serum chemistry would be of value in elk range evaluations.

Excitability stress² influences physiologic values. No attempt was made to evaluate the effect of this variable on other parameters but the S.G.O.T. (serum glutamic oxalacetic transaminase) standard deviation reflects the greater degree of excitement in the wild animals during periods of restraint. To minimize this effect in the captive elk, M99 was administered prior to manifestations of excitement. This method of restraint appeared to overcome excessive variations in body temperature. Calcium values were lower than reported by Knight⁷ from the Sun River, Montana area but phosphorous was higher in the penned animals. Calcium values may be a reflection of the available amounts in the habitat, since the soils in the Sun River area are derived from limestone and hence are higher in calcium than the Lochsa soils which are derived from granite.

It was not the purpose of this study to do an in depth study of the physiologic parameter variables. Physiological data obtained will add to the accumulating information so that the variables can be more accurately assessed.

The Lochsa elk herd reproduce normally as evidenced by the high pregnancy ratio. The serological survey did not reveal evidence of disease responsible for the high incidence of calf losses and the serum chemistry data when compared with that data of other investigators did not indicate nutritional imbalances that would contribute to the high calf mortality. There were no indications of an apparent or suggested cause of the calf losses except the possibility of heavy predation.

The terrain is a steep, heavily vegetated, mountainous area ranging in elevation from 1700 feet to 7000 feet. There is an abundant, undetermined, number of large predators; cougar, bear, coyote and bobcat are present. The terrain and vegetation is advantageous to heavy predation of the young.

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