BIOCHEMICAL AND HEMATOLOGICAL PARAMETERS IN RANCH-RAISED AMERICAN BISON (*BISON BISON*)

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Introduction

Recent years have seen a dramatic increase in the numbers of American bison (*Bison bison*) raised commercially. As commercial bison production grows, new information is needed on all aspects of production including disease syndromes seen in this species. Critical to the need to assess disease in bison is the need for normal parameters, particularly serum chemistries and hematological values. The few documented previous studies often include low numbers of animals, semi-wild populations, or address specialized groups. There was a need, therefore, for a study evaluating baseline clinical chemistry and hematology values in a large number of American bison. This work is an attempt to produce reliable normal values against which diseased samples can be compared for therapeutic purposes.

Materials and methods

Blood samples were collected during the months of October 1998 thru March 1999, and October 1999 thru March 2000. A convenience sample of 13 herds in eleven states (MN, IN, CO, WY, SD, NC, WI, NM, NE, MT, KS) was selected. Herd selection was based on bison raised in a production setting, voluntary participation in the study, all expenses in collecting the sample by a licensed veterinarian were borne by the participating herd, the bison in these herds were apparently healthy and each herd was located close enough to a national express shipping company to ensure samples could be collected and sent overnight to participating laboratories.

A convenience sample of approximately 30 bison per herd was selected: 10 animals from 0 to 12 months of age, 10 animals from 13 to 24 months of age, and 10 animals over 24 months of age. Bison were physically restrained with a squeeze chute. No tranquilizers or sedatives were used. Four tubes of jugular blood were collected from each animal: one royal blue top, one red top, and two purple tops. ID number, age and sex were recorded for each animal. A minimum of 3 ml of blood was collected in each of the Royal Blue Top and the Red Top tubes. A minimum of 1 ml of blood was collected in each of the Purple Tops. The Royal Blue Top and Red Top tubes were allowed to set at room temperature. The Purple Top tubes were inverted at least 8 times to ensure adequate mixing with the anticoagulant and kept cool.

Locally, the Royal Blue Top and Red Top tubes were spun in a centrifuge to separate the plasma and sera, respectively. Plasma and sera was then transferred to snap top (Falcon®) tubes for shipping. All tubes were sent via overnight delivery to respective laboratories on ice. Differential counts were done manually on Diff-Quik stained slides by a single operator. Data was collated and analyzed using Epi-Info software.

Results

A total of 406 blood samples were collected during the months of October thru March. The results are categorized in Table 1.

Table 1. North Dakota State University Survey of Complete Blood Counts, Serum Chemistries, and Serum Electrolytes for Bison from 13 herds in 11 States, 1998-2000.

Test	**Units**	*n*	Mean	Std Dev	95% Confidence Interval	NDSU Reference Values for Cattle
WBC	x 10^3/*Fl*	320	4.968	1.936	1.1 - 8.8	4.0 - 12.0
Monos	x 10^3/*Fl*	320	0.163	0.149	0 - 0.5	0 – 0.9
Lymph	x 10^3/*Fl*	320	2.167	0.992	0.2 - 4.2	2.5 – 7.5
Segs	x 10^3/*Fl*	320	2.395	1.413	0 - 5.2	0.6 – 4.0
Bands	x 10^3/*Fl*	320	0.049	0.122	0 - 0.3	0 – 0.1
Eos	x 10^3/*Fl*	320	0.192	0.223	0 - 0.7	0 – 2.4
Baso	x 10^3/*Fl*	320	0.001	0.006	0 - 0.01	0 – 0.2
RBC	x 10^6/*Fl*	361	9.375	1.270	6.8 - 11.9	5.0 - 8.0
Hgb	g/dl	361	17.764	1.532	14.7 - 20.8	8.0 - 14.0
HCT	%	361	49.934	4.588	40.8 - 59.1	26.0 – 42.0
MCV	fl	361	53.773	5.595	42.6 - 65.0	37.0 – 54.0
MCH	pg	361	19.135	1.943	15.2 - 23.0	
MCHC	%	361	35.611	1.092	33.4 - 37.8	26.0 – 36.0
RDW	%	361	24.016	3.038	17.9 - 30.1	
PLT	x 10^3/*Fl*	361	297.535	126.845	43.8 - 551.2	175.0 – 620.0
Glucose	mg/dl	406	122.623	42.936	36.8 - 208.5	45.0 – 75.0
BUN	mg/dl	406	15.879	6.497	2.9 - 28.9	20.0 – 30.0
Creatinine	mg/dl	406	2.573	0.494	1.6 - 3.6	1.0 – 2.0
T Protein	g/dl	405	8.181	1.096	6.0 - 10.4	6.7 – 7.5
Albumin	g/dl	405	4.182	1.093	2.0 - 6.4	3.0 – 3.5
GGTP	U/L	236	23.941	10.854	2.2 - 45.6	6.0 – 17.4
AlkPhosph	U/L	167	51.683	20.873	9.9 - 93.4	0.0 – 488.0
Calcium	ppm	360	97.699	7.229	83.2 - 112.2	85 – 110

Copper	ppm	360	0.789	0.249	0.29 - 1.29	0.65 – 1.50
Iron	ppm	360	1.486	0.439	0.61 - 2.36	1.30 – 2.50
Magnesium	ppm	360	21.098	2.813	15.5 - 26.7	20 – 35
Phosphorous	ppm	360	62.176	17.116	27.9 - 96.4	45 – 80
Zinc	ppm	360	10.18	0.252	0.51 - 1.52	0.80 – 1.40
Sodium	ppm	360	3327	141.753	3043 - 3611	2900 – 3450
Potassium	ppm	360	224.878	47.722	129 - 320	156 - 226
SE none	ng/ml	157	60.497	11.890	37 - 84	
SE supp	ng/ml	208	239.803	72.685	94 - 385	
SE toxic	ng/ml	30	623.267	132.804	358 - 889	
Selenium	ng/ml	395	197.658	162.347	0 - 522	120 - 200

White cell parameters
The range for total white cell numbers was shifted lower for bison as compared to cattle. Lymphocyte and monocyte numbers were shifted in the same direction as well. However, the range for granulocytes (neutrophils, bands, eosinophils and basophils) was expanded creating a higher end point than that seen for cattle.

Red cell parameters
Red cell indices were somewhat higher ($2.0 \times 10^6/\mu l$) in bison as compared to cattle. Additionally, hemoglobin concentrations in bison were appreciably elevated over cattle values, as was hematocrit. Finally, although bison and cattle ranges overlapped in the middle, bison platelet numbers were shifted lower than cattle.

Serum chemistry
Glucose, albumin, serum protein and GGTP had similar but somewhat wider ranges than bovine values. Both BUN and creatinine were slightly elevated above bovine levels

Minerals

Calcium, iron, magnesium, phosphorus, zinc, sodium and potassium correlate well with bovine reference values used at the NDSU-VDL. Copper is slightly lower in bison than in cattle. Selenium had a very wide reference range. For a more complete comparison, selenium was stratified by the non-use/use of selenium supplementation and for one group of bison grazing on selenium pastures toxic to cattle. These results are in Table 2. In this study, bison not supplemented for selenium had very low selenium levels. Bison on some type of selenium supplementation had selenium levels very comparable with normal bovine levels. Bison grazing selenium toxic pastures had very high selenium levels, yet no adverse health conditions were reported.

Discussion

The results of this study provide veterinarians and other bison health workers with usable clinical blood values. Blood values that correlate well with previous studies are HCT, Hb, Creat, and BUN (Miller89, Marler75 and Wallach83). The bison in this study had lower WBC parameters than in previous studies (Miller89, Marler75, and Azugg93). The reason for this finding is unknown. As noted in previous studies many environmental factors can cause variation in hematologic and blood chemistries (Franzmann71, Pederson75). Also, one previous study included actively infected animals in the results (Miller89), one study included animals shot with a high powered rifles (Zaugg93) and others were taken from animals on free range or received very little managed care (Marler75 and Mehrer76). The bison in these herds were from managed production units and utilized humane handling techniques to collect the samples. A plausible explanation for the lower WBC levels is that these bison were on a higher plane of health care because producers equate health animals with higher profitability. Also, these herds could have self-selected for higher health status because of the selection criteria.

This is the first study to report selenium levels in bison. Furthermore, this is the first study to stratify bison selenium levels by use or non-use of selenium supplementation and the effect of grazing selenium toxic pastures. These levels would suggest that bison have a much higher tolerance level for selenium than cattle, and they may even have a higher requirement for selenium in their diet. More research is needed in this area.

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