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BLOOD CHARACTERISTICS OF FREE-RANGING WHITE-TAILED DEER IN SOUTHERN TEXAS

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Abstract: We present an analysis of some blood characters in 31 newborn fawns and 79 older white-tailed deer *(Odocoileus virginianus)* from free-ranging populations in southern Texas. In the newborn fawns, averages were: Erythrocytes 6.95 10^6/mm^3, leucocytes 3.6 10^3/mm^3, hemoglobin 10.1 g/100 ml, sedimentation rate 2.2 mm/hr and hematocrit 29.1%. In the older fawns and adults averages were: Hematocrit 49.5%, serum calcium 5.2 mEq/L, serum sodium 157.6 mEq/L, serum potassium 6.8 mEq/L, BUN 14.4 mg%, total serum protein 6.4 g/100 ml, albumin 3.8 g/100 ml, globulins 2.6 g/100 ml, and albumin/globulin ratio 1.5. These values for fawns and older deer generally fell within the ranges reported in other studies. More data are needed, particularly from free-ranging populations, in order to determine which blood composition characters can be used efficiently to indicate subtle differences in health and condition of deer.

INTRODUCTION

The blood of mammals has a remarkable tendency to maintain constancy of composition during good health.[18] Data on blood characteristics and composition from wildlife populations reportedly are helpful in contrasting different species and comparing health and disease status among populations of the same species.[13,29]

We describe the blood of newborn fawns and older white-tailed deer from two populations in southern Texas. Samples of newborn fawn blood came from the Welder Wildlife Refuge, near Sinton, in San Patricio County. Samples of blood of older deer came from the Welder refuge and from the Aransas National Wildlife Refuge near Austwell, about 40 km to the northeast. Both populations are free-ranging, dense, and healthy.[8,27,28]

There are few reports in the literature of blood analyses from free-ranging whitetail populations, particularly of newborn fawns. Seal and Erickson[17] described the blood of free-ranging whitetails in Minnesota. Johnson et al.[12] presented blood characteristics for a large sample of penned whitetails in Michigan that included newborn fawns. Youatt et al.[30] gave blood values for captive newborn fawns and their postpartum dams. Dommert et al.[11] and Tumbleson et al.[22,23] analyzed the blood of penned whitetails in Missouri. Cowan and his colleagues[4,10,14] in British Columbia described blood characteristics of various races of mule deer *(Odocoileus hemionus)*, particularly the blacktail *(O. h. columbianus)*. Theirs[10] is the only large sample of free-ranging newborn fawns we find described in the literature. Rosen

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and Bischoff[16] in California, Browman and Sears[7] and Taber et al.[20] in Montana, and Anderson et al.[1,2,3] in Colorado also have presented the results of larger samples of blood of free-ranging mule deer.

MATERIAL AND METHODS

In June of 1965, 10 ml of blood were drawn from the jugular vein of newborn fawns, 1-14 days of age.[5] Between September, 1964 and May, 1965, blood samples were taken from a total of 79 older deer that were shot in the neck with a rifle. Within 5 minutes of death samples of blood were taken from the heart.

Ten ml aliquots of each sample were placed in vials with EDTA-K anticoagulant. Samples were cooled in the laboratory and analyzed within 6 hours. From these, cell counts, and measures of hemoglobin, hematocrit (packed cell volume), and sedimentation rate were made according to standard procedures.[5] A Spencer BriteLine hemacytometer was used for erythrocyte and leucocyte counts, a Haden-Hausser hemoglobinometer for hemoglobin estimation, and Wintrobe hematocrit tubes for sedimentation rates and packed cell volume.

Portions of samples from the older deer were cooled in a refrigerator and allowed to coagulate. When a clot had formed serum was decanted, centrifuged, and frozen for chemical analysis. Samples were discarded if hemolysis obviously had occurred. The analyses were conducted at the Department of Veterinary Medicine of Purdue University during the summer of 1965. Serum calcium levels were estimated by titration procedures,[15] sodium and potassium levels by flame photometry, BUN by Unitest methods (Biodynamics Inc., Indianapolis, Ind.), a total serum protein by Unitest methods using the Weichselbaum biuret reagent, and the albumin/globulin (A-G) protein fraction separation by paper electrophoresis using the Spinco apparatus (Spinco Tech. Bull. No. 6027A).

RESULTS

Newborn Fawns

The average rectal temperature of 50 newborn fawns on the Welder refuge was 39.9C. There was no apparent difference related to sex, or age in days. Blood cell counts, hemoglobin, sedimentation rate, and hematocrit were measured in 31 newborn fawns. A separation was made between fawns 1-3, 4-7, and 8-14 days old, but no significant differences ($P<.05$) in these blood values were observed. Composite mean values (table 1) were: Erythrocytes 6.95 $10^6/mm^3$, leucocytes 3.6 $10^3/mm^3$, hemoglobin concentration 10.1 g/100 ml, sedimentation rate 2.2 mm/hr, and hematocrit 29.1%.

Older Fawns and Adults

Blood samples were analyzed from a total of 79 older fawns and adults, 28 from the Welder refuge, and 51 from the Aransas refuge. There were 24 male deer and 55 females, 16 fawns (4-11 months), and 63 adults. All were collected from September through May. No significant differences (of $P>.05$) were observed between males and females, between these older fawns and adults, with season of collection, or between the two deer populations. Hence, all of the samples were combined (table 2).

For these older deer there was considerable variation between individuals in the blood values measured. Accordingly, ranges are provided in addition to the mean values (table 2). The mean hematocrit percentage was 49.5; of this, erythrocytes and platelets represented 49.1% and leucocytes 0.4%. Serum electrolyte values were 5.2 mEq/L (= 10.3 mg/100 ml) for calcium, 157.6 mEq/L for sodium, and 6.8 mEq/L for potassium. Serum blood urea nitrogen (BUN) levels averaged 14.4 mg%. Total serum protein averaged 6.4 g/100 ml. Of this, Albumin made up 3.8 g/100 ml (59%) and Globulins 2.6 g/100 ml (41%). The A/G ratio was 1.5 (table 2).

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TABLE 1. Blood characteristics for 31 newborn fawns on the Welder refuge.

Age in Days	Sample Size	Erythrocytes (10^6/mm^3) Mean	Erythrocytes (10^6/mm^3) S.E.	Leucocytes (10^3/mm^3) Mean	Leucocytes (10^3/mm^3) S.E.	Hemoglobin (g/100 ml) Mean	Hemoglobin (g/100 ml) S.E.	Sedimentation Rate (mm/hr) Mean	Hematocrit (%) Mean	Hematocrit (%) S.E.
1 - 3	14	6.79	0.32	3.7	0.5	10.2	0.2	2	28	0.9
4 - 7	11	6.89	0.45	3.9	0.6	10.1	0.1	2	30	1.0
8 - 14	6	7.45	0.13	3.1	0.5	10.0	0.1	3	30	2.2
Composite mean	31	6.95		3.6		10.1		2.2	29.1	

TABLE 2. Blood characteristics for 79 deer, four months and older, on the Welder and Aransas Refuges.

Parameter	Mean	Range	S.E.
Whole Blood			
Hematocrit (%)	49.5	39.4 - 66.1	8.2
Erythrocytes and platelets	49.1	39.2 - 65.8	7.8
Leucocytes	.4	.1 - 1.5	.1
Serum			
Ca (mEq/L)	5.2	3.8 - 7.0	.2
Na (mEq/L)	157.6	152 - 170	1.9
K (mEq/L)	6.8	4.2 - 9.9	.5
BUN (mg %)	14.4	4.0 - 23.5	2.8
Total protein (g/100 ml)	6.4	3.8 - 8.3	.5
Albumin	3.8	2.4 - 5.1	.2
Globulin	2.6	1.4 - 3.7	.2
A/G ratio	1.5	1.0 - 2.2	.1

DISCUSSION

The rectal temperature average of 39.9C in newborn fawns was higher than the only temperatures we find reported for deer, adult whitetails,[29] and older mule deer fawns.[9] Cowan and Wood[9] found a higher rectal temperature in 4-month mule deer fawns than in adult females.

Erythrocyte, leucocyte, hemoglobin, sedimentation rate and hematocrit values for these newborn fawns were similar to those reported for penned fawns in Michigan.[12,30] Compared to mule deer fawns,[10,14] erythrocyte averages were higher, and leucocyte, hematocrit and sedimentation rate values were lower in these newborn whitetails.

Mean blood values for the older whitetails generally fell within the parameters reported in other studies, according to a summary comparison presented in table 3. Variation with individuals is to be expected. In a natural population a few diseased and abnormal individuals often are present. Our mean values should characterize the typical blood values; some of the range extremes doubtless represent diseased or abnormal individuals. Values of 170 mEq/L for sodium, and 9.9 mEq/L for potassium (table 2), for example, probably represent abnormal individuals. Hemolysis also can affect the values of these electrolytes, however, all obviously hemolyzed samples were discarded.

There are few divergencies in blood characteristics between males and females, or with age after the first 12 months, reported in the literature for *Odocoileus*. However, there appear to be differences in several blood values between fawns, particularly newborn fawns, and adults. Higher levels in newborn fawns for albumin in proportion to globulins,[10] leucocytes,[10,12] and in rectal temperature[9] have been reported. Lower values in young fawns appear to occur in total serum protein, hemoglobin, erythrocytes, and hematocrit.[10,12,28,30]

Additionally, there are differences between whitetails and mule deer. Higher values for erythrocytes,[1,12,13,16] hemoglobin[1,12,14,16] and higher rectal temperature;[9,29] and a lower A/G ratio[4] have been reported in whitetails.

The effects of handling and treatment on blood values require more investigation. Restraint, handling, and immobilization with drugs can result in a hemodilution or expansion of plasma volume.[18] Blood samples obtained from deer that have been shot may show similar deviations from normal values, particularly in individuals that do not die instantly.

Although blood composition is suggested as an indicator for evaluating health and condition in mammals, the reported data at hand for deer, in most cases, do not appear to be sufficient to differentiate clearly between small changes in health and condition and other possible variation. Studies of the effects of restricted diet and winter weight and condition loss on the blood of penned whitetails suggest a tendency toward hemoconcentration, but the results have been variable.[18,21,24,25,26] Rosen and Bischoff[16] found a marked drop in erythrocyte and hemoglobin concentrations, but apparently only in those mule deer herds that were near starvation. Workers in British Columbia[4,14] reported no reductions of hematocrit, sedimentation rate, hemoglobin, or total plasma proteins in mule deer receiving a low plane of nutrition. Youatt et al.[30] reported no correlation between blood composition and diet in feeding experiments in Michigan. Anderson et al.[1,2] found some differences in blood chemistry associated with changes in habitat quality. Bolte et al.[6] observed marked reductions in hemoglobin and hematocrit levels in newborn whitetails in Oklahoma, but in individuals in very poor condition with tissue damage from infestation of ticks. More data are needed, particularly from free-ranging populations, in order to determine which blood composition characters can be used efficiently to indicate subtle differences in health and condition of deer, and to describe the range of normal variations in individuals, populations, races, and species of *Odocoileus*.

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TABLE 3. Representative blood values (means) for adult deer. Adopted from various sources.

	Hematocrit (%)	Serum Ca mEq/L[a] or mg/100 ml[b]	Serum Na (mEq/L)	Serum K (mEq/L)	BUN (mg %)	Total Serum protein	% Albumin	A/G Ratio
White-tailed deer								
**Michigan[11,19,24,25,26]	56.3	8.8 - 9.4[b]				8.1	63.6	1:1.7
	39.5 - 55.2		143 - 148	4.1 - 4.9	17 - 24	5.1 - 5.9	55.6 - 57.1	1:1.2-1:1.3
	51 - 59				16.9 - 25.6	6.4 - 10.5	55.4 - 63.6	1:1.2-1:1.7
*Minnesota[17]	39 - 44				12 - 16	4.9 - 5.2	64.0 - 64.2	1:1.7-1:1.8
**Missouri[11,28]	47.5 - 54.8	10.9 - 11.6[b]	154 - 156	6.0 - 6.4	22 - 25	7.2 - 7.6		
*Maryland[29]			174	10.4				
Mule deer								
*Montana[7,30]	39.6					5.9 - 6.4		
**British Columbia[4,14]	58.2					6.1 - 6.7	64 - 72	1:2.5
*Colorado[1,2,8]	46.7	6.1 - 6.4[a]	140 - 164	7.4 - 9.9		5.5 - 7.1		

* free-ranging deer

**penned deer

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