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BLOOD PARAMETERS OF DONKEYS IN BOTSWANA

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Blood levels of P, Ca, Mg, total protein, urea and red and white blood cells were examined monthly for two years in Botswana in an attempt to establish normal values and to evaluate the effect of mineral supplementation with an equal parts mixture of salt and dicalcium phosphate. Overall mean levels observed for the parameters were: P $3.79 \pm .97$ mg/100 ml, Ca 10.07 ± 2.11 mg/100 ml, Mg $2.07 \pm .65$ mg/100 ml, Cu 154.63 ± 63.27 µg/100 ml,

total protein 8.02 ± 1.16 g/100 ml, urea 39.28 ± 10.65 mg/100 ml, RBC count 5.4 ± 1.19 millions/mm³ and WBC count 9.86 ± 3.07 thousands/mm³. Supplemented donkeys showed significantly higher levels of Ca and RBC counts and lower levels of P, total protein and urea than did the control animals. The observed means fell within the normal ranges quoted in the literature with the exception of Ca and urea which were higher and Ca and RBC counts which were lower. It was concluded that mineral supplementation of this kind may be useful especially for working donkeys as it appears to increase the numbers of RBC's.

Keywords: Donkeys, Blood parameters, Minerals

Little is known of normal blood parameters in donkeys in Botswana. This makes it difficult to interpret findings from clinical material. At present figures obtained from Europe, South Africa and the United States are used for normal values. The study objectives were to determine (1) normal values in donkey blood for the levels of phosphorus, magnesium, calcium, copper, total protein, urea, red blood cells and white blood cells, (2) if these parameters differ in animals receiving supplementary feeding of mineral-mix, and (3) effects on the performance of the animal from feeding supplemental mineral-mix.

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Study area

The study was conducted from October 1984 to September 1986 in Mathangwane Village, Tutume Agricultural District, in northeastern Botswana.

Methods

Blood samples were taken monthly from ear-tagged animals in two donkey herds receiving ad libitum supplemental mineral-mix (an equal parts mixture of salt and dicalcium phosphate). Ear-tagged animals in two donkey herds not receiving supplemental mineral-mix served as controls. Donkeys were bled on the last Tuesday of the month. A total of 28 adult donkeys were included in the initial bleeding, but numbers declined during the years due to deaths, sale of animals and failure of farmers to present animals on the designated bleeding dates. A total of 404 blood samples were included in the analyses.

Subjective scores for condition were placed on each animal at the time of bleeding. Animals were scored as being in good, fair or poor condition.

Whole blood and heparin blood samples were sent to the National Veterinary Laboratory, Gaborone by overnight train packed on ice in an insulated container. At the laboratory the serum was taken off and examined for phosphorus, copper, urea and total protein by spectrophotometry and for calcium and magnesium by

atomic absorption spectrophotometry. Red and white blood cell counts were done with the heparin blood using a Coulter counter. Tests for statistical differences were made using Student's "T" test with the Daisy Professional Program on the Apple IIe Computer.

Results and discussion

Results are presented in Table 1 for control, treated (mineral-mix) donkeys and overall.

Condition: Condition scores of control and treated animals averaged $2.56 \pm .57$ and $2.48 \pm .61$, respectively, and did not differ significantly. Overall, the animals were in good condition. Calcium: Mean blood plasma calcium levels of control and treated donkeys were 9.79 ± 2.01 and 10.23 ± 2.15 mg/100 ml, respectively, and differed significantly ($P < .05$). The overall mean was 10.07 ± 2.11 mg/100 ml. Henderson et al (1983) give a range of 11.2-13.8 mg/100 ml as the normal level for horses while Rushton (1981) and Merck (1986) show a somewhat wider spread between normal high and low values. Values found in this study were slightly below the normal range.

Phosphorus: Mean blood plasma phosphorus levels for control and treated donkeys were 4.00 ± 1.08 and $3.68 \pm .89$ mg/100 ml, respectively, and differed significantly ($P < .01$). The overall mean was $3.79 \pm .97$ mg/100 ml. Henderson et al (1983) list a range of 3.1-5.6 mg/100 ml as the normal value for horses. Rushton (1981) and Merck (1986) list similar values for the equine species.

Magnesium: Mean blood plasma magnesium levels of control and treated donkeys were $2.08 \pm .73$ and $2.07 \pm .60$ mg/100 ml, respectively, and did not differ significantly. The overall mean was $2.07 \pm .65$ mg/100 ml and falls within the normal range of 1.8-2.5 mg/100 ml given by Henderson et al (1983) for horses. Rushton (1981) and Merck (1986) quote similar values for the equine species.

Copper: Mean blood plasma copper levels for control and treated donkeys were 151.72 ± 56.40 and 156.25 ± 66.87 μ g/100 ml, respectively, and did not differ significantly. The overall mean value was 154.63 ± 63.27 and is well above the normal value of 100 μ g/100 ml (Henderson et al 1983). However, Rushton (1981) quotes a mean value of 149.22 with a range of 121.28-177.16 μ g/100 ml for the equine species.

Total Protein: Mean blood serum total protein levels for control and treated donkeys were 8.25 ± 1.69 and 7.9 ± 1.13 g/100 ml respectively and differed significantly ($P < .01$). The overall mean was 8.02 ± 1.16 g/100 ml. Values appear to be slightly higher than the expected range. Henderson et al (1983) give a range of 6.0-7.7 g/100 ml as normal values for horses and Rushton (1981) and Merck (1986) quote similar values for the equine species.

Urea: Mean blood urea levels for control and treated donkeys were 42.18 ± 11.66 and 37.85 ± 9.76 mg/100 ml, respectively, and differed significantly ($P < .01$). The overall mean was 39.38 ± 10.65 mg/100 ml and appears to be above or in the high normal range. Henderson et al (1983) list a normal range of values of

10-20 mg/100 ml for horses while Rushton (1981) gives a mean value of 30.05 with a range of 15.02-49.88 mg/100 ml for horses. Merck (1986) quotes a range of 10.4-23.70 mg/100 ml for the equine species.

Red Blood Cells: Red blood cell counts of control and treated donkeys were $4.74 \pm .97$ and 5.21 ± 1.27 millions/ mm^3 , respectively, and differed significantly ($P < .01$). The mean value of 5.32 ± 1.27 millions/ mm^3 in 1985-86 was significantly ($P < .01$) higher than the mean value of $4.84 \pm 1.9/\text{mm}^3$ in 1984-85. This increase may be associated with a decline in internal parasite levels, since the donkeys were treated with an anthelmintic several times during the trial. The overall mean value was 5.04 ± 1.19 millions/ mm^3 . Rushton (1981) lists a value of 6.4 ± 1.04 millions/ mm^3 for adult donkeys and Merck (1986) quotes a range of 6.0-12.0 millions/ mm^3 for the equine species.

White Blood Cells: The white blood cell counts of control and treated donkeys were 10.19 ± 3.34 and 9.67 ± 2.89 thousands/ mm^3 , respectively, and did not differ significantly. The overall mean value was 9.86 ± 3.07 thousands/ mm^3 and falls within the range of 7.4-13.2 thousands/ mm^3 given for adult donkeys by Rushton (1981). Merck (1986) lists a value of 6.0-12.0 thousands/ mm^3 for the equine species.

Conclusions

The blood parameters of donkeys in this study were in close

agreement with values reported in the literature for horses. The results present workers with a set of "normal blood values" for donkeys in Botswana.

Feeding of supplemental mineral-mix significantly affected the blood levels of phosphorus, calcium, total protein and urea found in the blood of treated animals. Red blood cell counts were enhanced by mineral-mix feeding and white blood cell counts decreased. No differences were observed in reproductive performance of the control and treated animals during this two year study. Condition of animals, as determined by subjective scores, did not differ.

Although no measurable response in performance was found in this two year study, mineral-mix feeding should continue to be recommended for donkeys since the cost is small and such feeding may have beneficial effects on animal performance, especially for working donkeys as it appears to increase the number of red blood cells.

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TABLE 1: BLOOD PARAMETERS OF DONKEYS IN BOTSWANA

VARIABLE	CONTROL			TREATED			OVERALL		
	NO.	MEAN ^a	S.D.	NO.	MEAN	S.D.	NO.	MEAN	S.D.
Condition ^b	126	2.56	.57	240	2.48	.61	366	2.51	.60
Calcium (mg/100 ml)	143	9.79 _s	2.01	251	10.23 _t	2.15	394	10.07	2.11
Phosphorus (mg/100 ml)	132	4.00 _x	1.08	246	3.68 _y	.89	380	3.79	.97
Magnesium (mg/100 ml)	143	2.08	.73	249	2.07	.60	392	2.07	.65
Copper (µg/100 ml)	142	151.72	56.40	253	156.25	66.87	395	154.63	63.27
Total Protein (g/100 ml)	140	8.25 _x	1.69	257	7.90 _y	1.13	397	8.02	1.16
Urea (mg/100 ml)	139	42.18 _x	11.66	254	37.85 _y	9.76	393	39.38	10.65
Red Blood Cells (millions/mm ³)	137	4.74 _x	.97	239	5.21 _y	1.27	376	5.04	1.19
White Blood Cells (thousands/mm ³)	136	10.19	3.34	242	9.67	2.89	378	9.86	3.07

^aMeans in the same row followed by different letters (x and y) differ significantly (P < .01) while those followed by other different letters (s and t) differ significantly (P < .05).

^b1 = Poor 2 = Fair 3 = Good

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