



Influence of molybdenum on haematological indices in buffalo calves*

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Dairy animals are considered more susceptible to molybdenum toxicity than other livestock species (Boermans 2005), which creates critical health risks in exposed animals (McGuirk *et al.* 2005). In Punjab, areas around Sutlej belt (Ludhiana) are rich in molybdenum (Mo), so forages on such soils are considered as the most important source of molybdenosis in animals. However, despite the association of molybdenosis with haemopoietic disorders and alterations in dairy animals (Sharma 2002, Kusum 2010), detailed information of the effect of high molybdenum content in diet on the haematological parameters in buffalos is obscure. Therefore, the present study was undertaken to investigate the influence of molybdenum incorporation on various haematological parameters in buffalo calves.

An experimental trial was conducted on 8 healthy buffalo calves (80–150 kg) aged between 6 and 12 months, divided into 2 groups equally. The animals were housed in sheds 3 weeks prior to the start of experiment and maintained under normal feeding and watering schedule along with regular clinical examination as well as deworming. Group 1 (control group) calves served as healthy control. Group 2 (treatment group) calves were fed 30 mg/kg/day of sodium molybdate orally through drenching for 21 consecutive days between 9: 00 AM and 10: 00 AM.

Blood was collected in EDTA vials on days 0, 3, 7, 10, 14, 17 and 21 of treatment period and on seventh day post-treatment period (day 28) by jugular venepuncture. The haematological parameters, viz. haemoglobin (Hb), packed cell volume (PCV), erythrocyte sedimentation rate (ESR),

total erythrocyte count (TEC), total leukocyte count (TLC), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) and mean corpuscular volume (MCV) were analyzed as per standardized methods (Benjamin 2001). The data were subjected to the statistical analysis using t-test. Results were expressed as mean±SE. Statistical significance was considered at $P<0.01$ and $P<0.05$ levels as per Snedecor and Cochran (1994).

The results of haematological parameters in both groups are presented in Table 1. A significant decrease in the Hb, PCV, TLC, and TEC was noticed among group 2 calves in comparison to group 1. The observed findings are in agreement with study of Sharma (2002) and Kusum (2010) in cow calves and goats respectively. The decreased haemoglobin content may be attributed due to the defective iron metabolism and conditioned copper deficiency, which in turn is responsible for functional integrity of hematopoietic system (Randhawa *et al.* 2002, Radostits *et al.* 2007). However, no significant change in ESR, MCV, MCHC and MCH between groups was noticed except for a significant decrease in MCH 7 days post-treatment. Contrary to the above findings increase in PCV and a nonsignificant decrease in TLC by Soodan (1996), increase in ESR by Dhillon *et al.* (1991) were reported.

The decreasing trends once started in haematological parameters markedly remained continuous even on 7th day after the cessation of treatment. The probable reason behind this observation is presence of molybdenum traces in the animal body whose full excretion takes around two weeks as recorded in some previous studies (Vyskocil and Viau 1999, Turnlund and Friberg 2007). It is also evident in the present study that changes in blood parameters indicated significant anaemia and leukopenia just within first week of the start of feeding trial. Therefore, it is suggested that the subacute oral Mo toxicity exerts immediate though long-lasting anaemia and immune status depression in buffalo calves which causes significant deterioration in production and health status of the animals, directly or indirectly (Ward and Spears 1999, Radostits *et al.* 2007).

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Table 1. Effect of the subacute oral toxicity of sodium molybdate (30 mg/kg/day) on haematological indices (mean $\pm$ SE) in buffalo calves

Haematological parameters (units)	Groups	Days							21	28
		0	3	7	10	14	17	21		
Haemoglobin (g/dl)	1	9.93 $\pm$ 0.31	9.15 $\pm$ 0.97	9.43 $\pm$ 0.69 ^A	9.86 $\pm$ 0.28 ^A	9.82 $\pm$ 0.20 ^A	9.38 $\pm$ 0.27 ^A	9.15 $\pm$ 0.43 ^A	10.20 $\pm$ 0.23 ^A	
	2	9.24 $\pm$ 0.21	6.95 $\pm$ 0.39	7.02 $\pm$ 0.34 ^B	6.91 $\pm$ 0.29 ^B	7.82 $\pm$ 0.26 ^B	7.33 $\pm$ 0.27 ^B	7.39 $\pm$ 0.27 ^B	7.07 $\pm$ 0.16 ^B	
Packed cell volume (%)	1	40.32 $\pm$ 0.24	35.03 $\pm$ 0.64	37.00 $\pm$ 1.50	38.51 $\pm$ 1.68	51.55 $\pm$ 2.56 ^A	49.98 $\pm$ 2.71 ^A	50.61 $\pm$ 3.02 ^A	50.63 $\pm$ 4.31 ^A	
	2	38.91 $\pm$ 1.07	33.56 $\pm$ 1.90	32.25 $\pm$ 1.80	32.73 $\pm$ 1.58	41.17 $\pm$ 1.07 ^B	39.93 $\pm$ 1.68 ^B	36.91 $\pm$ 1.43 ^B	37.78 $\pm$ 2.14 ^B	
Erythrocyte sedimentation rate (mm/hr)	1	39.60 $\pm$ 3.40	39.60 $\pm$ 3.40	39.00 $\pm$ 3.30	45.60 $\pm$ 3.30	43.20 $\pm$ 3.20	44.40 $\pm$ 3.40	41.40 $\pm$ 2.80	35.40 $\pm$ 2.20	
	2	36.00 $\pm$ 3.00	34.80 $\pm$ 2.80	39.00 $\pm$ 2.80	34.20 $\pm$ 2.20	36.00 $\pm$ 2.70	38.40 $\pm$ 2.90	35.40 $\pm$ 2.40	36.60 $\pm$ 2.60	
Total erythrocyte count ($10^6/\text{mm}^3$)	1	5.90 $\pm$ 0.32	6.40 $\pm$ 0.30	6.15 $\pm$ 0.22 ^A	6.05 $\pm$ 0.22 ^A	6.15 $\pm$ 0.27 ^A	6.65 $\pm$ 0.12 ^A	5.80 $\pm$ 0.15 ^A	6.10 $\pm$ 0.10 ^A	
	2	5.15 $\pm$ 0.22	4.82 $\pm$ 0.26	4.90 $\pm$ 0.10 ^B	4.27 $\pm$ 0.18 ^B	4.70 $\pm$ 0.10 ^B	4.85 $\pm$ 0.12 ^B	4.50 $\pm$ 0.12 ^B	4.90 $\pm$ 0.10 ^B	
Total leukocyte count ($10^3/\text{mm}^3$)	1	8.40 $\pm$ 0.15	8.35 $\pm$ 0.27 ^A	7.10 $\pm$ 0.25 ^A	6.80 $\pm$ 0.30 ^A	7.00 $\pm$ 0.15 ^A	7.25 $\pm$ 0.17 ^A	6.95 $\pm$ 0.17 ^A	7.05 $\pm$ 0.17 ^A	
	2	7.60 $\pm$ 0.20	6.25 $\pm$ 0.17 ^B	5.90 $\pm$ 0.15 ^B	5.35 $\pm$ 0.17 ^B	5.40 $\pm$ 0.25 ^B	5.45 $\pm$ 0.18 ^B	5.90 $\pm$ 0.15 ^B	5.80 $\pm$ 0.20 ^B	
Mean corpuscular haemoglobin (pg/dl)	1	18.83 $\pm$ 1.48	14.23 $\pm$ 0.85	15.33 $\pm$ 0.63	16.33 $\pm$ 0.30	16.09 $\pm$ 0.60	14.33 $\pm$ 0.87	15.87 $\pm$ 0.91	16.72 $\pm$ 0.27 ^A	
	2	22.54 $\pm$ 1.10	14.47 $\pm$ 0.70	14.38 $\pm$ 0.84	16.16 $\pm$ 0.15	15.00 $\pm$ 0.83	15.21 $\pm$ 0.80	16.41 $\pm$ 0.36	14.48 $\pm$ 0.56 ^B	
Mean corpuscular haemoglobin concentration (g/dl)	1	27.11 $\pm$ 0.88	26.22 $\pm$ 2.80	28.81 $\pm$ 2.29	25.99 $\pm$ 1.92	19.27 $\pm$ 0.85	19.22 $\pm$ 1.40	18.37 $\pm$ 1.26	20.64 $\pm$ 1.31	
	2	27.21 $\pm$ 1.30	22.39 $\pm$ 2.35	22.10 $\pm$ 1.76	21.36 $\pm$ 1.35	17.04 $\pm$ 0.46	18.45 $\pm$ 0.78	20.51 $\pm$ 1.56	18.93 $\pm$ 0.58	
Mean corpuscular volume (fl)	1	69.05 $\pm$ 3.21	65.38 $\pm$ 2.77	60.82 $\pm$ 3.81	64.46 $\pm$ 4.13	83.98 $\pm$ 3.17	75.14 $\pm$ 2.32	88.21 $\pm$ 6.81	82.69 $\pm$ 5.70	
	2	83.79 $\pm$ 6.82	69.50 $\pm$ 3.94	66.15 $\pm$ 4.17	77.17 $\pm$ 4.09	87.81 $\pm$ 3.14	82.80 $\pm$ 5.13	83.15 $\pm$ 7.61	77.54 $\pm$ 5.79	

Day 0–21 treatment period; day 28–7th day post-treatment period. ^{A,B}Within a column and a haematological variable, values with different superscript alphabets differ significantly ($P < 0.05$). ^{a,b}Within a column and a haematological variable, values with different superscript alphabets differ significantly ($P < 0.01$).

SUMMARY

An experimental trial was conducted on eight healthy buffalo calves aged between 6 and 12 months, divided into 2 groups equally. Group 1 calves served as healthy control while group 2 (treatment group) was administered sodium molybdate @ 30 mg/kg/day. Among group 2 calves daily administration of sodium molybdate for three consecutive weeks produced immediate alterations in various haematological parameters in comparison to healthy buffalo calves. Repeated oral administration of sodium molybdate in treatment group exerted profound anaemia and decline in the mean values of Hb, PCV, TLC, TEC, and MCH. However, no significant effect on values of ESR, MCHC and MCV was noticed. Thus to maintain the proper health and production in buffaloes exposure to excess dietary molybdenum should be avoided.

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