
Mineral Deficiency Problems in Indonesian Ruminant Livestock

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Abstract

Studies on macro and micro elements in large and small ruminants were undertaken because mineral deficiencies are considered to be a major cause of poor production and disease in grazing ruminants in the tropics. Serum, plasma, saliva and liver were collected at several sites in West Java. Mineral concentrations were estimated by atomic absorption spectrophotometry (Ca, Mg, Cu, Zn, Na and K) and visual spectrophotometry (P).

Na deficiency was seen in a herd of grazing cattle where 17% had salivary Na/K ratios < 1 and 78% were in the range 1 to 6. Absolute average values were: Na = 1237, K = 529 ppm. 39% of grazing sheep sampled at Cirebon gave salivary Na/K < 6 ratios. In the same population of sheep, 53% had low serum Ca (< 80 ppm), 30% low serum P (< 40 ppm) and Mg levels were in the normal range. Of the microelements, 53% of sheep had serum Cu in the deficient range (< 0.5 ppm) while 11% had marginal levels (0.5-0.6 ppm), and 68% had marginal Zn in serum (0.4-0.8 ppm). These results clearly indicate that mineral deficiencies are a major problem in Indonesian ruminants.

Introduction

Mineral deficiencies severely inhibit ruminant livestock production in the tropics (McDowell, 1985). Although studies on mineral status of Indonesian livestock are limited, an extensive survey of mineral contents of forages and feedstuffs found low Na and Cu levels (Little, 1986). Here we present further information on potential mineral deficiencies in Indonesian ruminants.

Materials and methods

Forty-seven sheep sera and saliva samples were collected from two villages of Cirebon District, twenty-six sera and liver of cattle and thirty-five cattle saliva were collected from Bandung and Bogor respectively. Sera and liver from twenty buffalo were also collected from Sukabumi, West Java.

Serum was analysed for Cu, Zn, Mg, Ca and P, saliva for Na and K and liver for Cu, Zn, Mg and P.

Mineral contents were estimated by atomic absorption spectrophotometer (Varian Techtron, AA-1275) using BDH standard solutions and certified reference serum samples (Boehringer GmbH). Phosphorus levels in the sera was analysed by a colorimetric method using spectrophotometer (Varian DMS-80).

Liver tissue was digested by acid (HNO₃ and H₂SO₄, 2 : 1) on a hot plate 120° C for 6 hr and diluted prior to analysis. Sera and saliva were diluted with double distilled water before analysis.

Results and discussion

Results of analysis of sera for Ca, P, Cu and Zn and saliva for Na and K are given in Table 1. Results of analysis of liver for Cu and Zn are presented in Table 2. Table 3 shows the percentage of animals with mineral levels below the normal range.

Table 1. Mineral concentrations (ppm except Na/K which in molar ratio)

Species	site	n	Cu	Zn	Mg	Ca	OP	Na/K	*)
Sheep	Cirebon	47	0.48	0.76	28.0	78.9	48.0	13.7	
			± 0.03	± 0.03	± 1.1	± 3.0	± 1.9	± 1.7	
Cattle	Bandung	26	1.07	1.03	24.4	103.0	82.9	NM	
			± 0.25	± 0.27	± 0.9	± 2.1	± 5.6		
	Bogor	35	NM	NM	NM	NM	NM	3.2 ± 1.6	
Buff.	Sukabm	20	0.72	0.94	25.0	100.6	95.8	NM	
			± 0.01	± 0.01	± 0.8	± 2.3	± 6.6		

*) = Mean±SE

NM = not measured

Table 2. Mineral concentrations (ppm wet weight; Mean±SE) in the liver of cattle and buffaloes from West Java.

Species	site	n	Cu	% def.	Zn %	def.
Cattle	Bandung	26	29.3±4.0	19	36.5±3.8	0
Buff.	Sukabm	20	17.9±3.2	35	23.2±3.5	20
Normal levels (Fick et al, 1979).		10 - 60		15 - 25		

Table 3. Percentage of the animals with mineral levels in serum and saliva below the normal range

Species	site	n	Cu		Zn		Mineral (%)		P	Na/K	
			def.	mar.	def.	mar.	Mg def.	Ca def.		def.	mar.
Sheep	Cirebon	47	53	11	0	68	0	53	30	4.2	23.4
Cattle	Bandung	26	0	0	0	15	0	0	0	NM	NM
	Bogor	35	NM	NM	NM	NM	NM	NM	NM	17	78
Buff.	Sukabm	20	0	20	0	25	0	0	0	NM	NM

NM = not measured

Note: Mineral levels criteria in serum (ppm except Na/K ratio)

	def.	marg.	normal
Cu	< 0.5	0.5 - 0.6	> 0.6
Zn	< 0.4	0.4 - 0.8	> 0.8
Mg	< 18	-	18 - 31
Ca	< 80	-	80 - 120
P	< 40	-	40 - 60
Na/K	< 1	1 - 6	> 6

The sodium status was assessed by the Na/K ratio in saliva (Murphy and Connell, 1970). Na deficiency was observed on the herd of grazing cattle at Bogor where 17% had Na/K ratio below 1 and 78% were in the range 1 to 6. Thirty nine percent of the grazing sheep sampled at Cirebon gave Na/K ratios below 6. These and other results of animal analyses (Bahri et al, 1988), forage (Little, 1986) and response to supplementation (Panggabean and Little, 1987; Yates, 1983) indicate that Na deficiency is a problem.

Low serum Ca was seen in grazing sheep of Cirebon, but levels in cattle and buffaloes were in the normal range. Ginting et al (1985) reported low serum Ca in milk cattle in West Sumatra.

Low serum P was only observed in grazing sheep at Cirebon. (Little, 1986) reported marginal P levels in forages. Serum levels are not the best indicator of P status.

Magnesium concentrations in all investigated animals were within the normal levels. Mg deficiency has been reported in Riau (Manan and Sunardi, 1985).

Low serum Cu levels in cattle were reported previously in several provinces in Indonesia (West & North Sumatra, Madura, North Sulawesi and Timor) and low liver Cu levels were found in Bali cattle and in Bogor (Stoltz et al, 1985). The present results confirm earlier reports of generalized low Cu status of Indonesian livestock.

Low serum Zn was found in many of the animals sampled, supporting previous findings (Darmono et al, 1988).

These investigations indicate that mineral deficiencies may be a problem for ruminant livestock in Indonesia. Further study is needed to estimate the distribution of mineral deficiency diseases in all parts of Indonesia especially in transmigration areas where large and small ruminants are being introduced.

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