MINERAL STATUS AND ITS INTERACTION IN LACTATING COWS

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INTRODUCTION

Although the minerals requirement is relatively low but since their involvement in the metabolism is very important, therefore its effect on reproduction and feed efficiency are very significant. Unlike other nutrients, the level of minerals supplemented in the diet should be very precise since lower or higher of the minerals given in the diet would be very harmful to the animals. In warm climate, heat stress reduced feed intake and milk yields in dairy cows and alters mineral needs in ruminants (Toharmat and Kume, 1997).

In order to give a proper mineral supplementation, information on the availability of some minerals in the feed, its utilization and status in the body is required. Suryahadi (1990) reported that some mineral status in forages for dairy cattle in Java were under the mineral requirement for lactating dairy cows. The respond of cattle to mineral supplementation was different following the regional condition. It is therefore the practice on mineral supplementation for lactating cows need to be conducted after studying the status of the minerals.

This research was conducted to study the mineral status in lactating cows through the mineral content evaluation in the blood plasma and their feedstuffs.

MATERIALS AND METHODS

The research was conducted in Lembang West Java as a production center for milk in Java. Lembang is located in a high altitude, the forage given in the feed was collected from around the vicinity, while the concentrate was obtained from the dairy cooperative (KPSBU-Lembang). Sampling techniques, handling and minerals analysis of all diets and tissues were performed following the procedure describes by Fick *et al.* (1979). Feed samples were directly collected from feed storehouse on farm, as much as 1 kg concentrate and 3 kg forages. The samples were composite, dried and ground with Vibrating Sample Mill. Blood samples were taken from jugular vein using venoject tube as much as 10 ml. The blood samples were centrifuged at 3000 rpm for 15 minutes, kept in polypropylene tubes and stored in a cold place. All samples taken from feed and blood were analyzed for macro elements (Ca, P, K, NA, Mg, Cl, S) and microelements (Fe, Mn, Zn, Co, Cu, Ca), using Atomic Absorption Spectrophotometer (AAS). Wet-ashing procedure was used to digest feed samples using combination of perchloric acid (60%) and nitric acid (70%) placed in a fume hood for 3-4 hours, then boiled in a hot plate until clear solution was obtained and left overnight for AAS analysis. The blood samples were deproteinized as followed; One ml blood plasma was mixed with 9 ml TCA (10%), centrifuge at 3000 rpm for 15 min. The filtrate obtained was analyzed for Ca, P, Mg, and S while Co, Mn and Zn were read by AAS after adding with nitric acid (2%).

The statistical analysis was conducted as to compare the mineral status in the blood plasma of the lactating cows and that of the minerals level as reported by Georgivieskii (1982), through the T test. The correlation among the minerals in the plasma was analyzed as to achieve the mineral interaction.

RESULT AND DISCUSSIONS

The minerals content of feeds and the requirement for lactating cows are shown in

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Table 1. Minerals content of forage and lactating concentrate

No.	Feedstuffs	Minerals (Dry matter basis)								
		Ca %	P %	Mg %	Na %	S %	Fe ppm	Mn ppm	Zn ppm	Cu ppm
1	Native Grass	0.21	0.31	0.24	0.01	0.35	195	38	40	21
2	Elephant Grass	0.25	0.55	0.21	0.01	0.56	81	38	45	14
3	King Grass	0.21	0.28	0,21	0.01	0.40	97	38	29	19
4	Concentrate	0.33	0.29	0.21	0.08	0.21	146	85.16	65.9	28.2
NRC Requirement (Cow's bw 400 kg, milk = 10-15 kg/day)		0.48	0.34	0.20	0.18	0.20	50	40	40	10

Table 1. It showed that the Ca content in some forages (native grass, elephant grass and King grass) was under the normal requirement. It seemed that the need for Ca requirement was very much depending upon the mineral supplementation in the concentrate. The level of P was varied in the feedstuffs and It seemed to meet the requirement (NRC, 1978). The requirement of K could be provided from the forage, but the Na content was very low, it is therefore the supplementation of salt in the concentrate is very important. Sulfur is very important for dairy cattle and could be provided from the forage as well as from the concentrate. The iron requirement for dairy cattle is 50 ppm and its content in the forage and in the concentrate around Lembang area is pretty high. The iron content of forages could vary from 10 to 1000 ppm. Dauzier (1984) reported that the forages produced from the mountain region contained high iron (Fe). The Mn requirement is 40 ppm in the ration and the toxic level according to Mc. Dowell (1986) is around 1000 ppm. In general the Mn content in some forage is within the normal range. In case the forage supply is low, the Mn has to be added in the concentrate. The Zn concentration in the forages found in Lembang area is considered to be critical, because the level is within the marginal range. It Is therefore the Zn supplementation is very important in the concentrate. Mc.Dowell (1986) reported that the level of Zn toxicity was around 500 ppm. The level of Cu in the forages is close to the Cu recommendation (10 ppm). A great care for the Cu supplementation is needed because the narrow ranges between the deficient and the toxic level of Cu. A mistake in mineral Cu supplementation could result fatal condition for the cattle.

The level of some minerals in the plasma is shown in Table 2. It was found out

Table 2. Mineral status of lactating dairy cattle's in Lembang based on mineral plasma

No.	Minerals	Normal range Georgivieskii (1982)	Result			
			Mean	n	s_{n-1}	Mineral Status
1.	Ca, mg%	9-12	5.98	17	0.47	deficient
2.	P, mg%	4-7	7.79	17	2.31	normal
3.	Mg, mg%	1.7 - 2.25	2.22	17	0.27	normal
4.	Na, mg%	320-330	189.43	17	89.08	deficient
5.	K, mg %	17-20	13.60	17	6.01	deficient
6.	Fe, ppm	1.0	1.95	22	0.65	normal
7.	Zn, ppm	0.6-0.8	0.93	21	0.55	normal
8.	Mn, ppm	0.0015	0.03	22	0.01	normal
9.	Cu, ppm	0.65	0.52	22	0.05	normal

Table 3. Coefficient Correlation of Mineral Plasma Concentration of Lactating Dairy Cattle

Mineral	Ca	P	Mg	Na	K	S	Fe	Zn	Mn	Cu
Ca	1	0.029	-0.575	0.734	-0.54	0.05	0.64	0.57	0.048	0.33
P		1	-0.115	-0.194	-0.08	0.82*)	-0.45	0.37	0.119	0.28
Mg			1	-0.431	0.87*)	0.04	-0.43	-0.84*)	0.419	-0.83*)
Na				1	-0.37	0.17	0.33	0.34	-0.48	0.32
K					1	0.19	-0.41	-0.67	0.415	-0.47
S						1	-0.36	0.08	-0.061	0.31
Fe							1	-0.10	-0.063	0.14
Zn								1	0.184	0.14
Mn									1	-0.2

*) Significant different (P<.05)

that the minerals P, Mg, Fe, Zn, Mn and Cu in the plasma were within the normal range level, while Ca, Na and K were below the critical levels.. The low levels of Ca and Na in the blood were consistent with that of the levels in the feed (forage). Supplementation of Ca and Na in the concentrate improved the mineral status. Unlike Na and Ca, the potassium level in the forage was high, but their levels were low in the plasma. This was due to the low forage consumption (ratio of forage to concentrate 47:53). The high K content in the forage (Elephant and King grass) might be due to the use of fertilizer in the soil.

The correlation among the plasma minerals is shown in Table 3. There were some significant correlations among Mg, Zn and Cu. Mg could be provided from the feed or from the reserve Mg in the body. If the Mg content in the feed was high it depressed the Zn and Cu availability, therefore Mg supplementation could cause Zn and Cu deficiencies. Great care is needed as to provide the proper mineral mixture. When the forage supply is short, the farmer will give high concentrate diet and therefore will lower the fat content in the milk and as the consequences the price of the milk will decrease. In order to make the milk acceptable to the Dairy Cooperative some buffers such as soda ($NaHCO_3$), MgO or $MgCO_3$ will be added to the milk. The addition of buffers that contain mineral Mg might decrease Zn and Cu availability.

CONCLUSION

It is evident from this investigation that Ca and Na deficiencies might be a limiting factor to increase production of lactating cows in Lembang. It seemed that the need for Ca and Na requirement were very much depending upon the mineral supplement in the concentrate. The minerals P, Mg, Fe, Zn, Mn, and Cu in the plasma were within the normal range. A great care is needed on the mineral Mg supplementation, because the addition of high concentration of Mg in the diets tended to alter Zn and Cu metabolism.

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