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Status of Calcium and Phosphorus of Female Balinese Cattle in Mataram City West Nusa Tenggara

Desy Fridjayanti[1], Suhubdy[2], Syamsul Hidayat Dilaga[2]
[1]*Postgraduate student of Animal Husbandry, Mataram University, Mataram Indonesia*
[2]*Lecture of Animal Husbandry Faculty, Mataram University, Mataram Indonesia*
Corresponding Author: Desy Fridjayanti

Abstract: *Calcium (Ca) and Phosphorus (P) are closely related to the reproductive abilities of ruminants, especially female cattle; calves, pregnant and dry cattle. Especially in pregnant cattle, these elements are used for fetal growth in addition to maintain the condition of the parent body. The levels of Ca and P in the blood of livestock are strongly influenced by the levels of Ca and P in plants and in the soil where the plants grow. The aim of the study was to determine the status of Ca and P minerals in balinese calves, pregnant and dry balinese cattle which were raised by farmers in the Mataram City, West Nusa Tenggara. Blood samples of 3 ml from 12 balinese calves, 32 pregnant balinese cattles, and 19 dry balinese cattles were accommodated in vacuum tubes. Moreover, 100 g amount of forage were collected by using spot diagonal sampling technique in the feed place of each livestock. And the example of the soil where the forage grew by taking 500 g amount of soil as a composite of representatives of several soil samples from various locations. The results showed that the levels of Ca in the blood of calves were 2.87 ± 0.99 mg / dL; pregnant cattle 2.88 ± 0.85 mg / dL; and dry cattle 2.82 ± 1.2 mg / dL. And the levels of P in the blood of calves were 18.3 ± 2.8 mg / dL; pregnant cattle 21.7 ± 8.2 mg / dL; and dry cattle19.7 ± 3.9 mg / dL. The conclusion of the results is the status of Ca in the blood of female balinese cattle in the city of Mataram is deficient, and the status of P is excessive.*

Keywords: *Calcium, Phosphorus, Female Balinese Cattle*

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I. Introduction

Minerals are one of the most important nutrients in the growth, health, production, reproduction and immunity of animals [1]. In pregnant animals, macro mineral elements such as Calcium (Ca), Magnesium (Mg), and Phosphorus (P) are very important for fetal growth and for maintaining body condition [2]. Macro minerals are closely related to the reproductive abilities of ruminants [3]. Low levels of Ca can make the placenta difficult to come out due to loss of uterine contractions [4]; Metritis in dairy cows [5]; and low levels of Ca, Mg and P can cause low levels of fertility in buffaloes [6]; delayed postpartum ovulation and pregnancy failure or miscarriage in cattle [7]. P deficiency results in Anestrus, low conception level, long calving interval, embryo death, calf stillbirth and delayed sexual maturity [8].

Data from research on soil minerals and plants for animal feed in several regions have been widely reported, but none from the City of Mataram. Dilaga [9] stated that there is a relationship between the levels of selenium minerals in soil, water, plants, and livestock. Sirappa and Astiana Sastiono [10] reported that regosol soil in Lombok was formed from volcanic main material which had not developed yet, and had poor physical soil properties. So it is advisable for soil management in Lombok to add organic materials and fertilizers, especially nitrogen, phosphate and potassium, and dolomite lime to increase land productivity [10]. The results of a study in Bali by Besung [11] and Pujiastari et al., [12], the Ca level of blood serum balinese cattle which maintained in paddy fields was lower than the standard of cows' blood Ca content of other nations in the world [11] [12].

Availability of mineral nutrients is strongly influenced by the condition and type of soil where plants grow, and the seasons. Soil nutrient conditions such as mineral Ca and P soil will greatly affect the mineral content of plants for animal feed which will ultimately affect the mineral levels in the body of livestock. According to Sharma et al., [13], minerals cannot be stored in the body and cannot be synthesized in the body therefore it is needed to be constantly supplied through feed or supplementation. Meanwhile, farmers' habits in the city of Mataram in terms of obtaining forage will affect the adequacy of livestock mineral needs. In general, farmers in the city of Mataram do not have special land for forage. Most breeders do not weigh, or arrange rations according to nutrition need of their livestock. The amount and composition of the feed given is very dependent on the availability in the surrounding environment and the ability of farmers to obtain it.

Based on above explanation, a study of the Status of Calcium and Phosphorus of Female Balinese Cattle in Mataram City West Nusa Tenggara needs to be done.

II. Materials and Methods

The research was conducted from June to August 2018.

2.1 Location of Research

The sampling of female balinese cattle blood and plants was carried out in the East Rembige breeders group in Rembige Village Sub-district of Selaparang, *Bintang Tenggale* breeders group in Cakranegara Sub-district of Cakranegara, *Bahtera Damai* breeders group in Tanjung Karang Sub-district of Sekarbela, *Pade Genem* breeders group in Jempong Baru Village Sub-district of Sekarbela, *Pade Girang Jaya* breeders group in Karang Pule Village Sub-district of Sekarbela, and *Patuh Pacu* breeders group in South Ampenan Sub-district of Ampenan.

Soil sample were taken in paddy fields and lands which were locations for farmers to find and collect plants for animal feed. Analysis of Ca and P levels of soil, plants, and blood of balinese calves, pregnant and dry balinese cattle were carried out at the Analysis Laboratory of Mataram University.

2.2 Research Material

The material in this study consisted of blood from balinese calves, pregnant, and dry balinese cattle maintained by farmer groups in Mataram City, and forage as well as the soil where forage grew. Soil sample were where forage grew, sample of plants were forage in feed place of female balinese cattle, and blood samples were blood from 12 balinese calves, 32 pregnant balinese cattle and 19 dry balinese cattle.

2.3 Research Methods

2.3.1 Provision of Soil Samples

Provision of soil samples was by taking 100 g amount of paddy soil and 100 g amount of garden soil at depth of 15-20 cm by using spot diagonal sampling technique [14]. Sample soil was a representative of land from the location where forage grew which is a composite sample. The taking of soil samples was carried out in several locations where farmers usually search for and take forage in each District, namely in Selaparang District, Ampenan District, Sekarbela District, and Cakranegara District.

2.3.2 Provision of Sample Feed Plants

Provision of samples of feed in the form of fresh plants was by taking forage as much as 200 g by choosing 5–10 collection points randomly at each place of animal feed [15]. Samples of the plants are then composite, then cut to 3–5 cm long to be weighed and taken about 1000 g. Sampling of feed plants was carried out on the second, third and sixth day of the week, and was carried out for 3 (three) weeks. Examples of feed plants that had been taken were then dried, then recomposed, and analyzed in the laboratory.

2.3.3 Provision of Blood Samples

Provision of female balinese cattle blood sample was carried out by taking 2-3ml female balinese cattle blood from the jugular vein (neck section). Blood sampling was conducted by using a multiple sample needle (one package of needle, holder, and 3 ml vacuum tube) in 12 balinese calves, 32 pregnant balinese cattle, and 19 dry balinese cattle. Blood samples were then immediately taken to the Laboratory.

2.3.4 Laboratory Analysis

Analysis of Ca and P soil, plants, and blood of female balinese cattle were carried out at the University of Mataram Analysis Laboratory. Laboratory soil analysis included measurement of soil pH using the Electrode Glass method, analysis of soil Ca content using the AAS Flame method, and analysis of available P levels on the soil using the Bray and Kurtz I methods. The forage laboratory analysis included measurements of content of ash and organic matter using the Wet Dewatering method, Ca content using the AAS Flame method, and P content using the Spectrometry method. Blood laboratory analysis included measurement of blood Ca levels using the AAS Flame method, and P levels in the blood using the Spectrometry method.

2.4 Measured Variables

The variables measured in this study were the levels of Ca and P in the blood of female balinese cattle, forage and the land where forage grew.

2.5 Data Analysis

All data on Ca and P levels in soil, forage, and balinese cattle' blood which was collected sought for their average to determine the Ca and P mineral status of calves, pregnant, and dry balinese cattle.

III. Results and Discussion

3.1 General Condition of Research Areas

The Mataram city is the capital city of the province of West Nusa Tenggara has an area of 6,130 hectares, consisting of 6 (six) sub-districts [16]. The total area are 52.4% is flat land, 47.5% is undulating land (2-15%), and only 0.10% is steep land. According to BPS [17], the temperature, humidity, air pressure, number of rain days, and rainfall in Mataram City from May to September 2018 are listed in Table 3.1.

Table 3.1. The Temperature, Humidity, Air Pressure, Number of Rain, and Rainfall in the City of Mataram.

Month	Temperature (°C)		Humidity (%)	Air Pressure (mb)	Number of Rain Days	Rainfall (mm)
	Max	Min				
May	32.4	22.3	80.0	1.006.0	5.0	18.0
June	31.6	21.6	82.0	1.007.3	6.0	41.0
July	31.0	20.9	80.0	1.007.3	3.0	1.0
August	31.1	20.6	80.0	1,008.0	6.0	12.0
September	32.3	21.5	79.0	1,008.0	5.0	89.0

Source: BPS (2019)

In general, the farmers in Mataram City takes forages on the edge of rice fields and / or garden land. Not infrequently also from the old unoccupied land around the group cage. The soil condition in the area is a condition of land that has never been cultivated, has never been fertilized, and has not experienced good irrigation. So, it is very possible that soil is poor in soil nutrients needed by plants. Land in the location of plants collection by farmers in the Mataram City has an average pH of 6.5±0.84, this value is classified as neutral [18].

The forage composition provided by farmers in the Mataram City which given to female balinese cattle is mostly the same for all other types of cattle. Most of it is a type of field grass, a small portion of elephant grass is planted around the banks of the river, and very rare types of legumes. When the grain crop, farmers also provide corn and / or soybean waste to their balinese cattle. But most of the grain waste comes from outside the Mataram City. The levels of ash forage and organic matter forage are listed in Table 3.2. And the data of weight of female balinese cattle in Mataram City are listed in Table 3.3.

Table 3.2. The Content of Ash Forage and Organic Matter Forage in The Mataram City

Forage	Content of Ash (%)	Organic Matter (%)
at Calves	14,05±2,18	85,95±2,18
at Pregnant Cattle	13,42±1,92	86,58±1,92
at Dry Cattle	14,13±2,71	85,87±2,71

Source : Primary data processed (2018)

Table 3.3. The Weight of Female Balinese Cattle in the Mataram City

Female Balinese Cattle	n	Weight (Kg)
Calves	12	161,67±15,94
Pregnant Cattle	32	168,72±16,41
Dry Cattle	19	169,11±17,04

Source : Primary data processed (2018)

3.2 Status of Calsium

The results of analysis of Ca levels in soil, plants and blood of female balinese cattle are listed in Table 3.4.

Table 3.4. Levels of Ca soil, Plants, and Female Balinese Cattle's Blood

Matter	Analysis		Level	Standard	Information
Ca (%)	Soils		0,32±0,08	0,01-6 [19]	Low
	Plants		0,25±0,17	0,5[14]	Low
Ca (mg/dL)	Blood	Calves	2,87±0,99	8-12[20]	Low
		Pregnant Cattle	2,88±0,85		Low
		Dry Cattle	2,82±1,2		Low

Source : Primary data processed (2018)

The level of Ca blood in balinese cattle shown in Table 3.4 is low (2.87 ± 0.99 mg/dL). This value is much lower than the Ca level of balinese cattle blood in paddy fields reported by Besung [11], and Pujiastari, et al., [12], which ranges around 6 mg / dL. Moreover, it is very much lower than Ca blood levels of non-pregnant PO cattle reported by Arifin, et al., [21] 8.10-10.6 mg/dL. Referring to the standard Ca levels of cows from various nations in the world according to Mc Dowell [20], with a range of values of 8-12 mg/dL, it can be stated that the mineral status of Ca balinese cattle's blood in the Mataram City is deficient.

The levels of Ca in the blood of pregnant balinese cattle listed in Table 3.4 are 2.88 ± 0.84 mg/dL. This blood Ca level is lower than the results of Arifin, et al., [21], who reported that Ca blood levels of pregnant PO cattle ≥ 6 months were 5.8-7.7 mg/dL. In fact, this value is far lower than the Ca value of cows' blood in various nations in the world according to Mc Dowel [20]. So that it can be stated that the Ca status of the pregnant balinese cattle blood in Mataram City is deficient. Likewise with the levels of Ca in the blood of dry balinese cattle is also low, so it can be stated that the status of the blood of the dry balinese cattle is deficient.

The low levels of Ca in the blood of calves, pregnant and dry balinese cattle, are caused by low Ca levels in plants. And low levels of Ca in plants are strongly influenced by low levels of Ca in the soil. In accordance with what was explained by Gartenberg, et al., [22], that if the forage land grows poor in mineral elements, livestock that consume the forage will show symptoms of mineral deficiency.

3.3 Status of Phosphorus

The results of analysis of P levels in soil, plant and blood of female Balinese cows are listed in Table 3.5.

Table 3.5. Levels of Available P in Soil, Levels of P in Plants, and Female Balinese Cattle's Blood

Matter	Analysis		Level	Standard	Information
P (%)	Available P of Soil		0,007±0,002	0,01-0,5[19]	Very Low
	Plant		0,303±0,069	0,2[14]	High
P (mg/dL)	Blood	Calves	18,3±2,8	4-6[20]	Very High
		Pregnant Cattle	21,7±8,2		Very High
		Dry Cattle	19,7±3,9		Very High

Source : Primary data processed (2018)

In Table 3.5, it shows the results of analysis of available P levels in soil, P levels in forage, and blood of female balinese cattle. The level of P soil at the location where the forage taken in Mataram City is very low which is in the range of 0.007±0,002%. While the standard P content that must be available in the soil according to Andriesse [19], is 0.01-0.5%. This indicates that the land where the growth of plants for animal feed in the Mataram City is land that is poor in nutrient P, even though the land is an area around the ridge of rice fields and / or garden land. However, farmers in the city of Mataram often take forage for animal feed on land around their enclosures and / or in uninhabited houses. So that the land is very low in nutrients, has never been cultivated, and has never been given fertilizer.

Although the P level in the soil was very low, the P level in the plants in this study was high. This can happen due to several factors. First, it is because the soil pH of this research is classified as neutral, so that the absorption of soil nutrients by plant roots can occur optimally. As stated by Budi and Sari Sasmita [14], that absorption of soil nutrients by plants is strongly influenced by soil pH around plant roots, if the soil pH is too acidic or alkaline it will inhibit nutrient absorption. In this regard, plants also absorb P in the form of organic phosphates, namely nucleic and phytin acids. These compounds are formed through a process of degradation from decomposition of organic matter that can be directly absorbed by plants, so that P availability is limited and unstable depending on the population of microorganisms. If the population of microorganisms is high, P uptake will also be high. The second factor is because plants really need P as the main element in their metabolism, which plays a very important role directly as an energy producer through the hydrolysis process, has a role as an activator of enzymes, and plays a role in the synthesis of amylase which requires the P enzyme (glucosylase glucose) [14], so that the plant strives to fulfill the P element needs through its metabolism.

The level of P in the blood of female balinese cattle is very high. This is caused by high levels of P in forage given to livestock. In addition, the amount of P entering the digestive tract of livestock can exceed the P level in forage feed. Because, according to Georgievskii, et al., [23], in ruminants, P mainly comes from inorganic varieties, from hydrolysis of organic compounds by rumen microorganisms, and from intake with saliva. Pfeffer, et al. (2005) cited by France et al., [24] also stated that, in the intestine, endogenous P secretion diffuses with plasma and / or P originates from digestion of the secretion of saliva and intestinal tissue (cells that peel off mucosa), as a result the amount of P entering the intestine greatly exceeds the intake of P [24].

Based on the explanation above, the mineral content of P in calves balinese cattle's blood, pregnant, and dry balinese cattle in the Mataram City is very high, so it can be stated that the mineral status P in the blood of female balinese cattle in the Mataram City is excessive.

IV. Conclusion

Status of minerals Ca in blood of female balinese cattle raised by farmer groups in Mataram City was deficient by a low blood Ca level, which was 2.87 ± 0.99 mg/dL in balinese calves; 2.88 ± 0.85 mg/dL in pregnant balinese cattle; and 2.82 ± 1.2 mg/dL in dry balinese cattle. Mineral P status in blood of female balinese cattle which was raised by a group of farmers in the Mataram City was excessive, which was prove by a very high value of P in the blood, which was 18.34 ± 2.76 mg/dL in balinese calves; 21.70 ± 8.22 mg/dL in pregnant balinese cattle; and 19.69 ± 3.99 mg/dL in dry balinese cattle.

Look into the soil conditions in the Mataram City which is poor in nutrients, especially Ca and P, it is needs to be processed and given soil nutrients. In case of it will be used for planting forage. In addition, adequate Ca and P intake for female balinese cattle in the Mataram City is needed by taking into account the balance of nutrients and the right ratio for mineral content, especially minerals Ca and P. And it is very important to add additional mineral Ca supplementation to improve the quality of production and better reproduction.

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