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Effects Of Mount Agung Eruption On Chemical Composition And Physical Characteristics Of Bali Cattle Ration Fed In Talibeng Evacuation Zones Sidemen District Karangasem Regency

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ABSTRACT

Mount Agung eruption, August to December 2017, caused bali cattle to be evacuated. This aims of this study to compare the quality of bali cattle ration according to its chemical composition and physical characteristics before and after in evacuation zones. The first step is survey, conducted on January to April 2018 to the farmers to obtain information regarding the botanical composition of ration before and after in evacuation zones as well as sampling feed ingredients (forages and concentrates). The second step is analysis in the laboratory from May to June 2018. Ration sample was made according to observation at evacuation zones and the tabulation of questionnaire result data. The research variables were chemical compositionof ration ie: dry matter (%), organic matter (%), crude protein (%), crude fiber (%), ether extract (%) and gross energy (kcal/kg) and physical characteristics ie: bulk density (g/ml), water holding capacity (%), water solubility (%) of the ration. Study showed that the quality of bali cattle ration given before was better than after at the evacuation zones. Protein and energy content of ration before in evacuation zones were 17.94% and 4027 kcal/kg respectively and 8.85% and 3790 kcal/kg after evacuation zones. Physical characteristics of ration which includes bulk density, water holding capacity, and water solubility are higher before in evacuation zones.

Keywords: *chemical composition, bulk density, water holding capacity, water solubility*

INTRODUCTION

Bali cattle are native Indonesian germplasm originating from the island of Bali. Bali cattle have many advantages, so many are kept by farmers. Some of the advantages of Bali cattle are quite good adaptability to bad environments (Zulkharnaim *et al.*, 2010), high fertility reaches 80-82% with high meat quality and low fat percentage (Bugiwati, 2007; Sampurna and Suatha, 2010) and resistant to ticks and worms.

Maintenance of Bali cattle at the farmer level is generally traditional. One characteristic is that the feed provided only relies on forage-based without regard to the nutrient content. Setiana (2000), reported that forage is an important part of livestock production systems especially as ruminant feed, because more than 75% of the feed comes from forage.

August to December 2017, Mount Agung Eruption occurred which resulted in the evacuation of bali cattle to temporary evacuation zones located in several points. In evacuation zones, of course the feed given is different from the feed given before in evacuation zones. In the ruminants production system, forage feed sources are feed forage that are absolutely necessary both in terms of types and availability quantitatively and qualitatively and are followed by supplementation of concentrates to increase consumption and meet nutritional needs. The quality of a feed ingredient for bali cattle ration can be assessed by testing feed ingredients. Testing of ration constituent feed ingredients can be done by testing chemical composition (such as: crude protein, dry matter, organic matter, ether extract and crude fiber) and physical characteristics (such as bulk density, water holding capacity, and water solubility). The physical characteristics of ration constituents are one indicator to determine the quality of feed. The morphologically good feed surface is not rough, the odor is not rancid, and is not rotten or moldy. The density of the feed indicates hunger, the lower the density of a feed, the more amba the feed is (Suryani *et al.*, 2015). By paying attention to the conditions of the physical characteristics feed, it also indirectly pays attention to the quality of the feed to be given to bali cattle.

The chemical composition of ration constituent feed ingredients was analyzed by proximate analysis which was useful to determine the estimated digestibility and benefits of feed, as well as to determine the standard level of feed. Proximate analysis is an analytical method that classifies the components present in feed (Tillman *et al.*, 1998). The proximate analysis system was carried out to determine dry matter, ash, crude protein, ether extract, and crude fiber. Proximate analysis is the basis of chemical analysis useful for determining estimates of digestibility and benefits of feed, in order to determine feed for bali cattle (Kamal, 1998).

This study aims to compare the quality of bali cattle rations based on the chemical composition and physical characteristics of bali cattle rations given before and after the in evacuation zones.

MATERIALS AND METHODS

This study aims to compare at differences in the chemical composition and physical characteristics of bali cattle rations before the Mount Agung eruption and while in Talibeng evacuation zones, Sidemen District, Sidemen Regency. Data retrieval was carried out in two phase, namely surveys to farmers at the location of evacuation zones and analysis at the Animal Nutrition and Food Laboratory, Faculty of Animal Science, Udayana University.

In the field research using the survey method. Data retrieval technique is using a questionnaire with the number of respondents in this study as many as 12 farmers, interviews and direct observations in Talibeng evacuation zones, Sidemen District, Karangasem Regency. Sampling of feed ingredients (forages and concentrates) was given in evacuation zones to be further tested in the Animal Nutrition and Food laboratory, Faculty of Animal Science, Udayana University.

Forage samples and concentrates given at the Talibeng evacuation zones were sampled to determine their physical characteristics (bulk density, water holding capacity, and water solubility) and chemical composition such as dry matter (DM), organic matter (OM), crude protein (CP), crude fiber (CF), ether extract (EE) and Gross Energy (GE). The ration was made based on observations in Talibeng evacuation zones and tabulation data on the results of the questionnaire.

Data from the field research and data on the chemical composition of rations before and after in Talibeng evacuation zones were analyzed descriptive while the physical characteristics rations before and after in Talibeng evacuation zones were analyzed by a comparative analysis of the t test using SPSS for Windows version 24.0.

RESULT AND DISCUSSION

Chemical Composition Ration

The chemical composition of the ration constituent is one indicator to determine the quality of the ingredients. The efficiency of a process of handling, processing and storing in the feed industry requires information about the chemical composition and nutritional value of a feed material so that losses due to mishandling of feed ingredients can be avoided (Jaelani and Firahmi, 2007).

The eruption of Mount Agung affected the availability of animal feed because the ash was contaminated with feed so that the growth of forages in the disaster-prone zone decreased. As a result, the availability and quality of feed provided for livestock around Mount Agung declined. According to the results of the study Ratya (2011), the impact of the eruption of Mount Merapi in October and November 2010 was that animal feed forages, especially grasses and legumes, decreased production and the type of species that grew.

Based on field assessments before on Talibeng evacuation zones, forage feed given to bali cattle such as elephant grass (*Pennisetum purpureum*), Gliricidia, Leucaena leucocephala, native grass and Caliandra (*Calliandra callothyrsus*). Feed given to bali cattle in Talibeng evacuation zones such as elephant grass (*Pennisetum purpureum*), Gliricidia, concentrate and

native grass. Nutrient composition of bali cattle rations before and after in Talibeng evacuation zones, Sidemen District are listed in Table 1.

Table 1. Ration composition and nutritive values of feed provided in Talibeng evacuation zone

(a) Before Mount Agung Eruption in Talibeng Evacuation Zone								
Ration Composition	Weight (kg)	Dry Matter (%)	Crude Protein (%)	Crude Fiber (%)	Ether Extract (%)	Organic Matter (%)	Ash (%)	Gross Energy (kkal/kg)
Elephant Grass	20.0	38.30	3.96	11.79	2.61	31.68	6.62	1355.74
Caliandra	2.0	9.33	2.95	2.50	1.37	8.69	0.64	404.97
Gliricidia	4.0	15.27	3.92	2.03	0.61	13.99	1.28	725.25
L. leucocephala	4.0	17.77	5.30	3.49	0.93	16.68	1.09	835.48
Native grass	5.0	19.33	1.80	6.11	1.24	18.62	0.71	705.56
Total	35.0	100.00	17.94	25.92	6.77	89.67	10.34	4027.00
(b) After Mount Agung Eruption in Talibeng Evacuation Zone								
Ration Composition	Weight (kg)	Dry Matter (%)	Crude Protein (%)	Crude Fiber (%)	Ether Extract (%)	Organic Matter (%)	Ash (%)	Gross Energy (kkal/kg)
Elephant Grass	25.0	47.40	4.91	14.60	3.23	39.21	8.19	1678.03
Concentrate	0.5	7.15	1.17	0.78	0.61	7.11	0.04	300.49
Gliricidia	2.0	26.31	0.99	0.57	1.54	24.10	2.21	1007.60
Native grass	5.0	19.14	1.78	6.05	1.23	18.44	0.7	804.48
Total	32.50	100.00	8.85	21.98	6.62	88.85	11.14	3790.60

The results showed that the energy content of the bali cattle rations after in evacuation zones was 5.87% lower than the ration before in evacuation zones. The energy content in bali cattle rations after in evacuation zones is lower due to the composition and variation of the ration constituent material is lower than before in evacuation zones. Supported by Budiasa (2005), which states that the chemical composition of forages varies and is influenced by forages species and varieties, age levels of forages, climate and season. Differences were also seen in the levels of ash, crude protein, crude fiber and ether extract contained in bali cattle rations before and after in evacuation zones.

The ash content in the ration after in evacuation zones is 11.33% higher than the ration before in evacuation zones, this is due to differences in botanical composition and the amount given to bali cattle. Barry (2004), states that the origin of raw materials and the location of forage planting affects the ash content because the planting media in different regions have different mineral content, thus affecting the mineral content in forages. Each forages species has a different ability to absorb nutrients, especially minerals contained in the soil, thus causing differences in the mineral content of forages which also causes differences in quality.

The crude protein in the ration after being kept in evacuation zones is 50.68% lower than the ration before in evacuation zones, this is due to differences in botanical composition

and the amount given to bali cattle. The composition of the constituent ingredients before in evacuation zones varies more with the amount given to bali cattle more, in contrast to the composition of the ingredients of the ration after in evacuation zones. The composition of the constituent ingredients after concentrating in evacuation zones is concentrate, but this does not affect the protein content of the ration because giving to bali cattle is only 0.5 kg/head/day. Supported by Kamal (1998), which states crude protein levels are influenced by species factors, differences in forages age, and forages parts analyzed. The older the forages age, the crude protein content decreases. The older the forages age, the crude protein content decreases. The low levels of protein in old forages can be caused by the older forages having stems that are higher in percentage than leaves.

The crude fiber contained in the ration after in evacuation zones is 15.18% lower than the ration before in evacuation zones. This is because the composition of the ration compiler before in evacuation zones is dominated by various forage variations. The crude fiber content in the ration before in evacuation zones is higher but easily dissolved. This is supported by the results of the study of water solubility which obtained water solubility before in evacuation zones 14.36% higher than the water solubility after in evacuation zones. Another thing that can affect crude fiber levels according to Hartadi *et al.* (1993), namely the difference in forages age, type of environment, and fertilization of the parent forages used as samples. Strengthened by AAK (2008), which states that the older the forages, the higher the crude fiber because more fibers are covered by lignin and make the forages hard, also the lower digestibility. In addition to these factors, other factors such as forages type and forages composition affect the level of crude fiber in feed.

The ether extract content in the bali cattle ration after in evacuation zones shows 2.17% lower than the ration before in evacuation zones. Rianto *et al.* (2010), states that ether extract content is abundant in young leaves compared to the stem of a forages, but seeds in a forages generally have a higher ether extract content. The other factors that affect ether extract content are the development or distribution of forages material, diffusion, pH, particle size, temperature, and choice of extraction solvents.

The chemical composition of forages varies and is influenced by forages species and varieties, forages age, climate and season, soil type and limestone fertilization, sewage sludge, while forage production is influenced by season, land use and topography (Budiasa, 2005).

Physical Characteristics Ration

Based on the results of the study, the physical characteristics of bali cattle ration before and after in Talibeng evacuation zones, Sidemen District are presented in Table 2. The physical characteristics of the ration that the analysis in this study consisted of: bulk density, water holding capacity, and water solubility.

Table 2. Physical characteristics of bali cattle rations before and after in Talibeng evacuation zones

Variable	Before Mount Agung eruption	After Mount Agung eruption
Bulk Density (g/ml)	$0.2610^{a2)} \pm 0.00984$	$0.2109^{b} \pm 0.01050$
Water Holding Capacity (%)	$418.3717^{a} \pm 31.87937$	$306.9517^{b} \pm 47.83985$
Water Solubility (%)	$44.2014^{a} \pm 19.58570$	$37.8532^{a} \pm 14.42043$

Physical characteristics of the ingredients of the ration are one indicator to determine the quality of the ingredients. Bulk density of the ration indicates craving. The lower the density of a feed, the more bulk the feed is (Suryani *et al.*, 2015). The ration density after in eevacuation zones is 19.20% lower than before in evacuation zones. Statistical analysis of the bulk density of bali cattle rations before and after in Talibeng evacuation zones, was significantly higher ($P<0.05$) (Table 2). The ration density before and after in Talibeng evacuation zones, respectively: 0.2610 g/ml and 0.2109 g/ml. The ration density after in evacuation zones was 19.20% lower than before in Talibeng evacuation zones, Sidemen District.

This shows that the ration after in evacuation zones is more bulky than the ration before in evacuation zones. The ration after in evacuation zones is more bulky because the constituent material contains more elephant grass content. This is supported by the results of the study Suryani *et al.* (2015), which states that the more content of elephant grass in the ration, the smaller the density. The density of the material is much related to the fiber content in the material (Table 1 and 2), the higher the fiber content, the lower the density or the more bulky material. In this study obtained the results of crude fiber and density at lower in evacuation zones due to the possibility of forage after in evacuation zones older and the constituent material for more elephant grass, where crude fiber in elephant grass is insoluble. Forages generally have a low bulky density value (Khalil, 1999). Feeds with higher levels of bulky can cause greater strain and provide a sensation of fullness faster when consumed by bali cattle, so that the bulky can limit consumption in bali cattle. The ration bulk density value has a clear effect in reducing the consumption of ration dry matter.

Water holding capacity shows the results of statistical analysis are significantly higher ($P<0,05$) (Table 2). Water holding capacity before and after in Talibeng evacuation zones,

Sidemen District showed results of 418.3717% and 306.9517% respectively. Water holding capacity after in evacuation zones was 26.63% lower than before in Talibeng evacuation zones. This is due to the composition and number of different ingredients. Rations with higher crude fiber have high water solubility. The level of water holding capacity depends on the type of polysaccharide of the fiber component. Cellulose has a limited capacity to absorb water, whereas arabinoxylan has a very large absorption capacity (Trowell *et al.*, 1985).

According to Suhartati *et al.* (2004), high water holding capacity will cause the feed to be more open to attack by rumen microbial. Conversely, if the absorption of water is low, the rumen microbial are difficult to enter so that the digestibility of feed is also low. Strengthened by Robertson and Easwood (1981), water holding capacity is the ability of particles of feed ingredients to bind water. This causes the particles of non-dissolved dry matter to become saturated, then the particles expand and will be more easily degraded by the rumen microbial, thus increasing the rate of rumen emptying. There is a positive correlation between the physical characteristics and chemical composition of feed ingredients, especially between the water solubility of feed particles with fiber fractions (NDF, ADF, hemicellulose, and cellulose). The difference in the binding power of water to various feed ingredients can affect the volume and flow rate of digesta in the rumen.

Things that happen to water solubility that show was not significantly different ($P>0.05$) (Table 2). Water solubility after in evacuation zones was 14.36% lower than before in Talibeng evacuation zones, Sidemen District. Water solubility before and after in evacuation zones were 44.2014% and 37.8532% respectively.

Water solubility after in evacuation zones is 14.36% lower than before in evacuation zones. The ration after in evacuation zones has a lower value due to the ration constituent material, water content and particle size in the ration. The composition of the ration after in evacuation zones is dominated by elephant grass where the fiber in elephant grass is insoluble. One of the factors that affect water solubility is water content. Water content is the percentage of the amount of water content in the material based on dry weight (Syarief and Halid, 1993). Another thing that can affect water solubility is particle size, particle size of the ration before it is indicated to be coarser and has an inconsistent form of ration. This can reduce nutrient digestibility.

This shows that rations before in evacuation zones are more easily degraded in the rumen than rations after in evacuation zones. In accordance with the Ramanzin *et al.* (1994), which states the water solubility of a feed affects the speed of degradation of the feed material. Soluble feeds are more easily degraded in the rumen.

CONCLUSION

From the results of this study it can be concluded that the quality of bali cattle rations based on the chemical composition given before in evacuation zones is better than after in evacuation zones. Crude Protein and gross energy content of rations before in evacuation zones were 17.94% and 4027 kcal/kg respectively and 8.85% and 3790 kcal/kg after in evacuation zones. Physical characteristics of rations which include bulk density, water holding capacity, and water solubility before in evacuation zones is higher than after in evacuation zones.

SUGGESTION

The advice that can be given is that further research is needed regarding the chemical composition and physical characteristics of rations in other evacuation zones due to Mount Agung eruption and research needs to be done regarding the effect of ration feeding on the performance of bali cattle in evacuation zones.

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