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Exogenous Cellulase Enzyme Supplementation in Complete Feed Based On Fermentation of Banana Stems for Nutritional Consumption of Beef Cattle

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ABSTRACT: The obstacle to increasing beef cattle production in East Nusa Tenggara, especially Timor Island, is that feed by farmers is still below the dry matter requirements for beef cattle. This fact shows that it is necessary to add supplements to the feed. Therefore, the exogenous addition of cellulase enzymes is a solution to increase the digestibility of feed in the rumen of beef cattle that consume high fiber feed in areas with a long dry season and only available feed in the form of agricultural and plantation waste. The main aim of this research is to determine the effectiveness of its use. cellulase enzyme exogenously at different levels of use. In this study,18 male Bali cattle were used, aged 1 - 1.5 years with a body weight range of 108-116 kg with an average of 112.79 kg and a CV of 5.72%. The research method used was an experimental method using a Completely Randomized Design (CRD) with 3 treatments and 6 replications. The treatments in this study were P_0; *Leucaena leucocephala* forage 70% + complete feed 30%, P_1 *Leucaena leucocephala* forage 70% + complete feed 30% + cellulase enzyme 10 grams/kg dry matter complete feed, P_2; *Leucaena leucocephala* forage 70% + complete feed 30% + added cellulase enzyme 15 grams/kg dry matter complete feed. The results showed that the dry matter consumption (g/h/d) of treatment P_0 was 2,624.26±10.9, P_1 2,618.94±15.6, P_2 2,681.69±36.1, organic matter consumption (g/h/d) treatment P_0 2,148.93±9.0, P_1 2,149.66±12.9, P_2 2,200.75±29.9 and crude protein consumption (g/e/d) P_0 557.05±2.3, P_1 548.91±3.3, P_2 549.58±7.7. The results of the statistical analysis showed that the treatment had a significant effect of $P<0.05$ on the consumption of dry matter, organic matter and no significant effect of $P>0.05$ on the consumption of crude protein in fattening Bali cattle. The conclusion of this research is that complete feed supplementation based on fermented banana stems with cellulase enzyme supplementation at different levels has an influence on increasing consumption of dry matter and organic matter, but has the same influence between treatments on crude protein consumption of fattening Bali cattle.

KEYWORDS: banana stem, cellulase enzyme, complete feed, fattening Bali cattle, nutrient intake

INTRODUCTION

The obstacle to increasing beef cattle production in East Nusa Tenggara, especially the island of Timor, is that feed by farmers is still below the dry matter requirement for beef cattle, only around 3-4 kg DM/head/day, while the dry matter requirement for beef cattle to achieve optimal growth is around 6–7kg DM/head/day [1]. Other obstacles experienced by local cattle breeders according to [2] include the low level of body weight gain and growth rate of cattle, this is influenced by the low efficiency of feed conversion for growth and increasing body weight, which causes low productivity of beef cattle. especially for fattening cattle, among other things, the availability of feed is not continuous, it still relies on traditional cultivation systems, and local feed resources that are available have not been utilized, which has an impact on low livestock productivity.

This fact shows that it is necessary to add supplements to feed by using other ingredients to improve feed quality so that livestock productivity is maximized. Providing complete feed is an effort to increase the usability of feed, complementing feed elements so that it is hoped that it can increase consumption and the microbial fermentation process in the rumen in digesting low quality feed [3]. So providing complete feed aims to make it easier to fulfill nutritional needs (especially energy) and is able to contribute to fiber needs which are very important for stabilizing the rumen ecosystem. Apart from that, complete feed also ensures an even distribution of daily ration intake so that fluctuations in ecosystem conditions in the rumen are minimized [4]. Complete feed can be composed of local feed ingredients that are easy to obtain and do not compete with human needs but are energy source feed to meet the energy needs of livestock to suit their needs, thereby giving hope for efforts to improve meat production and fattening efficiency for Bali cattle.

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Many studies have used plantation waste as feed ingredients. Lignin is a limiting factor that affects the digestibility of this material. Therefore, the fiber content and fiber components in plantation waste must be reduced before being used as feed ingredients. One of the agricultural wastes that has the potential to be used as a feed ingredient for complete feed is banana stems. According to [5], the nutritional value of banana stems is dry matter 87.70%, organic matter 62.68%, ash 23.12%, crude protein 4.81%, crude fiber 27.73%, crude fat 14, 23%, extract material without nitrogen 30.11%, hemicellulose 20.34%, cellulose 26.64% and lignin 9.92%. Seeing the potential for availability, but it is constrained due to the high content of crude fiber and fiber components, it is necessary to process it through a fermentation process to increase the nutritional value, especially the fiber component, which becomes an energy source and reduce the fiber content as a result of breakdown by microbes so that it is easier to digest and metabolize into Volatile Vatty. acid (VFA) as the main energy source.

To optimize the potential of fibrous ingredients to make them more efficient for livestock, enzymes need to be added to complete feed, especially fiber digesting enzymes. The use of enzymes is effective in breaking lignocellulose bonds, the biggest use of enzymes in animal nutrition today is to increase the utilization of non-starch polysaccharide sources and reduce the anti-nutritional effects in feed utilization. According to [6] Cellulase is a complex enzyme that gradually cuts cellulose chains into glucose. As the effectiveness of complete feed increases, feed digestibility will increase and this will have an impact on increasing feed consumption by livestock because livestock will increase feed consumption to meet their needs, especially dry matter and organic matter and crude protein. Therefore, the main aim of this research is to determine the effectiveness of exogenous use of the cellulase enzyme at different levels of use.

RESEARCH METHODS

This research was carried out at the Dry Land Field Laboratory of the Nusa Cendana Islands University. The livestock used in this study were 18 feeder bulls aged 1-1.5 years with a body weight range of 108-116 kg with an average of 112.79 kg and a CV of 5.72%. The feed ingredients used in this research were basal feed in the form of Leucaena leucocephala leaves and complete feed based on local feed with the addition of cellulase enzymes. The composition of the feed ingredients that make up the complete feed and the nutritional content of the research ration for each treatment can be seen in Tables 1 and 2. The cages used were 9 individual cages, with plots measuring 1.5x2 m equipped with feed and drink containers. The equipment used consists of a Sonic Scale brand livestock scale with a capacity of 1000 kg with a sensitivity of 0.5 grams, a digital scale with a capacity of 1000 grams with a sensitivity of 0.1 grams, a feed flouring machine, a feed mixing machine, a container for holding and drying feed samples.

Research methods

The research method used was an experimental method, using a completely randomized plan (CRD) with 3 treatments and 6 replications. Feeding is based on the dry matter requirements of ruminants, namely 3% of body weight with a balance of 70% forage, 30% complete feed and each treatment is given cellulase enzyme supplementation. The treatments in this research are:

P_0 : lamtoro forage 70% + complete feed 30%
P_1 : lamtoro forage 70% + complete feed 30% + cellulase enzyme 10 grams/kg dry matter complete feed
P_2 : 70% lamtoro forage + 30% complete feed + cellulase enzyme supplement 15 grams/kg complete feed dry matter

Table 1. Percentage and Composition of Complete Feed Ingredients

Ingredients	Percentage (%)
Rice bran	45
Ground corn	10
Fish meal	5
Gliricidia sepium leaf flour	10
Moringa leaf flour	5
Fermented banana stems	20
Urea	2,5
Salt	2
Starbio	0,5
Total	100

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Table 2. Nutrient composition of treatment rations

Ingredients	%DM	OM (%DM)	CP (%DM)	C Fat (%DM)	CF (%DM)	NNFE (%DM)	Energy	
							MJ/kg DM	Kcal/kg DM
Leucaena leucocephala	29,62	82,77	21,23	3,66	16,88	41,00	16,41	3.906,52
Complete Feed	73,90	80,33	20,27	3,70	16,80	39,56	15,93	3.791,76

Note: Results of analysis of the Feed Chemistry laboratory, Faculty of Animal Husbandry, Marine and Fisheries, Nusa Cendana University, DM; dry matter, OM;Organic matter, C fat; Crude fat, CF;crude fiber, CHO; carbohydrate, NNFE; Non nitrogen free extract.

Parameters examined

The parameters examined in this research were the digestibility of dry matter (DM), organic matter (OM), crude protein (CP) according to [7] instructions:

Dry Matter Consumption = [Total ration consumed (g) × (% DM Feed)]

Organic Material Consumption = [Total ration consumed (g) × (% DM) × (% OM Feed)]

Crude Protein Consumption = [Total ration consumed (g) × (% DM) × (% Feed CP)]

Data Analysis

The data obtained were tabulated and calculated then analyzed using analysis of variance (ANOVA) according to a completely randomized design to determine the effect of treatment [8].

RESULTS AND DISCUSSION

It is necessary to know the amount of nutrition that can be consumed by a livestock in a day, how much the livestock is able to consume feed and its impact on livestock productivity, so that it can be estimated whether a livestock's need for food substances needed for growth, basic living and production has been met. The following is the average nutritional consumption of Bali fattening cattle as a result of providing complete feed containing fermented banana stems with added cellulase enzyme as presented in Table 3.

Table 3. Mean Nutritional Consumption of Fattening Bali Cattle

Parameter	Treatment				
	P_0	P_1	P_2	MSE	P-value
Dry Matter Consumption (g/head/day)	2.424,26±10,9	2.618,94±15,6	2.741,69±36,1	555,50	0,03*
Organic Matter Consumption (g/h/d)	2.048,93±9,0	2.449,66±12,9	2.500,75±29,9	380,57	0,03*
Crude Protein Consumption (g/h/d)	567,05±2,3	618,91±3,3	623,58±7,7	25,04	$0,17^{ns}$

Note: *significant effect (P<0.05), ^{ns} no significant effect (P>0.05)

Effect of Treatment on Dry Matter Consumption

Based on Table 3, it can be seen that the highest livestock dry matter consumption was obtained from livestock that received P_2 treatment amounting to 2,681.69±36.1 kg/h/day, followed by livestock that received P_0 treatment amounting to 2,624.26±10.9 kg/h/day and P_1 2,618.94±15.6 kg/h/day. The results obtained in this study were higher compared to the results obtained by [9]. By providing complete feed containing fermented corn straw waste, namely 100% Corn Straw Treatment, the dry matter consumption was 2.45 kg/e/d. complete consisting of Corn Straw 58.49%, Corn Flour 2.7%, Fine Bran 3.22%, Tofu Dregs 25.57%, Gamal Leaves 10, Salt 0.02%) obtained a dry matter consumption of 2.55 kg/h/d complete feed consisting of Corn Straw Feed 58.49% + Corn Flour 2.7% + Fine Bran 3.22% + Tofu Dregs 15.58% + Gamal Leaves 20% + Salt 0.02%) obtained dry matter consumption of 2.54

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kg/h/d, complete feed consisting of Corn Straw 58.49% + Corn Flour 2.7%+ Fine Bran 3.22%+ Tofu Dregs 5.57%+ Gamal Leaves 30% + 0.02% salt obtains a dry matter consumption of 2.74 kg/h/d. This difference is caused by the use of additional cellulase enzymes in this study to help digest fiber in the rumen, causing the feed to be digested more quickly from the rumen, which then has an impact on higher levels of dry matter consumption by livestock.

Based on the results of the *Analysis of Variance* (ANOVA), it shows that the treatment has a significant effect on dry matter consumption. Duncan's further test results showed that treatments P_0-P_2, P_1-P_2 were significantly different ($P<0.05$) while P_0-P_1 were not significantly different ($P>0.05$). This is due to differences in the dry matter requirements of cattle because it is based on body weight, and the presence of cellulase enzyme supplementation causes cattle to be able to consume the ration given, as a result of the speed at which the feed leaves the rumen to be digested in the small intestine, thus having an impact on differences in dry matter consumption of the ration. This result is also lower than the results previously obtained by [10] on Bali cattle fed by breeders using concentrate feed containing Gliricidia sepium leaf flour and banana hump, in treatment breeder pattern local feed + concentrate containing Gliricidia sepium leaf flour obtained a dry matter consumption of 3.40 kg/h/d, treatment breeder pattern local feed + concentrate containing banana hump flour obtained a dry matter consumption of 3.22 kg/h/d, then treatment; breeder pattern local feed + concentrate containing Gliricidia sepium leaf flour and banana hump obtained an organic material consumption of 4.14 kg/h/d.

Effect of Treatment on Organic Material Consumption

Based on Table 3, it can be seen that the highest consumption of organic matter was obtained from livestock that received P_2 treatment at 2,200.75±29.9 g/e/d, followed by livestock that received P_1 treatment at 2,149.66±12.9 g/e/d. h and P_0 2,148.93±9.0 g/e/hour. The results obtained in this study were lower than the results obtained by [11], namely in Balinese cattle fattening by local breeders through supplementation of concentrate feed containing gamal leaf flour and banana hump, in local breeders' feed treatment + concentrate containing gamal leaf flour obtained organic material consumption of 3.17 kg/h/d, local breeder feed + concentrate containing banana hump flour obtained organic material consumption of 3.13 kg/h/d, then local breeder feed treatment + Concentrate containing Gliricidia sepium leaf flour and banana hump obtained an organic material consumption of 3.62 kg/h/d. This difference is caused by the use of additional enzymes in this study to improve the quality of complete feed containing fiber. According to [12] Enzymes are used in animal feed formulation with the aim of increasing feed efficiency in order to achieve an increase in animal body weight (weight gain), the first application of enzymes in animal feed formulation is the use of β-glucanase in straw-based feed to reduce feed viscosity in the intestine.

The results of the Analysis of Variance (ANOVA) showed that the treatment had a significant effect on the consumption of organic Bali cattle fattening materials. Duncan's further test results showed that treatments P_0-P_2, P_1-P_2 were significantly different ($P<0.05$) while P_0-P_1 were not significantly different ($P>0.05$). This is in line with the consumption of dry matter in this study which was also significantly different, thus influencing the consumption of organic matter because organic matter is a constituent component of dry matter. Consumption of organic materials is closely related to consumption of dry materials, the higher the consumption of dry materials, the consumption of organic materials also increases along with other substances such as protein and fat [13]. [14] added that the nutrients contained in organic materials are components that make up dry materials. The composition of organic materials consists of fat, crude protein, crude fiber, and NNFE. Dry ingredients, plus ash. So the amount of nutrients consumed in the form of crude protein, fat, and NNFE will affect the consumption of organic materials. [13] added that many types of animal feed have poor digestibility so that the energy available from the feed is disrupted, resulting in low production.

Effect of Treatment on Crude Protein Consumption

Based on Table 3, it can be seen that the highest average crude protein consumption was achieved in livestock that received the P_0 treatment of 557.05±2.3 g/h/d, followed by P_1 549.58±7.7 g/h/d and the lowest was achieved in livestock that received the P_2 treatment. 557.05±2.3 g/h/d. The results obtained in this study were higher than the results obtained by [10] on fattening Bali cattle through feeding concentrates containing banana hump flour, namely the forage treatment of local farmers obtained crude protein consumption of 329.50 g/h/d, Forage feed from local breeders + 1 kg of concentrate feed containing 15% banana weevil flour obtained a crude protein consumption of 517.86 g/e/d, Forage feed from local breeders + 2 kg concentrate feed containing 20% banana hump flour obtained a crude protein consumption of 643.02 g/d e/hour.

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Based on the results of the Analysis of Variance (ANOVA), it shows that the treatment has no significant effect on crude protein consumption of Bali fattening cattle. This is because the protein content of the treatment rations is not much different even though fermented banana stems are added. According to [15] stated that increasing protein levels in feed will increase the rate of reproduction and population of rumen microbes so that the ability to digest feed becomes greater. However, in this study, the addition of banana stem silage did not make a difference in increasing the protein content of the ration and the protein consumption of Bali cattle for fattening. [16] also states that giving concentrate can increase the amount of crude protein consumption, but within certain limits increasing the amount of protein consumption can increase digestibility, but if protein consumption has exceeded the optimal limit then increasing protein consumption will actually reduce digestibility, even can cause decreased digestibility of other food substances.

CONCLUSION

The conclusion of this research is that complete feed supplementation based on fermented banana stems with cellulase enzyme supplementation at different levels has an influence on increasing consumption of dry matter and organic matter, but has the same influence between treatments on crude protein consumption of Bali fattening cattle.

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