Consumption and Digestibility of Nutrients in Bali Cattle at the Last Period of Pregnancy Kept under Semi Intensive System Supplemented with Nutritive Rich Feed Contained Lemuru Oil and Zinc

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ABSTRACT: An experiment was conducted for three months to examine the addition of nutritive rich feed (NRF) containing "lemuru" oil and zinc on consumption and digestion of dry matter, organic matter, crude fiber dan crude protein of cows of Bali cattle during late gestation period and kept under semi intensive system. Formulation of NRF consisted of palm (*borasus*) oil, *leucaena* leaves and *gliricidia* leaves meal, fermented rice bran, fish meal, "lemuru" oil, $ZnSO_4$, urea, and salt. The crude protein content of NRF was 23 %, while total digestible nutrient was 70 %. A total of 12 heads of last pregnancy period of Bali cattle with initial body weight of 241.90 ± 23.25 kg (coefficient variance = 9.61) were employed in this experiment. Experimental design used was completely randomized design consisted of three treatments and four replications. The treatments were: T_0 = cows consumed hay and standing hay as basal diet in pasture; $T_1 = T_0$ + bidara (*Zizipus*) leaves as feed addition; and $T_2 = T_1$ + NRF formulae contained lemuru oil 1.5% + 150 mg $ZnSO_4$/ kg (Table 1). NRF was given in the morning while bidara leaves in the noon. NRF was given 30% of dry matter requirement and dry matter requirement was 3% of body weight. All parameters measured in this experiment were both nutrients consumption and digestibility based on method described by Ranjhan (1988). Data were analyzed by analysis of variance and testing by Duncan's new multiple range tests.The results of this research indicated that there were highly significant change in dry matter, organic matter, crude fiber, and protein intake ($P<0.01$). Dry matter, organic matter, and crude protein digestibility were also highly significant differences ($p<0.01$), but crude fiber digestibility was significant ($P<0.05$) on supplementation of NRF containing 1.5 % "lemuru "oil and zinc level of 150 mg/ kg of dry matter of NRF. It was concluded that supplementation of NRF with 1.5% of lemuru oil and 150 mg of $ZnSO_4$/kg dry matter of NRF could increased intake and digestibility of dry matter, organic matter, crude fiber and crude protein of the last pregnancy period of Bali cows kept under semi intensive system during the dry season.

Keywords: consumption, digestibility, pregnancy, lemuru oil, $ZnSO_4$

INTRODUCTION

East Nusa Tenggara Province is one of primary cattle production area in Indonesia. This area is always have feed and feeding problems especially in dry season (which is around 8-9 month per year), where feed production is low and directly affected cattle productivity both population and gain. Heat stress during long dry season can affect both physiological of cattle and vegetation as source of feed for animal. In dry season, standing hay is still available to feed to cattle but their quality is poor due to their nutrient content of neutral detergent fiber (NDF), protein and crude fiber of 88.98%, 2.56% and 38.75% respectively. These nutritional condition caused low palatability and low *in vitro* with dry matter digestibility and organic matter digestibility of 45.86% and of 48.69% respectively (Hartati and Katipana, 2006).

In general, Bali cattle performance in West Timor is very much reliant on the herbage available on native pasture. Grass availability and particularly its quality fluctuate with season. Reasonable quality grass in this region is only available for a short period during the early rainy season. Even in this period, due to the shooting pattern of growth and more efficient photosynthesis, tropical forage matures rapidly and their crude protein content falls below 4%. For this reason, it is necessary to provide supplement for better utilization of the low quality tropical grasses in attempting to improve productivity of cattle (Belli and Sinlae, 2006). It has also been a general knowledge that ruminants have some advantages compared to monogastric animals, such as the ability to digest high fiber content feedstuffs for their benefits with the help of microorganisms in the rumen. The action of microbes in the rumen enables us to use fibrous roughages as ruminants feed. Urea is commonly used to enhance digestibility of fibrous by product through ammoniation process. Ammoniation of crop residues and agro-industrial by product with urea can supply nitrogen to rumen microbe.

Study with Holstein cattle, Hartati (1998) found that there is a need to give enough nutrients for rumen fermentation to optimalize the growth and activities of microorganisms in the rumen. Nutritive rich feed (NRF) contained lemuru oil and Zinc is the solution to maximize nutrient supply as the important pre-cursor for both microorganisms in the rumen and cattle. Hartati *et al*. (2008) produced a package of NRF formulae contained 1.5% lemuru oil and 150 mg of $ZnSO_4$/kg of NRF. This package gave optimal response to growth of last pregnancy period of Bali cattle kept under intensive system as well as birth weight and immunity level of their fetus due to better protein digestibility, but it was not given significant effect to feed their consumption and dry matter digestibility. This experiment was conducted to use the same package of NRF formulae and fed to Bali cattle kept under semi intensive system.

MATERIALS AND METHODS

A total of 12 heads of last pregnancy period of Bali cattle with initial body weight of 241.90 ± 23.25 kg (coefficient variance = 9.61) were employed in this experiment for three months. Experimental design used was completely randomized design consisted of three treatments and four replications. The treatments were: T_0 = cows consumed hay and standing hay as basal diet in pasture; $T_1 = T_0$ + bidara (*Zizipus*) leaves as feed addition; and $T_2 = T_1$ + NRF formulae contained lemuru oil 1.5% + 150 mg $ZnSO_4$/kg (Table 1). NRF was given in the morning while bidara leaves in the noon. NRF was given 30% of dry matter requirement and dry matter requirement was 3% of body weight.

Table 1. Ingredients and chemical composition of NRF Formulae

Ingredients	NRF (%)	Protein (%)*	TDN (%)*	Protein (%)**	TDN (%)**
Palm sugar	30	2.69	72.70	0.81	21.81
Leucaena leaves	24	25.00	77.00	6.24	18.48
Gliricidia leaves	17	27.50	76	4.68	12.92
Bran fermentation	15	19.79	67	2.97	10.19
Fish meal	10	61.2	69.00	6.12	6.90
Urea	1.0	281.25	-	2.81	-
Lemuru oil	1.5	-	-	-	-
Salt	1.5	-	-	-	-
Total				23.63	70.30

* Hartati *et al.,* 2008; **) Calculated analysis; TDN (total digestible nutrient).

Parameters measured in this experiment were both nutrients consumption and digestibility based on method described by Ranjhan (1988). Indicator consumption and digestibility of dry matter is used chromic oxide (Cr_2O_3) technique. After 24 hours of Cr_2O_3 distributed to cows, samples of feces of cows were collected and separated within 24 hours. Total feces samples were also used to analyze nutrient contents in the feces. The formulas used as followed:

$$\text{Dry matter of feces (g/day)} = \frac{\sum Cr_2O_3 \text{ intake daily}}{\text{g } Cr_2O_{3w} \text{ per g of feces}}$$

$$\text{Dry matter feed digestibility (\%)} = 100 - \left(100 \frac{\text{\% indicator in feed}}{\text{\% indicator in feces}} x \frac{\text{\% dry matter in feces}}{\text{\% dry matter in feed}}\right)$$

$$\text{Dry matter intake (kg/hour)} = \frac{\text{fecal output of dry matter}}{\text{indigestibility}} \; x \; 100$$

Data were analyzed by analysis of variance and testing by Duncan's new multiple range tests (Steel and Terrie, 1981).

RESULTS AND DISCUSSION

Body weight gain of animal is manifestation of accumulation of feed consumption, digestibility, metabolism and absorbing of nutrient in the body of animal. Mean of dry matter consumption and nutrients as affected by the treatments were presented in Table 2.

Table 2. Mean both nutrients Consumption and Digestibility of all treatments.

Parameters	Treatments		
	T_0	T_1	T_2
Consumption:			
- Dry matter (kg)	4.85 ± 0.17 [a]	5.83 ± 0.29 [b]	6.37 ± 0.38 [c]
- Organic matter (kg)	4.17 ± 0.15 [a]	4.63 ± 0.24 [b]	5.11 ± 0.36 [c]
- Crude protein (g)	157.34 ± 5.24 [a]	405.32 ± 17.16 [b]	636.44 ± 37.01 [c]
- Crude fiber (kg)	1.43 ± 0.05 [a]	1.60 ±0.08 [b]	1.67 ±0.10 [c]
- Non Protein Nitrogen (kg)	2.50 ± 0.09 [a]	2.83 ± 0.14 [b]	2.78 ± 0.16 [c]
- Zn (mg)	21.15 ± 0.74 [a]	24.48 ± 1.46 [b]	392.55 ± 3.24 [c]
Digestibility:			
- Dry matter (%)	54.98 ± 1.21 [a]	62.38 ± 1.08 [b]	66.21 ± 1.21 [c]
- Organic matter (%)	53.78 ± 2.16 [a]	67.79 ± 1.08 [b]	68.35 ± 2.90 [b]
- Crude protein (%)	52.54 ± 1.03 [a]	62.80 ± 3.37 [b]	69.11 ± 1.12 [c]
- Crude fiber (%)	49.62 ± 2.29 [a]	60.29 ± 0.92 [b]	67.40 ± 2.07 [c]
- Non Protein Nitrogen (%)	60.97 ± 5.55 [a]	65.92 ± 2.43 [b]	70.71 ± 3.84 [c]

Notes: [a,b,c] Different superscript within rows shows a highly significant differences between treatments ($p<0,01$).

Statistical results presented at Table 2 confirmed that T_2 supplemented with 1.5% of lemuru oil and 150 mg $ZnSO_4$/kg of dry matter NRF gave highly significant differences ($P<0.01$) to increase dry matter consumption, organic matter, crude protein and non protein nitrogen. The increase in the dry matter intake will linearly affected intake of other nutrients. It means that treating of zinc did not affected palatability of feed. Sentana (2005) reported that level of dry matter intake was highly significant affected by energy requirement, rumen capacity and level nutrients of feed intake. Animals will always consuming dry matter until their energy requirement were necessary need and then they will be stopping to consume their feeds. On the other hand, if rumen is full then animals will stop consume feeds even though their energy requirement are not nutritionally met. The increase of protein intake at T_2 was probably affected by intensifying of activities of microorganisms synthesis in the rumen. Hartati (2000) reported that addition of zinc until 75mg/kg of dry matter ration will be increased ($P<0.14$) bacteria population in the rumen. Also, the treatment can probably be rose zinc absorption and alkaline phosphatase activity.

Statistical results at Table 2 showed that carboxy peptidase activity was probably raised so that it will increased protein digestibility. Protein intake of cow which consumed NRF with zinc (T2) was 392.55g/head/day and this value higher than the recommendation of 342 g and 350g for basal metabolism of pregnancy cows recommended by NRC (1970). This condition was good because cows can deposit their protein as meat. Fat intake of cows at T_2 can increased dry matter digestibility, crude protein, crude fiber and non protein nitrogen. Fat content of T_2 was 4.48%/ kg dry matter over than optimal fat content (3-4%) required by cows but it was not changed to palatability of T_2 which showed at crude fiber digestibility higher the other two treatments (Table 2). These results confirmed the results of Jenkins and Palmquist (1984) that fat content around 6.8% of dry matter ration did not affected to NDF digestibility. Nevertheless, fat content over 10% can be affected rumen fermentation, decreased fiber digestibility and last but not least decreased fiber intake.

Statistical results in Table 2 also showed that fiber intake was increased. It means that fiber digestibility did not disturbing, so that rumen was relatively faster empty (hungry), and animals would be consumed more feeds. This result agrees with earlier works reported by Hungate (1966) and Arora (1989) that zinc requirement for growth and development of rumen microorganisms was relatively high because level of zinc was found around 130-220 mg/kg of dry matter of microorganisms. Therefore, cows which were kept under semi intensive system at dry season where their poor quality feeds from pastures are needed to supply with supplemented feed of high protein value and also zinc and fat as much as necessary. These results confirmed that NRF with 1.5% lemuru oil and 150 mg $ZnSO_4$/kg of dry matter NRF could probably be increased growth of microorganisms in the rumen. Zinc supply would be growing up microorganisms synthesis in the rumen especially bacteria synthesis and then it would be increased optimally fiber digestibility. Zinc was probably also increased the activity of enzyme carboxy peptidase which was supported the increase of protein digestibility at part after the rumen. T_3 was also effected to non protein nitrogen intake and it would be working together with nitrogen protein to support fermentation process in the rumen. It was found that pregnancy cows which were raised in pasture especially in the dry season need NRF with 1.5% lemuru oil and zinc of 150 mg $ZnSO_4$/dry matter NRF supply.

CONCLUSIONS

Based on result and discussion, it could concluded that supplementation of NRF with 1.5% of lemuru oil and 150 mg of $ZnSO_4$/kg dry matter of NRF could increased intake and digestibility of dry matter, organic matter, crude fiber and crude protein of the last pregnancy period of Bali

cows kept under semi intensive system during the dry season.

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