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Supplementation of Sakura Block Plus in Beef Cattle Fed with Palm Fronds and Its Effect on Nutrient Digestibility

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ABSTRACT

Sakura Block Plus is a modification of Sakura Block, incorporating 6% earthworms and palm kernel cake as substitutes for corn. The objective of this study was to evaluate the supplementation of Sakura Block Plus in palm frond feed on the nutrient digestibility of beef cattle. The research design employed a Latin Square Design (LSD) with treatments P0 (10% Sakura Block Plus), P1 (8% Sakura Block Plus), P2 (10% Sakura Block Plus), and P3 (12% Sakura Block Plus). Four male beef cattle, 18 months old, weighing approximately ± 110 kg, were utilized throughout four treatment periods, each lasting 15 days. The results of the study indicated a significant improvement in the 12% Sakura Block Plus treatment concerning the digestibility of Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF), and hemicellulose. In conclusion, the supplementation of Sakura Block Plus at the 12% level in palm frond feed resulted in the most optimal nutrient digestibility.

Keywords: Acid detergent fiber, Hemicellulose, Neutral detergent fiber, Sakura block plus

Introduction

Sakura Block is a modified UMB-based supplementary feed utilizing locally abundant raw materials such as coconut waste and sago residue from the Rumbia plant in the Bengkulu Province. It has been employed as a supplement to enhance the performance of beef cattle (Jarmuji *et al*., 2017; Santoso *et al*., 2017), to enhance the performance local goat (Jarmuji *et al*., 2023a), improve the production and quality of milk in dairy cows (Jarmuji *et al*., 2018a; Jarmuji *et al*., 2021a), and improve the production and quality of milk in dairy goat (Jarmuji *et al*., 2018b; Soetrisno *et al*., 2019). However, a notable drawback of Sakura Block as a supplementary feed is its low protein content, measuring 17.83% (Jarmuji *et al.*, 2017). Efforts to enhance the quality of Sakura Block by utilizing earthworms as a protein source and a source of Branched Chain Amino Acid (BCAA) are essential for improving its overall quality (Damayanti *et al*., 2008; Istiqomah *et al*., 2009). BCAA plays a crucial role in promoting the growth of rumen microbes, especially cellulolytic bacteria groups involved in degrading fibrous feed in the rumen (Li *et al*., 2005; Wang *et al*.,2008; Liu *et al*., 2009; Zhang *et al*., 2013). Sakura Block Plus, a modification of Sakura Block incorporating earthworm flour and palm kernel cake, exhibits excellent nutritional content for rumen microorganism growth (Jarmuji *et al*., 2021b). *In vitro* testing of Sakura Block Plus supplementation on palm frond feed has shown increased rumen fermentation products and reduced methane gas production (Jarmuji *et al*., 2022). Economically, supplementing Sakura Block Plus at 400 g/day in the fattening of 2-year-old Kaur cattle can yield a Revenue Cost Ratio (R/C) of 3.57 (Jarmuji *et al*., 2023b).

Sakura Block Plus holds potential for application in Kaur cattle receiving high-fiber feeds such as palm fronds. The rapid growth of the palm oil industry in Indonesia has the potential to generate abundant sources of fibrous feed, particularly palm fronds (Ebrahimi *et al*., 2015). The utilization of palm fronds as feed for beef cattle is currently limited due to its high lignin and tannin content, making it resistant to both chemical and enzymatic degradation (Febrina *et al*., 2016). The low crude protein content in palm fronds also acts as a hindering factor for the growth (Febrina *et al*., 2017). The supplementation of Sakura Block Plus in Kaur cattle fed with palm fronds is expected to enhance the digestibility of nutrients, particularly the fiber fraction.

Materials and Methods

Animals and treatmens

This study was conducted at Zone Commercial Animal Laboratory (ZCAL), Faculty of

Agriculture, Bengkulu University, over a period of 2 months. The beef cattle used in this study were 4 kaur male cattle aged 12 months with an average body weight of 101±5.23 kg. The design used in this study was the Latin Square Design (LSD), in which there were 4 treatments with 4 replications. The basal diet of 40% amoniated palm frond, 25% cassava flour, 15% oil palm cage, and dried tofu dregs was supplemented with 10% Sakura Block (P0), 8% Sakura Block Plus (P1), 10% Sakura Block Plus (P2), and 12% Sakura Block Plus (P3) respectively, based on the dry matter of ration. The raw material and chemical components of rations is presented in Table 1.

Tabel 1. The raw material and chemical components of rations

Raw materials	Treatment			
	P0	P1	P2	P3
Palm frond	40.00	40.00	40.00	40.00
Cassava flour	25.00	25.00	25.00	25.00
Dried tofu drugs	10.00	12.00	10.00	8.00
Oil palm cake	15.00	15.00	15.00	15.00
Sakura Block	10.00	0.00	0.00	0.00
Sakura Block Plus	0.00	8.00	10.00	12.00
Total	100	100	100	100
Chemical components (%)				
Dry matter	70.3	70.5	70.52	70.54
Organic matter	96.49	96.62	96.54	96.46
Crude protein	13.10	13.53	13.58	13.63
Crude fiber	23.11	23.50	23.34	22.78
Ether extract	4.36	4.33	4.26	4.19
Ash	3.51	3.38	3.46	3.54
Nitrogen free ectract	46.21	45.63	45.95	46.26
Total digestible nutrient	65.28	65.72	65.7	65.67
Neutral detergent fiber	54.24	54.84	55.12	55.63
Acid detergent fiber	32.63	33.97	34.97	33.86
Hemicellulose	21,62	20,86	20,15	21,71
Cellulose (%)	23.88	24,70	26.89	26.42
Lignin (%)	8.05	7.37	7.55	6.90

Source. Ruminant Animal Nutrition Laboratory, Faculty of Animal Husbandry, Andalas University (2023).

P0: 10% Sakura Block Plus, P1: 8% Sakura Block Plus, P2: 10% Sakura Block Plus, and P3: 12% Sakura Block Plus.

Rations preparation

Livestock rations provided included palm fronds, cassava flour, dried tofu pulp, palm kernel cake, Sakura Block, and Sakura Block Plus respectively, based on the dry matter. Palm fronds were abundantly available in the oil palm plantation near the research site. Cassava is made from cassava which is dried in the sun until dry and then ground into flour. Dried tofu dregs are obtained from tofu processing waste which has been dried in the sun until dry and then ground into flour. Palm kernel cake was obtained from the by-product of palm kernel oil processing. Sakura Block Plus was prepared according to Jarmuji *et al*. (2021b), containing a mixture of ingredients such as brown sugar, rice bran, palm kernel cake, earthworm flour, sago flour, urea, ground salt, ground Triple superphospate, vitamin mineral premix.

Data collection stages

The kaur cattle were weighed to determine the initial weight, and then the ration was made according to Kearl (1982). cattle were kept in metabolic cages and adapted first. Adaptation was carried out for ten days, during which time consumption and excretion became stable. During the collection period, all information was recorded, including the amount of rations given, the amount of remaining rations, and the amoun of feces. Feces samples were collected as much as 10% of the amount feces produced. The sampling of given rations (palm fronds, cassava flour, dried tofu dregs, palm oil cake, and Sakura Blok Plus) was 100 g.

The feces samples and rations samples were stored in a newsprint and then was dried in an oven at 55ºC. Next, samples ground using a mithosiba CH 200 chopper tool and filtered using a 1 mm diameter screen. the chemical composition of the feed ingredients was then analyzed using the AOAC method (2005), including the contents of dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), and crude fiber (CFb). Afterward, the nitrogen-free extract (NFE) and total digestible nutrient (TDN) were calculated (Hartadi *et al*., 1997). subsequently, determination of fiber fractions such as ADF, NDF, hemicellulose, and cellulose was analyzed using the Vansoest method.

Variables observed

Ration consumption was calculated based on dry matter, percent based on body weight, and metabolic body weight. Nutrient digetibility were calculated based on the digestibility of dry matter, organic matter, crude protein, ether extract, and the digestibility of the fiber fraction. based on Van soest method. The calculation of nutrient digestibility was carried out with the equation.

$$\text{Nutrient digestibility} = \frac{consumption\ (g) x\ \alpha - excreation\ of\ \ feces\ (g) x \alpha}{consumption\ (g) x\ \alpha}\ x100\%$$

Description: α means that the nutrient feed is being observed.

Statistical analysis

The obtained data were analyzed using an analysis of variance (Toutenburg and Shalabh, 2009). If there differences, they were then tested by Duncan"s multiple range test.

Results and Discussion

The effect of Sakura Block Plus on on ration consumption

The results showed that there was no significant difference (P>0.05) consumption of dry matter, organic matter, metabolic body weight, and crude protein (Tabel 2).

The consumption of palm fronds rations supplemented with Sakura Block Plus (P1, P2, and P3) tends to be higher than the control (P0). Consumption of DM, OM and CP in this study were 4.58 - 4.95 kg, 4.27 - 4.75 kg, and 0.57 - 0.64 kg, respectively. The consumtion of DM based on the percentage of cattle weight in this study were 2.88-3.16%. These results are in accordance with research conducted by Jarmuji *et al.* (2017) who obtained DM consumption of 3.12% body weight in

kaur cattle fed palm frond rations and Sakura Block. The same result was obtained by Batubara (2003) that the consumption of DM in cattle fed palm fronds ration was 3.02% of body weight, but this value was higher than that obtained by Nurhaita *et al*. (2014) who obtained a DM consumption of 2.51% - 2.76% of body weight in cattle fed ammoniated palm fronds ration.

Orskov and Ibrahim (1991) argued that the consumption of DM for beef cattle ranged from 2.0-3.0% of body weight. Another contributing factor to the absence of differences in DM, OM, and CP consumption is the comparable digestibility values for DM, OM, and CP, as indicated in Table 3. Consumption is largely determined by nutrient digestibility and rumen capacity, while digestibility is influenced by degradation characteristics and the rate at which undegraded nutrients exit the rumen (Ismartoyo, 2011). Degradation rate indicates how long a feed ingredient is degraded by rumen microbes. Rumen capacity depicts the amount of DM that can be accommodated in the rumen. More palatable feed is likely to be consumed in greater quantities, thereby increasing the volume of dry matter feed in the rumen. Consumption of DM based on the metabolic weight of Kaur cattle fed with palm fronds supplemented with Sakura Block Plus ranged from 101.34 to 103.13 g/head/day. This consumption value is higher compared to the findings of Nurhaita *et al*. (2014), who reported a consumption of 93.13 g/head/day based on the metabolic weight of cattle fed with 50% palm fronds and 50% concentrate.

The effect of Sakura Blok Plus on the digestibility of dry matter, organic matter and crude protein.

There were no significant different (P>0.05) in digestibility of DM, OM and CP of cows fed palm fronds ration supplemented with Sakura Block Plus (Table 3).

Although there was no significant difference between the treatments, there is a tendency for an increase in the digestibility of DM, OM, and CP in Kaur cattle receiving Sakura Block Plus treatment (P1, P2, and P3). The average digestibility of DM at P1, P2, and P3 was 71.43%, 72.26%, and 74.78%, respectively, while the control (P0) was 67.44%. Furthermore, the digestibility of OM at P1, P2, and P3 was 72.89%, 73.70%, and 74.50% respectively, while P0 was 68.54. The digestibility of CP was P0 (68.77%), P1 (74.58%), P2 (73.49%), and P3 (77.64%) (Table 3).

The digestibility of DM and OM in this study is higher compared to the digestibility of DM and OM in Kaur cattle receiving Sakura Block supplementation, which was reported as 55.48±3.13% and 66.75±2.63%, respectively (Jarmuji *et al.*, 2017). These results are also higher than the findings of Paramita et al. (2008), who reported digestibility values of 56.62% for DMr and 61.73% for OM in male Ongole crossbred cattle fed with a complete ration containing 12% CP. Mean while, Upeksa *et al.* (2016) reported that Bali cattle receiving a ration containing 10% CP and 2300 kcal ME/kg had digestibility values of 55.85% for DM, 57.50% for OM, and 71.41% for CP.

The high nutrient digestibility in this study is attributed to the optimal composition of feed ingredients and chemistry provided for rumen microbial growth, especially the supplementation of Sakura Block Plus as a source of branched-chain amino acids (Jarmuji *et al.*, 2021b). According to Widyobroto *et al.* (2007), a high-energy diet results in a greater synthesis of microbial protein compared to a low-energy diet. Chumpawadee *et al*. (2006) noted that the efficiency of absorption and metabolism of amino acids is influenced by the availability of dietary energy. High-energy consumption tends to produce relatively high concentrations of kinetic VFA, allowing animals to utilize it for basic needs and production.

The effect of Sakura Block Plus on the digestibility of fiber fractions

The digestibility of fiber fractions, especially NDF, ADF and hemicellulose, showed a significant increase (P<0.05) in cattle that were treated with a dose of 12% sakura block plus (P3). The average digestibility of NDF, ADF and hemicellulose in P3 was respectively 68.18%, 63.34% and 87.15% or an increase of 21.53%, 32.26 and 9.37% from the digestibility of the Sakura Block (P0). While P1 and P2, even though the digestibility of NDF, ADF and hemicellulose tended to increase, the results of Duncan's follow-up test showed no difference compared to P0 (Tabel 4).

The high increase in fiber digestibility in the oil palm ration supplemented with Sakura Blok Plus (P3) indicated that the composition and nutrient

Table 2. consumption of dry matter, organic matter, and crude protein

Variables	P0	P1	P2	P3
Dry matter (kg/head/day)	4.58±0.47	4.80±0.46	4.83±0.59	4.95±0.30
Dry matter (% body weight)	2.88±0.27	3.08±0.14	3.06±0.21	3.16±0.11
Dry matter ($g/W^{0.75}$)	96.13±10.08	102.48±6.48	102.34±9.02	104.15±4.93
Organic matter (kg)	4.27±0.53	4.60±0.46	4.63±0.63	4.75±0.31
Crude protein (kg)	0.57±0.,06	0.51±0.06	0.52±0.08	0.64±0.42

Table 3. Nutrient digestibility of dry matter, organic matter, and crude protein

Variables	P0	P1	P2	P3
		%		
Dry matter	67.44±3.04	71.43±3.62	72.26±5.41	74.78±3.80
Organic matter	68.54±7.25	72.89±4.32	73.70±7.15	74.50±2.30
Crude protein	68.77±4.50	74.58±3.49	73.49±6.23	77.64±2.47

Table 4. The nutient digetibility (%) based on the fiber fraction

Variables	P0	P1	P2	P3
	%			
NDF	56.10±6.70[a]	61.96±5.45[ab]	65.05±7.78[ab]	68.18±3.58[b]
ADF	47.89±9.18[a]	59.95±5.71[ab]	52.70±9.79[ab]	63.34±4.25[b]
Cellulose	77.95±5.15	83.15±2.45	81.99±6.31	85.82±2.76
Hemicellulose	79.68±4.17[a]	80.85±3.18[a]	84.36±5.28[ab]	87.15±2.63[b]

content in the ration was more optimal in increasing the growth of rumen microorganisms. This increase in digestibility of the fiber fraction in palm frond rations supplemented with 12% Sakura Block Plus (P3) due to the presence of earthworms. Earthworms as a Sakura Block Plus ingredient contain complete essential amino acids, low fat content, easily digested and do not contain toxins. Another advantage, worm flour contains branched amino acids (BCAA), namely 2.75% valine, 2.96% leucine and 3.14% isoleucine (Hayati *et al*., 2011). In the rumen valine, leucine and isoleucine undergo decarboxylation to produce isobutyrate, isovalerate, and valerate (Andries *et al*., 1987). Several researchers reported that supplementation with valerate, isovalerate, isobutyrate can increase cell wall digestibility (NDF), ammonia production and rumen microbial cell protein (Gorosito *et al*., 1985). Zain *et al*. (2007) revealed that supplementation with valine, leucine and isoleucine was able to increase the rumen microbial population and digestibility of palm fiber. The results of research by Nurhaita *et al.* (2010), supplementation of cassava leaves as a source of isoleucine in sheep fed ammoniated palm leaf rations increased the digestibility of DM from 51.50% to 57.70%.

Conclusion

Supplementation of Sakura Block Plus on palm frond-based rations markedly increased the digestibility of NDF, ADF and hemicellulose. Sakura block plus supplementation of 12% had the best increas the digestibility of NDF, ADF and cellulose in kaur cattle.

Conflict of interest

The authors have declared no conflict of interest.

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Author's contribution

The authors have jointly designed a study on Supplementation of Sakura Block Plus in Beef Cattle Fed with Palm Fronds and Its Effect on Nutrient Digestibility. The first author analyzed the experimental data and compiled the manuscript. All authors read and agreed to the final version of the manuscript.

Ethics Approval

Ethical approval was not sought for the present study because not a single procedure caused the animal to become momentary pain dan distress. The animals used during research are well maintained, the animals are housed in clean, permanent cages so that the animals are comfortable. Rations and drinking water are provided based on livestock needs.

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