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Variety and Digestibility of Forages Fed to Sacrificial-goats: A Preliminary Study in Mataram City

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Abstract: The study evaluated the variety and digestibility of forages fed to sacrificial-goats in Mataram. The study was carried out by direct observation method. A total of 20 points vendors selling sacrificial goats were used as sampling locations. From all stall selling point, all types of forage as feed were collected. The collected feed samples were identified and tested for digestibility. The results showed that Turi (*Sesbania glandiflora*) leaves had the highest Dry Matter Digestibility (DMD), which was 65.54%, compared to the DMD of other forage samples, while the lowest DMD was obtained of Gayam (*Inocarpus fagifer*) leaves, which was 24.86% ($P<0.05$). As with the DMD value, the highest organic matter digestibility (OMD) was by Turi (61.08%) and the lowest OMD obtain by Gayam which had an OMD value of 11.85% ($P<0.05$). The OMD of Waru leaves (48.68%) was not different but does not show any difference of Ketapang (*Terminalia catappa*) leaves (44.73%). It was concluded that among the ten forages offered by vendor to sacrificial-goats; by order of their digestibility, Turi (*Sesbania glandiflora*), Waru, (*Hibiscus tiliaceus*), and Ketapang (*Terminalia catappa*) leaves produced the highest DMD and OMD.

Keywords: Dry Matter Digestibility; Forage; Goats; Organic Matter Digestibility

Introduction

Goats have become one of the livestock commodities traded, which is quite profitable. In Indonesia, especially in West Nusa Tenggara, many sacrificial goats with various sizes and body weights are sold on the sides of the road. The sale of these sacrificial goats continues yearly to form an impromptu animal market that trades goats for sacrificial purposes. Komariah *et al*. (2015) stated that the demand for Qurban goats in various regions increased rapidly compared to other months towards Eid al-Adha.

Generally, vendor obtain goats from various regions in West Nusa Tenggara (WNT) province. The goats are kept and fed with forages from the surrounding area or from goat feed suppliers for approximately two weeks to one month. The sellers of sacrificial goats in WNT are pretty familiar with the typical eating habits of goats (browser habit), so sellers tend to feed leaves of forage rather than grass. The leaves given as feed are quite diverse, both with high nutrient content and vice versa; including the leaves of the lamtoro plant, jackfruit, turi, gamal, calliandra, and several other types of leaves.

Forage provided for goats consist of both leguminous and non-leguminous forages. The eating habits of goats, which are anxious to know the taste of new feed, allow goats to prefer many kinds of feed, mainly with high nutrient content. Influencing diet and forage quality will affect nutrient intake (Moyo et al., 2019). Different types of forage have different qualities. Feed quality and their physical characteristics, such as dry matter content (DM), crude fiber (CF), particle size, and resistance to feed breakdown affect prehension activities, which in turn affects the consumption rate. The digestibility of a feed is a determinant between nutrient content and energy availability for ruminants (Forejtová et al. 2005). The availability of sufficient protein and energy in the rumen will accelerate the rumen microbial proliferation rate, ultimately

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improving overall livestock performance (Dilaga *et al.*, 2022). Thus, the evaluation variety and digestibility of various types of forage provided to sacrificial goats with a cut-and-carry system are important as an initial step to determine its usefulness which can then be used as a basis for subsequent stages. This paper describes the results of preliminary research conducted to obtain such information regarding to the nutritional characteristics of forages temporary offered to sacrificial-goats in Mataram city.

Method

Forages sample collection

Forage was collected directly from the goats were kept. A total of 20 points of sacrificial goat vendors' pens were used as sampling locations. All forage types were fed to sacrificial goats at the 20 points locations were collected. The collected feed samples were identified and prepared for DMD and OMD analysis.

Dry matter and organic matter analysis procedures

All collected sacrificial goat feed samples were finely ground using a Wiley mill with a sieve size of ±1 mm. A total of 1 g of the sample was placed in a 105 ^{0}C oven until it reached a constant weight. Furthermore, burning was carried out at a temperature of 550 ^{0}C for ±1 hour or until the sample burned completely, marked by the color has become gray color. Dry matter (DM) and organic matter (OM) testing procedures follow the procedures of AOAC (2005). The DM and OM contents of feed samples are presented in Table 1.

Table 1. Organic matter and dry matter content of forage samples fed to sacrificial-goat.

Forage type		Nutrient (%)	
Scientific name	Local Name	Dry matter	Organic matter
Terminalia catappa	Ketapang	40.11	92.79
Hibiscus tiliaceus	Waru	40.80	88.37
Artocarpus heterophyllus	Nangka	45.73	85.46
Sesbania glandiflora	Turi	32.79	85.46
Leucaena leucocephala	Lamtoro	55.33	93.57
Musa spp	Pisang	38.90	93.94
Inocarpus fagifer	Gatep	51.65	93.74
Adenanthera pavonina	Saga	74.08	96.37
Acacia greggii	Akasia	67.61	95.26
Alsomitra macrocarpa	Tetandan	46.49	93.53

Digestibility analysis procedures

A 0.5 g sample was placed in a 100 mL test tube. Artificial saliva (McDougall solution) and rumen fluid used as media were prepared at a ratio of 4-parts artificial saliva and 1-part rumen fluid. Rumen fluid was obtained from abattoirs located around Mataram city. During the transportation of the rumen fluid from the collection location to the laboratory, the temperature of the rumen fluid was kept constant at 39 ^{o}C by using a thermos that had previously been filled with hot water at 40 ^{o}C. The incubation tubes containing the samples were mixed with the media while running $C0_2$ gas and then incubated in a water bath at 39 ^{o}C for 48 hours. The principle of in vitro applied follows the procedure of Tilley and Terry (1963).

Result and Discussion

Dry matter digestibility of various types of forages fed to sacrificial-goat

The results of our recent study (Table 2) showed that turi leaves had the highest DMD at 65.54% ($P<0.05$) compared to the forage digestibility of other feed samples, while the lowest DMD was obtained in Gayam leaves at 24.86%. The DMD of jackfruit, leucaena, banana, and tetandan forages showed no difference in digestibility values, which obtained DMD values of 42.69%, 43.00%, 44.30%, and 43.36%, respectively.

The high DMD in Turi is thought to be due to the high availability of suitable protein and energy and the relatively low crude fiber content contained in Turi. These conditions are very favorable for rumen microbes. Hadi et al. (2011) showed that the nutrient content of Turi was 20.43% (DM), 92.43% (OM), 23.76% (CP), 35.21% (NDF), 24.00% (ADF), and 11.21% (hemicellulose). A study on Bali cows with a gestation age of 6-7 months showed that turi leaf supplementation significantly increased consumption, nutrient digestibility, nitrogen balance, purine derivative excretion, calf birth weight and preweaning daily weight gain (Imran, 2013).

The digestibility of a feed is a determinant between nutrient content and energy availability for ruminants (Forejtová et al. 2005). The availability of sufficient protein and energy in the rumen will accelerate the rate of rumen microbial proliferation (Dilaga et al., 2022). Rumen microbes will digest feed well if their abundant population and their nutritional needs are fulfilled (Suroso et al., 2014). The faster the proliferation of rumen microbes, the faster the feed degradation process, resulting in a high digestibility value. The high digestibility value of a feed material indirectly indicates the high presence of rumen microbes in degrading it. The high rumen microbial population is the host's primary protein source (Lai et al., 2020).

The lack of difference in the DMD of Jackfruit leaves, Leucaena, Banana and Tetandan leaves may be due to the relatively similar availability of nutrients in these feedstuffs, although many kinds of literature show that the Leucaena has a higher crude protein content (Kariyani et al., 2021; Sutaryono et al., 2023). Leucaena higher protein and lower fiber content than grass may affect digestion (Qu et al., 2020). However, digestibility conditions that are not different are thought to be caused by digestibility-limiting compounds (anti-nutritional content) that limit the access of rumen microbes to degrading feed nutrients. Anti-nutritional compounds that are relatively always present in forage feedstuffs are tannins. Tannins with high concentrations in forage feed cause a low level of degradation in the rumen (Putra et al., 2017).

In their study, Tan et al. (2013) showed that increasing the level of condensed tannins of Leucaena from 10 - 30 mg/500 mg DM linearly decreased the dry matter digestibility of Leucaena. Similarly, Blanco et al. (2009) reported that crude protein in Leucaena is relatively less degraded in the rumen due to the condensed tannins it contains (1.80 - 4.00% DM). However, the presence of tannins in ruminant feed does not always have a negative effect but also has a positive effect on livestock productivity, especially related to its ability to modify rumen fermentation products. Jayanegara et al. (2009) stated that tannins or polyphenols are one of the compounds that can potentially reduce methane emissions among natural compounds found in plants. Further explained by Patra et al. (2012) explained that sometimes tannins also affect the efficiency of rumen microbial protein synthesis.

Table 2. Average dry matter and organic matter digestibility (%) of various forages fed to sacrificial-goats in Mataram city.

Forage type	DMD (%)	OMD (%)
Ketapang (*Terminalia catappa)*	48.88±5.03^{d}	44.73±3.18^{fg}
Waru (*Hibiscus tiliaceus)*	55.07±2.42^{e}	48.68±1.29^{g}
Nangka (*Artocarpus heterophyllus)*	42.69±2.75^{c}	40.62±3.68^{ef}
Turi (*Sesbania glandiflora)*	65.54±0.44^{f}	61.08±2.22^{h}
Lamtoro (*Leucaena leucocephala)*	43.00±0.63^{c}	39.74±1.51^{de}
Pisang (*Musa spp)*	44.30±0.30^{c}	36.36±2.21^{d}
Gayam (*Inocarpus fagifer)*	24.86±0.96^{a}	11.85±0.79^{a}
Saga (*Adenanthera pavonina)*	56.37±2.79^{e}	42.01±1.81^{ef}
Akasia (*Acacia greggii)*	29.17±0.60^{b}	20.22±3.53^{b}
Tetandan *(Alsomitra macrocarpa)*	43.36±1.66^{c}	31.12±1.44^{c}
P-value	<0.001	<0.001

$^{a-h}$ different superscripts in the same column show significant differences (P<0.05).

Organic matter digestibility of various types of feedstuffs offered to sacrificial-goat

The organic matter digestibility forage for sacrificial-goats ranged from 11.85 - 61.08%. All types of forage where analysis in our study produced a varied percentage of organic matter digestibility (P<0.05, Table 2). As the DMD value, the highest OMD of forage in our study was obtained in *Turi*, which amounted to 61.08%, and the lowest was obtained by *Gayam* which had an OMD of 11.85% (P<0.05). The OMD of Waru was 48.68% but showed no difference from Ketapang, with an OMD of 44.73%. The high OMD of Waru owing to their saponin content that can act as a defaunation agent. The study results of Suroso *et al*. (2014) showed that adding Waru leaves increased the digestibility of Neutral Detergent Fiber (NDF). Furthermore, it was explained that the increase in NDF digestibility might be due to the defaunation agents contained in Waru leaves that can reduce the protozoa population in the rumen.

Saponins can interfere with protozoan development by bonding with sterols on the surface of the protozoan cell membrane, causing membrane ruptures, lysis and death of protozoan cells. The presence of cholesterol in eukaryotic cell membranes (including protozoa) but not in prokaryotic bacterial cells allows rumen protozoa to be more susceptible to saponins because saponins attract cholesterol. The rumen bacteria population is unaffected because besides bacteria lack sterols that can bind to saponins, bacteria can also metabolize these anti-protozoa factors by removing their carbon chains. Putra (1999) stated that the addition of Waru can be used as a defaunation agent because, in addition, able to reduce 32.31% of the protozoa population, it can also increase the population of cattle rumen bacteria.

The value of organic matter digestibility illustrates the availability of nutrients that livestock can utilize. The OMD value of the feed also showed a trend in line with the DMD. The level of OMD is closely related to DMD because dry matter consists of organic matter; the difference is in ash content. This follows the statement of Raharjo et al. (2013) that OM degradation is closely related to DM degradation because most of the DM is composed of OM.

Conclusion

Our research results identified that among the ten forages given for sacrificial-goat in Mataram City; by order, Turi (*Sesbania glandiflora*), Waru, (*Hibiscus tiliaceus*), and Ketapang (*Terminalia catappa*) leaves produced the highest DMD and OMD. Thus, the three

types of leaves can be recommended to be served routinely as ruminant feedstuff for both meat, dairy production, and for breeding purposes.

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Author Contributions
The first author (Suhubdy) was responsible for establishing the research concept, supervising the research, and drafting the manuscript. Mr. Hasan collected the feedstuff sample from the vendor location and controlled the Lab Analysis, and Mr. Putra helped in in-vitro and data analyzing as well as joint in writing the manuscript.

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Conflicts of Interest
The is no such conflict of interest both academically and publicly due to conducting and publishing this research results.

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