Digestibility In Vitro *Discorea Hispida* Dennst using *Albizia Saponaria* Lour Extract as Local Feed

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Abstract: - The availability of local feed resources in various regions in Indonesia is quite abundant in quantity and availability, but their utilization is not optimal. This study specifically analyzes the In Vitro Digestibility of *Dioscorea hispida* Dennst Using *Albizia Saponaria* Lour (Langir) Extract as local feed, which was carried out at two locations, namely Tinanggea District, Konawe Selatan Regency, and the animal feed laboratory, Faculty of Animal Science, Halu Oleo University with a research duration of 6 months, namely January-July 2023 The study used a completely randomized design (CRD) unidirectional pattern with 4 treatments and 4 replications so that a total of 16 experimental plots. The experimental procedure begins with preparing *Dioscorea hispida* Dennst, the preparation of langir bark extract, the Soaking of the Trial Samples, and the Collection and Sampling. The findings showed that using langir bark extract up to 15% reduced cyanide acid (HCN) levels to 10,07 ppm or 49,06% compared to HCN levels in the study controls. Langir bark extract up to 15% usage level in *Dioscorea hispida* Dennst immersion has no effect on dry matter digestibility and organic matter digestibility in vitro because it still shows the maximum digestibility level of 91,54-93,48% dry matter and 69,74-77,86% organic matter, langir bark extract into *Dioscorea hispida* Dennst flour was used effectively in improving the concentration of NH_3 and VFA at the 5% level, with the achievement of a concentration of NH_3 of 5,09 mM and a concentration of VFA of 147,10 mM.

Key-Words: - In Vitro, *Dioscorea hispida* Dennst, Cyanide Content, *Albizia Saponaria* Lour, Local Feed

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1 Introduction

The availability of local feed resources in various regions in Indonesia has sufficient quantity and availability, and their utilization is not optimal due to limited capital and lack of human resources in applying technology for processing quality feed ingredients, [1], [2], [3]. Local feed resources can be an alternative to support the development of sustainable and competitive livestock production, [4], [5]. The value of benefits from using local feed ingredients can be seen ecologically and economically without neglecting the quality and quantity of these feed ingredients, [6], [7].

Important things to consider in utilizing local feed ingredients are the nutritional content of the feed (energy, protein, minerals, and vitamins), palatability, digestibility, limiting/anti-nutrient substances, price, and sustainability of the feed ingredients. In addition, an assessment of feed ingredients needs to be carried out, such as a physical assessment (color, shape, odor, specific gravity, and storage time), a chemical assessment (nutrients/nutrients and anti-nutrients), and a biological assessment (usefulness and effect) as well as potential feed glucose content that can be utilized optimally by livestock.

Southeast Sulawesi, especially in South Konawe Regency, has quite an abundant biodiversity, one of which is *Dioscorea hispida* Dennst, which has the potential to be used as a source of animal feed due to its abundant availability and does not require special expertise to cultivate it. In addition, it also

has good nutrient content, especially carbohydrate content, which can be used as an alternative to corn, which tends to be expensive and has competitiveness with humans.

Dioscorea hispida Dennst, as a source of animal feed, still requires further handling. After all, it has toxic anti-nutritional compounds, making this feed ingredient less desirable because it requires proper processing techniques so livestock can consume it. Anti-nutritional substances as a limiting factor for *Dioscorea hispida* Dennst are saponin glucosides, including tropane alkaloids called dioscorin and cyanogenic glucoside compounds and when decomposed produce HCN compounds (cyanide acid), [8], [9]. These compounds have high toxicity that can interfere with the nervous system of those who consume them, [10], [11]. However, the compounds dioscorin, saponins, and their sapogenin derivatives have the potential as drugs, [12], and are also beneficial for livestock regarding their resistance and immunity. Therefore, efforts must be made to process *Dioscorea hispida* Dennst by reducing the cyanide content to a threshold safe for animal feed consumption.

Cyanide compounds from *Dioscorea hispida* Dennst can be removed by physical, chemical, and biological methods, [13]. Several regions in Indonesia have long implemented methods of removing cyanide in *Dioscorea hispida* Dennst, such as immersion in table salt solution, immersion in running water, application of ashes pressing, or heat treatment by drying and boiling, [14]. The immersion method, with running water and non-flowing clean water, takes a long time. It is the method most commonly used by the village community because the immersion process does not require high costs, so it is very economical, [15], [16].

The application of simple technology widely practiced by the local community of the Moronene tribe in Southeast Sulawesi Province in eliminating HCN levels in *Dioscorea hispida* Dennst is by immersing *Dioscorea hispida* Dennst in a mixture of langir bark extract (*Albizia saponaria* Lour), which is done for 3 nights, [17]. This method is almost the same as the method used by the Tolaki tribe, who treats *Dioscorea hispida* Dennst with a mixture of Langir peel (*Albizia saponaria* Lour) for 4-5 nights, [18]. Phytochemical tests on the Langir stem and root bark showed the presence of triterpene saponin compounds, alkaloids, tannins, and flavonoids. Saponin extracts or plants containing saponins have several functions, including as an anticoccidials, immunostimulant, antibacterial, and antifungal, [19], [20].

The use of the *Dioscorea hispida* Dennst immersion method with the bark of Langir (*Albizia saponaria* Lour) stems from a method that must be preserved as local wisdom because it has begun to be eliminated due to modernization, so a more in-depth study is needed. Based on this, research on the Digestibility of In Vitro *Discorea Hispida* Dennst Using *Albizia saponaria* Lour Extract as local feed should be carried out.

2 Research Methods

2.1 Tools and Materials

The research materials consisted of 100 kg of fresh *Dioscorea hispida* Dennst, 15 kg of *Albizia Saponaria* Lour and water from Lalonggasu Village, Tinanggea District, South Konawe Regency, rumen fluid of Bali cattle, and chemicals such as Na HCO3, $Na_2HPO_4.7H_2O$, KCl, NaCl, $MgSO_4.7H_2O$, $CaCl_2$, $HgCl_2$, H_2SO_4, Boric Acid (H_3BO_3 crystal), Bromine Cresol Green (BCG), Methyl Red (MR), Aquadest, Pepsin, and N-Hexane as support in measuring digestibility in vitro.

The equipment used is grouped into two groups, namely equipment for the processing of *Dioscorea hispida* Dennst consisting of hoe, machete, knife, technical scales with a capacity of 150 kg, digital scales with a capacity of 10 kg, basins, buckets, tarpaulin, plastic packaging, waring, sacks, dippers, plastic clips, label paper, and stationery, while the activities carried out in the laboratory consisted of digital scales, water bath shakers, CO_2 gas cylinders, porcelain dishes, 105ºC ovens, 600ºC electric furnaces, Whatman No. Filter paper. 41, Conway cup, Erlenmeyer flask, distillation apparatus, titration apparatus, and writing materials.

2.2 Research Design

The study used a completely randomized design (CRD) unidirectional pattern, with a total of 4 treatments and 4 replications, so the total experimental unit of this study was 16 experimental plots. The treatment tested was langir bark extract with composition P_1 (0% langir bark extract), P_2 (5% langir bark extract), P_3 (10% langir bark extract), P_4 (15% langir bark extract) with a mathematical model $Yij = \mu + T(i) + e\ (ij)$. Data were analyzed using SPSS 21 software with a significant level of $\alpha = 0.05$ or a 95% confidence level, [21].

2.3 Research Procedure

2.3.1 Setup *Dioscorea hispida* Dennst

Dioscorea hispida Dennst was selected for good quality, such as not rotten, wound, intact, and not too old, marked by a yellowish tuber, then peeled 2 mm thick. The peeling aims to separate the skin and meat to reduce HCN levels of *Dioscorea hispida* Dennst. After stripping, wash to remove dirt attached to the tubers and slice 0.5 cm thick.

2.3.2 Manufacture of Langir Bark Extract

The langir bark extract is made by peeling the Langir bark from the stem, dredging the outer skin and cutting it along ± 10 cm, weighing it as needed, and then putting it in a basin to mix with water while rubbing it for ± 5 minutes to produce a lot of foam. langir bark extract is used in as much as 12 kg, then a concentration of 12 kg + 10 liters of water. I am making a solution of langir bark extract according to a predetermined concentration of 0% (without extract) Langir peel. I then made the same way for a solution of 5%, 10%, and 15% langir bark extract.

2.3.3 Immersion of Trial Samples

Langir bark extract solution was made from sliced *Dioscorea hispida* Dennst. The next activity was to soak *Dioscorea hispida* Dennst. Soaking is carried out for 48 hours in a basin container, and after that, it is removed and drained for 24 hours, soaked in running water for 48 hours, drained for 24 hours, and dried or dried for 3 days in normal weather.

2.3.4 Collection and Sampling

Samples dried for 3 days under the sun were followed by drying in an oven at 50°C for 8 hours. Samples were weighed to determine air dry weight (50°C oven) and followed by flouring. Samples are packaged in plastic clips and labeled for analysis to measure research parameters.

2.4 Research Variable

The research variable is:

1. Analysis of Cyanide Acid (HCN) Content of flour *Discorea hispida* Dennst
2. In vitro digestibility of *Dioscorea hispida* Dennst consists of dry matter and organic matter digestibility.

$$KcBk\ (\%) = \frac{BK\ Origin-(BK\ Residue-BK\ Blank\ Residue)}{BK\ Origin} \times 100\%$$

$$KcBO\ (\%) = \frac{BO\ Origin-(BO\ Residue-BO\ Blank\ Residue)}{BO\ Origin} \times 100\%$$

3. Characteristics of in vitro fermentability test of *Dioscorea hispida* Dennst Flour
4. Fermentation characteristics measured in this study were NH3 and total VFA:
   - ***a. NH3 concentration measurement (Conway micro diffusion method)***
     To calculate the levels of NH3 can be calculated by the formula:

$$N\text{-}NH3\ (mM) = \frac{ml\ H_2SO_4 \times N\ H_2SO_4 \times 1000}{gr\ Sample \times BK\ Sample}$$

   - ***b. VFA Concentration Measurement***
     The total VFA production is calculated as follows:

$$VFA\ Total\ (mM) = \frac{(a-b)ml \times N\ HCl \times 1000/5ml}{gr\ Sample \times BK\ Sample} \times 100\%$$

a. = volume of reactant blank HCl (only H_2SO_4 and NaOH, without sample) b = volume of sample HCl

3 Result and Discussion

3.1 HCN Levels of *Dioscorea hispida* Dennst in Langir Extract

Cyanide acid is a poison classified as strong with a fast-acting method. HCN will bind to the cytochrome oxidase enzyme, so the tissues cannot use oxygen. The toxic effects caused by cyanide cannot be seen so it can cause sudden death of livestock due to lack of oxygen to the heart, [22].

The detoxification process of *Dioscorea hispida* Dennst to reduce cyanide acid levels in this study used langir bark extract (LBE). Cyanide acid (HCN) levels of *Dioscorea hispida* Dennst flour treated with langir bark extract (LBE) immersion in this study can be presented in Table 1.

Table 1. HCN levels of *Dioscorea hispida* Dennst in Extract with Langir (ppm)

Repeat	Content HCN *Dioscorea hispida* Dennst (ppm)			
	P_1	P_2	P_3	P_4
1	20,21	13,45	12,26	9,93
2	19,51	13,25	12,36	10,20
3	19,25	13,10	12,15	10,05
4	20,10	12,84	12,20	10,10
Amount	**79,07**	**52,64**	**48,97**	**40,28**
Average	**19,77 ± 0,46^a**	**13,16 ±0,26^b**	**12,24 ± 0,09^c**	**10,07 ± 0,11^d**

Description: *1. P1 = Soaking Dioscorea hispida Dennst with 0% Langir extract; P2 = Dioscorea hispida Dennst soaking with 5% Langir extract; P3 = Dioscorea hispida Dennst soaking with 10% Langir extract; P4 = Dioscorea hispida Dennst soaking with 15% Langir 2 extract.* ^{a,b,c,d}*= different superscripts in the same column showed significant differences between treatments (P<0.05).*

The high levels of cyanide acid contained in *Dioscorea hispida* Dennst require detoxification

before *Dioscorea hispida* Dennst is used as a feed source and for food. After the detoxification process, the cyanide acid levels are measured again, [23].

In this study, *Dioscorea hispida* Dennst flour in low levels of HCN was caused by the dissolution of *Dioscorea hispida* Dennst before making it in flour and immersing it in running water. The soaking process allows the cyanide acid to dissolve into the water, ultimately reducing the HCN levels of *Dioscorea hispida* Dennst. *Dioscorea hispida* Dennst experiences tissue damage due to the process of slicing or crushing, so there will be contact between the substrate and endogenous enzymes, causing the substrate to undergo an overhaul into free cyanide compounds which are volatile and soluble in water, [24].

Table 1. shows that the levels of cyanide acid (HCN) in *Dioscorea hispida* Dennst flour treated by immersion in langir bark extract (LBE) in this study shows that the higher the level of LBE treatment, the lower the HCN level to 10,07 ppm or the lower the level of 49,06% when compared to control HCN levels (P1) and 23,48% compared to P2 (5% LBE). Studies on HCN levels of *Dioscorea hispida* Dennst flour, which have been treated in several studies, show that the HCN levels of *Dioscorea hispida* Dennst flour due to the combined treatment of soaking husk ash and boiling were 41,58–2,70 ppm, [25]. HCN levels of *Dioscorea hispida* Dennst flour modified from fermentation by grating and cutting treatment were 11,9 ppm and 10,63 ppm, respectively, [26]. Meanwhile, HCN levels in the grated and cut control treatments were 12,67 ppm and 15,76 ppm, respectively. Based on data from several previous research results, the HCN levels of *Dioscorea hispida* Dennst flour in this study as a whole treatment (Table 1) are still within the tolerance limit for consumption.

The statistical analysis showed that soaking *Dioscorea hispida* Dennst in langir bark extract significantly affected HCN levels of *Dioscorea hispida* Dennst flour ($P<0.05$). Based on the difference test between treatments using Duncan, the P1 treatment (0% LBE) showed a significant difference to both the P2 treatment (5% LBE), P3 (10% LBE), and the P4 treatment (15% LBE). Furthermore, further test results for the HCN content of *Dioscorea hispida* Dennst flour treatment P2 (5% LBE) showed a significant difference between the HCN content of *Dioscorea hispida* Dennst treatment P3 (10% LBE) and treatment P4 (15% LBE), and simultaneously the HCN content of flour *Dioscorea hispida* Dennst still showed significant differences between the P3 treatment (10% LBE) and the P4 treatment (15% LBE). In general, the difference in HCN levels of *Dioscorea hispida* Dennst flour in this study is suspected of having active compounds contained in the Langir extract (*Albizia saponaria* Lour) in the form of saponins. Papagan *Albizia saponaria* Lour has a fairly high saponin content, [27]. Phytochemical tests on the Langir stem and root bark showed the presence of a group of saponin compounds. Besides that, they also contained alkaloids, tannins, and flavonoids, [19], [20], [28].

The difference in the level of HCN content in *Dioscorea hispida* Dennst flour between treatments in this study presumably indicated that some of the cyanide acid in *Dioscorea hispida* Dennst flour accumulated/trapped in fat, so that when the saponin compounds emulsified or dissolved the fat, the HCN content of *Dioscorea hispida* Dennst would be easier to extract because HCN dissolves completely in water. It appears that numerically, the lipid content of *Dioscorea hispida* Dennst flour appears to decrease as the level of langir bark extract (LBE) increases, as does the HCN level. Another hypothesis is that the level of difference in the decrease in cyanide acid levels of *Dioscorea hispida* Dennst flour treated with langir bark extract may be the presence of an active compound in Langir peel, which can open the pores of *Dioscorea hispida* Dennst slices when *Dioscorea hispida* Dennst is soaked with langir bark extract. The higher the LBE level, the greater the possibility of pore slack in the *Dioscorea hispida* Dennst section, which in turn can affect more and more HCN diffusing out of the cell so that what is left in *Dioscorea hispida* Dennst decreases.

3.2 In Vitro Digestibility of *Dioscorea hispida* Dennst in Langir Extract

Determination of feed digestibility previously widely used was the in vivo and sacco digestibility method. However, these methods require a lot of energy, require a lot of livestock and feed, and are expensive, making them inefficient to use in routine feed evaluation, [29]. The next development in the evaluation of feed ingredients is the in vitro digestibility method. The in vitro method is an indirect digestibility estimation method done on a laboratory scale by imitating the processes that occur in the digestive tract of livestock. The results of the KcBk and KcBo research obtained can be presented in Table 2.

Table 2. In vitro digestibility of *Dioscorea hispida* Dennst in Langir extract

Treatment	Digestibility In Vitro *Dioscorea hispida* Dennst	
	Digestibility of Dry Matter (%)	Digestibility of Organic Matter (%)
P1	91,88 ± 0,62	73,22 ± 2,49
P2	91,54 ± 0,70	69,74 ± 3,53
P3	93,48 ± 1,18	77,86 ± 4,75
P4	93,20 ± 1,50	77,15 ± 7,46

Description: *1. P1 = Soaking Dioscorea hispida Dennst with 0% Langir extract; P2 = Dioscorea hispida Dennst soaking with 5% Langir extract; P3 = Dioscorea hispida Dennst immersion with 10% Langir; P4 = Dioscorea hispida Dennst soaking with 15% Langir extract*

The in vitro technique is to mimic rumen conditions. Conditions modified in this case include buffer solution, fermentation vessel, stirring and gas phase, fermentation temperature, optimum pH, inoculum source, anaerobic conditions, fermentation period, and end of fermentation. The buffer solution as a buffer element maintains rumen pH so that it is not easily reduced by organic acids produced during the fermentation process, [30].

The in vitro digestibility of *Dioscorea hispida* Dennst as a result of soaking langir bark extract (*Albizia saponaria* Lour) in this study was the digestibility of dry matter (KcBk) and organic matter digestibility (KcBo). The in vitro measurement of the digestibility of dry matter (Table 2) of *Dioscorea hispida* Dennst flour produced in this study was 91,54–93,48%. In general, the in vitro digestibility level of dry matter of *Dioscorea hispida* Dennst shows that all treatments provided a fairly high level of dry matter digestibility.

The dry matter digestibility value reflects the amount of nutrients livestock can utilize. Although *Dioscorea hispida* Dennst has HCN compounds, the highest HCN content produced in this study was 19,77, which is still within the threshold for consumption. The statistical analysis results showed that soaking Dioscorea hispida Dennst in langir bark extract did not significantly affect the digestibility of the dry matter of *Dioscorea hispida* Dennst flour in vitro (P>0.05). This fact means that the langir bark extract treatment used in this study did not respond to the digestibility of the dry matter of *Dioscorea hispida* Dennst flour.

The feed's crude fiber content limits the digestibility of nutrients in the rumen. The higher the crude fiber of the feed, the lower the digestibility of these feed substances. In this study, the crude fiber content of *Dioscorea hispida* Dennst flour was 1,21–1,48% (Table 2), a very low crude fiber range. The low crude fiber of *Dioscorea hispida* Dennst flour will provide space for the cellulose enzymes produced by cellulolytic microbes to penetrate more easily into feed ingredients, which can increase the digestibility of dry matter in this study.

Another factor that allows no difference in the digestibility of the dry matter of *Dioscorea hispida* Dennst flour in vitro in this study is also thought to be due to the protein content of *Dioscorea hispida* Dennst flour in all treatments still providing sufficient microbial needs for growth and activity. Microbial growth and activity due to the carrying capacity of the protein contained in *Dioscorea hispida* Dennst flour can affect the feed digestibility process to be higher.

The organic matter digestibility (KcBo) of *Dioscorea hispida* Dennst flour treated with langir bark extract (LBE) showed that numerically, the 10% LBE level gave a high level of organic matter digestibility (Table 2). The digestibility value of organic matter is closely related to the dry matter digestibility of a feed ingredient, [31]. Decreasing the digestibility of dry matter will decrease the digestibility value of organic matter, [32]. The digestibility value of the organic matter in this study was 69,74 in the P2 treatment (5% LBE) and appeared to increase with increasing dry matter digestibility in the P3 treatment (10% LBE) of 77,86%.

The results of statistical analysis showed that immersion of *Dioscorea hispida* Dennst in langir bark extract did not have a significant effect on the digestibility of organic matter of *Dioscorea hispida* Dennst flour in vitro (P>0.05). This fact means that the langir bark extract treatment used in the study did not respond to the digestibility of *Dioscorea hispida* Dennst organic matter. Although there was no significant difference in the LBE treatment in this study, it generally provided the maximum digestibility of organic matter. The digestibility of organic matter of *Dioscorea hispida* Dennst flour, which was not different in the study, was probably influenced by the nutrient content contributed by *Dioscorea hispida* Dennst flour, especially crude protein, which still provides sufficiency in increasing the growth of the microorganism population. Finally, it can contribute to degrading enzymes according to the substrate.

3.3 Characteristics of N-NH_3 and Total VFA Fermentability Test of *Dioscorea hispida* Dennst in Langir Extract in Vitro

The dynamics of the fermentation process involving compounds contained in plants and substrates in the

form of food substances will produce metabolite products that suppress the growth of unwanted spoilage bacteria. Metabolite products contained in ruminant feed fermentation are expected to influence rumen microbial development positively. One of the influences during the fermentation process in the rumen that is expected to increase is the concentration of NH_3 and VFA as a result of protein and carbohydrate fermentation.

Characteristics of the NH_3 fermentability test and total VFA of *Dioscorea hispida* Dennst flour in langir bark extract (*Albizia saponaria* Lour) in vitro can be presented in Table 3.

Table 3. Characteristics of N-NH_3 fermentability and total VFA of *Dioscorea hispida* Dennst Flour in Langir extract in vitro

Treatment	Characteristics of Fermentability Test	
	NH_3 (mM)	VFA (mM)
P1	$5,87^{b} \pm 0,43$	$147,78^{b} \pm 9,69$
P2	$5,09^{c} \pm 0,20$	$147,10^{b} \pm 5,41$
P3	$4,54^{c} \pm 0,66$	$182,61^{a} \pm 7,08$
P4	$7,01^{a} \pm 0,23$	$187,84^{a} \pm 9,15$

Description: *1. P1 = Soaking Dioscorea hispida Dennst with 0% Langir extract; P2 = Dioscorea hispida Dennst soaking with 5% Langir extract; P3 = Dioscorea hispida Dennst soaking with 10% langir bark extract; P4 = Dioscorea hispida Dennst soaking with 15% Langir extract. 2.* ^{a,b,c} *= different superscripts in the same column showed significant differences between treatments (P<0.05).*

Single feed testing can be carried out using the in vitro method, this method is more appropriate to use, especially if the nutrients contained in the feed ingredients are not sufficient for livestock. In vitro is a simulation of the digestive process in the livestock body with a relatively cheaper and easier cost by obtaining the value of the benefits of a feed ingredient by determining its fermentability in the rumen based on indicators of the value of NH_3 and VFA production.

The concentration of NH_3 in the fermentability test of *Dioscorea hispida* Dennst flour in the in vitro extract of *Albizia saponaria* Lour obtained in this study was in the range of 4,54–7,01 mM, with the highest concentration in treatment P4 (15% LBE) and lowest in treatment (P3 10% LBE) (Table 3). The NH_3 concentration values obtained in the P1, P2, and P3 treatments had not yet reached the optimum level of NH_3 concentration. However, they still provided the NH_3 concentration needed by rumen microbes to digest feed optimally.

The results of statistical analysis showed that immersion of *Dioscorea hispida* Dennst in langir bark extract (LBE) had a significant effect on the NH3 concentration of *Dioscorea hispida* Dennst flour (*P<0.05*). A follow-up test to find out the difference between treatments using Duncan showed that treatment P1 (0% LBE) showed a significant difference to treatment P2 (5% LBE), P3 (10% LBE), and P4 (15% LBE). The P2 treatment (5% LBE) did not significantly differ from the P3 treatment (10% LBE). However, it significantly differed from the P4 treatment (15% LBE). While the P3 treatment (10% LBE) showed a significant difference in the NH_3 content of wheat tuber flour with the P4 treatment (15% LBE).

The difference in the NH_3 concentration of *Dioscorea hispida* Dennst flour between the control treatment (P1 0% LBE) and the treatment that obtained LBE levels in both the P2 (5% LBE), P2 (10% LBE) and P4 (15% LBE) treatments in this study was probably due to The active compounds contained in Langir peel are saponins, flavonoids, alkaloids, phytochemicals and tannins, [28]. The saponins in LBE can affect microbial growth by reducing the protozoa population. These microbes have an important role in increasing the concentration of NH_3 by degrading proteins, amino acids, and other peptides into ammonia. However, due to saponin compounds donated from LBE, the NH_3 concentration of *Dioscorea hispida* Dennst flour showed a difference in the reduction to the 10% LBE level.

Administration of saponins can reduce the concentration of NH_3 in vitro and in vivo in cattle, [33]. Fermentation of feeds containing tannins in the rumen results in lower ammonia production compared to feeds that do not contain tannins, [34], [35].

Apart from saponins, Langir peel also contains flavonoid compounds, which are not easily hydrolyzed by rumen microbes or digestive tract enzymes. Flavanoids are included in condensed tannins, which are capable of forming complex bonding compounds with feed proteins that are stable at pH 4 to 7 and make them insoluble compounds, which will reduce their fermentability in the rumen, which is implemented by decreasing ammonia production, [36]. However, the P4 treatment (15% LBE) showed an increase in NH_3 concentrations reaching 7,01 mM and appeared to be significantly different compared to the treatment that obtained LBE levels of 10%, 5%, and control (without LBE). The high concentration of NH3 in the P4 treatment (10% LBE) is suspected that the nutrient content, especially protein in the P4 treatment, is more optimally available for microbial degradation into ammonia. The condition of protein

availability in *Dioscorea hispida* Dennst is influenced by the alkaloid compounds in the Langir peel.

Alkaloids in Langir are thought to contribute to the availability of amino acids, one of the ammonia production processes. Ammonia is produced with peptides and amino acids, which rumen microbes will use to form microbial proteins, [37]. The amino acid L-phenylalanine is one of the precursors in the formation of alkaloids, [38].

The main carbohydrate fermentation products are acetate, propionate, butyrate, and valerate. VFA acts as a carbon framework for the formation of microbial proteins. A high VFA concentration indicates a high content of carbohydrates fermented by rumen microbes. The VFA concentration of *Dioscorea hispida* Dennst flour treated with langir bark extract obtained in this study was 147,10 – 187,84 mM. This study's results illustrate that using langir bark extract as a numerical treatment can increase the VFA concentration of *Dioscorea hispida* Dennst flour.

The results of statistical analysis showed that immersion of *Dioscorea hispida* Dennst in langir bark extract (LBE) had a significant effect on the VFA concentration of *Dioscorea hispida* Dennst flour ($P<0.05$). A follow-up test to determine the differences between treatments using Duncan showed that treatment P1 (0% LBE) showed no significant difference from treatment P2 (5% LBE). However, P1 was significantly different from treatment P3 (10% LBE), and even when LBE was increased to 15% (P4) still showed a significant difference. Further tests of treatment P2 (5% LBE) still showed a significant difference from treatment P3 (10% LBE) and P4 (15% LBE). Meanwhile, the concentration of VFA in the P3 treatment did not significantly differ from the P4 treatment (15% LBE) in this study.

The VFA concentration of *Dioscorea hispida* Dennst flour with langir bark extract treatment (Table 3) appeared to be the highest and significantly different ($P<0.05$) was found in P4 (15% LBE) compared to the control treatment (P1 0% LBE) and P2 (5% LBE). The high concentration of VFA obtained, along with the increase in LBE in this study, was probably due to the better nutrient content of *Dioscorea hispida* Dennst, both protein and carbohydrates, compared to other treatments. Donation of carbohydrates from *Dioscorea hispida* Dennst flour, which is fermented by microorganisms in the rumen into volatile fatty acids (VFA) that VFA can also be formed from the process of hydrolysis of carbohydrate polysaccharides by rumen microbes.

Polysaccharides are converted into monosaccharides, especially glucose, then broken down into acetate, propionate, butyrate, isobutyrate, valerate, isovalerate, methane, and CO_2, [37]. A high concentration of VFA is an indicator of energy adequacy for livestock. The higher the concentration of VFA indicates, the more effective the fermentation process. However, the concentration of VFA that is too high can disturb the rumen system's balance, [39].

The difference in VFA concentrations of *Dioscorea hispida* Dennst flour obtained in this study is also thought to be due to an active compound in the langir bark extract. The saponin compound in the P3 and P4 treatments increased in this case. Increasing the saponin content will increase the VFA concentration. Supplementation of Sapindus saponaria fruit containing 120 g of saponins can improve the rumen microbial profile, VFA efficiency, and microbial protein flow in the duodenum of sheep, [40]. Administration of saponins can increase total VFA concentration and rumen microbial activity, [33], [41]. Table 3 shows that the increase in total VFA is in line with the increasing level of langir bark extract in *Dioscorea hispida* Dennst, making it possible for an increase in saponin compounds, which will ultimately affect increasing the proportion of propionic acid. Saponins increase propionate concentration and its relative ratio to total VFA in the rumen, [20].

4 Conclusion

The use of langir bark extract up to a level of 15% in soaking *Dioscorea hispida* Dennst was able to reduce cyanide acid (HCN) levels by up to 10.07 ppm or with a percentage reduction of 49.06% compared to the HCN levels of Dioscorea hispida Dennst in the control of this study.

Langir bark extract up to a use level of 15% in soaking *Dioscorea hispida* Dennst did not affect the digestibility of dry matter and organic matter in vitro. In general, the digestibility of dry matter and organic matter produced in all treatments still showed the maximum level of digestibility, namely 91.54–93.48% dry matter and 69.74-77.86% organic matter, so that *Dioscorea hispida* Dennst can be used as a source of local feed ingredients.

Dioscorea hispida Dennst flour produced by soaking with langir bark extract was effectively used to improve NH_3 and VFA concentrations at the 5% level, achieving an NH_3 concentration of 5.09 mM and a VFA concentration of 147.10 mM.

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