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Research Paper

The *In-vitro* Nutrients Degradation of Fragrant Lemongrass *(Cymbopogon nardus)* Waste and Characteristics of Fermented and Ammoniated Rumen Fluids

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ABSTRACT: *This research aimed to find out the processing techniques (fermentation and ammonia) that are more effective in soaked and non-soaked fragrant lemongrass (cymbopogon nardus) waste (FLW) as ruminant fodder based on the characteristics of rumen fluids; pH, NH_3 and VFA and digestation of DI (dry ingredients), OM (organic material), CP (coarse protein), ADF, NDF, cellulose and hemiscellulose in vitro. Fermented and ammonia using the help of microorganisms from probiotics namely starbio and urea. For fermentation use starbio. Ammonia uses urea. This research was conducted with four treatments such as A: fragrant lemongrass waste without immersion fermented for 10 days, B: fragrant lemongrass waste soaked for 4 hours at a temperature of 60 degrees then fermented for 10 days, C: fragrant lemongrass waste without immersion immersion for 10 days and D: fragrant lemongrass waste soaked for 4 hours with a temperature of 60 degrees and then diamoniasi for 10 days. The characteristics of rumen fluid and the nutritional digestability of fragrant lemongrass waste were tested by fermentation in vitro for 48 hours. Data analysis uses Group Randomized Design and is significant with DMRT (Duncan's Multiple Range Test). The results of the variety analysis showed that the treatment exerted a real different influence (P<0.05) on NH_3, the digestability of CP, ADF, NDF, cellulose and hemiscellulose. While pH, VFA and digestability of DI and OM are no different from real (P>0.05). It was concluded that the best nutritional digest is that soaked and diamoniasi fragrant lemongrass waste can also maintain pH, increasing the highest concentrations of VFA and NH_3.*

KEYWORDS: *Fragrant lemongrass waste (FLW), Starbio, Urea, characteristics of rumen fluid, digestibility, In vitro*

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I. INTRODUCTION

Forage feed rich in fiber, cellulose and hemiscellulose as a source of energy for ruminant cattle is very abundant, but the utilization of fiber feed is not optimal because the digestible value is relatively low. Fragrant lemongrass waste is one source of forage feed whose nutritional content is quite good where the protein content is 7.00% higher than rice straw which is only 3.93%, as well as other nutrient content such as: fat 2.35%, coarse fiber 25.73%, calcium 0.35%, phosphorus 0.14%, ash 7.19% and energy 3353.00 (kkal / GE / kg) [1]. [2] Fragrant lemongrass waste has great potential in the provision of forage feed for ruminant cattle because it is supported by the production of dry materials that are high enough to be available throughout the year and also have good quality. Generally all types of ruminant animal feed including fragrant lemongrass contain lignin. As [3] it states that fragrant lemongrass waste contains a fairly high lignin of 11.1%. The high content of lignin is an obstacle in its use as animal feed because of its low digest. Lignin is a major contributing factor to the inability of enzymes produced by microbes to digest feed materials, as lignin binds to cellulose which forms strong lignocellulose bonds and is very difficult to degrade by rumen microbes[4].

Ammonia and fermentation techniques are one way that can be done to break the lignin bond in fragrant lemongrass waste to increase its digestibility, increase its nutritional value and at the same time be able to

preserve the feed material. It has been proven by [5], that the use of starbio is able to increase the fermentation value of organic matter, especially fiber components so that fiber provides a better source of energy. The same opinion was also reported by [6] that the results of the application of fermented rice straw with starbio on folk farms showed a significant influence on the average consumption of dry materials where the consumption of dry ingredients fermented rice straw (4.41 kg / tail / day) with rice straw without fermentation (3.35 kg / tail / day) in Balinese cattle.

In addition to using fermentation techniques to increase the digestibility of ruminant animal feed ingredients, ammonization techniques are also no less great than it, where ammonia techniques are also able to increase the digestibility of nutrients contained in fragrant lemongrass waste. As [7] states, improvement in the quality of fibrous feed with urea ammonia is the occurrence of the tolerance of lignohemisellulosa and lignosellulosa bonds so that it is easy to digest and increases the nitrogen content of feed. [8] Also reported, ammonia processing techniques from several studies have been shown to improve the digestability of low-grade fiber feed. It has been proven in the results of experiments conducted by [9] that ammonia waste lemongrass fragrance with 4% urea is able to increase the digestability of dry materials 46.39% compared without ammonia.

One way to test the digestability quality of feed ingredients is to use in-vitro methods. In-vitro engineering[10] is a method of animal feed evaluation that uses laboratory chemical analysis. [11], which is used to predict what actually happens to the ruminant digestive process. [12] It states that In-vitro is a laboratory-scale indirect method for estimating digestion by mimicking processes that occur in the digestive tracts of ruminant animals.

Based on these conditions, this study was conducted to improve digestability and more efficient processing through fermentation and ammonia processes by using starbio and urea to find out the characteristics of rumen fluids (pH, VFA, NH_3) and to determine the digestability of DI (dry ingredients), OM (organic material), CP (coarse protein), NDF (Neutral Detergent Fiber) , ADF (Acid detergent fiber), Cellulose and Hemiscellulose invitro. The cellulolytic microbes found in Starbio and Urea are expected to produce cellulase enzymes that are able to remodel and stretch the bonds of lignosellulosa and lignohemisellulosa, so that fragrant lemongrass waste becomes more easily digested by rumen microbes.

II. MATERIALS AND METHODS

The material used in this experiment is fragrant lemongrass waste that has been dismembered, then fermented with starbio and diamoniasi with urea, then removed, the material to conduct in-vitro tests namely rumen fluid and Mcdougalls solution consisting of Na2CO3, Na2HPPO4.7H2O, KCL, MgSO4.7H2O, NaCl, CaCl22H2O, CO2 gas and aquades. Other chemicals used for the analysis of VFA and NH3 concentrations are vaseline, saturated Na2CO3 solution, indicator, H2SO4 solution 0.005 N, H2SO4 15%, NaOH solution 0.5 N, HCL solution 0.5 N and aquades. The equipment used in this study was a set of tools for fermentation and ammonia, a set of tools for proximal analysis, autoclaves, analytical scales, beaker glass, measuring pumpkins, magnetic stirrers, erlenmeyer, pH meters, penetes dolls, and a set of tools for Van Soest Analysis and others.

This research was conducted at the Ruminant Animal Nutrition Laboratory, the Feed Industry Technology Laboratory and the Non Ruminant Nutrition Laboratory, Faculty of Animal Science, Andalas University, Padang. The research design used a Randomized Block Design (RBD) with 4 treatments and 4 replications.

For Ammonia; (1) The fragrant lemongrass waste that is not soaked is cut into pieces, mixed with urea and chicken manure, then wrapped in glass plastic under aerobic conditions as much as 2 layers. Then, it was ammoniated for 10 days. (2) soaked fragrant lemongrass waste, this is similar to the previous ammonia. However, before being ammoniated, the material was soaked in a sheaker for 4 hours at a temperature of 60℃, then it was ammoniated. For Fermentation; (1) The fragrant lemongrass waste that is not soaked is cut into pieces, mixed with starbio and urea, then wrapped in glass plastic under aerobic conditions in 2 layers. Then fermented for 10 days. (2) soaked fragrant lemongrass waste, this is similar to the previous fermentation. However, before being fermented the material is soaked in a sheaker for 4 hours at a temperature of 60℃, then fermented. After the fragrant lemongrass waste is harvested, it is then ground and dried. The treatments obtained from the two different treatments were: A= FLW fermentation without immersion + starbio and urea for 10 days, B= FLW fermentation soaked at 60℃ for 4 hours + starbio and urea for 10 days, C = FLW ammonia without soaking + urea and chicken feces for 10 days, D = FLW ammonia soaked at 60℃ for 4 hours + urea and chicken feces for 10 days.

The measurement of the digestibility of citronella waste was carried out using the In vitro technique based on [11]. The samples of fragrant lemongrass waste from each treatment were weighed as much as 2.5 grams and put into an Erlenmeyer containing 200 ml of goat rumen fluid and 50 ml of Mc Doughal solution. Then put into a shaker waterbath which has been filled with water at 39°C and incubated for 48 hours. Then after incubation, all samples were analyzed to determine the digestibility of nutrients.

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The chemical analysis was carried out to determine the characteristics of the rumen fluid; pH, NH_3, VFA and digestibility of DI, OM, CP, NDF, ADF, cellulose, and hemicellulose from citronella waste. Statistical analysis to determine the effect of treatment on the observed variables was analyzed using the variance method and continued with Duncan's test [12].

III. RESULTS AND DISCUSSION

Based on statistical analysis of rumen fluid characteristics, it is known that the pH value of the rumen fluid, the results of measuring the concentration of NH_3 and the production value of VFA (Vollatile fatty acid) rumen fluid from fragrant lemongrass (*Cymbopogon nardus*) waste soaked and without soaking, fermented with starbio and ammoniated with urea in vitro can be seen in Fig. Table 1.

Table 1. Characteristics of in vitro rumen fluid of fermented and ammoniated fragrant lemongrass waste soaked and without soaking (mg%, mM)

Treatment	A	B	C	D	SE
pH	7,09±0,01	7,02±0,09	7,07±0,05	6,88±0,17	0,05
NH_3	$6,82^b$ ±0,04	$7,10^a$ ±0,20	$7,06^a$ ±0,17	$7,21^a$ ±0,05	0,07
VFA	77,5±5,00	82,5±2,89	81,5±2,50	87,5±5,00	2,13

Different superscript in the same rows were significantly different (P<0,05)

The results of statistical analysis of the characteristics of rumen fluid from the treatment of soaked and unsoaked fragrant lemongrass waste, fermented and ammoniated in vitro are shown in Table 1. Duncan's test results show that the NH_3 measurement value in the table is significantly different (P<0.05) while the pH value and VFA showed no significant difference (P>0.05).

The best results of NH_3 were shown in fragrant lemongrass waste that was soaked for 4 hours at a temperature of 60 degrees celsius then ammoniated with 4% urea for 10 days (7.21 mg%) compared to fragrant lemongrass waste without soaking then ammoniated with 4% urea for 10 days (7.06 mg%) and with fragrant lemongrass waste soaked for 4 hours with 60 degrees celsius milk then fermented with 0.6% starbio for 10 days (7.10 mg%) and with fragrant lemongrass waste without soaking then fermented with starbio 0, 6% for 10 days (6.82mg%).

The results of the in vitro measurement of VFA values were not significantly different (P>0.05) between treatments. However, the VFA value in Table 1 tends to increase. The highest VFA value was obtained in the treatment of fragrant lemongrass waste which was soaked for 4 hours at a temperature of 60 degrees celsius and then ammoniated with 4% urea for 10 days (87.5 mM) compared to fragrant lemongrass waste without soaking then ammoniated with 4% urea for 10 days (81.3mM) and with fragrant lemongrass waste soaked for 4 hours with 60 degrees celsius milk then fermented with 0.6% starbio for 10 days (82.5mM) and with fragrant lemongrass waste without soaking then fermented with 0.6% starbio for 10 days (77.5 mM).

The results of the analysis of variance showed that the treatment had no significant effect (P>0.05) on the pH of the rumen fluid and did not result in differences in the degree of acidity (pH) of the rumen fluid. The pH value of rumen fluid in Table 1 ranges from 6.88-7.09, where the resulting pH value is still in normal conditions for the development and growth of rumen microbes as stated by Owen and Goesth in [13] which states that the pH range is still in accordance with pH good rumen for the fermentation process is 6.0-7.2. [14] stated that those that affect the pH of the rumen fluid are the production of VFA and NH_3, an increase in VFA causes a decrease in the pH of the rumen fluid, but on the other hand, an increase in NH_3 causes an increase in the pH of the rumen fluid. However, according to [15] in Alqhafid (2019) the cause of the different conditions was not significantly the pH value of the rumen fluid obtained by each treatment due to the balance of acidic VFA and alkaline NH_3. In addition, it is also influenced by the presence of Mc.Dougalls solution (artificial saliva) which functions as a buffer or buffer solution that causes the pH of the rumen fluid to remain stable. Rumen microbes can work optimally to break down amino acids into ammonia at pH conditions of 6-7.2. An acidic rumen pH (low pH) can cause a decrease in microbial activity in the rumen [16]. [17] stated that the ideal rumen pH ranged from 6.50-7.10, at this pH condition it could support the growth of rumen microbes. According to [18] the degree of acidity of the rumen fluid is determined by the amount of bicarbonate (HCO3) and phosphate (HPO42) that comes from the salivary flow into the rumen. If the pH of the rumen fluid is lower than 6.00 or rising above 7.2, it can result in inhibition of the proteolysis process and deamination because cellulolytic microbial growth will be disrupted and cause the digestibility of crude fiber to decrease [19].

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The levels of NH_3 from the characteristics of the rumen fluid in the treatment of fragrant lemongrass waste which was soaked for 4 hours at a temperature of 60 degrees Celsius and then ammoniated with urea showed a significant effect ($P<0.05$) and the highest value compared to other treatments. This is because the N contained in urea undergoes N fixation into the fragrant lemongrass waste fiber, this is in accordance with the statement [20] which states that the ammonia treatment is effective in increasing the rumen NH_3 production. The soaking process can also remove the remaining citronella oil contained in the waste, thus affecting its digestibility. [21] explained that the minimum concentration of ammonia required for microbial protein synthesis is 5 mg%, equivalent to 3.74 mM, but if the feed has low fiber and protein digestibility, the optimum concentration of NH_3 required is higher, which is 20 mg% equivalent to 14.29 mM. According to [22] the concentration of NH_3 in the rumen fluid is influenced by the protein consumed and the protein degradation process in the rumen. Seen in the protein material in this study, the highest value was found in treatment D, which was 13.99%, while in treatment A the protein value of the material was only 12.71%. The digestibility of protein in the rumen in Treatment D was 56.81% while in treatment A was 42.13%. The protein available in the rumen greatly affects the production of ammonia. [23] stated that the factors that affect the production of NH_3 in the rumen are the length of feed in the rumen, carbohydrates in the ration, solubility and amount of feed and rumen pH. This is because treatment D has gone through the immersion stage so that the volatile and non-volatile compounds of citronella, citronellol, geraniol and compounds that have high boiling points such as resin polymer compounds contained in FLW have disappeared, while in treatment A has not gone through the process. the immersion stage so that there are still volatile and non-volatile terpene compounds such as citronella, sitonellol and geraniol that are not completely distilled in the citronella waste material, causing low NH_3 production. A higher value of NH_3 production is a more effective method, namely the AFLW method (ammoniated fragrant lemongrass waste) with 4 hours of immersion, but FFLW (fermented fragrant lemongrass waste) 4 hours of immersion is more effective than AFLW without soaking. According to [24] stated the concentration of NH_3 for optimal rumen microbial growth was in the range of 3.4-11 mg% rumen fluid. The concentration of NH_3 produced in this study is an ammonia concentration which is classified as an optimal concentration. Decreased NH_3 production was due to a decrease in protein protection so that microbial degraded feed decreased. [25] explained that the concentration of ammonia in the rumen is lower than 5 mg% will cause rumen microbial growth to be slow so that it can cause a decrease in feed digestibility, this is due to protein deficiency or protein deficiency is resistant to degradation, concluded that the level of ammonia in the rumen is an indication between the degradation process and the synthesis process by rumen microbes.

The VFA value of the characteristics of the rumen fluid in the treatment of fragrant lemongrass waste which was soaked for 4 hours at a temperature of 60 degrees Celsius and then ammoniated with urea showed a significant effect ($P<0.05$) and the highest value compared to other treatments. This happens because the process of immersing the volatile oil content from the heavy fraction group such as resins which have a high boiling point of polymer compounds contained in the fragrant lemongrass waste has disappeared while in treatment A it has not gone through the soaking stage process so that there are still volatile and non-volatile terpene compounds. such as citronellal, citronellol and geraniol which are not completely distilled are still present in the waste, causing low production of Volatile Fatty Acids (VFA). Higher production of VFA (Volatile Fatty Acid) becomes a more effective method, namely the AFLW (ammoniated fragrant lemongrass waste) metodh with 4 hours of immersion, but FFLW (fermented fragrant lemongrass waste) 4 hours of immersion is more effective than AFLW without soaking . The value of VFA concentration is more influenced by the substrate. The ammonia treatment was able to increase the VFA concentration compared to without going through the ammonia process, the ammonia treatment was able to damage the lignin bond with the feed fiber [26]. [27] also stated that the ammonia treatment would increase the digestibility of the fiber which resulted in an increase in the VFA concentration. The total VFA concentration in rumen fluid generally ranges from 70-130 mM [28]. According to [29] the high or low value of VFA concentration was influenced by the level of feed fermentability, the amount of soluble carbohydrates, rumen pH, digestibility of feed ingredients, the amount of feed, then the type of bacteria present in the rumen. In addition, non-structural carbohydrates (starch, pectin and simple sugars) are fermented faster than structural carbohydrates (cellulose, hemi cellulose and lignin). [30] explained that the concentration of VFA ranged from 60-150 mM. So that the production of VFA obtained in this study is able to support microbial growth and activity. If the VFA is too high, it can disrupt the balance of the rumen system [31].

Based on statistical analysis, it is known that the nutrient digestibility of fragrant lemongrass (*Cymbopogon nardus*) waste soaked and without soaking, fermented with starbio and ammoniated with urea in vitro can be seen in Table 2.

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Table 2. In vitro nutrient digestibility of fragrant lemongrass waste fermented and ammonia soaked and without soaking (%)

Digestibility	A	B	C	D	SE
	40,71±2,86	43,34±2,49	41,24±1,98	44,43±3,40	
DI (dry ingredients)	44,72+2,33	46,60+2,20	46,53+1,73	48,34+3,52	1.38
OM (organic material)	$42,13^{b}$ ±0,33	$50,96^{ab}$ ±3,45	$44,37^{b}$ ±1,79	$56,81^{a}$ ±10,33	1,31
CP (coarse protein)	$41,80^{b}$ ±0,70	$47,21^{a}$ ±3,15	$44,44^{ab}$ ±1,69	$47,67^{a}$ ±3,74	2,81
ADF	$41,81^{b}$ ±1,20	$47,54^{a}$ ±3,11	$44,50^{ab}$ ±1,96	$48,68^{a}$ ±3,63	1,26
NDF	$41,37^{b}$ ±2,14	$46,93^{a}$ ±1,84	$44,30^{ab}$ ±2,42	$47,19^{a}$ ±3,93	1,36
CELLULOSE	$41,82^{b}$ ±3,07	$48,11^{a}$ ±3,63	$44,62^{ab}$ ±2,85	$50,52^{a}$ ±3,60	1,35
HEMICELLULOSE					1,79

Different superscript in the same rows were significantly different (P<0,05)

The results of nutrient digestibility of fragrant lemongrass waste soaked and unsoaked, fermented and ammoniated in vitro are shown in Table 2. The results of Duncan's test showed that the digestibility of cellulose, hemicellulose, ADF, NDF and CP in the table was significantly different (P<0.05) while The digestibility of DI and OM in Table 2 showed no significant difference (P>0.05).

The digestibility results in DI and OM in vitro were not significantly different (P>0.05) between treatments. However, the digestibility values of DI and OM in Table 2 tend to increase. The highest digestibility of DI and OM was obtained in the treatment of fragrant lemongrass waste which was soaked for 4 hours at a temperature of 60 degrees Celsius then ammoniated with 4% urea for 10 days (DI; 44.43% and OM; 48.34%) compared to fragrant lemongrass waste. without soaking then ammoniated with 4% urea for 10 days (DI; 41.24% and OM; 46.53%) and with fragrant lemongrass waste soaked for 4 hours with 60 degrees Celsius milk then fermented with 0.6% starbio for 4 hours. 10 days (DI; 43.34% and OM; 46.60%) and with fragrant lemongrass waste without soaking then fermented with 0.6% starbio for 10 days (DI; 40.71% and OM; 44.72%).

The best results of CP digestibility in fragrant lemongrass waste were shown in the treatment of fragrant lemongrass waste which was soaked for 4 hours at a temperature of 60 degrees celsius then ammoniated with 4% urea for 10 days (56.81%) compared to fragrant lemongrass waste without soaking then ammoniated with urea. 4% for 10 days (44.37%) and with fragrant lemongrass waste soaked for 4 hours with 60 degrees celsius milk then fermented with 0.6% starbio for 10 days (50.96%) and with citronella waste without soaking then fermented with 0.6% starbio for 10 days (42.13%).

The best results of ADF and NDF digestibility of fragrant lemongrass waste were also shown in the treatment of soaking fragrant lemongrass waste for 4 hours at a temperature of 60 degrees celsius then ammoniated with 4% urea and fermented with 0.6% starbio for 10 days (ADF; 47.67% and 47.21%), (NDF; 48.68% and 47.54%) were compared with the treatment without immersion then ammoniated with 4% urea and fermented with starbio 0.6% for 10 days (ADF; 44.44% and 41 .80%), (NDF; 44.50% and 41.81%).

The best results of digestibility of cellulose and hemicellulose in fragrant lemongrass waste were shown in the treatment of fragrant lemongrass waste which was soaked for 4 hours at a temperature of 60 degrees celsius then ammoniated with 4% urea for 10 days (cellulose; 47.19% and hemicellulose; 50.52%) compared with fragrant lemongrass waste without soaking and then ammoniating with 4% urea for 10 days (cellulose; 44,30% and hemicellulose; 44,62%) and with fragrant lemongrass waste soaked for 4 hours with 60 degrees Celsius milk then fermented with starbio 0.6% for 10 days (cellulose; 46.93% and hemicellulose; 48.11%) and with fragrant lemongrass waste without soaking then fermented with 0.6% starbio for 10 days (cellulose; 41.37% and hemicellulose; 41.82%).

The results of the digestibility analysis of DI and OM in fragrant lemongrass waste did not give a significantly different effect (P>0.05) on the treatment. However, the highest DI and OM digestibility values were found in fragrant lemongrass waste which was soaked for 4 hours at a temperature of 60 degrees celsius and then ammoniated for 10 days (DI; 44.43% and OM; 48.34%) compared to other treatments. This happens because, this is because heating the fragrant lemongrass waste results in damage to the carbohydrate structure on its cell walls, thereby facilitating the penetration of enzymes during the ammoniating process with urea, where ammonia has the ability to cause changes in the composition and structure of the cell walls of fragrant lemongrass waste so that it loosens lignin bonds with cellulose and hemicellulose contained in the waste. This statement is in accordance with the opinion [32] which states that urea can loosen the lignocellulosic bonds so that they are stretched and the crystal portion is reduced. This facilitates the penetration of enzymes produced by bacteria and fungi so as to increase the digestibility of dry matter, organic matter, cell walls and TDN. Ammonia using urea will cause an overhaul of organic matter which is increasing due to the hydrolysis process of urea

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into NH_3 which then binds to water H_2O and undergoes hydrolysis to NH_4^+ and OH. The OH group is then able to break the hydrogen bonds between the carbons contained in the bonds of cellulose, lignocellulose and lignohemicellulose [33]. [34] also added, the ammonia formed from the hydrolysis of urea is able to change the composition and structure of the cell wall, besides that it can loosen or free the bonds between lignin and cellulose or hemicellulose, namely through breaking the hydrogen chain between cellulose and lignin or hemicellulose.

Digestibility of crude protein in fragrant lemongrass waste soaked for 4 hours at a temperature of 60 degrees Celsius and then ammoniated with urea showed a significant effect ($P<0.05$) and the highest value compared to other treatments. This happens, as a result of heating the fragrant lemongrass waste causing damage to the cell structure in the cell wall of the waste, thus facilitating the penetration of lignolytic, proteolytic, lipolytic, cellulolytic enzymes and others when amoniating the fragrant lemongrass waste, where urea is hydrolyzed. produce ammonia, which will later be fixed into the waste tissue so that this fixed N will increase the crude protein of fragrant lemongrass waste. As [35] stated that, the increase in crude protein levels ammoniated with urea was as a result of the presence of ammonia resulting from the hydrolysis of urea which was fixed into the fiber network and fixed nitrogen would be measured as crude protein. The statement above has been proven that in the table the composition of CP levels of soaked fragrant lemongrass waste ammoniation is 13.99% while the CP level of soaked fragrant lemongrass waste fermentation is 12.73% so the higher the N content in an ingredient, the higher the protein value. Measurable roughness. [36] also stated that the ammonia process will cause nitrogen (N) fixation into the feed material tissue (fragrant lemongrass waste) and this fixed nitrogen will later be measured as crude protein.

The digestibility of cellulose in fragrant lemongrass waste soaked for 4 hours at a temperature of 60 degrees Celsius and then treated with urea showed a significant effect ($P<0.05$) and the highest value compared to other treatments. This happens, as a result of heating fragrant lemongrass waste causing damage to the cell structure in the cell wall of the waste, thus facilitating the penetration of enzymes such as; lignolytic, proteolytic, lipolytic, cellulolytic and others when ammoniating the fragrant lemongrass waste, because ammonia contains bacteria contained in urea which are able to loosen cellulose bonds so that it is easily digested by rumen bacteria and is also able to supply nitrogen for the growth of rumen bacteria. NH3 will undergo hydrolysis with water molecules into NH4+ and OH, the OH group can break hydrogen bonds in lignocellulosic and lignohemicellulose [37]. [38] also explained that ammonia treatment with urea in fiber feed was able to loosen the cellulose bonds so that they were easily digested by rumen bacteria and were also able to supply nitrogen for the growth of rumen bacteria. Besides that, ruminants are able to utilize cellulose and hemicellulose due to the presence of microorganisms in the rumen that help the fermentation and ammonia processes so that these structural carbohydrates are remodeled into products that can be digested and absorbed by the small intestine [39]). Based on the table of chemical composition, the dry matter content of fragrant lemongrass waste treated by soaking has decreased in chemical composition, but there has been an increase in the chemical composition of cellulose, namely; fermentation of; 28.88% to 29.41% & ammonia from; 30.13% to 31.07%. As a result of a decrease in the dry matter composition due to the loss of soluble cell contents resulting in a decrease in the value of the feed and a decrease in lignin resulting in an increase in the fiber fraction, therefore the higher the cellulose content the higher the digestibility value, because the low quality of forage feed is characterized by high lignocellulose content and low nitrogen content [40].

The digestibility of ADF and NDF in fragrant lemongrass waste soaked for 4 hours at a temperature of 60 degrees celsius and then ammoniated also showed a significant effect and the highest value compared to other treatments. As previously explained, this occurs as a result of heating the fragrant lemongrass waste causing damage to the cell structure in the cell walls of the waste, thus facilitating the penetration of enzymes such as; lignolytic, proteolytic, lipolytic, cellulolytic and others when doing ammoniation of the fragrant lemongrass waste, because urea has the ability to break bonds such as hydrogen bonds between oxygen at carbon number 2 of one glucose molecule and carbon oxygen number 6 another glucose molecule contained in the bond. cellulose, lignocellulose and lignohemicellulose [41]. Urea ammonia can also cause changes in the composition and structure of cell walls that play a role in freeing the bonds between lignin and cellulose and hemicellulose [42]. As explained [43] the digestibility of cell walls is highly dependent on the level of lignification, it is because lignin often binds to structural carbohydrates of cellulose and hemicellulose which forms lignocellulosic and lignohemicellulose complex bonds which affect the digestibility of the ration. On the other hand, NDF is a food substance that is soluble in neutral detergents and is the largest part of plant cell walls. In accordance with the opinion of [44], the digestibility of fiber feed ingredients will be greatly influenced by the content of the constituent cell walls of the material, namely NDF. This material consists of cellulose, hemicellulose, lignin, silica and some fibrous proteins [45]. This is supported by research [46] that is, beef cattle and buffalo fed with ammonium hay basalt fed by intra-rumen urea infusion showed an increase in dry matter digestibility, crude protein and NDF digestibility values. Acid detergent fiber (ADF) is a food substance that is insoluble in acid. ADF consists of cellulose, lignin and silica [47]. The higher the ADF content, the lower the

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forage quality [48]. Because Lignin is a feed ingredient that is difficult to digest by rumen microbes. [49] stated that lignin binds cellulose and hemicellulose which cannot be digested by enzymes produced by rumen microbes. This will have an impact on the low value of feed digestibility.

Duncan's test showed that the digestibility of hemicellulose waste fragrant lemongrass which was soaked for 4 hours at a temperature of 60 degrees celsius and then treated showed a significant effect and the highest value compared to other treatments, the digestibility of the fiber fraction (hemicellulose) in fragrant lemongrass waste was superior to the digestibility fraction. other fibers (cellulose, ADF and NDF). Different hemicellulose digestibility was influenced by different levels of NDF and ADF. The content of ADF and NDF is high so that the digestibility of hemicellulose is also high. This increase in the digestibility of hemicellulose as a result of heating fragrant lemongrass waste causes damage to the cell structure in the cell wall of the waste, thus facilitating the penetration of enzymes such as; lignolytic, proteolytic, lipolytic, cellulolytic and others when doing ammoniation of the fragrant lemongrass waste, because, there has been a stretching of the lignin and hemicellulose bonds during urea ammoniation so that the degradation of hemicellulose in the rumen in-vitro increases. According to opinion [50] the digestibility of hemicellulose is higher than that of cellulose, because hemicellulose is a fraction that is more easily digested by rumen microbes than cellulose. Hemicellulose is the difference between the NDF content and the ADF content. The increased digestibility of hemicellulose is part of the plant cell wall that is easily utilized by livestock. [51] According to the most easily absorbed component in the rumen is hemicellulose compared to cellulose. According to [52], hemicellulose and cellulose are the two main carbohydrate compounds found in forage feeds and are very important for ruminants as an energy source. The digestibility of hemicellulose is higher than that of cellulose because the constituent components of hemicellulose consist of carbohydrate polymers containing hexose, pentose, araban, xylan, polyuronic sugars which are less resistant to chemical solvents or enzymatic reactions than cellulose [53].

IV. CONCLUSION

Based on the results of this study, it can be concluded that treatment D, namely citronella waste soaked for 4 hours at a temperature of 60℃ which was ammoniated with urea produced the best fiber fraction digestibility, namely ADF 47.67%; NDF 48.68%; Cellulose 47.19%; and Hemicellulose 50.52% and digestibility CP 56.81% and tend to increase digestibility DI 44.43%; OM 48.34% and maintain the pH, increasing the concentration of VFA and the highest concentration of NH_3.

V. RECOMMENDATION

Based on the research findings, the research offers some recommendations that for further research needs to be done by making rations that are added with fragrant lemongrass waste which is soaked for 4 hours at a temperature of 60℃ and ammoniated with urea to see the effect of nutrient digestibility of fragrant lemongrass waste and the characteristics of rumen fluid on livestock *in-vivo* metodh.

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