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DEGRADATION FERMENTED FEED ANIMAL BASED LOCAL MIKROORGANISM TO INCREASED NUTRIENT QUALITY OF THE WASTE GAMBIR FERMENTED

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ABSTRACT

The efforts to reduce production costs to minimize feed costs, so that farmers can benefit from livestock business. One way to meet the availability of feed ingredients quality and quantity as feed animal. The materials and tools used in this study were gambir extraction waste, local microorganism, rice washing water, fine bran, rumen microbes, Mc Dougall buffer solution, fermentation rack, salt, brown sugar, plastic and a set of tools for in-vitro testing. The study was conducted experimentally with a 3x4 factorial Randomized Block Design pattern with two replications for each treatment combination. Based on statistical analysis, it was shown that the use of bran and fermentation time had an insignificant ($P>0.05$) effect on Crude Protein (CP) degradation in the rumen in vitro and a very significant ($P<0.01$) effect on NH3 production, Crude Fiber (CF) Degradation and volatile fatty acid Production. The results of study was that leg fermented with local microorganisms showed no significant difference in CP degradation, while NH3 production. CF degradation and volatile fatty acid production increased from leg fermented with local microorganisms without the addition of bran, so it could be used as feed ruminant.

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INTRODUCTION

Feed was an important aspect of supporting a farm business in order to run properly. The need for feed of each type of cattle is of a different proportion, according to age, physiological condition, weight of the animal body and environment (Putu, 2017). Feed needs to be balanced and can be used for production such items as milk, meat, wool, and other items. According to the quality of the feed animal found in Indonesia, it can be quite low, resulting in low productivity and could disrupt the sustainability of the farm (Yulianto et al., 2017).

The foodstuff that will be given to cattle requires attention on the nutritional content and availability of all time and efficiency in the cost of production, so it is necessary to make alternatives or innovation in agricultural waste use as feed animal. Waste farms with high potential in Jember county are production of coffee. The waste gambir fermented has a high concentration of nutrients in the protein content. Gambir production in jember district increase in 2013-2017 from the total production of 3,105 tons to about 11,863 tons (BPS Jatim, 2022).

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Agricultural waste can be used as an alternative source of feed for livestock. Inovation and biotechnology in agricultural waste is often not used as feed cattle because low nutrients and thus requires effort to improve the quality of nutrients as a fodder that can be used over a long period of time (Yulianto et al., 2016). Agricultural waste can be used and available in large quantities such as gambir waste. The use of gambir waste can be used as an alternative source of feed animal with biotechnology innovations such as fermentation (Ingersoll, 2020).

The quality of gambir waste has a high protein content of approximately 11%, fat, 1,0%, coarse fiber 18,28%, phosphorus 0.03%, and calcium 0.21%. The antinutrition found in existing gambir waste is high enough that it would require a biotech innovation in improving nutrition quality and lowering the anti nutrient content in the gambir waste (Ofori et al., 2022).

An alternative feed livestock could be enhanced in nutritional quality with the use of the local microorganism (MOL) as a source of fermentation. Alternative feed cattle ingredients can be used when it enters the dry season in which greenish production begins to run short. Fermentation is a biological process by which microorganisms local are used to harness enzymes that would produce enzymes to change complexes, carbohydrates and fats. Microorganisms or shells that can be used to support fermentation processes are the MOL. The use of fermented gambir waste can improve the quality of coarse fibers, proteins and fat content (Daning & Foekh, 2018). The MOL, known to the public for their lipolitical and protective-such enzymes as amilase, lipase, and protease have functions that help substrate hydrolysis and thus be quickly digested by the livestock's digestive system (Tang et al., 2019).

Based on description of the background and research problem, the objectives of the this study as follows: 1. To find fermented gambir waste can improve the quality of high nutrition as innovation, and implications of biotechnology feed cattle; 2. Finding local raw materials for fermented gambir waste as animal feed in quality and quantity to increased nutritional value, increasing digestibility, growth and livestock production; 3. Finding ration formulations to reduce feed costs; 4. Finding optimal research results in the use of fermenters in improving the nutritional quality of gambir waste as animal feed that is more innovative.

LITERATURE REVIEW

Gambir Waste

Gambir Waste is one of the principal plants compared with others and important aspek in the Indonesian gambir farmer economy (Kasim et al., 2019). Gambir (Uncaria Gambir Roxb), the structure is made up of four parts of the seed (endosperm), inner skin (parchment), fruits meat (exocarp) and outer skin (exocarp) (Yulianto et al., 2017). In addition to the production of gambir, could also produce an abundance of waste shells. Are often neglected by communities for reuse and therefore disposed of indiscriminably, which can result in pollution, agricultural pests and plant diseases. Few farmers are left to turn the fruit into fertilizer for the plants. Nutrients in the waste from the gambir plant can be used as feed animal because of its high nutrient quality. The nutritional composition of gambir waste, such as rough fibers, is 17,2% of metabolic energy, 14,33 mj /kg, and 11% of crude proteins (Nurdin, 2018; Pramana et al., 2021; Sofyan et al., 2021).

Fermentation

Fermentation gambir waste is a biotechnological innovation used to improve the nutritional quality of a foodstuff, and it can lower the percentage of coarse fibers and enhance the scent of cattle. The process of fermentation by converting substrates into a specific molecule or product determined through the process of helping microorganisms. Microorganisms are often used for the preservation of food and drink in order to last a long period of time (Tamang et al., 2020). Nutrients in the waste from the gambir plant can be used as feed animal because of its high nutrient quality.

Fermentation can work by requiring microorganisms or microorganisms to be inoculated to ensure optimal fermentation (medium) and a source of nutrition for microorganism (Valero-Cases et al., 2020). Menurut Lynch et al., (2019), Fermentation is

a preservative method of changing aerobic or anaerobic chemical structures through a system created by enzymes of microorganisms. In addition, a number of microorganisms are known to be able to synthesize certain vitamins and amino acids (Szutowska, 2020).

The process of fermentation as well as the growth of microorganisms requires additional nutrition. Sufficient nutrients such as carbohydrates, minerals, nitrogen so that microorganisms can grow and reproduce to a maximum (Canon et al., 2021). The fermentation process can also use bacteria or a mixture of various microorganisms for fermentation, one of which is a mixture of rhizopus oligosporus and Em^{-4}, which has been shown to significantly reduce the fiber ratio of coarse and improve efficiency of the feed (Tafsin, 2019).

Local Microorganism (MOL)

Local Microorganism is a type of shell that is often used for improved nutritional qualities, one of which is used as a fermented media of agricultural waste. MOL commonly used to ferment waste agriculture for feet cattle into a feed product (Arifan et al., 2020). MOL is the shell producing such enzymes as amyliase, protease and lipase that are often found in processed plants and products.

This kapt MOL is often used by communities as a fermented media that serves to improve the nutritional quality of products and livestock health (Villa et al., 2022). According to Arifan (2020) MOL, a type of fermented that can form peptides or protease, this enzyme can catalyze the hydrolytic chains of peptides into short, free amino acids, which the animal can then absorb or assimilate faster. Some peptides are also biologically active, which can increase the quality of cattle by acting as antibacteria, antiinflammatory and immunomodulators (Zaky et al., 2021). Aspartate protease is often used by society to improve the nutritional and quality of a product (Kieliszek et al., 2021). Christensen et al., (2022) reveals that during the fermentation process, the protease produced by MOL has high-protein activities and does not produce toxins. Libraries and research have this far no evidence of the production of toxins caused by the kapt MOL.

Agricultural waste used for feed has a low quality because it contains coarse fibers and high-enough lignins that can cause health and cattle growth to become impaired (Li et al., 2021). Chen et al., (2020) reveals that the food material that has high fiber content can be neutralized by fermentation using the kapt MOL. Apart from alternatives to the low quality of fodder materials, there are several problems that can impede the metabolism of livestock because of toxins produced from the plant or shells that grow and contaminate the foodstuff caused by mismanagement of storage procedures (Tafsin, 2019). Some of these problems can interferences with the absorption of nutrients or minerals in livestock, which leads to growth being stunted and ruining health. The problem could be addressed in several ways, and one of the ways is the use of the MOL as the bastion of the feed ingredients.

Local s one of the shells that can grow and spread in a tropical climate, known for its presence in the agricultural industry for its ability to produce polluting aflatoxin compounds crops are like fodder of livestock (Arifan et al., 2020). MOL is one of the kapt that can control MOL and aflatoxin, rhizopus oligosporus interferes with the growth of aspergilus flavus or ignoring the aflatoxin concentration produced by competing systems and the ability to stimulate metabolism that, in some other way, impact competitive growth.

Based on the content of the legal nutritional value (gambir extraction waste) is sufficient to qualify for feed animal, but the tinnetic content of fiber fractions in the leg, it is necessary to promise promising processing to remodel fiber faction. MOL are microorganisms made from fluid of natural origin that is preferred as a living medium and development of microorganisms that are useful to accelerate the destruction of organic materials and additional nutritional actors for plants deliberately developed from the microorganisms located in the opposite. That to know the grossial rate of food substances need to be developed a laboratory method known as in-vitro method.

METHODS

The study uses a method of experimentation on random groupings (racks) factorial pattern 3 x 4 with 2 deuteronomy as a group for each combination of treatment. Matematical model of random design group (rack) factorial pattern stell and torrie (1985).

$$Yijk = \mu + \alpha i + \beta j + (\alpha\beta)ij + \Sigma ijk \quad (1)$$

The description of the above equation in equation 1, Yijk is observation value on the war unit that obtains treatment at the I-point level of factor A, at the level of J-Factor to B and repetition – k, μ is population middle value, αi is the impact of the I-point level of factor A. βj is effect of the J- level of factor B, (αβ)ij is influence of interaction between the i-level to factor of A with the level -j to Factor B, Σijk is effect of error from the k experimental unit that received the combination treatment ij, I (A1, A2, A3) bran addition A1= 100% LEG + 10% Bran, A2 = 90% LEG + 10% bran, A3= 80% LEG + 10% bran. J is duration of fermentation (5, 10, 15 and 20 days), and k is 1,2 (replication).

The materials and tools used in this study were gambir extraction waste, MOL, rice washing water, fine bran, rumen microbes, Mc Dougall buffer solution, fermentation rack, salt, brown sugar, plastic and a set of tools for in-vitro testing. The treatments tested were factor A: Addition of bran in LEG A1 (0% bran + 100% LEG), A2 (10% bran + 90% LEG), A3 (80% bran + 20% LEG) and factor B: duration of fermentation B1 (5 Days), B2 (10 Days), and B3 (15 Days). The study was conducted experimentally with a 3x4 factorial Randomized Block Design pattern with 2 replications for each treatment combination. If there is a difference between the treatments, it will be tested further with the Ducans Multiple Range Test (DMRT). The experimental design is presented in **Table 1**.

Table 1. Experimental Design

A1B1 I	**A1B2 I**	**A1B3 I**	**A1B4 I**
A1B1 II	A1B2 II	A1B3 II	A1B4 II
A2B1 I	A2B2 I	A2B3 I	A2B4 I
A2B1 II	A2B2 II	A2B3 II	A2B4 II
A3B1 I	A3B2 I	A3B3 I	A3B4 I
A3B1 II	A3B2 II	A3B3 II	A3B4 II

Based on **Table 1**, the data obtained were analyzed by using the diversity analysis of the random design of the group (RAK) of the factorial pattern. The difference between treatment was tested with Duncans Multiple Range Test (DMRT) according to Dwijoseputro (1997).

RESULTS AND DISCUSSION

The effect treatment to the degradation crude protein (%)

Protein degradation is a process of breaking protein from the bonds contained therein. This degradation can occur due to heating or contamination with chemicals. To determine crude protein analysis using proximate analysis in the laboratory. The result of this study crude protein of the degradation fermented feed animal using local mikroorganism to increased nutrient quality of the waste gambir fermented as feed animal using MOL between 43,00% - 50,86%. Regradronical degradation of the capacity waste frameration extraction of Gambir extraction is presented in **Table 2**.

Table 2. Regradronical degradation of the capacity waste frameration extraction of Gambir extraction (%)

Factor A (Bran addition)	Factor B (Duration of fermentation)				Average
	B1	B2	B3	B4	
A1	46,99	50,86	49,28	44,42	47,89
A2	45,79	47,10	45,75	44,00	45,66
A3	44,37	46,78	43,06	40,58	43,70
Average	45,72	48,25	46,03	43,00	45,75

Description: * The different little letters a and b and capital letter A and B on the same line indicate significant different (P <0.01); *The capital letter a and b on the same column were significant different (P<0.01).

Analysis of diversity shows that each combination of treatment influences differently is not significant (P>0.05) against crude protein degradation and no interaction between the addition of bran and the length of fermentation. According to the Dwijoseputro, (1990:123) the stationer phase or the regular growth of protein donated from the body of kapang and enzymes produced is the same, so the stationer stage is not growing again because of the nutrient decline. Canon et al., (2021), stating that the stationer stage is a fixed number of cells because the number of cells growing with the same number of cells that die.

Effects on treatment of NH_3 production

Protein synthesis can be done by synchronizing the availability of nitrogen and carbon sources with rumen microbial activity in degrading feed. The result of study NH_3 production of the degradation fermented feed animal using MOL to increased nutrient quality of the waste gambir fermented presented in **Table 3**.

Table 3. HN_3 (mg/100 ml of Rumen Fluid) In-Vitro Waste Extraction of Gambir with the Addition of Bran and Different Fermented Forms Using MOL

Faktor A (Bran Addition)	Faktor B (Duration of Fermentation)				Average
	B1	B2	B3	B4	
A1	21,87	23,00	20,75	18,51	21,03[a]
A2	18,51	19,63	17,93	16,83	18,09[ab]
A3	16,26	18,51	15,14	14,58	16,12[b]
Average	18,88[a]	20,38[a]	17,76[ab]	16,64[b]	18,41

Description: * The different little letters a and b and capital letter A and B on the same line indicate significant different (P <0.01); *The capital letter a and b on the same column were significant different (P<0.01).

The different capital letters in the same column shows differently very real (P<0.01). The result of diversity analysis shows that each different combination of treatment is (P<0.01) against NH_3 production. Advanced test results using DMRT show that the A and B factor provides significant different (P<0.01) against NH_3 production, while the interaction between factor A and B factor provides different unusable effects (P>0.05). A1 treatment is no different significantly to A2, while with a significant different A3 (P<0.01). In Table 2 it appears that without the addition of the NH_3 production distance is much higher than the addition of the bran. The same is also confirmed by Ørskov & McDonald, (1979) that the higher the protein that can be relegated by rumen microbes higher the NH_3 produced. The minimum limit of ammonia that can support the growth of rumen microbial is 5 mg / 100 ml of rumen fluid and NH_3 needs for maximum rumen fermentation activities in the forage is 23 mg / 100 ml of rumen fluid (Christensen et al., 2022).

The treatment B1with B2 and B3 obtained different results are not significant, while B1 treatment with B4 is different, where fermentation of 5-15 days of influence is not real to the production of NH_3, while in the treatment of B4 production of NH_3 is very real decreased. This illustrates that at the age of 20 days fermentation (B4) protein degradation has been very decreased, as some proteins have been used for the growth needs of microorganisms.

The effect of treatment on Volatile Fatty Acid production

VFA (volatile fatty acid) is the result of fermentation of organic matter in the form of carbohydrates. VFA is the main source of energy for ruminants and a source of carbon framework for the formation of microbial proteins. The result of this study VFA production of the degradation fermented feed animal using MOL to increased nutrient quality of the waste gambir fermented using MOLs between 100 mM - 145 mM presented in **Table 4**.

The result of diversity analysis shows that each different combination of treatment is significant different (P<0.01) to the VFA production. Advanced test results using DMRT show that the A and B factor provides a significant different effective (P<0.01) against the production of VFA, while the interaction between factor A and B factor provides a non-real influence (P>0.05).

Table 4. VFA production (mm) in-vitro waste of gambir extraction is fermented by MOL

Factor A (Bran Addition)	Factor B (Duration of Fermentation)				Average
	B1	B2	B3	B4	
A1	135,00	145,00	125,00	105,00	127,50[a]
A2	125,00	140,00	120,00	105,00	122,50[ab]
A3	105,00	125,00	115,00	100,00	111,25[b]
The Average	121,67[a]	136,67[a]	120,00[a]	103,33[b]	120,42

Description: * The little letters a and b on the same line indicate were significant different (P<0.01); * The capital letter a and b on the same column were significant different (P<0.01)

A1 treatment is not different with A2, while a very different with A3 (P<0.01). This is due to the addition of the bran in an fermentation using microorganisms making a feed material into fermentable. Riestanti & Retnani, (2020) states that the indication of a feed material is said to be fermentable is where the production of VFA is required for growth and rumen microbial activity is 80-160 mM.

In the B1 treatment with B2 treatment, and B3 is not different (P<0.05), while with BI is significant different (P<0.01). In this study it is seen that the longer the fermentation time provided does not guarantee the fermentability of an increase in materials, this is illustrated on the VFA produced, where at the long time fermentation of 5-15 days (treatment B1 to B3) the production of VFA reaches the optimum, but in the day of 20 VFA production decreases sharply. This is due to the longer fermentation, the larger the occurrence of rough fibers and the cellular component of other cells becomes a more simple molecule such as glucose. In accordance with the opinion of Mulianda et al., (2018) which states the high degree of rough fiber in the rumen will result in the production of VFA increased.

CONCLUSION

Based on the results of the study can be concluded that the legally fermented legally shows the result of different results is not significant to the degradation of a protein, as well as the debrasiation of the rough fiber, the production of VFA and NH_3 increased from the legally fermented leg without the addition of the bran, so it can be used as a rich animal rich in nutrients. For innovation in the biotechnology of feed processing using the leg, in the next study recommended media (fermentation substrate) particle size is expected to be smaller so it is easier to process in the digestive tract, and increased gustlic rate of ruminant livestock.

Author's declaration

Authors' contributions and responsibilities

The authors made substantial contributions to the conception and design of the study. The authors took responsibility for data analysis, interpretation and discussion of results. The authors read and approved the final manuscript.

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Availability of data and materials

All data are available from the authors.

Competing interests

The authors declare no competing interest.

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