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0972-3005 **ENHANCEMENT FERMENTED OLI PALM TRUNK ON RATION COMPLETE ON RUMEN DEGRADABILITY IN VITRO**

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(Received 28 February,

2018; accepted 30 April, 2018) Key words : Degradability, In vitro, Fiber fraction, Fermented Abstract – [This study aimed to](#)

[determine](#)

enhancement [of](#)

fermented oil palm trunk on ration complete on rumen degradability in vitro. The

experiment [was conducted using a Randomized Block Design](#) (RBD) consisted of 4 treatments and 4 replication. The treatment provided were A: 30% of fermented oil palm trunk plus 70% concentrates; B: 40% of fermented oil palm trunk plus 60% concentrates; C: 50% of fermented oil palm trunk plus 50% concentrates; D: 60% of fermented oil palm trunk plus 40% concentrates, and the measured variables were chemical composition and rumen degradability in vitro such as dry matter (DM), organic matter (OM) digestibility, rumen fluid characteristics (pH, NH₃, and VFA) as well as fiber fraction

digestibility (NDF, ADF, cellulose). [The results showed that](#)

the treatment [significantly](#)

affected ([P< 0.](#)

01) on [the](#)

DM, OM digestibility, fiber fraction digestibility (NDF, ADF, cellulose), NH₃ and VFA and [did not](#)

[significantly affect \(P> 0.05\)](#)

on pH. [The](#)

finding indicated that the use of 40% of fermented oil palm trunk plus 60% concentrates yields the best rumen degradability with the following characteristics: DM and OM degradability: 67.39%, and 67.52 %, ADF, NDF and cellulose degradability : 43.03%, 54.13%, and 58.26% for ADF, NDF and cellulose. The rumen characteristic were: 6.89, 18.49 (mg/100), 98.75 (mM) for pH, NH₃ and VFA, respectively. INTRODUCTION The lack of adequate feed in Indonesia is a major concern for livestock farmers despite the large amount of various byproducts produced in developing countries. Palm oil and industrial oil palm waste are among the most important lignocellulosic compounds (Awalludin et al., 2015). which contain larger quantities of such as oil palm trunk (OPT) and oil palm front (OPF) whereas the by-products are obtained from residues in the plantations. OPT is only available after oil palms are felled for replanting at an age of about 25 years. The biomass consists mainly of vascular bundles and parenchyma tissues. The nutritive value of OPT is similar to PPF and it contains about 3% CP. The vascular bundles contain less lignin than the parenchyma tissues and in digestibility studies with sheep; the parenchyma tissue had higher dry matter and organic matter values (Zahari et al., 2009). To improve usability of carbohydrates contained in parenchyma tissue, microorganisms of rumen should be provided with greater access to components of cell walls. OPT is not among the favorite nutrients easily accessible by livestock, processing can enhance their nutritional value and provide captive animals with suitable feed (Marlida et al., 2016). Low crude protein, high lignin and low palatability are the limiting factors of the OPT as animal

feeding. The biological treatment such as fermentation is the technique is safer and cheaper than other, and fermentation using fungi more easily compared to an other microbes. Among these fungi are white rot fungi that belong to Phanerochaete chrysosporium and are highly capable of degradation and consuming lignin and cell wall compounds (Elisashvili and Kachlishvili, 2009). White rot fungi have also been shown to selectively degrade lignin (Van Kuijk et al., 2015; Sindhu et al., 2016). To reach the target of Indonesia government it is necessary to create a local feed in the form of a *Corresponding author's email: yettimarlida@ansci.unand.ac.id Enhancement Fermented Oli Palm Trunk on Ration Complete on Rumen Degradability In vitro S37 complete feed that is cheap and gives a high daily weight gain. The complete feed based on palm oil waste (fermented oil palm trunk) hopefully can be used as animal feeding more than 30% in the ration. The present study, therefore, attempts to examine effects improvement of fermented oil palm trunk on ration complete to chemical composition and rumen degradability. MATERIALS AND METHODS [Preparation of oil palm trunk: Oil palm trunk \(OPT\)](#)

[collected from field used as](#) raw materials, [it was ground and sieved to 18-20 mesh by shredding machine. The](#)

[shredded oil palm trunk was dried at 60](#) OC [in an oven for 12 h. The dried oil palm trunk](#) (OPT) [was kept](#)

[ready for the further use.](#) Fermentation [of oil](#) palm [trunk:](#) Fermentation [of oil palm trunk was](#) performed using Phanerochaete chrysosporium mold, which was fermented for 21 days with the addition of 0.03% urea in the

fermentation medium. The proximate analysis [of oil palm trunk](#) and fermented [oil palm trunk](#) by AOAC (2000) and fiber fraction by Van Soest (1991). Preparation of complete ration: Complete ration is composed of a combination of fermented oil palm trunk and concentrate, where with increasing fermented oil palm trunk, there will be a decrease in the use of concentrate in the ration. The composition of concentrates (Table 1.) [In vitro digestibility assay: In vitro digestibility](#)

[was analyzed by Tilley and](#) Terry (1963). [Fistula cow rumen fluid was diluted using McDougal Buffer \(1:4\) and dispensed into a 1 g substrate-prepared incubation tube, which was purged with CO2 to maintain an aerobic condition. The tubes were incubated in a water bath at 39°C for 24 h. After fermentation, the erlenmeyer tube containing the sample was](#)

[inserted into ice water to stop the fermentation. All samples were then centrifuged at](#) Table1. The composition of concentrates using in completion Requirement (%) Corn Rice bran Palm kernel cake Urea Mineral Salt Total 33 30 35 0.5 1.0 0.5 100 1,200 [rpm for 15 min. The pH, NH3-N and total VFA of the supernatants were then recorded. The NH3-N concentration was measured using the micro- diffusion conway method and the total VFA concentration was measured using the steam distillation method. The previously incubated samples were vacuum filtered \(Whatman No. 41\) and dried at 60°C in an oven. The dried samples were used to analyze the NDF, ADF and cellulose in the in vitro digestibility](#)

[assay. Experimental design and statistical analysis: The study using Randomized Block Design](#) (RBD) consisted of 4 treatments and 4 replication. The treatment provided were A: 30% of Fermented oil palm trunk plus 70% concentrates; B: 40% of fermented oil palm trunk plus 60% concentrates; C: 50% of fermented oil palm trunk plus 50% concentrates; D: 60% of Fermented fermented oil palm trunk plus 40% concentrates. RESULTS AND DISCUSSION Chemical composition: The chemical composition of oil palm trunk (OPT) and fermented oil palm trunk (FOPT) using Phanerochaete chrysosporium can be seen in Table 1. In Table 1, showed that fermentation can be decrease the dry matter. organi matter, crude fiber and fiber fraction (ADF, NDF and cellulose), however crude protein increase. This research supported by Zhao et al., (2015) stated that all fungi caused a net loss in DM, OM, NDF and ADL, and consequently in cellulose and hemicellulose of the rape straw during fermentation. Tripathi et al (2008) added that Phanerochaete chrysosporium was effective in degrading lignin of mustard straw and resulted in lignin loss of approximate 40% at 35 days incubation. In this research lignin decreased about 43.48% at 21 days incubation. The increase of crude protein after fermentation approximate at 47%, caused by the enzyme produced during fermentation like laccase, mangan peroxidase and lignin peroxidase. Degradability [of dry matter,](#)

[organic matter in vitro: Increased levels of](#) fermented oil palm trunk (FOPT) and decreased levels of concentrate [had](#)

[a highly significant effect on](#) degradability ($P<0.01$), [with decreases in dry matter](#) and [organic matter](#) degradability as shown in Table 4. The average degradability ranged from 55.54-67.58% for the degradability of dry matter, 55.61-67.72% for the degradability of organic matter. S38 MARLIDA ET AL Table 4, [shows a trend of](#)

[decreased](#) degradability [of dry matter,](#) and [organic matter from treatment](#) A [to](#) D. [The](#)

[decrease in dry matter](#) and [organic matter](#) degradability [was caused by the differences in crude fiber content](#)

[and lignin content of each treatment. Imsya et al.](#) (2013) [stated that the](#) degradability [of dry matter and](#)

[organic matter decreases because of high levels of crude fiber content in the ration.](#) Treatment D [showed the highest](#)

[lignin contents](#) (13.6%) [and the lowest dry matter, organic matter and crude fiber](#) fraction (Table 3). [These](#)

[results suggested that although](#) FOPT [were fermented using P. Chrysosporium](#) [which decreased the lignin](#)

[content, the nutritional value produced by the fermentation process was not able](#) Table 2. Chemical composition of oil

palm trunk (OPT) and fermented oil palm trunk (FOPT) using *P. chrysosporium* Items Oil palm (% DM) trunk (OPT)

Fermentet oil palmtrunk (FOPT) [Dry Matter Organic Matter Crude](#) Protein Crude [Fiber](#) ADF NDF Cellulose Hemicellulose lignin Silica 49.54 87.56 3.64 44.43 75.75 96.10 55.33 20.35 15.41 5.02 33.41 74.60 5.37 31.34 57.24 75.20 46.12 7.96 8.71 2.41 Description: All nutrient contents of the complete rations determined by Proximate and Van Soest analysis at the Laboratory of Ruminant Nutrition, Faculty of Animal Sciences, Andalas University (2017) to achieve the nutritional value of rations (Table 3). It has been shown that lignin prevents polysaccharide digestion in the rumen and physically blocks hydrolytic enzymes produced by the rumen microorganism from affecting tissues with high digestibility (Albores et al., 2006) while fungi, with their exoenzymes like laccase, oxidase, aromatic cycles and aliphatic chains, oxidate lignin to produce products with low molecular weight (Alemawor et al., 2009; Ravindran and Jaiswal, 2016). Fermentation of

OPT with *P. chrysosporium* for 21 [days showed a good lignin degradation rate. The content of lignin of](#) OPT [without](#)

[fermentation was](#) 15.41%, [whereas lignin content of fermented](#) OPT [was](#) 8.71% . [This result showed](#)

[that although the lignin content could be reduced by the fermentation process, the lignin content remained higher.](#)

[Thus, at the high levels of](#) FOPT [used in the](#) complete [rations, the levels of digestibility remained low. The](#)

[high](#) degradability [of](#) ration A [suggested that this combination of](#) FOPT and concentrates [was more easily degraded by rumen microbes than the other treatments. Low lignin content is very helpful for rumen microbial](#)

[breakdown of cellulose and hemicellulose feed. The](#) pattern [of](#) degradability [of organic materials follows that](#)

[of dry matter](#) degradability, [i.e., the low](#) degradability [of the dry matter causes the low](#) degradability

[of organic materials. Thus, an increase in the](#) degradability [of dry substrate materials is followed by an increase in](#)

[the](#) degradability [of organic substrate](#) materials (Zain [et al.,](#) 2011; Zain et al.,2015) The values of [dry](#)

[matter](#) degradability (DMD) and [organic matter](#) degradability (OMD) [in this study are higher](#)

[than those in the treatment of 100%](#) Table 3. Proximate and Van Soest analysis of the complete rations with improvement of fermented oil palm trunk (FOPT) Items (% DM) Rations complete with fermented oil palm trunk A B C D Dry Matter Organic Matter Crude Protein ADF NDF Cellulose Hemicellulose lignin Silica 90.29 88.88 93.02 91.85 12.18 11.55 47.84 46.58 65.37 64.16 35.87 32.92 17.47 18.58 10.29 11.79 1.68 1.87 86.28 89.78 8.17 44.19 63.97 31.36 18.98 12.76 1.92 86.55 87.33 7.19 42.70 60.92 34.78 19.22 13.16 2.03 Description: All nutrient contents of the complete rations determined by Proximate and Van Soest analysis at the Laboratory of Ruminant Nutrition, Faculty of Animal Sciences, Andalas University (2017) Enhancement Fermented Oli Palm Trunk on Ration Complete on Rumen Degradabili In vitro S39 in vitro FOPT used by Marlida et al. (2016). [This is because this treatment combines several feed ingredients such that the composition of nutrient substances donated, particularly the mineral content and amino acids, was more complete. Minerals and more complex amino acids optimize the metabolic activities in the rumen. Rumen microbes also optimally degrade feed](#)

[ingredients, resulting in increased dry matter](#) and [organic matter](#) degradability. Degradability of [fiber](#)

Fraction [in](#) vitro. Degradability NDF, ADF and cellulose obtained in this study was also significantly affected ($P < 0.01$) by improvement of fermented oil palm trunk in the rations . NDF, ADF and cellulose were fiber from the carbohydrate fraction of potential as a source of energy for ruminants. In Table 4, can be showed that decreased digestibility of NDF, ADF and cellulose with increased the fermented oil palm trunk in the ration caused by increased lignin and fiber contents (Callaway and Martin, 1997). Rumen liquid characteristics: The results obtained showed that increased of fermented oil palm trunk (FOPT) in the rations complete did not affect of rumen pH. The relatively stable rumen pH for growth of rumen microbes, especially cellulolytic bacteria causing growth to be better so the fiber fraction digestibility also increased. It is also reported by several researchers such as Miller et al. (2002) and Fadel (2007). Total VFA production showed that the highly significant effect with increased FOPT ($P < 0.01$). Total VFA concentration decreased with the increased FOPT. Decreased VFA production is associated with low activities of microbes in the rumen because inhibit by high lignin content of rations. Zhao et al. (2015) found that production of total VFA during ruminal fermentation is indicative of availability of fermentable energy from the rations, its means the increased FOPT in the rations did not availability of fermentable energy. NH₃ concentration of rumen fluid obtained in this study was significantly affected by treatment ($P < 0.01$). NH₃ produced decreased from 17.38 to 16.52 mM due to increased FOPT. The concentration of NH₃ is one indicator that determines feed fermentability which is related to protein digestibility, rumen microbial activity and rumen microbial population (Singh and Chen, 2008), it can be concluded that the availability of N-NH₃ in the rumen fluid in the four treatments is within the normal range of NH₃ availability. These values included the value for optimum rumen microbial growth needs, the concentration of ammonia needed to support microbial growth 6-21 mM (Stewart, 1991). A decrease in rumen ammonia production due to an increase incorporation of ammonia into the protein microbial occurred when the microbial populations were also increasing. It is also founded by El-Waziry et al. (2000) and El-Ghani (2004). While ammonia is the main compound for the synthesis of microbes in the rumen. CONCLUSION Based on the results of this study, it can be concluded that the use of 40% of fermented oil palm trunk and 60% concentrate (B ration) can be used as ruminant feeding, whereas the in vitro degradability were: 67.39%, 67.52% for DM and OM, repectively. Fiber fraction degradability: 43.03, 54.13, and 58.26 for

ADF, NDF and cellulose, respectively. The rumen characteristic were: 6.89, 18.49 (mg/100), 98.75 (mM) for pH, NH₃ and VFA, respectively. Table 4. Degradability of the rations complete based offermented oil palm trunk Variables Ration complete with increased of fermented oil palm trunk A B C D pH N-NH₃ (mM) VFA (mM) Dry Matter Digestibility (%) Organic Matter Digestibility (%) NDF Digestibility (%) ADF Digestibility (%) Cellulose Digestibility (%) 6.94 6.89 17.38 18.49 87.50c 98.75a 67.58a 67.39a 67.72a 67.55a 55.24a 54.13a 43.28a 43.03a 58.43a 58.26a 6.85 18.28 96.25b 63.46b 64.92a 52.46a 40.18b 48.69b 6.76 16.52 77.25d 55.54c 55.91c 47.01b 38.06b 45.49b Means in the same row with different a,b,letters are

significant at $p < 0.05$, NDF: Neutral detergent fiber, ADF: Acid detergent fiber

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