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Abstract. This study aimed to evaluate the fiber fraction component and in-vitro digestibility of cocoa pod husk fermented by local microorganisms (MOL), namely the rumen contents. The research used completely randomized design with 5 treatments of 4 replications each. The dose of MOL to ferment pod cocoa was as follows A: 0 ml/kg of substrate, B: 3 ml/kg of substrate C: 6 ml/kg substrate, D: 9 ml/kg of substrate, and E: 12 ml/kg of substrate. The parameters measured were the fiber fraction component of fermented cocoa pod and in vitro digestibilities of dry matters and NDF. The results showed that the dose of MOL significantly ($P<0.05$) affected The NDF, ADF and hemicellulose contents, but it had no effect on cellulose and lignin contents ($P>0.05$). In vitro dry matters and NDF digestibilities were significantly ($P<0.05$) affected by the treatments. In conclusion, fermentation by MOL at a dosage of 12 ml/kg substrate reduced fiber fraction component and increased in–vitro digestibilities of dry matter and NDF.
Keywords – cocoa pod fermentation, rumen content, fiber fraction, in vitro, digestibility.

1. Introduction

Cocoa pod has enough potential as alternative feedstuffs to substitute grass, because the production of cocoa is numerous and concentrated in specific areas. An increased cocoa plantation will annually produce cocoa pod waste more. In 2015, an extensive cocoa plantation in Bengkulu Province has reached 13,125 hectares with a production of 4,039 tons/year [1], and produce a cocoa pod waste as much as 3.029,25 tons.

Cocoa pod waste has not been used, and cause environmental pollution. In addition, pod cocoa is usually allowed to pile up around the cocoa plant, which is a very good place for the development of *Phytoptora palmifora* causing black pod disease. The usage of cocoa pod as animal feedstuffs will provide a solution to address the problem of environmental pollution and conserve the environment. It also can break the chain of disease transmission for cocoa plants.

Cocoa pod has a good nutritional value for animal feedstuffs particularly ruminants. However, a high lignin content (31.51%) and *theobromine*, which is toxic become a limiting factor in its use as animal feedstuffs. To optimize the usage of cocoa pod as feedstuffs, they should be processed. There are some processing techniques which has beed proven to improve the value of the by product [2] [3]

[4] [5] [6] [7] [8] [9] [10] in order to improve the digestibility and eliminate toxins contained in the cocoa pod, the cocoa pod could be fermented.

Fermentation is the process of processing the material with the help of microbes capable of breaking down complex components into simpler forms, such as cellulose and hemicellulose to glucose [11]. Fermentation waste fiber materials ranging frequent lately, because in addition to more easily and cost are also safer and more environmentally friendly than the use of chemicals. The feedstuffs that undergo fermentation usually have better nutritional value of its origin, caused by microorganisms that break down the components of the complex into simple substances that are so easy to digest. In addition, fermentation can also increase the crude protein feed ingredients, improve palatability because it produces a fragrant smell and eliminate toxins, microorganisms can also synthesize certain vitamins such as riboflavin, vitamin B 12, pro-vitamin A and other growth factors. Thus, the fermentation treatment is expected to improve the quality of waste palm fronds for the better.

Fermentation with local microorganisms is one alternative and lately often used. Local microorganisms in the form of a solution are fermented from a variety of waste materials. The local microorganism solution contains bacteria and fungi which could degrade organic materials. The most benefit of local microorganism is no cost for local microorganism which can be made from the waste of fruits and vegetables, livestock waste, slaughterhouse waste or household waste. In addition, the manufacturing process is easy and applicable. In this study, local microorganism is derived from rumen contents. [12] showed that there are 8 thermophilic bacteria isolated from MOL rumen contents including gram-positive bacteria. Fermented cocoa pod with rumen contents is expected to improve the quality of the cocoa pod and eliminate toxic compounds. [13] showed that fermented cocoa pod with local microorganisms of rumen contents proved to increase the nutrient value of cocoa pod.

2. Materials and methods

2.1. Local microorganism manufacture of rumen contents

Local microorganism was made from rumen contents as a source of microorganisms and enriched with coconut water and palm sugar as a source of energy. The materials used were 10 liters of coconut water was filtered, 2 kg of palm sugar that has been dissolved and 2 kg of rumen contents. All the ingredients put into a container and then closed. The container was perforated to insert the tube. Another container was filled with water. Connect the first container with a small tube into the second container to to drain the gas formed, incubated for 10 days.

2.2. Fermentation of cocoa pod

Cocoa pod was chopped into 3-5 cm size, dried under the sun until its moisture content of 60%. Cocoa pod was then added rice bran as much as 10% and 1% sugar and local microorganisms according to each treatment and mixed. the cocoa pod was then put into a plastic bag, tied and incubated for 7 days. After 7 days of incubation, they were then opened, and measured pH, fungi, texture and smell. After that, they were then dried under the sun, and ground into flour. The results of this fermentation were then analyzed their nutrient content.

2.3. The experimental treatments

The present study used completely randomized design with 5 treatments of 4 replications each. The dose of MOL to ferment pod cocoa was as follows A: 0 ml/kg of substrate, B: 3 ml/kg of substrate C: 6 ml/kg substrate, D: 9 ml/kg of substrate, and E: 12 ml/kg of substrate. The content of fiber fractions was measured by the method of [14], whereas in vitro digestibility was measured using the Daisy^{II} method as described by ANKOM Technology Corporation.

3. Results and discussion

3.1. The content of fiber fractions

The content of fiber fractions of fermented cocoa pod is presented in Table 1.

Table 1. The content of fiber fraction of fermented cocoa pod.

Treatment	Parameters (%)				
	NDF	ADF	Hemicellulose	Cellulose	Lignin
A	70.66[a]	60.96[a]	9.71[a]	26.65	34.31
B	69.18[a]	60.23[a]	8.95[a]	26.14	34.09
C	68.44[a]	59.79[a]	8.65[a]	25.23	33.82
D	68.16[a]	59.39[a]	8.77[a]	26.66	32.73
E	61.75[b]	55.17[b]	6.57[b]	23.66	31.51
SE	0.34	0.22	0.27	0.44	0,56

The different superscripts in the same column indicate significantly different (P <0.05).

The unfermented cocoa pod had 71.06% NDF, 60.90% ADF, 10.17% hemicellulose, 25.04% cellulose and 35.29% lignin. The content of fermented fiber fraction tends to lower than the unfermented cocoa pod.

Experimental results showed that the dosage of MOL significantly (P <0.05) affected the contents of NDF, ADF and hemicellulose, but not significantly (P> 0.05) affected the content cellulose and lignin. The content of NDF, ADF and hemicellulose in E group treatment was significantly lower than other treatments.

The reduction in the fraction of the content of fiber in fermented cocoa pod occurred due to the microorganisms converted the complex molecules into simpler compounds. In this case, the bacteria contained in MOL converted the NDF, ADF into hemicellulose and cellulose, finally into glucose. This indicates that the MOL of rumen contents contains bacteria that have cellulolytic activity which can break down the components of fiber fraction.

Fraction fibers which are composed of NDF, ADF hemicellulose, and cellulose is a component of plant cell walls that can be digested by ruminants and is a major source of ruminant feed. However, the lignin binds the hemicellulose and cellulose to form lignohemicellulose and lignocellulose. This cause hemicellulose and cellulose could not be degraded by rumen microbes. Cell wall structure of cocoa pod have lignified further and its lignin has crystallized making it difficult to digest.

The reduction in NDF, ADF and hemicellulose contents of fermented cocoa pod reached 13.10% (71.06% vs 61.75), 9:41% (60.9% vs 55.15%) and 35.40% (10.17% vs 55.17%), respectively when compared with the unfermented cocoa pod. The largest decrease occurred in the treatment E, whereas in other treatment groups did not significantly differ from the unfermented cocoa pod. This suggests that a dose of MOL for fermentation should be higher, which means it contains more bacteria to degraded fiber components more.

3.2. The digestibility of dry matter and NDF

The digestibility of dry matter and NDF of fermented cacao pod are presented in Table 2.

Table 2. The digestibility of dry matter and NDF of fermented cacao pod (%).

Treatment	Parameters	
	Dry matter	NDF
A	42.97[a]	16.14[a]
B	42.65[a]	17.09[a]
C	42.65[a]	18.55[a]
D	42.44[a]	19.55[a]
E	55.89[b]	35.67[b]
SE	0.74	1.34

The different superscripts in the same column indicate significantly different (P <0.05).

Experimental results showed that the treatments significantly affected (P<0.05) the dry matter and NDF digestibilities. It was shown that E had higher dry matter and NDF digestibilities than A, B, C,

and D ($P<0.05$), whereas A, B and C and D did not differ significantly ($P>0.05$) to each other. Dry matter and NDF digestibilities in E was increased at a level of 31.69% and 121.0%, respectively. This phenomenon may closely relate to a decrease in the content of fiber fractions (NDF, ADF and hemicellulose) as a result of the activity of microorganisms, which convert the complex molecules into simple molecules during the fermentation process.

Digestibility is a reflection of the quality of the feedstuffs, which describes what percentage of substances that are digested and what percent is excreted through feces. Substances contained in the feedstuffs are not entirely available to the body, part of them will be excreted through the feces. The higher digestibility of feedstuffs will result the higher value of feedstuffs for livestock.

The values of dry matter and NDF digestibilities of fermented cacao pod were low, ranging from 42% -55% and 16.14% -35.67%, respectively.

4. Conclusion

In conclusion, fermentation by MOL at a dosage of 12 ml/kg substrate reduced fiber fraction component and increased digestibilities of dry matter and NDF.

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