Fermentation with Local Microorganism to Improve Pod Cacao Quality as Ruminants Feed

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ABSTRACT

This study was aimed to evaluate the nutritional value of fermented cocoa pod by local microorganisms (MOL) of the rumen contents. The research used completely randomized design with 5 treatments and 4 replications.The treatments tested dose of MOL to ferment pod cocoa consisting of 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. Parameters measured for the nutritional value of fermented cocoa pods were dry matter, organic matter, crude protein, crude fiber and crude fat. The results showed that the dose of MOL significantly ($P<0.05$) increased crude protein content up to 31.03% (5.93% vs. 7.77%), decreased crude fiber content up to 17.39% (31.86% vs 26,32%) but did not significantly ($P>0.05$) affect the dry matter content, organic matter and crude fat. Conclusively, fermentation can improve nutritional value of cocoa pod, with the best dosage of 12 ml / kg substrate.

Key words: cocoa pod, fermentation, local Microorganism (MOL), nutritional value

INTRODUCTION

Cocoa pod is a potential alternative feed for grass because of its numerous production and concentrated amount in specific areas. Increased cocoa plantations will annually produce more cocoa pod waste . In 2013 cocoa plantations in Bengkulu Province reached 13 517 ha, producing 6159 tons cocoa/year (Dinas Perkebunan, 2014). and 4619.25 tons cocoa pod waste.

Cocoa pod waste has not been utilized and only left to rot under the cocoa trees. It pollutes the environmental pollution because high water content makes it easily rotten and smelly. Besides, the heaping cocoa pods around cocoa plant is a very good growing place for *phytoptora palmifora* fungus that causes black pod desease in cocoa plant. The Utilization of cocoa pods as animal feed will also provide solutions to handle environmental pollution problem and to conserve the environment. It can also break the chain of disease transmission for cocoa plants.

Cocoa pod has sufficient nutrition for animal feed, especially ruminants (91,83% DM, 87,08% OM, 6,36% CP, 26,32% CF and 1,01% LK), but high lignin content (31.51%), which limits the digestibility and the toxic theobromine can interfere with the metabolism of livestock that consume it. To gain optimum function, cocoa pod waste needs to undergo certain process including physical, biological, and chemical elements proven to increase beneficial value of the waste (Akbar, 2001; Akbar *et al.,* 2005; Nurhaita, 2001, Nurhaita *et al*., 2007; 2008; and 2010[a]; Van Soest, 2006; Zain *et al.,* 2006 and 2010). To improve digestibility and eliminate toxins in cocoa pod, it is necessary for the processing effort beforehand, by fermentation.

Fermentation is processing material with the help of microbes capable of degrading components into simpler forms, such as cellulose and hemicellulose to glucose (Winarno *et al*., 1980). Fermentation of waste fiber materials has recently increased because it is easier, cheaper, safer and more environmental friendly than chemicals.

Fermentation with local microorganisms (MOL) is one alternative and recently popular. MOL in the solution form is the result of fermentation of various waste materials. MOL liquid contained by potentially bacteria and fungi to decompose organic matter. The main superiority of MOL is cheap even free of cost because MOL can be made from rotting fruits and vegetables and by product of--------

livestock, slaughterhouse or household, it is easy to make and applicable. In this study, MOL used is derived from rumen contents of slaughterhouse waste. Fermented cocoa pod with MOL is expected to improve the quality of the cocoa pod and eliminate toxic compounds.

MATERIALS AND METHODS

Materials used were cacao pod, rice bran, sugar, MOL from rumen content (slaughter house by product). Equipments were scales, plastic bag, chopping knife, measuring cup, plastic string, pH meter, proximate and van Soest analysis equipment.

The research used a completely randomized design with 5 treatments 4 replicates. The MOL dosage treatments were A= 0 ml/kg substrates, B = 3 ml/kg substrats, C= 6 ml/kg substrates, D = 9 ml/kg substrates and E 12 ml/kg substrates. The parameters observed were nutrition of fermented feed including dry matter, organic matter, crude protein, and ether extract. Data were subject to Analysis of Variance (ANOVA) followed by Duncan Multiple Range Test for differences among treatments' means (Steel and Torrie, 1995).

Fixing MOL from Rumen Contents

MOL was made from coconut water, palm sugar, and paunch manure as the source of microbes. Ten liters of filtered coconut water, 2 kg of dissolved palm sugar and 2 kg of rumen contents were poured into jerrycan and had the lid closed. Jerrycan's lid was holed to insert a small hose that was connected to another jerrycan filled with water. This was to drain the gas formed during 10 day incubation

Fermenting Cacao Pod

Cocoa pod was chopped 3-5 cm, dried in the sun until the water content was $\pm$ 60%. Cocoa pod was added with 10% rice bran, 1% sugar and MOL according to each treatment and mixed well. the mixture was stored in a plastic bag and left for 7 days. After 6 day fermentation, the plastic bag was opened to measure parameters including pH, fungus, texture and smell, and dry milled flour. This fermentation results were analyzed for nutrient content.

RESULTS AND DISCUSSION

Analysis of variance showed that the dosage of moles was significant (P<0.05) on crude protein and crude fiber, but was not significant (P>0.05) on dry matter, organic matter, and ether extract of fermented Cocoa Pod. The nutrition value of the fermented Cocoa Pod is presented on Table 1.

Table 1. The nutrition value of the pod cocoa fermented with MOL

Treatment	Parameters (% DM)				
	Dry Matter	Organic Matter	Crude Protein	Crude Fiber	Crude Fat
A	21.68	88.01	5.93^{a}	31.86^{d}	2.04
B	22.00	88.10	6.21^{a}	29.58^{c}	2.08
C	21.97	88.11	6.51^{ab}	28.61^{bc}	2.19
D	21.67	88.19	7.03^{b}	27.94^{b}	1.94
E	21.84	88.54	7.77^{c}	26.32^{a}	2.32
SE	0.134	0.074	0.089	0.027	0.005

Note: Values bearing different superscript within columns show significance (P <0.05)

Dry matter content of fermented cocoa pod ranges from 21.67% - 22.00%, whereas dry matter content of cocoa pod before fermentation was $\pm$ 40%. Although dry matter content was not significantly different between treatments (P> 0.05), it decreased about 46% compared to the original material (40% vs 21.67%). It was due to the activity microorganism during fermentation process which turned complex molecules into simpler compounds. Microorganisms used carbohydrates as a source of energy that was previously broken down into glucose, and then through the glycolytic pathway to ultimately generate energy. the process also produced water and CO_2 molecules, resulting in higher water content because dry matter content of fermentation products decreased. This is in accordance with Fardiaz (1988).

The content of organic material in this study ranged from 88.01 to 88.54%, and fat ranged from 1.94 to 2.32%. MOL dose treatment was not significant (P> 0.05) to organic matter content and crude fat of fermented products.

Crude protein content of fermented cocoa pod ranged from 5.93% to 7.77%. The statistical results showed that crude protein content in treatments A, B and C was similar, but higher in the treatment D and E which had higher MOL dose. Accordingly, high doses of MOL was required to increase protein content of fermented cocoa pod. .

Increased protein content in fermentation product is derived from the breakdown of complex molecules into simpler molecules by microbial activity. During the fermentation process, organic materials that produce organic acids such as amino acids were restored. In addition, microbial biomass growing and developing during the fermentation process also contributed to boost protein content on fermentation products. This was consistent with Jamarun, et al. (2000); Jamarun and Agustin, (1999) that the body of microbes (fungi / bacteria) itself contained 19-38% protein. Increased protein content in this study reached 31.03% (5.93% vs. 7.77%).

Crude fiber content of fermented cocoa pod ranged from 26.32% in treatment E and reached 31.86% in treatment A. Statistical analysis showed that the decline in crude fiber was linear with the increasing dose of MOL. This was because the higher the dose the more population MOL bacteria remodelled the material, so more and more fiber fractions were recycled into simpler components such as cellulose and hemicellulose changed into glucose.

Fermentation product in this research showed better quality, as reflected from the increase of crude protein and decrease of crude fiber content. This is in accordance with Saono (1988) that fermentation can improve certain properties of the material as it becomes more digestible, more can be retained and can eliminate toxic compounds, so that the economic value of the base ingredients gets better (Saono, 1988).

The Fermented products usually have better nutritional value than the original material, caused by microorganisms that break down the components of the complex into simple substances that are easily digested. 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 some vitamins such as riboflavin, vitamin B 12, pro-vitamin A and other growth factors (Nurhaita *et al.*, 2011).

CONCLUSION

From this study it can be concluded that fermentation can improve the nutritional value of the cocoa pod. The best dosage of MOL is 12 ml / kg of substrate.

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