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Characteristics, Digestibility and Rumen Fermentation Products of Rice Bran from Various Varieties of Rice

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Abstract. Rice has much kind of varieties with varied organic ingredients. The purpose of this study is to assess the influence of varied organic matter content on digestibility and fermentation products in the rumen. This study used in vitro method, using completely randomized design with 6 varieties of rice bran as treatments (Pandan Wangi, Ketan Putih, IR 64, Aek Sibundong, Ketan Hitam and Umbul). Each treatment was repeated 3 times, continued by Honestly Significant Difference (HSD). The objective of the study is to evaluate VFA level, N-NH₃, dry matter digestibility (DMD) and organic matter digestibility (OMD). The results of analysis of variance showed that the rice bran varieties have a High significant effect on the levels of VFA (P < 0.01), but there is no significant effects on N-NH₃ level, DMD and OMD. A Highly significant difference is shown by rice Bran of Pandan Wangi varieties with Ketan Putih and Ketan Hitam. Based on the results of the study can be concluded that the rice varieties effect the level of VFA but do not effect the level N-NH₃, DMD and OMD. Pandan Wangi has the highest VFA rate.

Key words: rice varieties, VFA, N-NH₃, DMD, OMD, in vitro

1. Introduction

Indonesia is the third largest rice bran producing country in the world, this makes rice bran a local feed material that has quite high economic potential. Indonesia's rice production in 2014 has reached 70.85 million tons of dry unhusked rice [1]. Overall, the process of milling rice into rice will produce husks (15-20%), namely the outer covering / seed coat, bran / bran (8-12%) which is the epidermis, produced from the process of scraping, and mating ($\pm 5\%$) is the part of rice that is destroyed [2]. Rice consists of rice as the main product and bran, rice bran, "menir", and husk as a byproduct. Bran and rice bran contain oil, protein, carbohydrates and minerals so that it can be used for feed, while the husk can be used to make fertilizer.

The availability of fluctuating rice bran throughout the year in accordance with the rice harvest season, the quality of rice bran today also varies greatly. Apart from being influenced by different varieties, several factors contribute to the low quality of rice bran available in the market such as contaminants, adulterant and poor handling of post-harvest. Rice has various varieties, such as Pandan Wangi, White Glutinous Rice, IR 64, Aek Sibundong, Black Glutinous Rice and Umbul. According to



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Luh [3], the main factors that determine the nature of rice grains are variety and environmental conditions.

These factors determine the chemical composition, constituent distribution, thickness of the anatomical layers, size and shape of rice or rice grains and grain resistance to grinding or polishing. Variety is one of the factors that determine the quality of bran, because the content of protein and crude fiber is determined by the diversity of physical and chemical properties of grain, mainly due to genetic factors carried by rice varieties [4]. According to Rukmini [5], the chemical composition of bran depends on various factors that are closely related to the grain itself and the grinding conditions. Rice bran from various rice varieties has different organic ingredients. High or low organic matter affects the digestibility and fermentation products in the rumen. This study aims to examine the characteristics of rumen fermentation products and digestibility of various rice varieties in vitro. The digestibility evaluation of several rice bran varieties is beneficial for farmers to adjust the feed ingredients composing ruminant's cattle rations (beef or dairy) with the available traditional feed conditions and production targets to be achieved.

2. Methodology

The study used in vitro experimental methods according to Tilley and Terry [6] with a Completely Randomized Design experimental design, as the treatments were 6 rice bran varieties, namely: Pandan Wangi, White Glutinous Rice, IR 64, Aek Sibundong, Black Glutinous Rice and Umbul. Each variety was repeated 3 times. If there is influence the treatment is continued with Honesty Significant Differences [7]. The data obtained were analyzed using analysis of variance with Excel ver software. 2010.

Basal feed used is elephant grass, with a ratio of 40% grass and 60% rice bran. VFA production was measured by steam distillation techniques, N-NH₃ was measured by conway microdiffusion technique, digestibility of dry matter and organic matter was measured [6].

3. Result and Discussion

Based on observations and calculations during the trial on VFA, N-NH₃, the dry matter digestibility (DMD) and organic matter digestibility (OMD), of some of rice bran varieties used during the experiment. the data showed VFA, N-NH₃ content, dry matter digestibility (DMD) and organic matter digestibility (OMD) presented in **Table 1**:

Table 1. VFA, N-NH₃ content, dry matter digestibility (DMD) and organic matter digestibility (OMD) of rice bran

Rice bran varieties	VFA (mM)	N-NH ₃ (mM)	DMD (%)	OMD (%)
Pandan wangi	126.00 ± 7.21 ^a	14.80 ± 1.51	61.59 ± 1.29	64.68 ± 1.72
Ketan putih	76.67 ± 11.02 ^d	16.27 ± 1.75	57.98 ± 3.34	61.57 ± 4.43
IR 64	110.00 ± 8.00 ^{abc}	17.60 ± 1.71	59.34 ± 3.57	62.39 ± 4.23
Aeksibundong	106.00 ± 2.00 ^{bc}	17.33 ± 2.81	59.04 ± 1.73	61.66 ± 1.98
Ketan hitam	113.33 ± 2.31 ^{abc}	15.67 ± 3.32	63.44 ± 2.32	67.08 ± 2.54
Umbul	98.6 ± 14.19 ^c	16.53 ± 2.64	58.08 ± 1.72	59.82 ± 2.16

Note: Different superscripts in the same column show significantly different or very significantly different (BNJ > 0.05 and BNJ > 0.01)

Based on BNJ test results, rice bran from pandanus fragrant varieties had the highest VFA content which was 126.00 ± 7.21 mM which was significantly different from the white sticky rice varieties, Aek Sibundong and Umbul (P < 0.01). While the varieties of Pandan Wangi with IR64 and Black Sticky rice showed no significant difference. White sticky rice varieties differed markedly from all varieties (P < 0.01), while between IR64, Sibundong, Black Sticky and Umbul varieties did not show differences in VFA production in the rumen. High and low levels of VFA indicate the fermentability of carbohydrates contained in each rice bran variety. Rice bran contains carbohydrates that vary

according to the variety of rice. For rice bran IR-64 variety has amylose content of 24.1%, aek sibundong variety (red rice) by 22%, setail variety (black sticky rice) by 6.8%, warp variety (white sticky rice) by 6% [8]. Those with high amylose content (70%) produce low starch digestibilities. Cereals with no amylose (waxy starch) do not show strong evidence of benefit despite lower resistance of starch granules. Reasons for starch digestibility variations are reviewed by considering starch granule structure, antinutritional factors and access problems in coarse particles. Feed technology treatments that can overcome low starch digestibilities [9]. Almost all sticky rice varieties contain amylopectin which is more difficult to digest than amylose. A further research result Alawiyah [10] shows the nutrient content of rice bran in various varieties as follows:

Table 2. Nutrient content of rice bran from various varieties

Rice bran varieties	DM	Ash	CP	EE	CF	NFE	FFA
	------(%)-----						
IR -64	91.16	7.7	10.68	9.94	9.92	52.92	0.25
Pandan wangi	92.28	10.93	11.11	11.74	13.01	45.49	0.21
AekSibundong/Beras merah	92.18	8.15	11.73	10.45	11.58	50.27	0.27
Setail/Ketan hitam	92.15	7.08	12.27	11.72	7.87	53.21	0.30
Lusi/Ketan putih	90.26	9.71	11.81	14.93	14.18	39.63	0.19

Note: [10]

The average N-NH₃ levels ranged from 14.8 ± 1.51 mMol to 17.6 ± 1.71 mMol. Based on the results of analysis of variance, rice bran varieties did not affect N-NH₃ levels in vitro (P > 0.05). All rice bran varieties showed different levels of N-NH₃ levels. This is thought to be because although the crude protein content of rice bran varies between different varieties, the composition of non-protein N and N protein is relatively the same. In contrast to the statement Ishaq et al. [4] that varieties have a very significant effect on crude protein content of rice bran. McDonald et al. [11] suggest that the digestibility of the feed is affected by the chemical composition of the feed and the fraction of fibrous feed tremendous effect on digestibility. The average digestibility of dry matter (DMD) ranged from 57.98 ± 3.34% to 63.44 ± 2.32%. The results of the analysis of variance showed that the variety did not affect the digestibility of dry matter in vitro (P > 0.05). High digestibility of DM on ruminants showed high nutrient that is digested by rumen microbes [6]. The results showed that the digestibility of rice bran was higher than the dry matter digestibility of rice bran reported by Zakariah et al. [13] that is 48.62 ± 1.92% in PO cows, 49.49 ± 3.13% in PFH cattle.

The average digestibility level of organic matter (KBO) ranged from 59.82 ± 2.16% to 67.08 ± 5.54%. The results of the analysis of variance showed that the variety did not affect the digestibility of organic matter in vitro. Organic matter digestibility describes the availability of nutrients from feed and shows nutrients that can be utilized by livestock. Dry matter digestibility can affect on organic matter digestibility [14]. Provision of a concentrate containing a high crude protein activates rumen microbial thus increasing the number of proteolysis bacteria and rising deamination resulting in an increased value of the organic matter digestibility [15]. The results showed the digestibility of rice bran was higher than the digestibility of organic rice bran material reported by Zakariah et al. [13] that is equal to 47.08 ± 1.32% in PO cows and 46.83 ± 3.46% in PFH cows.

4. Conclusion

Based on the results of the study it can be concluded that rice bran varieties affect VFA levels but do not affect N-NH₃ levels nor the digestibility of dry matter and organic matter in vitro. Pandan Wangi variety rice bran produced the highest levels of VFA.

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