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The Nutrient Evaluation of Fermented Rice Bran as Poultry Feed

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Abstract: This research was conducted to find out the effect of fermentation of rice bran by *Aspergillus niger* in term of nutrient content. Rice bran was incubated with different length of time period of incubation; 0, 24, 48 and 72h. Parameter observed included the content of dry matter, organic matter, crude protein, soluble protein, NPN (non protein nitrogen), reducing sugar and nitrogen retention. Data obtained were subjected into analysis of variance of the completely randomized design. The result showed that incubation period gave the different significant effect ($p<0.01$) on the content of dry matter, organic matter, crude protein, diluted protein and nitrogen retention. But there was no significant effect ($p>0.05$) on the crude protein. By 72h incubation time, the fermented rice bran containing the highest nutritive value.

Key words: *Aspergillus niger*, rice bran, fermentation

INTRODUCTION

Rice bran was available paddy industry by product and has been used as poultry feed. In Indonesia rice bran produced about 50,7 million ton/year and consist of a 8-10% of total paddy weight. The amount of rice bran as poultry feed was limited due to high crude fiber, low protein content and containing anti nutrition phytate which affected to P and Ca availability (Luh, 1991). In term of increasing rice bran proportion on poultry feed, it was need increasing of nutrient content and availability through pre-treatment to decrease crude fiber and increase protein.

Fermentation process was treatment method beside as optimal food/feed storage also could increase nutrient content. Winarno and Fardiaz (1980) found that fermented food containing higher nutrient compared to a raw material. According to Pasaribu *et al*. (1998), substrate fermentation using *Aspergillus niger* could be use to increase agricultural by product, which a high crude fiber, low protein and digestibility. A *Aspergillus niger* produced protease, which increasing diluted protein by breaking disulfide bond of protein molecule chain.

This research aimed to find out the effect of fermentation of rice bran by *Aspergillus niger* in term of nutrient content

MATERIALS AND METHODS

The research conducted in Nutrition and Feed Laboratory, Faculty of Animal Science and Organic Chemistry Laboratory, MIPA, Brawijaya University, Malang. The materi used are: 1) crude rice bran, purchase in public huller in Lowokwaru Malang, 2) *Aspergillus niger* inoculum from Food Research and Development Institute, Agricultural Department, Bogor, 3) a 13 cocks as animal trial of *in-vivo* test with a range body weigh 1,3 kg and 4) feed treatment, a mixed of test feed (fermented rice bran) and basal feed (BR-1 from PT. Jafpa Comfeed) with ratio 1:3. The Nutrient content of rice bran, BR-1 and mixed feed was available in Table 1.

The rice bran added by aquadest (3:1 ratio), then steamed for 60 minutes. After cooling, the rice bran mixing with 0.6% *Aspergillus niger* inoculum (w/w) until homogen. The mixed rice bran was put on plastic bag with 5 cm thickness. Upper part of plastic bag was holed for aeration of substrate and growth of *Aspergillus niger*, and incubated on room temperature with different time incubation as treatment.

The research arranged on completely randomized design with 4 time incubation treatments : 0, 24, 48 and 72h, 3 replication each. The parameter calculated were Dry Matter (DM) and Organic Matter (OM) content (AOAC, 1990), Crude Protein (CP) (Sudarmadji *et al*., 1989), diluted protein (Lowry-folin) and N retention (*in-vivo* total collection). The fermentation process of rice bran was done by solid state culture method.

RESULTS AND DISCUSSION

The research analysis showed that fermentation process caused a rice bran nutrient change, as presented at Table 2. The dry matter of fermented rice bran was increase ($p<0.01$) among a different time incubation treatments. The increasing of dry matter caused by water evaporation during fermentation process. Supriyati *et al*. (1998) stated that increasing of substrate temperature due to carbohydrate breakdown releasing water from substrate. This statement of Purwadaria *et al*. (1998) also supporting that water evaporation affected by climate, a dry climate caused a evaporation water of substrate running well. Hardjo *et al*. (1989) stated that a releasing water from substrate will be better in the low material thickness on the plastic bag and have a good pores. On aerobe fermentation, cell

Table 1: Nutrient content of treatment feed (% dry matter)

			Mixed feed			
Nutrient	Rice Bran	BR-1	0h	24h	48h	72h
Dry matter,%	92.68	89.33	-	-	-	-
Organic matter,%	85.01	-	-	-	-	-
Crude Protein ,%	9.55	22.05	18.40	18.36	18.35	18.47
Crude fiber,%	23,55	-	-	-	-	-
Gross Energy, kcal/kg	3563	3795	3948	3895	3764	3590

Note: result analysis of Lab. of Nutrition and Feed, Fac. Animal Science, UB

Table 2: Dry matter (% as fed), organic matter (% DM), crude protein (% DM), diluted protein (% CP) and N retention (%) of fermented rice bran

Treatments	dry matter	Organic matter	Crude Protein	Diluted Protein	N Retention
0 h	62.45±0.29^{a}	90.67±0.61^{b}	10.57±0.28	38.84±3.58^{a}	31.42±4.60^{a}
24 h	65.96±0.21^{b}	88.90±0.36^{b}	10.15±0.21	56.47±3.49^{b}	31.44±0.24^{a}
48 h	71.35±0.07^{d}	87.69±0.30^{a}	10.12±0.73	75.20±7.35^{c}	36.17±3.15^{a}
72 h	69.70±0.24^{c}	87.73±0.19^{a}	10.60±0.40	74.19±8.89^{c}	47.36±0.75^{b}

*Value in the same column with different superscripts are significantly different

growth was higher compared in an-aerobe fermentation, then the metabolic activity also higher and caused a substrate temperature also higher.

The increasing of substrate DM also affected by mycelium growth of microbe. According to Griffin (1991) microbe cell containing organic matter as carbohydrates, fat and protein, which were used during metabolic process and further biosynthesis. A decreasing of substrate DM at 72h time incubation showed the increasing of substrate water content produced at 72h.

The organic matter fermented rice bran decrease with a longer time incubation. A fermented rice bran OM were significantly different among treatment ($p<0.01$). The OM decreasing due to the OM used as energy sources by *A. niger* cells (Djunaidi and Nasir, 2001). The microbe need a media containing water and OM as carbon, nitrogen and ion organic sources, which taken from substrate OM, because of *A. niger* was saprophyte microorganism does not produce a food for himself from CO_2 and water. According to Rahman (1992), a substrate OM used by microbe for cell biosynthesis and activation energy during molecule transport, maintaining cell structure and cell mobility. On 48h time incubation, the OM content decrease significantly. This phenomena showed that on 48h the cell microbe growth exponentially (logarithmic), microbe cell grow and cleavage himself until maximum according to the nutrient substrate availability .

The crude protein content of fermented rice bran was similar than a non treatment rice bran. The analysis of variance showed that not different crude protein among treatments ($p>0.05$). This could be due to a low crude protein content of rice bran. According to Shin (1988), protein content of fermented substrate was affected by protein content of raw material. Beside that, nitrogen was a crucial component needed by *A. niger* after carbon and oxygen. A low crude protein content of rice bran caused cell synthesis process running low due to low adaptation time (Griffin, 1991), which need a much amino acid.

The diluted protein of fermented rice bran increase with a long time incubation. A diluted protein of fermented rice bran showed a significant differences among treatment ($p<0.01$). Stainer *et al*. (1984) stated that during fermentation process organic molecule complex was breaking into a simple molecule and non diluted molecule become diluted and this could be increase of OM digestibility. During fermentation process, the activity of proteolitic breaking protein into amino acid and increase diluted protein.

A longer incubation time of *A. niger* need a higher nitrogen needed (Djunaidi and Nasir, 2001). In order to covering these nitrogen, Ingold (1984) stated that microbe will be breakdown protein substrate into amino acid and the deaminated to ammonia as nitrogen sources for his growth (Rahman, 1992). The increasing of these metabolism caused a higher nitrogen substrate will breaks and produce a simply and easily diluted protein. During fermentation, the increasing of protein content was low but the diluted protein was 50% and only a simple, dilute and a low molecule weight can be used during transport through cytoplasm membrane (Ingold, 1984). Martin *et al*. (1998) stated that during fermentation process *A. niger* produced phytase which hydrolyze phytic acid of rice bran, then protein trapped by phytic acid release and become diluted and easy to digest.

The N retention of fermented rice bran increase with longer incubation time. A nitrogen retention of fermented rice bran showed a significant differences among treatment ($p<0.01$). The increasing of N retention have positive relation with diluted protein content, a higher a diluted protein followed by a high digestibility value and N retention. These could be a higher diluted protein will be absorb easily by cell. The increasing of N retention

showed that fermentation increase nutritive value of substrate as a proteolytic activity. Hamada (1999) stated that *A. niger* was a microbe produced protease, which can be improve diluted protein of rice bran by hydrolyzing protein into amino acid, a higher diluted protein content of substrate will be absorb easily in the digestive tract. Purnomo and Adiono (1987) stated that fermentation caused protein, fat and carbohydrate of fermented product hydrolyzed easily and have a higher digestibility.

Conclusion: Fermentation process of rice bran with *Aspergillus niger* caused a change of nutrient content. The fermentation of rice bran does not increase crude protein, but increase diluted protein and N retention. A fermented rice bran of 72h time incubation has a higher nutrient content and a highest diluted protein and N retention.

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