ผลของการเพิ่มองค์ประกอบของโปรตีนในรำข้าวโดยใช้น้ำนมหมัก

Effect of protein enrichment in rice bran by using fermented milk

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บทคัดย่อ: วัตถุประสงค์ของงานทดลองครั้งนี้ เพื่อศึกษาถึงผลของการเพิ่มองค์ประกอบของโปรตีนในรำข้าวโดยใช้น้ำนมหมัก งานทดลองครั้งนี้ศึกษาโดยใช้แผนการทดลองแบบ t-test เพื่อศึกษาเปรียบเทียบองค์ประกอบทางเคมีระหว่าง รำข้าวไม่หมักนมและรำข้าวหมักนม โดยนำตัวอย่างอาหารที่ใช้ในงานทดลองครั้งนี้มาวิเคราะห์หาค่า DM, OM, CP, EE, CF, NDF และ ADF จากผลการทดลองพบว่าทั้งสองกลุ่มไม่มีผลต่อความแตกต่างของ DM และ OM (P<0.05) ในขณะที่ CP และ EE ในกลุ่มที่หมักน้ำนมมีค่าสูงกว่ากลุ่มที่ไม่หมักน้ำนมอย่างมีนัยสำคัญทางสถิติ (P<0.05) จากผลการทดลองสามารถสรุปได้ว่า น้ำนมหมักสามารถเพิ่มคุณค่าทางโภชนะของรำข้าวได้ โดยเพิ่มองค์ประกอบของ CP และ EE และลดค่า CF, NDF และ ADF มากไปกว่านั้น งานวิจัยในอนาคตควรมีการศึกษาถึงการใช้รำข้าวหมักนมเป็นแหล่งโปรตีนสำหรับสัตว์ทั้งในหลอดทดลองและในตัวสัตว์
คำสำคัญ: รำข้าว, น้ำหมักนม, ยีสต์, แลคติกแอซิดแบคทีเรีย, แหล่งโปรตีน

ABSTRACT: The aim of this study was to study effect of protein enrichment in rice bran by using fermented milk. Experiments were conducted according to t-test to compare chemical composition between unfermented milk rice bran and fermented milk rice bran. Experimental feed sample were analyze for DM, OM, CP, EE, CF, NDF and ADF. The result illustrated that both treatments did not effect on DM and OM (P>0.05) while CP and EE in fermented milk group were significantly (P<0.05) higher than unfermented group, CP up from 7.7 to 10.4 % of dry matter and EE from 4.2 up to 5.2 % of DM. For CF, NDF and ADF in fermented milk group were significantly (P<0.05) lower than unfermented milk group. In conclusion, fermented milk could improve nutritive value of rice bran by increasing CP and EE and decreasing CF, NDF and ADF. Moreover, the further research should be investigate the used of rice bran fermented milk as a protein source for animal both *in vitro* and *in vivo* trials.
Keywords: Rice bran, Fermented milk, Yeast, Lactic acid bacteria, Protein source

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Introduction

For livestock production, feed resources are very important especially during the dry season in the tropical area. The scarcity of feed has been critically exerting in terms of quantity and quality, particularly protein sources which result in low productivity. Researchers try to find alternative protein sources which may help to increase livestock productivity (Wanapat and Rowlinson, 2007).

The process of protein enrichment of animal feed using microorganisms to improve the nutritional value of ruminants feed has been evaluated (Oboh and Akindahinsi, 2003; Oboh, 2006; Aro, 2008). Incorporation of microbial additives such as a culture of *Saccharomyces cerevisiae* to the diet has become common practice in ruminant nutrition. Recently, Oboh and Akindahinsi (2003) reported that *S. cerevisae* could also be used for enriching cassava products. Boonnop et al. (2009) demonstrated that supplementation of cassava chip with Bakers' yeast (*S. cerevisae*) could increase crude protein from 2% to 32.4%. Polyorach et al. (2012, 2013) could prepare crude protein of yeast fermented cassava chip protein (YEFECAP) up to 47.5%.

Moreover, Fermented milk, yeast growing in fermentation process utilizes some of the acid and produce a corresponding decrease in the acidity, which may favor the growth of putrefactive bacteria (Ifeanyi et al., 2013). Yeasts are a major cause of spoilage of yogurt and fermented milks in which the low pH provides a selective environment for their growth (Fleet, 1990; Rohm et al., 1992). Giudici et al. (1996) studied the role of galactose in the spoilage of yogurt by yeasts and concluded that galactose, which results from lactose hydrolysis by the lactic starter cultures, was fermented by galactose-positive strains of yeasts such as *S. cerevisiae*.

Rice bran is the most important rice by-product. Rice bran has received increased attention as a feedstuff for animal and as a source of oil for human consumption. Depending on milling conditions and hull contamination, rice bran contains 15 to 20 percent oil, 30 to 40 percent digestible carbohydrate, and 12 to 14 percent protein. Moreover, Rice bran is also an excellent source of vitamins and minerals. The fiber content of rice bran can vary due to contamination with rice hulls. Good quality bran (<9% crude fiber) may be fed up to 50% of the total ration (dry feed basis), however it is usually restricted to 15-25% of the diet to avoid the deposition of soft fat. However, rice bran for animal diet in tropical area still high crude fiber and low crude protein content, limits utilization of this feed stuff. Therefore, the objective of this experiment was to study the enrichment of protein content in rice bran by using fermented milk.

Materials and methods

Fermented milk process

Activated yeast: by weight 20g of Baker's yeast into a flask and add with sugar 20 g and distill water 100 ml. then mixed and incubated at room temperature for 1 h (A). Activated Lactic acid bacteria: by weight 50 g commercial yoghurt, 25 g molasses and 25 ml distilled water, mixed well and incubated at room temperature for 2 h (B). Mix (A) and (B) with 500 g of raw milk (pH 5-7) then flushed with air for 4 days at room temperature by using air pump (600 W).

Rice bran fermented milk production

After fermenting milk for 4 days, mixed fermented milk with rice bran in tank at proportion 1.5 : 1 kg for 3 days. After that make pellet by used rice bran fermented milk 2 kg with cassava chip mashed 1 kg and then sundry for 2 days. Final products were stored in plastic bag for using as a high protein protein feed source for animal.

Rice bran product

Rice bran treatment also make a pellet by mixed water with rice bran in tank at proportion 1.5 : 1 kg and then mixed with cassava chip mashed at proportion 2:1 after that sundry for 2 days.

Chemical analysis

Dry matter (DM) of rice bran product and rice bran fermented milk product was analyzed by drying at 100 °C for 12 h in a hot air oven, organic matter (OM), ether extract (EE), crude fiber (CF) and crude protein (CP) determined according to AOAC (1990). The sample was also analyzed for neutral detergent fiber (NDF) and acid-detergent fiber (ADF) according to Van Soest et al. (1991).

Analysis of data

All data were analyzed by using the t-test (SAS, 1998) to compare the chemical composition of the two treatments. Each treatment was containing 5 replication. Treatment means were statistically compared using Duncan's New Multiple Range Test (Steel and Torrie, 1980). Differences were assumed to be significant at $P<0.05$.

Results and discussion

The result from this study as showed in Table 1. It was found that the fermented rice bran with yeast treatment lactic acid bacterial fermented milk did not effect dry matter and organic matter ($P>0.05$) while crude protein and ether extract were significantly ($P<0.05$) higher than control, crude protein up from 7.7 to 10.4 % of dry matter and ether extract from 4.2 up to 5.2 % of dry matter. Crude fiber, neutral detergent fiber and acid detergent fiber were significantly ($P<0.05$) lower in fermented treatment.

Table 1. Effect of fermented milk on chemical composition of experimental feed.

Item	Rice bran	Rice bran plus fermented milk	SEM	P-value
Dry matter	89.0	88.9	2.26	0.9456
Organic matter	84.0	84.2	1.97	0.8766
Crude protein	7.7[a]	10.4[b]	0.62	<.0001
Ether extract	4.2[a]	5.2[b]	0.52	0.0200
Crude fiber	12.8[a]	11.7[b]	0.67	0.0317
Neutral detergent fiber	50.0[a]	32.9[b]	4.69	0.0004
Acid detergent fiber	35.5[a]	16.2[b]	1.81	<.0001

[a,b] Value on the same row with different superscripts differ ($P<0.05$), SEM= standard error of the means.

The increasing of crude protein and ether extract and decreasing of crude fiber, neutral detergent fiber and acid detergent fiber content contents could be attributed during rice bran fermented with yeast and lactic acid bacteria fermented liquid. Raimbault (1998) showed that *S. cerevisae* have ability to secrete some extracellular enzymes (proteins) such as amylases, linamarase and cellulase into the feedstuff mash by use of the feedstuff as a source of carbon and protein during their metabolic activities which would lead to yeast growth (Oboh and Akindahunsi, 2003). Moreover, Milk is a good food substrate for yeast and lactic acid bacteria. Lactose is the major carbohydrate of milk, which is utilised to varying extent by lacteic acid bacteria. The lactic acid bacteria containing aldolase, i.e., Streptococci, Lactococci, Pediococci and obligately homofermentative Lactobacilli carry out homolactic fermentation with production of only lactic acid as end product and then lactic acid utilised by yeast (Gandhi, 2006).

Generally, a significant increase in the soluble fraction of a feed is observed during fermentation. The quantity as well as quality of the feed proteins as expressed by biological value, and often the content of water soluble vitamins is generally increased, while the anti nutritional factors show a decline during fermentation (Paredes-López and Harry, 1988). Fermentation results in a lower proportion of dry matter in the feed and the concentrations of vitamins, minerals and protein appear to increase when measured on a dry weight basis (Adams, 1990). Mixed culture fermentation of pearl millet flour with *S. diastaticus, S. cerevisiae, Lactobacillus brevis* and *L. fermentum* was found to improve its biological utilisation in rats (Khetarpaul and Chauhan, 1991). Thongkratok et al. (2010) reported that microbial fermentation played a significant role in nutritional enrichment of erstwhile worthless and often discarded agro-industrial by-products generated through the harvesting and processing of cassava roots. Recently, Wanapat et al. (2011) and Polyorach et al. (2012, 2013) reported that yeast could prepare to increased crude protein content of cassava chip up to 30-47% of dry matter. Oboh (2006) studied nutrient enrichment of cassava peels using a mixed culture of *S. cerevisae* and *Lactobacillus* spp using the solid media fermentation technique. It was found that there was a significant ($P < 0.05$) increase in the protein content of the cassava peels fermented with squeezed liquid from the inoculated cassava pulp (21.5%) when compared with the unfermented cassava peel (8.2%).

Conclusions

Base on this study it could be concluded that fermented milk with yeast and lactic acid bacteria could improve nutritive value of rice bran by increasing crude protein and ether extract and decreasing crude fiber, neutral detergent fiber and acid detergent fiber. Moreover, further research could be investigate the use of rice bran plus fermented milk as a protein source for animals both *in vitro* and *in vivo* trials.

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