THE EFFECTS OF WATER SOAKING, ENZYME SUPPLEMENTATION AND MICROWAVE TREATMENT ON THE NUTRITIVE VALUE OF RICE BRAN FOR BROILER CHICKEN

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ABSTRACT

The objectives of the current project were to examine the relative improvement in the metabolisable energy content of rice bran for poultry after treatment by water soaking, enzyme supplementation and microwave heating. Unsexed broilers (144 chicks), 21 days of age, were used in a completely randomized design of treatments. There were 6 treatments, replicated 6 times with 4 birds per treatment. The birds were allocated to treatments on an approximate equal liveweight basis. Experiment was a 2x3 factorial design with 2 factors (with or without water soaking for 48h) and 3 treatments (control diet containing 30% rice bran, control + enzyme supplementation, and control + enzyme + microwave). Soaking had a negative effect on ME, but had positive effect on feed intake, weight gain and feed conversion. Supplementation of the diet with a xylanase significantly ($P<0.01$) increased ME, but had little effect on broiler performance. Application of microwave energy to enzyme-rice mixed bran, improved ME. There were no effect of this treatment on broiler performance. It can be concluded that ME of broiler diets containing a high level (30%) rice bran may be improved by supplementation, and application of appropriate microwave energy to enzyme supplemented rice bran may increase theME of the diet.

(Key words: Supplementation enzyme xylanase, Energy microwave, Rice bran, Broiler, Metabolizable Energy (ME), Non Starch Polysaclaride (NSP))

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PENGARUH PERENDAMAN, SUPLEMENTASI ENZIM DAN PERLAKUAN DENGAN MICROWAVE TERHADAP NILAI NUTRISI DEDAK PADI PADA AYAM BROILER

INTISARI

Tujuan dari penelitian ini yaitu untuk menentukan perbaikan relatif terhadap kandungan energi termetabolis (ME) pada dedak padi untuk unggas setelah perlakuan dengan perendaman, suplementasi enzim dan pemanasan dengan mikrowave. Sebanyak 144 ekor ayam broiler jantan dan betina (umur 21 hari) digunakan pada penelitian ini dengan rancangan acak lengkap. Ada 6 perlakuan, diulang 6 kali dengan 4 ekor ayam per perlakuan. Rancangan percobaan yaitu faktorial 2x3 dengan 2 faktor (dengan dan tanpa perendaman selama 48 jam) dan tiga perlakuan (ransum kontrol yang mengandung 30% dedak padi, kontrol + suplementasi enzim, dan kontrol + enzim + mikrowave). Perendaman mempunyai efek negatif terhadap ME, tetapi berpengaruh positif terhadap konsumsi pakan, pertambahan berat badan dan konversi pakan. Ransum yang disuplementasi dengan enzim xilanase secara nyata ($P<0.01$) dapat meningkatkan ME, tetapi hanya sedikit pengaruhnya terhadap performan ayam. Penerapan energi mikrowave terhadap ransum yang dicampur enzim dapat memperbaiki ME. Perlakuan ini tidak berpengaruh terhadap performans ayam. Dapat disimpulkan bahwa ME dari ransum broiler yang mengandung tingkat dedak padi yang tinggi (30%) dapat diperbaiki dengan suplementasi enzim xilanase, dan aplikasi energi mikrowave yang tepat terhadap dedak padi yang disuplementasi enzim tidak hanya dapat meningkatkan degradasi NSP, tetapi juga meningkatkan energi ransum.

(Kata kunci: Suplementasi enzim xilanase, Energi mikrowave, Dedak padi, Broiler, Energi Metabolis (ME), Non Starch Polisakarida (NSP)).

Introduction

In the case of nutrition, the broiler inductry is continually looking for new dietary ingredients. By-products of cereal milling processes are appealing as potential feedstuffs because they often contain considerable amounts of protein, starch and fat. Their introduction, however, may lead to problems due to presence of components which possess anti-nutritive properties.

Rice bran, a by product of rice milling industry, is available in many parts of the world and is used mainly in monogastric diets. The latest world paddy rice harvest by the Food and Agriculture Organization (FAO, 1997) was 562 million metric tons (MT) per year. Approximately 91% of all rice bran is produced in Asia, and this is greater than the production of any other single crop. It however, has high levels of phytate phosphorus that is largely indigestible, and high levels of non-strach polysaccharides (NSP, ie 25%), which cause a general inhibition of absorption of macronutrients and probably micronutrients (Farrell *et al.*, 1993). Rice bran also lacks stability due to its high oil content, especially in a warm and humid environment (Farrell, 1994). NSP are not digested by poultry and are mostly wasted in the excreta. The NSP, primarily arabinoxylans, correlate closely with the AME values of a range of cereals (Choct and Annison, 1992). If the NSP could be degraded to their monomeric constituents, the nutritive value of rice bran would theoretically be improved by 15-20%.

Generally several methods of improving the nutritive value of rice bran have been developed, either by markedly reducing the anti-nutritive properties or by reducing the unfavorable effects of the anti-nutritive factors on nutrient absorption (Reddy, 1993). Feed

enzyme technology may offer possible solution to the problems of feeding rice bran to poultry by allowing enhanced utilization of the nutrient in rice bran, reducing the deleterious effects of the anti nutritive factors and facilitating access of endogenous enzymes to the feed (Donkers, 1989). Production of efficacious enzyme could allow the NSP in rice bran to be a potential source of energy for poultry.

Another method to stabilize rice bran is dry heating, which is effective but requires a long period of heating. Also, severe processing conditions are likely to damage the components of rice bran. Recently, microwave treatment has been suggested to inactive lipoxygenase and trypsin inhibitors (Vetrimani *et al.*, 1992). In addition, application of microwave energy could increase the activity of supplementary enzymes which in turn accelerate the breakdown of NSP.

The objectives of the current project were to examine the relative improvement in the metabolisable energy content of rice bran for poultry after treatment by water soaking, enzyme supplementation and microwave treatment.

Materials and Methods

The experiment consisted of six dietary treatments in a 2 x 3 factorial design. The two treatments were : soaking and no soaking; and the 3 diets were: control, enzyme, and enzyme + microwave. Each diet contained a fixed level of 30% full fat rice bran. The six experimental diets were as follows:

- Diet 1: 70% of basal diet (Table 1) + 30% full fat rice bran. This product was designated as Control.
- Diet 2: Control + 7 L of water, continuos stirring for 48h at 25°C. It was then dried at 45°C and hammer-milled to pass a 1 mm screen. This product was designated RB + S.
- Diet 3: Control + enzyme (11.2 mL) which had been diluted in 300 mL water. This product was designated RB + E.
- Diet 4: Control + enzyme (11.2 mL) + 7 L water , continuos stirring for 48h at 25°C. It was then dried at 45°C and hammer-milled to pass a 1 mm screen. This product was designated RB + E + S.
- Diet 5: Control + enzyme (11.2 mL) + microwave. This product was designated RB +E+MV.
- Diet 6: Control + enzyme (11.2 mL) + 7 L water , continuos stirring for 48h at 25°C, and was then microwaved. It was then dried at 45°C and hammer-milled to pass a 1 mm screen. This product was designated RB + E + MV + S.

All ingredients used for the control diet (Table 1) were accurately weighed, and thoroughly mixed in a rotary mixer. A recommend amount of enzyme A was diluted in 300 mL water and sprayed into the ingredients using a pressure-spray while feed mixing continued.

Table 1. The composition of the basal diet used in the experiment

Ingredients	Amounts (g/kg)
DL Methionine	2.0
Maize (8.5% CP)	423.5
Rice Pollard (13% CP)	300.0
Tallow (Stabilized)	10.0
Limestone	18.0
Salt	1.5

Table 2. Effects of water soaking, enzyme supplementation and microwave treatment on the ME, FCR, WG, FI and excreta moisture of broiler chicken fed diets containing rice bran

Diet	ME (MJ/kg)	FCR (feed : gain)	WG (g/d/b)	FI (g/d/b)	Excreta Moisture (%)
Control	11.89	2.39	32.08	79.4	79.62
RB + S	11.87	2.14	39.71	83.48	80.01
RB + E	13.01	2.32	33.87	78.28	80.09
RB + E + S	11.82	2.29	37.45	83.99	80.20
RB + E + MV	13.61	2.33	38.97	89.47	80.33
RB + E + MV + S	12.66	2.18	43.39	92.40	77.82
Pooled SEM	0.22	0.11	2.92	4.77	1.00
F test and level of significance:					
Treatment	16.09**	0.15	2.28	2.72	0.31
Diet	15.88**	2.74	4.77*	1.17	0.82
Treat X diet	3.86	0.55	0.27	0.04	1.24

*P<0.05; **P<0.01.

One hundred and forty four mixed sex broiler chicks (21 days of age) were used in a completely randomized design of treatments. There were 6 treatments, replicated 6 times with 4 birds per treatment. The birds were allocated to treatments on an approximate equal liveweight basis.

Results and Discussion

Data from the experiment are shown in Table 2. There was evidence of an increase (P<0.05) of ME (Diet 3,5, and 6). However, water soaking (Diet 4) of rice bran decreased AME. Feed intake and weight gain of the birds were significantly increased (P<0.5) by water soaking. Addition of an enzyme (xylanase) to diets 3,5 and 6 markedly increased the ME (P<0.05), but feed intake, weight gain and FCR were not significantly improved. Moreover, birds fed diets 5 and 6 which contained enzyme and were treated with microwave had significantly better ME and growth compared to those fed the other diets. The ME values for control, enzyme and enzyme + microwave diets were: 11.89; 13.01 nad 13.61 MJ/kg, respectively. the three diets (diet 1, 3 and 5) differed significantly (P<0.05). The moisture content of excreta of the birds was not affected by treatment.

Water soaking of rice bran depressed ME (Diet 4), but increased feed intake and weight gain of the birds. The negative effect on the ME was possibly due to an increased oxidation of lipids during soaking and subsequent drying at 45°C. The positive effect of soaking, on the other hand were probably due to the activation of endogenous phytase present in rice bran, which increased the availability of organic phosphorus to the birds.

Diment (1984) reported that oxidation of lipids might have contributed to the rather excessive loss in nutritive value he observed in soaked rough rice. Roberts and Yudkin (1970) reported that when ground rough rice was water soaked and dried an adverse effect was noted on both poult growth and feed efficiency. However, Barber (1978) found favorable nutritional responses from water soaking of cereal grains, especially from barley, when they used in broiler rations.

Addition of xylanase to ht ediets markedly increased ME, but had little effect on bird performance. This suggest that phosphorus was limiting in the current diets to a greater extent than energy. The current diets contained 30% of rice bran which was much higher than commercial inclusion levels. This rice bran contained a high level of phytate, which presumably increased the availability of organic phosphorus to the birds.

Bedford and Morgan (1996) confirmed that strach digestibility may account for up to 35% of the improvement in ME as a result of xylanase supplementation. Under Australian condition, Choct (!996) demonstrated that supplementation of a low-ME wheat diet with a commercial glycanase preparation increased the ME by 24% and the FCR by 25% in 3-4 week old broiler chickens. Taken together, these reports show that enzyme addition to a high NSP basal diet may result in improvement in feed conversion ratio, and a reduction in feed intake. In contrast, Campbell *et al.* (1984) did not observe any significant effect of enzyme addition from three to four weeks of age, but during the finisher period observed that while enzyme addition did not affect weight gain, it did reduce feed intake by 2.9% and thus improved feed conversion efficiency.

In the current work, birds fed the diets which contained enzyme and were treated with microwave heating metabolized significantly more energy than birds in the other groups. This suggests that the microwave treatment enhanced the activity of the enzyme and released more absorbable nutrients from the NSP of rice bran. Again, the lack of response on bird performance was probably due to phosphorus limitation in the current diets.

Conclusions

It can be concluded that soaking had a negative effect on ME, but was positive effect on feed intake, weight gain and feed conversion. Supplementation of the diet with a xylanase significantly ($P<0.01$) increased ME, but had little effect on bird performance. Application of microwave energy to enzyme-rice bran mix, improved ME. There were no effect of this treatment on bird performance. AME of broiler diets containing a high level (30%) rice bran may be improved by supplementation, and application of appropriate microwave energy to enzyme supplemented rice bran may increase the AME of the diet.

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