RELEASING ENERGY FROM RICE BRAN BY ENZYME SUPPLEMENTATION AND MICROWAVE TREATMENT

by
N.G.A. Mulyantini

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Department of Animal Science
University of New England
AUSTRALIA

DECLARATION

I certify that the substance of this thesis has not already been submitted for any degree and is not being submitted currently for any other degree.

I certify that, to the best of my knowledge, all the work for this project was carried out solely by the candidate. All assistance received in the preparation of the thesis and all resources used have been acknowledged herein.

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N.G.A. Mulyantini

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Summary

Three experiments were conducted to determine whether various exogenous enzymes (xylanase, lipase, and phytase) would enhance the nutritive value of rice bran for poultry. Water soaking and microwave treatment of rice bran, in combination with xylanase supplementation, were also examined both *in vitro* and *in vivo*.

Experiment 1 was conducted in two parts. First, the ability of commercial glycanases to release sugars from rice bran *in vitro* was examined. Full-fat or de-fatted rice bran (50 g) was incubated with 100 mL of water containing either a multi-activity glycanase (enzymes A; recommended dosage rate 800 mL/kg or 2 x 800 mL/kg) or a xylanase-based glycanase (Enzyme B; recommended dosage rate 500 mL/kg or 2 x 500 mL/kg). The mixtures were continuously shaken at 40°C for 24h. Negligible amounts of sugars were released from both full-fat rice bran and de-fatted rice bran by both enzymes at two dosage rates. Second, specific frequencies of microwave energy (68°C) were applied to a mixture (50:50) of rice bran and Enzyme A for 5,10, 20 or 30 min. Five minutes of microwave treatment released 3.5% free sugars from rice bran. Longer periods of treatment did not lead to increased release of sugars.

Experiment 2 was a 2 x 3 factorial design with two factors (with or without water soaking for 48h) and three treatments (control diet containing 30% rice bran, control diet + enzyme (xylanase) supplementation, and control diet + enzyme (Xylanase) + microwave). Soaking had a negative effect on AME, but was positive on feed intake, weight gain and feed conversion. Supplementation of the diet with a xylanase significantly ($P<0.01$) increased AME, but had little or no effects on bird performance. Application of specific frequencies of microwave energy to enzyme-rice bran mix, further improved AME. There was no effect of this treatment on bird performance.

Experiment 3 was conducted to examine the effect of supplementation of xylanase (Enzyme B), phytase, and lipase on the performance of broilers fed a diet containing 30% rice bran. There were eight diets in a 2 x 2 x 2 factorial design: 1) Control diet; 2) Control + xylanase; 3) Control + lipase ; 4) Control + phytase; 5) Control + xylanase + lipase; 6) Control + xylanase + phytase; 7) Control + lipase + phytase; and 8) Control + lipase + xylanase + phytase. Enzyme products (xylanase, phytase and lipase) did not have a significant effect (P>0.05) on weekly feed intake and weight gain of birds. But feed intake tended to drop and weight gain tended to increase in response to supplementation of all three types of enzymes. Thus, weight gain of the birds was increased by 0.6% with lipase, 3.7% with phytase and 2.4% with xylanase. There were no interaction of the enzymes on these two parameters. Xylanase had a marked effect (P<0.01) on both FCR and AME, decreasing FCR from 1.52 to 1.44 and increasing AME from 12.29 to 12.60 MJ/kg. There was also a highly significant (P<0.01) interaction between the three enzymes on AME. The lipase and phytase both improved FCR but had no effect on AME. The improvement in FCR by lipase, phytase and xylanase was 2.1, 2.6 and 5.4%, respectively.

It is concluded that (a) the release of free sugars from rice bran *in vitro* by the current commercial glycanases is minimal; (b) AME of broiler diets containing a high level (30%) of rice bran may be improved by xylanase supplementation, and (c) application of appropriate microwave energy to enzyme-supplemented rice bran can not only increase NSP degradation *in vitro*, but also increase the AME of the diet.

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