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**INCREASING THE NUTRITIVE VALUE OF FULL-FAT RICE BRAN  
FOR BROILER CHICKENS**

**A Thesis Presented in Partial Fulfilment of the Requirements for  
the Degree of Master of Science in Nutritional Science  
at Massey University**

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## ABSTRACT

In the series of experiments presented in this thesis, two hypotheses were examined: 1) Use of a lipase preparation in diets containing full-fat rice bran (FFRB) would increase AME content by increasing lipid digestibility; 2) Use of lipase and phytase enzyme preparations would increase production of broiler chickens when FFRB was added to diets at 9 and 18%. Two experiments were conducted to study the effects of the enzyme preparations and FFRB from two sources (Australia and Thailand) on the performance of male broiler chickens when substituted in a maize-soyabean meal basal diet (Experiments 1 and 2). The third experiment was conducted to examine the effect of lipase and(or) phytase enzyme preparations on the performance of male broiler chickens fed diets that were formulated with FFRB (9 and 18%) as an ingredient in the diet formulation. In the first experiment, using Australian FFRB, the lipase preparation was added to a basal diet and the basal diet substituted with 9% FFRB. Birds were fed pelleted feed *ad libitum* from day 0-35. Excreta were collected over three periods, from day 4-7, day 18-21 and day 32-35, for determination of AME content and lipid digestibility. On day 36, eight randomly-selected birds from each treatment were euthanased to measure digestive organ weights. The lipase preparation did not improve ( $P > 0.05$ ) lipid digestibility of both the basal and 9% FFRB diets. However, the AME content of enzyme-supplemented basal diet was significantly improved between days 18-21 ( $P < 0.05$ ). The AME content was significantly higher in the 9% FFRB diet with enzyme supplementation between days 32-35 ( $P < 0.05$ ). Only the performance of birds fed the basal diet with the lipase preparation was improved numerically from days 8-21 ( $P = 0.08$ ). The lipase preparation reduced ( $P < 0.05$ ) relative caecal weight of the birds fed basal diet, and relative small intestinal weight of birds fed 9% FFRB diet. In Experiment 2, in which a sample of FFRB from Thailand was used, six diets were prepared, being basal, basal + lipase, 9% FFRB, 9% FFRB + lipase, 18% FFRB and 18% FFRB + lipase. Birds were fed pelleted feed *ad libitum* from day 0-14. Excreta were collected over two periods of time, from day 4-7 and day 11-14, for subsequent AME content and lipid digestibility determination. On day 14, six birds from each treatment were randomly selected and euthanased. Lipid digestibility was not improved ( $P > 0.05$ ) by the

addition of the lipase preparation. Performance of birds fed basal diet was improved ( $P < 0.05$ ) by the use of the lipase preparation. Bird performance (growth rate and feed conversion ratio) deteriorated ( $P = 0.066$ ) with increasing level of FFRB in the diets, but feed intake was not affected. The AME contents of the basal and FFRB diets were higher in diets containing the lipase preparation ( $P = 0.080$ ). In Experiment 3, the lipase and/or phytase preparations were used in association with nine diets of similar crude protein (21%) and AME content (3050kJ/kg), these being: a control diet, 9% FFRB + no enzyme, 9% FFRB + lipase, 9% FFRB + phytase, 9% FFRB + lipase + phytase, 18% FFRB + no enzyme, 18% FFRB + lipase, 18% FFRB + phytase and 18% FFRB + lipase + phytase. Birds were fed pelleted feed *ad libitum* from day 0-35. No improvement was found in bird performance when enzyme preparations were added to the FFRB diets. All birds except those on 18% FFRB + lipase + phytase ate significantly less feed than controls ( $P < 0.05$ ). All birds on FFRB-based diets had better feed efficiency value than control. However, only Diet 18% FFRB + no enzyme, 9% FFRB + lipase and 18% FFRB + lipase were significantly better than control ( $P < 0.05$ ).

These studies indicated that:

- The use of a lipase preparation added to diets containing either Australian or Thai FFRB generally improved AME content of both diets and FFRB. However, this was not associated with an improvement in lipid digestibility, suggesting that other enzyme activities in the preparation contributed to the improvement in AME content.
- When added to diets containing FFRB, the lipase preparation produced equivocal results in chicks, as it improved performance with Thai FFRB but not the Australian FFRB. This may be due to the level of FFRB included and varietal and(or) environmental differences during growth.
- Enzyme preparations did not improve performance of birds at low nutrient specification, such as in Experiment 3. This is because a sub-optimal nutrient specification may suppress the feed intake of the birds, thus affecting mean retention time and nutrient digestibility.

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**LIST OF ABBREVIATIONS**

AME	Apparent metabolisable energy
BW	Body weight
Ca	Calcium
Cu	Copper
EDTA	Ethylene-diaminetetraacetate
FCR	Feed conversion ratio
Fe	Iron
Fe <sup>3+</sup>	Ferric ions
FFRB	Full-fat rice bran
FI	Feed intake
GR	Growth rate
HCL	Hydrochloric acid
K	Potassium
Mg	Magnesium
Mn	Manganese
Ni <sup>2+</sup>	Nickelous ions
NSP	Non-starch polysaccharides
P	Phosphorus
RB	Rice bran
Si	Silicon
Zn	Zinc