Effect of Fibre Hydrolytic Enzymes Supplementation on Performances of Broiler Chickens Fed Diets Containing Rice Bran

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ABSTRAK

KETAREN, P.P., T. PURWADARIA, A.P. SINURAT dan T. HARYATI. 2012. Pengaruh suplementasi enzim pemecah serat pada kinerja ayam broiler yang diberi pakan mengandung dedak padi. *JITV* 17(3): 229-233.

Dedak padi diproduksi sepanjang tahun di Indonesia oleh penggilingan padi dengan harga yang relatif lebih rendah. Penggunaan dedak padi sebagai pakan unggas dibatasi oleh kandungan serat yang tinggi karena unggas tidak dapat menghidrolisis serat menjadi energi yang tersedia. Tujuan penelitian ini adalah untuk menginvestigasi pengaruh suplementasi enzim terhadap performan ayam pedaging yang diberi pakan mengandung 30% dedak padi. Rancangan penelitian menggunakan rancangan acak lengkap dengan sembilan perlakuan. Perlakuan 1-5 mengandung protein dan energi 5% kurang dari rekomendasi dan energi metabolis dedak ditetapkan 2040 kkal/kg, tanpa memperhitungkan keuntungan pengaruh suplementasi enzim. Perlakuan tersebut adalah: 1. Pakan kontrol (D2040, tanpa enzim); 2. D2040 + *E. javanicum* (BS4) + *P. nalgiovense* (S11); 3. D2040 + BS4 + *A. niger*; 4. D2040 + BS4 + enzim komersial (CE); 5. D2040 + *B. pumilus* (PU4-2) + CE. Empat perlakuan lainnya mengandung protein dan energi sama dengan perlakuan 1-5, akan tetapi telah memperhitungkan pengaruh suplementasi enzim. Perlakuan tersebut adalah 6. D2702 + BS4 + S11; 7. D2650 + BS4 + *A. niger*; 8. D2465 + BS4 + CE; dan 9. D2465 + PU4-2 + CE. Setiap perlakuan diulang enam kali yang terdiri dari lima ekor anak ayam broiler/ulangan. Hasil penelitian menunjukkan bahwa efisiensi pakan ayam yang diberi pakan D2040 + PU4-2 + CE (FCR 1.38), dan D2465 + PU4-2 + CE (FCR = 1.46) secara nyata ($P < 0.01$) lebih baik dibanding pakan kontrol (FCR = 1.64). Peneilitian ini jelas menunjukkan bahwa suplementasi enzim PU4-2 + CE secara nyata meningkatkan efisiensi pakan sebanyak 11-16%.

Kata Kunci: Enzim, Pemecah Serat, Ayam Pedaging

ABSTRACT

KETAREN, P.P., T. PURWADARIA, A.P. SINURAT and T. HARYATI. 2012. Effect of fibre hydrolytic enzymes supplementation on performances of broiler chickens fed diets containing rice bran. *JITV* 17(3): 229-233.

Use of the rice bran as poultry feed is restricted by its high fibre content as poultry is unable to hydrolyse the fibre into available energy. This experiment was aimed The aim of this experiment was to investigate the effect of crude enzymes supplementation on performances of broiler chickens fed diets containing 30% rice bran. The experiment was based on completely randomized design with nine experimental diets. Diets 1-5 contained 5% less than recommended protein and energy, based on determined metabolizable energy (ME) content in the rice bran at 2040 kcal/kg, without taking into account on the beneficial effect of the enzyme supplementation. These diets were: 1. A control diet (D2040, without enzymes); 2. D2040 + *E. javanicum* (BS4) + *P. nalgiovense* (S11); 3. D2040 + BS4 + *A. niger*; 4. D2040 + BS4 + commercial enzymes (CE); 5. D2040 + *B. pumilus* (PU4-2) + CE. Four other experimental diets contained the same protein and energy levels as in the diets 1-5, but had taken into account on the beneficial effect of the enzyme supplementation;. These diets were: 6. D2702 + BS4 + S11; 7. D2650 + BS4 + *A. niger*; 8. D2465 + BS4 + CE ;and 9. D2465 + PU4-2+ CE. Each experimental diet was repeated six times and each replication consists of 5 day-old broiler chickens. Results showed that FCR of the chickens fed D2040 + PU4-2 + CE -diet (FCR = 1.38) and D2465 + PU4-2 + CE diet (FCR = 1.46) were significantly ($P < 0.01$) improved compared to the control diet (FCR = 1.64). This experiment strongly shows that supplementation of PU4-2 + CE enzymes significantly ($P < 0.01$) improved feed efficiency of the broiler chickens by 11-16%.

Key Words: Fibre Hydrolytic Enzymes, Broiler Chickens, Performances

INTRODUCTION

Most of poultry feed in Indonesia are imported from overseas except few ingredients such as rice bran which is produced by milling intact rice (*paddy*). Intact rice production in Indonesia in year 2008 was reported at 62.56 million tonnes (BPS, 2009) and approximately 10% of it produces rice bran or equal to 6.25 million tonnes. The inclusion of the rice bran in poultry feed is limited by its high fibre content which is approximately

11.4% (NRC, 1994). This fibre are mostly non-starch polysaccharides (NSP) of arabinoxylans and cellulose (CHOCT, 2011). These NSP are not digested in the chickens digestive tract as the chickens do not have internal hydrolytic enzymes and therefore has to be supplemented in their diets. Balai Penelitian Ternak in Indonesia produced fibre hydrolytic enzymes extracted from various microbes and it's mixture: *Penicillium nalgiovense* (S11), *Eupenicillium javanicum* (BS4), *Aspergillus niger* (NRRL 337), and *Bacillus pumilus* (PU4-2). The cocktail of those enzymes were more effective in digesting fibres in rice bran and wheat pollard (PURWADARIA *et al*., 2003a, b). These types of enzymes are needed to improve nutrient digestibility, hence feed efficiency of chickens fed diet containing high level of rice bran.

The aim of this experiment was to investigate the use of fibre hydrolytic enzymes in improving broiler chickens performances fed diet containing 30% rice bran.

MATERIALS AND METHODS

The experiment was based on completely randomized design with nine experimental diets. Diets 1-5 contained 5% less than protein and energy recommended levels (NRC, 1994), based on determined metabolizable energy (ME) content in the rice bran at 2040 kcal/kg, without taking into account on the beneficial effect of the enzyme supplementation, particularly on energy improvement levels. These diets were: 1. A control diet (D2040, without enzymes); 2. D2040 + cocktail enzymes of *E. javanicum* BS4 + *P. nalgiovense* S11; 3. D2040 + cocktail enzymes of *E. javanicum* BS4 + *A. niger*; 4. D2040 + cocktail enzymes of *E. javanicum* BS4 + commercial enzymes (CE); 5. D2040 + cocktail enzymes of *B. pumilus* PU4-2 + CE. Four other experimental diets contained the same protein and energy levels as in the diets 1-5, but had taken into account on the beneficial effect of the enzyme supplementation, particularly on energy improvement levels. These diets were: 6. D2702 + *E. javanicum* BS4 + *P. nalgiovense* S11 diet; 7. D2650 + *E. javanicum* BS4 + *A. niger* diet; 8. D2465 + *E. javanicum* BS4 + CE diet; and 9. D2465 + *B. pumilus* PU4-2 + CE diet. The commercial enzymes contained xylanase and β-glucanase enzymes. Each experimental diet was repeated six times and each replicate consists of 5 day-old broiler chickens. Two hundred and seventy day-old broiler chickens were randomly alloted into the treatments and fed ad lib. for four weeks. Feed intake, live weight gain, feed conversion ratio (FCR), and mortality rate were used as parameter responses. Then the data were statistically analysed based on the analysis of variance, and the mean differences were tested using Duncan multiple range test. The effect of fibre hydrolytic enzymes supplementation was then determined based on the best parameter responses to the dietary treatments.

Therefore, at first stage of this experiment, it was determined the effect of crude enzyme supplementation on the improvement of metabolizable energy in the rice bran. There were four different combination of crude enzymes added to the rice bran. In addition, the rice bran without enzymes was also evaluated. This study was carried out based on the SIBBALD (1983) method. The result of this study was shown on Table 2. Thereafter, nine dietary treatments were formulated based on the metabolizable energy content in the rice bran with or without enzyme supplementation as shown on Table 1.

RESULTS AND DISCUSSION

Effect of crude enzyme supplementation on the apparent metabolizable energy content in the rice bran.

The effect of crude enzyme supplementation on metabolizable energy in the rice bran was shown on Table 2. All combination of enzymes supplementation increased the AME in the rice bran from 2040 kcal to 2465-2702 kcal/kg. The highest increase was found when the rice bran was supplemented with crude enzymes from S11 + BS4 (2702 AME/kg). The improvement of the AME in the rice bran were ranging from 20.68-32.45%. The improvement of the metabolizable energy was also reported by CHENG *et al*. (2005), MCDEVITT *et al.* (2004), and SELLE *et al.* (2003) by supplementing various enzymes in the poultry diets.

The effect of crude enzyme supplementation on feed intake of broiler chickens from 1-4 weeks.

Feed intake of broiler chickens were calculated based on the same DM content (88.35%, Table 3). Averages of cumulative feed intake up to four weeks old were from 1436-1760 g/head. Most of the feed intake was reduced with the crude enzyme supplementation to the diets. Feed intake of chickens fed diets supplemented with crude enzyme in R4, R5, R6, R7 and R9 were all significantly ($P < 0.01$) lower then the control diet (R1). However, two of the lowest feed intake were recorded on chickens fed diets supplemented with crude enzymes of BS4 + CE (R5 and R9) which were significantly ($P < 0.01$) lower than all diets.

Tabel 1. Composition of dietary treatments for broiler chickens from 1-4 weeks old

Ingredients	R1 (2040)	R2 (2040)	R3 (2040)	R4 (2040)	R5 (2040)	R6 (2702)	R7 (2650)	R8 (2465)	R9 (2465)
Rice bran (%)	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Maize (%)	26.24	26.24	26.24	26.24	26.24	31.15	30.76	29.39	29.39
Soya-bean meal (%)	26.98	26.98	26.98	26.98	26.98	26.03	26.11	26.37	26.37
Fish meal (%)	7.00	7.00	7.00	7.00	7.00	7.00	7.00	5.46	5.46
Palm oil (%)	8.00	8.00	8.00	8.00	8.00	4.04	4.35	7.00	7.00
Premix (%)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Methionine (%)	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Salt (%)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Lime (%)	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
BS4+S11 enzymes	0.00	100 U	0.00	0.00	0.00	100 U	0.00	0.00	0.00
BS4+NRRL enz.	0.00	0.00	100 U	0.00	0.00	0.00	100 U	0.00	0.00
BS4+CE enzymes	0.00	0.00	0.00	100 U	0.00	0.00	0	100 U	0.00
PU4-2+CE enzymes	0.00	0.00	0.00	0.00	100 U	0.00	0.00	0.00	100 U
Monensin (%)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total (%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Crude protein (%)	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
Kcal ME/kg	3075	3075	3075	3075	3075	3075	3075	3075	3075
Crude fibre (%)	6.25	6.25	6.5	6.25	6.25	6.31	6.31	6.29	6.29
Lysine (%)	1.30	1.30	1.30	1.30	1.30	1.29	1.29	1.30	1.30
Methyonine (%)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Total Ca (%)	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Total P (%)	0.95	0.95	0.95	0.95	0.95	0.94	0.96	0.96	0.96

Tabel 2. Effect of crude enzyme supplementation on the metabolizable energy content in the rice bran

Treatments	Energy (kcal. AME/kg)	Energy improvement (%)
Rice bran (RB) without enzymes	2040	0.00
RB + S11 + BS4	2702	32.45
RB + BS4 + NRRL	2650	29.88
RB + BS4 + CE	2465	20.82
RB + PU4-2 + CE	2465	20.68

Table 3. Effect of crude enzymes supplementation on performances of broiler chickens at 4 weeks old (at the same DM content = 88.35%)

Dietary treatments	Feed intake (g/head)	LWG	FCR
R1= RB 2040 (control)	1760^{A}	1074^{a}	1.64^{AB}
R2= RB 2040 + BS4+ S11	1725^{ABC}	1072^{a}	1.61^{AB}
R3= RB 2040 + BS4 + NRRL	1715^{ABC}	1095^{a}	1.57^{B}
R4= RB 2040 + BS4 + CE	1672^{BC}	1050^{a}	1.59^{AB}
R5= RB 2040 + PU4-2 +CE	1436^{E}	1044^{a}	1.38^{D}
R6= RB 2702 + BS4+ S11	1649^{C}	1031^{a}	1.60^{AB}
R7= RB 2650 + BS4 + NRRL	1654^{C}	1020^{a}	1.63^{AB}
R8= RB 2465 + BS4 + CE	1739^{AB}	1053^{a}	1.65^{A}
R9= RB 465 +PU4-2 +CE	1506^{D}	1033^{a}	1.46^{C}

The effect of crude enzyme supplementation on live weight gain of broiler chickens from 1-4 weeks

Average live weight gain of chickens in this experiment ranging from 1020-1095 g/head at 4 weeks old (Table 3). The crude enzymes supplementation did not significantly affect the live weight gain of the chickens. This indicates that the chickens supplemented with crude enzymes particularly with the lowest feed intake such as in R5 and R9 (RB 2040 + PU4-2 + CE and RB 2465 + PU4-2 CE) did grow normally as fast as in other diets that had higher feed intake. This simply means that under sub optimal feed intake as in the R5 and R9, the enzymes did improve the nutrient digestibility not only energy but possibly also other nutrients such as protein and fat. This is in line with other research results reported by KETAREN (1991) using phytase in pig diets, and MARQUARDT (1997) using fibre hydrolytic enzymes in broiler chickens. However, KETAREN *et al.* (2002) and BINTANG *et al*. (2006) found that the same type of commercial enzymes alone did not improve broiler chicken performances when fed diet containing rice bran, but effective in wheat bran basal diet (KETAREN, 2006).

The effect of crude enzyme supplementation on FCR of broiler chickens from 1-4 weeks

Average cumulative FCR of broiler chickens fed crude enzymes were ranging from 1.38-1.65 (Table 3). This experiment revealed that the best FCR obtained when the chickens were supplemented with PU4-2 + CE for both in R5 and R9. FCR of these chickens fed R5 (FCR 1.38) and R9 (FCR = 1.46) were significantly ($P < 0.01$) more efficient than fed other diets. These diets were significantly ($P < 0.01$) more efficient compared to other enzyme supplementation and also chickens on the control diet. These were because the feed intake of chickens on those two diets were much lower than other diets while the live weight gain of the chickens was not significantly different. This strongly suggests that the combination of crude enzymes from PU4-2 and CE were effective in hydrolyzing the crude fibre and possibly also in improving the digestibility of protein and fat in those diets. This was also supported with the fact that those two diets, in particular diet R9 were containing nutrients lower than NRC (1994) recommendation. But nevertheless, those chickens fed both diets supplemented with those crude enzymes did produce the best feed efficiency. This could simply because the rice bran contained 90% arabinoxylan and cellulose (CHOCT, 2011). WIDJAJA *et al.* (2008) reported that PU4-2 was producing high level of xylanase. This xylanase worked well with the commercial enzymes in reducing viscocity and hydrolyzed the fibre in the rice bran (MATHLOUTHI *et al*., 2002) and improved protein and fat digestibilities (KETAREN, 1991; MARQUARDT, 1997)

CONCLUSION

This experiment concludes that supplementation of fibre hydrolytic enzymes extracted from PU4-2 mixed with the commercial enzymes to the chicken diets, significantly improved feed efficiency (11-16%) of the broiler chickens when fed diets containing 30% of rice bran.

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