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OPTIMIZING WHEAT BRAN UTILIZATION FOR POULTRY PRODUCTION THROUGH ENZYME SUPPLEMENTATION:1. BROILER CHICKEN

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ABSTRACT

A study on optimizing wheat bran (WB) utilization for broiler chicken production through enzyme supplementation was carried out at Balai Penelitian Ternak, Ciawi in cooperation with PT. Indofood Sukses Makmur Tbk., Bogasari Flour Mills in year 2002-2003. The aim of this study was to estimate the optimal level of WB in broiler chicken diets. This study used 225 day-old broiler chickens (doc) obtained from commercial local broiler chicken breeding farm. The design of the experiment was based on the completely randomized factorial experiment 3 x 3. Three levels of WB: 30, 40 and 50 % with three levels of enzyme supplementation: 0.00, 0.01 and 0,02% were tested. There were 9 treatment diets, 5 replicates and 5 doc in each replicate. Broiler chickens were fed pellet diets and drinking water *ad lib.* for 5 weeks and then sacrificed. The results indicate that the increasing level of WB up to 50% in the diet significantly ($P<0.05$) decreased feed intake and growth rate but had no effect on feed conversion ratio (FCR) of the broiler chicken. FCR of 5 weeks old chicken were ranging from 1.61-1.77 with the best value obtained when fed 30% WB supplemented with 0.02% enzyme. Increasing level of the enzyme in the diet improved growth rate and significantly ($P<0.05$) increased feed efficiency (6%). There was no interaction effect between WB and enzyme supplementation levels on the parameters measured. This study indicates that the optimal and economical level of WB to be included in broiler chickens diet was 30% with 0.02% enzyme supplementation.

Key Words: Enzyme, Wheat Bran, Broiler Chicken

INTRODUCTION

More than 60% of meat production in Indonesia in 2005 was produced by poultry meat primarily broiler chickens (Anon., 2005). Approximately 70% of broiler production cost comes from feed cost. Unfortunately, protein sources like soybean meal and fish meal and some maize are still imported to meet the need of poultry industry. Some local feeds are available throughout the year like palm kernel meal, rice bran and wheat bran but contain high fibre. The use of wheat bran as broiler feed has some limitation such as low energy content (1300 Kcal ME/kg), and high fibre (11%) (National Research Council, NRC, 1994). Wheat contains β-glucans and high pentosan (5.8-8.3%, Anon., 2001) which predominantly consists of arabinose and xylose (Marquadt, 1999). Approximately 15% of the pentosans are soluble in water that may produce high viscosity in the small intestine and thereby inhibit digestion and absorption of nutrients in poultry (Smiths and Annison, 1996). Supplementation of enzymes to a diet that

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contains high soluble pentosans and β-glucans reduced viscosity, improved the digestion and absorption of nutrients particularly fat and protein, energy, lower water intake and improved feed efficiency of chickens (Marquadt, 1999). The aim of this study is to estimate the optimal level of wheat bran (WB) supplementing with xylanase and β-glucanase enzymes in broiler chicken diet.

MATERIALS AND METHODS

*Table 1. Composition of the experimental diets (%) for broiler chicken from 1-5 weeks old**

Feed ingredient	30% WB	40% WB	50% WB
Wheat bran	30	40	50
Maize	40.6	28.45	15.7
Soya-bean meal	5.8	4.5	3.2
Fish meal	14	14	14
Methionine	0.15	0.2	0.25
Lysine	0.3	0.35	0.45
Vitamins & Minerals Premix	0.5	0.5	0.5
Vegetable oil	6.15	9.5	13.1
Dicalcium phosphate	2	2.3	2.6
Lime	0.5	0.2	0.2
Total	**100**	**100**	**100**
Composition**			
Protein (%)	20.71	20.71	20.70
Energy (kcal ME /kg)	2900	2901	2902
Crude fibre (%)	5.16	5.76	6.33
Methionine (%)	0.50	0.52	0.53
Lysine (%)	1.12	1.10	1.11
Ca (%)	1.12	1.07	1.12
P (%)	0.89	0.90	0.91

* Commercial enzyme were added 0.00; 0.01 and 0.02% to each diet. The enzyme contains: β-glucanase1200 BGU (β-glucanase unit)/g and 55000 EXU (endo-xylanase)/g.
**Calculated values (2900 kcal ME/kg) were 10% lower than NRC (1994) recommendation for broiler chicken at 1-3 weeks old.

This study used 225 day-old broiler chickens (doc) obtained from commercial local broiler chicken breeding farm. Each chick was numbered using wing band, weighed, and randomly allocated to pens. Each pen has the same size of 70 x 45 x 35 cm respectively for length, width and height. The design of the experiment was based on the completely randomized factorial experiment 3 x 3. Three levels of WB: 30, 40 and 50 % with three levels of enzyme supplementation: 0.00, 0.01 and 0.02% were tested. Wheat bran was locally traded as "polar" purchased from a poultry shop in Bogor. Commercial enzyme in granulated form contains β-glucanase and endo-xylanase was produced by Gist-brocades, Holland distributed by BASF-Germany. There were 9 treatment diets, 5 replicates and 5 day-old chicks in each replicate. The experimental diets were allocated randomly to the pens diets. The diets were formulated to contain

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similar methionine, lysine, Ca, and P to meet the NRC (1994) recommendation for broiler chickens (table 1). Crude protein (20.7% and energy
The experimental pellet diets and water were offered *ad libitum*. All chickens were vaccinated against New Castle Disease (ND) at 4 and 25 days old and against Infectious Bursal Disease (IBD) at 18 days old. The chickens were raised in the wire cages for 5 weeks and then sacrificed for carcass determination. Feed consumption, weight gain, FCR, and mortality were recorded. The data were statistically analyzed using Statistical Analysis System (SAS) program.

RESULTS AND DISCUSSION

Feed intake

The increasing level WB in the diets significantly (P<0.05) decreased feed intake (Table 2). Feed intake of chickens fed diet containing 30% WB was 2170 g/head was decreased to 1902 g/head when WB level increased up to 50% in the diet. The decreasing feed intake in the highest WB could possibly be related to the increasing level of crude fibre in the diet containing high level of WB. It was reported that high viscosity caused by water soluble fibre affected feede intake due to slower passage (Hetland *et al.*, 2004). However, there was no difference between feed intake of the diets containing 30 and 40% WB. This indicates that 30-40% of WB can be included in the broiler chicken diet

The enzyme levels did not significantly affect feed intake. The average of feed intake was ranging from 2047-2097 (Table 1). The feed intake in this experiment was lower than the feed intake of broiler chickens fed on 30% WB diet (2373 g/head) reported by Ketaren *et al.* (2002). There was also no interaction effect of WB and enzyme levels on the feed intake of the broiler chickens. This indicates that feed intake was solely affected by the level of WB in the diet.

Live weight gain.

Live weight gain (LWG) of chickens was significantly (P<0.05) decreased by the increasing levels of WB in the diet (Table 3). LWG of chickens fed diet containing 50% WB was significantly (P<0.05) lower than the chickens fed 30-40% WB in the diets. This could be due to the low feed intake of chickens fed the diet containing 50% WB as shown in Table 2. However,.

*Table 2. Cummulative feed intake (g/head) of broiler chickens from 1-5 weeks old**

WB (%)	Enzyme (%)			Average
	0,00	0,01	0,02	
30	2250	2219	2041	**2170** [a]
40	2124	2147	2178	**2149** [a]
50	1917	1865	1924	**1902** [b]
Average	**2097**	**2077**	**2047**	

* Different superscripts within column mean significantly different (P<0.05).

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*Table 3. Live weight gain (g/head) of broiler chickens from 1-5 weeks old**

WB (%)	Enzyme (%)			Average
	0,00	0,01	0,02	
30	1281	1273	1270	**1275** [a]
40	1200	1257	1306	**1254** [a]
50	1081	1058	1127	**1089** [b]
Average	**1187**	**1196**	**1234**	

* Different superscripts within column mean significantly different (P<0.05).

LWG of chickens fed 30 and 40% WB were not significantly different. This indicates that 30-40% WB could be used ibn the broiler chicken diet

The enzyme levels, interaction between enzyme and WB levels did not affect LWG of the chickens. However, LWG tends to increase by the increasing level of the enzyme in the diet. LWG of chickens with or without enzyme supplementation in this study was ranging from 1187-1234 g/head. This LWG was slightly lower than LWG of broiler chickens reported by Ketaren *et al.* (2002). This result shows that LWG of the chickens in this experiment was only affected by the level of WB in the diets. The highest the level of the WB in the diet the lowest the LWG of the chickens. This could also be related to the increasing level of the crude fibre in the diet containg higher level of the WB.

Feed Conversion Ratio (FCR)

FCR of the chickens was only affected by the levels of the enzyme in the diets (Table 4). FCR was significantly (P<0.05) improved by the increasing levels of the enzymes in the diets. FCR was ranging from 1.66-1.77. The FCR range in this experiment was slightly higher than FCR of broiler chickens (1.57-1.66) fed 30% WB reported by Ketaren et al. (2002). FCR of the chickens was significantly (P<0.05) better when fed diet supplementing with 0.02% enzyme compared to the diet containing 0.00 and 0.01%. Consistently, FCR of the chickens improved when fed diet supplementing with 0.02% enzyme regardless the level of WB in the diet. The level oh WB did not significantly affect FCR of the chickens although the FCR value tends to worse on the increasing level of the WB in the diet. This indicates that 30-50% WB could be included in the broiler chicken diet by supplementing with 0.02% enzyme. There was no interaction effect between WB and enzyme levels on the FCR value.

*Table 4. FCR of broiler chickens at 5 weeks old **

WB (%)	Enzyme (%)			Average
	0,00	0,01	0,02	
30	1,75	1,75	1,61	**1,70**
40	1,79	1,71	1,67	**1,72**
50	1,77	1,77	1,69	**1,74**
Average	**1,77** [a]	**1,74** [a]	**1,66** [b]	

* Different superscripts within row mean significantly different (P<0.05).

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Carcass

*Table 5. Carcass (%) of broiler chickens at 5 weeks old**

WB (%)	Enzyme (%)			Average
	0,00	0,01	0,02	
30	70,22	71,18	71,09	**70,83** [a]
40	68,49	70,93	71,38	**70,27** [a]
50	68,35	69,85	69,40	**69,20** [b]
Average	**69,02** [a]	**70,65** [b]	**70,62** [b]	

* Different superscripts within row or within column mean significantly different (P<0.05).

Carcass of the broiler chickens was significantly (P<0.05) affected by both WB and enzyme levels. However there was no interaction effect of WB and enzyme levels on the carcass of the chickens (Table 5). Carcass of the chicken significantly (P<0.05) decreased by the increasing level of the WB in the diet. Carcass value in chickens fed 30-40% WB were significantly higher then the carcass of the chicken fed 50% WB. This indicates that in term of carcass percentage, the use of the WB in the broiler chicken diets was recommended to be no more than 40% in the diet.

The increasing level of the enzyme in the diet significantly (P<0.05) improved the carcass. The carcass of the chickens fed diets supplementing with 0.01-0.2% enzyme were significantly higher than chickens fed diet without enzyme supplementation. Carcass of the chickens fed 0.01 and 0.02% enzyme were not significantly different. This indicates that 30-40% of WB and 0.01-0.02% enzyme could be incorporated in diet without adverse effect on the carcass of the broiler chickens.

It was recorded that no mortality found in this experiment, showing that incorporating WB up to 50% with or without enzyme supplementation were safe to be used in broiler chicken diet.

Overall, the results of the experiment show that the optimal inclusion level of the WB was 30-40% with 0.02% enzyme in the broiler chicken diet.

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