Coprase Produced by *Aspergillus niger* and *Trichoderma* spp Improved Broiler Performance Fed Copra Meal Based Diets

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ABSTRACT

Despite the fact that copra meal is rich in protein (up to 25%), and can meet the crude protein demands for young chicks, it is poor in quality. An experiment was carried out to determine the effect of coprase (an enzyme produced by solid state fermentation that suit to copra meal) on performance of birds fed different levels of copra meal and different enzyme treatments. A total of 108 day old unsexed Cobb were obtained from local company and randomly allocated to brooder cages. The birds were fed with starter diet from days 1 to 21 and grower diets from days 21 to 42. Feed and water were available at all times. The experimental design was a two way factorial with two basal diets (10% and 30% copra meal in the diets), three enzyme treatments (nil, 2.0% coprase produced by *Aspergillus niger* and 2.0% coprase produced by *Trichoderma* spp) and three replicate cages. Analysis of variance indicated that the inclusion of 0.05% coprase produced by *Aspergillus niger* significantly increased body weight gain of birds kept for 42 days from 1494 gram to 1686 gram. Feed conversion ratio was also significantly affected by coprase from *Aspergillus niger*. No interaction between diets and enzyme treatments was found. Among enzyme treatments, enzyme produced by *Aspergillus niger* was more effective in improving body weight gain and decreasing feed conversion ratio.

Key words: coprase, copra meal, broiler and solid state fermentation

INTRODUCTION

Problems of using copra meal in poultry diets have been well reviewed by Sundu *et al*. (2009). Despite the vast amount of previous research conducted into the improvement of the quality of copra meal, there have been few studies of the inclusion of enzymes for increasing its feeding values. Sundu *et al*. (2005) found that the inclusion of commercial enzymes did not improve growth rate of birds to the same level of the growth of birds fed corn-soy diet, particularly in the birds fed the copra meal based mash diets during the starter period. It seems likely that the enzymes used did not entirely suit copra meal as the major ingredients in the diet. This is possibly because most of enzymes available in the market were designed for soybean and wheat diets.

Attempts to improve copra meal quality through the use of specifically designed enzyme have not been reported in data base. The term "coprase" in this project refers to enzyme produced that is suitable for copra meal. Of two methods of producing enzyme, production of enzyme by solid state fermentation method has potential advantages in animal nutrition applications (Filler, 2001). Filamentous fungi such as *Aspergilus niger* is one of the best microorganisms producing enzyme in solid state fermentation method (McCleary, 1988), due to their hyphal growth, which have the capability to not only grow on the surface of the substrate particles but also penetrate through them.

This study was designed to examine the effect of enzyme "coprase" produced by *Aspergillus niger* and *Trichoderma* spp through the solid state fermentation method on birds fed high level of copra meal.

MATERIALS AND METHODS

Solid state fermentation Copra meal was used as solid substrate for fermentation. A total of 500 gram of substrate was placed in a plastic tray and moistenned with 250 ml distelled water. The medium was sterilized by steaming it for 1 hour. The substrate was then incubated with 1 gram fungi (either *Aspergillus niger or Trichoderma* spp). Those fungi were purchased from Laboratory of plant disease at Agriculture Faculty, University of Tadulako. The substrate was placed in a cabin for 5 days at room temperature for fermentation.

Enzyme Extraction

A method of Jacob and Prema (2006) was used in this study to extract enzyme. A 100 gram of fermented copra meal was throughly mixed with 900 gram distilled water. The mixture was shaked for 1 hour at 200 rpm then was filtered through muslin cloth. The filtrate was centrifuge at 10,000 rpm for 20 minutes. The supernatant was collected as crude enzyme of coprase.

Location and Animals Used in Study

The study was conducted in the animal house at The University of Tadulako, Palu, Indonesia. A total of 108 day-old unsexed Cobb chicks were available for use as experimental animals. They were placed in a brooder pen from days 1 to 21 and given a starter diet. After the 21 day, birds were transferred into floor pen and were offered a grower diet.

Feed and Feeding

Diets were formulated to meet the nutrient requirements of starter broilers (see Table 1), using the UFFF computer program version 1.11 (Pesti *et al.*, 1986). The six diets imposed are described in Table 2. Four hundred ml of a solution of "coprase" was sprayed onto 20 kg feed using a small pressure sprayer and then mixed. The diets were then sun-dried for a day prior to feeding. Feeds were offered *ad libitum* twice a day at 08.00 and 16.30 hours, and water was available at all times. Feed intake and body weight were measured on day 1 and day 42.

Statistical Analysis

The experimental design was a two way factorial with two different levels of copra meal, three different enzyme treatments and three replicate cages. Data was analysed by analysis of variance using the SAS 6.2 statistical program (SAS Institute, 1990). The significance of difference between pairs of treatment means within any overall treatment effects, found significant by analysis of variance, was tested by Duncan's Multiple Range Test (Steel and Torrie, 1980).

Table 1. Ingredient and nutrient composition of the experimental diets (%)

Dietary components	10% CM diet		30% CM diet	
	Starter	Grower	Starter	Grower
Copra Meal	10.0	10.0	30.0	30.0
Maize	44.2	48.0	31.2	32.9
Soybean	24.0	23.0	25.5	25.0
Fish Meal	12.5	9.5	8.0	6.0
Rice bran	7.5	8.0	0.2	0.1
Vegetable oil	0.0	0.0	2.5	3.5
Dicalcium Phosphate	1.1	1.0	1.8	1.8
Premix	0.3	0.3	0.3	0.3
DL-Methionine	0.3	0.1	0.3	0.2
L-Lysine	0.1	0.1	0.2	0.2
Calculated composition; ME (kcal/kg)	3086	3113	3032	3105
Protein	22.0	20.2	22.2	20.9
Methionine	0.7	0.5	0.7	0.6
Lysine	1.3	1.2	1.3	1.2
Calcium	1.1	0.9	1.0	0.9
Available phosphorus	0.8	0.6	0.8	0.6

CM: Copra meal; ME: Metabolizable energy; Kcal: Kilo kalori.

Table 2. Details of the experimental treatments

Diet	Enzymes	Treatments
Diet 1; 10% copra meal based diet (D1)	- without enzymes (E1)	- D1E1
	- with enzyme from *Aspergillus niger* (E2)	- D1E2
	- with from *Trichoderma* spp (E3)	- D1E3
Diet 2; 30% copra meal based diet (D2)	- without enzymes (E1)	- D2E1
	- with enzyme from *Aspergillus niger* (E2)	- D2E2
	- with from *Trichoderma* spp (E3)	- D2E3

Table 3. The effect of level of copra meal in the diets on broilers performance from day 1 to 42

Diet	Feed intake (g)	Weight gain (g)	FCR	Uniformity (% CV)
10% copra meal diet	2837	1671 [a]	1.70	5.4
30% copra meal diet	2883	1534 [b]	1.90	8.3

Table 4. The effect of coprase supplementation on broilers from day 1 to 42

Enzymes treatment	Feed intake (g)	Weight gain (g)	FCR	Uniformity (% CV)
Nil	3017	1494 [b]	2.04 [b]	8.4
Enzyme from *Aspergillus niger*	2650	1686 [a]	1.58 [a]	6.8
Enzyme from *Trichoderma* spp	2913	1627 [ab]	1.78 [ab]	5.4

Note: values with the same superscript within a column are not significantly different (P<0.05).

Table 5. The effect of enzyme treatments in two different diets on broilers performance from day 1 to 42

Diet	Enzyme treatments	Feed intake (g)	Weight gain (g)	FCR	Uniformity (% CV)
10% CM	Nil	2950	1568	1.88	2.1
	Aspergillus niger	2417	1733	1.40	6.9
	Trichoderma spp	3143	1714	1.82	7.2
30% CM	Nil	3083	1421	2.20	14.7
	Aspergillus niger	2883	1641	1.77	6.8
	Trichoderma spp	2683	1540	1.74	3.6

Note: CM: copra meal; CV: cofficient variation.

RESULTS AND DISCUSSION

Data of live weight gain, feed intake, feed conversion Ratio (FCR) and growth uninformity are shown in table 3 and 4. The inclusion of 30% CM significantly decreased (P<0.05) the body weight gain of birds fed from 1 to 42 days. Inclusion of enzymes significantly (P<0.05) affected body weight gain and feed conversion rasio. No interaction between levels of copra meal in the diet and enzyme treatments was found for body weight, feed intake and FCR (Table 5).

Meat chickens fed the 10% copra meal based diet (D1) tended to consume less feed (but not significant) than those fed the 30% CM diet. This finding is contrary to the earlier finding of Sundu *et al*. (2004), who found that chicks fed a higher level of CM based diet had decreased feed intake. The reduction in body weight gain due to increased level of copra meal in the diet may indicate that copra meal impaired the quality of diets. According to Sundu *et al*. (2006), there was a very strong negative correlation between the percentage of copra meal in the diet and dry matter digestibility of diet. This is may be the reason of a decreased body weight gain of birds from 1671 gram to 1534 gram.

It has long been believed that enzymes can improve feed intake through hydrolysis of components of the diet. The faster the food components are hydrolyzed the faster the gastro-intestinal tract empties. Studies by Farrell and Martin (1993), Choct *et al.* (1995) and Pluske *et al.* (1997) examining the effect of enzymes on feed intake did not give consistent results for feed consumption. Our current data on the effect of enzymes "coprase" on feed intake also adds to this inconsistency.

Improvement of live weight gain following the addition of enzymes to many different feedstuffs has been reviewed by Teves *et al.* (1988). Data of this current study also gave the same results. Addition of coprase produced by *Trichoderma spp* improved body weight gain by about 9%, compared to those birds fed the diet without coprase supplementation. When coprase produced by *Aspergillus niger* was added to copra meal based diets, the body weight gain was 13% more than birds fed unsupplemented enzyme. It appears that *Aspergillus niger* tended to be more effective in producing enzyme which is suitable for copra meal. The reason why *Aspergillus niger* was slightly more effective in enzyme production in this current study is unclear. Possibly, this filamentous fungi *(Aspergillus niger)* could penetrate their filaments inside the copra meal particle and thus could broken down the nutrient of copra meal into smaller size.

Another reason, method of enzyme production in this study may be suitable for *Aspergillus niger* rather than for *Trichoderma spp.* Further experiment is needed to prove this rationale.

Since the pattern of weight gain of broilers fed different enzyme treatments did not correlate with their intake, this may indicate that the factor which is mostly responsible for weight gain is feed digestibility. Sundu *et al*. (2006) found that dry matter, protein and lipid digestibilities were improved due to enzyme supplementation in copra meal based diets. In this current study, broilers fed diet supplemented with coprase produced by Aspergillus niger ate less feed but produce higher body weight. Therefore, their feed conversion ratio was much lower than those feed without any coprase suppmentation (1.58 vs 2.04).

CONCLUSIONS

Addition of 30% copra meal in the diet deteriorate feed quality and thus impairs the performance of birds. Enzyme "coprase" produced by *Aspergillus niger* made a large improvement in body weight gain of birds and reduced feed conversion ratio.

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