Effects of Copra Meal Fermented by *Aspergillus niger* and *Trichoderma* spp on Performance of Broiler

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ABSTRACT

Inclusion of copra meal in the diet could impair the performance of birds due to its physical and nutritional problems. Improving feed quality by fermentation has long been believed. An experiment was conducted to examine the effects copra meal (CM) fermented by *Aspergillus niger* and *Trichoderma spp* on bird performance. One hundred twenty six day old unsexed Cobb chicks were used in this study. The birds were fed seven different diets (0% CM, 10% CM, 10% CM supplemented with 1% *Aspergillus niger* fermented CM, 10% CM supplemented with 1% *Trichoderma* fermented CM, 30% CM diet, 30% CM supplemented with 1% *Aspergillus niger* fermented CM, 30% CM supplemented with 1% *Trichoderma* fermented CM. Feed and water were available at all times. A completely randomised design was applied in this experiment with seven treatments and three replicate cages. Data indicated that body weight gain of birds fed the supplemented CM diet with 1% fermented CM tended to be higher than those of birds fed the un supplemented CM diet. This trend became evident when the birds fed 30% copra meal diet. The birds fed 30% copra meal diet supplemented with 1% Trichoderma fermented CM had higher body weight gain than those of birds fed the un supplemented 30% CM diet (1711 gram vs 1421 gram). Feed conversion ratio of bird fed 30% CM was also affected by fermentation with *Trichoderma spp*. Feed consumption was not affected by addition of copra meal diet with 1% fermented CM. Fermentation of copra meal with Trichoderma spp could improve the performance of bird in a diet containing 30% copra meal.

Key words: fermentation, copra meal and broiler

INTRODUCTION

Nutritionally, copra meal contains 21 - 25% protein and 7% lipid. The nutrient contents of copra meal appear quantitatively favourable. However, nutrient qualities are poor, possibly because of heat damage during the drying or oil extraction processes (Butterworth and Fox, 1963), the presence of indigestible polysaccharides, especially mannan and galactomannan (Balasubramanian, 1976; Saittagaroon *et al*., 1983), and low levels of several limiting amino acids (NRC, 1994). These components impair the nutritive value of the diet when copra meal is added into the diet (Sundu *et al*., 2006).

Fermentation has been practiced for quite long time as a means to improve the quality of food. Fermentation process using filamentous fungi, such as Aspergillus niger, has been applied to improve nutritive value of soybeans (Chah *et al*., 1975; Mathivanan *et al*., 2006), guar meal (Nagra *et al*., 1998) and tofu waste (Rasud, 2009) for poultry. The fermentation process can create conditions for the growth of microorganisms that break down fibre and anti-nutrients.

Filamentous fungi, such as Aspergillus niger, has capacity to produce various enzymes such as hemicellulase, pectinase, lipase and tannase (Pinto *et al*., 2001; Mathivanant *et al*., 2006). Fermented feedstuffs (fermented copra meal using filamentous fungi) can simply be used as enzymes sources. Accordingly, the use of fermented copra meal in small quantity can improve nutritive value of copra meal based diet. This study was undertaken to examine supplementation of fermented copra meal in copra meal based diets on bird performance.

MATERIALS AND METHODS

Fermentation Process

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.

Animal and Feed

The study was conducted in the animal house at The University of Tadulako, Palu, Indonesia. A total of 126 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. 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 seven diets imposed are described in Table 2. 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

A completely randomized design was adopted with seven treatments, each with three replicate cages of six birds. Data were analysed by analysis of variance using the SAS 6.2 statistical program (SAS Institute, 1990). Differences among treatments were tested for significance by using Duncan's Multiple Range Test (Steel and Torrie, 1980).

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

Dietary components	Control diet		10% CM diet		30% CM diet	
	Starter	Grower	Starter	Grower	Starter	Grower
Copra Meal	0.0	0.0	10.0	10.0	30.0	30.0
Maize	51.7	54.0	44.2	48.0	31.2	32.9
Soybean	22.0	25.0	24.0	23.0	25.5	25.0
Fish Meal	13.5	9.5	12.5	9.5	8.0	6.0
Rice bran	11.0	10.0	7.5	8.0	0.2	0.1
Vegetable oil	0.0	0.0	0.0	0.0	2.5	3.5
Dicalcium Phosphate	1.0	0.7	1.1	1.0	1.8	1.8
Premix	0.3	0.3	0.3	0.3	0.3	0.3
DL-Methionine	0.3	0.3	0.3	0.1	0.3	0.2
L-Lysine	0.2	0.2	0.1	0.1	0.2	0.2
Calculated composition;						
ME (kcal/kg)	3078	3134	3086	3113	3032	3105
Protein	22.0	20.9	22.0	20.2	22.2	20.9
Methionine	0.7	0.6	0.7	0.5	0.7	0.6
Lysine	1.4	1.3	1.3	1.2	1.3	1.2
Calcium	1.1	0.8	1.1	0.9	1.0	0.9
Available phosphorus	0.7	0.6	0.8	0.6	0.8	0.6

Note: CM: Copra meal; ME: Metabolizable energy; kcal: Kilo kalori.

Table 2. Details of experimental treatments

Diet	Fermentation	Treatments
0% CM (control)	- Without fermented CM	- D1
10% CM diet	- Without fermented CM	- D2
10% CM diet	- With 1% Aspergillus niger fermented CM	- D3
10% CM diet	- With 1% Trichoderma spp fermented CM	- D4
30% CM diet	- without fermented CM	- D5
30% CM diet	- With 1% Aspergilus niger fermented CM	- D6
30% CM diet	- With 1% Trichoderma spp fermented CM	- D7

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

Diet	Feed intake (g)	Weight gain (g)	FCR	Uniformity (% CV)
D1	3070	1729[a]	1.78[ab]	0.5
D2	2950	1568[ab]	1.88[ab]	2.1
D3	3283	1741[a]	1.89[ab]	4.6
D4	3083	1824[a]	1.69[b]	4.4
D5	3084	1421[b]	2.20[a]	14.7
D6	3143	1586[ab]	1.99[ab]	5.3
D7	2837	1711[a]	1.66[b]	3.3

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

RESULTS AND DISCUSSION

Data of live weight gain, feed intake, feed conversion ratio (FCR) and growth uniformity are shown in Tables 3. Feed intake of broilers was not affected by addition of CM and fermented CM. Growth of birds fed the 10% CM diet was not significantly different (P<0.05) from the growth of birds fed the control diet.

The inclusion of 30% CM significantly decreased the body weight gain of birds fed from 1 to 42 days. However, when a 30% CM diet was supplemented with either *Apergillus niger* fermented CM or *Trichoderma* spp fermented CM, weight gain of birds was improved to the level of body weight gain of birds fed control diet. The 30% CM added with 1% *Trichoderma* spp fermented CM had better FCR than the 30% CM diet without fermentation. The cofficient variation of weight gain was improved when the level of copra meal in the diet was reduced.

The earlier experiment by Sundu *et al*. (2004; 2005; 2006) indicated that birds fed 10% copra meal diet were consistently better than those birds fed 30% copra meal diet. Our current data on the use of 10% and 30% copra meal in this study also adds this consistency. It is not difficult to rasionalize these findings since the nutrients quality of copra meal is poor. Addition of this feedstuff in a greater quantity deteroriates nutritive value of the poultry diet (Sundu *et al*., 2009).

The results also demonstrate that birds fed the 10% copra meal supplemented with either 1% *Aspergillus niger* fermented copra meal or 1% *Trichoderma* spp fermented copra meal exhibit good performance in terms of body weight gain and feed conversion ratio. This indicates that the use of 10% copra meal did not impair the growth of birds, particularly when the diet was supplemented with fermented copra meal. The performance of 42 day old birds fed the 10% copra meal diet plus 1% *Trichoderma* spp fermented copra meal was increased by nearly 250 gram and 100 gram compared with the birds fed the unsupplemented 10% copra meal diet and control diet respectively. However, the differences were not significant.

Effectiveness of supplementing 1% *Trichoderma* spp fermented copra meal in copra meal based diet became evident when the concentration of copra meal in the diet was increased to the level of 30%. Possible reasons of the improvement in body weight gain are an increase in nutrients availability (Nagra *et al*., 1998) and the presence of enzymes in the diets due to addition of fermented feedstuff (Filler, 2001). These speculations need to be clarified.

The cofficient variation of weight gain of birds fed the control diet was 0.5%. It appears that the quality of control diet is homogenous from one cage to another and this led to uniform growth of birds. When the diet contained 10% of copra meal, the variation of growth was still below 5%. Further addition of copra meal in the diet to the level of 30%, variation of body weight gain of birds was ununiform, even reached 14.7% in birds consuming unsupplemented 30% copra meal.

The 1% *Trichoderma* spp fermented copra meal in the diet produced better feed efficency than the 30% copra meal diet without any supplementation. It appears that *Trichoderma* spp worked well in solid state fermentation when copra meal was used as a solid substrate. However, modus of operandi how fermented copra meal with this fungi could improve nutritional value is difficult to answer. The presence of enzymes in the fermented product, availability of nutrients and the possibility of this fungi as a probiotic in gastro intestinal of birds are some possible causes.

CONCLUSION

Supplementation of copra meal based diet with 1% Trichoderma spp fermented copra meal increased the nutritive value of the diet.

REFERENCES

Balasubramaniam, K. 1976. Polysa-ccharides of the kernel of maturing and mature coconuts. Journal of Food Science, 41:1370-1373.

Butterworth, M. H. and Fox, A. C. 1963. The effect of heat treatment on the nutritive value of coconut meal and the prediction of the nutritive value by chemical methods. British Journal of Nutrition, 17: 445-452.

Chah, C.C., Carlson, C.W., Semeniuk, G., Palmer, I.S. and Hasseltine, C.W. 1975. Growth promoting effects of fermented soybeans for broilers. Poultry Science, 54: 600-609.

Filler, K. 2001. Production of enzymes for the feed industry using solid substrate fermentation. In. Proceedings of Alltech's 17th annual symposium. Editors: T.P. Lyons and K.A. Jacques. Nottingham University Press. United Kingdom, pp: 131-154.

Mathivanan, R.P., Selvaraj, P. And Nanjappan, K. 2006. Feeding of fermented soybeans meal on broiler performance. International Journal of Poultry Science, 5: 868-872.

Nagra, S.S., Sethi, R.P. and Copra A.K. 1998. Feeding of fermented guar (Cyamopsis tetragonoloba L taub) meal to broiler chicks. Indian Journal of Animal Production Management, 14: 40-44.

NRC. 1994. Nutrient Requirements of Poultry. National Academy Press, Washington, DC.

Pesti, G.M., Miller, B.R. and Chambers, R. 1986. User Friendly Feed Formulation Program (UFFF) version 1.11 – 256 k. Department of Poultry Science and Agricultural Economics, The University of Georgia Atlanta.

Pinto, G.A.S., Leite, S.G.F., Terzi, S.C. and Couri, C. 2001. Selection of tannase producing Aspergillus niger strains. Brazillian Journal of Microbiology, 32: 24-26.

Rasud, E. 2009. Pengaruh fermentasi ampas tahu dan supplementasi enzim dalam ransum terhadap indeks performans, persentase karkas dan lemak abdominal ayam pedaging. Thesis S2. Universitas Tadulako. Palu.

Saittagaroon, S., Kawakishi, S. and Namiki, M. 1983. Characterisation of polysaccharides of copra meal. Journal of Science and Food Agriculture, 34: 855-860.

SAS Institute. 1990. SAS/STAT Users guide: statistic version 6.12. Cary, North Carolina, SAS Institute Inc.

Steel, R. G. D. and Torrie, J. A. 1980. Principles and Procedures of Statistics. New York, McGraw Hill.

Sundu, B., Kumar, A. and Dingle, J. 2009. Feeding value of copra meal for broilers. World's Poultry Science Journal, 65: 481-491.

Sundu, B., Kumar, A. and Dingle, J. 2006. Response of broiler chicks fed increasing levels of copra meal and enzymes. International Journal of Poultry Science, 5: 13-18.

Sundu, B., Kumar, A. and Dingle, J. 2005. Growth pattern of broilers fed a physically or enzymatically treated copra meal diet. Proceedings Australian Poultry Science, 17: 291-294.

Sundu, B., Kumar, A. and Dingle, J. 2004. The effects of level of copra meal and enzymes on bird performance. Proceedings Australian Poultry Science, 16: 52-54.

Teves, F. G., Zamora, A. F., Calapardo, M. R. and Luis, E. S. 1988. Nutritional value of copra meal treated with bacterial mannanase in broiler diets. In: Recent Advances in Biotechnology and Applied Biology. Proceedings of Eighth International Conference on Global Impact of Applied Microbiology and International Conference of Applied Biology and Biotechnology. Chinese University Press, Hong Kong, pp. 497-507.