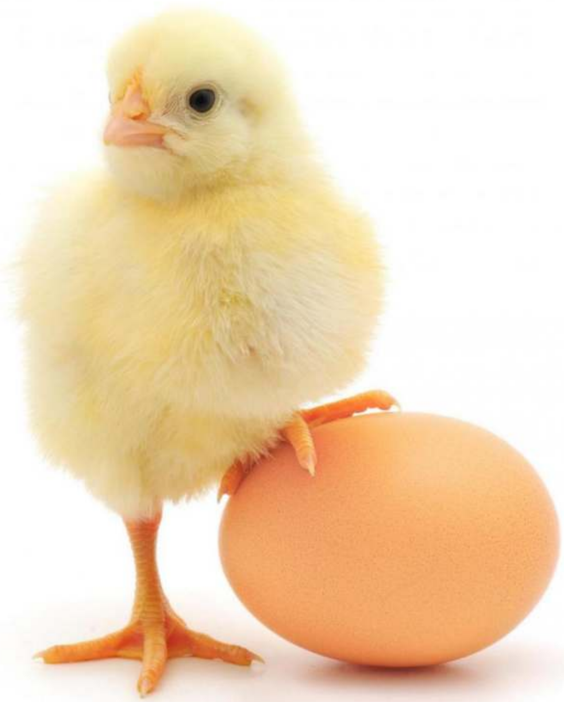
ISSN 1682-8356
ansinet.org/ijps



INTERNATIONAL JOURNAL OF POULTRY SCIENCE

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

International Journal of Poultry Science 10 (7): 537-541, 2011
ISSN 1682-8356

Evaluation of Palm Kernel Cake Fermented by *Aspergillus niger* as Substitute for Soybean Meal Protein in the Diet of Broiler

Mirnawati[1], Yose Rizal[1], Yetti Marlida[1] and I. Putu Kompiang[2]
[1]Department of Animal Feed and Nutrition,
Faculty of Animal Sciences, Andalas University, Indonesia
[2]Research Institute for Animal Production, (BPT) Ciawi, Bogor, Indonesia

Abstract: An experiment was conducted for the evaluation of Palm Kernel Cake Fermented (PKCF) by *Aspergillus niger* as a substitute for soybean meal protein in the diet of broiler. The experiment used a Complete Randomize Design (CRD) with 6 treatments and 4 replications. The treatments were arranged as follows: 1) 0% basic ration (0% PKCF), 2) 20% substitution of soybean meal protein with PKCF, 3) 40% substitution of soybean meal protein with PKCF, 4) 60% substitution of soybean meal protein with PKCF, 5) 80% substitution of soybean meal with PKCF, 6) 100% substitution of soybean meal with PKCF. The ration were formulated in iso protein 22% and iso caloric 3000 k cal/kg ration. This study used a completely randomized design with six treatments and four replications. The parameters of this study were feed consumption, body weight gained, feed conversion and percentage of carcass. The result of this study showed that feed consumption, body weight gained, feed conversion and percentage of carcase were not significantly affected ($p>0.05$) by any treatment. In conclusion the Palm Kernel Cake Fermented (PKCF) by *Aspergillus niger* can be 100% a substitute of soybean meal protein or 17% in broiler ration.

Key words: Fermented, *Aspergilus niger*, palm kernel cake, soybean meal

INTRODUCTION

The price fluctuation of feedstuff is an obstacle that often causes the unstability of livestock husbandry in Indonesia. The price fluctuation is caused by some of the composition of feedstuff such as fish flour, corn and soybean meal are still imported. This condition causes the cost of feedstuff could reach 60% to 70% of production cost.

To decrease the cost of livestock, there are many efforts to be done such as the use of alternative feedstuff that comes from waste industry that is not useful for human being. One of the potential wastes to be used is the waste of oil palm processing such as Palm Kernel Cake (PKC). PKC is the side result of oil palm production that can be used as feedstuff for livestock. The nutrition content of PKC is: dry matter 87.30%, protein 16.07%, fiber 21.30%, fat 8.23%, Ca 0.27%, P 0.94% and Cu 48.04 ppm (Mirnawati *et al*., 2008).

Even though the crude protein content of PKC is quite high, but the usage of it is still low in livestock ration. The usage of PKC is around 10% in duck ration (Supriadi, 1997; Rizal, 2000). It is caused by the low quality Garcia *et al*. (1999); Perez *et al*. (2000); Odunsei *et al*. (2002); and Ezhieshi and Olomu (2004). The low quality of PKC is caused by the high crude fiber content and metal of Cu that is characterized as toxic to livestock. The high crude fiber decreases the energy usage and protects the molecule protein so it will be hard to be degradation by protease of livestock. Meanwhile the high Cu of PKC will fasten the protein compound (amino acid that contains sulphur) that causes the quality of protein in PKC was still low (Babjee, 1989). Lysine and methionine have been reported to be deficient in PKC which also limits their use in poultry feed (Onwudike, 1986).

A research had been done by using humic acid in the fermentation method to use the microorganism of cellulose characteristic such as *Aspergillus niger* to increase the quality of protein in PKC. The research gave the improvement of protein, the decrement of crude fiber and low Cu of PKC. The nutrition content of PKC fermentation was: dry matter 42.38%, crude protein 23.20%, crude fiber 10.59% and Cu 0% (Mirnawati *et al*., 2010).

The objective of this research is to determine the percentage of PKCF to replace the soybean meal protein in broiler ration.

MATERIALS AND METHODS

The materials are as follows: 1). 100 broilers. 2). The battery cage size 75 x 70 x 75 cm provided with a place to put foods and drinks. 3). Three 60 watt lamps. 4). OHause scale 2610 gram to scale the eggs. 5). This research is conducted by using 6 treatments of ration which are arranged based on the needs of protein and

Corresponding Author: Mirnawati, Department of Animal Feed and Nutrition, Faculty of Animal Sciences, Andalas University, Indonesia

Table 1: Ration composition of treatment (%)

	Treatment (%)					
Feedstuff	A	B	C	D	E	F
Corn	50.0	48.0	47.9	44.5	42.7	38.0
Rice brand	10.0	6.8	1.1	0.5	1.0	2.0
Soybean meal	17.0	13.6	10.2	6.8	3.4	0.0
Coconut meal	3.0	8.0	14.0	18.0	18.0	22.5
Fish meal	17.0	17.0	17.0	17.0	18.0	18.5
PKCF	0.0	3.4	6.8	10.2	13.6	17.0
Oil	2.5	2.7	2.5	2.5	2.8	3.5
Top mix	0.5	0.5	0.5	0.5	0.5	0.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table 2: Ingredient content and metabolic energy of ration treatment (%)

	Treatment (%)					
Ingredients	A	B	C	D	E	F
Protein	22.21	22.03	22.07	21.92	21.77	21.85
Fat	4.96	5.31	5.28	5.48	5.78	6.66
Fiber	3.37	3.70	3.89	4.47	4.58	5.06
Calcium	1.23	1.19	1.13	1.33	1.11	1.09
Phosphor	0.28	0.34	0.40	0.48	0.50	0.57
Methionine	0.43	0.42	0.41	0.40	0.41	0.41
Lysine	1.32	1.23	1.14	1.07	1.04	0.98
Tryptophan	0.30	0.30	0.30	0.30	0.30	0.30
Energy (kcal/kg)	3013.00	3005.00	3001.00	2984.00	2977.00	2965.00

metabolism of broiler ration. It is arranged based on equal amount of energy and protein which are 3000 kcal/kg and 22% respectively.

The research was conducted with experiment methodology. It used a Complete Randomly Design (CRD) with 6 treatments and 4 replications. The data were analyzed by using analysis of variance. The differences in treatments are determined by Duncan's multiple range test (Steel and Torrie, 1991). The feed treatment was the replacement of soybean meal protein with PKC fermentation on the following rations:

R1 0% PKCF
R2 The replacement of 20% soybean meals protein with PKCF
R3 The replacement of 40% soybean meals protein with PKCF
R4 The replacement of 60% soybean meals protein with PKCF
R5 The replacement of 80% soybean meals protein with PKCF
R6 The replacement of 100% soybean meals protein with PKCF

The Measurement of the Changes: 1). Feed consumption, 2). Weight gain, 3). Feed conversion, 4). Carcase percentage. The Ration composition and ingredient content and metabolic energy of treatment is presented in Table 1 and 2.

Table 3: Average feed consumption of broiler chicken (gram)

Treatment	Feed consumption
A (Control)	1678.04
B	1678.63
C	1681.25
D	1680.04
E	1677.75
F	1682.88
SE	3.28

SE = Standard Error

RESULTS AND DISCUSSION

Feed consumption of broiler chicken: The average feed consumption of broiler chicken for each treatment is presented in Table 3.

The result of statistical analysis of variance showed no significant difference among treatments ($p>0.05$) towards feed consumption of broiler chicken.

Feed consumption did not differ significantly in each treatment was due to a fermentation that PKC has suffered where a fermented material has a scent and flavor that are favorable to livestock which is in accordance with the opinion of Shurtleff and Aoyagi (1979) that fermentation can alter the unfavoured flavor and become favorable. In addition, fermented products are more palatable compared to the original materials as fermentation can produce preferred flavor and vitamin B such as B1, B2 and B12 and minerals (Murugesan *et al.*, 2005; Kubad *et al.*, 1997). Also, the extent to which an animal will consume a particular feed is dependent on the fiber source (Linderman *et al.*, 1986), palatability of the diet (Cherry and Jones, 1982), its composition of the feed and chemical variation in fibre it self (Kass *et al.*, 1970).

The fact that feed consumption did not significantly in each treatment was also due to the addition of 100ppm humic acid during the manufacturing of the fermented products. According to Humin Tech (2004), humic acid can stabilize flora inside the gut and increase the usability of nutrients from ration without increasing the amount of consumption. This result was similar to the result obtained by Yoruk *et al.* (2004) that showed no significant difference the feed consumption with the addition of humic acid.

Body weight gain of broiler chicken: The average body weight gain of broiler chicken for each treatment is presented in Table 4.

The result of the statistical analysis of variance showed that treatments did not significantly affect (p>0.05) Body Weight Gain (BWG) of broiler chicken.

The fact that there was no significant difference of body weight gain among treatments was due to feed consumption of each treatment was not significantly different either. Besides, it also may be influenced by the use of PKC fermentation, in accordance with the opinion of Winarno *et al.* (1980) which stated that the quality of fermented materials is much better which is reflected in BWG that is not differ with the BWG of rations control, although giving PKCF as a 100% replacement for soybean meal protein in broiler ration. Dairo and Fasuyi (2008) can be used PKCF only 50% replacement for soybean meal protein in laying hens.

The actuality that there was no significant body weight gain in each of these treatments is attributable to the use of fermented products, where the fermented materials have a better quality, a higher digestibility and can eliminate toxic compounds (Winarno *et al.*, 1980) and increase the content of vitamins and minerals (Shurtleff and Aoyagi, 1979). This was reflected through nitrogen retention of palm kernel cake fermented was higher (65.30%) compared to before fermentation (55.99%). Therefore, treatments that use fermented products are easily absorbed by livestock and reflected through the equal amount of BWG with control despite the usage of PKCF as a replacement for soybean meal protein (soybean meal in ration was 17%). This is consistent with some findings in literature from (Aderolu *et al.*, 2002).

Moreover, the result of no significant difference of body weight gain on each treatment is also caused by the relatively higher and balanced amino acid content in PKC fermentation, especially amino acid methionine and lysine (Mirnawati *et al.*, 2009; Dairo and Fasuyi, 2008). Leeson and Summers (2001) that stated broiler chicken amino acid requirements are 0.4% methionine, 1.0% lysine and 0.24% tryptophan. Hence, it can be concluded that critical amino acid in ration treatments is within the normal limits of poultry needs.

Table 4: Average Body Weight Gain (BWG) of broiler chicken (gram)

Treatment	Body weight gain
A (Control)	973.75
B	942.50
C	948.13
D	949.06
E	930.31
F	943.13
SE	12.35

SE = Standard Error

Table 5: The average feed conversion of broiler chicken during research

Treatment	Feed conversion
A (Control)	1.72
B	1.78
C	1.77
D	1.77
E	1.80
F	1.78
SE	0.04

SE = Standard Error

The result of no significant difference of body weight gain in each of the conducted treatment was due to the addition of 100 ppm humic acid in the manufacture of fermented product PKCF, whereas humic acid has beneficial activity to livestock as it can increase micro flora activity in digestive system thus increase digestibility. In accordance with the opinion of Humin Tech (2004) that humic acid can stabilize flora and improve the usability of nutrients from fodder without increasing consumption. In addition, according to Kompiang (2000); Kompiang *et al.* (2002 and 2004) humic acid can increase microbe population in digestive system. The increment of microbe population will improve the performance of chickens that includes body weight gain.

Feed conversion of broiler chicken: The average feed conversion of broiler chicken for each treatment is portrayed in Table 5.

Based on the statistical analysis of variance, treatments did not significantly affect (p>0.05) feed conversion of broiler chicken. Feed conversion did not differ significantly in each treatment is due to the fact that body weight gain and consumption in each treatment were not significantly different either (p>0.05). This is in accordance with the opinion of Scott *et al.* (1982) that the value of ration conversion is determined by the amount ration consumption and BWG produced. The result showed that the average ration conversion ranged from 1.72-1.80. This result is lower compared to the result obtained by Ezhieshi and Olomu (2008) which stated that ration conversion of broiler chicken is 1.89-2.33. However, this result is higher compared to the result obtained by Ugwu *et al.* (2008) which ranged from 2.61-3.46. Kartasudjana and Suprijatna (2006) which ranged from 1.70-1.78.

Table 6: The average carcass percentage of broiler chicken over research

Treatments	Carcass percentage (%)
A (Control)	65.45
B	66.51
C	65.97
D	65.99
E	66.63
F	65.40
SE	0.67

SE = Standard Error

Furthermore, feed conversion did not differ significantly in each treatment is due to the usage of fermented BIS that has better quality than without fermentation (Winarno *et al*., 1980), thus allows easier utilization by livestock and yields a better conversion that equals to feed conversion in treatment A (control). This is due to the ability of humic acid to stabilize flora in the gut and improve the usability of nutrients in fodder and increase the body weight of livestock without increasing the amount of consumption. In addition, Kocabagli *et al*. (2002), Yoruk *et al*. (2004) and Kucukersan *et al*. (2005) stated that the addition of humic acid over the growth period has benefited the broiler chicken performance which can be seen from the growth and feed conversion.

The carcass percentage of broiler chicken (%): The average carcass percentage of broiler chicken in each treatment is portrayed in Table 6.

Based on the statistical analysis of variance, treatments did not significantly affect ($p>0.05$) the carcass percentage of broiler chicken. The carcass percentage did not differ significantly among treatments such as A, B, C, D, E, F is due to the live weight that was not significantly different either. In accordance with Siregar (2001) which states that carcass percentage was a ratio between carcass weight and live weight multiplied by 100%. Based on the research, the carcass percentage obtained ranged from 65.40-66.63%. This result is in line with that recommended Wahju (1992) which states that the carcass percentage of broiler chicken ranged from 65-75%.

The result of no significant difference of broiler chicken carcass percentage in each treatment is due to the usage of fermented PKC that has better quality than without fermentation (Winarno *et al*., 1980), thus allows easier utilization by livestock and yields a better carcass percentage. The high quality of feedstuffs provided had led to the sufficient protein and energy consumption to produce carcass weight. Likewise, the crude fiber content in each treatment still within broiler standard requirements (5-6%) and have not hindered protein and energy digestibility yet. This can be seen from the equal amount of feed consumption that results in the same carcass weight (Nurhayati, 2008). In contrast, a high crude fiber in ration can reduce the digestible components as well as to reduce enzyme activities that assist the carbohydrate, protein and fat digestion (Parakkasi, 1983; Tulung, 1987).

Furthermore, the result of no significant difference of carcass percentage in each treatment is attributable to the addition of humic acid in the production fermented. This is due to the ability of humic acid to stabilize flora in the gut and improve the usability of nutrients in fodder and increase the body weight of livestock without increasing the amount of consumption. In addition, Kocabagli *et al*. (2002), Yoruk *et al*. (2004) and Kucukersan *et al*. (2005) state that the addition of humic acid over the growth period has benefited the broiler chicken performance which can be seen from the growth and carcass percentage.

The average carcass percentage in this research is ranging from 65.40-66.51%. This result was not significantly differ from the result obtained by Siregar (2001) that states the average carcass percentage of broiler chicken was ranged at 65-75% from live weight.

Conclusion: From the research, PKC fermented by *A. niger* can be a 100% substitute to soybean meal protein in broiler ration or 17% in broiler ration without adversely affecting the performance of broiler chickens.

ACKNOWLEDGEMENTS

The author was very grateful for the financial support of Hibah Bersaing 2009 from Directorate General of Higher Education, Ministry of National Education, republic of Indonesia (No. 126.a/H.16/PL/HB.PHB/IV/2009).

REFERENCES

Aderolu, A.Z., E.A. Iyayi and S.T. Ogunbanwo, 2002. Nutritional status of palm kernel meal inoculated with *Trichoderma harzianum*. Trop. J. Anim. Sci., 5: 103-108.

Babjee, A.M., 1989. The Use of Palm Kernel Cake, As Animal Feed. FAO, Regional Office for Asia and The Pasific. Bangkok.

Cherry, J.A. and L.E. Jones, 1982. Dietary cellulose, wheat brand and fish meal in relation tohepatic lipids, serum lipidsand exertion in laying hens. Poult. Sci., 61: 1873-1878.

Dairo, F.A.S. and A.O. Fasuyi, 2008. Evaluation of fermented palm kernel meal and fermented copra meal protein as substitute for soybean meal protein in laying hens diets. Central Eur. Agric., 9: 35-44.

Ezhieshi, E.V. and J.M. Olomu, 2004. Comparative performance of broiler chickens fed varying levels of palm kernel cake and maize offal. J. Nutr., 3: 254-257.

Ezhieshi, E.V. and J.M. Olomu, 2008. Nutritional evaluation of palm kernel meal types: 2. Effects on live performance and nutriton retention in broiler chicks diets. Afr. J. Biotechnol., 7: 1171-1175.

Garcia, C.A., A.G. Gemat and J.G. Murilo, 1999. The effect of four levels palm kernel meal in broiler diets. Ceiba, 40: 29-295.

Humin, Tech., 2004. Huminfeed-Tierfutterzusatze and Veterinar Medizin and Huminsaure Basierende Produkte. Humintech-Humintech GmbH, Heerdter Landstr. 189/D, D-40549 Dusseldorf Germany.

Kartasudjana, R. and E. Suprijatna. 2006. Manajemen ternak unggas. Penerbit Penebar Swadaya, Jakarta.

Kass, M.L., P.J. Van Soest and W.G. Pond, 1970. Utilization of dietary fibre from alfalfa by growing swine. Apparent digestibility of diet component in specific segmens of the gastro intestinal tract. J. Anim. Sci., 50: 125-191.

Kocabagli, N., M. Alp, N. Acar and R. Kahramam, 2002. The effect of dietary humate supplementation on broiler growth and carcass yield. Poult. Sci., 81: 227-230.

Kompiang, I.P., 2000. Pengaruh suplementasi kultur *Bacillus* spp. Melalui pakan atau air minum terhadap kinerja ayam peterlur. J. Ilmu Ternak dan Veteriner, 5 (5).

Kompiang, I.P., D. Zaenuddin and Supriyati, 2002. Pengaruh suplementasi *Bacillus apiarius* atau *Torulaspora delbrueckii* terhadap penampilan ayam pedaging. J. Ilmu Ternak and Veteriner, 7: 139-143.

Kompiang, I.P., Supriyati and O. Sjofjan, 2004. Pengaruh suplementasi *Bacillus Apiarius* terhadap Penampilan Ayam Petelur. J. Ilmu Ternak and Veteriner, 9: 1-4.

Kucukersan, S., K. Kucukersan, I. Colpan, E. Goncuoglu, Z. Reisli and D. Yesilbag, 2005. The effect of humic acid on egg production and egg traits of laying hen. Vet. Med-Czech., 50: 406-410.

Kubad, R.C., K. Singh, K. Saxena and K. Eriksson, 1997. Microorganism as alterntive source protein. Nutr. Rev., 55: 65-75.

Leeson, S. and J.D. Summers, 2001. Nutrition of Chicken. 4rd Edn., University Books. Guelph. Ontario, Canada.

Linderman, M.D., E.T. Kormegay and R.J. Moore, 1986. Digestibility and feeding values of peanut hulls for swine. J. Anim. Sci., 62: 412-421.

Mirnawati, I. Putu Kompiang and Harnentis, 2008. Peran asam humat sebagi penetralisir logam berat dalam bioteknologi bungkil inti sawit untuk pakan ungas. Laporan penelitian Hibah Bersaing tahun anggaran.

Mirnawati, I. Putu Kompiang and Harnentis, 2009. Peran asam humat sebagi penetralisir logam berat dalam bioteknologi bungkil inti sawit untuk pakan ungas. Laporan penelitian Hibah Bersaing tahun anggaran.

Mirnawati, Y. Rizal, Y. Marlida and I.P. Kompiang, 2010. The role of humic acid in palm kernel cake fermented by *Aspergillus niger* for poultry ration. Pak. J. Nutr., 9: 182-185.

Murugesan, G.S., M. Sathishkumar and K. Swarninathan, 2005. Suplementation of waste tea fungal bomass as a dietary ingredient for broiler chicken. Bioresour. Technol., 96: 1743-1748.

Nurhayati, 2008. Pengaruh tingkat penggunaan campuran bungkil inti sawit dan onggok terfermentasi oleh *Aspergillus niger* dalam pakan terhadap penampilan ayam pedaging. Journal Production, Vol. 10. No. 1. Terakreditasi No. 56/DIKTI/Kep/2005.

Odunsei, A.A., T.O. Akande, A.S. Yusup and R.J. Salam, 2002. Comparative utilization high inclusion rate of four agro industrial by products in the diet of egg type chickens. Arch. Zootec., 51: 465-468.

Onwudike, O.C., 1986. Palm kernel meal as a feed for poultry 1. Composition of palm kernel meal and availability of its amino acid to chick. Anim. Feed Sci. Technol., 16: 179-186s.

Parakkasi, 1983. Ilmu Gizi dan Makanan Ternak Monogastrik. Angkasa, Bandung.

Perez, J.F., A.G. Gernat and J.G. Murillo, 2000. The effect of different levels of palm kernel meal in layer diets. Poult. Sci., 79: 77-79.

Rizal, Y., 2000. Respon Ayam Broiler terhadap Pengganti Bungkol Kedelai dengan BIS Dalam Ransum. J. Petrnakan Lingkungan, Vol. 6 (02).

Scott, M.L., M.C. Nesheim and R.J. Young, 1982. Nutrition of chicken. 3rd Edn., M.L. Scott and Associates Publishers, Ithaca, New York.

Shurtleff, W. and Aoyagi, 1979. A Super Food from Indonesia. The Book of Tempeh. Harper and Raw. New York.

Siregar, B., 2001. Pengaruh penggantian bungkil kelapa dengan bungkil inti sawit terhadap performa produksi puyuh (*Coturnic-coturnic japonica*). J. Peternakan Lingkungan, 7: 6-11.

Steel, R.G.D. and J.H. Torrie, 1991. Prinsip and prosedur Statistik. Suatu pendekatan. Biometrik PT. Gramedia Pustaka Utama. Jakarta.

Supriadi, 1997. Pengaruh penggunaan bungkil inti sawit terhadap organ fisiologis itik periode pertumbuhan. Skripsi Fakultas Peternakan Universitas Andalas. Padang.

Tulung, B., 1987. Efek fisiologis serat kasar di dalam alat pencernaan bagian bawah hewan monogastrik. Makalah Simposium Biologi, Unstrat Menado.

Ugwu, S.O.C., A.E. Onyimonyi and Ozono, 2008. Comparative performance and haematological indices of finishing broiler fed palm kernel cake, Barbara rice husk as partial replacement for maize. Int. J. Poult. Sci., 7: 299-303.

Wahju, J., 1992. Ilmu Nutrisi Unggas. Cetakan ketiga. Penerbit Gadjah Mada University Press, Yogyakarta.

Winarno, F.G., Srikandi Fardiaz and D. Fardiaz, 1980. Biofermentasi dan Biosintesa Protein. Angkasa Bumi.

Yoruk, M.A., M. Gul, A. Hayirli and M. Macit, 2004. The effect of suplementation of humate and probiotic on egg production and quality parameters during the late laying periodic hens. Poult. Sci., 83: 84-88.