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Livestock Research for Rural LRRD LRRD Guide for preparation LRRD Citation of this Development 32 (2) 2020 Search Misssion of papers Newsletter paper Broiler performance on a diet containing palm kernel meal fermented with Bacillus subtilis Mirnawati, Gita Ciptaan and Ferawati amyloliquefaciens and Humic Substances and Its Utilization as a Feed Ingredient for Broiler Chickens", Asian-Australasian Journal of Animal Sciences, 2014">Department of Animal Nutrition amyloliquefaciens and Humic Substances and Its Utilization as a Feed Ingredient for Broiler Chickens", Asian-Australasian Journal of Animal Sciences, 2014">and Feed Technology, amyloliquefaciens and Humic Substances and Its Utilization as a Feed Ingredient for Broiler Chickens", Asian-Australasian Journal of Animal Sciences, 2014">Faculty of Animal Science, amyloliquefaciens and Humic Substances and Its Utilization as a Feed Ingredient for Broiler Chickens", Asian-Australasian Journal of Animal Sciences, 2014">University of Andalas, Padang 25163, amyloliquefaciens and Humic Substances and Its Utilization as a Feed Ingredient for Broiler Chickens", Asian-Australasian Journal of Animal Sciences, 2014">Indonesia mirnawati@ansci.unand.ac.id Abstract This study was done to evaluate the incorporation in broiler diets of palm kernel meal fermented with Bacillus subtilis (FPKM). Day-old chicks (n=140) were allocated to 5 treatments with 4 replications in a completely randomized design. The treatments were increasing levels of FPKM: 0, 15, 20, 25 and 30% in the diet. Feed intake, body weight gain, nitrogen retention and crude fiber digestibility were reduced with linear or curvilinear trends as the level of FPKM was increased. However, the absolute changes over the range of values from 0 to 25% FPKM were relatively small and it is concluded that palm kernel meal after fermentation with Bacillus subtilis can be used up to 25% in broiler diets with minimal loss of performance and with 50% saving in soybean meal Keywords: byproducts, fermentation, local resources, oil palm Introduction Indonesia, as the largest crude palm oil (CPO) producer in the world, produced 23,096,541 tonnes in 2015 (Directorate General of Plantation 2017). CPO and palm kernel production increase every year along with that there is also an increase in byproducts from the production process of palm kernel oil, namely palm kernel meal (PKM).The proportion of PKM is approximately 45-46% of the palm kernel meal (Sindu 1999). PKM production in 2017 was almost 3.2 million tonnes (Pasaribu 2018).The high production of PKM is a factor that can support its use as alternative feed ingredient for poultry. The proximal analysis of palm kernel meal is: dry matter 87%, crude protein 16%, crude fat 8.2%, crude fiber 21%, Ca 0.27% and P 0.94% (Mirnawati et al 2010). Palm kernel meal has high potential to be used as poultry feed, but normally is limited to 10% in broiler rations (Rizal 2006). The limiting factor of palm kernel meal utilization especially for monogastric livestock is the high crude fiber content of which around 56% is dominated as β- mannan (Daud et al 1993).The low usage is due to the digestive tract of poultry does not produce β- mannan-breaking enzymes. In order to improve the nutrient quality of palm kernel meal, fermentation with mananolytic fungi can be done (Mirnawati et al 2012; Mirnawati et al 2013). Fermenting palm kernel meal with mananolytic molds namely Sclerotium rolfsii with 7 days fermentation time and 10% inoculum dose gave the best results with an increase in CP content, in N retention and in digestibility of crude fiber (Mirnawati et al 2017). In a subsequent study it was found that the FPKM produced by fermentation with Sclerotium rolfsii mold could be used up to 25% in broiler rations (Mirnawati et al 2018). Bacillus subtilis is one of the micro-organisms that are mananolytic (Jiang et al 2006). Bacillus subtilis is often used as a probiotic to help balance beneficial bacteria in the digestive tract (Iman et al 2012). Bacillus subtilis has anti- microbial resistance and can produce anti-microbial properties, so that these bacteria can survive in the digestive tract of chicken (Barbosa et al 2005). Fermenting PKM with Bacillus subtilis at a dose of 7% and 6 days fermentation time gave the best results, seen from the crude protein content of 24.7%, nitrogen retention of 68.5%, crude fiber content 17.45 and activities of mannanase, cellulase, protease respectively 6.27 U/ml, 16.11 U/ml and 10.27 U/ml (Mirnawati et al 2019). From the above data it is seen that the nutrient content of PKM fermented with Bacillus subtilis is sufficient for it to be considered as an alternative feed ingredient for poultry. However, biological tests of this feed ingredient are needed to determine the limits of use and its effect on poultry, especially broilers. Methodology Purpose of the experiment This experiment aimed to study the effect of several levels of palm kernel meal fermented with Bacillus subtilis on the performance of broilers. Experimental animal and diet composition One hundred and forty day-old chicks (DOC) Lohmann strain MB-202 Platinum from PT. Japfa Comfeed Indonesia, were assigned to this experiment. The five treatments in a completely randomized design were levels of 0 15, 20, 25 and 30% of FPKM) with four replications. There were seven broilers per experimental unit kept in a box cage (80 x 80 x 60cm). The diets were formulated with 22% protein. Feed ingredients consisted of yellow maize, soybean meal, fermented palm kernel meal (FPKM), fish meal, coconut oil and premix of vitamins-minerals (Tables 1 and 2). Feed and drinking water were provided ad-libitum. Preparing FPKM Fermented palm kernel meal was the product of 80% PKM plus 20% rice bran that was fermented with Bacillus subtilis. The dose of inoculum of Bacillus subtilis was 7% of the substrate incubated for 6 days. After harvesting the product, FPKM was dried, milled and mixed in the diets. Data collection Feed intake, weight gain, feed conversion, carcass percent, abdominal fat percent, nitrogen retention and crude fiber digestibility were measured. Data analysis Data were processed by analysis of variance for a completely randomized design, followed by the test for the differences between treatments, according to Steel and Torrie (2002). Table 1. Composition of diets Feed Ingredients FPKM in diet, % 0 15 20 25 30 Commercial feed Yellow maize Soybean meal FPKM Fish meal Coconut oil Vitamin mix 15 15 45 37.5 23 15.2 0 15 15 15 1.5 1.5 0.5 0.5 15 15 35 32.3 12.6 10.2 20 25 15 15 19 15 0.5 0.5 15 29.6 7.7 30 15 15 0.5 Table 2. Proximate analysis of the diets (% in DM) FPKM in diet, % 0 15 20 25 Crude protein 22.1 22.0 22.0 22.1 Crude fat 4.09 4.46 4.58 4.70 Crude fiber 2.83 5.05 5.79 6.53 Ca 1.22 1.16

1.14 1.12 Available P 0.64 0.63 0.62 0.61 30 22.1 4.92 7.27 1.11 0.61 Results Feed intake, growth rates, feed conversion and carcass yield Performance traits (feed intake, weight gain, feed conversion and carcass yield) showed negative curvilinear trends with little change over the replacement range 0-25% of FPKM. The point of inflexion appeared to be at 25% FPKM, with loss of performance being apparent when the FPKM reached 30% (Table 3; Figures 1-4). The negative effect of the highest level of FPKM was especially evident in the response curve for feed conversion (Figure 3). Table 3. Mean values for growth and carcass traits of broilers fed increasing levels of FPKM FPKM in diet, % 0 15 20 25 30 SEM Feed intake, g/wk 530a 529a 527a 527a 520b 3.96 LW gain, g/wk 284a 283a 281a 280a 271b 4.98 Feed conversion# 1.88 1.92 1.90 1.91 2.17 0.12 Carcass, % of LW 70.36a 70.35a 70.33a 70.24a 69.97b 0.16 Abdomen fat, % 1.66 1.64 1.63 1.61 1.58 0.03 N retention, % 58.36a 58.06a 57.79a 57.37a 54.14b 1.71 CF digestibility, % 50.21a 50.08a 49.79a 49.51a 47.87b 0.95 p 0.05 0.01 0.01 0.01 0.01 0.01 0.01 ab Mean values amyloliquefaciens and Humic Substances and Its Utilization as a Feed Ingredient for Broiler Chickens", Asian-Australasian Journal of Animal Sciences, 2014">in the same row without common superscript amyloliquefaciens and Humic Substances and Its Utilization as a Feed Ingredient for Broiler Chickens", Asian-Australasian Journal of Animal Sciences, 2014">differ at amyloliquefaciens and Humic Substances and Its Utilization as a Feed Ingredient for Broiler Chickens", Asian-Australasian Journal of Animal Sciences, 2014">$p<0.05$ # Feed intake/LW gain Figure 1. Effect of level of FPKM on feed intake Figure 2. Effect of level of FPKM on weight gain Figure 3. Effect of FPKM on feed conversion Digestibility and N retention Figure 4. Effect of FPKM on carcass yield The trends in diet digestibility and N retention followed that for body weight gain with the inflection point occurring at about the 25% FPKM level with increased rate of decline in these criteria when the FPKM level was 30% of the diet (Table 3; Figures 5 and 6). Figure 5. Effect of FPKM on crude fiber digestibility Abdomen fat Figure 6. Effect of FPKM on N retention There was a slightly curvilinear reduction in abdomen fat percentage as the level of FPKM increased (Figure 7) mirroring the slight decline in production traits. Figure 7. Effect of level of FPKM on abdominal fat in the carcass Discussion The constraints to use of higher proportions of FPKM in the diet almost certainly are the high levels of fiber in this feed. In this context, future research could consider the use of carbohydrate sources with lower levels of fiber. Cassava root has less fiber than maize and using it to replace maize would also enable lower levels of protein in the diet as maize protein is seriously imbalanced in essential AA. Conclusions Feed intake, body weight gain, nitrogen retention and crude fiber digestibility were reduced with linear or curvilinear trends as the level of FPKM was increased; however, the absolute changes over the range of values from 0 to 25% FPKM were relatively small. It is concluded that palm kernel meal after fermentation with Bacillus subtilis can be used up to 25% in broiler diets with minimal loss of performance and with 50% saving in soybean meal. Acknowledgement This study was financially supported by funds provided by BOPTN of Andalas University, number 42/UN.16.17/PP.RGB/LPPM/2019, dated April, 23rd 2019. I would like to thank all of those with whom I have had the pleasure to work during this project. References Barbosa T M, Serra C R, La Ragione R M, Woodward M J and Hariques A O 2005 Screening of Bacillus isolates in the broiler gastrointestinal tract. Appl. Environ. Microbial. 71 (2): 968-978. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC546680/ doi: 10.1128/AEM.71.2.968-978.2005 Daud M J, Jarvis M C and Rasidah A 1993 Fibre of PKC and its potential as poultry feed. Proceeding. 16th MSAP Annual. Conference, Kuala Lumpur, Malaysia. http://agris.fao.org/agris-search/search.do?recordID=MY9505008 Direktorate Generale Plantation 2017 Statistik Perkebunan Indonesia. Kelapa Sawit. Departemen Pertanian, Jakarta. http://ditjenbun.pertanian.go.id/?publikasi=buku-statistik-kelapa-sawit-palm-oil-2011-2013. Iman E R S, Mahendra I and Utomo R B 2012 Uji kepekaan Bacillus subtilis yang diisolasi dari sedimen tambak udang dan tambak ikan terhadap bahan antimikroba.Media Veterinaria Medika. 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