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Research Article

Optimizing The Use of Fermented Palm Kernel Cake in Feed by Giving Humic Acid in Drinking Water on Broiler Performance

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ABSTRACT

This study aims to determine the dose of humic acid in drinking water to optimize the use of fermented palm kernel cake (FPKC) in broiler feed. The experimental design used was a completely randomized design (CRD) with 5 treatments (T1: 0% FPKC and 0% humic acid, T2: 25% FPKC + 100 ppm humic acid, T3: 25% FPKC + 200 ppm humic acid, T4: 30% FPKC + 100 ppm humic acid and T5: 30% FPKC + 200 ppm humic acid) and 4 replications. The variables observed were feed consumption, body weight gain, feed conversion, live weight, carcass percentage and abdominal fat percentage. The data obtained were analyzed by analysis of variance (ANOVA), if there was an effect between treatments it was continued with Duncan's multiple range test (DMRT). The results showed that the effect of humic acid in drinking water had no significant effect (P>0.05) on the T1, T2 and T3 treatments, but had a highly significant effect (P<0.01) on the T4 and T5 treatments. Giving humic acid in drinking water has not been able to optimize the use of FPKC up to 30%, but giving 100 ppm humic acid can optimize the use of FPKC as much as 25% in feed.

Keywords: broiler, fermentation, humic acid, palm kernel cake, performance

INTRODUCTION

The cost of feed in Indonesia is the largest component of production costs, around 70-80%. To reduce feed costs, local feed ingredients are used. Local feed ingredients that can be used are palm kernel cake (PKC). PKC contains crude protein 17.31%, crude fiber 27.62%, crude fat 7.14%, Ca 0.2% and P 0.94% and Cu 48.04 ppm (Mirnawati et al., 2018). High crude protein, but its utilization in broiler rations can only be used 10%. The low utilization of PKC in the ration is due to its crude fiber content. Crude fiber component of PKC in the form of -Mannan 57.8% (Azman et al., 2016). It is necessary to improve PKC nutrition so that its utilization in rations can be increased.

Nutrient enhancement of PKC can be done through fermentation using mannnolytic bacteria *Bacillus subtilis*. Mirnawati et al. (2019a) that PKC fermentation using *Bacillus subtilis* with a fermentation time of 6 days, there was an increase in crude protein content of 24.65, crude fiber 17.35, nitrogen retention 68.47 and crude fiber digestibility 53.25%. Also, the activities of mannanase 24.27U/mL, cellulase 17.13U/mL and protease 10.27 U/mL (Mirnawati et al., 2019b). Utilization of fermented palm kernel cake with *Bacillus subtillis* in broiler rations can only be used up to 25% in the ration. If the use is increased to 30%, there will be a decrease in broiler performance (Mirnawati et al., 2020).

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To increase the utilization of PKCF in broiler rations up to 30%, in this study, humic acid was added in drinking water. This is because humic acid can stabilize the flora in the intestine and increase the use of nutrients from animal feed and can increase animal body weight without increasing the amount of consumption (Humin Tech, 2004). Provision of humic acid through drinking water can increase body weight and provide efficiency in the ration. This is because humic acid can stimulate microbial growth in the gut. The use of humic acid in animal feed has several benefits, namely for health and growth, carbohydrate and protein metabolism (Kucukersan et al., 2005).

Mirnawati et al. (2013) stated that the addition of 100 ppm humic acid in drinking water in broilers that received PKC fermented with *Aspergillus niger* (15%) in the ration could provide better broiler performance than broilers that did not receive humic acid, with the following results consumption of rations (1748.89 g/head), body weight gain (1074.70 g/head), ration conversion (1.63) and carcass percentage (73.15%). Mirnawati et al. (2017) the addition of 200 ppm humic acid in PKC fermentation with *S. rolfsii* resulted in 27.43% crude protein, 59.17% nitrogen retention, 11.53% crude fiber and 55.40% crude fiber digestibility and its use in rations can be given as much as 32% (Mirnawati et al., 2018). From the description above, it is hoped that by increasing the dose of humic acid in drinking water, it is hoped that the use of PKCF with *Bacillus subtilis* in broiler rations can be increased.

MATERIAL AND METHODS

Experimental Animal

This study used 100 broilers (8 days old) Cobb strain CP-707 strain from PT. Charoen Pokhphand Indonesia, without the separation of males and females (unsex). Sometimes the experiment used as many as 20 units of box cages. Each unit is occupied by 5 broilers.

Experimental Design

The research design used was a completely randomized design (CRD) with 5 treatments and 4 replications. The treatments consisted of R1/control ration (0% PKCF and 0% humic acid), R2 (25% PKCF + humic acid 100 ppm), R3 (25% PKCF + humic acid 200 ppm), R4 (30% PKCF + humic acid 100 ppm) and R5 (30% PKCF + humic acid 200 ppm).

Food Ingredients and Nutritional Content

The feed ingredients consisted of commercial CP 511 ration, yellow corn, soybean meal, fermented palm kernel cake (PKCF) with *Bacillus subtilis*, fish meal, coconut oil and top mix. The ration used was prepared with a crude protein content of 22% and a metabolic energy of 3000 kcal/kg. The composition of feed ingredients (%) of the treatment can be seen in Table 1 and Nutritional content of treatment feed can be seen in Table 2.

Table 1. Treatment Feed Ingredients (%)

Feed Ingredients	Treatment Feed				
	R1	R2	R3	R4	R5
Commercial CP 511	15	15	15	15	15
Corn	45	32.3	32.3	29.6	29.6
Soybean meal	23	10.2	10.2	7.7	7.7
PKCF	0	25	25	30	30
Fish meal	15	15	15	15	15

Feed Ingredients	Treatment Feed				
	R1	R2	R3	R4	R5
Coconut oil	1.5	2	2	2.2	2.2
Top Mix	0.5	0.5	0.5	0.5	0.5
Total	100	100	100	100	100

Table 2. Nutritional Content of Treatment Feed (%)

Nutrition	R1	R2	R3	R4	R5
Crude Protein	22.07	22.06	22.06	22.08	22.08
Crude Fat	4.09	4.70	4.70	4.92	4.92
Crude Fiber	2.83	6.53	6.53	7.27	7.27
Calcium	1.22	1.12	1.12	1.11	1.11
Available Phosphorus	0.64	0.58	0.58	0.56	0.56
Metabolizable Energy	3011.30	3008.29	3008.29	3012.24	3012.24

Statistical Analysis

The data obtained were processed statistically with analysis of diversity according to Steel and Torrie (1995). If there is a difference between treatments, a DMRT (Duncan's Multiple Range Test) further test is carried out.

RESULTS AND DISCUSSION

The effect of the average application of humic acid in drinking water to increase the utilization of fermented palm kernel cake with Bacillus subtilis in the ration on the performance of broilers can be seen in Table 3.

Table 3. Average Feed Consumption, Body Weight Gain, Feed Convesion Ratio, Live Weight, Carcass Percentage and Abdominal Fat Percentage

Measured Parameters	Treatment Feed					SE
	R1	R2	R3	R4	R5	
Feed consumption	525.53^{a}	524.06^{a}	523.21^{a}	506.33^{b}	503.08^{b}	1.44
Body weight gain	294.51^{a}	292.39^{a}	291.46^{a}	283.21^{a}	281.93^{b}	0.95
Feed conversion ratio	1.78	1.79	1.80	1.79	1.78	0.01
Live weight	1519.50^{a}	1504.00^{a}	1495.00^{a}	1389.00^{b}	1366.25^{b}	8.77
Carcass percentage	71.60^{a}	70.68^{a}	70.47^{a}	68.59^{b}	67.75^{b}	0.52
Abdominal fat percentage	1.21	1.13	1.06	1.00	0.94	0.06

Note: Different superscripts have not significant (P>0.05) and very significant effect (P<0.01)

Feed consumption, body weight gain, live weight and carcass percentage in treatments R1, R2, and R3 was not significant (P>0.05), but very significantly (P<0.01) higher than the treatment rations R4 and R5. but the treatment of R4 was not significantly different (P>0.05) with R5. While the feed conversion and the percentage of abdominal fat in the treatment R1, R2, R3, R4 and R5 were not significant (P>0.05).

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Feed Consumption

Feed consumption in treatment R2 and R3 was not significantly different from the control ration/R1. There was no significant difference between R2 and R3 with the control due to the addition of humic acid in drinking water and fermented palm kernel cake with Bacillus subtilis in the ration. Although the addition of humic acid in broiler drinking water in R2 and R3 treatments was different, the ration of fermented palm kernel cake with *Bacillus subtilis* was the same. Humic acid can stimulate feed intake (Kucukersan et al., 2005).

Body Weight Gain

Body weight gain in treatment R2 and R3 was not significantly different from the control ration. This is due to the presence of humic acid in broiler drinking water so that the utilization of nutrients is more optimal. The addition of humic acid can stimulate broiler growth (Kocabağli et al., 2002). Humic acid can also increase digestibility (Windisch et al., 2008), so that the nutrition of the ration is better utilized even though the composition of the ration is different from R1. Humic acid in drinking water can also increase the utilization of ration nutrients (Ozturk et al., 2010). Humic acid in drinking water has a positive effect on performance (Pistova et al., 2016). Palm kernel cake fermented with *Bacillus subtillis* at R2 and R3 also did not differ by as much as 25%. so that the increase in body weight of broilers is also not different. This is also in accordance with the consumption of the ration obtained.

Meanwhile, the treatment R4 and R5 had a low body weight gain when compared to R1, R2 and R3. The first low body weight was caused by the addition of 30% PCKF in the ration so that the crude fiber content of the ration exceeded the capacity limit of broilers. Although there is humic acid in drinking water, it has not been able to optimize the addition of fermented palm kernel cake by 30%.

Feed Conversion Ratio

Feed convertion ratio on treatment R1, R2, R3, R4 and R5 was not significantly different. This is caused by the comparison of the amount of ration consumed and the resulting body weight gain balanced between treatments, where high consumption is also followed by high body weight gain and vice versa, low consumption is also followed by low body weight gain. While the conversion is a comparison between consumption and body weight gain, therefore the conversion of the ration is the same between treatments. Conversion is the ratio of ration consumption to the body weight gain obtained. The higher the conversion value, the more rations used to increase body weight. Conversely, the lower the ration conversion value, the less ration is used to increase body weight (Shroha et al., 2019).

Live Weight

The difference in live weight in treatments R2 and R3 to treatment R1 was also influenced by feed consumption and body weight gain was not significantly different in treatments R1, R2 and R3. Consumption of the same ration and body weight gain will produce relatively the same live weight. The low live weight in the R4 and R5 treatments was also due to the consumption of rations and low body weight gain.

Carcass Percentage

The difference between the treatments of R1, R2 and R3 on the carcass percentage was due to the same live weight and carcass weight, so there was no difference even though the treatments were different. The low percentage of carcass in treatment R4 and R5 was due to low carcass

weight and live weight. The lower live weight and carcass weight obtained, the lower the percentage of broiler carcass obtained. Carcass percentage was obtained from the ratio of carcass weight to live weight of broilers.

Percentage of Abdominal Fat

It was not significant that the percentage of abdominal fat in each treatment was also due to the relatively the same energy content in the treatment rations, resulting in the same percentage of abdominal fat as well. Energy consumption directly affects the accumulation of abdominal fat in the body of broiler chickens. In addition, age also affects the percentage of abdominal fat in broilers. Broilers at the age of 5-6 weeks are still in their infancy so that the nutrients absorbed by the chicken's body are still utilized for growth and the fat formed is still small. Broiler fat tissue begins to form quickly at the age of 6-7 weeks, then fat accumulation continues to accelerate (Nikolova et al., 2007).

CONCLUSION

The addition of 100 ppm and 200 ppm humic acid in drinking water has not been able to increase the use of PCKF up to 30% in the ration. Addition of 100 ppm humic acid in drinking water and 25% fermented palm kernel cake in the ration gave better results in terms of feed consumption of 524.06 (g/head/week), body weight gain 292.39 (g/head/week), ration conversion 1.79, live weight 1504.00 (g/head), percentage carcass 70.68% and the percentage of abdominal fat 1.13%.

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