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Performance of Broilers Supplemented with Porang Glucomannan and Bacillus subtilis

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ABSTRACT

The study was designed to evaluate the effect of porang glucomannan and Bacillus subtilis on the performance of broiler chickens. One hundred and sixty day old chick of broilers were kept for 5 weeks with average body weight 42.6 ± 2.9 gram. The experiment was arranged as a completely randomized design with 4 treatments and 4 replications. The treatments were T0 (control), T1 (supplementation of prebiotic porang glucomannan), T2 (supplementation of probiotic Bacillus subtilis), and T3 (supplementation of synbiotic porang glucomannan and Bacillus subtilis). Parameters measured were body weight, feed intake, and feed conversion ratio (FCR). Overall body weight in treatments T1, T2, and T3 were greater (p<0.05) than T0. Moreover, FCR of T1, T2, and T3 were lower (p<0.05) than T0. However, there was no effect of dietary treatments on feed intake. It was concluded that supplementation of porang glucomannan and/ or Bacillus subtilis increased body weight and decreased feed conversion ratio than control without any negative effect of dietary treatments on feed intake of broilers.

***Keywords**: Bacillus subtilis, broiler, performance, porang glucomannan*

INTRODUCTION

The use of antibiotic growth promoters (AGP) for livestock including poultry had been prohibited. Antibiotic resulted in resistance in poultry and public health. Antibiotics made microflora imbalance in the digestive track of poultry. Antibiotic Growth Promoters also left the residues in poultry carcass and unsafe for consumption. The imposition of a ban on the use of AGP in feed encouraged intensive research to find alternatives to AGP to support the health, performance, and safety of poultry products.

Evaluation of prebiotics, probiotics, and synbiotics as alternatives to AGP for animals was continued to be examined. Prebiotics, probiotics and synbiotics had been applied to broiler chickens. Some researchers found the prebiotic MOS had ability to increase the population of beneficial bacteria and to reduce pathogenic bacteria (Kim *et al.*, 2011, Peinado *et al.*, 2013).

The probiotic *Lactobacillus ingluviei* in broiler chickens decreased pathogenic bacteria (Baldwin *et al.*, 2018). Synbiotic MOS and *Lactobacillus spp.* lowered the number of *Eschericia coli* (Abdel-Raheem *et al.*, 2012). The study of prebiotic was related to the higher performance of broiler chickens on xylooligosaccharide (XOS) treatment (Zhenping *et al.*, 2013). Abdel-Hafeez *et al.* (2017) also stated that synbiotic improved performance in broilers.

Porang (*Amorphophallus oncophyllus*) was commonly grown in Indonesian forest. Porang tuber could be extracted into glucomannan. Extraction of glucomannan from porang flour yielded 18.05% with 92.69% purity for cabinet drying and 93.84% for freeze drying (Harmayani *et al*., 2014). Monomers of D-glucose and D-mannose with β-1.4 bonds composed glucomannan (Katsuraya *et al.*, 2003; Tester and Al-Ghazzewi, 2013). Chicken was unable to digest β bonds so that glucomannan had a potential to be prebiotic.

Glucomannan could be hydrolyzed by the enzymes endo-1,4-β-mannanase and endo-β-glucanase (Mikkelson *et al.*, 2013). Bacillus produced β-mannanase and β-glucanase enzymes (Chauhan *et al.*, 2012; Mikkelson *et al.*, 2013). *Bacillus subtilis* was one of the probiotic candidates used in poultry. Nhi and Huong (2016) proved that *Bacillus subtilis* natto had ability to be probiotic. Several studies using *Bacillus subtilis* could reduce Salmonella, Coliform, and Enterococci populations and increase the performance of broiler chickens (Knap *et al.*, 2011; Deniz *et al.*, 2011; Harrington *et al.*, 2016; Koli *et al.*, 2017).

Porang glucomannan and *Bacillus subtilis* combined into synbiotic for broiler chickens was expected to be able to improve health status and had an impact on improving the performance of broiler chickens such us body weight, feed intake, and feed conversion ratio (FCR).

MATERIAL AND METHOD

One hundred and sixty of unsex DOC broiler strain New Lohmann from PT. Japfa Comfeed were used in the study for 5 weeks with average body weight 42.6 ± 2.9 gram. Porang glucomannan were prepared according to the method of Harmayani *et al.* (2014).

Probiotic candidate used was *Bacillus subtilis* natto FNCC 0059 from Center for Food and Nutrition Studies, Universitas Gadjah Mada, Yogyakarta, Indonesia. Basal ration was consisted of yellow corn, rice bran, soybean meal, meat bone meal, poultry meat meal, dicalcium phosphate, L-lysine, DL-methionine, calcium carbonate, and premix that had nutritional content 2965.7% metabolizable energy, 21.3% crude protein, 4.7% ether extract, 4.5% crude fiber, 0.6% methionine, 1.2% lysine, 1% calcium, and 0.7% phosphorus.

A completely randomized design with 4 treatments and 4 replications (10 birds each) was arranged. The treatments were T0 (control), T1 (supplementation of porang glucomannan 0.1%), T2 (supplementation of *Bacillus subtilis* 1 mLx10^8 cfu/mL), and T3 (supplementation of porang glucomannan 0.1% and *Bacillus subtilis* 1 mLx10^8 cfu/mL). the treatments were given every morning by mixing with a small amount of feed according to the treatment level in order to make sure that they were totally consumed. Fed and drinking water were provided *ad libitum*.

Feed intake and body weight were recorded weekly at 1, 2, 3, 4, and 5 weeks of age. Feed conversion ratio (feed intake/body weight gain) was calculated. Data were analysed using analysis of variance (ANOVA) and continued with Tukey Test at 5% probability level.

RESULT AND DISSCUSSION

Body Weight

Feed additives such as prebiotic, probiotic, or synbiotic can formed balance microflora in the gastrointestinal track. Supplementation of glucomannan prebiotics had higher *Lactobacillus* and lowest *Clostridium* in the caecum of broilers (Larasati *et al.*, 2021). The balance of microflora improved the immunity and digestive efficiency in the villi of broilers so the nutrients could be converted in to body mass. Taklimi *et al.* (2012) proved that glucomannan improved the length of broiler small intestine villi.

Table 1. Body weight of broiler chickens supplemented with porang glucomannan and/ or *Bacillus subtilis*

Number	Treatments	Week (gram)				
		1	2	3	4	5
1.	T0	156.24 ^{b}	397.32^{b}	775.73^{b}	1204.49 ^{b}	1677.43 ^{b}
2.	T1	175.23^{ab}	471.52^{a}	853.89^{a}	1309.85 ^{a}	1962.42 ^{a}
3.	T2	181.46 ^{a}	488.53^{a}	867.16^{a}	1329.93 ^{a}	2011.21 ^{a}
4.	T3	180.77 ^{a}	471.01^{a}	860.34^{a}	1324.93 ^{a}	1998.59 ^{a}

Note: T0 (control), T1 (porang glucomannan), T2 (*Bacillus subtilis*), and T3 (porang glucomannan and *Bacillus subtilis*). $^{a-b}$Mean values in the same row with different superscript differ significantly ($p<0.05$).

Better digestibility and absorption of nutrients were the main mechanism that led to higher growth performance of broiler chickens in response to the addition of Glucomannan Yeast Product (Kamalzadeh *et al.*, 2009). Glucomannan porang also increased the immunity by lowering heterophil to lymphocyte ratio as indicator of stress and the mortality of broiler chickens (Perdinan *et al.*, 2019).

Several studies used *Bacillus* as probiotic in poultry. Broiler chickens supplemented with *Bacillus subtilis* had better body weight, body weight gain, and FCR than control (Harrington *et al.*, 2016; Koli *et al.*, 2017). *Bacillus subtilis* also reduced the population of *Salmonella*, *Coliform*, and *Enterococci* (Knap *et al.*, 2011; Deniz *et al.*, 2011). Abdel-Hafeez *et al.* (2017) stated that synbiotic *Bacillus licheniformis* and *Bacillus subtilis* 0.125 kg/ton and MOS 0.25 kg/ton improved performance of broiler chickens in 56 days.

Feed Intake

This case might be happened because chickens fed with same nutrient contents of feed in all treatments. Utami and Wahyono (2019) stated that feed intake of broilers supplemented with probiotics were not significantly different because the chickens were given the same protein and energy of ration. Furthermore prebiotic, probiotic, and synbiotic were only added at the low percentage level. Thus, if the energy was fulfilled, chickens stopped eating.

Table 2. Feed intake of broiler chickens supplemented with porang glucomannan and/ or *Bacillus subtilis*

Number	Treatments	Week (gram)				
		1	2	3	4	5
1.	T0	148.57	559.79	1175.21	1905.65	2827.17
2.	T1	159.34	583.82	1222.05	1975.09	2925.87
3.	T2	166.44	617.75	1268.41	2010.93	2930.34
4.	T3	157.01	595.50	1232.70	2005.48	2981.61

Note: T0 (control), T1 (porang glucomannan), T2 (*Bacillus subtilis*), and T3 (porang glucomannan and *Bacillus subtilis*).

Feed Conversion Ratio

Table 3 shows feed conversion ratio of broiler chickens between T1, T2, and T3 than control in the 5th week was significantly different ($p<0.05$). The dietary treatments had lower FCR than control in the finisher phase. Falaki *et al.* (2011) said that feed additives like prebiotic, probiotic, or synbiotic were more efficient to convert feed into body mass during the rearing stage. It is also suggested that the effect of the additives may be worthless under benefit management or environmental conditions. Chacher *et al.* (2017) stated that microflora balancing between beneficial bacteria and pathogenic bacteria caused the improvement of villi growth. The higher villi created a wider surface area to increase the activity of digestive enzymes and absorption of nutrients that were converted into body mass (Spring *et al.*, 2000; Yang *et al.*, 2009; Chacher *et al.*, 2017) so the treatments had better FCR than control.

Table 3. Feed conversion ratio of broiler chickens supplemented with porang glucomannan and/ or *Bacillus subtilis*

Number	Treatments	Week				
		1	2	3	4	5
1.	T0	0.95	1.41^{b}	1.51	1.58	1.68^{b}
2.	T1	0.91	1.24^{a}	1.43	1.51	1.49^{a}
3.	T2	0.92	1.27^{a}	1.46	1.51	1.46^{a}
4.	T3	0.87	1.27^{a}	1.43	1.51	1.49^{a}

Note: T0 (control), T1 (porang glucomannan), T2 (*Bacillus subtilis*), and T3 (porang glucomannan and *Bacillus subtilis*). $^{a-b}$Mean values in the same row with different superscript differ significantly ($p<0.05$).

CONCLUSION

Supplementation of porang glucomannan and/ or *Bacillus subtilis* increased body weight and decreased FCR of broiler than control without any negative effect of dietary treatments on feed intake.

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