98-Enhance of Protein Efficiency Affected by Synbiotic Supplementation in the Diet of Broiler Chicken

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Abstract. The objective of this study was to evaluate the effect of synbiotic on enhance of protein efficiency of broiler chicken. The research was used 144 birds of unsexed broiler chicken at one day of age with initial body weight 45.68 g ± 1.52 g. Experimental design used was completely Randomized Designed with 4 treatments and 6 replicates, and every unit experiment consist of 6 birds. The treatments were as follows: T0: basal diet (without synbiotic), T1: basal diet + synbiotic 1 ml/100 g of feed, T2: basal diet + synbiotic 2 ml/100 g of feed and T3: basal diet + synbiotic 3 ml/100 g of feed. The basal diet was formulated to contain 3000 kcal/kg metabolizable energy (ME) and 22% crude protein (CP). Variables observed were nitrogen intake, nitrogen retention and net protein utility. The result showed that synbiotic supplementation significantly (p<0.05) increased nitrogen intake, nitrogen retention and net protein utility. Conclusion of the research is synbiotic supplementation at 2 ml/100 g of feed was enhance of protein efficiency of broiler chicken.

1. Introduction

Antibiotic growth promoter (AGP) which has been widely used by the poultry industries is generally used to enhance broiler chicken immunity and as growth promoters, but nowadays, the utilization of AGP has been banned by all countries around the world such us European, America and also Indonesia. This is due to negative effect of AGP on livestock and human health, which is leading of antibiotic resistance and residues in livestock products [1]. Therefore, it is necessary to find alternatives feed additives to replace of AGP, which is safe and effective, one of which is by using synbiotics (a combination of probiotics and prebiotics).

Inulin is a type of prebiotic that acts as a substrate source for probiotics and can work synergistically to maintain the resistance of beneficial bacteria in the digestive tract [2]. Inulin is commonly found in the plant tubers, especially gembili tubers (Dioscorea esculenta L). Winarti [3] and Zubaidah [4] reported that gembili tuber has inulin content of 14.77% and can support the growth of Lactobacillus casei and Lactobacillus plantarum.

Probiotic is a living organism that contributes to increasing the growth of beneficial bacteria, immune response and reducing the number of pathogenic bacteria in the host [5]. Lactobacillus plantarum is one type of probiotic that can be combined with inulin, because it has the inulinase enzyme which can break down the long chain inulin bonds into a simple component as an energy source to support the growth of probiotic [6]. Synbiotics are synergisms between probiotics and prebiotics. Synbiotic can improve the survival of probiotics, because prebiotic provides a specific substrate for
probiotics to be able to survive in the digestive tract of host and maintain the balance of intestinal microbial so that increases the intestinal health [1,7].

Symbiotic used in this research was combination of inulin extracted from gembili tuber and Lactobacillus plantarum. The results of previous studies showed that symbiotic supplementation (a combination of inulin extracted from gembili tuber and Lactobacillus plantarum) were increased the growth performance, lactic acid bacteria, intestinal morphology and reduce the growth of coliform bacteria of broiler chicken [8]. Based on this, the symbiotic (a combination of inulin extracted from gembili tuber and Lactobacillus plantarum) has an opportunity to be substitutes for AGP. However, studies on the utilization of symbiotic (a combination inulin extracts of gembili tuber and Lactobacillus plantarum) are still not widely done, especially, with the respond to the value of nitrogen retention and net protein utility (NPU). Nitrogen retention and NPU are the reflection of the amount of nitrogen that can be absorbed and used for the growth. The objective of this study was to evaluate the effect of symbiotic on enhance of protein efficiency of broiler chicken.

2. Materials and Methods

The research used 144 birds of broiler chickens at 1 d of age with initial body weight 45.68 g ± 1.52 g, inulin from extracted gembili tubers and Lactobacillus plantarum. Experimental design used was completely Randomized Designed with 4 treatments and 6 replicates, and every unit experiment consist of 6 birds. The treatments consisted of basal diet without symbiotic (T0), basal diet + symbiotic 1 ml/100 g of feed (T1), basal diet + symbiotic 2 ml/100 g of feed (T2) and basal diet + symbiotic 3 ml/100 g of feed (T3). The experimental ration was formulated to contain of 3000 kcal/kg metabolizable energy (ME) and 22% crude protein (CP), the composition of basal diet presented on Table 1.

| Ingredient            | %     |
|-----------------------|-------|
| Rice bran             | 12.90 |
| Corn                  | 48.00 |
| Meat bone meal        | 10.80 |
| Soy bean meal         | 28.00 |
| Mix mineral¹          | 0.30  |
| Amount                | 100.00|
| Chemical composition (%)|       |
| Crude protein¹        | 22.08 |
| Crude fiber¹          | 5.19  |
| Crude eter¹           | 3.53  |
| ME (kcal/kg)²         | 3038.33|
| P¹                    | 0.68  |
| Ca³                   |       |
| Lysine⁴               | 1.07  |
| Arginine⁴             | 1.22  |
| Methionine⁴           | 1.54  |

¹Proximate analysis in the Laboratory of Feed Nutrition Science, Faculty of Animal and Agricultural Sciences, Diponegoro University, Semarang
²Based on Balton (1967) citied by [9]
³Analysis in the Chem-Mix Pratama Laboratory
⁴[10]

The research began with extraction of inulin from gembili tuber, preparation of symbiotic and supplementation of symbiotic on broiler chicken. Extraction of inulin from gembili tuber based on modification of Callefi method [11]. Gembili tuber was made into flower then conduct of inulin extraction. Gembili tuber added of hot water (90 °C, 1:15, w/v) and heated in water bath 80 °C for 1 hour, cooled and filtered, then precipitated with ethanol 40% (1:2.5), frozen for 6 hours, thawed and
centrifuged for 5 minutes at 5000 rpm. Inulin then dried and ground into powder. Preparation of synbiotic by mixing 7 g/100 ml of inulin extracted from gembili tubers with 10 ml of Lactobacillus plantarum (1 x 10⁶ cfu/ml) and incubated at 37 °C for 24 h. The treatment supplementation of synbiotic began at the broiler chicken at 1 day up to 42 days of age. Nitrogen intake, nitrogen retention and net protein utility determined at the end of experiment (42 days) with a total collection method combined with indicators Cr2O3: 0.3% during 3 days according to the modified of Hann [12] method. Excreta were collected, weighed, dried, ground and taken sample for analyzed of nitrogen.

Nitrogen analyzed based on AOAC [13] method. Nitrogen intake and nitrogen retention was calculated based on Mahfudz [14]. Net protein utility was calculated according to Mahfudz [15].

The data were analysed using analysis of variance (ANOVA) with F test, to known the effect of treatment and if significant of treatment, continued tested with Duncan's multiple range test used software SAS 9.0.

3. Results and Discussion

The average of nitrogen intake, nitrogen retention and net protein utility presented at Table 2. The result showed that synbiotic supplementation increased (p<0.05) the nitrogen intake, nitrogen retention and net protein utility.

Table 2. The effect of synbiotic on nitrogen intake, nitrogen retention and net protein utility of broiler chicken

| Parameters                  | Parameters | T0     | T1     | T2     | T3     |
|-----------------------------|------------|--------|--------|--------|--------|
| Nitrogen intake (g/bird)    |            | 3.81ᵇ  | 4.11ᵇ  | 4.62ᵃ  | 4.65ᵃ  |
| Nitrogen retention (g/bird) |            | 2.67ᶜ  | 3.10ᵇ  | 3.75ᵃ  | 3.84ᵃ  |
| Net protein utility (%)     |            | 70.01ᵇ | 75.31ᵇ | 81.22ᵃ | 82.36ᵃ |

Means with different superscript in the same row are significantly different (p<0.05)

3.1. Nitrogen Intake

The mean of nitrogen intake was presented in Table 2. The results showed that synbiotic supplementation had a significant effect on increasing of nitrogen intake. The synbiotic supplementation at 2 ml / 100 g of feed significantly (p <0.05) increased the nitrogen intake, while supplementation of 1 ml / 100 g of feed showed the same results as control (synbiotic 0 ml / 100 g of feed). This result was in line with the data of feed intake which has increased along with the increased of synbiotic supplementation [8]. Nitrogen intake is the multiplication between the amount of feed intake and the nitrogen content in the feed [14]. If the amount of feed intake increases, then, the amount of nitrogen intake also increases [16].

The increases of nitrogen intake due to synbiotic supplemetations was influenced by the presence of microbial balance in the intestine. This is in accordance with the opinion of Mountzouris [17], it reported that the balances of microbial in the intestine due to the increased growth of lactic acid bacteria would improve the function and health of the digestive tract. The synbiotic supplementation also stimulates the secretion of digestive enzymes, especially in the intestinal mucosa, bile and pancreas [18], so that it affects the process of digestion and absorption of nutrients, which will be ultimately effect on the increasing of animal appetite. This was in line with the research of Mousavi [19]. He reported that synbiotic supplementation affected on increasing the appetite of broiler, so the feed intake also increased. Increasing of appetite will be also affected the increasing of nitrogen intake.

3.2. Nitrogen Retention

The mean of nitrogen retention was presented in Table 2. The results showed that the maximum increases in nitrogen retention of broilers with synbiotic supplementation at 2 ml / 100 g of feed. This result was supported by the value of nitrogen intake with synbiotic supplementation at 2 ml/100 g of feed. Nitrogen retention value was extremely influenced by the amount of nitrogen intake. Increased of
nitrogen intake will be followed by the increasing of nitrogen retention value. Nahashon [16], said that the higher of nitrogen amount absorbed in the body, will also increases the nitrogen retention value.

Table 2 showed that the symbiotic supplementation could increase the nitrogen retention value compared than control. These results indicate that the symbiotic supplementation could increase the ability of chickens to digest nutrients, especially protein, so that the retained of nitrogen also increases. This is indicated by the increasing of digestibility protein of broiler chicken [8]. Supplementation of probiotics increase the stimulation of endogenous enzyme production in the digestive tract which will influence the increase of digestion and absorption of nutrients, especially protein [20] and [21]. The increase of digestion and nutrient absorption process was also supported by the increasing of population of lactic acid bacteria and a decreasing of coliform bacteria population from the research results [8]. The symbiotic supplementation can be increase the growth of beneficial bacteria and inhibit the growth of pathogenic bacteria [22]. The symbiotic supplementation also increased the concentration of lactic acid from the fermentation process of the substrate by bacteria, so that reducing pH in the digestive tract [23]. This intestinal environmental conditions can increase the digestion and absorption of nutrient, as evidenced by the increased nitrogen retention of the present finding.

The nitrogen retention value was also extremely determined by the amount of nitrogen that was excreted in excreta. The less amount of nitrogen excreted in excreta, then the nitrogen amount was left in the body also higher [16].

3.3. Net Protein Utility
The Net Protein Utility (NPU) value of this research was presented in Table 2. The results showed that the symbiotic supplementation significantly (p<0.05) increased the NPU value. The symbiotic supplementation at 2 ml / 100 g of feed significantly increased NPU, but the symbiotic supplementation at 1 ml / 100 g of feed gave the same results as control. The increasing of NPU in this research was supported by the nitrogen retention and nitrogen intake which showed an increase along with the increasing the symbiotic supplementation. The net protein utility value was influenced by nitrogen intake and nitrogen retention [15]. Furthermore, increased of nitrogen retention with increasing nitrogen intake will be increase the NPU value.

Broiler chickens symbiotic supplemented at 2 ml/100 g of feed were able to produce higher NPU values compared than controls, these results indicate that the use of protein in broiler chickens that the symbiotic supplementation is more efficient. Increased the efficiency of protein in this research was supported by the data of villi height and ratio of villi height to crypt depth in the intestinal that increases with the increasing of the symbiotic supplementation [8]. Increasing the villi height and ratio of villi height to crypt depth will be enlarge the surface area of absorption, increase digestibility and nutrient absorption capacity [24]. The increasing of NPU value was also influenced by the better of intestinal microbial balance and decreases the growth of harmful bacteria due to the symbiotic supplementation [8]. Dibaji [25], reported that the supplementation of symbiotic increases the growth of lactic acid bacteria and reduced the growth of harmful bacteria (E. coli and coliform) in the intestine, so that the intestine became healthier.

4. Conclusion
The conclusion of this research was symbiotic supplementation at 2 ml/100 g of feed was enhanced the protein efficiency of broiler chicken.

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