The effect of synbiotic through feed and drinking water on growth performance and nutrient digestibility of Tegal duck

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Abstract. Synbiotics are a combination of probiotics and prebiotics that have a positive effect on livestock performance. The method of giving synbiotics as a growth supplement needs to be studied to get the best results. This study aimed to investigate the effect of administering synbiotic (a mixture of Lactobacillus casei and porang tuber extracts (LCPE) in water or as feed supplement on performance and nutrient digestibility of Tegal duck. The research used a total number of 240-day old ducks with an average body weight of 47.84 ± 6.32 g. The ducks were weighed and distributed into 24 groups. Two experiments (I and II) were carried out simultaneously in the same cage and time. Each experiment used 120 ducks. Ducks were adapted from the age of 1 to 14 days. Parameter data were measure in ducks aged 15 to 42 days. Trial I included 3 groups of dietary synbiotic (0, 10, 20 ml/ kg) through feed, while in trial II, the ducks were fed synbiotics (0; 10; 20 ml/L) through water drinking for four weeks. The observed variables included growth performance and nutrient digestibility. The mixture of Lactobacillus casei and glucomannan from porang tuber extract improved nutrient digestibility and duck performance. The best performance and nutrient digestibility is LCPE 20 ml/L drinking water.

1. Introduction

Antibiotics had been used by livestock companies for decades to modify the gut microbiota and improve the growth performance of poultry. On the other hand, antibiotics have an impact on bacterial resistance and the presence of antibiotic residues in livestock products that harm consumers. Synbiotics were use as an alternative to antibiotics to stimulate intestinal microbiota, increase nutrient digestibility and improve livestock performance. Synbiotic are reported to modulate gut microbiota and intestinal health of the host. Synbiotics are synergistic combinations of prebiotics and probiotics [1]. the mechanism of action of probiotics includes competitive exclusion, promoting villi intestine, improving the immune system, anti-inflammatory abilities, enhancing nutrient metabolism and utilization, and improving growth performance [2]. Lactobacillus sp. is capable of producing various short-chain fatty acids (SCFAs) and bacteriocins, lowering intestinal pH or modifying receptors for microbial pathogens, increasing energy and protein utilization [3][4]. Prebiotics selectively stimulate the growth and activity of one or more commensal bacteria in the large intestine. Prebiotics and probiotics synergize so that the population of lactic acid bacteria (LAB) increases and increases the implantation of beneficial bacteria in the digestive tract. Increasing the amount of LAB in the intestine helps in reducing pathogenic bacteria.
[1]. Glucomannan is one of the prebiotics that can be found from porang tuber flour (*Amorphophallus oncophalus*) at a level of 41% [5].

The method of giving probiotics can affect the performance of probiotics, the results of previous studies have shown that giving probiotics through drinking water seems to be superior to feeding in feed [6]. Zhang et al [7] showed that administration of 1% probiotics (*L. casei, L. acidophilus*, and *Bifidobacterium*) in broiler drinking water resulted in increased growth performance, improved carcass properties, and immune function, improved gut microbial population, and antioxidant capacity. To date, very few studies have been carried out comprehensively to investigate the effect of giving synbiotics (from porang tuber extract combined with *Lactobacillus casei*) through drinking water and feed on the nutritional performance and digestibility of Tegal ducks. Therefore, this study was conducted to evaluate the effect of the level of synbiotic administration (porang tuber extract and *Lactobacillus casei*) through feed and drinking water on growth performance and nutrient digestibility of Tegal ducks.

2. Materials and methods

2.1. Ducks, experiment design, and management

The study used 240-day old ducks with an average body weight of 47.84 ± 6.32 g. Ducks are given starter feed from the age of 1-14 days. At 14 days, each duck was weighed and placed randomly in 24 experimental units and treated with synbiotics until the age of 42 days. During the study, ducks were fed and watered ad libitum. Two experiments (I and II) were carried out simultaneously in the same cage and time. Each experiment used 120 ducks. Trial I included 3 groups of dietary synbiotic (0, 10, 20 ml/ kg) through feed, while in trial II, the ducks were fed synbiotics (0; 10; 20 ml/L) through water drinking for four weeks. This probiotic product is composed of 1.47 × 10^9 cfu/g of *Lactobacillus casei*. The basal diets show in Table 1.

| Ingredient       | Amount (%) |
|------------------|------------|
| Maize            | 61         |
| Rice bran        | 13         |
| Soybean meal     | 19.25      |
| Meat Bone Meal   | 5          |
| CaCO₃            | 1          |
| Premix           | 0.5        |
| Total            | 100        |

| Nutrient                   | Amount (%) |
|----------------------------|------------|
| Metabolizable energy (kcal/kg) | 3067       |
| Crude protein              | 18.38      |
| Crude Fiber                | 6.87       |
| Ether extract              | 5.85       |
| Calcium                    | 1.08       |
| Phosphorus                 | 0.69       |
| Methionine                 | 0.45       |
| Lysine                     | 1.35       |

2.2. Data collection

Growth performance: At the start of the study, the ducks were individually weighed. The subsequent weighing was carried out every week during the experiment. Bodyweight gain (BB) was calculated as the difference between the final weight and the initial weight. Feed was given to ducks every day at 7 am. Provision of synbiotics through the feed is done by spraying synbiotics into 100 grams of the feed.
mixture on that day. The administration of synbiotics through drinking water is done by mixing the synbiotics into 200 ml of drinking water and given in the morning. After the feed and drinking water mixed with synbiotics have been consumed, the ducks are given basal feed. Feed consumption is calculated by the following formula: the amount of feed minus the rest of the feed. The feed conversion ratio was calculated by dividing the total feed consumed during the study by the body weight gain during the study (taking into account dead ducks), expressed in the same unit of weight.

Nutrient digestibility: Data were obtained at the end of the research when the ducks were 43-45 days old by collecting excreta. Twenty-four ducks from each experimental unit used as samples. Ducks placed in cages and fed according to the treatment. Excreta excreted accommodated, and analyzed for nutrient content. The amount of ration consumption and the number of excreta measured. Nutrient digestibility measured according to Mangisah et al.[8] as follows:

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\text{Nutrient digestibility} = \left( \frac{\text{nutrient consumed} - \text{nutrient in excreta}}{\text{nutrient consumed}} \right) \times 100\% \tag{1}
\]

2.3. Statistical Analysis
Data were analysis of variance and Duncan multiple range test using SPSS.

3. Results and discussion

3.1. Growth performance
Our results show that giving synbiotics through feed and drinking water can increase the growth performance. Giving LCPE through drinking resulted in better performance than giving LCPE through feed. This result was in accordance with Torshizi et al.[6] and Zhang [7] that supplementation of probiotics through drinking water significantly increased growth performance and carcass trait. The feed intake, body weight gain (BWG) and feed conversion ratio (FCR) increased in the observed ducks. LCPE supplementation through feed and drinking water can increase the LAB population which causes a decrease in intestinal pH and coliform. The decrease in coliforms was caused by the competition of bacteria in obtaining nutrients and attachment to the intestinal wall, as well as bactericidal compounds produced by Lactobacillus casei. This causes the balance of bacteria in the intestines to be better and the condition of the duck's digestive tract to be healthier. Intestinal improvement has an effect on increasing the digestive process and absorption of nutrients so that the growth of ducks increases. This result supported by Perdinan et al [9], adding glucomannan extracted from Amorphophallus oncophyllus tuber (GEPT) in the ration increases the total LAB, and decreases total of coliforms in the intestine of broiler chicken. Likewise, Wang et al [10] found that Probiotic supplementation improves the balance of the gut microbiota. Mannan oligosaccharides (MOS) in porang tuber extract cannot be digested by monogastric animals and can produce SCFAs that can lower pH, increase the bacterial population of Lactobacillus and Bifidobacterium species, and can inhibit the colonization of pathogenic microorganisms in the intestinal tract by binding to pathogenic bacteria that have type-I fimbriae specific for mannose and with its prebiotic activity.

| Parameters       | Level Synbiotic through feed (g/kg feed) | Level Synbiotic through water (ml/L) |
|------------------|------------------------------------------|--------------------------------------|
|                  | 0            | 10           | 20           | 0            | 10           | 20           |
| BWG (g)          | 943±21.13b   | 993±21.15a   | 996±29.13a   | 954±21.13c   | 998±25.12b   | 1045±21.15a  |
| Feed intake (g)  | 3319,36a     | 3296,76b     | 3237b        | 3319,92a     | 3133,72b     | 3187,25b     |
| FCR              | 3.52a        | 3.32b        | 3.25b        | 3.48a        | 3.14b        | 3.05b        |
3.2. Nutrient digestibility
LCPE synbiotic supplementation can improve protein digestibility and crude fiber digestibility (Table 3). This supported by Afriyati et al [11], the digestibility of crude fiber in broiler chickens has increased due to the addition of 1.2 ml of lactic acid bacteria Lactobacillus sp. The increase in crude fiber digestibility in LCPE1 and LCPE2 affected the increase in protein digestibility, both in ducks that given LCPE through drinking and feed supplement. Symbiotic LCPE was able to improve the balance of microbes in the digestive tract so that the digestive process increased [12]. Porang tuber extract can be a substrate for the development of L. casei. Lactobacillus casei produces antimicrobial substances that can suppress the growth of pathogenic bacteria, so that the digestive tract becomes healthy and the digestive process of nutrients increases [1,13]. Lactobacillus has the ability as an anti-inflammation of the intestine, increasing the immunity of the intestinal mucosa by regulating the balance between cytokine and chemokine receptors, increasing the number of intraepithelial lymphocytes, and therefore effectively suppressing intestinal inflammation [14]. It has an impact on increasing digestibility and nutrients absorption. The availability of nutrients for the synthesis of body tissues increases so that the performance of ducks becomes better. Julendra [15] showed that supplementation of inulin oligosaccharides or mannan oligosaccharides (MOS) in the diet significantly improved gut morphology, energy availability, and nitrogen retention in broiler chickens.

| Parameters    | Level Synbiotic LCPE through feed | Level Synbiotic LCPE through water |
|---------------|-----------------------------------|------------------------------------|
|               | 0       | 10      | 20      | 0       | 10      | 20      |
| Crude fiber   | 30,67b  | 32,71b  | 38,46a  | 35,02b  | 38,67a  | 39,43a  |
| Crude protein | 84,28b  | 85,24b  | 89,31a  | 83,43b  | 89,06a  | 90,17a  |

4. Conclusions
The conclusion was the addition of LCPE 20 ml/L through water drinking resulted in the best performance and nutrients digestibility.

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