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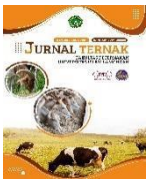

Effect of Probiotics on the Length and Weight of Broilers Small Intestine

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ABSTRACT

The increasing need for chicken meat consumption every year makes farmers have to optimize the target of broiler production performance. One solution to maximize production targets is to provide probiotics. Probiotics are live microorganisms that function to increase the effectiveness of the gastrointestinal tract. The media used in making probiotics is prebiotics in the form of milk powder waste with kefir grain starter. In probiotic solutions there are several types of bacteria such as Lactobacillus, Bacillus sp. The purpose of this study was to increase the intestinal length of broiler chickens by probiotic supplementation in finisher phase broiler chickens. The research employed a Group Randomized Design (RAK) comprising 4 treatments and 5 repeats, namely P0 (Without probiotics), P1 (3% probiotics), P2 (5% probiotics) and P3 (7%) implementation of probiotics in broiler chicken drinking water given every afternoon to morning, using One Way ANOVA statistical test parameters with Duncan follow-up tests. Based on the results of P0, P1, P2 and P3 studies that have been carried out, the best probiotic dose research results were obtained at P3 (7% probiotics) with duodenal length worth 50.4 cm, jejenum 86.2 cm and ileum worth 52 cm. The weight of duodenum is worth 29.7 grams, jejenum is worth 30.4 grams and ileum is 30.1 grams.

1. Introduction

Broiler chickens are meat-type poultry known for their higher meat yield and are utilized in meat production [3]. Broiler chicken productivity is influenced by breeding, feed, and management practices, including disease control. To achieve optimal growth performance, high-quality feed such as feed additives are essential [12].

Farmers face several challenges such as achieving target body weights and maintaining livestock health. The body weight of broiler chickens can increase if they are healthy and free from diseases. One common practice is the use of antibiotics, which can result in residues and bacterial resistance in both humans and animals. In this case, the government has issued a policy prohibiting the use of antibiotics in feed in Indonesia. This is regulated in Law Number 18 of 2009 and Law Number 41 of 2014. The government through Permentan No. 14/permentan/pk.350/5/2017 on the classification of veterinary drugs also emphasizes the prohibition of the use of antibiotics as feed additives [13]. An alternative approach is the use of natural antibiotics, such as probiotics. Probiotics improve gut conditions and

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enhance nutrient digestibility [11]. Probiotics can be administered using waste milk powder and kefir grain starter media. Probiotics, living bacteria given in optimal amounts, aim to maintain gut health. Adding probiotics to drinking water helps maintain gut microflora balance and detoxify harmful substances and metabolites [4].

The probiotics used are lactic acid bacteria, particularly the genus Lactobacillus sp., known for their resilience to low pH and ability to increase lactic acid bacteria populations [8]. Lactic acid bacteria are microorganisms with probiotic potential [17]. These bacteria can be classified into two types homofermentative species, which can convert 95% of hexose into lactic acid and heterofermentative species, which produce small amouunts of lactic acid along with ethyl alcohol. Lactic acid bacteria are classified as heterofermentative.

Meanwhile, waste milk powder is a milk product that is expired or expired but its nutritional content is not much different from milk that is not expired [9]. Waste milk powder can be used as animal feed because it contains 25.8%, 0.9% fat, 4.6% lactose and other nutrients such as sodium, potassium, vitamins, minerals and amino acids [1]. Waste milk powder that meets the requirements as an additional feed or substitute for ration raw materials in broilers is easily available, relatively affordable prices do not compete with human needs and quality nutrient composition with high protein content. Waste milk can be used as a medium for growing bacteria that can produce probiotic products.

The bacteria found in grain kefir are Lactobacillus, Pediococcus, Lactococcus, Streptococcus, Saccharomyces, Leuconostoc, Bifidobacterium, Enterococcus [15]. The bacteria most commonly found in grain kefir, namely the Lactobacillus species, are classified as probiotics because they can improve poultry health. These bacteria enhance digestive function by generating lactic acid, which can inhibit certain harmful bacteria within the digestive tract [2]. The reduction of harmful bacteria in the digestive tract produces.

Probiotics positively impact digestion and improve poultry digestibility, ensuring nutrient fulfillment for livestock. The small intestine, where digestion and nutrient absorption primarily occur, consists of three parts: the duodenum, jejunum, and ileum [18]. A healthy and normal digestive system in broiler chickens is characterized by optimal development of intestinal weight, length, and villi, which optimize nutrient absorption from feed [14].

Based on the aforementioned issues, research the study aimed to examine the impacts of probiotic supplementation on body weight and length of the intestines in broiler chickens. The research hypothesis posits that probiotics administered in drinking water can enhance the weight and length of the small intestine in broiler chickens.

2. Method

Location and Duration

The research was conducted for 36 days in Tambaksari Village, Pasuruan Regency, East Java.

Materials and Methods

The equipment used to observe the motility of probiotic bacteria included an ose, test tubes, Bunsen burner, glass slides, cover slips, measuring pipettes, and a microscope. Additional equipment included feeders, water containers, and measuring cups. Materials used during the broiler chicken rearing period included rice husks, drinking water, disinfectant, Gumboro and ND vaccines, and two types of feed: commercial feeds New Hope 810 and New Hope 811. The probiotic used was derived from powdered milk waste and kefir grain starter.

Research Method

Probiotic solution administration took place during the 21-24 days adaptation period, with probiotics given at a predetermined dosage on day 25. The study utilizied a Randomized Complete Block Design (RCBD) comprising 4 treatments and 5 replications/experimental units consisting of 10 broiler chickens each. The treatments included P0 (0% probiotic), P1 (3%), P2 (5%), and P3 (7%).

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Sample Selection

The study sample comprised 200 broiler chickens housed in an open-house system. Purposive sampling was used, selecting chickens that were healthy, physically sound, and free from defects.

Research Parameters

Measured parameters included the lengths of the broiler chicken's small intestines: duodenum, jejunum, and ileum. Measurements were taken by isolating the digestive tract, especially the small intestine, and using a measuring tape to determine the lengths of the duodenum, jejunum, and ileum. Measurements were conducted on the gross small intestines, prior to content removal.

Data Analysis

Data were analyzed using One Way ANOVA. Significant findings (if F observed > F critical at a confidence level of α = 0.05) were further analyzed using Duncan's multiple range test to identify significant differences among treatments.

3. Results and Discussion

Table 1: Weight and Length of Small Intestines of Broiler Chickens

Parameter	P0	P1	P2	P3
Length of Small Intestines (cm)				
Duodenum	33,2^{a}	36,0^{a}	41,4^{b}	50,4^{c}
Jejenum	52,8^{a}	62^{b}	71,4^{c}	86,2^{d}
Ileum	30,4^{a}	36,2^{b}	40,4^{c}	52,0^{d}
Weight of Small Intestines (grams)				
Duodenum	13,5^{a}	20,6^{b}	24,8^{c}	29,7^{d}
Jejenum	15,1^{a}	22,3^{b}	26,5^{c}	30,4^{d}
Ileum	14,9^{a}	22,1^{b}	26,3^{c}	30,1^{d}

Note: Different superscripts within the same row indicate significant differences (P < 0.05).

ANOVA results for the lengths of the broiler chicken's small intestines under four probiotic treatments are indicated by different superscripts: a, b, c, and d. Different superscripts denote significant differences (P < 0.05), while the same superscript indicates no significant difference (P > 0.05). The following discusses the lengths and weights of the small intestines of broiler chickens given probiotics:

Length of Small Intestines

Research results and data analysis indicate that the duodenum length of broiler chickens given a 7% probiotic dosage had a higher average length compared to the other three treatments. P3 had an average length of 50.4 cm. The duodenum's length correlates closely with villi length and the relative weight of the duodenum. Longer villi increase the surface area for nutrient absorption, leading to optimal nutrient absorption and consequently, increased duodenum weight and length. The length of the duodenum was 41.4 cm for P2, 36 cm for P1, and 33.2 cm for P0 (control). Different percentages of probiotic supplementation significantly influenced duodenum length.

Significant differences were observed in the length of the jejunum across treatments. Table 1 shows that treatment P3, with a 7% probiotic dosage, had the highest jejunum length at 86.2 cm, followed by P2 at 71.4 cm, P1 at 62 cm, and P0 at 52.8 cm. The highest ileum length was recorded in treatment P3 with a 7% probiotic dosage at 52 cm, followed by P2 at 40.4 cm, P1 at 36.2 cm, and P0 at 30.4 cm.

Probiotic supplementation at a 7% dosage enhanced the lengths of the duodenum, jejunum, and ileum compared to the other three treatments. This enhancement is attributed to lactic acid bacteria and antimicrobial substances that antagonize pathogenic bacteria and enhance beneficial bacteria in the small intestines. Lactobacillus sp. it also generates Short Chain Fatty Acid (sch as acetate, butyrate and

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propionate), especially butyric acid, which contributes to the proliferation of goblet cells in the small intestine epithelium, protecting it from damage [5] that short-chain fatty acids produced by probiotic bacteria fermentation stimulate the proliferation of epithelial cells in the intestines. Lactic acid bacteria reduce the establishment of harmful bacteria in the digestive tract. The low pH in probiotic products supports the growth and development of lactic acid bacteria, while inhibiting the colonization of pathogenic bacteria. According to [7], probiotic dosage can expand the absorption area by affecting the anatomical structure of villi, making them taller and denser, thereby maximizing nutrient absorption compared to chickens not supplemented with probiotics.

The influence of probiotic supplementation can positively impact the segments of the small intestine by increasing villi length, thereby maximizing the absorption of protein nutrients. This is consistent with the statement by [16] that probiotics enhance the digestive process in the intestines, facilitating the absorption of nutrients, especially those containing calcium and protein. Increased villi length enhances nutrient absorption, thereby impacting the health of broiler chickens.

Weight of Small Intestines

Based on Table 1, it can be observed that the average weights of the duodenum, jejunum, and ileum of broiler chickens given a 7% probiotic dosage were significantly higher compared to the other three treatments: duodenum weighed 29 grams, jejunum weighed 30.4 grams, and ileum weighed 30.1 grams. This is attributed to the addition of Lactobacillus sp. probiotics in the drinking water of treatment P3, which increased the length of the small intestine villi, thereby expanding the absorption surface area for optimal nutrient absorption. This finding is consistent with the assertion [6] that Lactobacillus in probiotics enhances absorption processes by influencing the anatomical structure of small intestine villi to be taller and denser, thereby optimizing nutrient and protein absorption. Efficient protein digestion can impact the duodenum weight, which is related to the role of proteins [10]. Proteins are essential for cell formation, the replacement of damaged cells, and the creation of new tissues. This includes the formation of epithelial cells in the small intestine. An increased number of epithelial cells in the small intestine results in a larger surface area, which consequently increases the weight of the duodenum, jejunum, and ileum.

4. Conclusions

Based on the research results, it can be concluded that among the four probiotic treatments, the 7% dosage significantly increased the lengths of the small intestines, namely the duodenum (50.4 cm), jejunum (86.2 cm), and ileum (52 cm). The weight of the small intestines in P3 was higher compared to the other three treatments, with the duodenum weighing 29.7 grams, jejunum 30.4 grams, and ileum 30.1 grams.

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