Supplementation of probiotic and prebiotic on the performance of broilers

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Abstract. The purpose of this research was to study the effect of probiotic-prebiotic on the performance of broiler. Two hundred one day broiler age were used in this study for 35 days. The chickens were randomly divided into five treatments, each treatment consists of four replications and each repetition consist of ten chickens. This research using completely randomized design, such as: T0: control, T1: probiotic 0.2% + prebiotic 0.2%, T2: probiotic 0.4% + prebiotic 0.2%, and T3: probiotic 0.2% + prebiotic 0.4%. The treatments started at 10 day-old chick. The parameters of research were feed consumption, body weight, and feed conversion. The results of significant analysis continued by Duncan's New Multiple Range Test. Two-hundred day old chicks divided into four treatments, each treatment has five replications, and every treatment has 10 chickens. The result showed supplementation probiotic 0,4% and prebiotic 0,2% increased body weight and decreased feed conversion ($P<0.05$) and had no significant difference in feed consumption.

1. Introduction

Feed costs in poultry farms are the largest production component reached 70%. Broilers need high-quality feed to sustain growth. Giving feed additive is proven to improve feed efficiency so that it provides profits for farmers. Problems arise when broilers are given high-quality feed and feed use additionally antibiotics. According to the study of [1] antibiotic resistance causes problems in animals and public health. Addition antibiotic in broiler is a problem in order to unsafe for consumption and cause drug-resistant drugs [2], residues in poultry carcass [3], and unbalanced microflora [4]. Antibiotic accumulation in the human body can kill microfloral.

Prebiotics, probiotics, symbiosis are used as feed additives to improve health and production performance. Feed conversion of broiler with probiotic-fed broilers was not different from those fed an antibiotic [5]. Probiotics are feed additives contains a number of bacteria (microbes) which give an effect which benefits of health because it can improve the balance of intestinal microflora, so it can provide advantages of protection, protection disease and improvement in digestibility feed. In addition, probiotics can also accelerate growth and increase body immunity from certain pathogenic diseases [6]. Broiler increase body weight significantly with probiotic and prebiotics [7].

Probiotics develop in the intestine and can benefit the host well directly or indirectly directly from the results of its metabolites [8]. Which bacteria contained in probiotics can change intestinal microecology such that microbes which can be profitable well developed [9]. Enzymes produced by

microbes found in probiotics are amylase enzymes, protease and cellulose [10]. Using a prebiotic oligosaccharide dose of 0.4% is based on the results [11] observed using fructooligosaccharides 0.4% can significantly increase the population of Bifidobacterium bacteria spp and Lactobacillus sp. Lactobacillus spp. Lactobacillus spp. produce digestive enzymes, increase concentration intestinal digestive enzymes. According to [12] reported that the Lactobacillus strain shows amylase activity. Increased amylase activity in the small intestine in broilers given lactobacillus, but none effects on lipolytic and proteolytic activity [13]. Flora in intestinal bacteria has a role in digestion and absorption, such as carbohydrates, proteins, lipids, and minerals and in vitamin synthesis.

The effect of probiotics on growth is to prevent colon colonization by pathogenic bacteria, such as *Clostridium perfringens*, *Escherichia coli*, and *Salmonella spp.* through competitive exclusion mechanisms [14] [15], then [16] showed that *Bacillus subtilis* were able to increase immune modulation by producing antimicrobial factors against *Clostridium perfringens*. Reported by [17] inhibition of nutrient absorption in pathogenic bacteria by producing toxic metabolites that irritate the intestinal mucosa.

Prebiotics are food ingredients that cannot be digested and beneficial to the host by selectively stimulating growth and or the activity of one or a number of bacteria that are in the colon so that they can improve the health of the host. Prebiotics, in general, are carbohydrates which are not digested and is not absorbed especially by single-bellied cattle (monogastric like chicken and pork) usually in the form of oligosaccharides and dietary fiber (inulin) [18]. Some prebiotics such as fructooligosaccharides and inulin play a role in improving health by modifying the balance of intestinal microflora [19] and selectively stimulates bacterial growth beneficial such as Lactobacillus and Bifidobacteria [20].

Symbiotics are a combination of probiotics and prebiotics that have a positive effect on intestinal health, food digestion, and the life performance of broilers [21]. Symbiotic is defined as a combination of prebiotics and probiotics that benefit the host by increasing defense and implantation of feed supplements containing live microbes in the channel digestion by selectively triggering growth and or activating metabolism of a number of good bacteria so as to improve health the host. The advantage of this combination is to increase survival probiotic bacteria because specific substrates are available for fermentation so the body gets more perfect benefits from a combination of probiotics and prebiotics [20]. The effects of ratio probiotic and prebiotic in association to performance are still unclear. Therefore, This research was conducted to study the effects of supplementation probiotic and of prebiotics with a different ratio to improve the health and growth of broilers.

2. Materials and Methods

Two hundred one day broiler was obtained from a commercial hatchery were used in this study for 35 days. The chickens were randomly divided into five treatments, each treatment consists of four replications and each repetition consist of ten chickens. This experiment using completely randomized design, the treatments were: T0: control, T1: probiotic 0.2% + prebiotic 0.2%, T2: probiotic 0.4% + prebiotic 0.2%, and T3: probiotic 0.2% + prebiotic 0.4% diluted on water.

The ration used during the study was basal ration divide into two rations such as starter period (age 0-3 weeks) with 21-22% protein content and metabolic energy 2800-3000 Kcal/Kg and finisher period (age 3-5 week) with a protein content of 18-20% and metabolic energy 3000-3200 Kcal/Kg. The prebiotic and probiotic were obtained commercially. Chicks were given the experimental diets from 10 days of age.

Feed consumption and body weight were recorded weekly, and the feed conversion ratio was calculated. Data were analyzed based on a completely randomized design model using the SPSS software. For interpretation purposes, main effect means were used when the interaction term was not significant, and individual means were considered when the interaction term was significant. Means were considered as significantly different at $P<0.05$.

3. Results and Discussion

3.1 Feed Consumption

Supplementation of probiotic and prebiotic on productive performance of broiler, based on the result from the statistical test are shown in table 1. The effect of treatments on feed consumption of broiler showed results that were not significantly different (P>0.05). There is no significant difference in this effect may be because the chicken is given the same feed as the amount of protein and energy. The amount of feed consumption is largely determined by the energy content in the ration. If the energy content in the ration is high then feed consumption will decrease and low energy content makes increasing feed consumption.

This research has different result with [22] reported supplementation of probiotics causes an increase in feed consumption as much 2.6% higher than T0 and it is suspected that this difference will be significant if the number of chickens used was increased and rations were used not a commercial ration and [23] showed that supplementation of Lactobacillus culture in feed increase feed consumption of laying hens

Table 1. Effect of supplementation probiotic-probiotic on feed consumption

Treatments	Replication					Average
	1	2	3	4	5	
T0	2836	2864	2997	2913	2861	2894[ns]
T1	2956	2998	2715	2918	2926	2902[ns]
T2	3018	2883	3012	2910	2897	2944[ns]
T3	2937	2915	2908	2914	2895	2914[ns]

[ns] Nonsignificant

3.2 Body Weight

The effect of treatments on body weight of broiler showed results that significantly different (P<0.05). the result from the statistical test is presented in table 2. The difference in body weight gain is closely related to more high feed consumption and possibly due to the increased digestibility of substances nutrition due to the provision of probiotics. Lipolytic, cellulolytic, and lignolytic microbes contained in probiotics are thought to have played a role active in increasing nutrient digestibility. This result different from [22] increased the dose of probiotics from 1 to 2 cc per liter of water drink did not have an effect (P> 0.05) on body weight gain chicken. It seems there are optimal limits on chickens in their tolerance to microbial populations in his digestive tract.

Table 2. Effect of supplementation probiotic-probiotic on body weight

Treatments	Replication					Average
	1	2	3	4	5	
T0	1694	1620	1637	1614	1693	1652[a]
T1	1662	1667	1630	1624	1618	1640[a]
T2	1782	1738	1797	1710	1712	1748[b]
T3	1646	1641	1651	1646	1608	1638[a]

[a, b] Means within each line and under the same factor with different superscripts are significantly different (P<0.05)

The result of body weight showed treatment of T2 has higher body weight than others treatment (P<0.05). Addition probiotics in broiler increase the growth of broiler [24] [25] [26], increasing body weight due to an increase in beneficial microbial populations [27], so cause improve digestive efficiency [28]. Supplementation from Lactobacilli mixture provides varied results. According to [29]

chicken feed given *Lactobacillus sporogenes* and *Clostridium butyricum* found a significant weight gain, [30] reported weight gain increased significantly (P<0.05) in chickens containing feed *Lactobacillus acidophilus* and *Streptococcus faecium,* then [31] observed that feed efficiency and body weight increased significantly (P <0.05) compared to broiler with antibacterial products. From [32] observed weight gain can vary from 5% to 9% when chicken is added with probiotics containing a mixture of *Lactobacillus acidophilus*, *Lactobacillus casei*, *Bifidobacterium bifidum*, *Aspergillus oryzae*, and Torulopsis.

3.3 Feed Conversion

According to [33] in broiler management, performance production that must be observed includes life weight, weight gain, weekly ration consumption, ration conversion, and feed conversion every week. The effect of treatments on feed conversion of broiler showed results that significantly different (P<0.05). The result from the statistical test is presented in table 3. The lowest feed conversion was T2 (probiotic 0.4%+prebiotic 0.2%) was 1.67 according to [20] reported a combination of probiotics and prebiotics is called synbiotics, a mixture of probiotics and prebiotics that affect survival and implant microbial food supplements living in the digestive tract by activating the metabolism of one or a number of bacteria that promote health or selectively stimulate growth. combination of prebiotics and probiotics more effective when compared with addition separately [34]. As well as, [35] reported positive results from symbiotics to improve broiler performance. Probiotic-supplemented birds had a lower feed conversion rate (1.85) than control (1.89).

Many factors influenced feed conversion are feed consumption and body weight, as reported by [30] feed efficiency increased significantly (P<0.05) in chickens containing feed *Lactobacillus acidophilus* and *Streptococcus faecium*. Probiotics are feed additives in the form of living microorganisms given to livestock which has a positive effect on livestock consume. This concept of utilizing microflora balance is what becomes the basis for using probiotics to suppress the development of pathogenic bacteria, well in the digestive tract of the chicken or in the litter (environment in the cage livestock). Addition of probiotics to drinking water also functions to maintain the balance of the microflora ecosystem in the digestive tract and provides enzymes that can digest crude fiber, protein, fat and detoxify toxins or their metabolites [36].

Table 3. Effect of supplementation probiotic-probiotic on feed conversion

Treatments	Replication					Average
	1	2	3	4	5	
T0	1.67	1.77	1.83	1.80	1.69	1.75[a]
T1	1.78	1.79	1.66	1.79	1.81	1.76[a]
T2	1.69	1.61	1.67	1.70	1.69	1.67[b]
T3	1.78	1.78	1.76	1.77	1.80	1.78[a]

[a, b] Means within each line and under the same factor with different superscripts are significantly different (P<0.05)

Addition of probiotics containing Lactobacillus, *Bacillus thermophilum* and *Enterococcus faecium* on the broiler diet increases the height of the villi [37]. The size of villi and the crypt depth ratio directly affect the increase in the epithelial cell [38], longer villi are associated with active mitosis cells [39]. Then reported by [40] high mitosis cells cause acceleration of rapid replacement of villus crypt tissue thereby accelerating villus renewal. Using synbiotics caused histomorphological changes in broiler intestines, the changes were increasing in villi size and increasing the surface area of nutrient absorption [41], while short villi caused low nutrient absorption [42].

Supplementation probiotics and prebiotics in rations can increase the population microbes that are beneficial for livestock, prevent the development of microbes detrimental in the digestive tract so as to improve digestion food, thus giving probiotics can make consumption efficient feed.

Conclusion

The result showed supplementation probiotic 0,4% and prebiotic 0,2% increased body weight and decreased feed conversion (P<0.05) and had no significant difference in feed consumption

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