Effect of indigenous lactic acid bacteria probiotics on broiler performance

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ABSTRACT: The objective of the study was to investigate the effect of supplementation of indigenous lactic acid bacteria probiotics on broiler performance in two different ways application. One hundred and five chicks were placed randomly into seven treatment groups, three replications of five birds each. Chicks in group 1 were unsupplemented birds as a control group (T0). Group 2 was daily supplemented 10^7 cfu/ml/bird of probiotics (T1). Group 3 was daily supplemented 10^8 cfu/ml/bird of probiotics (T2). Group 4 was daily supplemented 10^9 cfu/ml/bird of probiotics (T3). Group 5 was given 10^7 cfu/ml/ bird of probiotics in intermittent day supplementation (T4). Similarly to group 5, the way to application of both group 6 (T5) and group 7 (T6) that those were supplemented the dosages of 10^8 and 10^9 cfu/ml/bird respectively. All of broiler groups fed the broiler basal diet which was formulated to meet nutrient requirements of the NRC recommendation standard and were provided ad libitum. The results shown that cumulative feed consumption of broilers during 28 days of experiment was not different between the control and all of treatments, that those were such as (g/bird) 1306.30, 1485.88, 1359.72, 155.48, 1350.33, 1476.33 and 1307.33 for the T0, T1, T2, T3, T4, T5 and T6 respectively. However the cumulative gain weight (g/bird) between T0 as the control group and the others (T1, T2, T3, T4, T5 and T6) were significantly different ($P< 0.05$). The cumulative gain weight (g/bird) of all of the treatment groups were such as 611.05 (T0), 707.06 (T1), 702.57 (T2), 754.63 (T3), 722.42 (T4), 772.87 (T5) and 667.34 (T6) respectively. Feed to gain ratios of all experiment groups (T1= 2.12, T2= 1.93, T3= 1.98, T4= 2.00, T5= 2.22 and T6= 2.11) were improved significantly ($P<0.05$) compared to the control group (T0= 2.23). The conclusion of the study can be drawn that both either daily supplementation of indigenous lactic acid bacteria probiotics or intermittent day supplementation affected the improvement of growth performance of broiler chickens when compared to the unsupplemented birds. Daily administration of this probiotics was slightly effective more than intermittent day application when compared to the control. The dosage of probiotics of 10^8 cfu/ml/bird daily resulted the best broiler performance.

Key words: indigenous lactic acid bacteria probiotics, broiler performance

INTRODUCTION

High efficiency in broiler production requires maximizing the feed utilization and minimizing the losses due to mortality and growth retardation. For maintaining an optimal productivity, supplementation of feed with probiotics is an interest alternative that would replace the antibiotic as growth promoters. Antibiotics have been a common feed additive in poultry ration as a growth promoter to improve performance by reducing the burden of pathogens (Sun *et al.,* 2005). However the use of growth promoting antibiotics as a routine feed additives has been banned in some countries because of public concern over possible antibiotic residual effects and development of drug-resistant bacteria (Jin *et al.,* 1997; Muzaffer *et al.,* 2003). Nowadays probiotics have been introduced as an alternative to antibiotics, however their effects on poultry production have not consistent yet, resulting in uncertainties for development of the products. Inconsistent result in using probiotics might be due to differences in species and strains of microbes, in mono or in combination, in the dosage and way to application.

Food and Agriculture Organization (FAO) and World Health Organization (WHO) concentrated the probiotic definition exclusively on its health purpose: "live microorganisms which when administered in adequate amounts confer a health benefit on the host" (Lee and Salminen, 2009).

Supplementation of multispecies probiotics are more effective than monospecies probiotics and also that species-specific probiotics elicit different health effects than do probiotics derived from another host species (Timmerman *et al.*, 2006).

Similarly to the use of antibiotics, probiotics usage as a daily supplementing agent has also increasing the management cost. It will be a reasonable cost when the chicken supplemented the probiotics in an intermittent day. And for these uses resulting a high quality meat, that those edible broiler tissue are protected with harmful concentrations of antibiotic residues.

The present experiment aimed to study the effect of supplementation of indigenous lactic acid bacteria probiotics in two different ways application (daily and intermittent day supplementation) on broiler chickens performance.

MATERIALS AND METHODS

Animals and Diets

One hundred and five chicks were randomly divided into seven treatment groups, three replications of five birds each. Chicks in group 1 were unsupplemented birds as a control group (T0). Group 2 was daily supplemented 10^7 cfu/ml/bird of probiotics (T1). Group 3 was daily supplemented 10^8 cfu/ml/bird of probiotics (T2). Group 4 was daily supplemented 10^9 cfu/ml/bird of probiotics (T3). Group 5 was intermittent day supplementation 10^7 cfu/ml/bird of probiotics during the study for 28 days (T4). Similarly way to application of both group 6 (T5) and group 7 (T6) which were supplemented of 10^8 and 10^9 cfu/ml/bird respectively. Each group was assigned to a cage (1 m x 0,5 m) that had raised wire floor and contained feeder and waterer to provide *ad libitum* access to feed and water. All of the broiler groups fed the broiler basal diet which was formulated to meet nutrient requirements of the NRC recommendation standard (CP 22.81 % and ME 3053.45 kcal/kg).

Probiotics

The indigenous lactic acid bacteria probiotics included *Lactobacillus murinus* Ar3, *Streptococcus thermophilus* Kp2 and *Pediococcus acidilactici* Kd6 were obtained from the tractus digestivus of the Indonesian native chicken (Sri-Harimurti *et al.,* 2007). Previous study to these lactic acid bacteria showed their adhesion to the IEC of broiler chickens either *in vitro* and *in vivo* (Sri-Harimurti *et al*., 2008). These probiotics supplemented to the chicken orally.

Statistical Analysis

Data were analyzed using analysis of variance and continued by polynomial contrast test and Duncan Multiple Range Test.

RESULTS AND DISCUSSION

The cumulative feed consumption or cumulative feed intake (g/bird), cumulative body weight gain (g/bird) and cumulative feed to gain ratio or feed conversion ratio (FCR) during experimental period (28 days) present in Table 1.

As presents in Table 1 the cumulative feed consumption of broilers during 28 days of experimental period was not different among treatments and between the control, that those were such as (g/bird) 1485.88, 1359.72,1500.48, 1350.33, 1476.33, 1307.33 and 1306.30 for the P1, P2, P3, P4, P5, P6 and P0 groups respectively. When the cumulative feed intake of the chickens correlated to the body weight gain showed that unsupplemented birds have the lowest growth among the others. Studying broiler had reported the increase in feed intake and the enhancement in body weight gain. In this case, although all of the cumulative feed consumption were statistically the same however probiotics supplementation to all of the treatment groups significantly improved the weight gain (Table 1). The improvement in weight gain of broilers supplemented with probiotics similarly the results obtained by Djouvinov *et al.,* (2005[a]) and Djouvinov *et al.,* (2005[b]). That those have been suggested by the best

effect from the multistrain probiotics as a growth promotant (Timmerman *et al*., 2006). It was strengthened to the previous researchers provided evidence that multistrain probiotics are more effective than single strain probiotic (Timmerman *et al*., 2004). Previous reports of the probiotics used in this study proved that those *Lactobacillus murinus* Ar3, *Streptococcus thermophilus* Kp2 and *Pediococcus acidilactici* Kd6 have a good attachment ability to intestinal epithelial cells of broiler chickens and showed their scanning electron micrograph of those probiotics adherence to the epithelium of intestine (Sri-Harimurti *et al*., 2008). Also the supplementation of them improved the morphology of small intestinal broiler chickens, increased the crypt depth and the villus height and width (Sri-Harimurti and Endang Sutriswati, 2009). When broiler chickens supplemented with multi species probiotics consisted of *Lactobacillus murinus* Ar3, *Streptococcus thermophilus* Kp2 and *Pediococcus acidilactici* Kd6, the number of lactic acid bacteria in the intestine of all treatments showed significantly greater than that the control (Sri-Harimurti *et al*., 2009). Base on the important and potentially properties have been possessed of this probiotics which were used in this study, it supposedly that supplementation of probiotics in difference way to application produced in slightly similar results of cumulative feed to gain ratio or feed conversion ratio (Table 1).

Table 1. The effect of supplementation of probiotics in two different way application on performance of broiler chickens during experimental period (28 days).

	P0	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**
Feed intake, g/bird	1306.30	1485.88	1359.72	1500.48	1350.33	1476.33	1307.33
Gain weight, g/bird	611.05^{a}	707.06^{bc}	702.57^{bc}	754.63^{cd}	722.42^{cd}	772.87^{d}	664.34^{b}
FCR	2.23^{b}	2.11^{ab}	1.93^{a}	1.98^{a}	2.00^{ab}	2.23^{b}	2.11^{ab}

P0 = unsupplemented as a control; P1,P2,P3 = daily supplemented ; P4,P5, P6 = supplemented in intermittent day. P1 and P4 = 10^{7} cfu/ml/bird of probiotics supplementation ; P2 and P5 = 10^{8} cfu/ml/bird of probiotics supplementation; P3 and P6 = 10^{9} cfu/ml/bird of probiotics supplementation. ^{a,b,c,d} Mean in the same row with no common superscript differ significantly ($P < 0.01$).

Table 2. The results of the statistical contrast test among treatments and the control group

Contrast coeficient	VS	Feed intake	Gain weight	FCR
1	P0 vs P1,2,3,4,5,6	NS	S	S
2	P0 vs P1,2,3	NS	S	S
3	P0 vs P4,5,6	NS	S	NS
4	P1 vs P4	NS	NS	NS
5	P2 vs P5	NS	S	S
6	P3 vs P6	NS	S	NS

P0 = unsupplemented as a control; P1,P2,P3 = daily supplemented ; P4,P5, P6 = supplemented in intermittent day. P1 and P4 = 10^{7} cfu/ml/bird of probiotics supplementation ; P2 and P5 = 10^{8} cfu/ml/bird of probiotics supplementation; P3 and P6 = 10^{9} cfu/ml/bird of probiotics supplementation. NS = non significant. S = significant.

CONCLUSION

Supplementation of indigenous lactic acid bacteria probiotics (mixed of *Lactobacillus murinus* Ar3, *Streptococcus thermophilus* Kp2 and *Pediococcus acidilactici* Kd6) on broiler performance in two difference ways to application improved cumulative gain weight. The dosage of probiotics of 10^{8} cfu/ml/bird daily resulted the best broiler performance.

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