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STUDY ON PROBIOTIC AS ANTIBIOTIC REPLACEMENT TO IMPROVE EGG PRODUCTION IN COMMERCIAL DUCK FARMS

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Abstract. A research has been conducted to study the potency of probiotics as antibiotic replacements in terms of egg production and income over feed cost at commercial duck farms. The treatments were control, probiotic administration ($P_1=5$ and $P_2=7$ ml/kg feed), and antibiotic administration ($A_1=0.5$ and $A_2=1$ dose). Thus, there were 5 treatment units which were replicated 4 times. Each unit had 30 laying ducks, so in total there were 600 local laying ducks. Parameters observed were egg production as Hen Day Production and egg mass. Hen Day Production was measured by calculating the number of eggs, divided by the number of female ducks in percentage. Egg mass was calculated by the number of eggs multiplied by the weight of the eggs, divided by the number of ducks. The results showed that egg production in control, P_1 , P_2 , A_1 and A_2 was 50.95%, 62.90%, 60.85%, 56.75% and 65.40% respectively. For egg mass, the data were 36.07 ± 3.25 ; 44.58 ± 3.63 ; 42.64 ± 4.31 ; 41.44 ± 3.76 ; and 45.27 ± 4.57 respectively. Statistical analysis revealed that, for both parameters, there was a significant difference ($P < 0.05$) between control and treatments but not a significant difference among treatment groups. It seemed that probiotics and antibiotics had similar effects on Hen Day Production and egg mass. It can be concluded that probiotics could replace antibiotic administration for laying ducks in terms of egg production.

Keywords: probiotic, antibiotic, egg production, ducks, commercial farms.

Introduction

The use of antibiotic in poultry farming grew rapidly and even inclined under uncontrollable condition so that antibiotic could be purchased freely in poultry shops. Misuse of antimicrobials through improper licensing and unwatched withdrawal periods are commonly observed in developing countries [1]. There were evidence for a significant effect of antibiotic on growth rates, feed conversion efficiency, or quality of the flock, which are the characteristics of importance in the economics of poultry production [2]. The use of antibiotics in poultry and livestock production is favorable to farmers and the economy as well because it has generally improved poultry performance effectively and economically but at the same time, the likely dissemination of antibiotic resistant strains of pathogenic and non-pathogenic organisms into the environment and their further transmission to humans via the food chain could also lead to serious consequences on public health [3]. As a feed additive,

antibiotic was administrated in small amount continuously with a purpose to prevent pathogenic microbes development. Although antibiotic was given to poultry, the use of antibiotic could affect consumer health [4].

Antibiotic residue, which affects antibiotic resistance, can be found in both meat and eggs of poultry. Antibiotic resistance is of great public health concern because the antibiotic-resistant bacteria associated with farm animals may be pathogenic to humans, easily transmitted to humans via food chains, and widely disseminated in the environment via animal waste [5]. Antibiotics in animal feed have the potential to cause pathogenic microbes to develop resistance [6], as well as increase the risk of pathogenic bacteria materials being transmitted from poultry to humans [7]. Various antibiotics used in the treatment of animal diseases have been shown to occur in animal products used as human food.

The presence of antibiotics in human food is associated with several adverse public health effects including hypersensitivity, tissue damage, gastrointestinal disturbance, and neurological disorders [8]. Repeated use of antibiotics in poultry diets resulted in severe problems like resistance of pathogen to antibiotics, accumulation of antibiotics residue in their products and environment, imbalance of normal microflora and reduction in beneficial intestinal microflora [9]. Since the mid 2000's many countries has baned antibiotic use as Antibiotic Growth Promotor (AGP), including avilamycin, avoparcin, bacitracin, flavomycin, spiramycin, tylocin, and virginiamycin [10]. Those antibiotics produce residue in poultry products. Nowadays, food safety is one of the global interests, particularly relating to increased virulence as impact of antibiotic use in poultry [11]. The use of natural feed additive, such as probiotic, was an alternative to improved poultry performance as antibiotic replacement. Nowadays, probiotic has been widely used not only for poultry, but also for fishery [12].

Probiotics are known to be beneficial to their host [13]. Probiotics contain yeast cells, bacterial culture, or both, which are capable of stimulating gut microbes to modify the gastrointestinal environment to support health status and increase feed efficiency [14]. In probiotic, *Lactobacillus sp.* has several enzymes improve digestion and absorption of nutrients of the host [15]. *Saccharomyces cerevisiae* is highly advantageous since they are organisms that are immune to the action of antibacterials and they can play an important role by being part of the gut microbiota [16].

Dietary supplementation with probiotics has potential commercial applications for improvements in hen performance and eggshell quality during the early laying period [17]. Probiotic administration improved egg production, shell weight and thickness, and decreased yolk cholesterol content [18]. Previous studies indicated that probiotics increased productivity and welfare of laying ducks [19] [20].

Hen day production was (HDP) was the most important traits in commercial egg laying duck, since HDP directly effected farm income. The other main egg characteristics were mass which represented egg weight produced per duck [21]. This research has been conducted to study the potency of probiotics as antibiotic replacements in terms of hen day production and egg mass at commercial duck farms.

Materials and Method

Method

Experimental method was applied in this research, which has been conducted in collaboration with the 'Berkah Abadi' duck farmer group, which keeps the birds under a dry system intensively. The intensive system refers to the ordinary way done by the farmers in which ducks are confined to the farmer's village with a closed fence so that the birds have no access to the outside area, and the amount of feed provided can be controlled and measured. The farmer group contributed to this research by providing ducks as the main material, as well as

housing and feed. Daily records were kept for egg production, for both number and weight. The 'Berkah Abadi' farmer group was one of several duck farmers' groups in Tegal City, which is located in the northern plains coastal area of Java Island. The city, which is one of the most important duck centers in Indonesia, is home to a famous local laying duck breed, namely the Tegal Duck. It is believed that the duck belongs to the Indian Runner family.

Materials

Six hundred local laying ducks (Tegal ducks) at the age of 12.3 ± 0.9 months were used. The feedstuffs were locally available and mainly consisted of rice bran, dried rice, and fresh fish (Leiognathidae) with a proportion of 39,65%, 25%, and 35% respectively. The nutrient content was 26,38% crude protein, 2.923 kcal/kg metabolic energy, 2,29% calcium, and 0,78% phosphorus. Feed was given twice a day, i.e. in the morning and in the afternoon, while drinking water was provided ad libitum three times a day, i.e. in the morning, noon, and afternoon.

The study used a Completely Randomized Design with 3 groups, namely control, probiotic administration ($P_1=5$ and $P_2=7$ ml/kg feed), and antibiotic administration ($A_1=0.5$ and $A_2=1$ dose). There were 5 treatment units which were replicated 4 times. In total, there were 20 treatment units with 30 laying ducks per unit. The probiotic used was a mix of *Lactobacillus sp.* and *Saccharomyces sp.*, while the antibiotic administered was amoxitine. Probiotics and antibiotics were thoroughly mixed with the feed, and it was given every morning.

Parameters observed were:

- Hen day production as a percentage of hen day production is measured by calculating the number of eggs divided by the number of female ducks in percentage.

$$HDP = (\text{number of eggs} / \text{number of female ducks}) \times 100\%.$$

- Egg mass is calculated by the number of eggs multiplied by the weight of the eggs divided by the number of ducks.

$$EM = (\text{number of eggs} \times \text{weight of eggs}) : \text{number of female ducks}.$$

Data obtained was analysed using variance analysis at a 5% level of confidence.

Results and Discussion

Average hen day production and egg mass per treatment unit during this study are presented in Table 1

Table 1. Average egg production and egg mass per treatment unit

Parameter	Control	Probiotic		Antibiotic	
		P_1	P_2	A_1	A_2
Hen day prod. (%)	50.95 ± 2.57^a	$62,90 \pm 2.55^b$	$60,85 \pm 4.52^b$	$56,75 \pm 3.79^b$	$65,40 \pm 5.87^b$
Egg Mass (g/bird/day)	$36.07 \pm 3,25^a$	$44.58 \pm 3,63^b$	$42.64 \pm 4,31^b$	$41.44 \pm 3,76^b$	$45.27 \pm 4,57^b$

Note: a different superscript on the same line indicates a significant difference ($P < 0.05$)

Hen Day Production

During this study, the average egg production per treatment unit ranged from $50.95 \pm 2.552\%$ to $65,40 \pm 5.87\%$. These figures were in accordance with previous research [22], which found that the egg production of ducks kept intensively was 64.50% on average. The lowest egg production was found in the control group, whereas the highest was in A_2 . Statistical analyses showed that the egg production was significantly different ($P < 0.05$) between control and treatment groups. These findings confirm previous studies that probiotic administration had higher egg production [19]. Probiotics positively affected production performance, egg

quality, and blood metabolite parameters in laying hens [23]. Using probiotics as a food supplement improves the intestinal microbial balance of the host. Probiotics cooperate with the host to enhance intestinal immunity and morphology but can also induce metabolism function, thus decreasing the risk of infection by opportunistic pathogenic bacteria [24]. Probiotics had a significant effect on gut anatomy in that they macroscopically extended the chicken gut and microscopically increased gut density and villi. Therefore, probiotics improved gut surface area to absorb nutrients. Probiotics can modulate the ecosystems of intestinal microflora while also producing a natural antibiotic that has the potential to affect the health and performance of the host [25]. Those phenomena, most probably, were the reasons why egg production in probiotic administration was higher than in control.

A similar condition was also found in antibiotic administration. The main purpose of antibiotics is to prevent pathogenic organisms, thus preventing poultry health, as well as to increase feed efficiency and growth through, among others, improving favourable gut microflora [26]. The antibiotics, as a result, maintained the healthy status of the ducks. It is not surprising, therefore, that egg production under probiotic and antibiotic administration groups was higher than in the control group. The egg production was not significantly different among treatments. It revealed that the use of probiotics and antibiotics had similar effects on egg production. Duck egg production of control and treatment units is presented in Figure 1.

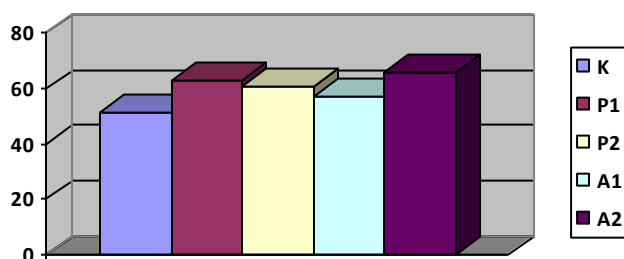


Figure 1. Hen day production of control and treatment units

Egg mass

The average egg mass was ranging from 36.07 ± 3.25 to 45.27 ± 4.57 g. These figures were in the range of previous research [27] who reported that egg mass was 38 to 51 g. The lowest egg mass was found at control, while the highest was at A₂. Statistical analyses showed that egg mass at control unit was significantly different ($P < 0.05$) compared to that at treatment units. It indicated that additional probiotic and antibiotic in duck feed has increased egg mass. This result is in accordance with [28] who concluded that supplementation of laying duck diets with *Saccharomyces sp.* increase egg mass. Dietary protein and amino acids, among others, were significant factors affected egg mass [29]. The use of antibiotics promotes the elimination of pathogens from the gastrointestinal tract, and improvement in nutrient absorption, lower energy and protein expenditure, lower ammonia production, and a lower rate of food passage [30]. Among the treatments, however, probiotic and antibiotic had no significant difference ($P > 0.05$). It implies that supplementation probiotic and antibiotic in duck diets had similar effect on egg mass. Figure 2 illustrates egg mass during the study.

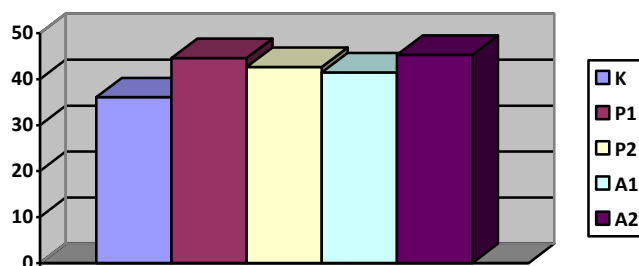


Figure 2. Egg mass of control and treatment units

Conclusion

Based on the findings of this study, it is possible to conclude that probiotics could replace antibiotic administration in laying ducks in terms of hen day production and egg mass.

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