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# Effects of Combinations of *α-Lactobacillus* sp. and *Curcuma longa* Flour on Production, Egg Quality, and Intestinal Profile of Mojosari Ducks

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**Abstract** | This study aims to determine the effect of added dietary turmeric flour and probiotics on gut characteristics and production performance of Mojosari ducks. The turmeric consisted bioactive substances, while *Lactobacillus sp.* produced lactic acid bacteria. The 280 laying ducks used were Mojosari ducks aged 20–28 weeks reared for eight weeks on the experimental diet. The *Curcuma longa* flour used was produced by Balai Materia Medika, Batu District and the liquid probiotics used contained *Lactobacillus* sp. bacteria in concentration of 1.4 x $10^{10}$ CFU/ml. A completely randomized design with six treatments and four replications was employed, with each experimental unit consisting of eight Mojosari ducks. The treatments consisted of $T_0$ = basal diet, $T_1$ = basal diet + 0.2% turmeric, $T_2$ = basal diet + 0.8% turmeric, $T_3$ = basal diet + 0.2% turmeric + 0.1% probiotics, $T_4$ = basal diet + turmeric 0.8% + 0.6% probiotics, and $T_5$ = basal diet + bacitracin 0.01%. Results were analysed via one-way ANOVA and if a significant effect ($p \leq 0.05$) was identified, least significant difference testing was then applied. The effect of $T_4$ on egg production performance, feed conversion and egg weight were highly significant ($p \leq 0.01$) and from the results it was concluded that the best treatment was $T_4$, namely basal dieting with the addition of 0.8% turmeric and 0.6% probiotics.

**Keywords** | *Curcuma longa*, Egg quality, Growth performance, Mojosari Duck, Probiotic

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## INTRODUCTION

The Mojosari duck is a local superior laying variety originating from the island of Java that can be traditionally and intensively maintained and has the potential to be developed as a commercial duck breed both in traditional and intensive environments. This duck first lays eggs at 24 weeks (six months) and has a longer production time than other breeds, of up to three productive periods. Average egg production is 230–250 eggs/year, average egg weight is 65 grams, eggshell colour is greenish-white, and production period is eleven months per year (Ketaren and Prasetya, 2012). Nowadays, the used egg production can be increasing by using feed additive.

Feed additives in modern poultry farming are generally used to spur growth or increase livestock productivity and feed efficiency (Sjofjan et al., 2020a). Feed additives often used are antibiotics at the subtherapeutic level and these have residual effects on human health. The EU has imposed a ban on the use of antibiotics in animal feed since January 1, 2006 (regulation number 1831/2003), while in Indonesia, a ban was implemented on January 1, 2018 (based on Ministry of Agriculture regulation 14/2017). Negative effects of the use of antibiotics in animal rearing include consumer exposure to residues and the development of livestock resistance to certain types of pathogenic microorganisms (Adli, 2021a).

As alternatives to synthetic antibiotics, bioactive substances in plants that are sources of natural antibiotics have received attention from both the public and researchers. Plant extracts, phytogenic additives, essential oils, prebiotics and probiotics have been extensively studied as replacements for synthetic antibiotics and have been tested to identify the best options (Toghyani et al., 2011). Another possibility is the use of natural herbal ingredients that are widely available in nature and are environmentally friendly; one such plant is turmeric. Ulfah (2011) states that the bioactive substances contained in the turmeric plant consist of curcumin (73.4%), desmetoxycurcumin (16.1%) and bisdemethoxycurcumin (10.5%), and suggests that these substances have positive properties including anti-bacterial effects, anti-bacterial oxidants, improved digestibility, increased body weight, improved immunity and reproductive performance, reduced mortality, and the prevention of livestock disease. According to Wheeler and Fields (2013), medicinal plants contain bioactive compounds that can modify the intestinal microflora, improving immunity and the response of livestock to nutrition and the environment. Liju et al. (2011) stated that the essential oil in turmeric functions as an anti-bacterial by denaturing cell proteins and dissolving fats in bacterial cell walls. Meanwhile, phenol acts as an anti-oxidant because it contains hydroxyl groups that are easily oxidized and consequently are able to donate electrons and hydrogen to free radicals, thus stabilizing them. Phenol also acts as an anti-bacterial by entering the cytoplasm of bacterial cells, resulting in bacterial cell lysis. One of the rhizome plants that contain phenolic compounds is galangal essential oil. The use of galangal essential oil has been shown to reduce the population of gram-positive bacteria in the rumen and increase feed efficiency in dairy cows (Daning, 2022a, b).

Ismoyowaty et al. (2021) reports that turmeric flour supplementation in feed can increase egg weight in chickens but does not significantly affect egg production (hen day production or HDP). Besides turmeric, probiotics can also be used as antimicrobials in poultry feed. They can produce antimicrobial compounds that kill or inhibit the growth of pathogenic bacteria and improve the host's nutritional value by producing digestive enzymes and improving immune responses. Probiotics are live microorganisms that play a role in the balance of microbes in the digestive tract (Amara and Shibl, 2015) and are non-toxic, and can survive and colonize in the intestines and produce microbial substance antagonists against pathogenic bacteria such as lactic acid bacteria. Song et al. (2014) state that giving probiotics to poultry can affect the balance of microflora in the digestive tract and intestinal villi, enabling better nutrient absorption which will in turn be used for growth and production. Therefore, this study aims to determine the effect of added dietary turmeric flour and probiotics on gut characteristics and production performance of Mojosari ducks.

## MATERIALS AND METHODS

### Ethical approval

Ethical approval for the study was given by the Animal Care and Use Committee, University of Brawijaya, No. 34-KEP-UB-2019 Date 1st July, 2019.

### Experimental design

A total of 200 female Mojosari ducks were used in an eight-week trial. In this experiment, the probiotic used was *α-Lactobacillus* sp. 1.4 x $10^{10}$ Riset Antar Perguruan Tinggi dan Industri (RAPID© commercially) and the additive used was derived from turmeric (*Curcuma longa*) rhizomes harvested at 11 to 12 months. All ducks were housed in environmentally controlled rooms in 50 x 50 x 50 $m^2$ rice-hull-littered pens. All ducks were allowed *ad libitum* access to water through adjustable nipple drinkers. Each treatment was randomized as a completed block design for position (four replicates with eight ducks per replication pen). Treatments were as follows: $T_0$ = basal diet + 0% control, $T_1$ = basal diet + 0.2% turmeric flour, $T_2$ = basal diet + 0.8% turmeric flour, $T_3$ = basal diet + 0.2% turmeric flour + probiotics 0.1%, $T_4$ = basal diet + 0.8% turmeric flour + 0.6% probiotics, $T_5$ = basal diet + bacitracin antibiotic 0.01%. The formulated feed consisted yellow maize, maize bran, soybean meal, bone meal, meat meal, soy oil, mineral premix, vitamin premix, anti-oxidant, and canthaxanthin. Representative of the formulated feed were analyzed for metabolizable energy (Kcal/kg), crude protein (CP), crude fibre (CF), calcium (Ca), and phosphorus (P) according to established procedures described by (AOAC, 2000). The composition of formulated feed showed in the Table 1.

### Growth performance

Feed intake was calculated as the difference between feed given and remaining feed. In addition, feed egg ratio was expressed by dividing the amount of feed given by the total number of eggs produced (Adli, 2021b).

### Intestinal profile

First, intestinal profile specimens of 0.5–1 cm were cut. Selected pieces were stretched at a floating-out temperature of about 400°C to ensure the specimen tissues were

Table 1: Ingredient of Mojosari duck diets (20-28 weeks).

| Ingredients (% as is basis) | $T_0$ | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ |
|---|---|---|---|---|---|---|
| Yellow Maize | 50.00 | 50.00 | 50.00 | 50.00 | 50.00 | 50.00 |
| Maize bran | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 |
| Soybean | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 |
| Bone meal | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 |
| Meat meal | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 |
| Soy oil | 2.00 | 2.00 | 2.00 | 2.00 | 0.90 | 1.99 |
| Custom mineral premix* | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Vitamin premix** | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| Antioxidant*** | 0.20 | 0.20 | 0.20 | 0.10 | 0.00 | 0.20 |
| Canthaxanthin | 0.30 | 0.08 | 0.00 | 0.10 | 0.00 | 0.30 |
| Probiotics | 0.00 | 0.00 | 0.00 | 0.10 | 0.60 | 0.00 |
| *Curcuma longa* flour | 0.00 | 0.20 | 0.80 | 0.20 | 0.80 | 0.00 |
| Bacitracin | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| **Calculated composition** | | | | | | |
| ME (Kcal/kg) | 2700.00 | 2700.00 | 2700.00 | 2700.00 | 2700.00 | 2700.00 |
| Crude Protein (CP) | 18.30 | 18.30 | 18.30 | 18.30 | 18.30 | 18.30 |
| Crude fibre (CF) | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 |
| Calcium (Ca) | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 |
| Phosphorus (P) | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 |
| **Proximate composition (Wet chemical analysed)** | | | | | | |
| ME (Kcal/kg) | 2721.03 | 2734.02 | 2678.01 | 2712.01 | 2713.22 | 2713.01 |
| Crude Protein (CP) | 18.56 | 18.21 | 18.11 | 18.20 | 17.93 | 19.01 |
| Crude fibre (CF) | 4.01 | 4.32 | 4.01 | 4.03 | 4.11 | 4.12 |
| Calcium (Ca) | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 |
| Phosphorus (P) | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 |

**: Vitamin A, 6000IU, Vitamin D3, 1000IU, Vitamin E, 10mg, Vitamin K3, 1.5mg, Vitamin B1, 5mg, Vitamin B2, 2.5mg, Vitamin B6 0.5mg, Vitamin B12, 2.0mg, niacin, 5.5mg, pantothenic acid, 0.2mg, betaine, 30mg. *: Iron, 12.50mg, copper, 3mg, manganese, 37.5mg, zinc, 31.32mg, iodine, 5mg and selenium 0.0625mg***Carrier was $CaCo_3$.

not wrinkled. Five grams of gelatin powder was then sprinkled into 100 cc of distilled water and allowed to dissolve completely. Next, a good specimen that was not scratched or wrinkled was selected and taken with a glass slide numbered according to the epi/pathological number. Slides containing tissue pieces were placed on a slide-heating plate for at least two hours. The specimens were then stained using the following method. All dyes were checked for clarity and adjusted to the available replacement schedule (three uses for each). After staining, cover slipping was carried out and one to two drops of Entellan mounting medium were added to each cover slip. These were then turned and covered on slides that had just been stained to avoid the formation of air bubbles and then left to dry completely. The sliding glass was then cleaned with xylol and numbered according to the number on the label of the sliding glass, ready to be examined under a light microscope to reveal morphological changes in the examined specimens. The results of the microscopic examinations were then recorded and entered into a computer program available for definitive diagnosis and then sent to the Epidemiology section (Sjofjan et al., 2020b).

### Hen day production (%) and mortalities

Hen day production (%) was recorded on a day as the number of eggs produced divided by the total population number of ducks on that day (%). Eggs were weighed using a digital scale and mortalities were calculated as the total of dead ducks from the beginning of the study period (%) (Adli, 2021b).

### Data analysis

Prior to statistical analysis, analysis of variance (ANOVA) using general linear model (GLM) was carried out using SAS OnDemand for Academics (ODA, Cary, NC,USA). The results were presented as standard error mean (SEM). Moreover, probability values were calculated using least significant different testing. The following model was used:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where $Y_{ij}$ was parameters observed, μ was the overall mean, $T_i$ the effect level of *α-Lactobacillus* sp. and *Curcuma Longa* flour, and $e_{ij}$ the amount of error number. The linear and quadratic effects of adding of *α-Lactobacillus sp.* and *Curcuma Longa* (i= $T_0$ = basal diet + 0% control, $T_1$ = basal diet + 0.2% turmeric flour, $T_2$ = basal diet + 0.8% turmeric flour, $T_3$ = basal diet + 0.2% turmeric flour + probiotics 0.1%, $T_4$ = basal diet + 0.8% turmeric flour + 0.6% probiotics, $T_5$ = basal diet + bacitracin antibiotic 0.01%.) were determined by applying polynomial orthogonal contrasts.

## RESULTS AND DISCUSSION

### Effects of adding turmeric flour and probiotics on the intestinal profile of *Mojosari* ducks

The results of measuring the average length of the intestine (duodenum), intestinal weight, and intestinal villi height and width of Mojosari ducks fed with and without the addition of turmeric and probiotics can be seen in Table 2. The results of the analysis of variance showed that feeding with the addition of 0.8% turmeric flour and 0.6% probiotics ($T_4$) had a significant effect ($p \leq 0.05$) on the height and width of the intestinal villi, but did not show a significant difference ($p > 0.05$) in the length and weight of the intestines. This is because the bioactive substances in turmeric and probiotics work on the digestive organs to improve intestinal conditions in the presence of good bacteria and working with peristaltic movements. As a result, the protrusions of the intestine move more actively to digest food which affects the height and width of the intestinal villi when actively digesting food. However, the additions did not change the morphology of the intestine in terms of length and weight.

Table 2 shows that the greatest average intestinal length was in treatment 0.2% turmeric flour and the lowest in basal diet + bacitracin antibiotic 0.01%. The highest average bowel weight was in control and the lowest was in 0.8% turmeric flour and 0.6% probiotics This indicates that high and low percentage of weight and length of the digestive tract is a form of adaptation of ducks to the crude fibre content in the ration (Amrullah, 2004). Crude fibre in the feed given in this study was moderate, at about 7%. Feed in the digestive tract of poultry moves quickly if it contains high levels of crude fibre. This fast feed rate must be balanced by maximizing the growth of the gastrointestinal tract so that the surface area is sufficient to absorb nutrients and enable them to be properly digested (Sjofjan and Adli, 2020). The results of histopathological analysis of the height and width of the intestinal villi of ducks given additional turmeric and probiotics in their feed can be seen in Figure 1. Treatments $T_4$ and $T_3$, using a combination of turmeric and probiotics, had better gut anatomy and physiology than $T_5$ using synthetic antibiotics and $T_0$ as a control. The increase in width of the intestine indicates increased activity of digestion and absorption of food juices. The results of research by Shah (2007) using probiotics at a concentration of $10^{-6}$ cells/ml can increase the productivity of ducks. The results of the least significant difference further test on the mean height of the intestinal villi (Table 1) showed that $T_0$ was very significantly different ($p \leq 0.01$) to $T_4$ but that there was no significant difference ($p > 0.05$) with the other treatments. Similarly, the mean width of the intestinal villi in $T_0$ was significantly different ($p \leq 0.05$) to $T_4$, which contained the addition of 0.8% turmeric and 0.6% probiotics. The mechanism between turmeric flour and probiotic used was begin with the turmeric secrete the bioactive substances. While, probiotic produced lactic acid in the intestinal. Second, these additions are thought to cause the intestinal villi to develop maximally because probiotics are able to maintain the pH conditions of the digestive tract necessary to suppress populations of pathogenic microbes and to increase the growth of non-pathogenic microbes (Adil et al., 2010).

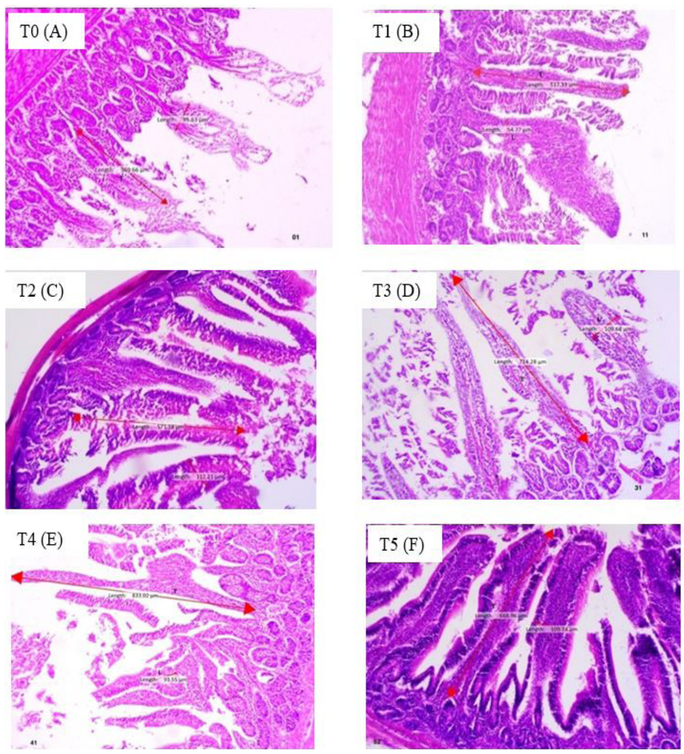


**Figure 1:** Intestinal profile of Mojosari ducks with 100x scale of zooming. $T_0$ = basal diet + 0% control (A), $T_1$ = basal diet + 0.2% turmeric flour (B), $T_2$ = basal diet + 0.8% turmeric flour (C), $T_3$ = basal diet + 0.2% turmeric flour + probiotics 0.1% (D), $T_4$ = basal diet + 0.8% turmeric flour + 0.6% probiotics (E), $T_5$ = basal diet + bacitracin antibiotic 0.01% (F).

**Table 2:** Intestinal profile of Mojosari ducks.

| Parameters | Treatments | | | | | | | Polynomial contrasts | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $T_0$ | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ | SEM | L | Q | C |
| Intestinal length (cm) | 178.75 | 180.25 | 179.50 | 175.25 | 173.50 | 168.25 | 7.32 | 0.31 | 0.45 | 0.80 |
| Bowel weight (mg) | 108.50 | 97.75 | 103.75 | 87.75 | 87.25 | 88.75 | 7.13 | 0.66 | 0.65 | 0.80 |
| Villi height (µm) | 416.22[a] | 517.70[ab] | 464.72[a] | 511.00[a] | 630.25[b] | 492.75[a] | 40.42 | 0.81 | 0.82 | 0.72 |
| Crypt depth (µm) | 67.54[a] | 80.62[ab] | 86.91[b] | 84.81[ab] | 106.88[c] | 85.99[ab] | 4.05 | 0.42 | 0.41 | 0.73 |
| VH/CD | 6.16 | 6.42 | 5.34 | 6.02 | 5.89 | 5.73 | 2.13 | 0.65 | 0.66 | 0.71 |

[a, b, c, d] Means with different superscripts in the row differ significantly ($p \leq 0.05$). $T_0$ = basal diet + 0% control, $T_1$ = basal diet + 0.2% turmeric flour, $T_2$ = basal diet + 0.8% turmeric flour, $T_3$ = basal diet + 0.2% turmeric flour + probiotics 0.1%, $T_4$ = basal diet + 0.8% turmeric flour + 0.6% probiotics, $T_5$ = basal diet + bacitracin antibiotic 0.01%. L – linear; Q – quadratic; C – cubic.

**Table 3:** Duck Production and feed egg ratio of Mojosari ducks.

| Parameters | | | | | | | | Polynomial contrast | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $T_0$ | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ | SEM | L | Q | C |
| FI (g/head/day) | 160 | 160 | 160 | 160 | 160 | 160 | 0.30 | 0.33 | 0.55 | 0.67 |
| HDP (%) | 86.77[ab] | 87.45[a] | 87.76[c] | 81.98[c] | 85.00[d] | 87.86[b] | 0.76 | 0.56 | 0.76 | 0.88 |
| FER | 7.03[a] | 6.75[ac] | 5.32[b] | 4.68[d] | 4.41[d] | 6.85[c] | 0.10 | 0.82 | 0.83 | 0.77 |
| Egg weight (g) | 62.00[a] | 63.50[b] | 63.13[ab] | 65.75[c] | 66.25[c] | 63.00[ab] | 0.58 | 0.42 | 0.43 | 0.77 |
| Mortalities (%) | 4.00[a] | 0.00[b] | 2.00[c] | 0.00[b] | 0.00[b] | 2.50[ac] | 0.13 | 0.66 | 0.76 | 0.82 |

FI – feed intake; FER – feed egg ratio; HDP – Hen Day production. [a, b, c, d] Means with different superscripts in the row differ significantly ($p \leq 0.05$). $T_0$ = basal diet + 0% control, $T_1$ = basal diet + 0.2% turmeric flour, $T_2$ = basal diet + 0.8% turmeric flour, $T_3$ = basal diet + 0.2% turmeric flour + probiotics 0.1%, $T_4$ = basal diet + 0.8% turmeric flour + 0.6% probiotics, $T_5$ = basal diet + bacitracin antibiotic 0.01%. L – linear; Q – quadratic; C – cubic.

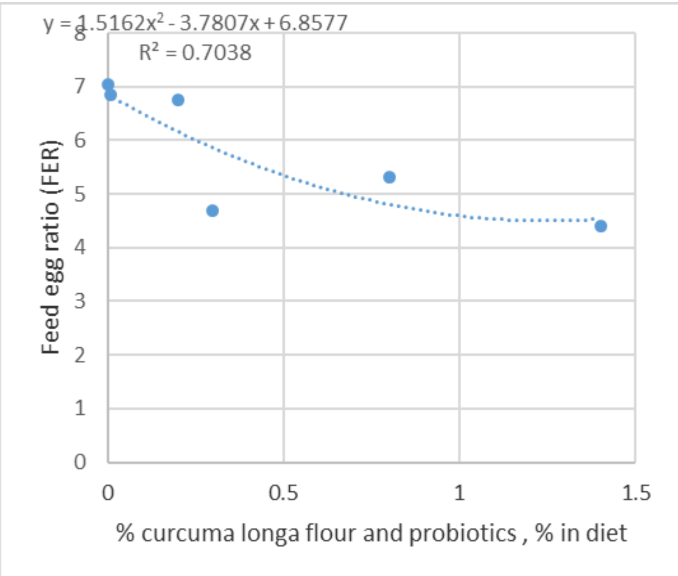


**Figure 2:** Feed egg ratio after adding *Curcuma longa* flour and probiotic on Mojosari ducks.

## Effects of adding turmeric flour and probiotics on *Mojosari* duck production

Analysis of the feed intake, hen day production, feed egg ratio, egg weight, and mortalities of Mojosari ducks fed with turmeric and probiotics is presented in Table 2. Average feed intake in all treatments (Table 3) was the same, at 160 g/head/day for laying ducks. The feed intake in this study was in accordance with the standards for the preparation of national feed ingredients based on the nutritional formulation for ducks according to their physiological growth. Prasetyo (2006) stated that the feed requirement for adult laying ducks aged more than 20 weeks was 160–180 grams/head/day. Feed for adult laying ducks is recommended as being a mixture of concentrate with bran/groats/corn with a ratio of 1:2 or 1:3, according to the level of production.

The highest hen day production 85% was found in the $T_4$ treatment, followed by $T_3$, $T_2$, $T_1$, $T_5$ and $T_0$. Based on analysis of variance, the egg production of Mojosari ducks was significantly affected ($p \leq 0.01$) by the treatment given. The results of the least significant difference further testing showed that treatment $T_0$ was not significantly different ($p > 0.05$) to $T_1$ and $T_5$, but was very significantly different ($p \leq 0.01$) to $T_2$, $T_3$, and $T_4$. Treatment $T_4$, which had the largest number, showed a significant difference ($p \leq 0.01$) to other treatments. This is because in $T_4$ the administration of turmeric impacts on the production of eggs, and the probiotics used contain lactic acid bacteria. Turmeric is a natural antibiotic, and lactic acid bacteria balance the composition of microbes in the digestive tract. Kompiang (2009) stated that probiotics can improve the digestive tract to support the development of beneficial bacteria and help the absorption of food substances. Astuti et al. (2015) added that those bacteria that ferment lactose and produce lactic acid as a main product and provide beneficial effects are a group of bacteria that have been widely used as probiotics.

The average egg weight during the eight weeks of rearing in each treatment can also be seen in Table 3. The $T_4$ treatment had the highest average weight compared to other treatments, followed by $T_3$, $T_1$, $T_2$, $T_5$ and $T_0$. Reported from Suswoyo and Rosyidi (2021) high egg weight indicates a high amount of egg yolk and egg white. The high egg weight indicated there is greater amount both egg yolk and egg white. Both of egg yolk and egg white give 35% from total of egg weight (Suswoyo and Rosyidi, 2021). The more egg yolk and egg white, the more available nutrient there is for embryo development, resulting in greater hatching weight. The factors that influence the weight of day-old chicks include feed and egg quality (Yousefi and Karkodi, 2007). Based on the least significant difference further test, $T_4$ had was significantly different ($p \leq 0.01$) to all other treatments except for $T_3$, in which the difference was not significant ($p > 0.05$). The $T_4$ treatment contained added 0.8% turmeric and 0.6% probiotics while the $T_3$ treatment contained 0.2% turmeric and 0.6% probiotics. The addition of probiotics can have a very significant effect on egg weight. The use of synthetic antibiotics can cause residues in the bodies of livestock and humans who consume them (Suswoyo and Rosyidi, 2021). To replace them, natural antibiotics can be used, including turmeric and probiotics. Turmeric content can work as a natural antibiotic in the body. Sjofjan et al. (2020b) stated that herbal ingredients containing natural antibiotics such as turmeric, which contains essential oils and curcumin, play a role in improving the work of the digestive organs, stimulating the bile wall, secreting bile, and stimulating the release of pancreatic sap containing amylase, lipase and protease enzymes that improve digestion and absorption of nutrients. In addition, the mechanism of action of antibiotics can allow them to act as growth promoters (Sjofjan et al., 2021).

Sjofjan (2003) stated that the balance of nutrients and intensive maintenance patterns can also affect egg production. Widodo (2002) opinion is that this is not only a problem of very low protein content to support maximum egg production, but that the balance of nutrients also reduces egg production. The best feed egg ratio among all treatments was $T_4$ at 4.41, followed by $T_3$, $T_2$, $T_1$, $T_5$ and $T_0$ (Figure 2). Feed conversion had a significant relationship ($p \leq 0.01$) to the treatment given. The results of this study are similar to those of Ketaren and Prasetya (2012), which stated that for local ducks aged seven months kept intensively, the best average ratio conversion rate was in Mojosari ducks (4.08), followed by *Tegal* ducks (5.72) and *Magelang* ducks (5.71). The lowest was in Bali ducks (8.28). The results of the LSD further test showed that $T_4$ was very significantly different ($p \leq 0.01$) to all treatments except for $T_3$, which did not show a significant difference ($p > 0.05$). The addition of probiotics to $T_3$ and $T_4$ in the feed at rates of 0.1% and 0.6% provided very significant effects on feed conversion, and this finding is in line with Kompiang (2009), who found that ducks could convert food well. The quality of the given ration influences these abilities so that the addition of probiotics in feed and drinking water can be used to support increased productivity, immunity and maintenance (Suswoyo et al., 2021).

The mortality rate in this study is also shown in Table 2 and indicates that the treatment given had a significant effect ($p \leq 0.01$) on mortality. $T_0$ had the highest rate then $T_5$ and $T_2$, with a total of 17 deaths. This livestock mortality rate is still in the normal range of 2–5%, because ducks are a poultry type resistant to disease and have a low mortality rate compared to chickens. Good body condition will reduce mortality in livestock. Sjofjan et al. (2021) stated that mortality in adult ducks was in the range of 2–5%, with ducks being a type of livestock with fairly high adaptability to a rural environment. Jin et al. (2000) have investigated the use of *Lactobacillus acidophilus* as an additive to broiler feed. The results of this study found that the administration of *Lactobacillus* probiotics could increase body weight gain and feed efficiency and reduce mortality compared to controls.

## CONCLUSIONS AND RECOMMENDATIONS

To sum up, the combination of combinations of *α-lactobacillus* sp. and *Curcuma longa* flour help stimulating the intestinal profile, increasing egg production, and reduce feed egg ratio.

## ACKNOWLEDGEMENTS

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## NOVELTY STATEMENT

Our novelty besides in the point of view of the using *curcuma longa* with probiotics. our study reported on how effective used combination to reduce the feed egg ration on Mojosari Duck.

## AUTHOR'S CONTRIBUTION

WA, OS, EW, and SS participated on conceptualization and research design. DNA is drafted the manuscript, grammaticality checking, data analysis, creating illustration, and image figuring. All authors contributed in giving input and approved the final manuscript.

## Conflict of interest

The authors have declared no conflict of interest.

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