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Anak Agung Ngurah Badung Sarmuda Dinata
Bali Assesment Institut of Agricultural Technology, Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture, Denpasar-Bali, Indonesia

I Gusti Nyoman Gde Bidura
Faculty of Animal Science, Udayana University, Denpasar-Bali, Indonesia

I Made Gede Rusdianta
Faculty of Agriculture, Tabanan University, Bali, Indonesia

I Wayan Sukasana
Faculty of Agriculture, Tabanan University, Bali, Indonesia

Suprio Guntoro
Bali Assesment Institut of Agricultural Technology, Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture, Denpasar-Bali, Indonesia

Corresponding Author:
Anak Agung Ngurah Badung Sarmuda Dinata
Bali Assesment Institut of Agricultural Technology, Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture, Denpasar-Bali, Indonesia

Productivity of Arabian chicken given probiotic *Lactobacillus* sp. isolated from the digestive tract of broiler chickens and laying hens

Anak Agung Ngurah Badung Sarmuda Dinata, I Gusti Nyoman Gde Bidura, I Made Gede Rusdianta, I Wayan Sukasana and Suprio Guntoro

Abstract
The development of poultry farms has experienced relatively with expensive feed prices. To improve the efficiency of feed usage, can be done through the use of probiotics. The aim of this study was conducted to determine the response of probiotics, containing microbes *Lactobacillus* sp isolated from the digestive tract of laying hens (Bio-L) and modern broiler (Bio-B). The study used 8 month old of 180 Arabic hens for 6 month period. The study designed using completely randomized design with 3 treatments and 6 replications. Feed given according to farmer formula consisting of factory concentrate 25%, corn 40%, and rice bran 35%, respectively. The treatment given were as follow; P0: chicken without probiotics, P1: chicken with probiotic Bio-L of 1 cc/l drinking water and P2: chicken with probiotic Bio-B of 1 cc/l drinking water, respectively. The results showed that P2 treatment had egg production as 119 egg/head were significantly higher than P1 and P0 tretment. The FCR of chicken on P2 as 2.26, was significantly smaller than on P1 or P0. While the composition and physical quality of eggs did not significantly difference in among all treatments.

Keywords: Probiotics, Arab chicken, egg production

Introduction
The business of growing Arabic chickens in the province of Bali is increasingly in demand by farmers. This is due to the resulting eggs have similarities with free-range chicken eggs whose price is relatively higher compared to eggs on other laying hens. Arabic chicken is a type of chicken that has a high egg production of 190-250 eggs/year with an average egg weight of 30-35 grams (Sulandari *et al*., 2007) [32]. The laying Arabic chicken maintenance system is generally carried out intensively using battery cages. To obtain maximum production results, farmers provide feed in the form of a mixture of concentrated manufacturers.

To increase feed efficiency can be done by using probiotics. Probiotics are food supplements in the form of living microorganisms that are beneficial in improving the health and natural balance of microbes in the digestive tract (Natsir *et al*., 2010) [21]. Probiotics are usually applied orally with the aim of improving the health and absorption of animal nutrition by manipulating microbes in the body of livestock (Pribadi *et al*., 2015) [25]. Probiotics can increase livestock productivity by mechanisms: attaching and colonizing the digestive tract, competing with pathogenic microbes by producing anti-microbial pathogens and increasing the host immune system (Sumarsih *et al.*, 2012) [33]. Bidura *et al*. (2019a) [6] reported that implementation in diets of 0.20-0.30% *Saccharomyces* spp. isolated from buffalo rumen were increased egg mass, feed efficiencies, feed digestibility, yolk colour, yolk and egg shell, shell thickness, Mg and Ca contents in the yolk, but decreased yolk cholesterol contents in ducks and laying hens (Bidura *et al*., 2019b) [7]

Lactobacillus sp. is one of the genera of lactic acid bacteria that is most commonly found in the gastro intestinal tract in both humans and animals that have potential as a probiotics (Sumarsih *et al.*, 2012) [33]. Astuti *et al*. (2015) [4] reported that that used of liquid probiotics *Lactobacillus* sp. Bacteria as much as 0.6 v/w in feed can reduce feed consumption, protein consumption, mortality and increase weight gain, feed efficiency, weight and percentage of broiler carcasses. Pradikta *et al.* (2018) [23] reported that the addition of *Lactobacillus* sp. probiotics to laying hens feeds caused increased egg production, egg weight and decreased feed conversion.

So far, some probiotic products for poultry are mostly imported from abroad with relatively expensive prices (Hartono and Kurtini, 2015) [11]. Therefore, it is necessary to develop probiotics derived from chicken digestive tract microbes. *Lactobacillus* probiotics which are isolated from the digestive tract of chickens have many types. Between laying hens and broilers may have different content and types of *Lactobacillus*. The purpose of this study was to determine the effectiveness of the use of Lactobacillus sp derived from the digestive tract of laying hens (layer) and those derived from broilers (broilers) as probiotics for laying Arabic chickens.

Material And Methods

Experimental design, animals, housing and diets. The study was conducted for 6 months (180 days). The study used female Arabic chickens aged 8 months who had entered the egg-laying phase (Fig.1). The study was designed with a Completely Randomized Design, using 180 Arabic chickens which were divided into 3 treatments and each with 6 replications with 10 chickens per cage. The treatments given were as follows: P0: Chickens were fed according to the formula of the farmer consisted of: 25% manufacturer's concentrate, 40% corn and 35% rice bran, without being given probiotics; P1: Chicken were given ration as in P0+Bio-L probiotics as much as 1 cc/l of drinking water; and P2: Chicken were fed with rations as in P0+Bio-B probiotics as much as 1 cc/l of drinking water. The nutritional content of the ration given were 16.30% crude protein; energy 3,670 k.cal/kg; crude fiber 7.73%; 6.39% fat; Calcium 1.60% and phosphorus 0.65%.

Fig 1: Arabian chickens laying hens

Measurement of egg production were done by counting the number of eggs produced by Arabian chickens per head per day. Hen day production (HDP) was a percentage of the number of eggs produced during the study. To determine the weight of the eggs carried out weighing on the eggs produced. Feed consumption were the difference in the amount of feed given with the remaining feed per week. FCR was calculated by the formula: the amount of weight of feed consumed divided by the amount of weight of egg production. To find out the mortality rate of chickens, observations and records of the number of dead chickens were carried out. To find out the egg's physical composition, an analysis was conducted at the Poultry Laboratory of the Faculty of Animal Science, Udayana University, Denpasar.

The data obtained were analyzed by analysis of variance and continued with the Duncan Test with an error rate of 5% (P<0.05).Data analysis process, using SPSS software for Windows-7.

Results

During the research the average egg productivity was obtained in each treatment as in Table 1. Chicken given probiotic Bio-B (P2) had the highest average egg production of 119 eggs/ hens or 15.53% and 10.19% was significantly higher (P<0.05) compared to treatment chickens P0 and P1. Chicken egg production of P1 treatment was not significantly different (P>0.05) from chicken treatment of P0.

Table 1: Productivity of Arabic chicken eggs given by probiotic *Lactobacillus* sp.

Variable	Treatment[1]		
	P0	P1	P2
Egg production (egg/hens)	103[a]	108 [a]	119 [b]
Hen day production (%)	57.22 [a]	60.00 [a]	66.11 [b]
Eggs weight (g/eggs)	46.75 [a]	45.63 [a]	47.14 [a]

Note

1. P0: Chickens were fed according to the formula of the farmer consisted of: 25% manufacturer's concentrate, 40% corn and 35% rice bran, without being given probiotics; P1: chicken were given ration as in P0+Bio-L probiotics as much as 1 cc/l of drinking water; and P2: chicken were fed with rations as in P0+Bio-B probiotics as much as 1 cc/l of drinking water
2. Means within rows with different superscripts are significantly different (P<0.05)

The high egg production in P2 treatment chickens caused the highest hen day production value to be 66.11%. However, the weighing results showed the average weight of the eggs of each treatment was not significantly different (P>0.05).

The highest daily feed consumption was found in P0 treatment chickens which was 73.38 g/head, significantly higher (P<0.05) compared to P2 treatment, but not significantly different (P>0.05) compared to P1 treatment chickens (Table 2). While daily feed consumption and total feed consumption were also significantly higher (P<0.05) compared to P2 treatment, but not significantly different (P>0.05) from P1 treatment.

Table 2: The effect of *Lactobacillus* sp. Supplemented on drinking water of Arabic chickens on feed consumption and FCR

Variable	Treatment[1]		
	P0	P1	P2
Feed consumption (g/hens)	73,38 [b]	73,26 [ab]	70,53 [a]
FCR (feed consumption:egg weight)	2,74[b]	2,68[b]	2,26[a]

Note

1. P0: Chickens were fed according to the formula of the farmer consisted of: 25% manufacturer's concentrate, 40% corn and 35% rice bran, without being given probiotics; P1: chicken were given ration as in P0+Bio-L probiotics as much as 1 cc/l of drinking water; and P2: chicken were fed with rations as in P0+Bio-B probiotics as much as 1 cc/l of drinking water
2. Means within rows with different superscripts are significantly different (P<0.05)

The calculation results show that the chicken treatment in P2 has the lowest FCR value which is 2.26. The FCR was significantly lower (P<0.05) compared to treatment chickens P0 and P1.

In general the condition of the chicken looks healthy and agile with a normal appetite. During maintenance, only cases of sick chickens were found (4) chickens and 1 (one) chicken died in P0. The death was due to symptoms that arise indicating the chicken attacked by coryza disease. The results of the analysis of the physical composition of eggs showed that the administration of probiotics (P1 and P2) did not cause a significant change in composition between the egg whites, egg yolks and eggshells. Overall the egg's physical composition is normal, as presented in Table 3.

Table 3: Physical composition of Arabian chicken eggs given by probiotic *Lactobacillus* sp.

Composition of eggs (%)	Treatment[1]		
	P0	P1	P2
Albumen	51,31[a]	51,39[a]	49,13[a]
Yolk	35,06[a]	35,11[a]	36,04[a]
Eggshell	13,50[a]	13,91[a]	13,41[a]

Note

1. P0: Chickens were fed according to the formula of the farmer consisted of: 25% manufacturer's concentrate, 40% corn and 35% rice bran, without being given probiotics; P1: chicken were given ration as in P0+Bio-L probiotics as much as 1 cc/l of drinking water; and P2: chicken were fed with rations as in P0+Bio-B probiotics as much as 1 cc/l of drinking water
2. Means within rows with different superscripts are significantly different (P<0.05)

The use of probiotics, both P1 and P2 also did not affect the physical quality of eggs (Table 4). Overall egg index data shows normal chicken egg shape. Likewise, the Haugh Unit (HU) and the color of the yolk is normal.

Table 4: The effect of *Lactobacillus* sp. supplemented on drinking water of Arabic chickens on internal eggs quality

Variable	Treatment[1]		
	P0	P1	P2
Egg index	78.12[a]	77.71[a]	78.13[a]
Houg unit	67.35[a]	66.45[a]	67.15[a]
Yolk color (1-15)	7.4[a]	7.8[a]	7.4[a]
Eggshell thickness	0.43[a]	0.41[a]	0.43[a]
Egg drade	A	A	A

Note

1. P0: Chickens were fed according to the formula of the farmer consisted of: 25% manufacturer's concentrate, 40% corn and 35% rice bran, without being given probiotics; P1: chicken were given ration as in P0+Bio-L probiotics as much as 1 cc/l of drinking water; and P2: chicken were fed with rations as in P0+Bio-B probiotics as much as 1 cc/l of drinking water
2. Means within rows with different superscripts are significantly different (P<0.05)

Discussion

The highest egg production in P2 treatment was due to the content of the *Lactobacillus* sp. bacteria isolated from broiler chickens having a better ability to produce protease enzymes. *Lactobacillus* sp. bacteria produce lactic acid which causes a decrease in the pH of the digestive tract. Acidic conditions in the digestive tract will inhibit the growth of pathogenic bacteria and increase the function of the protease enzyme (Gabriela, 2010) [9]. The presence of protease enzymes helps to degrade protein and amino acids in the feed so that it is easily digested and absorbed better in the chicken's body. This protein and amino acids will later be used by chickens to produce eggs.

For egg weight, the three treatments were not significantly different. Some factors that influence chicken egg weight are chicken age, ambient temperature, strain or breed, nutrient content in rations, chicken body weight and time of eggs produced (Sodak, 2011). The addition of probiotics can improve egg production, feed consumption but not the average egg weight (Balevi *et al.*, 2001; Kompiang (2000) [5, 17]. In this study all treatment chickens had age, and obtained feed with the same composition of rations so there was no difference in weight eggs produced The weight of chicken eggs in all treatments was normal for Arabic chicken eggs, which was 45.20-50.71 grams (Istinganah *et al.*, 2013) [13]. This indicated that the composition of nutrients in the ration used was in accordance with standard, Arabian chickens have higher egg weight than native chickens. The results of Andika *et al.* (2017) [2] report that the weight of native chicken eggs ranges from 34.66 to 37.11 grams.

Higher egg productivity in P2 treatment chickens is very efficient because of the lowest feed consumption. The results of this study are in line with Priastoto *et al.* (2016) [24] which states that administration of probiotics can reduce ration consumption in laying hens. Bidura *et al.* (2019a) [6] states that the presence of probiotics in feed can increase enzymatic activity and increase digestive activity. According to Rodríguez-Lecompte *et al.* (2010) [26], the addition of probiotics in chicken feed can increase the number of microorganisms in the digestive tract, stimulate the growth of digestive organs of chickens so that they develop optimally. Provision of probiotics in native chicken rations can increase the weight of digestive organs (Sarwono *et al.*, 2012) [28]. Increasing the weight of the digestive organs, especially in the anatomy of the intestine, namely the intestinal villi become longer and denser densities (Kompiang, 2009) [18]. The more villi in the intestine, the better the digestion of chickens so that the less consumption of rations. With the increase in the surface area of the intestine will cause better absorption of nutrients so that it will be more efficient in utilizing feed.

The lowest feed consumption in P2 chickens causes the FCR to be the lowest. The FCR value is one of the successes in the livestock business. The higher FCR value indicates that more feed is needed to produce egg production. Conversely, the lower FCR value means better feed quality. This is in accordance with the findings of Jin *et al.* (1998) [15] that the use of probiotics can increase feed efficiency or decrease FCR. Pradikta *et al.* (2018) [23] reported that the addition of *Lactobacillus* sp probiotics to laying hens feeds caused increased egg production, egg weight and decreased feed conversion.

Probiotics can also be used to replace the use of antibiotics in rations (Haryati, 2011) [12]. The use of probiotics in poultry is able to produce natural antibiotics, so as to increase endurance (Jin *et al.*, 1996; Asli *et al.*, 2007) [14, 3]. This condition is proven by the absence of death in chickens that were treated

with probiotics. This is related to the ability of *Lactobacillus* sp. bacteria to remodel simple carbohydrates into lactic acid. Increased lactic acid will cause the pH to be low so that other microbes especially those which are pathogenic will die (Harimurti *et al.*, 2005) [10]. *Lactobacillus* sp. produces natural antibiotics namely acidolin, acidhopilin, lactobacillin and lactocidin. *Lactobacillus* sp. bacteria are able to inhibit the growth of population of pathogenic bacteria such as Escherichia coli and *Salmonella* sp in the digestive tract of chickens (Sjoftan, 2015) [29]. Through competitive exclution mechanism, namely competition between pathogenic bacteria and probiotic microorganisms, the pathogenic bacteria cannot live in the digestive tract and will go out with excreta (Murwani, 2008) [20].

Egg weight that was not significantly different caused the composition of eggs produced was also not significantly different. Campbell (2003) [8] states that egg weight is closely related to its constituent components consisting of egg white (58%), egg yolk (31%) and eggshell (11%). Different results obtained in this study, namely the composition of the yolk 35.06-36.04%, egg whites 49.13-51.39% and eggshell 13.41-13.91%. Data for egg white composition is not much different from the results of the study of Abubakar *et al*. (2005) [1] who obtained the percentage of Arabian chicken egg whites in one whole egg which was around 51.07%. Shell portion is generally positively correlated with shell weight and thickness, and eggshell portion ranges from 9-12% (Stadelman and Cotterial, 1995) [31]. Thus, the overall shell composition is relatively thick. The relatively high thickness of the shell gives a positive effect where the egg is not easily cracked or broken. In accordance with the research of Panda *et al.* (2003) [22] that the provision of probiotics (probiolac at 100 mg/kg ration) in laying hens can improve egg production, eggshell weight and eggshell thickness and reduce cholesterol levels in egg yolks.

The use of probiotics in this study has not been able to significantly improve the physical quality of eggs. It is suspected that the role of probiotics has not been able to help the maximum absorption of nutrients in the intestine. The egg index in this study ranged from 77.71 to 78.13, higher than the results of Mulyadi's research (2013) [19] which obtained an Arabic chicken egg index ranging from 75.73 to 77.86. The haugh unit value (HU) is a number that shows the physical quality of an egg. Jones (2006) [16], classifies HU based on egg quality AA quality if the haugh unit value is above 79, A quality if the haugh unit value ranges between 55-78, B quality if the haugh unit value ranges between 31-54 and C quality if the haugh unit value is less of 31. Based on the results of this study, the value of HU is included in the category of quality A.

Egg yolk color values are included in the normal category. A good standard of yolk color values is in the range of 7-12 (Stadellman and Cotterial, 1995) [31]. Factors that influence the color of the yolk are substances in the feed, including beta carotene, chlorophyll, xanthophyll and cytosan (Sahara, 2010) [27]. Coloring egg yolk pigments in the feed will be absorbed by organs in the digestive tract.

Conclusion

The use of probiotics containing microbial *Lactobacillus sp.* (isolated from the digestive tract of broilers) can increase egg production, hen day production and increase feed efficiency. The use of probiotics has no effect on chicken mortality, composition and physical quality of eggs in Arabic laying hens.

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Conflict of Interest Declaration

We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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