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Original Article

# Probiotics Addition Potential to Increase Body Weight, Feed Consumption, and Feed Conversion on Pre-Layer Laying Hens

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## ABSTRACT

Probiotics are all forms of microbial cell preparations or components of microbial cells that have a beneficial effect on the health and life of the host. Some feed additives such as the Antibiotic Growth Promoter (AGP) hormone have been banned. Therefore, nowadays, probiotics are often used as additives to replace antibiotics. The probiotics that are widely used are lactic acid bacteria because they can increase the efficiency of digestion and absorption of nutrients. The purpose of this study was to determine the effect of giving probiotics a combination of *Bacillus coagulans* and *Bacillus subtilis* with doses of 2 ml, 4 ml, and 6 ml/head/day orally on weight gain, feed consumption, and decreased feed conversion of laying hens. This study was conducted for 2 weeks using pre layer chickens aged 21 weeks to 23 weeks old as many as 24 chickens, randomized into 4 treatments with 6 replications with P0 as control, P1 = 2 ml, P2 = 4 ml, and P3 = 6 ml. The probiotic used is a combination of probiotics *Bacillus coagulans* and *Bacillus subtilis* with a concentration of 1x107 CFU/ml in liquid. The conclusion is that the oral administration of a combination of probiotics with *Bacillus* subtilis and *Bacillus coagulans* can increase body weight, feed consumption, and reduce the feed conversion value of laying hens with the highest yield when given a dose of 4 ml.

Keywords: Antibiotic, *Bacillus coagulans*, *Bacillus subtilis,* Laying hens, probiotic

## Introduction

The livestock sector provides many benefits for meeting animal protein needs. Fulfilling animal protein needs from the poultry industry, especially laying hen farming (Castro *et al*., 2023). A number of factors should be considered to optimize productivity. These factors include the selection of superior seeds, quality feed, and good maintenance management. Appropriate, balanced and efficient feed, as well as according to needs, certainly influences growth, feed consumption, body weight gain and feed conversion rates, as well as the health of laying hens (England *et al*., 2023). The success of a laying chicken farming business is determined by feed, breed and management. Feed is a determining factor for success in animal husbandry to determine consumption, body weight and product yield The problem with laying hen farming is dependence on the use of antibiotics.

In the laying hen farming business, feed requires the highest costs of all total costs. The method used by breeders is to increase the efficiency of feed use, including by adding various feed additives such as enzymes and antibiotics (Ayalew *et al*., 2022). Quality feed is needed to support optimal livestock performance. One of the efforts to improve feed quality is by adding additives to the feed (Mantovani *et al*., 2022). In general, the addition of feed additives can be in the form of antibiotics, prebiotics, probiotics, enzymes, organic acids, phytobiotics or plant bioactives and essential oils (Magdalena *et al*., 2014). The feed factor in the laying chicken farming business reaches 60-70% of the total production costs. Farmers can reduce production costs if there is an increase in feed efficiency. A chicken's digestive tract that works optimally in digesting and absorbing food substances can produce high feed efficiency resulting in an increase in the productivity of laying hens.

The use of antibiotics causes side effects for consumers who frequently consume them (Llor and Bjerrum, 2014). Efforts made to overcome the efficiency of using chicken feed so that the productivity and health of chickens can be maintained are by adding additives to the feed, one of which is the use of synbiotics. Nowadays, probiotics and prebiotics are often used as additional additives in an effort to increase the feed efficiency of laying hens (Krysiak *et al*., 2021). Some feed additives, such as the Antibiotic Growth Promoter (AGP) hormone, have been banned. The prohibition on the use of AGP and anti-oxidants as feed additives is in accordance with the mandate of Article 22 paragraph 4c of Law No. 18/2009 in conjunction with No. 41/2014 concerning Animal Health Farming. Regarding the prohibition of AGP, an alternative to maintain good chicken performance is the use of probiotics (Agustono *et al*., 2022).

It is hoped that giving probiotics can replace the role of antibiotics. Probiotics are additional food in the form of live microbial cells which have a beneficial effect on the host and humans who will consume them (Kechagia *et al*., 2013). Probiotics are able to increase the digestibility of livestock so that livestock are able to optimally absorb the nutrients in the feed, so that production needs are met and the body's needs are also met (Uyeno *et al*., 2015). The probiotics that are widely used are lactic acid bacteria because they can increase the ability of non-specific immunity (Plaza-Diaz et al., 2019). Apart from that, lactic acid bacteria are also able to increase the efficiency of digestion and absorption of nutrients (Vieco-Saiz *et al*., 2019). The effectiveness of lactic acid bacteria in inhibiting pathogenic bacteria is influenced by the density of lactic acid bacteria, the strain of lactic acid bacteria, and the composition of the media (Zapaśnik *et al*., 2022).

One of the microbes that has the potential to be used as a probiotic is *Bacillus spp.* which can survive up to 100°C temperatures, so it is very suitable to be added to poultry feed which is made through a heating process. Besides that, the results of in vitro research show the ability of *Bacillus spp*. can inhibit the growth of several pathogens, such as *Escherichia coli*, *Clostridium spp*. *Campylobacter spp*. and Streptococcus (Barbosa *et al*., 2005). Based on the description above, it is important to carry out research on the potential of providing probiotics on body weight, consumption and feed conversion of laying hens with the hope of providing a positive effect both on quality and on consumption and feed conversion value.

## Materials and methods

### *Research design*

This research was carried out in the experimental animal cages of the Faculty of Veterinary Medicine, Airlangga University, Surabaya from October to December 2021. This research used 24 pre-layer phase laying hens aged 21 weeks, randomized into 4 treatments with 6 replications. Treatment for laying hens was control and treatment with probiotics.

### *Feeding*

Chickens are given food twice a day, namely in the morning at 8 AM to 9 AM and in the afternoon at 3 PM to 4 PM. The research was conducted for 3 weeks with 1 week of adaptation period before treatment and 2 weeks of treatment. The ratio of the amount of feed to the number of bacteria is as follows: P0: without giving probiotics, P1: given probiotics combination of *Bacillus* coagulans and *Bacillus* subtilis 2 ml orally, P2: given probiotics combination of *Bacillus* coagulans and *Bacillus* subtilis 4 ml orally,


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P3: given probiotics combination *Bacillus* coagulans and *Bacillus* subtilis 6 ml orally.

***Treatment of experimental animals***

Twenty-four laying hens were divided into four treatment groups with six replications. 20 weeks laying hens are adapted for one week until they are 21 weeks old, then treated for two weeks at 21 – 23 weeks of age. Probiotics are given orally every 3.30 PM.

***Sample data collection***

Data collection started from laying hens aged 21 weeks to 23 weeks. Every day feed consumption is recorded by calculating the feed given minus the remaining feed every morning and evening and calculated every week. At the end of every week, the weight of the laying hens is weighed to calculate their weight gain.

***Data analysis***

The data obtained will be statistically analyzed using Analysis of Variance (ANOVA). If significantly different results are obtained then the Duncan Multiple Distance Test will be continued (Kusriningrum, 2012). Statistical analysis using the SPSS 21.0 for Windows program.

## Result

**Weight gain**

**Table 1.** Weight Gain

| Treatment | Weight Gain Value (gr/head/week) |
|---|---|
| P0 | $54.083^{a} \pm 2.354$ |
| P1 | $62.667^{b} \pm 3.460$ |
| P2 | $78.500^{c} \pm 2.387$ |
| P3 | $63.583^{b} \pm 3.917$ |

Note: Different superscripts ($^{abc}$) in the same column indicate significant differences ($p<0.05$).

Table 1 shows the results of the one way ANOVA analysis were the average weight gain values of laying hens given probiotics the combination of *Bacillus* subtilis and *Bacillus* coagulans showed significant differences ($p<0.05$) between P0, P1, P2 and P3. Further analysis using Duncan's technical test analysis with a significance level of 5% can be seen that P3 is not significantly different ($p>0.05$) from P1.

**Feed consumption**

Table 2 show the results of the one way ANOVA analysis were the average feed consumption values of laying hens given the *Bacillus* combination probiotics subtilis and *Bacillus* coagulans showed significant differences ($p<0.05$) between P0, P1, P2 and P3. Further analysis using Duncan's technical test analysis with a significance level of 5% can be seen that P3 is not significantly different ($p>0.05$) from P1.

**Table 2.** Feed Consumption Value

| Treatment | Weight Gain Value (gr/head/week) |
|---|---|
| P0 | $514.083^{a} \pm 12.971$ |
| P1 | $551.083^{b} \pm 15.794$ |
| P2 | $626.750^{c} \pm 27.978$ |
| P3 | $552.500^{b} \pm 17.759$ |

Note: Different superscripts ($^{abc}$) in the same column indicate significant differences ($p<0.05$).

**Feed conversion**

Table 3 shows the results of the one way ANOVA analysis were the average feed conversion values for laying hens given the *Bacillus* combination probiotics subtilis and *Bacillus* coagulans showed significant differences $p<0.05$) between P0, P1, P2 and P3. Further analysis using Duncan's technical test analysis with a significance level of 5% can be seen that P3 is not significantly different ($p>0.05$) from P1.

**Table 3.** Feed Conversion Value

| Treatment | Average ± SD |
|---|---|
| P0 | $9.527^{c} \pm 0.620$ |
| P1 | $8.817^{b} \pm 0.573$ |
| P2 | $7.984^{a} \pm 0.275$ |
| P3 | $8.706^{b} \pm 0.392$ |

Note: Different superscripts ($^{abc}$) in the same column indicate significant differences ($p<0.05$).

## Discussion

**Weight gain**

Based on this research, the highest score is P2 at 78,500 grams, P3 at 63,583 grams, P1 at 62,667 grams and P0 at 54,083 grams. The increase in body weight shows that the feed consumed by chickens is quite efficient and widely used for growth. If the chicken consumes large amounts of feed but the weight gain is


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not high, it is suspected that the absorption of food in the chicken's digestive tract is not perfect. Apart from that, it could also be caused by the chicken being sick, other factors are gender, temperature and food quality. This weight gain is in line with feed consumption which shows very significant differences in influence (England et al., 2022).

Laying hens given a probiotic combination of *Bacillus* subtilis and *Bacillus* coagulans 4 ml orally produced the highest weight gain compared to laying hens given a probiotic combination of *Bacillus* subtilis and *Bacillus* coagulans 2 ml and 6 ml orally. At the highest dose, namely 6 ml, weight gain was not significant as in treatments P1 and P2. It is suspected that the probiotic microorganisms in P3 work less synergistically so that they are less than optimal for improving the digestive system in the body. Markowiak and Śliżewska (2017) stated that probiotics had no effect at the highest dose because probiotics were no longer effective in digesting food nutrients in the body. It is suspected that chickens have optimal limits in their tolerance to the microbial population in their digestive tract.

Meanwhile, treatment P2 experienced the highest increase in body weight because probiotics could work well to reduce the number of pathogenic bacteria. This is in accordance with Nam et al. (2022) who reported an increase in *Lactobacillus* content in chickens given a probiotic mixture of *Bacillus* sp. At the same time, the E. coli content decreased and Salmonella sp. not detected. The reduction or elimination of pathogenic microbes may be one of the causes of the improved appearance of chickens given probiotics. Zhang *et al.* (2015) reported that in the intestine, *Bacillus* sp. adheres strongly to the intestinal wall, preventing colonization of the intestine by pathogenic microbes, so that the opportunity for Salmonella to attach to the intestine is greatly reduced. Thus, Salmonella is only in the lumen and will be excreted with feces.

The main factors that influence the body weight of poultry are the amount of feed consumed and the nutritional content in the feed (Fouad and El-Senousey, 2014). Other factors that influence body weight in poultry are species, strain, production type, gender, environmental temperature, season, quality and quantity of feed, rearing management, form of feed, feeding system, and initial weight of the chicken (Mir *et al*., 2017).

Nuraini *et al.* (2020) stated that the increase in body weight of chickens is influenced by age, the feed given, the content contained in the feed and environmental conditions. This is because the feed consumed by laying hens will be used for metabolic processes and physiological processes in the laying hen's body. However, not all food consumed by laying hens is used for meat formation, body weight gain and body physiological processes. Some parts of the food that are not digested or are not able to be digested by laying hens will be thrown away as feces (von Waldburg-Zeil *et al*., 2019).

**Feed consumption**

The average feed consumption in treatments P0, P1, P2, and P3 showed significant differences ($p>0.05$). In this study, the highest average score for feed consumption was P2 of 626,750 grams/week, P3 of 552,500 grams/week, P1 of 551,083 grams/week, then P0 of 514,083 grams/week. This means that chickens that were treated with probiotics had an effect on increasing feed consumption compared to chickens that were not given probiotics.

The highest feed consumption was in the P2 treatment or with a dose of 4 ml, this is in accordance with the opinion of Bottone (2010) that Bacillus has several properties, namely, it is a facultative aerob so it is expected to be able to live and develop in the intestines of livestock, it has spores so its storage is simpler, it produces digestive enzymes such as protease and amylase which can help digestion, as well as producing short chain fatty acids which have anti-microbial properties. Garcia-Gutierrez *et al*. (2019) stated that these anti-microbials are able to kill harmful microbes in the digestive tract, so that beneficial microbes can increase. In this way, the opportunity for absorption of food substances can be more optimal, thus having an impact on increasing chicken growth. The increasing growth of chickens causes the need for food to increase to support this rapid growth so that ration consumption increases The P3 treatment had lower feed consumption than the P2 treatment, this was thought to be a result of the total bacterial population and enzyme activity. The addition of large numbers of microbe's results in a large


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number and density of bacteria. Bacteria are increasingly competitive to obtain nutrients from the substrate so that microbes that lack nutrients are hampered in their activity and lead to death and suboptimal performance of probiotics. The higher the dose given, the more energy used for metabolism because in this metabolism the microbes will produce enzymes and organic acids so that feed consumption tends to decrease.

The highest feed consumption score is P2 of 626,750 grams/week, which means only around 89 grams per day. This result is different from the management of the Isa Brown Guide in 2015, which stated that feed consumption for Isa Brown strain laying hens during production aged 21-23 weeks was 112 g/head/day. This situation can be influenced by the health of the chickens, environmental factors, and the temperature in the chicken coop so that feed consumption is lower because the chickens consume more water. Stress levels also affect feed consumption due to the nature of laying hens which are easily stressed by being treated with probiotics orally every day. Determining the amount of feed consumed by laying hens will also be influenced by the feed (Clark *et al*., 2019).

Uyeno *et al.* (2015) stated that giving sufficient probiotics to livestock can affect the composition and ecosystem of digestive microflora. The condition of the microflora ecosystem in the digestive tract will affect the performance and health of livestock. The effect of giving probiotics to livestock focuses on improving the composition and ecosystem of the digestive system so that the effect of adding probiotics to feed is more emphasized on nutrient absorption or the digestive process and not on animal feed consumption.

**Feed conversion**

Feed conversion is a parameter to indicate the level of efficiency of feed use. The smaller the conversion value produced, it means that the feed consumed is used as well as possible (Fry *et al*., 2018). The average value of feed conversion for laying hens given a probiotic combination of *Bacillus subtilis* and *Bacillus coagulans* showed significant differences ($p<0.05$) between the four treatments. Based on the results of data analysis using Analysis of Variance (ANOVA), the administration of a combination of *Bacillus subtilis* and *Bacillus coagulans* probiotics on the resulting feed conversion rate from smallest to largest from each treatment P2 was 7.984, P3 was 8.706, P1 was 8.817, and the feed conversion value at P0 it is 9.527.

This research shows that the presence of 4 ml of probiotics tends to be better because it has the lowest feed conversion value compared to P1 and P3 treatment feed. This is in line with the results of weight gain and feed consumption value because the feed conversion calculation uses the amount of feed consumed divided by body weight. The highest consumption and body weight values were also produced by the P2 treatment or giving a dose of 4 ml per head per day. This means that feed consumption can increase body weight in laying hens in the pre-layer phase thereby improving the feed conversion value. Improvement of FCR in chickens that received the probiotic *Bacillus* sp. most likely because the digestibility of the feed ingredients is more complete. This is reflected in the increased activity (content) of digestive enzymes and more complete absorption with a wider absorption area (Ravindran and Abdollahi, 2021).

## Conclusion

Based on the research that has been carried out, it can be concluded that giving probiotics a combination of *Bacillus coagulans* and *Bacillus subtilis* at a dose of 4 ml can increase feed consumption in pre-layer phase laying hens, giving probiotics a combination of *Bacillus coagulans* and *Bacillus subtilis* at a dose of 4 ml at a dose of 4 ml can increase body weight of pre-layer phase laying hens, giving probiotics combined with *Bacillus coagulans* and *Bacillus subtilis* can reduce the feed conversion value of pre-layer phase laying hens.

## References

Agustono B, Lokapirnasari WP, Yunita MN, Kinanti RN, Cesa AE, Windria S. Efficacy of dietary supplementary probiotics as substitutes for antibiotic growth promoters during the starter period on growth performances, carcass traits, and immune organs of male layer chicken. Vet World. 2022; 15(2): 324–330.

Ayalew H, Zhang H, Wang J, Wu S, Qiu K, Qi G, Tekeste A, Wassie T, Chanie D. Potential Feed Additives



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as Antibiotic Alternatives in Broiler Production. Front Vet Sci. 2022; 9: 916473.

Barbosa TM, Serra CR, La Ragione RM, Woodward MJ, Henriques AO. Screening for bacillus isolates in the broiler gastrointestinal tract. Appl Environ Microbiol. 2005; 71(2): 968–978.

Bottone EJ. *Bacillus cereus*, a volatile human pathogen. Clin Microbiol Rev. 2010; 23(2): 382–398.

Castro FLS, Chai L, Arango J, Owens CM, Smith PA, Reichelt S, DuBois C, Menconi A.Poultry industry paradigms: connecting the dots. J Appl Poult Res. 2023; 32(1): 100310.

Clark CEF, Akter Y, Hungerford A, Thomson P, Islam MR, Groves PJ, O'Shea CJ. The intake pattern and feed preference of layer hens selected for high or low feed conversion ratio. PLoS One. 2019; 14(9): e0222304.

England A, Gharib-Naseri K, Kheravii SK, Wu SB. Influence of sex and rearing method on performance and flock uniformity in broilers-implications for research settings. Anim Nutr. 2022; 12: 276–283.

Fouad AM, El-Senousey HK. Nutritional factors affecting abdominal fat deposition in poultry: a review. Asian-Australas J Anim Sci. 2014; 27(7): 1057–1068.

Fry JP, Mailloux NA, Love DC, Milli MC, Cao L. Feed conversion efficiency in aquaculture: do we measure it correctly? Environ Res Lett. 2018; 13: 024017.

Garcia-Gutierrez E, Mayer MJ, Cotter PD, Narbad A. Gut microbiota as a source of novel antimicrobials. Gut Microbes. 2019; 10(1): 1–21.

Kechagia M, Basoulis D, Konstantopoulou S, Dimitriadi D, Gyftopoulou K, Skarmoutsou N, Fakiri EM. Health benefits of probiotics: a review. ISRN Nutr. 2013; 2013: 481651.

Krysiak K, Konkol D, Korczyński M. Overview of the Use of Probiotics in Poultry Production. Animals (Basel). 2021; 11(6): 1620.

Llor C, Bjerrum L. Antimicrobial resistance: risk associated with antibiotic overuse and initiatives to reduce the problem. Ther Adv Drug Saf. 2014; 5(6): 229–241.

Magdalena S, Natadiputri GH, Nailufar F, Purwadaria T. 2014. Utilization of natural products as functional feed. Wartazoa. Indonesian Bull Anim Vet Sci. 2014; 23(1): 31–40.

Mantovani A, Aquilina G, Cubadda F, Marcon F. Risk-Benefit Assessment of Feed Additives in the One Health Perspective. Front Nutr. 2022; 9: 843124.

Markowiak P, Śliżewska K. Effects of Probiotics, Prebiotics, and Synbiotics on Human Health. Nutrients. 2017; 9(9): 1021.

Mir NA, Rafiq A, Kumar F, Singh V, Shukla V. Determinants of broiler chicken meat quality and factors affecting them: a review. J Food Sci Technol. 2017; 54(10): 2997–3009.

Nam TVB, Anh LH, Loc HT, Trang CTH, Thiet N, Lan LTT, Diep TH, Xuan NH, Ngu NT. Effects of probiotic (Lactobacillus plantarum and Bacillus subtilis) supplementation on mortality, growth performance, and carcass characteristics of native Vietnamese broilers challenged with Salmonella Typhimurium. Vet World. 2022; 15(9): 2302–2308.

Nuraini, Napirah A, Hafid H, Nasiu F, Libriani R, Yaddi Y, Elfia, Ananda SH. Feed Consumption, Average Daily Gain and Feed Conversion of Broiler Chicken with Different Feed. IOP Conf. Ser.: Earth Environ. Sci. 2020; 465: 012047.

Plaza-Diaz J, Ruiz-Ojeda FJ, Gil-Campos M, Gil A. Mechanisms of Action of Probiotics. Adv Nutr. 2019; 10(suppl 1): S49–S66.

Ravindran V, Abdollahi MR. Nutrition and Digestive Physiology of the Broiler Chick: State of the Art and Outlook. Animals (Basel). 2021; 11(10): 2795.

Uyeno Y, Shigemori S, Shimosato T. Effect of Probiotics/Prebiotics on Cattle Health and Productivity. Microbes Environ. 2015; 30(2): 126–132.

Vieco-Saiz N, Belguesmia Y, Raspoet R, Auclair E, Gancel F, Kempf I, Drider D. Benefits and Inputs from Lactic Acid Bacteria and Their Bacteriocins as Alternatives to Antibiotic Growth Promoters During Food-Animal Production. Front Microbiol. 2019; 10: 57.

von Waldburg-Zeil CG, van Staaveren N, Harlander-Matauschek A. Do laying hens eat and forage in excreta from other hens? Animal. 2019; 13(2): 367–373.

Zapaśnik A, Sokołowska B, Bryła M. Role of Lactic Acid Bacteria in Food Preservation and Safety. Foods. 2022; 11(9): 1283.

Zhang YJ, Li S, Gan RY, Zhou T, Xu DP, Li HB. Impacts of gut bacteria on human health and diseases. Int J Mol Sci. 2015; 16(4): 7493–7519.



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