World Journal of Biology Pharmacy and Health Sciences

eISSN: 2582-5542

Cross Ref DOI: 10.30574/wjbphs

Journal homepage: https://wjbphs.com/

(Research Article)

Check for updates

Probiotic supplementation on the morphometric response of broiler digestive organs

Ni Wayan Ayu Ningsih, Ni Wayan Siti * and Salsabila

Faculty of Animal Husbandry, Udayana University, Denpasar, Bali, Indonesia.

World Journal of Biology Pharmacy and Health Sciences, 2026, 26(03), 030-035

Publication history: Received on 25 April 2026; revised on 02 June 2026; accepted on 04 June 2026

Article DOI: https://doi.org/10.30574/wjbphs.2026.26.3.0338

Abstract

This study aims to determine the morphometric response of the digestive organs of broilers given probiotic supplements. The design used was a completely randomized design (CRD) with four treatments and five replicates, where each replicate consisted of ten broilers. The treatments given were (P0) broilers that did not receive probiotic supplements, (P1) broilers given probiotic supplementation at 0.25% of target body weight per week, (P2) broilers given probiotic supplementation amounting to 0.50% of target body weight per week, and (P3) broilers given probiotic supplementation amounting to 0.75% of target body weight per week. The variables observed included the percentage of pancreas, small intestine, large intestine, and cecum weight, as well as the length of the pancreas, small intestine, large intestine, and cecum. The results showed that probiotic supplementation at 0.25%, 0.50%, and 0.75% did not have a significant effect ($P>0.05$) on the percentage of pancreas, small intestine, large intestine, cecum, or the length of the small intestine, large intestine, and cecum. However, the addition of 0.75% probiotics had a significant effect ($P<0.05$) on increasing the length of the pancreas. Based on the results of the study, it can be concluded that the addition of 0.75% probiotics can increase the length of the pancreas.

Keywords: Antibiotic Growth Promoter; Probiotics; Broilers; Pancreas Length; Intestinal Weight Percentage

1. Introduction

Modern broiler chickens grow very rapidly, requiring optimal digestive tract function. However, the chicken digestive system is highly susceptible to various disturbances, especially infections caused by pathogenic intestinal bacteria. Such digestive problems can reduce the efficiency of nutrient absorption and increase the Feed Conversion Ratio (FCR) [1]. The current challenge in broiler production is high feed intake, which is not always supported by adequate intestinal function and may decrease nutrient absorption efficiency [2]. In addition, to improve nutrient utilization and livestock productivity, the government has prohibited the use of Antibiotic Growth Promoters (AGP) as stated in Law No. 14 of 2014. The use of AGP is banned because it can contribute to antibiotic resistance, which poses a risk to human health.

One alternative to Antibiotic Growth Promoters is the use of probiotics. [3] describes probiotics as useful microorganisms capable of surviving in the digestive tract and helping suppress harmful intestinal microbes through the enzymes they produce for food breakdown. Several studies, including those by [4, 5, 6] report that probiotic supplementation can support a more balanced gut microflora, limit pathogen growth, improve nutrient digestion, promote mucosal development, and enhance immune activity. [7] notes that providing supplements such as probiotics in poultry not only affects microbial composition but is also indirectly linked to anatomical changes in the intestine, including intestinal length and histological features, such as increased villi height, which reflect structural adjustments of the digestive system to its microbial environment.

* Corresponding author: Ni Wayan Siti

[8] through the P2MW Bio-Safe team, successfully formulated Poultry-BS poultry probiotics using *Lactobacillus casei* lactic acid bacteria (BAL), a multifunctional product that serves as both a probiotic and a biosupplement. It contains nutrients such as calcium 257.813 ppm, phosphorus 30.060 ppm, iron 27.503 ppm, and zinc 2.349 ppm.

Previous studies have widely examined the influence of probiotics on growth performance, FCR, and intestinal villi and crypt morphology [9, 10, 11], but the direct association between probiotics and digestive tract length and intestinal weight has not been explored in detail, particularly regarding specific probiotic species and defined doses administered through drinking water. Based on this background, the researchers aimed to investigate the effect of administering Poultry-BS probiotics via drinking water on the length and weight of broiler chicken intestines.

2. Materials and methods

2.1. Materials

Using 80 CP 707 strain broilers aged one day (Day Old Chick), the study used colony-type cages and commercial CP 511B feed.

2.2. methods

2.2.1. Poultry BS Probiotics

Poultry-BS probiotics are produced using natural ingredients such as molasses, Javanese ginseng, turmeric, tofu pulp, papaya leaves, nagar fruit, moringa leaves, mango, and orange, followed by a 7 day fermentation process with *Lactobacillus casei*.

2.2.2. Research Design

The study applied a completely randomized design (CRD) with four treatments and five replicates, with each replicate consisting of four broiler chickens. The treatments included the first group (P0), which functioned as the control, representing broilers that did not receive probiotic supplementation. In treatment P1, broilers received probiotics at 0.25% of their weekly body weight. In treatment P2, probiotics were provided at 0.50% of their weekly body weight, while treatment P3 involved probiotic administration at 0.75% of their weekly body weight.

2.3. Observed Variables

Percentage of the pancreas, small intestine, large intestine, and cecum (right and left), with percentage values determined using the following formula:

$$Organ\ percentage\ (\%) = \frac{Organ\ weight}{Slaughter\ weight} x\ 100\%$$

Length of the pancreas, small intestine, large intestine, and cecum, where measurements are taken using a measuring tape in centimeters (cm)

2.4. Data Processing and Statistical Testing

The data on intestinal percentage and length were evaluated using analysis of variance (ANOVA). When the results indicated a significant effect among treatments (P<0.05), additional comparisons were performed using Duncan's multiple range procedure based on the method of [12].

3. Results of the Study

Table 1 Percentage of broiler digestive organ weights (%)

VARIABLE (%)	TREATMENT				SEM$^{2)}$
	P0$^{1)}$	P1	P2	P3	
Pancreas	0.25	0.26	0.27	0.27	0.00
Small intestine	2.32	2.39	2.53	2.25	0.04
Large intestine	0.07	0.07	0.07	0.07	0.00
Cecum	1.24	1.28	1.35	1.34	0.02

Notes: (P0) broilers that did not receive any probiotic supplementation.; (P1) broilers given probiotics at 0.25% of their weekly body weight. (P2) broilers given probiotics at 0.50% of their weekly body weight.; (P3) broilers given probiotics at 0.75% of their weekly body weight.

3.1. Standard error of the mean.

Based on the analysis results, the inclusion of probiotics at levels of 0.25%, 0.50%, and 0.75% of the target body weight per week did not produce a significant effect (P>0.05) on the percentage of pancreatic, small intestine, large intestine, and cecal weight. This suggests that the broilers were in a healthy physiological condition. [13] noted that intestinal infections such as coccidiosis and necrotic enteritis can lead to thickening of the intestinal wall, which consequently increases intestinal mass. Since the chickens in this study did not show any signs of illness, this mechanism did not occur. In addition, [14] reported that increased mucosal activity, such as taller villi or deeper crypts, may also contribute to higher intestinal mass. However, in this study, no change was observed in the percentage of intestinal weight with the inclusion of probiotics at 0.25%, 0.50%, and 0.75%, indicating that the supplementation did not provide sufficient mucosal stimulation to alter organ mass.

Meanwhile, [15] reported that administering feed containing antinutritional compounds to broilers led to an increase in pancreatic mass, which was associated with a greater workload on the pancreas due to the presence of these antinutrients, requiring the pancreas to work harder to produce digestive enzymes. Thus, the present study shows that probiotic supplementation did not increase pancreatic workload. The percentage of cecal weight also showed no significant differences (P>0.05) following probiotic administration. [16] noted that digestive organs, including the cecum, may increase in size due to cellular enlargement triggered by higher fiber intake and elevated fermentation activity.

The percentage values of the small intestine, large intestine, pancreas, and cecum observed in this study remained within the normal range. According to [17], the normal percentage weight of the small intestine in broilers is approximately 3.13%, the cecum is around 0.50%, the colon is roughly 0.18%, and the pancreas is about 0.29%. Meanwhile, a study by [18] indicated that probiotic supplementation did not significantly alter the relative weight of digestive organs. In the control group, the small intestine accounted for 2.89%, while in the probiotic treatment, the small intestine reached 3.17%. The cecum ranged from 0.52 to 0.54%, the colon ranged from 0.37 to 0.38%, and the pancreas ranged from 0.23 to 0.28%.

Table 2 Length of Broiler Digestive Organs

VARIABLE	TREATMENT				SEM$^{3)}$
	P0$^{1)}$	P1	P2	P3	
Pancreas	$8.8^{b2)}$	10^{ab}	7.6^{b}	11.6^{a}	0.50
Small intestine	171^{a}	178.4^{a}	175^{a}	179.4^{a}	2.12
Large intestine	7.4^{a}	7.4^{a}	6^{a}	7.6^{a}	0.37
Cecum	29.8^{a}	30.6^{a}	32.6^{a}	33^{a}	1.70

Notes: (P0) broilers that did not receive any probiotic supplementation.; (P1) broilers given probiotics at 0.25% of their weekly body weight. (P2) broilers given probiotics at 0.50% of their weekly body weight.; (P3) broilers given probiotics at 0.75% of their weekly body weight.

3.2. Different superscripts in the same row denote significant variation (P<0.05).

3.2.1. Standard error of the mean.

Table 2 shows that the length of the pancreas receiving a 0.75% probiotic supplement was 32.82% longer than that of broilers without probiotic supplementation, and this difference was statistically significant (P<0.05). [19] noted that the pancreas is highly responsive to digestive stimuli, as its enzyme secretion is reflexively regulated in relation to feed intake and nutritional factors. Feeding itself serves as a strong stimulator of pancreatic secretion, which is controlled through neural and hormonal pathways [20] Thus, the pancreas may exhibit slight morphological adaptations, such as increased length without a notable increase in organ mass, as a physiological response to digestive stimulation.

In contrast, the small intestine, large intestine, and cecum showed no significant differences (P>0.05). This suggests that probiotic administration does not induce morphological alterations in digestive organs. In other words, probiotics do not impose additional load on the digestive tract, enabling the organs to maintain proportional size. This is supported by findings from [21], who reported that probiotics do not affect the weight of internal organs such as the liver, heart, spleen, and gallbladder. These organs are involved in metabolic and systemic immune functions, and maintaining their proportional weight indicates the absence of metabolic stress or systemic inflammation.

The stable condition of the internal organs supports the maintenance of physiological homeostasis, preventing structural adaptation in the intestine that would otherwise increase absorptive capacity [22]. The average intestinal length in this study ranged from 171.00 to 179.40 cm, which is consistent with the findings of [23], who reported an intestinal length of 177.12 cm in broilers receiving mannan oligosaccharide prebiotics. Thus, the intestinal length remained within a normal range because no systemic disturbances were present that could place additional strain on the digestive tract.

4. Conclusion

The inclusion of 0.75% probiotics was found to increase pancreatic length. However, probiotic levels of 0.25%, 0.50%, and 0.75% did not affect the percentage of digestive organ weight.

Compliance with ethical standards

Acknowledgments

The author extends gratitude to the Dean of the Faculty of Animal Science, Udayana University, for the institutional assistance and support that enabled the completion of this study.

Disclosure of conflict of interest

The author declares that this work was carried out without any financial or personal relationships that could have influenced the research process or its interpretation.

Statement of ethical approval

The Animal Ethics Committee of the Faculty of Veterinary Medicine, Udayana University Badung, Bali, Indonesia authorized the use of day-old CP 707 broilers for this research.

References

[1] Widodo, T. S., Sulistiyanto, B., and Utama, C. S. (2015). he number of lactic acid bacteria (LAB) in the small intestinal and caecal digesta of broiler chickens fed with fermented factory feed mash. Journal Agripet, 15(2), 98-103. DOI: https://doi.org/10.17969/agripet.v15i2.2376

[2] Azizi, M. N., Aminullah, N., Alam, S., & Danish, F. (2023). Poultry gut health: Industry drivers, management determinants, and emerging research directions. Journal of Advanced Veterinary and Animal Research, 10(3), 427–438. DOI: https://doi.org/10.1016/j.vas.2026.100566

[3] Telaumbanua, B. V., Telaumbanua, P. H., Lase, N. K., and Dawolo, J. (2023). The Use of EM4 Probiotic in Fish Culture Media. Journal of Aquatic Resource Management, 19(1), 36-42. DOI : https://doi.org/10.30598/TRITONvol19issue1page36-42

[4] Higgins, J. P., Higgins, S. E., Vicente, J. L., Wolfenden, A. D., Tellez, G., & Hargis, B. M. (2007). Temporal effects of lactic acid bacteria probiotic culture on Salmonella in neonatal broilers. Poultry science, 86(8), 1662–1666. https://doi.org/10.1093/ps/86.8.1662

[5] Jha, R., Das, R., Oak, S., & Mishra, P. (2020). Probiotics (Direct-Fed Microbials) in Poultry Nutrition and Their Effects on Nutrient Utilization, Growth and Laying Performance, and Gut Health: A Systematic Review. Animals, 10(10), 1863. DOI : https://doi.org/10.3390/ani10101863

[6] Biswas, S., Kim, M. H., Baek, D. H., & Kim, I. H. (2023). Probiotic mixture (Bacillus subtilis and Bacillus licheniformis) — potential in-feed additive to improve broiler production efficiency, nutrient digestibility, caecal microflora. Journal of Animal Physiology and Animal Nutrition. https://doi.org/10.1111/jpn.13784

[7] Zeng, X., Li, Q., Yang, C., Yu, Y., Fu, Z., Wang, H., Fan, X., Yue, M., & Xu, Y. (2021). Effects of Clostridium butyricum- and Bacillus spp.-Based Potential Probiotics on the Growth Performance, Intestinal Morphology, Immune Responses, and Caecal Microbiota in Broilers. Antibiotics, 10(6), 624. https://doi.org/10.3390/antibiotics10060624

[8] Madanugrahaya, M. R. T., N. P. G. Tampa, K. A. Dwipayana, dan N. M. P. Arisa. 2024. BIO-SAFE: Probiotic as a Substitute for Antibiotic Growth Promoters (AGP) and a High-Nutrient Livestock Supplement. P2MW Report. Unpublished manuscript, Faculty of Animal Husbandry, Udayana University, Bali.

[9] Ardika, I. N., Siti, N. W., Sukmawati, N. M. S., & Wirapartha, I. M. (2017). Physical Quality of Local Chicken Eggs Fed a Diet Containing Probiotics. Scientific Journal of Animal Husbandry. 20(2), 68-72. DOI:10.24843/MIP.2017.v20.i02.p06

[10] Ni Wayan Siti, I Gst. Nym. Gde Bidura, Ni Wayan Sudatri. (2021). Effect of Tamarindus indica leaf meal in feed on the growth of pathogenic bacteria, intestinal histology, and blood lipid profile in broilers. Annals of the Romanian Society for Cell Biology, 4689–4697. Retrieved from http://annalsofrscb.ro/index.php/journal/article/view/5656

[11] Candrawati DPMA, Mahardika IG, Bidura IGNG, Siti NW (2024). Effect of prebiotics-probiotics synbiotic supplementation in feed on performance, serum cholesterol, and pathogenic bacteria in broilers intestines. Advances in Animal and Veterinary Sciences. 12(9): 1752-1758. DOI: https://dx.doi.org/10.17582/journal.aavs/2024/12.9.1752.1758

[12] Steel, R.G.D. dan J.H. Torrie. 1993. Principles and Statistical Procedures. PT. Gramedia. Pustaka Utama, Jakarta.

[13] M. Yegani, D. R. Korver, Factors Affecting Intestinal Health in Poultry, 2008, Poultry Science, 87(10), 2052–2063, https://doi.org/10.3382/ps.2008-00091

[14] Yamauchi, K., Buwjoom, T., Koge, K., & Ebashi, T. (2006). Histological alterations of the intestinal villi and epithelial cells in chickens fed dietary sugar cane extract. British poultry science, 47(5), 544–553. https://doi.org/10.1080/00071660600963149

[15] W. J. Pacheco, C. R. Stark, P. R. Ferket, J. Brake. 2014 Effects of trypsin inhibitor and particle size of expeller-extracted soybean meal on broiler live performance and weight of gizzard and pancreas, Poultry Science, 93 (9), 2245–2252, https://doi.org/10.3382/ps.2014-03986

[16] Montagne, L., Pluske, J. R., & Hampson, D. J. (2003). A review of interactions between dietary fibre and the intestinal mucosa, and their consequences on digestive health in young non-ruminant animals. Animal Feed Science and Technology, 108(1–4), 95–117. https://doi.org/10.1016/S0377-8401(03)00163-9

[17] Wang, Y.-S., Li, M., Tell, L. A., Baynes, R. E., Davis, J. L., Vickroy, T. W., Riviere, J. E., & Lin, Z. (2020). Physiological parameter values for physiologically based pharmacokinetic models in food-producing animals. Part II: Chicken and turkey. Journal of Veterinary Pharmacology and Therapeutics, 44(2), 155–173. https://doi.org/10.1111/jvp.12931

[18] Awad, W. A., Ghareeb, K., Abdel-Raheem, S., & Bohm, J. (2009). Effects of dietary inclusion of probiotic and synbiotic on growth performance, organ weights, and intestinal histomorphology of broiler chickens. Poultry Science, 88(1), 49–56. https://doi.org/10.3382/ps.2008-00244

[19] Vertiprakhov, V. G., Grozina, A. A., Fisinin, V. I., & Surai, P. F. (2023). Adaptation of chicken pancreatic secretory functions to feed composition. World's Poultry Science Journal, 79(1), 27–41. DOI: https://doi.org/10.1080/00439339.2023.2163042

[20] Vertiprakhov, V., Grozina, A., & Fisinin, V. (2024). Editorial: The role of the pancreas in poultry. Frontiers in physiology, 15, 1463203. https://doi.org/10.3389/fphys.2024.1463203

[21] Salsabila, N. W. S., & Ningsih, N. W. A. (2026). Offal characteristic responses of broiler chickens to probiotic supplementation. World Journal of Biology Pharmacy and Health Sciences, 25(01), 111–117. https://doi.org/10.30574/wjbphs.2026.25.1.0021

[22] Sellers RS, Mortan D, Michael B, et al. Society of Toxicologic Pathology Position Paper: Organ Weight Recommendations for Toxicology Studies. Toxicologic Pathology. 2007;35(5):751-755. doi:10.1080/01926230701595300

[23] Kim, G. B., Y. M. Seo, C. H. Kim, and I. K. Paik. 2011. Effect of dietary prebiotic supplementation on the performance, intestinal microflora, and immune response of broilers. Poultry Science 90 (1): 75– 82. DOI: https://doi.org/10.3382/ps.2010-00732