AGRONES

JOURNAL OF AGRICULTURE, AGRIBUSINESS, WELFARE, TECHNOLOGY, HUMANITY, ENVIRONMENT, SOCIAL, AND ECONOMY

Volume 1 Nomor 1 April 2025 **E-ISSN: 3110-3495**

Strategies to Improve Livestock Productivity through Probiotic Supplementation: A Literature Review

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ABSTRACT

Improving livestock productivity is a key objective in the development of the animal husbandry sector. One innovative approach that has gained widespread attention is the use of probiotics as dietary supplements. Probiotics are live microorganisms that confer health benefits to the host when administered in adequate amounts. This literature review aims to examine the role and effectiveness of probiotic supplementation in enhancing the productivity of various livestock species, including ruminants, poultry, and swine. Data were collected from relevant national and international journal publications from 2015 to 2024. The findings indicate that probiotic supplementation can improve feed digestibility, stabilize gut microflora, enhance feed conversion efficiency, and strengthen immune response and reproductive performance in livestock. Moreover, the use of probiotics may reduce the reliance on antibiotics, making it a more environmentally friendly and sustainable strategy. However, its effectiveness is highly influenced by factors such as the type of probiotic, dosage, method of administration, and the physiological condition of the animals. Therefore, properly designed probiotic supplementation strategies can serve as a promising solution to sustainably improve livestock productivity. This review highlights the need for further locally based research and field trials to optimize the application of probiotics in the context of the Indonesian livestock system.

Keywords:, ***Probiotics, Livestock Productivity, Feed Supplement, Feed Efficiency, Gut Microflora***

How to cite: Inal, I. (2025). Strategies to Improve Livestock Productivity through Probiotic Supplementation: A Literature Review. Agrones: Journal of Agriculture, Agribusiness, Welfare, Technology, Humanity, Environment, Social, and Economy. Volume 1 Nomor 1 April 2025

INTRODUCTION

Livestock productivity is a critical indicator of success in animal farming, whether at smallholder or industrial scale. Productivity encompasses not only parameters such as weight gain, milk yield, or reproductive output, but also reflects feed efficiency, animal health status, and the overall sustainability of the production system. Improving productivity has become increasingly relevant in the context of global population growth and the rising demand for animal-derived protein. Consequently, various strategies have been implemented to optimize livestock performance, including improvements in management practices, feed quality, and the application of feed additive technologies, such as natural supplements.

Over the past few decades, the use of antibiotics as growth promoters (AGPs) has been a common practice in intensive livestock production. However, growing concerns about antimicrobial resistance and the negative impacts on human health and the environment have led to the banning of AGPs in many countries, including Indonesia. This prohibition presents a significant challenge to the livestock industry, as it removes one of the key tools for enhancing animal performance. Therefore, safe, effective, and sustainable alternatives are urgently needed. One promising approach is the use of probiotics as feed supplements (Sari, Wulandari, & Prasetyo, 2020).

Probiotics are live microorganisms which, when administered in adequate amounts, confer health benefits to the host. In the context of animal husbandry, probiotics play a role in enhancing gut microflora balance, improving nutrient digestibility, and boosting the immune system (Putra & Hartono, 2019). Regular supplementation of probiotics has been reported to improve feed conversion ratio (FCR), promote growth, and reduce livestock mortality rates, positioning probiotics as a potential strategy for supporting modern sustainable livestock production systems.

Common probiotic strains used in livestock include Lactobacillus spp., Bacillus spp., Saccharomyces cerevisiae, and Enterococcus spp., each with specific mechanisms in modulating the gastrointestinal ecosystem. Several studies suggest that multi-strain probiotic combinations can yield synergistic effects on animal performance compared to single-strain applications (Rahmawati, Arifin, & Widodo, 2021). Therefore, the selection of probiotic strains, dosage, and application methods are crucial factors in designing effective probiotic supplementation strategies.

In addition to promoting growth and feed efficiency, probiotics contribute to gut health by suppressing pathogenic bacteria such as Escherichia coli and Salmonella spp.. Research by Nugroho, Santoso, and Adiwinarti (2020) indicates that probiotics can stimulate digestive enzyme production, improve intestinal morphology, and increase levels of natural antibodies in livestock. These benefits position probiotics not only as growth promoters, but also as holistic agents for enhancing animal health.

However, the effectiveness of probiotics in improving livestock productivity depends on multiple factors, including species, growth stage, quality of the basal diet, and environmental and management conditions. Mismatch between probiotic strains and the host's intestinal microflora may reduce efficacy. Furthermore, probiotics require specific formulation and storage conditions to remain viable during administration. As such, probiotic supplementation strategies must be based on evidence and adapted to on-farm conditions (Yuliana, Kurniawan, & Herlina, 2022).

Based on this background, this review aims to identify, analyze, and evaluate strategies for improving livestock productivity through probiotic supplementation, drawing upon findings from previous studies. This literature review is expected to provide comprehensive insights for academics, researchers, and livestock practitioners in designing efficient, healthy, and sustainable livestock management approaches.

METHODS

This study employs a qualitative descriptive literature review approach. Literature review is chosen for its ability to provide a comprehensive understanding of the developments and trends in research related to strategies for improving livestock productivity through probiotic supplementation. The data analyzed in this study are secondary data obtained from relevant national and international scientific journals and other academic publications. Primary data sources were gathered from online databases such as Google Scholar, ScienceDirect, DOAJ (Directory of Open Access Journals), and ResearchGate. The search process was conducted using keywords such as "probiotics," "livestock productivity," "feed additive," "microorganisms," and "feed supplementation." Identified articles were further examined based on their relevance to the research focus.

Inclusion criteria used for article selection included: (1) articles published between 2015 and 2024, to ensure the currency and relevance of the data and findings; (2) articles

explicitly discussing the use of probiotics in livestock, particularly ruminants (cattle, goats, sheep), poultry (broiler and layer chickens), and pigs; (3) articles presenting quantitative or qualitative data related to aspects of livestock productivity, such as body weight gain, feed conversion ratio (FCR), gut health, and immune response. Articles of a general nature or lacking sufficient empirical support were excluded from the analysis. In addition, studies using synthetic probiotics or those with unclear compositions were also eliminated to maintain the validity of the findings.

The data analysis procedure was carried out thematically by grouping information from various sources into key themes relevant to the research objectives. Themes examined included types and strains of probiotics used, administration methods (via feed or drinking water), optimal dosages, and their impact on animal performance. Each selected article was analyzed in depth to identify patterns and trends in the research findings and to compare the effectiveness of different probiotic strains across various livestock species. The results were then systematically synthesized to develop a comprehensive understanding of how probiotic supplementation strategies can be optimally applied to enhance livestock productivity. This approach enables researchers to draw conclusions based on existing scientific evidence while identifying research gaps that need to be addressed in future studies.

RESULTS AND DISCUSSION

1. Commonly Used Probiotic Strains

Various types of microorganisms have been utilized as probiotics in the livestock sector, particularly lactic acid bacteria such as Lactobacillus spp., spore-forming bacteria like Bacillus spp., and yeasts such as Saccharomyces cerevisiae. These three types of microorganisms are well-known for their high resilience within the gastrointestinal environment of livestock and their positive effects on gut microbiota balance. Lactobacillus spp. help lower intestinal pH through lactic acid production, which inhibits pathogenic bacterial growth. Bacillus spp. are resistant to high temperatures and pressures during feed processing and produce digestive enzymes such as proteases, amylases, and lipases. Meanwhile, Saccharomyces cerevisiae supports the fermentation of fibrous feed in the rumen and enhances nutrient bioavailability (Wahyuningrum & Dewantara, 2022; Fadillah et al., 2023).

The effectiveness of each probiotic strain greatly depends on the livestock species,

physiological status, and feed formulation. In ruminants, Saccharomyces cerevisiae has been shown to enhance rumen microbial activity, accelerate fiber fermentation, and reduce methane emissions, leading to improved feed conversion efficiency, milk production, and daily weight gain. In poultry, the combination of Lactobacillus and Bacillus supports gastrointestinal integrity, improves villi structure, and increases nutrient absorption. In fact, multi-strain combinations have been proven to have synergistic effects in enhancing immune resilience and reducing mortality during critical growth periods (Ramadhani & Prasetyo, 2024).

Beyond direct benefits to animal performance, probiotics also contribute to reduced dependence on antibiotics and lower incidences of gastrointestinal diseases. Probiotics compete with pathogens for nutrients and binding sites in the intestinal mucosa and stimulate the local immune system. A recent study by Hidayat, Lestari, and Ramlan (2023) reported that routine administration of Bacillus subtilis and Lactobacillus plantarum increased lymphocyte proportions and immunoglobulin levels in broiler chickens. Thus, proper probiotic selection is crucial. Formulation should take into account microbial stability, viability during storage, and application methods that ensure probiotics remain active upon reaching the gastrointestinal tract.

2. Effects on Digestive Performance

The use of probiotics in animal feed has a positive impact on digestive efficiency, particularly by enhancing nutrient utilization. In ruminants, microorganisms such as Saccharomyces cerevisiae and Lactobacillus acidophilus have been shown to stabilize rumen pH and create ideal conditions for the activity of beneficial rumen microbes. This stability prevents acidosis, accelerates the fermentation of fibrous feed, and promotes the activity of cellulolytic microorganisms. As a result, fiber and protein digestibility improves, positively affecting weight gain and milk production (Syafrudin, Kurniasih, & Putra, 2023). In addition, probiotics stimulate the production of endogenous digestive enzymes such as proteases, amylases, and lipases, which facilitate the breakdown of nutrients in the digestive tract.

In poultry, probiotics significantly influence intestinal morphology, especially in the small intestine. Increases in villi height, crypt depth, and the villi-to-crypt ratio enhance the surface area available for nutrient absorption. Research by Mahendra, Sulastri, and Wahyuni (2023) showed that regular probiotic supplementation in broilers contributed to improved feed conversion efficiency and better nutrient retention. Furthermore, microbial fermentation by

probiotics in the posterior intestine produces short-chain fatty acids (SCFAs) such as acetate and butyrate, which serve as primary energy sources for intestinal cells and help maintain mucosal health.

The presence of probiotics also suppresses pathogenic microbial growth through competition for space and nutrients, as well as the secretion of antimicrobial compounds like organic acids and bacteriocins. This reduces the incidence of digestive disorders such as diarrhea and enteric infections. A study by Firdaus, Lestari, and Hakim (2024) reported an increase in lactic acid bacteria populations and a significant reduction in Escherichia coli and Salmonella spp. colonies in the intestines of laying hens fed probiotic-supplemented diets. Improved digestive efficiency also reduces energy requirements for basic metabolic functions, allowing more energy to be allocated for growth and production. Therefore, integrating probiotics as natural feed additives is a sustainable approach to enhancing livestock productivity.

3. Feed Conversion Efficiency and Growth

Feed Conversion Ratio (FCR) is a key indicator in assessing the effectiveness of feed utilization in producing animal products such as meat, milk, or eggs. The lower the FCR value, the more efficiently the feed is converted into body mass. Probiotic supplementation as a feed additive has been proven to improve FCR by enhancing digestion and nutrient absorption in the gastrointestinal tract. Probiotics help balance gut microflora, improve fiber fermentation, and optimize energy and protein utilization.

A study by Prasetyo, Hidayat, and Mawardi (2023) showed that broiler chickens supplemented with Bacillus subtilis experienced a significant reduction in FCR and an increase in average daily gain (ADG). The treatment group achieved an FCR of 1.6 compared to 1.9 in the control group, indicating improved feed efficiency.

In beef cattle, a study by Lestari, Wulandari, and Ardiansyah (2022) revealed that adding Saccharomyces cerevisiae and Lactobacillus plantarum to the diet improved fiber digestibility and stabilized rumen pH. This enhanced the activity of rumen microbes responsible for lignocellulose breakdown, accelerating the supply of energy and protein for muscle growth.

Furthermore, probiotics exhibit adaptogenic effects against environmental stress. Research by Wicaksono, Fitriani, and Saputra (2024) demonstrated that probiotic

supplementation in broilers raised under high-temperature conditions maintained stable daily weight gain and reduced mortality by up to 25%. This effect is linked to the ability of probiotics to maintain microbial balance and reduce dysbiosis caused by heat stress or feed changes.

Thus, probiotic supplementation strategies not only improve feed conversion efficiency but also enhance animal resilience under suboptimal environmental conditions, making it a sustainable solution for modern livestock management.

4. Immunity and Reproduction

Probiotic supplementation has impacts beyond digestion, contributing significantly to improved immune function in livestock. Probiotics modulate immune responses by activating phagocytic cells, increasing immunoglobulin production, and stimulating T and B lymphocytes (Prasetyo et al., 2023). An increase in leukocyte counts and serum immunoglobulin levels has been consistently observed in animals receiving regular probiotic supplementation. Additionally, probiotics suppress pathogenic microorganisms in the gut through competition for nutrients and adhesion sites, indirectly strengthening systemic immunity.

In terms of reproduction, probiotics have shown positive effects on female livestock reproductive performance. Probiotic administration has been reported to enhance estrus synchronization, conception rates, and pregnancy success (Wahyuni & Rahayu, 2022). Moreover, colostrum quality, particularly IgA and IgG content, is improved providing essential passive immunity to neonates in their early life stages, supporting optimal survival and early growth.

Recent studies also indicate that probiotics can influence endocrine function. Probiotic supplementation has been shown to stimulate the production of reproductive hormones such as luteinizing hormone (LH) and follicle-stimulating hormone (FSH), which regulate estrous cycles and improve responsiveness to artificial insemination (Ramadhani et al., 2024). Therefore, integrating probiotics into reproductive management strategies not only enhances biological efficiency but also contributes to long-term economic benefits.

5. Implementation Challenges

Despite the promising potential of probiotics in improving livestock productivity, their practical implementation still faces various challenges. One major obstacle is the variability in responses across different livestock species to specific probiotic strains and dosages. A dosage

effective in broilers may not yield the same results in beef cattle or dairy goats, due to differences in digestive systems and metabolic processes that determine probiotic host microbiota interactions (Ramadhan & Cahyani, 2023). Additionally, the quality of probiotic products plays a crucial role. Products that lose viability during storage or fail to meet microbiological standards will no longer deliver the intended physiological benefits.

Technical challenges also exist at the farm level. Many farmers, especially in rural areas, lack sufficient knowledge about proper probiotic usage, including administration timing, feed mixing techniques, and application frequency. The absence of technical outreach and support has contributed to low adoption rates of this technology. A study by Lestari and Utama (2024) reported that farmers who participated in intensive training on probiotic use experienced up to a 25% increase in production performance compared to those who received only informal information. This finding underscores the importance of science-based extension services and continuous field demonstrations.

In addition, regulatory and standardization issues must be addressed. In Indonesia, there are currently no stringent national regulations governing labeling, content, or efficacy claims of livestock probiotic products. Consequently, many commercial products circulate without standardized quality or scientifically proven effectiveness, risking reduced farmer confidence in probiotic technologies. According to Suryana and Pramudito (2022), consumer protection for farmers should be ensured through collaboration between research institutions, industry stakeholders, and government bodies in developing certification systems and quality control measures for probiotics, ensuring that only high-quality, scientifically validated products reach the market.

CONCLUSION AND IMPLICATIONS

The strategy of enhancing livestock productivity through probiotic supplementation has demonstrated significant positive impacts on various aspects of animal health and performance. Probiotics not only improve feed conversion efficiency and growth rates but also contribute to the stabilization of gut microflora, which directly enhances nutrient absorption. Additionally, probiotics exhibit immunomodulatory effects that strengthen the animals' resistance to pathogens, thereby reducing morbidity and mortality rates. These effects highlight probiotics as a promising alternative to antibiotics in modern livestock systems focused on food safety and sustainability.

Furthermore, probiotic supplementation has been shown to positively influence reproductive performance in female livestock, including increased conception rates, improved colostrum quality, and more regular estrous cycles. These findings indicate that proper use of probiotics can support long-term production cycles. However, the effectiveness of probiotics is highly dependent on livestock species, probiotic strains, dosage, and environmental conditions. Therefore, implementing this strategy requires an integrated approach that includes farmer training, product standardization, and continued research support to ensure optimal outcomes in field applications.

REFERENCES

Astuti, W., & Mahendra, D. (2021). Peran Saccharomyces cerevisiae dalam Fermentasi Rumen dan Efisiensi Pakan pada Ruminansia. Jurnal Teknologi Peternakan, 9(3), 103–110.

Firdaus, R., Lestari, N., & Hakim, A. (2024). Pengaruh Suplementasi Probiotik terhadap Keseimbangan Mikroflora Usus dan Kesehatan Pencernaan Ayam Petelur. Jurnal Ilmu Ternak Tropis, 9(1), 45–52.

Haryanto, T., Mulyani, R., & Farhan, A. (2024). Efektivitas Probiotik Berdasarkan Spesies Ternak dan Metode Aplikasi. Jurnal Peternakan dan Bioteknologi, 8(2), 55–66.

Hidayat, M., & Maulana, R. (2023). Pemanfaatan Probiotik dalam Sistem Pencernaan Ternak dan Efeknya terhadap Kinerja Produksi. Jurnal Ilmu Peternakan Indonesia, 18(1), 12–21.

Kurniasih, A., & Siregar, L. A. (2022). Efektivitas Lactobacillus dan Bacillus dalam Menunjang Kesehatan Usus Ternak Unggas. Jurnal Peternakan Tropika, 10(2), 88–97.

Lestari, N., & Utama, D. (2024). Efektivitas Pelatihan Probiotik terhadap Peningkatan Produktivitas Ternak di Daerah Pedesaan. Jurnal Inovasi Peternakan Tropis, 15(1), 55–64.

Lestari, N. S., Wulandari, R., & Ardiansyah, M. A. (2022). Pengaruh Probiotik Rumen terhadap Kinerja Pertumbuhan dan Kecernaan Nutrien pada Sapi Potong. Jurnal Peternakan Nusantara, 9(3), 187–195.

Mahendra, D., Sulastri, E., & Wahyuni, I. (2023). Efek Morfologis Probiotik terhadap Usus Halus Ayam Broiler. Jurnal Peternakan Indonesia, 18(2), 89–97.

Nugroho, B., Santoso, S. I., & Adiwinarti, R. (2020). Pengaruh Suplementasi Probiotik terhadap Kesehatan dan Produktivitas Ternak. Jurnal Ilmu Ternak, 21(2), 98–107.

Prasetyo, A., Kurniawan, R., & Lestari, H. (2023). Peran Probiotik dalam Meningkatkan Imunitas Ternak: Tinjauan Literatur. Jurnal Ilmu Ternak Tropis, 10(1), 22–30.

Prasetyo, A. D., Hidayat, M., & Mawardi, S. (2023). Efektivitas Probiotik Bacillus subtilis terhadap FCR dan Pertumbuhan Ayam Broiler. Jurnal Ilmu dan Teknologi Peternakan Tropis, 11(2), 101–109.

Prasetyo, T., & Fitriani, S. (2020). Sinergi Strain Probiotik terhadap Imunitas dan Pertumbuhan Ayam Pedaging. Jurnal Penelitian Veteriner, 16(4), 55–63.

Putra, A. Y., & Hartono, B. (2019). Peran Probiotik dalam Meningkatkan Kinerja Produksi Ternak Unggas. Jurnal Peternakan Nusantara, 4(1), 12–20.

Rahmawati, S., Arifin, M. R., & Widodo, E. (2021). Suplementasi Probiotik dan Dampaknya terhadap Sistem Pencernaan Ruminansia. Jurnal Ilmu Nutrisi Ternak Tropis, 6(3), 143–152.

Ramadhan, A., & Cahyani, R. (2023). Respons Spesifik Ternak terhadap Suplementasi Probiotik: Tinjauan Sistematis. Jurnal Nutrisi dan Teknologi Pakan, 12(2), 101–110.

Ramadhani, N., Firmansyah, H., & Yusnita, D. (2024). Efek Suplementasi Probiotik terhadap Hormon Reproduksi dan Sinkronisasi Estrus pada Sapi. Jurnal Reproduksi dan Bioteknologi Peternakan, 6(2), 45–54.

Sari, D. P., Wulandari, N., & Prasetyo, L. (2020). Optimalisasi Probiotik sebagai Feed Additive Alami dalam Sistem Peternakan Berkelanjutan. Jurnal Peternakan Indonesia, 22(1), 33–41.

Suryana, B., & Pramudito, A. (2022). Urgensi Regulasi Probiotik Ternak di Indonesia: Tinjauan Kebijakan dan Standarisasi Produk. Jurnal Kebijakan dan Teknologi Peternakan, 9(3), 88–97.

Syafrudin, M., Kurniasih, D., & Putra, Y. A. (2023). Peran Probiotik dalam Menstabilkan pH Rumen dan Meningkatkan Kinerja Ternak Ruminansia. Jurnal Riset Peternakan Nusantara, 7(1), 25–34.

Wahyuni, D., & Rahayu, S. (2022). Pengaruh Pemberian Probiotik terhadap Kualitas Kolostrum dan Fertilitas Sapi Perah. Jurnal Peternakan Nusantara, 8(3), 89–97.

Wibowo, R., & Anggraini, M. (2023). Stabilitas Formulasi Probiotik untuk Pakan Ternak: Tantangan dan Solusi. Agrivet Journal, 21(2), 67–75.

Wicaksono, R., Fitriani, Y., & Saputra, H. R. (2024). Peran Probiotik dalam Menurunkan Mortalitas Ayam Pedaging di Lingkungan Tropis. Jurnal Ilmu Peternakan dan Lingkungan, 7(1), 55–63.

Yuliana, R., Kurniawan, T., & Herlina, S. (2022). Efek Suplementasi Probiotik terhadap Efisiensi Konversi Pakan dan Pertumbuhan Ayam Broiler. Jurnal Produksi Ternak, 9(2), 77–85.