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Editorial

Dietary probiotics in poultry: a game-changer for growth, immunity, and microbiota balance

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Probiotics, defined as live microorganisms that confer health benefits to the host when administered in adequate amounts, have become a pivotal innovation in modern poultry farming (Krysiak *et al.*, 2021; Das *et al.*, 2022). With the global poultry industry facing challenges such as antibiotic resistance, disease outbreaks, and consumer demand for healthier products, probiotics have emerged as a sustainable and effective solution (Nath *et al.*, 2023; Ayana and Kamutambuko, 2024). These dietary supplements are now integral to achieving optimal growth performance, robust immunity, and balanced gut microbiota in poultry production systems (Kabir *et al.*, 2004; Kabir, 2009a; Rahman and Kabir, 2013).

Probiotics work primarily by enhancing the gut microbiota, a vital determinant of health and productivity in poultry. By promoting beneficial bacteria and suppressing pathogenic species, probiotics improve nutrient absorption, immune function, and overall health (Jha *et al.*, 2020; Shehata *et al.*, 2022; Halder *et al.*, 2024). Research has consistently highlighted the benefits of probiotics in fostering a healthy gut environment, which directly influences growth and disease resistance in poultry (Islam *et al.*, 2004; Kabir *et al.*, 2005a). As an alternative to antibiotic growth promoters, probiotics provide a safer and eco-friendly option. They offer similar benefits without contributing to the growing issue of antimicrobial resistance (Ali *et al.*, 2023; Wickramasuriya *et al.*, 2024). Studies have shown that dietary probiotics improve feed conversion ratios, reduce mortality rates, and enhance the quality of poultry products, making them an essential component of sustainable farming practices (Kabir, 2009b; Khatun *et al.*, 2017; Krysiak *et al.*, 2021; Dong *et al.*, 2024).

Growth performance is a critical factor in poultry farming, directly impacting profitability and productivity. Probiotics have been shown to enhance growth rates by optimizing nutrient utilization and improving gut morphology (Jeni *et al.*, 2021; Sharifuzzaman *et al.*, 2025). Increased villus height and deeper crypts in the intestine, as observed in studies, facilitate better absorption of nutrients, leading to improved feed efficiency and weight gain in broilers (Awad *et al.*, 2009; Islam *et al.*, 2014; Khatun *et al.*, 2017). Research also highlights that probiotics can mitigate the adverse effects of stressors such as high temperatures and poor biosecurity. By stabilizing the gut microbiota and enhancing the immune response, probiotics ensure consistent growth even under challenging conditions, demonstrating their versatility and effectiveness in diverse farming environments (Roy *et al.*, 2015; Arif *et al.*, 2021; Chandrasekaran *et al.*, 2024).

A robust immune system is essential for poultry to resist infections and thrive in diverse environmental conditions. Probiotics have been shown to enhance both innate and adaptive immunity in poultry (Jha *et al.*, 2020). They stimulate the production of immunoglobulins, modulate cytokine responses, and improve the gut-associated lymphoid tissue, all of which contribute to a strengthened immune system (Kabir *et al.*, 2004;

Ashaolu, 2020; Arif *et al.*, 2021). Studies have demonstrated that dietary probiotics can significantly reduce the incidence of diseases, leading to lower dependency on antibiotics. This not only benefits poultry health but also addresses consumer concerns regarding antibiotic residues in meat products (Jeni *et al.*, 2021; Ayana and Kamutambuko, 2024). By integrating probiotics into feeding regimens, farmers can achieve healthier flocks and higher-quality products for the market (Islam *et al.*, 2004; Kabir, 2009a).

The gut microbiota is a cornerstone of poultry health, influencing everything from digestion to disease resistance. Probiotics help maintain a balanced and diverse gut microbiota by encouraging the growth of beneficial bacteria such as *Lactobacillus* and *Bifidobacterium* while suppressing harmful pathogens like *Salmonella* and *Clostridium* (Hossain *et al.*, 2005; Kabir *et al.*, 2005b; Islam *et al.*, 2014). The inclusion of probiotics in poultry diets has been shown to reduce the colonization of pathogenic bacteria, thereby minimizing the risk of disease outbreaks (Kabir *et al.*, 2015). This is particularly crucial in intensive farming systems, where the risk of disease transmission is higher. By fostering a stable gut environment, probiotics enhance overall resilience and productivity in poultry flocks (Roy *et al.*, 2015; Khatun *et al.*, 2017).

The economic benefits of probiotics are evident in their ability to improve feed efficiency and reduce production costs. By enhancing nutrient absorption and growth rates, probiotics ensure that farmers get more value from their feed investments. Additionally, the reduced need for antibiotics and disease management interventions further contributes to cost savings (Akhter *et al.*, 2018; Kabir *et al.*, 2023). From an environmental perspective, probiotics offer a sustainable solution by reducing the environmental impact of poultry farming. Improved gut health leads to better digestion and lower emissions of harmful gases such as ammonia. Furthermore, probiotics support the production of antibiotic-free poultry, aligning with consumer preferences and regulatory requirements in many regions (Kamruzzaman *et al.*, 2005; Kabir, 2009a; Kabir and Islam, 2021). While the benefits of probiotics are well-documented, their application in poultry farming is not without challenges. Variability in probiotic strains, formulations, and dosages can influence their efficacy. Moreover, factors such as storage conditions and feed compatibility can affect the viability of probiotics (Kabir and Islam, 2021). Standardizing probiotic use and educating farmers about best practices are essential to maximize their potential. Research and innovation are also crucial to developing more robust and versatile probiotic formulations that can withstand diverse farming conditions and meet the specific needs of different poultry species (Kabir and Islam, 2021; Kabir *et al.*, 2023).

The future of probiotics in poultry farming lies in precision nutrition and personalized solutions. Advances in microbiome research and genomics are enabling the development of targeted probiotic formulations that cater to the unique genetic and microbiota profiles of poultry flocks. This approach promises to optimize the benefits of probiotics and enhance their impact on health and productivity (Kabir and Islam, 2021; Kabir *et al.*, 2023). Additionally, the integration of probiotics with prebiotics and other dietary supplements offers new possibilities for improving gut health and overall performance. Synbiotics, which combine probiotics and prebiotics, have shown promising results in enhancing gut microbiota balance and immune function, paving the way for more comprehensive nutritional strategies (Kabir *et al.*, 2005b; Roy *et al.*, 2015).

Dietary probiotics represent a transformative innovation in poultry farming, offering a sustainable and effective alternative to traditional growth promoters. Their ability to enhance growth performance, strengthen immunity, and maintain gut microbiota balance makes them a valuable tool for modern poultry production systems. As research and technology continue to advance, the potential of probiotics to address the challenges of sustainable farming will only grow. By embracing probiotics and integrating them into best practices, the poultry industry can achieve new levels of productivity, health, and environmental sustainability. This not only benefits farmers but also meets the growing demand for safer and healthier poultry products in global markets.

Ethical approval and informed consent

Not applicable.

Data availability

Not applicable.

Conflict of interest

None to declare.

Author's contribution

Conceptualization, formal analysis, writing-original draft preparation, review and editing: S. M. Lutful Kabir. The author has read and approved the final version of the published editorial.

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