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PROBIOTICS, PREBIOTICS AND POSTBIOTICS - A SUSTAINABLE ALTERNATIVE TO ANTIBIOTIC GROWTH PROMOTERS

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Abstract: The widespread use of antibiotic growth promoters in poultry production has raised serious concerns regarding antimicrobial resistance and antibiotic residues in poultry products. Probiotics, prebiotics and postbiotics have emerged as promising non-antibiotic feed additives that improve gut health, immune function and production performance in poultry. This review highlights the mechanisms of action, benefits and limitations of probiotics, prebiotics and postbiotics, and emphasizes their potential as sustainable alternatives to antibiotic growth promoters for achieving antibiotic-free poultry production and improved food safety.
Keywords: Probiotics, prebiotics, postbiotics, antibiotic and antimicrobial resistance

Introduction

One of the major concerns in the poultry industry is the indiscriminate use of antibiotics as growth promoters to improve feed conversion ratio (FCR) and prevent mild infections in birds. Although the use of antibiotics is regulated by governments and poultry integrators, misuse at the farm level still occurs. Excessive antibiotic usage has led to antimicrobial resistance and antibiotic residue accumulation in humans, creating an urgent need for safer alternatives.

Several alternatives such as phytochemicals, nanoparticles and antibodies have been explored for disease prevention and growth promotion. However, the high cost of nanoparticles and the limited specificity of phytochemicals restrict their practical application in large-scale poultry production. Therefore, probiotics, prebiotics and postbiotics are gaining importance as effective and sustainable alternatives to antibiotics.

Probiotics as an alternative

Probiotics are beneficial microorganisms that maintain gut microbial balance and act as effective alternatives to antibiotic growth promoters by improving gut health, immunity and

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disease resistance. Their mechanisms include competitive exclusion of pathogens, enhancement of intestinal barrier function, immune modulation and production of antimicrobial compounds. They compete with pathogens such as Escherichia coli and Salmonella enterica for nutrients and adhesion sites, thereby reducing pathogen colonization (Dhanani and Bagchi, 2013; El-Sharkawy et al., 2020).

Probiotics also stimulate mucin secretion, promote intestinal cell proliferation (Gou et al., 2022) and produce antimicrobial substances such as organic acids and bacteriocins (Lei et al., 2022; Wei et al., 2021; Lauková et al., 2018). In addition, they enhance immunity by stimulating macrophage activity, regulating cytokines and increasing IgA secretion (Jha et al., 2008; Dargahi et al., 2020; Pietrzak et al., 2020). Lactobacillus species further help reduce Salmonella colonization by maintaining acidic pH in the crop (Durant et al., 1999).

Prebiotics as a Supplement to Probiotics

Prebiotics are non-digestible feed ingredients that stimulate the growth and activity of beneficial gut microorganisms. Common prebiotics include fructo-oligosaccharides (FOS), galacto-oligosaccharides (GOS) and mannan oligosaccharides (MOS).

When administered along with probiotics, prebiotics enhance probiotic multiplication and efficacy. They also directly interfere with pathogen attachment by binding to the flagella of pathogens such as Escherichia coli and Salmonella (Fomentini et al., 2016). Fermentation of prebiotics by probiotic bacteria produces short-chain fatty acids, which help reduce bacterial invasion and toxin translocation (Van Immerseel et al., 2006; Fukuda et al., 2011). The combined use of probiotics and prebiotics is known as synbiotics, which provide synergistic benefits in poultry health and performance.

Postbiotics – An Advancement to Synbiotics

Recent advances in poultry nutrition have introduced postbiotics, which are non-viable microbial metabolites and cell components such as enzymes, peptides and organic acids (Aguilar-Toalá et al., 2018). Postbiotics are more stable than probiotics and do not require live microorganisms. Postbiotics derived from Lactobacillus plantarum improved growth performance, gut health and antioxidant activity in broilers under heat stress (Humam et al., 2019), while those from Lactobacillus animalis enhanced quail performance (Kareem, 2020).

Challenges Associated with Probiotics

Despite their advantages, probiotics also have certain limitations. Their effectiveness may decrease under stressful environmental conditions, and maintaining microbial viability during storage and feed processing can be challenging. Moreover, probiotics generally require a longer period to exhibit beneficial effects compared to antibiotics, which may reduce their preference among farmers in some situations.

Conclusion

Probiotics, prebiotics and postbiotics are promising sustainable alternatives to antibiotic growth promoters in poultry production. They improve gut health, immunity and production performance while reducing the risks of antimicrobial resistance and antibiotic residues, thereby supporting safer and antibiotic-free poultry production.

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