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Combating Antibiotic Resistance in Poultry Farms: An Indian Perspective

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Abstract:

Antibiotic resistance in India's rapidly growing poultry industry poses a significant threat to both animal and public health. The warm climate, high population density, and varying biosecurity practices across farms create an environment conducive to the spread of resistant bacteria. Alarming levels of resistance to critical antibiotics have been observed, particularly in South Asian poultry farms. Factors exacerbating this issue include the overuse of antibiotics for growth promotion, poor biosecurity measures, lack of farmer awareness, and environmental contamination. To combat this challenge, innovative strategies are essential. Addressing antibiotic resistance in poultry farms requires a concerted effort from all stakeholders to reduce antibiotic dependence while maintaining productivity and safeguarding health across the One Health spectrum.

Keywords: Antibiotic resistance, innovative strategies, biosecurity, One health, Poultry Nutrition, Growth promoters.

Introduction:

The poultry industry in India has experienced remarkable growth over the past few decades, emerging as one of the largest producers of eggs and broiler meat globally. With an annual production exceeding 100 billion eggs and 4 million tonnes of poultry meat, India's poultry sector plays a crucial role in the country's food security and rural economy (Directorate of Animal Husbandry and Dairying, 2022). However, this rapid expansion has been accompanied by a significant increase in antibiotic use, leading to growing concerns over antibiotic resistance in poultry farms.

India's unique challenges in combating antibiotic resistance are multifaceted. The country's warm climate, high population density, and varying levels of biosecurity practices across farms create an environment conducive to the spread of resistant bacteria. Moreover, the lack of stringent regulations

governing antibiotic use in animal husbandry until recently has contributed to the widespread and often indiscriminate use of these drugs in poultry production (Laxminarayan & Chaudhury, 2016).

The Current Landscape of Antibiotic Resistance:

Antibiotic resistance in poultry farms has reached alarming levels, particularly in South Asia, which has emerged as a major hotspot for antimicrobial resistance (AMR). A study conducted across 18 poultry farms in Punjab, India, revealed that 87% of the farms surveyed reported using antimicrobials, with 39% acknowledging the use of critically important antimicrobials like colistin. Even more concerning was the detection of extended-spectrum beta-lactamase (ESBL) producing E. coli in 87% of broiler chicken samples, indicating a high prevalence of multidrug-resistant bacteria (Brower et al., 2017).

The pattern of resistance varies, with higher degrees of resistance observed in commonly used antibiotics like ampicillin, tetracycline, streptomycin, and ciprofloxacin. This trend is not unique to India; similar patterns have been observed in neighbouring countries such as Pakistan, Bangladesh, and Nepal (Brower et al., 2017).

Factors Contributing to Antibiotic Resistance:

Several factors contribute to the development and spread of antibiotic resistance in Indian poultry farms. The overuse of antibiotics for growth promotion and disease prevention has been identified as a primary driver of resistance. In many farms, antibiotics are routinely added to poultry feed at sub-therapeutic levels, creating an environment that selects for resistant bacteria (Van Boeckel et al., 2015).

Poor biosecurity measures on farms have also played a significant role in the spread of resistant bacteria. Inadequate farm hygiene, improper waste management, and insufficient control of pest animals can all contribute to the dissemination of resistant organisms within and between farms. Furthermore, the lack of awareness among farmers about proper antibiotic use and the risks associated with antibiotic resistance has exacerbated the problem (Laxminarayan et al., 2013).

Environmental contamination is another crucial factor in the spread of antibiotic resistance. A study on the Kshipra River in Central India, associated with religious mass-bathing, highlighted the potential for environmental dissemination of antibiotic-resistant bacteria and genes (Diwan et al., 2017). This underscores the interconnectedness of human activities, environmental health, and the spread of antibiotic resistance.

Innovative Strategies to Combat Antibiotic Resistance:

To address the growing threat of antibiotic resistance in Indian poultry farms, a multi-faceted approach is necessary. The Indian government has taken steps to address this issue, including the implementation of the National Action Plan on Antimicrobial Resistance (2017-2021) and the ban on the use of colistin in animal feed (Government of India, 2019).

One of the most critical strategies is the improvement of biosecurity measures on farms. This

involves implementing strict hygiene protocols, such as regular cleaning and disinfection of poultry houses, proper management of litter, and controlled access to farm areas. The use of footbaths with appropriate disinfectants at entry points can significantly reduce the introduction of pathogens (Laanen et al., 2013).

Exploring alternatives to antibiotics for disease prevention is another crucial approach. Probiotics and prebiotics have shown promise in promoting beneficial gut microflora and enhancing the immune system of poultry. These supplements can help maintain a healthy gut environment, reducing the need for antibiotics (Mountzouris et al., 2007).

Plant-based growth promoters offer another promising alternative to antibiotics in poultry production. These natural substances can enhance growth performance and improve bird health. A study by Kumar et al. (2021) demonstrated that supplementation with plant-based additives such as shatavari, garlic, aloe vera, and moringa in broiler diets had positive effects on bird performance. These plant-based alternatives not only promote growth but also have potential antimicrobial and immunomodulatory properties, making them valuable tools in reducing antibiotic use in poultry farms.

Bacteriophage therapy is an innovative alternative gaining attention in India. This approach uses viruses that specifically target pathogenic bacteria without harming beneficial microbes. Research has shown that bacteriophages can be effective against antibiotic-resistant strains of bacteria commonly found in poultry, such as Salmonella and E. coli (Atterbury et al., 2007).

Developing and implementing comprehensive vaccination strategies is also crucial in preventing common poultry diseases and reducing reliance on antibiotics. Advances in vaccine technology, including the development of autogenous vaccines tailored to specific farm pathogens, have shown promising results in disease prevention (Delany et al., 2014).

When antibiotics are necessary, their use should be optimized through precision antibiotic use practices. This involves conducting antibiotic susceptibility testing before treatment to ensure the most effective antibiotic is chosen. Using narrow-spectrum antibiotics, when possible, can help minimize the impact on beneficial bacteria (Prescott, 2014).

Education and training play a pivotal role in addressing antibiotic resistance in the Indian context. Providing comprehensive education to farmers and farm workers on proper antibiotic use, the importance of biosecurity measures, and alternative disease prevention strategies can lead to more informed decision-making and better farm management practices (Coyne et al., 2019).

Establishing robust surveillance systems is essential for monitoring antibiotic use in poultry farms, tracking the prevalence and patterns of antibiotic resistance, and identifying emerging resistant strains early. The Indian Council of Medical Research (ICMR) has initiated efforts in this direction through the establishment of the National Programme on AMR Containment and the Antimicrobial

Resistance Surveillance and Research Network (AMRSN) (ICMR, 2022).

Conclusion:

Combating antibiotic resistance in Indian poultry farms requires a concerted effort from farmers, veterinarians, researchers, and policymakers. By implementing these innovative strategies, we can work towards reducing the reliance on antibiotics while maintaining poultry health and productivity. This approach not only benefits the poultry industry but also contributes to safeguarding public health by reducing the risk of antibiotic-resistant infections in humans.

As India continues to grapple with the challenges of antibiotic resistance, it is crucial to adopt a One Health approach that recognizes the interconnectedness of human, animal, and environmental health. By addressing antibiotic resistance in poultry farms, India can make significant strides in protecting both its agricultural sector and public health, setting an example for other developing nations facing similar challenges.

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