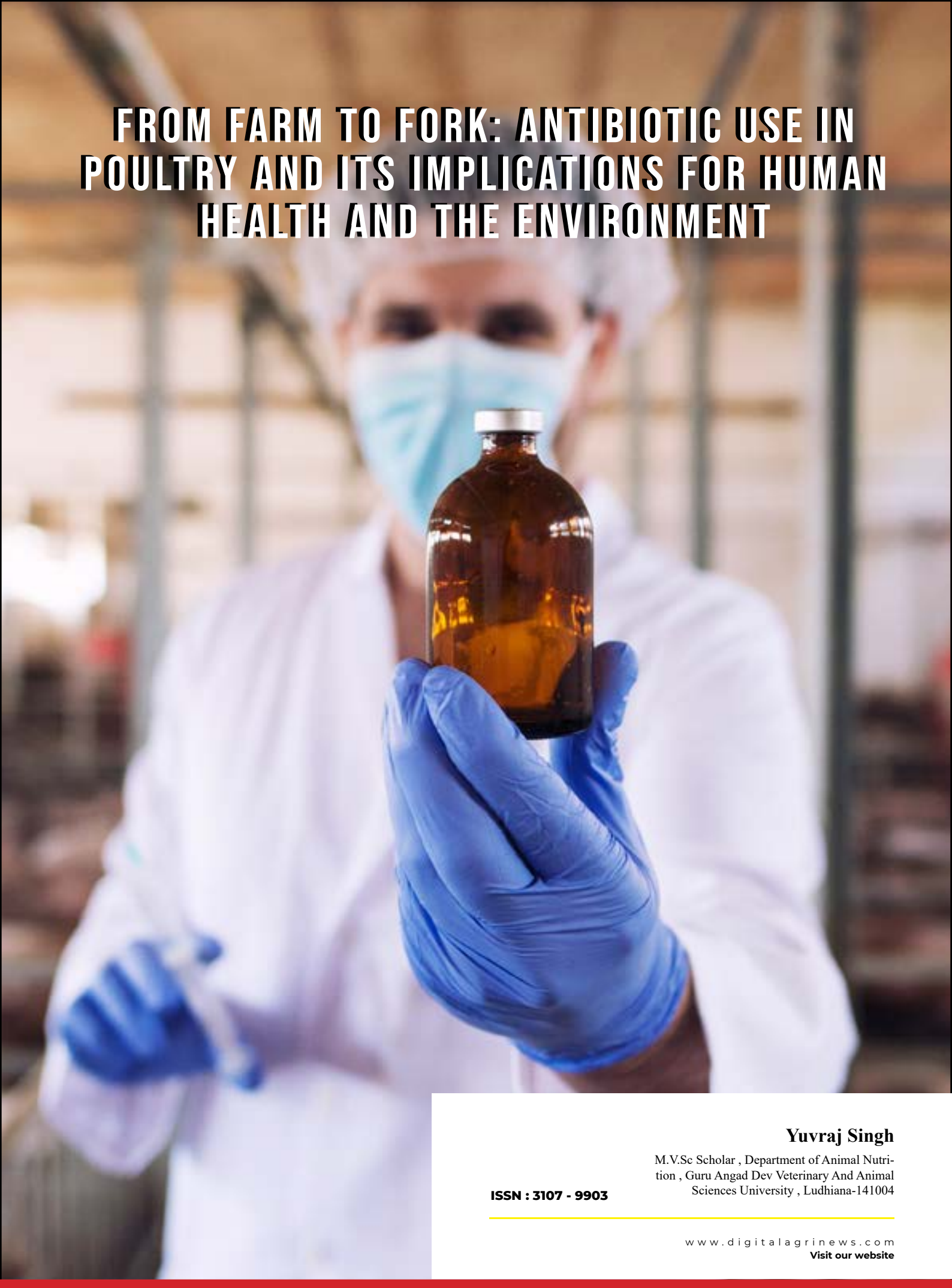
FROM FARM TO FORK: ANTIBIOTIC USE IN POULTRY AND ITS IMPLICATIONS FOR HUMAN HEALTH AND THE ENVIRONMENT



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ISSN : 3107 - 9903

EDITION: VOLUME 02, ISSUE 03 , - MARCH 2026

From Farm to Fork: Antibiotic Use in Poultry and Its Implications for Human Health and the Environment

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ISSN No.: 3107-9903
Frequency: Monthly
Month: March
Volume- 2, Issue- 3

Introduction

In recent years, terms like "antibiotic-free chicken" and "safe poultry products" have become increasingly common in markets and among consumers. With growing awareness about food safety and health, people are beginning to question how poultry is produced and whether the use of antibiotics in farming poses any risks. Poultry meat, especially chicken, is one of the most widely consumed and affordable sources of animal protein globally, and its production has expanded rapidly to meet increasing demand. However, behind this rapid growth lies an important issue, the use of antibiotics in poultry production and its consequences for human health and the environment.

Why Are Antibiotics Used in Poultry?

Antibiotics have been an integral part of modern poultry production for decades. They are used primarily for three main purposes: treatment of diseases, prevention of infections, and improvement of growth and productivity.In intensive poultry farming systems, where large numbers of birds are raised in confined spaces, the risk of disease outbreaks is high. To prevent losses, farmers often use antibiotics not only to

treat sick birds but also as a preventive measure. Additionally, antibiotics have historically been used at low levels in feed to enhance growth and improve feed efficiency, allowing birds to reach market weight faster.This practice contributed significantly to the success and expansion of the poultry industry, making chicken meat more affordable and accessible worldwide. However, over time, concerns have emerged about the long-term consequences of such widespread use.

The Growing Concern: What Is the Problem?

The major issue associated with antibiotic use in poultry is the development of antimicrobial resistance (AMR). This occurs when bacteria evolve and become resistant to antibiotics that were once effective in killing them.The extensive and sometimes inappropriate use of antibiotics in poultry production has created conditions that favor the development of resistant bacteria. These bacteria can survive antibiotic treatment and continue to multiply, making infections harder to treat in both animals and humans.Research shows that poultry farming is one of the significant contributors to the spread of antimicrobial resistance due to the scale of production and the frequent use of antibiotics.Importantly, this is not just an animal health issue, it has direct implications for human health.

Impact on Human Health

1. Transfer of Resistant Bacteria

One of the primary concerns is that antibiotic-resistant bacteria can be transmitted from poultry to humans. This transmission can occur through several pathways:

- Consumption of contaminated poultry meat
- Direct contact with live birds or farm environments
- Environmental exposure through soil and water

Bacteria such as *Escherichia coli, Salmonella*, and Campylobacter commonly associated with poultry have shown increasing resistance to antibiotics due to their exposure in farming systems.When these resistant bacteria infect humans, they can lead to illnesses that are more difficult to treat, requiring stronger or last-resort antibiotics.

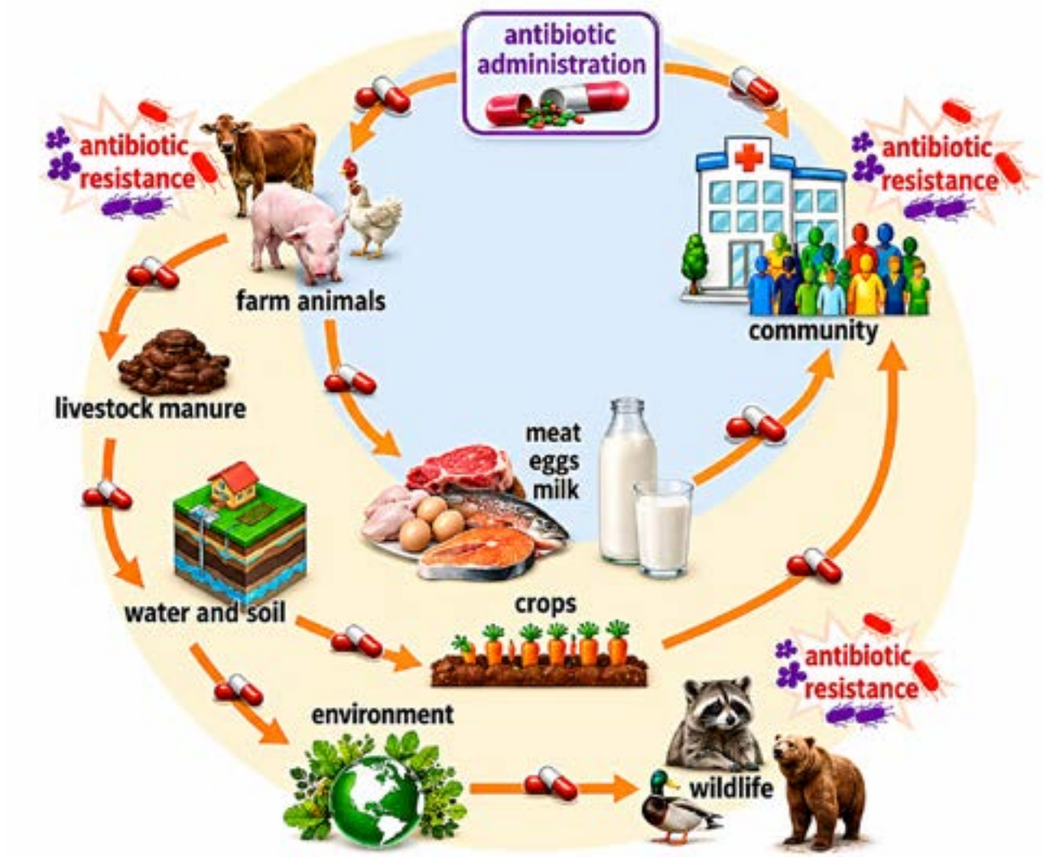

Figure 1:*Pathways of antibiotic resistance from animal production to humans and environment.*
Source: *Golowczyc & Gomez-Zavaglia (2024).*

2. Antibiotic Residues in Poultry Products

Another important concern is the presence of antibiotic residues in poultry meat and products. These residues may occur when proper withdrawal periods are not followed before slaughter.Studies highlight that such residues can pose risks to consumers, including allergic reactions, toxicity, and disruption of the human microbiome. In developing countries, weak regulatory systems and lack of awareness have contributed to the persistence of this issue.

3. Reduced Effectiveness of Antibiotics

Perhaps the most serious long-term consequence is that overuse of antibiotics in animals can reduce their effectiveness in human medicine. Evidence suggests that resistant bacteria originating in animals can enter the human population through the food chain, contributing to a wider pool of resistance genes.This means that common infections in humans may become harder to treat, increasing the risk of complications, longer illness durations, and higher healthcare costs.

Environmental Impact

The impact of antibiotic use in poultry is not limited to animals and humans, it also affects the environment.A large proportion of antibiotics administered to animals is not fully metabolized and is excreted in active form through feces and urine. These residues enter the environment through poultry litter, which is often used as fertilizer in agricultural fields.As a result:

- Soil and water systems become contaminated
- Antibiotic residues accumulate in ecosystems
- Resistant bacteria spread beyond farm boundaries

This creates a cycle where resistance can develop and persist in the environment, eventually affecting both animals and humans.

Rising Awareness and Changing Trends

In recent years, there has been growing awareness among consumers, researchers, and policymakers regarding the risks associated with antibiotic use in poultry.Several countries have introduced regulations to restrict or ban the use of antibiotics as growth promoters. For example, European countries have taken significant steps to limit non-therapeutic antibiotic use in livestock production. Consumer demand for “antibiotic-free” or “organic” poultry products has also increased, encouraging producers to adopt alternative practices.However, despite these efforts, challenges remain, particularly in developing countries where regulatory frameworks may be weak and access to veterinary guidance is limited.

Alternatives to Antibiotics

With increasing restrictions on antibiotic use, the poultry industry has been actively exploring alternatives to maintain productivity

and animal health.Research highlights several promising options:

- Probiotics and prebiotics to improve gut health
- Phytogenic additives (plant-based compounds) with antimicrobial properties
- Enzymes to enhance nutrient utilization
- Essential oils and herbal extracts
- Vaccination and improved biosecurity practices

Studies show that probiotics and phytogenic additives are among the most widely researched alternatives, indicating a shift toward more sustainable production systems.However, no single alternative can completely replace antibiotics. Instead, a combination of strategies is often required to achieve optimal results.

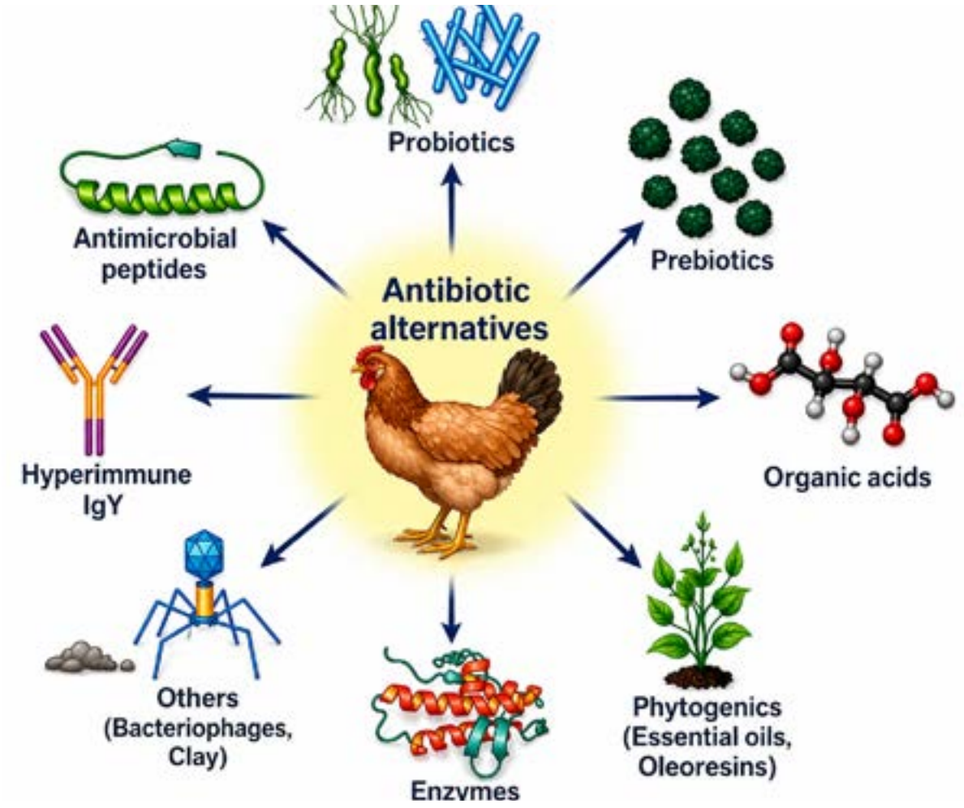

Figure 2:ALTERNATIVES TO ANTIBOTIC GROWTH PROMOTERS Source: Benison Media. (2023). Alternatives to antibiotic growth promoters. Retrieved from https://benisonmedia.com/alternatives-to-antibiotic-growth-promoters/

Challenges in Reducing Antibiotic Use

Despite the availability of alternatives, reducing antibiotic use in poultry production is not straightforward. Several challenges exist:

- Economic pressure on farmers to maintain productivity and profitability
- Lack of awareness and training among farmers
- Easy availability of antibiotics without strict regulation
- Inconsistent implementation of policies

Additionally, once resistance develops, it can persist in the system even after antibiotic use is reduced, making it difficult to reverse the problem.

A Balanced Perspective

It is important to note that antibiotics themselves are not the problem, the issue lies in their misuse and overuse. When used responsibly under veterinary supervision, antibiotics play a crucial role in maintaining animal health and preventing disease outbreaks. Eliminating antibiotics completely without proper alternatives could compromise animal welfare and food security. Therefore, the focus should be on:

- Judicious use of antibiotics
- Improved management practices
- Better regulation and monitoring

Conclusion

The use of antibiotics in poultry production has played a vital role in meeting the global demand for affordable animal protein. However, its widespread and sometimes inappropriate use has led to significant concerns regarding antimicrobial resistance, human health risks, and environmental contamination.Poultry production represents a critical link between animal agriculture and public health, highlighting the importance of a “One Health” approach, where human, animal, and environmental health are considered together. Moving forward, sustainable poultry production will depend on a balanced strategy that combines responsible antibiotic use, adoption of effective alternatives, stronger regulations, and increased awareness among all stakeholders.Ultimately, protecting the effectiveness of antibiotics is not just a scientific challenge, it

is a shared responsibility that affects farmers, consumers, policymakers, and society as a whole.

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