

# Antibiotic Resistance in Food Animals

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**Abstract**—*Indiscriminate use of antibiotics in food animals is leading to an increase in antibiotic resistance in both humans as well as animals. Antibiotic use in animals play a significant role because a lot of drug resistant bacteria can be transmitted between humans and animals through contact, food items and aerosol spread. A large number of antibiotics are used in animals for growth promotion and disease prevention. And particularly in poultry and small ruminants the whole lot is being treated with a single or multiple antibiotics to suppress or treat the ingress of disease in a few affected birds. And most of the antibiotics are similar to those used in humans thereby diminishing the effectiveness of these agents due to regular usage. There is extensive use of antibiotics in agriculture and animal husbandry sector. Prudence use of antibiotics in food animals and that too for therapeutic purpose only will certainly help in antimicrobial resistance in both humans and animals.*

## Introduction

AMR is emerging as a major global public health concern and an important food safety issue. According to WHO (World Health Organization) AMR has already reached alarming levels in many parts of the world. It is only recently that the issue of AMR and its implications has been widely addressed nationally and internationally, and the regulatory agencies are trying to deal with the issue holistically.

India is the second most populated country in the world with the demand for food items growing at an extensive pace. Livestock is responsible for over a fourth of India's total agricultural output, and 4 percent of the gross domestic product (GDP). An important segment of food is of animal origin, both terrestrial and aquatic. Antibiotics are being rampantly used for treatment of infectious diseases not only in humans but in animals as well. Antibiotics are also used as growth promoters in poultry industry as a feed component to fatten and increase meat yield. Common microbes present in human and animal intestines upon encountering these antibiotics regularly in sub-lethal concentrations gradually acquire resistance to them. Lack of regulation and monitoring of antimicrobials contribute to their overuse, and the subsequent development of antibiotic resistant infections in animals, which can be passed from animals to humans.

Estimates of global antibiotic use in animal sector in 2010 indicate that India accounts for 3 percent of global consumption and is among the top consumers worldwide,

along with China, the United States, Brazil and Germany (Van Boeckel *et al.* 2015). In India the infectious disease burden is among the highest in the world and recent report showed the inappropriate and irrational use of antimicrobial agents against infectious diseases, have led to increase in development of antimicrobial resistance. In May 2015, the sixty-eighth World Health Assembly endorsed the Global Action Plan on Antimicrobial Resistance (GAP-AMR) – including antibiotic resistance. The WHA resolution urges Member States to align their National Action Plan on AMR with GAP-AMR by May 2017. Commitment by global leaders to combat AMR was further strengthened at the High Level Meeting on AMR at the United Nations General Assembly on 21 September 2016.

## AMR in Animals:

The food supply chain plays an important part in the dissemination of antibiotic resistant bacteria from animal to human population and can pose a greater human health consequence by increasing the frequency of infection and treatment failure. The global extent of modern food and feed supply chains provides a mechanism for the spread of antibiotic resistant strains around the world. The continuously increasing world demand for animal protein has led to increasingly efficient intensive farming systems where animals are raised to maximize the amount of utilizable product at the least cost.

## Uses of Antibiotics in Animals:

**1 Therapeutic:** Use of antimicrobial in animals with diagnosed disease.

## 2 Non-therapeutic:

- **Prophylactic:** Use of antimicrobial in healthy animals in advance of expected exposure or after an exposure to an infectious agent, before laboratory diagnosis.
- **Use as growth promoter:** Supplementing animal feed with antimicrobials to enhance growth.

Disease outbreaks in farm animals occur due to overcrowding, unhygienic conditions and environmental stress. Instead of minimizing these predisposing factors the farmers rely on prophylactic antibiotic treatment. While, it does prevent many

disease outbreaks, but the frequent and regular use of small concentrations of antibiotics leads to the development of virulent strains of bacteria thereby, making it difficult to treat.

Projections for 2030 estimate an overall increase of about two thirds in animal antibiotic consumption worldwide. More antibiotics are used worldwide in poultry, swine, and cattle production than in the entire human population (CDDEP 2015). And, the amount of antibiotics given to animals for non-therapeutic reasons and growth promotion far exceeds the volume used to treat disease. The exact mechanism how small doses of antibiotics increase the rate of weight gain and 'feed efficiency' in animals is still unclear, but was first noted in the 1940s, and the practice has gained widespread use since then (Dibner and Richards 2005; Cogliani, Goossens, and Greko 2011).

In the BRICS countries (Brazil, Russia, India, China and South Africa) antibiotic use in animals is expected to double. Use of antibiotics in chickens, in particular, is expected to triple in India by 2030 (Van Boeckel *et al.* 2015).

#### Laws that Apply to Animal Products in India:

1. In January 2012, G.S.R. 28(E) requires that medicine for treatment of animals state a withdrawal period in the labeling (Ministry of Health and Family Welfare, Department of Health 2012).
2. In addition to veterinary-specific regulations on antibiotic use, the Second Amendment of the Drugs and Cosmetics Rules (2006) contains a list of 536 drugs that fall under Schedule H. These drugs, which include antibiotics, require by law a prescription for their use (Ministry of Health and Family Welfare, Department of Health 2006). In 2013, a new category of H1 drugs was added in a Fourth Amendment to the Drugs and Cosmetics Rules (GSR 588 (E)). Use of these drugs now requires a prescription and pharmacists must provide separate prescription documentation for review, and non-compliance with the regulations can incur penalties (Department of Health and Family Welfare 2013). The 2015 amendment (GSR 289 (E)) further prohibits the advertisement of drugs in Schedule H, H1 or X without prior government approval.

#### Strategies to conserve antibiotic effectiveness in animals:

1. In case of animals most of the antibiotics/antimicrobials are used through feeds and the animal feed in India has been left unregulated, therefore setting up a regulatory body for animal feed is first and foremost requirement to restrict/check the AMR.
2. An extensive public awareness campaign: In order to curtail the indiscriminate use of antibiotics an extensive awareness program covering all interior districts and villages of India so that the farmers don't demand and veterinarians don't prescribe antibiotics when not needed.

3. Incentives to discourage unnecessary antibiotic use in animals: There is a need to develop incentives and motivation to reduce antibiotic use without endanger to animal or human health. This will aid in antibiotic free animal production.
4. Education of farmers is critical to improving farmer's adherence to withdrawal times and strict penalties for failing to withhold milk / meat from treated animals.
5. Repeated use of same antibiotic can escalate the rise of resistant strains of bacteria. So, rotational change of susceptible antibiotic is necessary.
6. There is a need to have approved label claims for pesticides, antimicrobials and veterinary drugs, to be duly authorized by a competent regulatory authority.
7. Education of farmers and consumers on the dangers of antibiotic resistance: awareness among farmers and public can play a pivotal role in reducing antibiotic use in animals. Farmers could be targeted through extension activities by field Veterinarians and by radio, television and print campaigns. Raising awareness among the general public, through social media, will be able to generate increased demand for antibiotic-free products.
8. Holistic treatment of diseases: Use of alternate treatment methods like ayurveda and homeopathy will also help in reducing the indiscriminate use of antibiotics.
9. National Good Aquaculture practices should be developed to limit the usage of antibiotics and pesticides during farming operations.
10. Promote organic farming: Sale and promotion of organic products free from antibiotic residues and rearing of animals in organic environment. This will assist in improving the overall health of human population.
11. Reduce incidence of infections and diseases: Improving hygiene and sanitation is crucial in reducing the spread of infection and thereby reducing the increase in drug resistance. Proper disposal of waste, reducing stress and maintaining good hygiene augments the immunity which in turn helps in reducing disease outbreaks.
12. Surveillance of drug resistance and antibiotic use in animals: Surveillance is one of the backbones of management of any disease outbreak. The surveillance should be conducted at the level of each Government Veterinary Hospital and data should be collected about the consumption of antibiotics, the levels of antibiotic resistance, and the reasons for the development of such resistance.
13. Diagnostics to cut unnecessary use of antibiotics: The use of antibiotics in cases of mastitis and metritis is very extensive and uncontrolled. Establishment of Disease diagnostic laboratories at each block level and rapid diagnostics could transform the way we use antibiotics in

animals. The animal owners also need to be educated to use the antibiotics on the prescription of a qualified Veterinarian.

14. Promote development of vaccines: Vaccines prevent infections and therefore decrease the demand for treatments and so slowing the rise of antibiotic resistance. Preventing the disease outbreaks with effective use of vaccines is therefore of utmost importance.
15. Evaluation of prescription of Veterinarians: Antibiotics should be prescribed only when necessitated and used in optimal dosage and intervals to ensure maximum response.
16. Continuing education (CE) program: Field Veterinarians and postgraduates should be evaluated to ensure that preventive medicine, judicious antibiotic use and antimicrobial resistance are given top priority. Veterinarians can be educated by modifying college curricula to include antibiotic resistance content.
17. Antibiotics used in human population shall be best avoided for use in food producing animals.

### Summary

There are circumstances where antibiotics are required in agriculture and aquaculture – to maintain animal welfare and food security. However, much of their global use is not for treating sick animals, but rather to prevent infections or simply to promote growth. The quantity of antibiotics used in livestock is vast, therefore the extensive and unnecessary use of antibiotics in agriculture should be avoided and also there is a need to make much faster progress on banning or restricting the use of antibiotics in animals that are vital for human health.

The surveillance and monitoring system is to be developed for getting the actual status on AMR, and identifying trends and developing mitigation strategies for reducing the risk. The surveillance and monitoring of the antibiotic residues in foods, specifically of animal origin and food-borne pathogens will provide useful information for risk analysis and formulation of policies to tackle the growing menace of AMR.

The adoption of alternatives to antibiotics in conjunction with other incentives as recommended above may help to encourage the gradual phase-out of sub-therapeutic uses of antibiotics while maintaining animal health. Prudence use of antibiotics in food animals and that too for therapeutic purpose only will certainly help in antimicrobial resistance in both humans and animals. As the spread of AMR is across the borders and has been recognized globally so collaboration under “One Health Approach” both with national and international organization is the need of the hour.

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