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## Antimicrobial agent used in poultry: Consequences and alternatives

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### Abstract

For fulfilling the dietary needs of human population in malwa region there is great focus on raising hens and chickens for meat and eggs. For better production, antibiotics are commonly used in poultry industry as prophylactic, therapeutic and nutritive purposes to ensure rapid growth and prevent infection. Large amount of antibiotic used in poultry industry which lead to proliferate multi drug resistant bacteria. This condition become more worse because this drug resistant bacteria are now spreading in the environment due to unsafe disposal of poultry litter and waste in agricultural field. But non judicious use of these drugs result in accumulation of toxic and harmful residues in meat and eggs of treated birds which ultimately affect consumer health by triggering allergic reaction and transmitting antibiotic resistant microbial infections. In this article we pay more attention toward the hygienic status of poultry farm, use of various antimicrobial agents, their distribution and their subsequent effect on human health. The main aim of this study is to provide some other alternatives which have similar beneficial effects of growth promoters as well as good level of animal yield.

**Keywords:** Antibiotics, antimicrobial agent, poultry and resistant

### Introduction

Over the past few decades in malwa region, poultry has gone through tremendous growth. The improvement in production rate is partly due to the use of antibiotic growth promoter. Antibiotics are mainly employed for chemotherapeutic and prophylactic purposes and also used as feed additives to increase growth and improve feed efficiency <sup>[1]</sup>. Antibiotics are produced by lower fungi or certain bacteria to treat and prevent infection in human and animals. But indiscriminate use of these antimicrobial agents has led to increased problem of antibiotic resistance <sup>[2]</sup> and presence of antibiotic residues in feed and environment affect human and animal health <sup>[3]</sup>. The drug resistance has gained serious problem due to transmission of antibiotic resistant factor to other enteric organisms and create serious impact on health. This paper focus toward the use of various antimicrobial agents used in poultry industry, their residues present in environment and its impact on environment and human health.

### Hygienic status and problem encountered in poultry industry

Poor farm management and poor ventilation that increases the humidity in the house and develop more Gram negative bacteria in the intestine can result in diarrhoea leading to wet litter and inflammation in the intestine. This has a detrimental effect on performance both in terms of growth rate and feed efficiency in poultry industry. It also result in egg production losses and sale of dirty eggs. Quality of feed and water which includes contaminated ingredients and the lack of biosecurity also contribute to this problem. There are many factors that contribute to spread of disease include inadequate cleaning programme, leaking water bowls, rat and fly problem, overcrowding of chicks, chickens of mixed ages reared together, too hot or too cold conditions, dirty bedding, high build up of chicken droppings, no air circulation, no security measures to prevent people and animals from entering the chicken house.

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### Antimicrobial agents used in Poultry industry

In order to prevent such disease, additional calls for heavy use of antimicrobial drugs [7, 8]. Some of the antimicrobial agents

used in poultry along with their derivatives, mode of action and their characteristics is given in table 1.

Antibiotic Class	Synthesis	Mechanism Bacterial Infection	Spectrum of Activity	Characteristics
Aminoglycosides	Streptomyces spp.	Protein synthesis	Gram negative	Exhibit a post-antibiotic effect in which there is no or very little drug level detectable in blood, but still inhibits bacterial re-growth due to strong, irreversible binding to the ribosome.
Beta lactams	Fungal product	Cell wall synthesis	Gram negative and some Gram positive	Unstable in acidic conditions. Many bacteria produce lactamase that break the cyclic bond in the chemical structure.
Ionophores	Chemically Synthesised	Leakage of cell membrane	Parasitic coccidia	Some coccidiostats are converted by bacteria present in the litter into inorganic arsenic
Macrolides	Produced by a variety of bacteria	Protein synthesis	Gram positive	Effective against Mycoplasma
Polypeptides	Fungi, Bacteria, plants and Eukaryotic Cells.	Interference with cytoplasmic membrane	Bacilli including E.coli and Pasturella.	Includes Bacitracin, which is no longer approved for use at sub-therapeutic dosages.
Quinolones	Chemically synthesized	DNA Coiling	Gram Positive Gram negative	Were used prophylactically. FDA banned use in poultry in 2005.
Sulfonamides	Chemically synthesized	DNA And RNA Synthesis	Gram Positive Gram negative	Used for the treatment of fowl typhoid and pullorum disease.
Bambermycins	Streptomyces bambergiensis	Cell wall synthesis	Gram Positive	Used as a feed additive for growth promoting effects.

The most commonly used antibiotics are tetracycline, gentamycin, neomycin, tylosine, erythromycin, virginiamycin, ceftiofur and bacitracin which are usually helpful in the reduction and prevention of respiratory diseases and necrotic enteritis infections, fluroquinolones and quinolone compounds are used for gastroenteritis, skin or soft tissue infection [9-12]. Sulfonamide compounds are administered as preventive and chemotherapeutic agents against coccidiosis, fowl typhoid, coryza and pullorum disease [13, 14] while piperazine, oxytetracycline, amoxicillin, amprolium, ciprofloxacin and sulpha drugs are used to treat coccidiosis [15]. Many anticoccidial drugs (sulphonamides, clopidal, amprolium, nicarbazin etc.) are widely used as antidotes in poultry feed to prevent and treat coccidiosis [16, 17]. These antibiotic or antimicrobial was seen as hallmark and allowed to be used without any regulation. However the negative effects of these growth promoter remained undetected until emergence of resistance against antibiotic.

### Presence and distribution of drugs residues in poultry products

Indiscriminate use of antimicrobial drugs in poultry industry result in accumulation of harmful residues in edible tissue of the poultry [18-21]. These drugs residues can indirectly enter the food chain through litter, which is generally used as manure, soil and water get contaminated with heavy metals, pesticides

or toxic chemical etc. [22, 23]. These contaminants residues leads to create toxicity in human and change the microflora with the possible development of resistant strains due to continuous exposure to antibiotics [24]. Ingestion of contaminated poultry product [25] it has been reported that beta lactam residues present and cause dermatitis, cutaneous eruptions, anaphylaxis and gastrointestinal symptoms. Penicillin residues are considered as the most problematic due to toxic effect and allergic manifestation seen in human population [26]. The level of tetracycline residues have also been reported in a diet intended for human consumption lead to poor development of foetus, staining of teething young children, gastrointestinal disorders and pro-inflammatory, cytotoxic and immune-pathological effects [27-30].

### Other Alternatives used in Poultry Industry

Excessive use of antibiotic gave rise to bacteria resistant strains, this create threat to human and animal health. There are so much research has been carried out to find out natural agents with similar beneficial effects of growth promoters. The aim of these alternatives is to maintain a low mortality rate, good animal yield and to control infectious diseases. The most popular alternatives used in poultry industry are probiotics, prebiotics, enzymes, organic acids, immunostimulants, bacteriocins, bacteriophages, phytogetic feed additives, nanoparticles and essential oils.

Other Alternatives Feed	Sources	Function
1. Phytogetic feed additives (Melissa balm, peppermint, oak, clove, thyme, neem, black seed)	Derived from plants, herbs spices	<ul style="list-style-type: none"> <li>To improve growth, immune system, reduce stress response.</li> </ul>
2. Nanoparticles	Ag, Cu, certain metal oxides	Have antimicrobial action (Gangadoo <i>et al.</i> , 2016)
3. Essential oil	Natural or Synthetic origin (mostly used thymol, trans-cinnamaldehyde, Carvacrol and Eugenol)	<ul style="list-style-type: none"> <li>Good promoters in chicken production (Khattak <i>et al.</i>, 2019, Peng &amp; Li, 2016, Pirgozlieu <i>et al.</i>, 2015)</li> </ul>
4. Probiotics	Live Microorganisms	<ul style="list-style-type: none"> <li>Improve growth, feed efficiency and intestinal health (Ghasemi <i>et al.</i>, 2014, Giannenas <i>et al.</i>, 2012, Samli <i>et al.</i>, 2007)</li> </ul>
5. Organic acid	Malic acid, lactic acid, acetic acid, formic acid, tartaric acid, butyric and propionic acid	<ul style="list-style-type: none"> <li>Protect from microbial and fungal proliferation (Kum <i>et al.</i>, 2010)</li> </ul>

## Conclusion

Poultry farms are reservoirs of multi-drug resistant bacteria and that resistance is moving from farms to agricultural fields. So there is need to control the spread of antibiotic resistance by banned excessive exposure to antibiotics. Antibiotics should be used as a last resort to control the disease. In order to avoid bacterial infection in poultry industry we need to focus other alternatives agent that have similar beneficial effect for growth promoter.

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