

ANTIBIOTIC RESIDUES IN MEAT AND MEAT PRODUCTS

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ABSTRACT

The presence of antimicrobial residues (AMRs) in meat poses a significant public health risk in the twenty-first century. This study seeks to explore the issue of AMRs in meat by examining their origins, adverse effects, detection methods, and strategies for prevention and control. The health hazards linked to these residues include direct toxicity, allergic reactions, hypersensitivity, and the emergence of antibiotic-resistant bacteria. Additionally, prolonged exposure to low levels of AMRs can disrupt gut microbiota and lead to bone marrow disorders. Furthermore, long-term exposure to antibiotic residues during pregnancy has been associated with various congenital defects in newborns. The potential carcinogenic and mutagenic effects of antibiotic residues in food are also concerning. Several practices contribute to the introduction of AMRs into meat and meat products, including the improper use of chemotherapeutic agents, non-compliance with withdrawal periods, even when anti-infective agents are administered correctly, and the use of antibiotics as growth promoters and feed additives. Addressing this issue necessitates collaboration across multiple sectors to limit the misuse of antimicrobial drugs, establish standardized usage protocols, and develop alternative chemicals or biological agents for meat preservation and as growth enhancers for livestock.

Keywords: Meat, Antibiotic residues, antimicrobial resistance.

1. INTRODUCTION

Meat is characterized as the skeletal muscles and related tissues from specific mammals and birds that are suitable for human consumption. It is a nutrient-dense food, rich in high-quality proteins that provide all essential amino acids, along with various minerals such as iron, zinc, selenium, and magnesium. Additionally, meat serves as a significant source of five B-complex vitamins, which are crucial cofactors in energy metabolism. As the global population continues to grow rapidly, the demand for food, particularly animal-based products, is increasing correspondingly. Consequently, the need for animal protein is rising significantly worldwide. To address this demand, intensive farming practices in both livestock and aquaculture are becoming increasingly prevalent and are recognized as vital sectors within the food industry.

Antimicrobial Agents in the Meat Industry: Appropriate and Inappropriate Applications Antimicrobials are chemical substances that possess the ability to eliminate or suppress microorganisms, including bacteria, fungi, protozoa, and parasites, even at low concentrations. This term encompasses a variety of drugs, such as antivirals, antibiotics, antifungals, and antiprotozoals. Following the administration of antimicrobials, residues may persist in the tissues of the treated animals as well as in food products derived from them, including milk, meat, and eggs.

The Origin of Antimicrobial Resistance- (AMR) in Meat The confinement of a large number of animals in limited spaces facilitates the rapid spread of infections, making the use of antimicrobials, including antibiotics, a necessity in livestock farming. Antimicrobial resistance (AMR) is predominantly present in meat and meat products due to the inappropriate application of these substances during the treatment of sick animals or as a preventive measure for healthy ones. The majority of residues found in meat consist of pharmaceutical agents, including antimicrobials, anthelmintics, and hormones. Among these pharmaceuticals, antibiotics are the most widely utilized in both human and veterinary medicine. Additionally, other substances such as insecticides, herbicides, pesticides, mycotoxins, heavy metals, detergents, disinfectants, nitrates, and nitrites have also been identified. In general, the origin of AMRs in meat and meat products can be traced back to one or more of the following sources.

Use of antibiotics as growth promoters- Antimicrobials are occasionally incorporated into animal feed at low concentrations to enhance the growth rate of livestock. The discovery of antibiotics' growth-promoting properties in animals and birds occurred by chance in the 1940s. This finding was subsequently leveraged extensively, leading to the widespread practice of adding antibiotics to animal feed for growth stimulation on a global scale. In the United States alone, approximately 24.6 million pounds of antibiotics are utilized in animal agriculture each year, with a significant portion allocated for growth promotion rather than for treating infections. A recent report indicated that out of 13 million kilograms of antibiotics administered to animals in 2010, the majority was intended for livestock growth enhancement. The precise mechanism behind the growth-promoting effects of antibiotics remains unclear. It is suggested that microorganisms in the animal gut consume a significant amount of nutrients from the feed, hinder nutrient absorption

in the intestine, and produce toxins that negatively impact animal health. The growth-promoting effects of antibiotics may arise from their capacity to inhibit these detrimental organisms that lead to chronic or latent infections.

Application of Antibiotics in Meat Preservation Antibiotics are utilized in the preservation of food, especially those derived from animals, such as poultry and fish. These substances are incorporated into water at concentrations ranging from 5 to 40 ppm, with poultry meat being immersed in this treated water for chilling during production. Alternatively, antibiotics can be added to ice in quantities of 2 to 5 ppm to significantly extend the shelf life of these products. However, due to rising health concerns, consumers are increasingly resistant to the use of synthetic chemical preservatives. Consequently, the use of antibiotics for food preservation has been prohibited in numerous countries due to public health issues.

Effects on Consumer Health Residues of antimicrobials and their toxic byproducts are frequently detected in various meats and meat products, collectively referred to as veterinary drug residues. The consumption of these products presents significant health risks. As noted by Falowo and Akimoladun, there are two primary categories of adverse effects associated with antibiotic residues in animal-derived food concerning human health. The first category includes immunological responses, such as allergies and hypersensitivity reactions, which can range from mild symptoms like rashes to severe, life-threatening conditions such as anaphylactic shock. The second category involves the emergence of antibiotic resistance. Additionally, there are other detrimental effects of antimicrobial resistance (AMR) on human health, which are outlined below.

2. CONCLUSION

The presence of AMRs in different types of meat and meat products is one of the global challenges for the meat industry and consumers. The most common causes of drug residues in food products are prophylactic use of antibiotics, and usage of antibiotics as growth promoters and as feed additives. The misuse and overuse of antimicrobials, particularly in the local animal industry, pose a serious health risk to the public and may complicate the treatment of human infections. Food-borne hypersensitivity reactions and the emergence of microbial resistance, as well as cross-resistance to the various groups of antibiotics in animals and their transfer to human pathogens, are well-documented consequences of AMRs in food. Insufficient withdrawal period and inappropriate health status of animals, which affect the drug metabolism, both result in residues presence in meat. Adherence to usage instructions and medical guidelines could significantly reduce the incidence of AMRs in meat and meat products. Finally, veterinary use of antimicrobial agents, especially those with dual animal and human applications, should therefore be restricted.

3. REFERENCES

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