IFT Expert Report

Antimicrobial Resistance: Implications for the Food System

Summary

Antimicrobials are important tools that are integral to our complex food system. Antimicrobials (e.g., antibiotics and other substances that act against microorganisms) provide for high quality or good physical condition of crops and good health of food animals entering the food chain. Non-antibiotic antimicrobial agents enable disinfection or sanitization of animal production premises, transport equipment, carcasses, slaughter facility equipment, and effective sanitation during food processing, and ensure food quality and safety.

Antimicrobial resistance may be intrinsic to a microorganism, or it may develop via mutation or adaptation to stressors. Antibiotic-resistant pathogens may create an increased burden to human health in different ways: (1) resistant pathogens contaminating food animals have the potential to reach humans; (2) human use of antibiotics may increase the risk of acquiring an infection with an antimicrobial resistant pathogen; (3) human infection with a resistant microbe may limit illness treatment options (in the uncommon instances of foodborne illness in which antibiotic use is warranted); and (4) antibiotic-resistant foodborne pathogens may develop increased virulence. The extent to which antibiotic use in food animals produces clinically important antibiotic-resistant infections in humans is unknown.

Antibiotic-resistant intestinal bacteria may be present in food animals, irregardless of exposure of the animals to an antibiotic. In spite of the best efforts to prevent or eliminate them, some antibiotic-resistant bacteria contaminate carcasses, as do antibiotic susceptible bacteria. The key points of influence that food scientists have in preventing the spread of antibiotic-resistant and sensitive pathogenic microorganisms in foods are preventing them from entering the food supply, and if present, inactivating them or preventing their growth. Interventions that effectively reduce the prevalence of foodborne pathogens also reduce the prevalence of those that are resistant to antibiotics.

A single approach to solving the resistance issue is not possible. To address the complexity of resistance selection, transfer through the food chain, and human health consequences, qualitative and quantitative risk assessments are now being applied. For many antibiotics for which a risk assessment has been conducted, estimated risk to human health is small.

Risk management strategies to minimize and contain antibiotic-resistant foodborne bacteria are in place all along the food chain, but can be improved. The strategies that have been implemented include use of antibiotic alternatives, implementation of judicious or prudent antibiotic use guidelines, and implementation of national resistance monitoring programs.

Environmental impacts of antimicrobials are not completely understood. Evidence suggests that it is not likely that antimicrobials in manure pose any direct risk to soil microbiota. It is not yet possible, however, to exclude other indirect effects on soil microbiota and ecosystems that are driven by changes in the microbial community from the presence of antibiotics.

Although bacteria may be exposed to an antibiotic several times on the farm or in humans, bacterial exposure to food antimicrobials generally occurs only once. The prevalence and mechanism of resistance among most food-use antimicrobial compounds is often unknown. When it occurs, resistance to food antimicrobials is of little practical relevance to the food industry because the antimicrobial concentrations used in food manufacturing are well above the low levels to which bacteria exhibit resistance, and the resistance mechanisms are often temporary adaptations. The use in foods of chemical and biological antimicrobials and physical preservation systems has been remarkably successful in providing safe foods and has not been compromised by the occurrence of resistant microorganisms.

There is evidence that there are significant human health benefits from subtherapeutic antibiotic use to prevent subclinical disease in food animals and reduce levels of *Salmonella* and *Campylobacter* contamination of poultry carcasses. In the future, the public health benefit as well as risks of losing the efficacy of existing and future antimicrobials must be considered. Further, regulatory targeting of specific antibiotic-resistant foodborne pathogens may not be the most successful or cost effective means to reduce overall foodborne illness. Applying interventions to control foodborne pathogens in general, rather than focusing on antibiotic-resistant strains specifically, would have the greatest impact in reducing overall foodborne illnesses.

The Institute of Food Technologists (IFT) convened a panel of internationally renowned experts to address the concern that the use of antimicrobials in food production, manufacturing, and elsewhere may lead to the emergence of foodborne pathogens that are resistant to antimicrobials and compromise the ability to subsequently control them. The outcome of the panel's deliberations is presented in its fourth Expert Report, funded by the IFT Foundation. Copies of the Expert Report are accessible at www.ift.org. Founded in 1939, IFT is a nonprofit scientific and educational society with 22,000 members working in food science, technology, and related professions in the food industry, academia, and government. As the society for food science and technology, IFT brings sound science to the public discussion of food issues.

Please refer to the Expert Report for panelists, attributions, and references.