The growing threat of antimicrobial resistance in foodborne bacteria and the role of food spoilage microorganisms.

Murat Yuksel*

Department of B Food Science Division, University of São Paulo, Brazil

Introduction

Food safety has become a major global concern as antimicrobial resistance (AMR) in foodborne bacteria continues to rise, posing significant risks to human health. At the same time, food spoilage microorganisms are responsible for substantial food waste and economic losses worldwide. These two issues are interconnected, as the misuse of antimicrobials in food production not only leads to resistant pathogens but also affects the microbial ecosystems responsible for food spoilage. Understanding these challenges is essential to developing sustainable solutions that ensure food safety and public health [1].

The excessive use of antibiotics in livestock and agriculture has led to the emergence of resistant bacterial strains, such as Salmonella, Escherichia coli, and Campylobacter. These pathogens can be transmitted to humans through contaminated food, causing infections that are difficult to treat. AMR bacteria in food products reduce the effectiveness of antibiotics, leading to prolonged illnesses, increased medical costs, and higher mortality rates [2].

Foodborne bacteria can acquire resistance through genetic mutations or horizontal gene transfer. Contaminated meat, dairy, and vegetables can serve as carriers of these resistant bacteria, passing them to consumers. Poor hygiene during food handling and improper cooking methods further contribute to the spread of AMR. Additionally, the presence of antibiotic residues in food can promote bacterial adaptation, making them more resistant over time [3].

AMR-related infections place a heavy burden on healthcare systems worldwide. The cost of treating resistant infections is significantly higher than treating non-resistant ones due to prolonged hospital stays and the need for alternative, often more expensive, antibiotics. Furthermore, outbreaks of AMR foodborne pathogens can lead to large-scale food recalls, causing financial losses for the food industry and supply chain disruptions [4].

While AMR bacteria pose serious health risks, food spoilage microorganisms contribute to food insecurity and economic waste. Spoilage is caused by bacteria, yeasts, and molds that deteriorate food quality, leading to changes in texture, odor, and taste. Common spoilage organisms include Pseudomonas, Lactobacillus, and Penicillium, which thrive under specific environmental conditions [5].

Although food spoilage microorganisms do not always cause illness, some can produce harmful toxins that pose health risks. For example, Clostridium botulinum produces botulinum toxin, a potent neurotoxin that can cause severe food poisoning. Mold species like Aspergillus can generate mycotoxins, which are linked to liver damage and cancer. Preventing spoilage is crucial to reducing food waste while ensuring consumer safety [6].

The indiscriminate use of antimicrobials in food preservation can disrupt the natural microbial balance. While preservatives like organic acids and nitrates are used to extend shelf life, their overuse may contribute to AMR development in spoilage organisms. Some foodborne bacteria can develop resistance to these preservatives, making traditional food safety interventions less effective [7].

To combat both AMR and food spoilage, researchers are exploring alternative solutions such as probiotics, bacteriophages, and natural antimicrobial compounds. Probiotic bacteria like Lactobacillus can outcompete harmful microbes, reducing the need for antibiotics in food production. Bacteriophages, which are viruses that infect bacteria, offer a promising method for targeting AMR pathogens without disrupting beneficial microbes [8].

Food producers and policymakers play a crucial role in controlling AMR and food spoilage. Implementing strict antibiotic usage policies, improving hygiene practices in food processing, and promoting better storage conditions can help reduce the risks associated with resistant bacteria and spoilage microorganisms. Regulatory agencies like the World Health Organization (WHO) and Food and Agriculture Organization (FAO) advocate for antimicrobial stewardship programs to prevent the overuse of antibiotics in agriculture [9].

Consumers also have a role to play in minimizing the spread of AMR and food spoilage. Proper food handling, cooking at appropriate temperatures, and avoiding the unnecessary use of antibiotics contribute to reducing resistance. Additionally, reducing food waste through better storage practices and choosing fresh, minimally processed foods can help mitigate the impact of spoilage microorganisms [10].

Conclusion

Antimicrobial resistance in foodborne bacteria and food spoilage microorganisms are critical issues that require urgent

***Correspondence to**: Murat Yuksel, Department of B Food Science Division, University of São Paulo, Brazil. E-mail: Murat@Yuksel.com

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attention. While AMR poses a direct threat to public health, spoilage microorganisms contribute to global food waste and economic losses. Addressing these challenges demands a collaborative approach involving governments, industries, researchers, and consumers. By implementing sustainable food safety practices, investing in alternative antimicrobial strategies, and raising public awareness, we can work toward a future with safer and healthier food systems.

Reference

1. Ibrahim SA, Ayivi RD, Zimmerman T, et al. Lactic acid bacteria as antimicrobial agents: Food safety and microbial food spoilage prevention. Food. 2021;10(12):3131.
2. Grudlewska-Buda K, Bauza-Kaszewska J, Wiktorczyk-Kapischke N, et al. Antibiotic Resistance in selected emerging bacterial foodborne Pathogens An issue of concern?. Antib. 2023;12(5):880.
3. Mokoena MP, Omatola CA, Olaniran AO. Applications of lactic acid bacteria and their bacteriocins against food spoilage microorganisms and foodborne pathogens. Mole. 2021;26(22):7055.
4. Misiou O, Koutsoumanis K. Climate change and its implications for food safety and spoilage. Trend Food Sci Technolo. 2022;126:142-52.
5. Mohanty D, Suar M, Panda SK. Nanotechnological interventions in bacteriocin formulations–advances, and scope for challenging food spoilage bacteria and drug-resistant foodborne pathogens. Crit Rev Food Sci Nutr. 2023:1-8.
6. Nisa M, Dar RA, Fomda BA, et al. Combating food spoilage and pathogenic microbes via bacteriocins: A natural and eco-friendly substitute to antibiotics. Food Control. 2023;149:109710.
7. Wu-Wu JW, Guadamuz-Mayorga C, Oviedo-Cerdas D, et al. Antibiotic resistance and food safety: Perspectives on new technologies and molecules for microbial control in the food industry. Antib. 2023;12(3):550.
8. György É, Laslo É, Antal M, et al. Antibiotic resistance pattern of the allochthonous bacteria isolated from commercially available spices. Food Sci Nut. 2021;9(8):4550-60.
9. Sivalingam KM, Sama DS, Vaithilingam S. Prevalence and antibiotic susceptibility pattern of foodborne bacterial pathogens isolated from spoiled vegetables at Wolaita Sodo town, South Ethiopia. Journal of Food Quality. 2024;2024(1):8823056.
10. Stanley D, Batacan Jr R, Bajagai YS. Rapid growth of antimicrobial resistance: the role of agriculture in the problem and the solutions. Appl Microb Biotech. 2022;106(21):6953-62.

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