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Editorial

Advances in Food Safety and Microbial Control

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1. Introduction

Consumer demand for high-quality, shelf-stable foods is rapidly increasing, mainly due to changing dietary habits and global population growth. Furthermore, consumers are increasingly seeking natural preservatives to replace conventional ones [1]. Research has led to the development of novel food bioprotection and biopreservation strategies aimed at preserving nutritional and organoleptic qualities, ensuring microbiological safety while extending shelf life [2,3]. The recent exploitation of natural products to eliminate pathogens, control spoilage, and prolong the shelf life of perishable products has attracted growing interest among researchers [4]. Probiotics and postbiotics are emerging as natural preservatives that combine antimicrobial activity with health benefits. These bioactive systems must be supported by advanced technological applications such as smart packaging and biosensors. Bioactive systems and their applications must be monitored for safety, stability, and functionality to ensure applicability and uniformity of use [5,6].

2. An Overview of Published Articles

This Special Issue focuses on new perspectives in food safety from a microbiological standpoint. The use of biopreservatives to counteract the growth of pathogens and spoilage microorganisms are extensively explored. Natural substances such as bovine colostrum, which is naturally rich in antimicrobial and antioxidant compounds, are shown to be active against *Listeria monocytogenes* in rabbit meat (Contribution 1).

Polyphenol-rich substances are natural compounds known for their antioxidant, anti-tumor and anti-inflammatory, and antimicrobial properties. Calvo et al. tested an extract of white Albariño grape pomace to inhibit the growth of pathogenic bacteria after simulated in vitro digestion. During gastric and intestinal digestion, many of the molecules present in the extract decreased due to degradation or dilution, although some remained in the soluble fraction. Before digestion, the extract exhibited strong bactericidal activity at low concentrations, particularly against Gram-positive bacteria (*Staphylococcus aureus* and *L. monocytogenes*). After simulated digestion, antimicrobial activity was maintained or even enhanced against certain bacteria, especially Gram-negative species in the intestinal phase, suggesting that digestion may increase the bioavailability of some compounds at the microbial level (Contribution 2).

Furthermore, the in vitro antibacterial activity of polyphenolic extracts obtained from mango (*Mangifera indica*) processing by-products was evaluated against food spoilage-associated and pathogenic bacteria. The study suggests that the observed antibacterial activity may result from synergistic effects among multiple compounds or from other co-extracted substances, such as carotenoids (Contribution 3). Of further particular interest is the use of fermentation with lactic acid bacteria (LAB) to enhance the biochemical, antioxidant, and antimicrobial properties of hemp (*Cannabis sativa* L.) seeds (Contribution 4).

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The studies included in this Special Issue address not only antibacterial but also antifungal activity. Karpiński et al. analyzed the activity of 21 plant-derived organic acids against various bacterial and fungal food pathogens, also assessing their potential safety based on predicted toxicity. Many plant organic acids showed good antibacterial activity, but only a few were effective at concentrations that do not pose potential health risks. Antifungal activity was generally weaker and required higher concentrations (Contribution 5).

Fungal contamination originating from the farming environment was detected on duck eggs. Some of these fungi, particularly those belonging to the genus *Aspergillus*, pose a risk to both animal and human health, especially due to their resistance to antifungal agents (Contribution 6). The presence of phytopathogenic fungi (*Botrytis cinerea* and *Fusarium oxysporum*) leads to crop rot and significant losses. In the study presented by Pérez-López et al., the woody fungus *Pycnoporus sanguineus* was used to inhibit these pathogens. This approach contributes to the development of biological control strategies for crop protection, offering alternatives or complements to chemical fungicides (Contribution 7).

The growing interest in bioactive compounds of natural origin is challenged by several technical and practical issues, including compositional variability, extract stability during processing and storage, and interactions with food matrices that may limit efficacy. To address these limitations, innovative technologies are being developed, such as nanoencapsulation to improve compound stability and controlled release, complexation with polysaccharides, and advanced extraction methods (Contribution 8).

Innovative technologies are also increasingly important in food packaging to enhance both food safety and material performance. Kraśniewska et al. combined silver nanoparticles (AgNPs), known for their antibacterial activity, with biopolymers to develop packaging materials with improved antibacterial and physical properties (Contribution 9). Another study proposes an antifungal packaging material based on pectin and gelatin, incorporating bioactive extracts from *Azadirachta indica* (neem), to extend the post-harvest shelf life of papaya (*Carica papaya* L.) and counteract spoilage-causing fungi (Contribution 10).

To improve food safety, the development of novel molecular diagnostic tools is essential for implementing surveillance programs in livestock farms, enabling faster and more accurate detection, and thus improving public health (Contribution 11). To accelerate the evaluation of microbial food quality, Terrones-Fernandez et al. propose an alternative to autoclaving for sterilizing microbiological culture media, thereby reducing preparation time (Contribution 12).

Finally, alongside new technical strategies aimed at protecting the food chain from intentional contamination, there is a growing need to update regulatory frameworks. Traditional food safety systems should be integrated with specific approaches targeting malicious threats, supported by more coherent regulations and effective operational strategies to ensure global food chain protection (Contribution 13).

3. Conclusions

This Special Issue provides a comprehensive overview of current approaches aimed at inhibiting pathogens, spoilage bacteria, and fungi responsible for food contamination. The collected studies underscore the urgent need to move beyond conventional methods and to develop innovative and sustainable strategies. Despite the significant challenges that remain, ongoing research efforts offer promising perspectives for overcoming these limitations and for improving food quality, safety, and shelf life in the future.

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