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THE ROLE OF MICROORGANISMS IN FOOD SAFETY AND PRESERVATION

Mousumi Acharjee, Mahabuba Islam Mitu*

Microbio Medicare Diagnostic Centre, Habiganj, Independent Researcher, Bangladesh.

ABSTRACT: Microorganisms act as both food spoilage and disease causing agents in food system as well as necessary tools for food preservation and safety. Disease-causing microorganisms, such as Salmonella, Listeria, and Escherichia coli are the primary culprits of foodborne illnesses and spoilage; ultra-cleanliness and constant vigilance are required from farm-to-table to minimize the risk. On the other hand, beneficial microorganisms such as lactic acid bacteria and yeasts are essential components of fermentation process causing enrichment of nutritional value and inhibition of the growth of pathogens. This review focuses on the dual roles of microorganisms in food safety and on the microbiota of fermented foods, including concerns related to food spoilage, food spoilage mechanisms, with emphasis on microbial spoilage of foods, current control approaches, as well as non-specific and specific molecular methods detecting food spoilage, microbial risk analysis, biotechnological application of beneficial microorganisms and novelty, and creativity to concern on harmful microorganisms.

KEYWORDS: Microbes, Food Safety, Fermentation, Spoilage, Preservation.

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Corresponding Author: Mahabuba Islam Mitu*

Microbio Medicare Diagnostic Centre, Habiganj, Independent Researcher, Bangladesh.

Email Address: Mahabubaislammitu@gmail.com

1. INTRODUCTION

Micro-organisms have a dual role in the food system of importance: They are the source of Contamination and disease, but also important tools for food preservation and safety. On the Other hand, pathogenic microorganisms, such as Salmonella spp., Listeria monocytogenes, and Escherichia coli, are some of the major causes of foodborne diseases and spoilage and are responsible for posing

a significant threat to public health and the global food supply (Scallan et al., 2011; Gurtler et al., 2014). Potentially contaminated at any stage of the process from Production through consumption, strict hygienic considerations and surveillance are required to Prevent potential outbreaks (World Health Organisation [WHO], 2022). As a contrast, there are also non-pathogenic microorganisms, including lactic acid bacteria and Yeasts that play indispensable roles in fermentation of foods which have been used to enhance Food shelf-life, safety and nutritional value for millenniums (Marco et al., 2017). These Microorganisms are involved in the synthesis of antimicrobial substances, acidification, and Generation of probiotic metabolites which can inhibit the proliferation of spoilage and pathogenic Micro-organisms (Yadav et al., 2020).The latest discoveries in microbiological research have permitted the production of molecular tools for quick diagnosis, microbial risk management, and the implementation of control policies. Methods including polymerase chain reaction (PCR), next-generation sequencing (NGS) and biosensors contribute significantly to food safety diagnostics (Zhao et al., 2014). Furthermore, nowadays microbial biotechnology aids the development of novel preservation processes, including bacteriocins, protective cultures and biofilms, as sustainable and consumer-friendly substitutes of chemical preservatives (De Vuyst & Leroy, 2020).

2. CONCLUSION

Microorganisms have two dynamic and opposing functions with regard to the food system, being a threat to safety and quality when pathogenic and a natural source of sustainable solutions when beneficial. This review demonstrates that even though infectious organisms (Salmonella, Listeria and E. coli) still pose threats to public health, their counter-part the beneficial microbes, in the form of LAB and yeasts are indispensable in food fermentation and preservation. With modern molecular detection methods and biopreservation options, our capacity to detect, trace and control microbial hazards in food has improved significantly.There is, however, a substantial knowledge gap in the transfer and application of these advancements to various food system in different settings, particularly low resource environments. Future work would need to concentrate on the production of economical, scalable,strain-specific microbial interventions that simultaneously optimize food safety, nutritional quality, and consumer acceptance. Interdisciplinary cooperation of microbiologists, food technologists, public health officials and politicians will be essential for maintaining this balance.An integrated approach of the knowledge of microbial functions not only for food safety and preservation to minimize food-borne diseases, but also for the sustainable and healthy food system in the long run.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

No animals or humans were used for the studies that are based on this research.

CONSENT FOR PUBLICATION

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CONFLICT OF INTEREST

The authors declare that they have no known financial or personal conflicts of interest that could have appeared to influence the work reported in this paper.

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