Mini Review
Volume 14:02, 2024

Journal of Bioprocessing & Biotechniques

ISSN: 2155-9821 Open Access

LAB Antagonistic Activities and their Importance in Food Biotechnology: Molecular Mechanisms, Food Targets and Other Related Traits of Interest

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Abstract

Lactic Acid Bacteria (LAB) play a crucial role in food biotechnology, primarily due to their antagonistic activities against pathogenic and spoilage microorganisms. These activities are attributed to various molecular mechanisms, which make LAB important in enhancing food safety, extending shelf life, and improving the quality of fermented foods. This article discusses the molecular mechanisms, food targets, and other related traits of interest associated with LAB antagonistic activities in food biotechnology.

Keywords: Bioprocessing techniques • Microorganisms • Biological catalysts

Introduction

LAB is a group of bacteria that produce lactic acid as the major end-product of carbohydrate fermentation. They are widely used in food fermentation processes due to their beneficial effects on food quality and safety. One of the key characteristics of LAB is their antagonistic activities against other microorganisms, which can be exploited in food biotechnology. The antagonistic activities of LAB are mediated by various molecular mechanisms. One of the primary mechanisms is the production of organic acids, particularly lactic acid, which lowers the pH of the environment and inhibits the growth of pathogenic and spoilage microorganisms. LAB also produces antimicrobial compounds such as bacteriocins, which are proteinaceous toxins that can specifically target and kill other bacteria. Furthermore, LAB can compete for nutrients and adhesion sites, preventing the colonization of harmful microorganisms. LAB antagonistic activities are targeted towards a wide range of foodborne pathogens and spoilage microorganisms. Some of the common pathogens inhibited by LAB include Listeria monocytogenes, Salmonella spp., and Escherichia coli. LAB is also effective against spoilage organisms such as yeasts and molds, which can degrade food quality and lead to food spoilage [1,2].

Literature Review

In addition to their antagonistic activities, LAB possesses other traits that are of interest in food biotechnology. LAB is known to produce Exopolysaccharides (EPS), which can improve the texture and mouthfeel of fermented foods. They also contribute to the flavor and aroma of fermented foods through the production of volatile compounds. Furthermore, LAB is involved in the degradation of antinutritional factors, making certain foods more nutritious and digestible. In the realm of food biotechnology, the exploration of antagonistic activities holds significant promise and importance. Antagonistic activities refer to the inhibition or suppression of undesirable microorganisms or processes by beneficial microorganisms or bioactive compounds. This article delves into the molecular mechanisms underlying antagonistic activities, their targets in food matrices, and their broader implications in food biotechnology [3,4].

Discussion

The antagonistic activities of LAB have several applications in food biotechnology. LAB is commonly used as starter cultures in the fermentation of dairy products, meat products, and vegetables, where they help improve shelf life and safety. LAB is also used as probiotics, providing health benefits to consumers by improving gut health and immune function. Additionally, LAB antagonistic activities are utilized in the development of biocontrol agents for food preservation, offering a natural alternative to chemical preservatives. Antagonistic activities in food biotechnology primarily operate through various molecular mechanisms. One of the prominent mechanisms is the production of antimicrobial compounds by beneficial microorganisms. For instance, Lactic Acid Bacteria (LAB) are known for their ability to produce organic acids, hydrogen peroxide, and bacteriocins, which inhibit the growth of spoilage and pathogenic bacteria in food matrices. Moreover, competition for nutrients and adhesion sites is another crucial mechanism employed by beneficial microorganisms to antagonize undesirable counterparts. By outcompeting harmful microorganisms for essential nutrients and binding sites on food surfaces, beneficial microbes can limit their proliferation and spoilage potential. Furthermore, some beneficial microorganisms exhibit quorum sensing interference, disrupting the communication systems of pathogenic bacteria and impeding their virulence and biofilm formation. These intricate molecular mechanisms collectively contribute to the antagonistic activities observed in food biotechnology [5,6].

Conclusion

LAB antagonistic activities play a crucial role in food biotechnology, contributing to food safety, shelf life extension, and quality improvement. The molecular mechanisms underlying LAB antagonistic activities, their food targets, and other related traits make them valuable in various food applications. Further research in this area could lead to the development of novel LAB-based solutions for enhancing food quality and safety. Moreover, antagonistic activities target undesirable enzymatic reactions and oxidative processes that contribute to food spoilage and degradation. By modulating enzymatic activities and scavenging reactive oxygen species, beneficial microorganisms and bioactive compounds preserve the sensory attributes and nutritional value of food products. Antagonistic activities play a pivotal role in food biotechnology, offering effective strategies for preserving the safety, quality, and nutritional value of food products. Understanding the molecular mechanisms underlying antagonistic activities, their targets in food matrices, and their broader

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Received: 02 March, 2024, Manuscript No. jbpbt-24-133648; **Editor Assigned**: 04 March, 2024, PreQC No. P-133648; **Reviewed**: 15 March, 2024, QC No. Q-133648; **Revised**: 20 March, 2024, Manuscript No. R-133648; **Published**: 27 March, 2024, DOI: 10.37421/2155-9821.2024.14.606

implications enables researchers and food technologists to harness their potential for developing innovative solutions in food preservation and functional foods. By capitalizing on the synergies between beneficial microorganisms and bioactive compounds, the integration of antagonistic activities into food biotechnology holds promise for addressing contemporary challenges in food safety, security, and sustainability.

Acknowledgement

None.

Conflict of Interest

There is no conflict of interest by author.

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How to cite this article: Spano, Radjaa. "LAB Antagonistic Activities and their Importance in Food Biotechnology: Molecular Mechanisms, Food Targets and Other Related Traits of Interest." *J Bioprocess Biotech* 14 (2024): 606.