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Perspective

Strategies to Minimize Biogenic Amines in Mexican Fermented Foods

Kim Elez*

Department of Food Fermentation, University of Lleida-Agrotecnio CERCA Center, Lleida, Spain

DESCRIPTION

Fermented foods have been an integral part of human diets across various cultures for centuries. In Mexico, traditional fermented foods such as pozol, pulque, and tejuino are not just food delights but also rich sources of beneficial microorganisms, particularly Lactic Acid Bacteria (LAB). LAB plays an essential role in the fermentation process, contributing to the flavor, texture, and safety of the food. However, the production of Biogenic Amines (BAs) by these bacteria under stress conditions poses significant health concerns. This object explores into the effects of stress factors on the production of biogenic amines by lactic acid bacteria isolated from fermented Mexican foods, exploring the underlying mechanisms and potential implications.

Understanding biogenic amines and their significance

Biogenic amines are nitrogenous compounds formed primarily through the decarboxylation of amino acids. Common BAs include histamine, tyramine, putrescine, and cadaverine. While they are naturally present in many fermented foods, their excessive intake can lead to adverse health effects such as headaches, hypertension, and allergic reactions. The presence and concentration of these amines in food are influenced by various factors, including the types of microorganisms involved, the raw materials, and the conditions during fermentation and storage.

Lactic acid bacteria in mexican fermented foods

Lactic acid bacteria are a diverse group of Gram-positive bacteria that are crucial in the fermentation of foods. In Mexican cuisine, LAB is found in numerous traditional fermented foods. For example, *Lactobacillus plantarum*, *Lactobacillus brevis* , and *Pediococcus acidilactici* are commonly isolated from tejuino, pozol, and pulque. These bacteria are known for their ability to produce lactic acid, which helps preserve the food and imparts a distinctive sour taste.

Stress factors affecting LAB and BA production

Several stress factors can influence the metabolic activities of LAB, including temperature, pH, salt concentration, and the presence of oxygen. These factors not only affect the growth and survival of LAB but also their ability to produce biogenic amines.

Salt concentration: Salt is commonly used in fermented foods to enhance flavor and inhibit undesirable microorganisms. However, high salt concentrations can impose osmotic stress on LAB. This stress can trigger the bacteria to produce more biogenic amines as a protective mechanism. Therefore, controlling salt levels during fermentation is essential to balance microbial growth and BA production.

Oxygen availability: Most LAB is facultative anaerobes, meaning they can grow in both the presence and absence of oxygen. However, oxygen levels can affect their metabolic pathways. Under aerobic conditions, the oxidative deamination of amino acids can increase, leading to higher BA levels. Maintaining anaerobic conditions during fermentation can help control BA production.

Mechanisms of BA Production by LAB

The production of biogenic amines by LAB involves specific enzymes, primarily decarboxylases. These enzymes convert amino acids into their corresponding amines. For instance, histidine decarboxylase converts histidine into histamine, while tyrosine decarboxylase converts tyrosine into tyramine. The expression of these decarboxylases can be induced by stress conditions, as part of the bacteria's adaptive response to environmental changes. Given the health risks associated with high levels of biogenic amines, it is crucial to develop strategies to minimize their production in fermented foods. Some potential approaches include:

Starter cultures: Using carefully selected starter cultures of LAB that have low decarboxylase activity can help reduce BA levels in

Correspondence to: Kim Elez, Department of Food Fermentation, University of Lleida-Agrotecnio CERCA Center, Lleida, Spain, E-mail: kimelez45@gmail.com

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fermented foods. These cultures can out compete indigenous bacteria that might produce higher amounts of bas.

Optimizing fermentation conditions: Maintaining optimal temperature, pH, and salt concentration during fermentation can help control the stress factors that lead to increased BA production.

Enzyme inhibitors: Incorporating natural or synthetic inhibitors of decarboxylase enzymes can prevent the formation of biogenic amines. However, this approach requires careful consideration to avoid affecting the overall quality of the fermented food.

Modified atmosphere packaging: Reducing oxygen levels during the packaging and storage of fermented foods can limit the oxidative pathways that contribute to BA production.

The production of biogenic amines by lactic acid bacteria in fermented Mexican foods is influenced by various stress factors. Understanding these factors and their impact on microbial metabolism is essential for ensuring the safety and quality of these traditional foods. By implementing targeted strategies to control BA production, it is possible to enjoy the benefits of fermented foods while minimizing health risks. Continued research and innovation in fermentation technology will be key to achieving this balance, preserving the rich food heritage of Mexican cuisine.