



FROM SOUR TO SCIENCE: THE ROLE OF LACTIC ACID BACTERIA IN FOOD PROCESSING

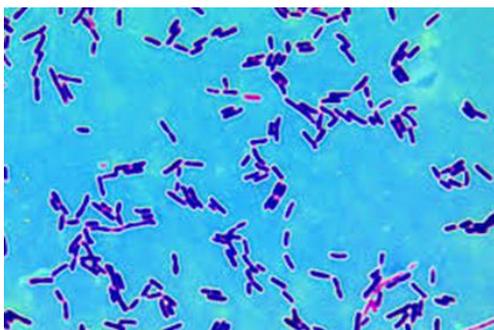
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INTRODUCTION

Lactic Acid Bacteria are a group of friendly bacteria that produce lactic acid as their major metabolic end product of carbohydrate fermentation. They are Gram-positive, non-motile, catalase-negative microbes that grow best in nutrient-rich, low-oxygen conditions. They tolerate acidity well because they produce lactic acid during fermentation. Lactic acid bacteria though they are invisible to our naked eyes, are tiny champions behind food's silent transformations. From sweet yogurts to spicy kimchi these little alchemists not only flavor our food but also preserve them and boost our health in surprising ways.



WHAT LACTIC ACID BACTERIA REALLY DO??

The function of LAB is very crucial in food processing. Even though they seem tiny, their impact on food is massive.

They keep our food safe

The LAB through their metabolism produce lactic acid, which lowers the pH of the food and inhibits the growth of spoilage microorganisms.

They also produce natural protective agents like bacteriocins which further prevents the growth of other organisms.

They add flavor and texture

During fermentation, they not only produce lactic acid but other metabolites like organic acids, esters, aldehydes and exopolysaccharides which contribute to the unique texture and flavor in food. The fluffy dosa batter, the soft creamy cheese etc are its examples.

They enrich nutritional value of food

LAB not just keep our food safe and improve its taste but they also act as pre-digesters which help in the breakdown of complex carbohydrates and proteins into simpler forms. Certain LAB strains can naturally enrich fermented foods by synthesis of B group vitamins especially folic acid, riboflavin, and cobalamin. Wonders of our tiny hero doesn't end with this.

Even some strains of LAB are considered as probiotics, meaning they improve gut health by balancing gut microbes and improves digestion. Yogurt, fermented buttermilk, pickles, traditional fermented rice water etc are good source of probiotics. Lactic acid bacteria also reduces the activity of anti-nutrients like phytates and oxalates.

DIVERSE FOOD PRODUCTS AND LAB ACTIVITY

The use of the lactic acid bacteria in food processing dates back to thousands of years, even before we knew about them.

From grandma's kitchen to modern cuisines Lactic acid bacteria is used worldwide for delicious revolution in food industry. Some of the many known food products associated with lactic acid bacteria are listed below:

(i) Dairy products

(a) Yogurt /curd: it is dairy product made by fermenting milk using *Lactobacillus bulgaricus* and *Streptococcus thermophilus*.



(b) Buttermilk: it is a fermented dairy drink produced especially using *Lactobacillus bulgaricus*.



(c) Cheese: cheese is a type of dairy product produced by coagulation of milk protein using lactic starters.



(d) Kefir: It is a fermented beverage with low alcohol content, acidic and bubbly from the fermentation carbonation of kefir grains with milk and water using *L. bulgaricus*.



(e) Tarhana: It is a traditional Turkish food made using fermented cereals, yogurts etc using *Lactis* bacteria.



(f) Kumiss: it is a traditional fermented dairy product made from mare milk using various LAB species.



(ii) Cereal and legume based fermented food

(a) Idli/dosa batter: They are made from fermented batter of rice and lentils with the help of *Leuconostoc mesenteroides* bacteria.



(b) **Sourdough bread:** It is a type of bread that uses the fermentation by naturally occurring yeast and lactobacillus bacteria.



(c) **Ogi:** It is a cereal pudding and popular street food from Nigeria. The fermentation of ogi is performed using *L. plantarum*, *L. lactis* and *Saccharomyces rouxii*.



(iii) fermented vegetable products

(a) **Vegetable pickles:** it is prepared with the help of edible acids, usually formed as a result of fermentation using organisms like *L. plantarum* and *P.cerevisiae*.



(b) **Kimchi:** It is a traditional Korean dish prepared with cabbage and Korean radish along with fermentation using LAB.



(c) **Sauerkraut:** It is a finely cut raw cabbage simple dish and is fermented by various lactic acid bacteria.



(d) **Poi:** It is a Hawaiian dish made from fermented root of taro.



(iv) fermented meat and fishery products

(a) Fermented sausages: It is prepared by microbial fermentation of comminuted meat and fat mixed with salt, spices and curing agents.



(b) Izushi: It is a traditional Japanese food which is made by lactic acid fermentation with fish, vegetables and rice in low temperature.



(c) Fermented fish: It is a type of food preservation where fish is preserved by natural fermentation process.

**(v) Beverages and related products**

(a) Fermented rice drink: it is a traditional beverage produced from fermented rice. It is known by different names in different regions.



(b) Palm wine: it is prepared by the fermentation of palm sap by microbes like lactics, yeasts and *Acetobacter* spp.



(c) Kombucha: it is a fermented black tea drink made using tea, sugar, various bacteria including lactic acid bacteria and yeast.

**Challenges associated with lab in food processing**

Despite their many benefits, LAB-based processes face certain challenges.

Different strains perform differently across food types, and many are sensitive to temperature, oxygen, and pH changes. Their limited shelf life and potential loss of beneficial traits during storage can affect their effectiveness. LAB may also be difficult to incorporate into modern or plant-based foods, and some strains raise safety or regulatory concerns.

Additionally, consumer acceptance of fermented flavors and technical issues in large-scale production add to the complexity. Overcoming these challenges is key to expanding their industrial applications.

CONCLUSION

Lactic acid bacteria have journeyed from being humble souring agents to scientifically recognized powerhouses in food processing. Their ability to ferment, preserve, enhance flavor, and promote health has made them essential to both traditional and modern food systems. Despite facing challenges like strain variability, sensitivity to environmental factors, and limited shelf life, ongoing research and technological advancements continue to unlock new possibilities for their use. Since people nowadays look for safe, healthy and toothsome foods, lactic acid bacteria are emerging as key players to shape the future of what we eat

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