

Microorganisms in Food

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SUMMARY

Since hundreds of years ago, microorganisms, mainly bacteria and fungi, have benefited humans by producing food, medicines, and other high-value chemical compounds. Molds and yeast are effective microorganisms that contribute significantly to the enhancement of the flavor and essence of various foods or their constituents. Microorganisms are now widely used in the food business to produce chocolate, food coloring, preserve fruits, vegetables, and meat, as well as probiotics that are good for human health. One of these bacteria is *Lactobacilli*, which are used in the manufacturing of food because they ferment lactic acid. In the preparation or processing of certain foods, microbial enzymes are also significant such as microbial transglutaminase for the synthesis of fish. Different types of food fermentation are carried out in the food industry by a variety of microorganisms or microbial enzymes. Microorganisms for their diverse functions in the preparation of food, fermentation, and many other advantageous processes that help to secure human food security in the present period. This article has covered the various functions of microbe in some food product.

INTRODUCTION

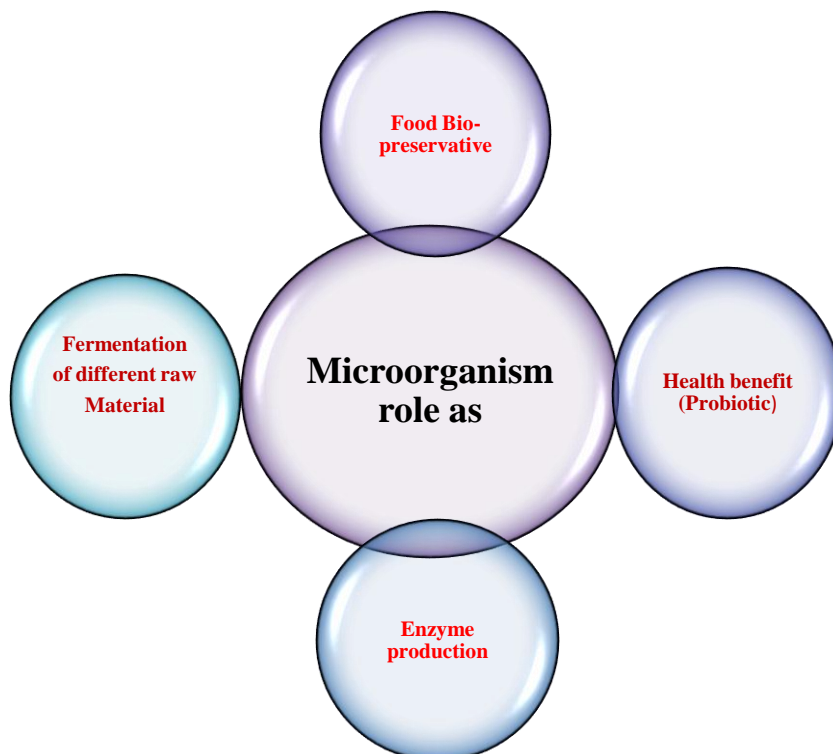
Microbes were unknown to humans for thousands of years. Microorganisms in food have either confronted or benefited human civilization since ancient times. Across 8000 B.C., ancient human civilization discovered agriculture and animal husbandry, which resulted in an abundance of food, their storage, prevention of spoilage, and preservation became important tasks. Our ancestors used ice and fire to freeze and sterilize food. Preservation techniques, including sun-drying, salting, freezing, smoking, sugaring, and cooking known since ancient times. The correlation between food and microorganisms were not known until the 1800s. Louis Pasteur was the first to recognize and understand the presence and purpose of microbes in food in 1837. In 1860, he used heat for the first time to destroy undesirable organisms in wine and beer and this process is known as pasteurization. Pasteur demonstrated that microorganisms are responsible of the chemical alterations that occur in foods and beverages. Microbes not only add flavor, texture, and aroma to foods, but they also produce inhibitory compounds that help to prevent food spoilage, increasing food storage and safety.



Molds, yeast, and bacteria are the three types of microorganisms that can be found in food. Molds are generally associated with food spoilage; their use in the food industry is limited (e.g., mold-ripened cheese). Yeast has ability to ferment sugars into ethanol and carbon dioxide and most widely used microorganisms in the food industry. Some yeasts, such as baker's yeasts, are grown commercially, and others may be used as protein sources, primarily in animal feed. For centuries, most microorganisms, including bacteria and fungi, have been used to produce food, antibiotics, and other products. Recently, the use of microorganisms on a large scale in the food industry has begun for the production of chocolate, food colour, preserving fruits, vegetables, and meat. Food production, storage, and consumption all rely greatly on microbes. This article has discussed the function of various types of microbes in food processing.

Microorganisms' Function in the Fermentation and/or in bio preservative

Fermented foods are made using a variety of plant and animal-based raw components viz., Meat, fish, eggs, vegetables and vegetable juices, fruits and fruit juices, cereal grains, lentils, beans, and seeds (Ray, 2004) . The shelf life of fermented foods is increased in addition to their excellent nutritional content. Foods that have undergone fermentation not only have anticancer (Restuccia et al., 2006) and anticholesterol effects, but they also lower nitrite levels [Murooka and Yamshita, 2008; Swain et al., 2014). To extend the shelf life of the food, advance technological large-scale food production frequently makes use of a number of artificial or chemical food preservatives. These involve using substances such as nitrites, sulfites, and ethyl formates, among others. Some of these chemicals are linked to various types of food allergies and may have harmful effects on human health. Due to these limitations, bio preservatives with microbial origin have been developed and are now being looked out. By using microbes and its metabolites, bio preservation refers to extending the shelf life and enhancing the safety of food. It is a procedure that depends on the bioactivity of microbes to produce a variety of metabolites that can prevent the survival and proliferation of harmful microflora in foods.



Lactobacilli are one type of bacteria that are used in food production because they ferment lactic acid. In order to prevent the spread of pathogenic *Listeria*, uncooked fermented sausages and meats are frequently stored with lactobacilli. According to the Food and Drug Administration, certain exopolysaccharides can be produced by lactic acid-producing bacteria like *Wiessella* spp. and *Limosilactobacillus* spp., *Leuconostoc* spp. and *Lactobacillus* spp. create a homopolysaccharide known as -glucans that is commonly utilized in the baking industry to enhance the softness and texture of baked goods like breads. Traditional food preparation methods use lactobacilli to enhance flavor and texture while stopping the decay of dairy foods, meat, and vegetables. The different types of microorganisms in various food product have been mentioned in Table 1.

Microbes as a source of enzyme

Today, a wide variety of enzymes from bacterial, yeast, and molds sources as well as from plant and mammalian sources are employed to convert foods and food ingredients. Examples include the synthesis of high-fructose corn syrups, the extraction of juice from fruits and vegetables, and the improvement of cheese flavour. An enzyme called transglutaminase is responsible for catalysing acyl-transfer reactions between proteins, peptides, and amines. Fish products, such as Japanese fish paste, frequently use transglutaminases. Additionally, the transglutaminase-treated fish paste had superior texture. When a coat of transglutaminase is applied to vegetables and fruits, transglutaminase can also help keep them fresh. Microbial transglutaminase is employed as a preservative in addition to enhancing the quality of dough's manufactured using substandard flour, which enhances bread baking and texture.

Microorganisms as Probiotic

Probiotics were initially mentioned by Lilly and Stillwell in 1965. The term "probiotic" comes from the Greek phrase meaning "for life," and in the field of microbiology, it refers to living microorganisms that offer advantages to human health that cannot be obtained by regular diet. Probiotics are known to be produced by the microorganisms found in the GI tract and are believed to promote good health. The most of probiotics are *Lactobacillus* and *Bifidobacterium* species, but some *E. coli* and *Bacillus* species as well as the yeast *Saccharomyces cerevisiae* are also used. While *Lactobacillus* and *Streptococcus* species produce yoghurt, it is known as a naturally occurring source of probiotics. The probiotics in food products contribute to the nutritional value and flavor of the food while also preserving milk products through the production of lactic acid. The phytochemicals, fiber, and antioxidants in these foods lower the risk of cell damage and improve consumer health. The food, pharmaceutical, and dietary supplement industries are currently very interested in probiotics.

Table 1: Microbes used in foods

Food	Microorganism
Cheese	<i>Leuconostoc</i> spp., <i>Propionibacter</i> spp., <i>Lactobacillus</i> spp., <i>Lactococcus</i> spp., <i>Propionibacter</i> spp.
Coffee	<i>Erwinia dissolvens</i>
Wine, Beer	<i>Saccharomyces cerevisiae</i>
Yogurt	<i>Lactobacillus bulgaricus</i> , <i>Streptococcus thermophilus</i>
Bread	<i>Saccharomyces cerevisiae</i>
Butter	<i>Streptococcus</i> spp., <i>Leuconostoc</i> spp.
Pickles	<i>Leuconostoc mesenteroides</i>
Sausages	<i>Pediococcus</i> spp., <i>Lactobacillus</i> spp.
Vegetables	<i>Enterococcus</i> , <i>Lactococcus</i> (<i>cremoris</i> , <i>lactis</i>), <i>Lactobacillus</i> (<i>plantarum</i> , <i>casei</i>)
Kefir	<i>Lactococci</i> , <i>Saccharomyces kefir</i> , <i>Torula kefir</i>
Chocolate	<i>Saccharomyces cerevisiae</i> , <i>Candida rugosa</i>
Olives	<i>Candida</i> spp., <i>Cryptococcus</i> spp., <i>Lactobacillus</i> spp., <i>Saccharomyces</i> spp.
Soy Sauce	<i>Aspergillus oryzae</i>

Swiss-type cheese	<i>Lactobacillus (delbruckii, bulgaricus)</i>
Fish	<i>Carnobacterium (piscicola, divergens)</i>
Sauerkraut	<i>Coliform spp., Leuconostoc plantarum,</i>

CONCLUSION

Microorganisms play important role in food industry to improve food quality and its shelf life. The majority of bacteria are used in food preservation. A number of meat and meat products are preserved using the lactic acid that the lactic acid bacteria generate. Additionally, these microbes produce transglutaminase, an essential enzyme for the preservation of fish products. In addition to being hazardous, the microbes found in food can also be helpful and give humans access to essential goods. The food business is also greatly benefited by the use of microbial enzymes. In the food sector, various food fermentations are conducted. Various food processing technologies can protect foods from any form of harm. Since the ancient period, humans have had to coexist with these amazing creatures. Humans cannot ignore these organisms in the future either.

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