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Determination of Traditional and Biologically Viable Methods for Food Preservation: A Review

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Abstract: This review summarizes the nature, types and biological viable methods of food preservation and their applications as health aspect. The study of traditional quality of food preservation are summarized. The bio preservation of kind and their technique of activity are completed. Food preservations are drying, freezing, sugaring, pickling, canning, smoking, curing and fermentations are the traditional methods. Fermentation is a technique uses microorganism which to preserve food and a conversion food processing of carbohydrate to alcohol and carbon dioxide which using yeast, bacteria, and combination under anaerobic conditions. Lactic acid bacteria and yeasts are the major group of microorganisms associated with traditional fermented foods. The main food protective duty promised a number of criteria like acceptable low toxicity, stability to processing and storage, efficacy at less concentration, no deleterious effect on the food and economic viability. It is also aimed with regard to protective and dominance of growth of spoilage microbials and bacteria including fungi and yeasts and also decreasing the unpleasant smell due to oxidation of lipids. It is also a selected in direction of decreasing of stain of food products by enzymatic browning which present through tout preparation of processed food products. Micro-organisms are preserved microbial pathogens in an environment toxic for themselves and other micro-organisms by producing acid. LAB and yeasts are the important organization of microorganisms related to traditional fermented foods. The present article discusses on the traditional, biologically and ecologically viable methods for food product preservation that is obtaining application in food processing industries.

Keywords: Biological, Microorganisms, Bio-Preservative, Bacteriocin, LAB, Fermentation

1. Introduction

Foods are a substance that are consumed for nutritional and health purposes. It has been a plant and animal source which contains proximate composition, minerals, and other organic substances. It is a susceptible to different form of degraded by oxygen available in the atmosphere, microbial factor, enzymatic reaction and the others, being especial to investigate new systems of preserving food. It is also undergone spoilage due to microbiological factor, chemical and physical action [1]. However, the foods are requirements to preserved to keep their quality for a longer time. The basic problem of getting food has always been followed by the problem of a satisfactory method for preserving it for later consumption. The basic traditional methods of food preservation-drying, curing, pickling, uses of sugar/salt, and different combinations have a lack of application. The modern methods of food preservations are freezing, freeze drying, and irradiating, have been however, make possible the preservation of nearly all foods. The basics and advancements of various trivial and modern food preservation method, that are attributed to impede food spoilage and to yield longer shelf life, are discussed with their mechanisms, application manner, merit, and demerits. In general, the preservation processes consist of a combination of mild heat stress and low concentration of chemical preservatives to control food spoilage and the outgrowth of pathogenic spore-forming bacteria, as well as retard the oxidation of fat that causes rancidity [16]. The bio preservatives are the most option derived from natural sources to preserve and increases the protecting safety of food and good suitable for food application with increasing demand of consumers for chemical free food products. To enlarge the shelf life of food products by uses of natural

controlled microorganism and antimicrobial compounds gotten from microbes is called to as bio-preservation. The food preservation controls are, the food by reducing the pH value, changing water activity and settling the redox potential of the product [32]. The major selected microorganism for bio-preservation are lactic acid bacteria and their metabolites. The functional food products along with natural raw materials promoting health instead of synthetic additives have been strongly launched by the food product industry. During the last decade, the food industries are looking for new natural bio-preservation which could be promoted human health besides acting as food preservatives [4]. Thus, the overview and core objective of this review is to provide insights in to the researchers, technologists, and industry managements a comprehensive understanding which could be highly useful to develop effective and integrated food preservative methods and to ensure food safety.

1.1. Traditional Food Preservation Methods

1.1.1. Drying

Drying is the oldest means of hampering the decomposition of food products [5]. The aim of drying is to getting a solid product with low water content [27]. Many microorganisms could grow at water activity above 0.95. According to [20] stated, most of the microorganisms couldn't grow at water activity below 0.88. Most of drying has advantages which, reduces weight and volume of foods, facilitates foods storage, packaging, and transportation, and also provides different favors and smells [2]. Nevertheless, these methods also have limitations. After during some important organoleptic are lost. During drying, some functional compound components such as vitamin C, Protein, fat and thiamine are lost [31].

1.1.2. Freezing

Freezing is the slow down temperature and inhibits the growth deteriorative, chemical reaction, cellular metabolic response in hindered, and pathogenic microbial in food product [12]. Not like other methods, freezing preserves food's taste, texture, and nutritional content. The heat transfer during freezing of a food item involves a complex situation of simultaneous phase transition and alteration of thermal properties and cases little damage to cell structure of food. Shorter freezing period of time protects the diffusion of sugar and prevents decomposition of foods during freezing [3].

1.1.3. Sugaring

Sugaring is used in many food products to prevent the growth of unwanted microorganisms. It has inhibition which attributed to reducing the water activities as sugar draws moisture from tissues. The sugar formed and provides a medium for the growth of lactic acid bacteria, that are responsible for the fermentation process. The plasmolysis of cells may available, because of the higher osmotic pressure caused by sugars [22].

1.1.4. Pickling

Pickling is also the oldest method of preserving food in an edible anti-microbial. The chemical process of pickling methods is put the food product in an edible liquid which prevent bacteria and other microorganisms. Kindly the pickling agents like the salt, citric acid, vinegar, alcohol, and vegetable oil, particular olive oil, but also many other oils. According to the [19], the microorganism safety of fruits and vegetables, preservative method including major preservative factors used in pickling technology. The fruits and vegetables could be contaminated with pathogenic microorganisms from various sources. In the pickling food products, acid, salt, and heating are main factors which contribute to food preservation and these factors are applied in combination. Therefore, found the combination effects of main factors is important to the correct application of preservation factors which can be increases the microorganism safety and total quality of pickled food products.

1.1.5. Canning

The canning process involves placing food, sealing it in sterile cans, and heating the containers to inhibiting any remaining bacteria as a form of sterilization. Canning as a processing and preservation method offers a unique advantage of preservation food of the sensory attributes of the fermented product, with the added elongation of the shelf life. Canning is a type of food preservation that was established with a combination of processes, such as heating, and cooling. Canning prevents the growth of microorganisms and inhibits the activity of enzymes. First, the raw materials must be properly treated because some foods, particularly fish, contain dangerous microorganisms such as Clostridium botulinum, which can be death.

1.1.6. Smoking

Smoking is one of the old methods of food preservation which to provide better sensory acceptability to the foods to deactivate enzymes and to deliver an antimicrobial effect. Smoked food products are mainly stored on chilled conditions, but they have a problem product when compared to dried and frozen food product. The shelf life of food items perishable by exposing them to smoked of the burning plant materials such as wood. The smoked is a number of pyrolysis food into the product, contain the phenols, syringol, guaiacol, [23] these volatile phenolic compound's help in dying and preservation of the food.

1.1.7. Curing

The biggest form of curing was removing. always salt to add to speed up this process. In the part of world, it was a main to option raw salts from different origin (rock salt, sea salt, etc.) [26]. The modern instance of salts which are used as preservatives like sodium chloride, sodium nitrate, and sodium nitrite. Even at high concentrations sodium chloride (that is present in many food products) is capable of neutralizing the antimicrobial character of natural compounds [23].

1.2. Fermentation

Fermentation is a method uses microorganism which to

preserve food. It is a conversion food processing of carbohydrate to alcohol and carbon dioxide which using yeast, bacteria, and combination under anaerobic conditions Microorganism such as bacteria, yeasts, molds are the main groups of microbial that is involved in the fermentation of a wide range of food items, like dairy products, cereal- based foods, and also meat products [6]. The fermentation increases the nutritional value, healthfulness, and highly digestibility of foods. These is the healthy optional to much toxic chemical preservatives Some micro-organisms preserve microbial pathogens in an environment toxic for themselves and other micro-organisms by producing acid. Starter micro-organisms, salt, hops, controlled temperatures, controlled levels of oxygen and other methods are used to create the specific controlled conditions that will help the desirable organisms that produce food fit for human consumption. Equally, the resistance of some microorganisms to most commonly used preservatives has created problems for the food industry. In particular, modern consumer trends and food legislation have left the successful attainment of this objective to be more of a challenge. Firstly, consumers demand high quality, preservative-free, safe but minimally processed foods with extended shelf life. Secondly, legislation has restricted the use as well as the permitted levels of some of the currently approved preservatives in different foods. These consumer and legislative needs call for innovative approaches to preserve foods [13]. Much research has been carried out on the antimicrobial effect of heat in combination with modified environmental factors such as low water activity, pH and ultra-high pressure, but very little has been reported on the combination of physical treatments with natural antimicrobials [13, 17].

2. Bio-Preservation

The better alternative food preservation method, especially attention has been paid to bio preservation techniques, that extended the shelf-life and increases the hygienic quality, thereby minimizing the negative effect on the nutritional and sensory attribute. Bio preservation exploits the antimicrobial activities of some microorganisms to inhibit the growth of spoilage and pathogenic microbes in foods. This biological approach seeks to minimize the addition of chemical additives to foods, such as nitrite, sodium chloride, and organic acids [11, 25] Lactic acid bacteria (LAB) have been exploited for a decade production of fermented foods because of their capable to production good alter in the sensory attribute as well as prevent pathogenic microorganisms. Since they are distributed in many fermented foods product, it is supposed which most delegate actives of this group do not give rise to any health risk to man, and are appoint as generally recognized as safe organisms. The LAB, totally examine as food quality organisms, has a better promise as safety cultures. There are many prospective uses of safety cultures in different food systems [14]. A number of various factors have been associating to give to the antimicrobial activity of LAB. These bacteria generate various antimicrobials, like lactic acid, acetic acid, hydrogen peroxide, carbon dioxide and bacteriocins, that can prevent pathogenic microorganisms, lengthen the shelf-life and increasing the protective of food products [14].

2.1. Lactic Acid Bacteria as Bio-Preservative

Lactic Acid Bacteria (LAB) is a kind of Gram-positive bacteria connected to an associate of structural, metabolic and physiological characteristics. They are included in the group of non-spores forming, non-respiring cocci or rods, catalase-negative, devoid of cytochromes; non- aerobic but aero-tolerant, fastidious, acid tolerant and exactly fermentative with lactic acid as the significant end product during the fermentation of carbohydrates. They have been unique from grains, green plants, dairy and meat products, fermenting vegetables and mucosal surface of animals The enhancing demand for high quality protects, processed foods has created for natural food preservatives [18]. The main food protective duty promised a number of criteria like acceptable low toxicity, stability to processing and storage, efficacy at less concentration, no deleterious effect on the food and economic viability.

Table 1. *Classification and characteristics of bacteriocins.*

Class	Bacteriocins	Sources	Characteristics	Organism food contaminants	Reference
Class-I (Lantibiotics)	Nisin	Lactobacillus lactissubsp. Lacti	Heat stable at low pH (2), resistant to trypsin, elastase, pepsin, carboxypeptidase A and sensitive to α-chymotrypsin	Staphylococcus aureus, Bacillus cereus, Clostridium botulinum.	[21]
Class-II (Large heat labile)	1) Lacticin Pediocin PA-1 2) Enterocin 1071	Lactobacillus plantarum C11	Stable at neutral and acidic pH Stable at pH 4-6, lipase, catalase, lysozyme and phospholipase C Sensitive to treatment with proteolytic enzymes	L. monocytogenes, S. aureus and B. subtilis L. monocytogenes, Pediococcus pentosaceus, Lactobacillus	[29]
Class-III (Bacteriolysin)	1) Lytic Bacteriocin (Enterolysin A) 2) Non lytic heat labile Bacteriocin	Helveticin J of L. helveticus and Bc-48 of E. faecalis.	Causes cell damage by attacking peptidoglycan layer of cell wall in susceptible Gram-positive bacteria Hamper glucose uptake and strave the bacteria, hence depleting energy reserve causing cell death	Enterococcus faecalis, L. monocytogenes, L. innocua E. faecalis, Bacillus spp., Enterococcus spp S. aureus Streptococcus pyogenes	[24]
Class-IV (Circular peptides)	Enterocin AS-48	Enterocin AS-48	Compatible with several chemical compounds like EDTA, lactic acid, per acetic acid, phosphoric acid, sodium hypochlorite, hyrdrocinnamic acid	Bacillus spp., Geobacillus stearothermophilus, S. aureus, L. monocytogenes, Brocothrix thermosphacta.	[8]

2.2. Bacteriocins

Bacteriocins are secondary antimicrobial proteinaceous compounds that are kills to sensitive strains and are produced by both Gram-positive and Gram-negative bacteria [28]. Bacteriocin biological action appear through the certain receptors cited on the small microbial cell surface [34]. Bacteriocins are dangerous toxins, frequently specific and always produced during the exposition of some bacteria lineages to harmful conditions. When released in environment cause quick elimination of non-immune or non-resistant neighboring microbial cells to their action [33]. Antibiosis occurred when two or more microorganism occur in an environment can be interfere on the growth and survival of other ones [27]. Bacteriocins are powerful toxins, often specific and usually produced during the exposition of some bacteria lineages to stressful conditions. Bacteriocins are regular effective against Gram-positive bacteria situation to various genera and closely related species.

3. Application of Bio-Preservation

An importance of Bacteriocins for biological protection of food products; in totally, biological preservation approaches like attractive as a preservative parameter in foods with decreased contents of ingredients like salt, sugar, fat and acid that always provide as factors potentially inhibitory to microbial growth. It is expected that biological preservation technique might be enjoy desirable consumer acceptance than their preservation counterparts that use traditional chemical preservatives. many possible methods for the application of bacteriocins in the preservation of foods may be considered. The kinds of product and the intrinsic as well as extrinsic parameters existing during processing, storage and distribution will determine the especially approach of biological preservation required. In non-fermented refrigerated products, minimally processed meats, prepackaged vegetable salads, only those strains producing sufficient and potent amounts of bacteriocin but no other metabolic compounds, at levels detrimental to the sensory quality of the product, can be applied. Currently, the methods of processing and preservation of foods can be produced having an effect less than lethal injury, and in the presence of bacteriocin, the injured cells can be death [10]. The process of antibacterial organization of the two bacteriocins from LAB, has been expressed that they were much antibacterial in union than when they were used alone [15]. This examination has led to put forward the assumption of this higher antimicrobial bands of colour and can be used benefit to design efficient natural food bio preservative (s).

4. Factors That Inhibiting Bacteriocin Producing

Insufficient physical situation and chemical composition of food (pH, temperature, nutrients, etc.); (a) natural lost in producing amount; (b) producing the strain by phage of deactivation; (c) opposition effect of another microbial in foods product [7]. The usefulness of bacteriocin action in food is negatively affected by: (a) Resistance development of pathogens to the bacteriocin; (b) insufficient environmental situation for the living action; (c) Greater uses of the bacteriocin chemical reaction by food system components (e.g., fat); (d) deactivation by another additives; lower dissemination and dissolved and improper dispensation of bacteriocin chemical reaction in the meat matrix [30]. Many factors, such as the occur of salts, other food ingredients, poor dissolved and the irregular dispensation of the bacteriocin, have all indicated to affect the effectiveness of bacteriocins in food [9].

5. Conclusion

In principle of science, the most urgent problem is that there is still understanding of the efficacy of the utilize of traditional preservatives and naturally presenting antimicrobial biomolecules (biological, natural preservatives) in coexistence with other major components of food preservation system. The fermented food engages a important role in diet, human health and nutrition. The profit which are associated with fermentation are increased shelf life and able to continue for a long time, and nutritional value, Bacteriocins generated by LAB may become a potential drug candidate for replacing antibiotics so as to treat many drugs resistance pathogens in the future human health. An important of lactic acid bacteria for the food industry focus capability and authorization farther research particularly in Africa, so as to increase the works of LAB genetically adapt LAB is being produced. The establishment of beneficial bacterial populations is preserved by traditional method such as freezing, curing fermenting, sugaring/salting, Drying, canning, smoking, and pickling are promoted. However, LAB based opposition do not importantly reduced feasible food safety issues in total, as they may be well planned only in a small range of food environment (pH, fat content, etc.) and this restrict their important in more food products. Thus, item by item deliberation of applying such a bio preservative to a sure unique nourishment matrix is essential.

Authors' Contributions

KD is main author of the review, KK has a co-authored and supervised manuscript preparation, and helped to contribute in literature collection and editing of the review. All the two authors have read and approved the final manuscript.

Competing Interests

The authors declare that they have no competing interests.

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