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Modern Food Preservation Techniques: Balancing Shelf Life and Nutrition

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Food preservation is the process of stopping or, inhibiting the spoilage of food that inhibits the food borne diseases while keeping the food's nutritional value, flavor, aroma & texture unchanged. Food is an organic substance consists of all the essential nutrients like proteins, fats, carbohydrates, vitamins and minerals. It can be either solid or liquid form and can be absorbed, digested, and assimilated in the body of an organism to gain the energy that the body need to work, repair tissue, grow and perform other necessary processes. The demand for food production is increasing remarkably due to increase in population and change in food diversity. As food are nutritious enough, they can be spoiled by physical, chemical, & microbial process. According to WHO, about 1 out of 10 people became ill from eating spoiled food. It has been seen that during food transportation, the surrounding environment including bacteria, fungi, chemical, and enzymes present in food, can cause changes in the morphology of food & reduction of nutrients in food (Gram et al, 2002). Thus, the food needs to be preserved to avoid spoilage by contamination & maintain food stock storage & shelf life without affecting nutritional value and qualities (texture, aroma, freshness, flavour & colour etc.) Food preservation is also helpful in avoiding the oxidation of fat in food by inhibiting microbial growth (Prokopov and Tancher2007). Food preservation is also known as food processing (Lianou et al,2016; Necidova et al.,2019).

Classification of Food: Food classified on the following basis-

A. On the basis of shelf life

B. On the basis of Function

C. On the basis of Nutrition

D. On the basis of extent of processing

A. On the basis of shelf life: We classified the food as 1. perishable food, 2. Non-perishable food and 3. semi-perishable food.

1. Perishable food- They can be stored for several days to 2-3 weeks (eg. sea food, meat, milk & its products, poultry, eggs, and all cooked leftovers). They become spoiled if not refrigerated.

2. Non-perishable food- They are naturally processed food with unlimited life and can be stored for several days. (eg. Dry beans, nuts, flour, sugar, canned fruits, peanut, butter, dry meat) (Jones and Lennard,2020)

3. Semi-perishable foods- They can be stored for several months (About six months) under appropriate storage states (eg. vegetables, fruits, cheese, & potatoes, ginger & biscuits).

B. On the basis of Function: we classify the foods in two classes namely,

a. Body building & repairing food – These food increases the body's mass and repair cell and tissue damage. Eg. milk, meat, fish, vegetables, & nuts.

b. Regulatory and protective foods- The food that regulate the body through homeostasis and protect the body from external pathogens called regulatory & protective foods. Eg. water, raw vegetables, beverages, milk, & meat.

C. On the basis of Nutrients, we classify the food as-

a. Carbohydrate rich food eg. Rice, wheat, & starchy vegetables.

b. Protein rich food eg. milk, meat, fish, eggs & nuts

c. Fats rich food eg. Oil, butter, & egg yolk.

d. Vitamins & minerals rich food eg. Fruits & vegetables.

D. On the basis on Processing- There are three classes of food based on processing-

a. Unprocessed food: Foods that are not processed or, may be physically processed to make whole food more available. It makes food to preserve for more time. eg. Freash fruits, vegetables, nut, pasta, tea and coffee.

b. Processes food: Those foods in which components of food are extracted to make it prepared for dish cooking, vegetables, sweetener, pasta, & noodle preservatives fall into this category.

c. Ultra-processed food: Foods that are processed culinary to produce accessible, palatable and readily available food stuffs with longer shelf-lives. eg. Cakes, biscuits, bread, chocholate, milk-

drink, sausage, salted pickled, fish canned in oil. (Monterio et al., 2010)

Modern methods of food preservation

The following are the modern methods of food preservation are as follows

a. **Pasteurization**: It is the process in which food is heated to destroyed all types of bacteria & enzymes to extend the shelf life of food items and keep them fresh for a longer period of time. This process kills almost all pathogenic bacteria, yeast, & moulds, but the temperature and duration should be optimal. They must not destroy the vitamins & proteins of foods. This technique was first time used by a French scientist known as Loius Pasteur, who preserve the milk & milk products, wine & beer are also treated by this technique. Modern procedures like Low temperature long time (LTLT), High temperature short time (HTST) and Ultra- high temperature (UHT) are also accessible.

b. **Freeze drying**: This is one of the modern techniques where moisture content from the food stuffs are removed at much lower temperature under frozen conditions using vacuum. The basic principle applied is to evaporate solid water (ICE) by sublimation at lower pressure. This technique is used in food processing & preservation of coffee. Vacuum drying is also used for long term storage of bacteria & yeast.

c. **Vacuum packing**: In this technique, food stuff is put in a plastic film bag and vacuum is created inside the bag by a sucking air using a vacuum pump before sealing the bag under this condition, microbes do not grow since there is no oxygen inside , that is required for survival. This technique is used for packing Nuts.

d. **Irradiation**: In this technique food stuffs is exposed to ionizing radiation either as B-particles or, y-rays. The radiation is capable of killing bacteria, molds, and pests among others. The irradiation is also capable of decreasing the ripening of fruits and stops spoilage. This technique has been mostly used for spices, condiments & fresh fruits.

e. **Chemical food preservatives**: In processed food, antimicrobial chemical agents are added to preserve them. These chemical agents are added in small amount since they are mostly toxic when consumed in larger amount. Common preservatives are benzoic acid and benzoates which are used in acidic food such as jams, salad dressing, juices, pickles, carbonated drinks, soya sauce etc.

f. **Pascalization**: In this technique, food stuff is pressed inside a vessel exerting very high pressure to the tune of 70000lb per square inch. This technique is good since food stuffs retain their freshness, flavour, texture & nutrients with destruction of microbes.

g. **Bio preservation:** When natural microbes or, antimicrobials are used for preservation and increasing shelf life of food stuffs, it is called bio preservation. Here, generally either beneficial bacteria or, fermentation products are used for controlling the spoilage and to inactivate pathogenic microbe, if present in the food-stuff. Lactic acid bacteria have been used as bio preservatives. These bacteria produce Lactic acid, acetic acid, bacteriocins and hydrogen peroxide among other which acts as antimicrobials.

h. **Nano thermal plasma**: In this technology, surface of the food stuff is exposed to a flame of ionized gas molecules such as nitrogen and helium. It helps in killing the microbes if present on the surface of the food stuff.

Conclusion

Considering food borne disease due to consumption of spoiled food, balancing shelf life & nutrition to food, proper preservation of food stuffs is very important. Although, there are many existing techniques used for food preservation, considering the economic viability & social responsibility more effective & safer modern techniques must be carried out in this direction.

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