

# Extended shelf life of foods

[Food & Diet](#)



Food preservation is a critical control point that influences and determines a whole range of outcomes, ranging from preservation of nutritional quality, food safety, the wholesome nature of food, texture, taste and organoleptic qualities, and consumer appeal, along with compliance to several points in the value chain that include long-term storage, long-distance transportation and marketing. The purpose of food preservation is to eliminate any possible microbiological harm to the people who eat the food, to maintain the quality of food (texture, taste, smell), and to preserve or protect the nutrition of a safe food product.

The processes of food preservation can be classified into physical method, chemical method, biological method, and preservation by controlled or modified atmosphere. Physical methods are heat treatment, cold processing, dehydration, irradiation (or cold pasteurization). Chemical methods are salting, curing, smoking, and preservatives. Biological method is fermentation. The main idea of heat treatment is to kill the microorganisms in food and inactivate the tissue enzymes. Heat treatments are thermisation, pasteurization, UHT (Ultra High Temperature), sterilization, and blanching.

Thermisation is a method of sterilizing raw milk with heat, 57 – 65 oC for at least 15 seconds to kill the mesophilic microbes. Pasteurization is a preservation process by giving heat to food, for example milk, to reach a minimum temperature for a minimum length of time and then immediately cooling it to 4 oC. Pasteurization can be differentiated to LTLT (Long Time Low Temperature) which is heating at 62 – 65 oC for 30 minutes, and HTST (High Temperature Short Time) which is heating at 72 – 75 oC for 15 – 40 seconds. All the pasteurized products have to be chill-stored (4 oC).

UHT (Ultra High Temperature) processing holds milk at 135 - 140 °C for 1 - 2 second. Sterilization is the preservation process to inactivate of all kinds of microbes (including spores) by heating at 121 - 140 oC for 1 - 2 seconds. Sterilized food can be stored without chilling. Blanching is a cooking process by putting the food (usually vegetable, fruit) into boiling water, removing it after a short time (length of time depends of the type of the food), and then plunging the food into iced water to stop the cooking process. The purpose of blanching is to inactivate the enzyme to retain the color, flavor, and texture of vegetables and fruits.

The main idea of cold processing is to inhibit the metabolism and reproduction of the microorganisms in food. However, cold processing cannot produce sterility. Cold processing are chilling and freezing. Chilling is done to extend the shelf life of highly perishable food, e. g. meat, fish, milk. It prevents the growth of the pathogens. Chilling temperature is 3 - 4 oC, must be lower than 5 oC. Freezing is done to lower the water activity of the food and create internal ice crystals that cause mechanical damage to the bacteria cell. Water activity is the measure of the activity of the water in a food.

Food with higher water activity usually gives more chance for the growth of microbes. Bacteria commonly need a minimum of 0. 91 of water activity. Usually freezing temperature is at -18 oC where the water activity becomes 0. 84, and no bacteria can survive. The aim of dehydration preservation is to lower down the water activity of foods without causing significant changes to the original characteristics of the foods. Dehydration of food can be done by

physical removal of water from food or by adding substances that bind water in food.

Physical removal of water is done by drying the food with hot air (sun light drying, e. g. fruits), freeze drying (e. g. meat, vegetables, fishes), spray drying / mechanical drying (e. g. milk), concentration / evaporation. Spray drying is the process of creating a dry powder from a liquid or slurry by rapidly drying it with a high temperature gas, evaporating the water in the food. Freeze drying, which is known as lyophilization, is process to dehydrate the food by freezing it rapidly and then lowering the pressure around the food to allow the ice in the food to sublime directly from the solid phase (ice) to the gas phase (water vapor), removing the water from the food.

Freeze drying usually uses liquid nitrogen, another way is by using dry ice and methanol. The substances that bind water in food can be sugar (jam or syrup) or salt (fish, meat, vegetables). Sugar or salt can bind water in food resulting to lower water activity in the food. The irradiation process destroys the DNA of bacteria, parasites, insects, and moulds. The radiation is gamma ray from radioactive materials such as Cobalt-60 and Cesium-137. It gives damage to the internal metabolism of bacteria cells by damaging the chemical bonds, cells lose the ability to reproduce, slower down the ripening of fruits.

Irradiation process is also known as cold pasteurization. Chemical preservations are salting, curing, smoking, and using preservatives. Salting of food products can lower down the water activity of the food and give flavor. Salt can bind the water in the food, which will lower down the water activity. The amount of salt used in meat products is usually 2 - 7 %.

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is the adding of salt (99.5 %) and Sodium nitrite (0.5 %) into the food. The purpose of curing is to preserve (lowering water activity), give color (with Sodium nitrite; pink), and improve the flavor (with salt).

The purpose of the smoking of food is to give drying effect to the surface of food (lower water activity), give color (pinkish). It also gives formaldehyde, a bacteriostatic agent, which is a chemical or biological agent that can inhibit the reproduction of bacteria. Preservatives such as propionic acid, benzoic acid, can prevent the growth of microorganisms. Fermentation is the production of alcohols and carbon dioxide from carbohydrates by bacteria or yeasts, under anaerobic conditions. Fermentation produces acids (lowering the pH), alcohol can inhibit the growth of harmful microbes.

The preservation by controlled or modified atmosphere is by removal of oxygen to inhibit the growth of aerobic bacteria and moulds, adding carbon dioxide and nitrogen to replace the oxygen and inhibit the oxidation of fats by oxygen. Removal of ethylene gas can be done to slow the ripening of the fruits; Ethylene gas accelerates ripening process.

In conclusion, the process of food preservation is based on creating a condition where microorganisms cannot survive while maintaining the quality of the food and eventually extend the shelf life of the food.