

Food Preservation

Foods are materials, raw, processed, or formulated, that are consumed orally by humans or animals for growth, health, satisfaction, pleasure, and satisfying social needs. Generally, there is no limitation on the amount of food that may be consumed (as there is for a drug in the form of dosage) . This does not mean that we can eat any food item as much as we want. Excessive amounts could be lethal, for example, salt, fat, and sugar. Chemically, foods are mainly composed of water, lipids, fat, and carbohydrate with small proportions of minerals and organic compounds. Minerals include salts and organic substances include vitamins, emulsifiers, acids, antioxidants, pigments, polyphenols, and flavor-producing compounds . The different classes of foods are perishable, nonperishable, harvested, fresh, minimally processed, preserved, manufactured, formulated, primary, secondary derivatives, synthetic, functional, and medical foods . The preservation method is mainly based on the types of food that need to be prepared or formulated.

Food preservation involves the action taken to maintain foods with the desired properties or nature for as long as possible. The process is now moving from an art to a highly interdisciplinary science. In most countries, innovation, sustainability, and safety have become the main foci of modern industry and economy. A sustainable way of designing and developing food products stands to appeal to consumers. Innovation is vital to maintain progress in technology and engineering. Food safety is now the first priority of the food production and preservation industry, incorporating innovation and sustainability. The preservation and processing of food is not as simple or straightforward as it was in the past. A number of new preservation techniques are being developed to satisfy current demands of economic preservation and consumer satisfaction in nutritional and sensory aspects, convenience, safety, absence of chemical preservatives, price, and environmental safety. Understanding the effects of each preservation method on food has therefore become critical in all aspects.

Preservation Methods

Preservation methods start with the complete analysis and understanding of the whole food chain, including growing, harvesting, processing, packaging, and distribution; thus an integrated approach needs to be applied. It lies at the heart of food science and technology, and it is the main purpose of food processing. First, it is important to identify the properties or characteristics that need to be preserved. One property may be important for one product, but detrimental for others. For example, collapse and pore formation occur during the drying of foods. This can be desirable or undesirable depending on the desired quality of the dried product, In another instance, the consumer expects apple juice to be clear whereas orange juice could be cloudy.

Why Food Needs to be Preserved

The main reasons for food preservation are to overcome inappropriate planning in agriculture, produce value-added products, and provide variation in diet. The agricultural industry produces raw food materials in different sectors. Inadequate management or improper planning in agricultural production can be overcome by avoiding inappropriate areas, times, and amounts of raw food materials as well as by increasing storage life using simple methods of preservation. Value-added food products can give better-quality foods in terms of improved nutritional, functional, convenience, and sensory properties. Consumer demand for healthier and more convenient foods also affects the way food is preserved. Eating should be pleasurable to the consumer, and not boring. People like to eat wide varieties of foods with different tastes and flavors. Variation in the diet is important, particularly in underdeveloped countries to reduce reliance on a specific type of grain (i.e., rice or wheat). In food preservation, the important points that need to be considered are

- The desired level of quality
- The preservation length
- The group for whom the products are preserved

After storage of a preserved food for a certain period, one or more of its quality attributes may reach an undesirable state. Quality is an illusive, ever-changing concept. In general, it is defined as the degree it is defined as the degree of fitness for use or the condition indicated by the satisfaction level of consumers. When food has deteriorated to such an extent that it is considered unsuitable for consumption, it is said to have reached the end of its shelf life. In studying the shelf life of foods, it is important to measure the rate of change of a given quality attribute. In all cases, safety is the first attribute, followed by other quality. The product quality attributes can be quite varied, such as appearance, sensory, or microbial characteristics. Loss of quality is highly dependent on types of food and composition, formulation (for manufactured foods), packaging, and storage conditions. Quality loss can be minimized at any stage of food harvesting, processing, distribution, and storage. When preservation fails, the consequences range broadly from minor deterioration, such as color loss, to food becoming extremely hazardous.

For Whom to Preserve?

It is important to know for whom the preserved food is being produced. Nutritional requirements and food restrictions apply differently to different population groups. Food poisoning can be fatal, especially in infants, pregnant women, the elderly, and those with depressed immune systems. The legal aspects of food preservation are different in case of foods produced for human and for animal consumption. Thus, it is necessary to consider the group for whom the products are being manufactured.

How Long to Preserve?

After storage for a certain period, one or more quality attributes of a food may reach an undesirable state. At that time, the food is considered unsuitable for consumption and is said to have reached the end of its shelf life. This level is defined by the manufacturer according to criteria when the product is saleable. Best before date is set shorter than the shelf life with a good margin. Hence, it is

usually safe and palatable to consume a product a long time after the best-before date, provided the product has been stored at the recommended conditions. Products may be marketed with the production date “pack date” and “best-before date.” Alternative markings are use-by date or expiration date, which may be closer to shelf life than best before date. In studying the shelf life of foods, it is important to measure the rate of change of a given quality attribute. The product quality can be defined using many factors, including appearance, yield, eating characteristics, and microbial characteristics, but ultimately the final use must provide a pleasurable experience for the consumer . The various stages of food production, manufacture, storage, distribution, and sale are shown in Figure 1.1. Quality loss can be minimized at any stage and thus quality depends on the overall control of the processing chain. The major quality-loss mechanisms and consequences are shown in Table 1.1 and Figure 1.2. The required length of preservation depends on the purpose. In many cases, very prolonged storage or shelf life is not needed, which simplifies both the transport and marketing of the foodstuff. For example, the meals prepared for lunch need a shelf life of only one or even half a day. In this case, there is no point in ensuring preservation of the product for weeks or months. In other cases, very long shelf life up to 3–5 years may be required, for example, foods for space travelers and food storage during wars.

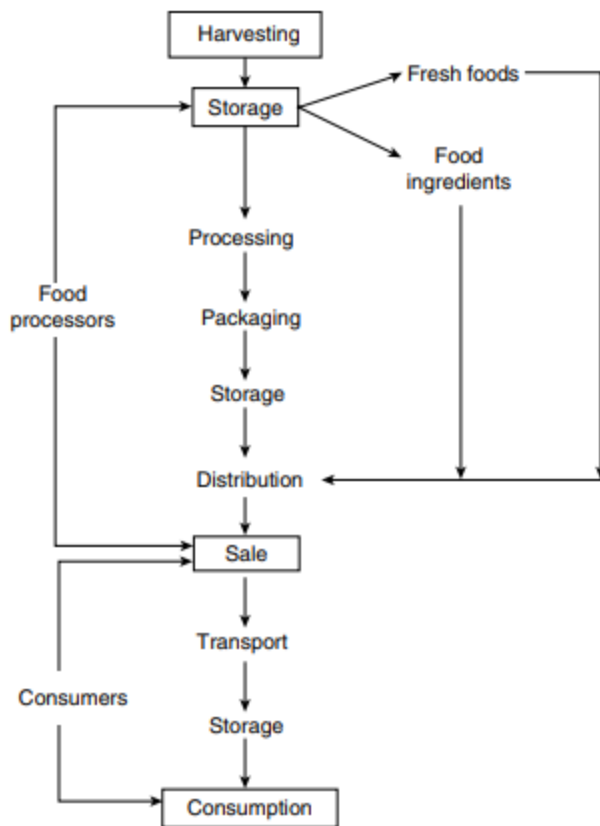


FIGURE 1.1 Various stages of food production, manufacture, storage, distribution, and sale.

TABLE 1.1

Major Quality-Loss Mechanisms

Microbiological	Enzymatic	Chemical	Physical	Mechanical
Microorganism growth	Browning	Color loss	Collapse	Bruising due to vibration
Off-flavor	Color change	Flavor loss	Controlled release	Cracking
Toxin production	Off-flavor	Nonenzymatic browning Nutrient loss Oxidation-reduction Rancidity	Crystallization Flavor encapsulation Phase changes Recrystallization Shrinkage Transport of component	Damage due to pressure

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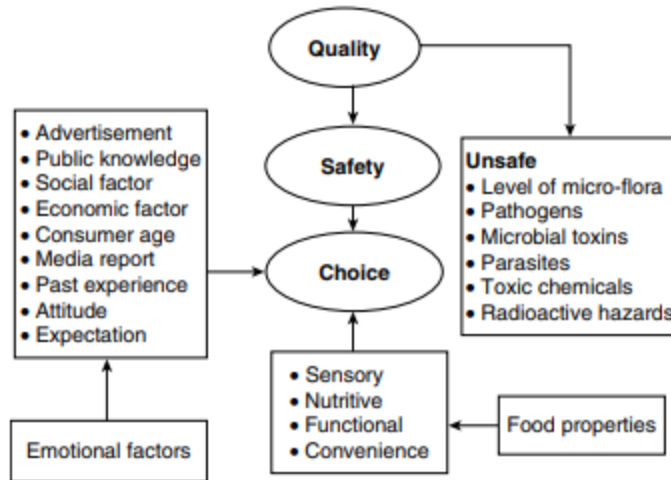


FIGURE 1.2 Factors affecting food quality, safety, and choice.