

Food Poisoning Bacteria that Grow in the Refrigerator

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Over the years, food microbiologists have formulated various rules of thumb to help them predict how foodborne microorganisms will behave in different food environments. One of these rules was that cold will help preserve foods, that is, extend their edibility and maintain their desirable freshness simply by keeping the food cold, refrigerating them (5°C/41°F).

Over time, two groups of food microorganisms emerged to challenge this cold preservation rule: psychrotrophic spoilage agents and psychrotrophic food poisoning agents. Historically, the first group to challenge this rule was the psychrotrophic spoilage agents. In the early 1950s, adequate mechanical refrigeration, i.e., units capable of maintaining food temperatures in the range of 45-50°F (7.2 - 10°C), became widely available. Refrigeration was used to maintain the freshness and microbial shelf life of many foods including fresh and cured meat, poultry products, fish and seafood, milk and dairy products, and fruits and vegetables to name a few.

With the widespread application of refrigeration, a group of spoilage agents, now termed psychrotrophic (microorganisms capable of growing in the cold), emerged and began to limit the shelf life of many fresh foods. This group contained bacteria, yeasts, and molds, and became responsible for the spoilage of various foods. The source of these psychrotrophic spoilage agents varied, but often they were isolated from water, soil, and the food processing environment. Most of the time, they could not be detected in the food immediately after they were produced, but their presence became evident and they were detectable only after extended refrigeration.

As this spoilage group became more of a problem, food microbiologists developed control methods to eliminate them from foods or reduce their numbers. Some control measures included monitored water and air in the processing environment, improved sanitizers and sanitation, improved temperature monitoring and control (for many products, this involved holding the food at as low a temperature as possible without freezing it), and improved methods to detect and quantify these agents. These measures, when followed carefully and judiciously, can reduce but do not eliminate the problems and concerns posed by these psychrotrophic spoilage agents. Growth by these agents is probably still the single major factor that limits the microbial shelf life, sell by date, or freshness date of refrigerated fresh foods.

With the problem of psychrotrophic spoilage agents managed, food microbiologists relaxed a bit with the thought that while refrigerated foods might spoil, they were at least protected from the growth of food poisoning agents. This was not true. Not only can refrigeration not prevent spoilage agents from growing in foods, but it also cannot prevent a second group of psychrotrophic microorganisms- food poisoning agents- from growing in fresh foods (Table 1). Food poisoning agents (many of the more common ones) can grow at temperatures just above the ideal 5°C (41°F) (Table 2).

The modern American consumer is demanding fresher foods, i.e. foods that contain few if any additives and that have received minimum if any processing treatments. These demands mean that food processors, handlers, and retailers must depend almost exclusively on refrigeration as a means to protect the shelf life and safety of many foods. Various surveys have consistently shown that foods are not held at the proper low temperatures whether during shipping or retailing, or by the consumer.

Food microbiologists have traditionally depended on the three

Ks to protect the shelf life and safety of foods: keep the microorganisms out of foods, kill the ones present, and/or keep the ones present from growing. To protect foods from the problems associated with psychrotrophic pathogens, the food industry must use various combinations of the three Ks. One promising area for protecting the shelf life and safety of food is the use of emerging technologies such as high pressure processing, pulsed electric fields, and ultraviolet light to kill pathogens and spoilage agents. The advantage of these new technologies is that they can kill the microorganisms while retaining the fresh qualities of foods. A second promising area is the use of protective cultures such as lactic acid bacteria. These cultures produce lactic acid as well as natural antimicrobials known as bacteriocins. Thus, these cultures can prevent the growth of foodborne pathogens and even spoilage agents using a natural system. A third approach is the use of hurdle or multiple barriers. In this approach, low levels of inhibitors or a series of barriers are used, i.e., small decreases in pH and low levels of salt are combined with low levels of various GRAS antimicrobial agents. This approach could prove very effective since many inhibitory systems become more restrictive when combined with low temperature holding of the food.

In summary, while refrigeration offers an ideal means of maintaining the fresh qualities of foods, it can also provide an environment that allows the growth of various food poisoning agents. Keeping food cold is no longer synonymous with keeping a food safe. Everyone along the food handling chain from processor to consumer must realize this and do everything to minimize the risk from these agents.