



## FOOD SAFETY

Few factors are more important in assuring the wholesomeness of food than handling practices—from processing plant to your customers' kitchens—including *good sanitation* and *proper temperatures*. Some of the most significant instances of food-borne illnesses, resulting from product contamination—or exposure of foods to harmful bacteria, including meat foods—have been the result of poor handling and storage and improper cookery. Such contamination may occur at the processing plant, in transit from the plant, in the retail store cooler or retail case, or in a shopper's basket, car or home. In other words, bacteria are everywhere! The key to food safety is to minimize, or eliminate, harmful bacteria in or on meats during processing, handling and packaging.

**Spoilage bacteria vs. pathogenic bacteria.** As food **spoils**, the color, odor and texture deteriorate, thus reducing its desirability and acceptability. These signs are a signal, alerting an observer that taste, food safety, and quality have diminished. While the foodstuff may still be safe to eat, it has become unpalatable. However, when food is *contaminated* with **pathogenic organisms**, it has been exposed to microorganisms which can *cause food-borne illness in humans*. There often are no alerting signs of contamination with food pathogens, such as off-odor or color.

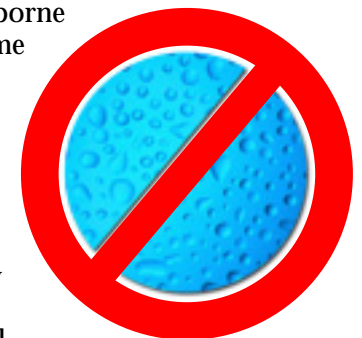
*Therefore, it is essential that exposure to pathogenic contamination be minimized, if not prevented altogether. Much can be done through careful product control at every step of handling.*

### Conditions

Proper storage is essential to maintain food safety and quality. For microorganisms to thrive, there must be conditions which encourage growth. Factors which should be controlled are *moisture, temperature, oxygen, exposed meat surface areas* and *degree of acidity or alkalinity*. Several types of mold and yeast, as well as microorganisms such as bacteria and viruses, can grow **on** meat.

Bacteria are the leading offender. Molds/yeasts are less frequently seen on meats but do grow under certain conditions. Viruses are a potential cause of food-borne illness. A few parasites are also potential problems in meat. We'll discuss some of these troublemakers, but first, let's look at conditions.

**Moisture.** Moisture must be present for microorganisms to grow. Molds grow in dryer environments, but there is enough natural water in fresh meats to satisfy the growth of both. The moisture level in meat is affected by air flow, humidity and temperature in the storage area. Air flow increases evaporative losses in unwrapped meat. The relative humidity in storage effects the amount of moisture drawn to the surface. When relative humidity is high, condensation of moisture occurs. If the relative humidity is low, moisture evaporates and meat surfaces stay relatively dry, inhibiting bacterial growth. When the combination of desired low relative humidity and proper temperature



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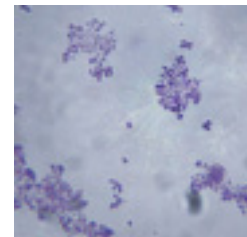
levels is maintained, spoilage will be retarded and shrinkage, discoloration and dehydration will be minimized.

**Temperature.** Temperature is a critical factor during meat handling and storage. One class of microorganisms that grows well between 32°F and 68°F includes some strains of bacteria and some yeasts and molds. They are called “psychrotrophs.” But most bacteria thrive at temperatures of 60°F to 104°F. They are “mesophiles.” A few grow at higher temperatures of 104°F to 150°F and are called “thermophiles.”

Most of the bacteria that can cause food-borne illness will not grow well at normal refrigerator temperatures (32°F to 40°F). Temperatures below 40°F retard (but do not stop) bacterial growth. And as the temperature nears 28°F (freezing point of meat), few microorganisms grow and reproduction is greatly retarded. That’s why refrigeration and freezing prolong shelf life. At temperatures higher than 40°F quality, appearance and safety are in jeopardy. A good rule of thumb is to remember that, “Life begins at 40°F” for most microorganisms.

**Oxygen.** Some microorganisms, called *aerobic* bacteria, must have free oxygen to grow. All molds and most yeasts that grow in meat are aerobic. Other microorganisms grow only in the absence of oxygen. They are *anaerobic* bacteria. Yet another group, called *facultative*, will grow either with or without oxygen.

*Aerobic* conditions are present primarily on the surface of meat cuts, allowing for the presence of bacteria that need oxygen. The growth of *anaerobic* bacteria might occur when contaminated cuts are vacuum packaged and the internal surfaces are not exposed to air. *Facultative* organisms also might exist on the surface or inside portions of blocks of ground meat, but never inside an intact, healthy muscle. (An exception would be meat injected with curing or tenderizing agents, or meat which is needle tenderized, in the possible case of contaminated ingredients or equipment.)



Vacuum packaging extends shelf life by reducing the exposure of meat to oxygen, inhibiting the growth of *aerobic* bacteria. However, if the meat had been improperly handled before packaging, a vacuum could allow *anaerobic* bacteria to grow; therefore, proper refrigeration is still critical with vacuum packaged meats.

**Exposed surface area.** The interior portions of intact muscles are generally free of microorganisms. Meat surfaces, however, are susceptible to exterior contamination and subsequent spoilage. The greater the surface area, the greater the potential for microbial growth. A large roast would have a relatively smaller surface exposed than a package of ground meat, which has hundreds of surfaces exposed. Because of the greater potential for



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needle-tenderized or ground meat to be contaminated, great care is necessary during handling and storage, including sanitary conditions of the grinder or needles, as well as hands, table and tray surfaces. While refrigeration will inhibit growth, avoiding exposure to both spoilage and pathogenic bacteria is a critical goal.

**Acidity or Alkalinity.** The “pH factor” describes a measurement of the acidity (below pH7) or alkalinity (above pH7) of a substance. For most bacteria, the optimal pH level is around pH7 (neutral), but most will grow between levels of pH5 and pH8. On either side of this pH range, the environment for microorganisms is less hospitable. Fresh meat has a natural pH value ranging from pH5.3 to pH6.5, good growing conditions for bacteria, should they be present.

Among substances which increase the acidity are vinegar and citric acid. Both are used in food preservation, since they inhibit bacterial growth.

Bear in mind that some molds and bacteria are beneficial. Both Roquefort and blue cheese, for example, have their distinct characteristic flavors developed by the blue molds that are safe to eat. Summer Sausage is a fermented sausage with a *lactobacillus* bacteria culture added, thus increasing acidity through a controlled fermentation, also achieving the desired flavor.

### Food-Borne Illnesses & Infections

*Food-borne illness* is caused by eating foods containing toxins produced by pathogenic bacteria or by infectious organisms. Bacteria that can grow and produce toxins in meat include *Clostridium botulinum*, *Staphylococcus aureus* and *Clostridium perfringens*.

*Infections* occur from eating meat, poultry, fish or other protein foods contaminated with pathogenic organisms which then multiply in the human intestinal tract, causing illness. *Escherichia coli O157:H7 (E.coli O157:H7)*, *Salmonella* and *Listeria* are examples. *Trichinella spiralis*, a parasite, also multiplies in the intestinal tract and migrates into muscles. (The disease, *Trichinosis*, is rarely seen in the U.S., since the advent of laws which require cooking of garbage which may be fed to pigs [most states have outlawed garbage feeding altogether]. Additionally, the vast majority of market hogs are fed a grain-based diet and therefore would not come in contact with the parasite.)

Special mention is made of *E.coli O157:H7*, due to its severity and cause of death in humans. If present in the intestinal tract of an animal, and if improper sanitary handling of the animal occurs during the slaughtering and further processing, the bacteria may be transferred to the surface of the meat and thence into consumption as with any facultative bacteria. *E.coli O157:H7* may also be transferred from humans to meat, or from humans to humans. It could be present in the intestinal tract and feces of a meat handler. If an infected handler does not properly wash his/her hands after defecating, the transfer to the surface of meat or meat dishes is possible. Outbreaks of *E.coli O157:H7*



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food-borne illness have occurred most frequently after consuming foods from foodservice operations, but it is also possible to have contamination occurring in meat sold at the retail meat case.

Some of the foregoing illnesses can be fatal, while others can cause from mild to severe illness and discomfort. Of special concern are very young children, older adults, and immuno-comprised (HIV/AIDS) individuals.

The table at the end of this chapter provides a brief glance at the characteristics of some common food-borne illnesses.

### HACCP

A food safety program that the food industry and government have implemented is “*Hazard Analysis/Critical Control Points*,” or *HACCP*, designed to identify certain points in the processing system—from farm to the consumers’ shopping cart—as critical to assuring food safety, and which therefore need to be carefully monitored. The USDA’s Food Safety and Inspection Service has joined with the meat industry in the common goal of making *HACCP* principles the foundation for the safest possible meat and poultry inspection system.

While *HACCP* efforts in the meat industry have initially been concentrated at meat processing operations, retail store and foodservice management has become increasingly aware of *HACCP* principles and applications.

Quality control encompasses product composition, specifications, processing, packaging, storage and distribution, as well as microbiological safety in relation to a plant’s equipment, sanitation and pest and rodent control. A quality assurance program requires the concerted involvement and all-out effort by all persons involved—management, supervisors and all workers—in order to produce and deliver wholesome, quality products to consumers.

For consumers at home, avoiding most spoilage and exposure to pathogenic organisms can be assured though proper cooking and handling. Tips for meat preparation and handling are noted in the Meat Cookery section of this manual.



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