

# FOOD SAFETY SENTINEL

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## DRIED MEAT PRODUCTS

### Introduction

Meat drying, or dehydration, is one of the most ancient and reliable methods for preserving meat. Low water content creates conditions that are not suitable for the growth and multiplication of microorganisms. A variety of meat products can undergo drying, but in order to produce a shelf-stable meat product, the water activity ( $a_w$ ) must be low enough that no microorganism can survive at room temperature.

Water activity ( $a_w$ ) is the measure of free water in food products. It ranges from 0.00 (total dryness) to 1.00 (pure water).

Meat drying consists of the gradual dehydration of pieces of meat cut to a specific uniform shape. The uniform shape permits the equal and simultaneous drying of whole pieces of meat. The duration of the drying process depends on air temperature, humidity and air circulation. Beef jerky and other meat products are usually smoked. The antimicrobial substances present in the smoke may contribute to the safety of dried products.

Examples of dried meat are beef jerky, dry and semi-dry sausages, and prosciutto. The manufacturing of dry and semi-dry sausages and prosciutto involves a fermentation process which includes a drying step. (Drying of fermented products is not covered in this article. For more information on fermented products, refer to the June and July 2008 editions of the *Food Safety Sentinel*.)

Past cases of illness caused by *Salmonella* spp. and *E. coli* O157:H7 in jerky raised questions about the safety of drying methods in the production of beef jerky. The Canadian Food Inspection Agency's current recommendation is to **heat meat products to 71°C (160 F) before starting the dehydrating process**. This step assures that any bacteria present will be destroyed by heat.

### Hazards

Most pathogenic bacteria present in raw meat can be destroyed by a proper cooking step. The most common bacteria which are killed by cooking are: *E. coli*, *Salmonella* spp., *Campylobacter jejuni* and *Listeria monocytogenes*.



- be for the facility to manually monitor and record ambient humidity at a predetermined frequency with a properly calibrated humidity recorder; and
- Meat strips should be strung individually from one end and arranged on drying racks to allow free air circulation along the whole length of the pieces for fast and uniform drying. Do not allow the meat pieces to contact each other, as these areas will remain wet and humid for a prolonged period, making them a favourable environment for spoilage bacteria.

### Employee Hygiene Practices After Drying

After cooking and drying, improper hygiene and food-handling practices will cause the meat to become re-contaminated. Fifty percent of all humans carry the bacteria *Staphylococcus aureus* in their nose and throat. If employees touch their nose or face, then touch equipment or the meat itself they could contaminate the meat. If the  $a_w$  is not lowered enough by the drying process, *Staph aureus* toxin can multiply once packaged and left at room temperature.

### Record Keeping/Documentation requirements

Dehydrating to Shelf Stable Conditions:

- Written Drying procedure; and
- A water activity ( $a_w$ ) record

Training requirements

Training program should include:

- Training in personal hygiene and hygienic handling practices for all employees; and
- Job-specific technical training for employees involved in the processing, storage and handling of dehydrated meat products.

### References

- The Canadian Food Inspection Agency – *Meat Hygiene Manual of Procedures*, Chapter 4, <http://www.inspection.gc.ca/english/fssa/meavia/man/ch4/table4e.shtml>
- Food and Agriculture Organization of the United Nations, *Principles of Meat Drying*, <http://www.fao.org/docrep/003/x6932e/X6932E02.htm>

## FUNDING AVAILABLE TO IMPROVE FOOD SAFETY PRACTICES

Funding is still available for you to improve your food safety practices or implement the Meat Facilities Standards or HACCP. Even small changes may be eligible for funding. You may qualify for up to \$20,000.

We are ready to assist you!

Getting started is easier than you think.

[www.agriculture.alberta.ca/aha](http://www.agriculture.alberta.ca/aha)  
[aha@gov.ab.ca](mailto:aha@gov.ab.ca)

780-427-4054, toll free 310-0000

Funding is available through the Agricultural Policy Framework, Food Safety Initiative (APF/FSI) – a Federal, Provincial, Territorial Initiative.

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## CRITICAL LIMITS

Drying may be done at temperatures of 13-18°C (55-65°F) and at a relative humidity of 65-70 percent for a period of 21-90 days. Regular checks should be made to ensure that the daily weight loss during drying does not exceed 0.7 percent. If drying occurs too fast, (one reason may be excessive air movement) hardening of the products may happen. If drying takes too long (because of humidity excess) mould may develop on product surface.

A water activity ( $a_w$ ) of 0.85 or less will stop the growth of all microorganisms which may still be present once the beef jerky has been thoroughly cooked. These bacteria can be present in the forms of spores prior to cooking and survive to the treatment, or be the result of a contamination post-cooking. It must be remembered that a decrease in water activity does not destroy microorganisms or toxins. It only delays the growth of microorganisms.

For products labeled as shelf stable (there is no "Keep refrigerated" statement on the label), production records must prove that one of the following conditions has been met:

- 1) The  $a_w$  of the final product is 0.85 or less, regardless of the final pH; or
- 2) The pH of the finished product is 4.6 or less.

In addition to meeting one of the above requirements, in all products containing beef.

A kill step for *E.coli* 0157:H7 must be used before the drying process (e.g. heating the product to 71°C for 15 seconds).

Non-fermented meat products are cooked before the drying process in order to control bacterial hazards. However, after cooking, the drying process must also be controlled. This process must be fast enough to dry the meat before it spoils and must also remove enough water to prevent microorganisms from growing.

During the cooking step, if the critical limit of time/temperature is reached, all non-spore forming bacteria that were present prior to cooking are destroyed. However, spore-forming bacteria\* can withstand very high temperatures (above 100°C, depending on the bacteria specie).

\* Spore-forming bacteria, as the name implies, produce resistant spores. Spore formation allows these bacteria to survive for a long time and provides a basis for the continuation of the bacteria species. In suitable conditions (typical temperature range is between 10° and 50°C), spores germinate and grow, and produce harmful effects.

A product that has a water activity of below 0.85 will prevent the spores remaining (especially in a vacuum-sealed, airtight package) from germinating and producing a toxin if held at room temperature.

Two potential hazards identified at the drying step are:

a) Growth of pathogenic spores not killed in the cooking process.

These include:

- *Clostridium botulinum* and
- *Clostridium perfringens*

b) Toxin production from bacteria deposited on products after cooking (cross contamination from workers or equipment after removal from smokehouse), including:

- *Staphylococcus aureus*

### Thawing of Meat

Meat can be thawed in either air or water, and this must be done as rapidly as possible depending on the defrosting process being used. The



temperature of the meat should be controlled to minimize the time that the temperature, in any portion of the meat, is above 4°C. Acceptable active methods could include the use of microwaves, forced air, or continuously circulating water. When air is used as a thawing medium, the room temperature should not exceed 10°C, and the product surface temperature be maintained under 7°C. Where meat products are thawed in water, the water must be cold, potable and continuously exchanged. Packaging material, such as cardboard boxes, should be removed prior to thawing. Meat products packaged in plastic bags can be thawed without removing the plastic.

Thawing should be monitored to determine when all portions of the meat have thawed (e.g., have reached a temperature of 0°C or greater). As soon as thawing is complete, the product is immediately processed or stored at a temperature of 4°C or lower. When water is used, it must be drained before storage.

### Facility and Equipment Requirements

The following should be in place during processing of dried products:

- Temperature in the smokehouses or drying rooms should be uniform and controlled to prevent any fluctuation that could impact on the safety of the final product;
- Smokehouses or drying rooms should be equipped with a shatter-resistant thermometer with gradations of 1°C or less. If liquid thermometers are used, their liquid columns should be free from separations. All thermometers should be located so they can be easily read;
- Thermometers should be checked for accuracy against a standard and records kept;
- Drying rooms or smokehouses should be equipped with humidity recorders in order to prevent uncontrolled fluctuation of the relative humidity. An alternative to an automatic humidity recorder would

## RAW MATERIALS SELECTION

Meat drying begins with the selection of the raw material and proper handling of the pieces to be dried.

Dry meat is generally manufactured from beef, although meat from sheep, goats and venison (e.g. antelope, deer) is also used. The meat best suited for drying is that of a medium-aged animal in good condition with no fat. Meat from animals in poorer nutritional condition can also be used for drying, but the amount of additional connective tissue is likely to increase toughness.

As a general rule, only lean meat is suitable for drying. Visible fatty tissues adhering to muscle tissue have a detrimental effect on the quality of the final product. Rancidity can occur quickly under the conditions necessary for processing and storing dry meat, resulting in flavour deterioration.

It is important to examine raw materials used in the manufacture of dried meat products very carefully for undesirable changes such as discoloration and blood spots, and off-odours. Such defects must be trimmed off.