



Cornell University
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Fermented Sausages

Fact Sheets for the
Small Scale Food Entrepreneur

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Fermented Sausages

Modern Understanding of Ancient Products

The drying by salting of a highly valued food, meat, has occurred for many centuries to prevent spoilage. Under favorable conditions, primarily the inclusion of salt and the subsequent addition of sugar to overcome the harshness of the salt, these comminuted products were often found to have a distinctive and enticing aroma, flavor, and “bite.” Although an in-depth understanding of the process was lacking, many sausage-makers were able to replicate the results from batch to batch. Since many sausage-makers and/or regions had unique styles and seasonings, a vast array of fermented sausages were passed down with various differences, similarities, and names.

Sausage terminology is, at best, a confusion of historic, regional, seasonal and political nomenclature. Thus, what is known in some parts of the world as a Keilbasa is known elsewhere as Salami (or even Salame). We will try to ignore most of this confusion as we take a modern look at a class of very popular value-added meat products: fermented sausages. To do this, we will first give a few general, as well as regulatory, definitions with examples:

Fermented Sausages – Are a class of chopped or ground meat products that, as a result of microbial fermentation of a sugar, have reached a pH of 5.3 (although 4.6-5.0 is more typical) and have undergone a drying/aging process to remove 15-25% of the moisture. These products are typically cured, but not necessarily cooked/smoked. Although the USDA does not formally define a Semi-Dry or Dry sausage, they do regulate the “moisture to protein ratio” (MPR) of each as follows:

Semi-Dry Sausages – (MPR max. range of 2.25-3.7 : 1*) Undergo a moisture loss of up to 15% of the total. Final water activities (a_w) range from .90-.94. These sausages are generally cooked/smoked prior to sale or consumption. These sausages should be refrigerated. Examples: Summer sausage, Thüringer, Cervelat, Landjaegar.

Dry Sausages – (MPR max. range of 1.6-2.3 : 1*) Undergo a moisture loss of up to 25% of the total. Final a_w ranges from .85-.91. Typical pH ranges are 4.7-5.0, slightly higher than Semi-dries. Many of these products are considered shelf stable due to low a_w , and may be sold and consumed without heat treatment. Examples: Pepperoni, Salami(s).

Sausage products must have a water activity reading below 0.85 and a pH under 5.3 to be shelf stable.

In light of foodborne outbreaks of *E.coli* 0157:H7 linked to dry fermented ready-to-eat sausage products, all procedures for dry and semi-dry fermented sausages must be validated to show products achieve a 5-log reduction of *E.coli* 0157:H7.

Okay, so you want to make fermented sausage! Since there is a natural presence of fermentative bacteria present on meat surfaces in small relative numbers, the process of producing a fermented product may be as simple as grinding, salting, sugaring, and waiting.

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However, the chances of a failed product resulting in great health risks are considerable. While the production of fermented sausages relies heavily on the art of the procedure, we can use a modern, scientific, understanding of the fermentation process and microbiological inversion from spoilage/pathogenic bacteria to the correct fermentation bacteria to consistently produce high quality, safe products. Here are some steps to help control the process to a successful product:

1. **Raw Meat and Non-Meat Ingredients:** Only the highest microbiological quality meat should be utilized in these products. If in doubt, don't use it! Remember: the process will set up conditions for the growth of bacteria. Give your fermentative bacteria a chance and minimize their competition.
2. **Starter Cultures:** Use them! Follow manufacturer's recommendations and utilize the technical services of the manufacturer (generally free or inexpensive).
3. **Fermentation Process:** Critically monitor the time that the product is above 60° F prior to reaching a minimum pH of 5.3. This is the period in which toxicogenic Staphylococcus may grow. Develop a process that will lower the pH within regulatory guidelines for Staph (Degree/Hour limitations). If your product does not reach pH 5.3 within the specified time – DISCARD!
To achieve a 5-log reduction of E.coli 0157:H7, specific fermentation procedures must be followed or a moist heating step after fermentation must be applied prior to drying.
4. **Drying:** If drying is too slow, moisture buildup at the surface allows unwanted yeast and mold growth. If drying is too fast, a protein crust develops which hinders interior moisture loss resulting in possible spoilage. A relative humidity of the drying chamber maintained 3-5 points below that of the sausage with a low velocity air flow is suggested.

We hope that your venture into the art and science of fermented sausage production will be successful. Below are some suppliers of starter culture and/or technical services.

ABC Research Corp.
3437 SW 24th Ave.
Gainesville, FL 32607
(352) 372-0436
www.foodingredientsonline.com

Chr. Hansen Ingredient Technology
1595 MacArthur Blvd.
Mahwah, NJ 07430
(800) 343-4680
www.chr-hansen.com

Butcher & Packer Supply, Co.
P. O. Box 07468
Detroit, MI 48207
(800) 521-3188 Will sell small quantities for 100 lbs. meat

(Footnotes)

* May be lower depending on specific product label name.