

Fermented sausages

(Mónica Flores and Carmela Belloch)



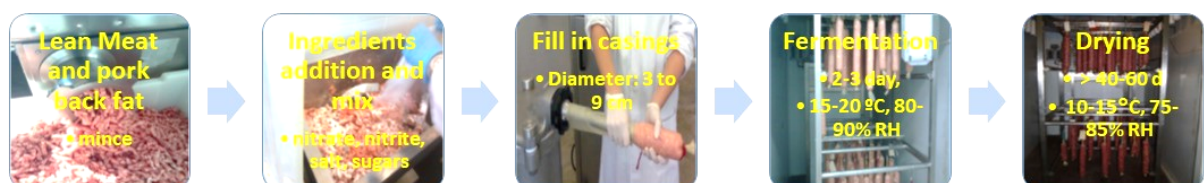
Fermented sausages are produced all over the world as a way of storing meat for long periods of time. Originally, they were produced in areas where the climate conditions, mild winters and limited rainfall, allowed the natural drying process, as occurs in the Mediterranean area. In cold climates, the drying process is enhanced by smoking.

Diversity of fermented sausages. There are many different types of fermented sausages around the world reflecting differences in processing, ingredients, shape, and sizes that are formulated according to preferences and traditions.

Examples of typical fermented sausages made using pork meat are Salami (Italy), Chorizo (Spain), Saucisson (France), Fuet (Spain), Greußner salami (Germany), Katwurst (Austria), Hungarian salami (Hungria), Pepperoni (USA), Harbin dry sausage (China). Beef and lamb are used in Soudjouk and Sucuk (Turkey).

How do we make them?

The batter. Fermented sausages are made using a combination of minced meat and fat from different animal species, together with ingredients that include salt, sugar, spices, curing salts like nitrite, etc., to which starter cultures may be added. The mixture constitutes the meat batter which is stuffed into natural or artificial casings to form sausages. These are introduced into chambers and subjected to an initial fermentation stage followed by the drying stage. The chamber conditions promote the gradual loss of water from the batter to obtain the fermented sausage.

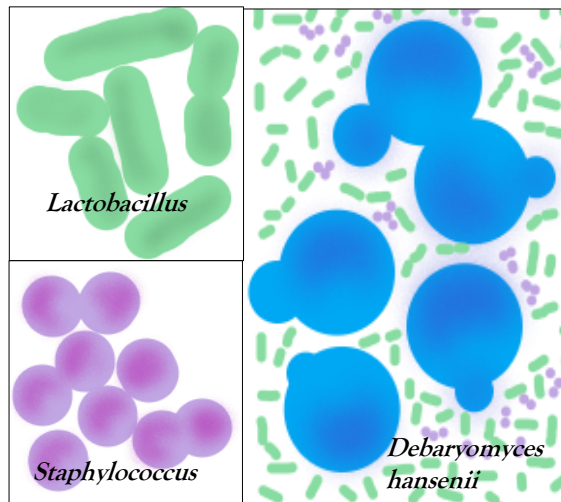


Main stages involved in the manufacturing of fermented sausages

A child-centric microbiology education framework

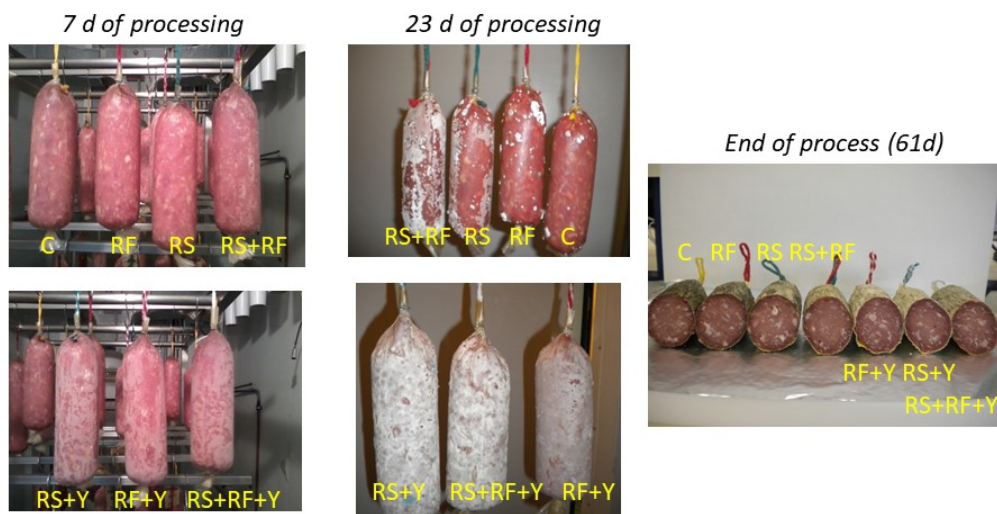
The microbial fermentation. The first step of the process is a fermentation stage, made with the microbes occurring naturally on the meat or by the addition of selected microbial starter cultures to the meat batter before stuffing. During this stage, the temperature and relative humidity conditions of chambers allows lactic acid bacteria to grow and ferment the sugars in the batter, generating lactic acid and lowering the pH. This causes a coagulation of the muscle proteins which increases the cohesiveness of the mixture-batter, and contributes to the drying process.

The main microorganisms involved in the production of fermented sausages are lactic acid bacteria from the genus *Lactobacillus* (green), coagulase negative cocci *Staphylococcus* (purple), and the yeast *Debaryomyces hansenii* (blue).



Drying. The drying process has evolved from the earlier use of natural chambers, in which product drying depended on the climate, to the current use of controlled climate chambers that allow selection of optimal temperature, relative humidity and air speed conditions.

The drying time depends on sausage calibre: small sausages like fuet can be dried for a few weeks while high calibre sausages (around 9 cm diameter), like chorizo, can be dried for 2 to 3 months. The most important change observed during the process is sausage weight loss caused by moisture reduction that can be up to 40 % of the initial weight in long-ripened products. This is the reason they are also named dry sausages.



Drying of fermented sausages (see yeast growth on the surface).

Consequences of fermentation and drying

Taste and aroma. The combination of starter cultures together with different processing parameters – temperature, relative humidity, etc. – produce fermented sausages with different sensory characteristics. Besides lactic acid production by *Lactobacillus*, the microbial starters utilize the amino acids and fatty acids hydrolysed from the proteins and lipids to produce different volatile compounds that contribute to the aroma. All these reactions occur during the fermentation and drying stages and create a variety of volatile compounds that produce the characteristic aroma of each type of sausage.

One of the main ingredients controlling flavour development is the salt which acts as solubilisation agent of muscle proteins, improves texture, and controls the enzymatic reactions during drying.

Conservation. All life is based on water, with most cells consisting of about 90% water. This means that most cells, including and for this topic especially most spoilage and pathogenic microbes, cannot grow in environments with a low water content, so drying foodstuffs like meat is a good way of conserving them and enabling them to be stored for long periods of time. In addition, the salt reduces “available water” – *the water activity* – and thereby additionally inhibits microbial growth. Finally, most spoilage and pathogenic microbes cannot grow under acidic conditions, so the acidity created by the lactic acid bacteria inhibits their growth and further increases the shelf life of the sausage.

Regional variations and sensory properties. The variety of dry fermented sausages around the world is due to differences in processing, ingredients, shape, and sizes.

The flavour of fermented sausages is generally described by the presence of salty, bitter and acid taste, together with cured, spicy, fatty, rancid and vinegar odours, and sometimes smoky odours and others.

Spices are widely added according to preferences and traditions. Paprika (dried and ground red peppers) contributes to the red colour of chorizo (Spain) and pepperoni (USA), while black pepper is generally added for example to fuet (Spain) and saucisson (France) sausages.

Pork meat and fat is widely used in the Mediterranean area, while beef and lamb are used in Asian countries due to culture habits.

The smoking process done in smokehouses also contributes to aroma, flavour and color. Nowadays, smoke flavours can be added in a seasoning blend that develops the desired flavour.

Consumption and beneficial properties. Fermented sausages are widely consumed but their nutrient profile is a cause of concern due to their high fat and salt content. A lot of effort has been made to reduce these ingredients without affecting the quality of the meat products.

Fermented sausages as part of a healthy diet contain a variety of living microorganisms that contribute to the overall gut microbial diversity. Moreover, the manufacturing of fermented sausages uses less-desired carcass parts, they have high shelf-life stability at room temperature, and they are mainly eaten raw, increasing their positive impact on the sustainability of the food chain.

In conclusion, fermented sausages are widely used due to their sensory characteristics, ease of preparation and long shelf-life. They can be consumed in small portions, 25-35 g in sandwiches or snacks, and can also be part of cooked dishes enhancing the flavour of the food.