Chapter 5

Salchichón

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Abstract

"Salchichón" is a traditional dry-cured sausage specialty well distributed in Spain. This sausage is processed in artisanal or industrial techniques. It's one of the "flagships" of Spanish meat products. According to the Spanish Government Departments (Ministry of Agriculture) in 2019, Spaniards eat 11.41 kg/year of processed meats and represented 25.2% of the consumed meat. In these statistics, "*Salchichón"* is the second most-consumed dry-cured fermented sausage in Spain (0.42 kg/year/inhabitant), Andalusia is the Spanish region with higher consumption of these types of meat products (12.09 kg/year/inhabitant). *"Salchichón"* is the third most-consumed dry-cured meat product in Spain for this, is protected by the Spanish Laws. "Salchichón" cover a wide variety of dry-cured sausages ("Fuet", "Imperial de Lorca", "Longaniza de Pascua", among others"). "*Salchichón*" normally is elaborated using lean (shoulder, loins, ham, and other trimmings) and fatty (backfat, belly, among others) pork meats from white and/or Iberian pig breeds, salt, and spices.

Notwithstanding the great variety of "Salchichón" specialities, they have in common the following processing steps: mincing (meat cuts), mixing (meat, salt and spices), stuffing (natural or artificial casing and 8–120 mm diameter), fermentation (14–26 °C) and dry-maturation (natural, cave, artificial maturation chambers, 3–4 days to 2 months processing times). According to its specialty, *"Salchichón"* has legal regulations that guarantee product quality. They have Traditional elaboration processes mean that both products differ enormously from one region to another, or even between different producers. Therefore, nowadays, both sausages have a protected geographical indication, which establishes the minimum characteristics and the processing and formulation conditions that guarantee the quality of the aforementioned products.

In this chapter, formulation and the different elaboration processing steps are described.

Key words Salchichón, Dry-cured meat product, Fermented sausage, Dry-cured fermented sausage, Spanish meat products, Research and innovation

1 Introduction

From a technological point of view, dry-cured meat products (whole and/or comminuted, dehydrated, or fermented) are one of the oldest meat preparations but, these meat products represent something else. In these types of meat products, art, tradition,

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culture, gastronomy, food technology, innovation is combined, without forgetting the use of local raw materials (sustainability) and also, enhance the Circular Economy.

"*Salchichón,*" as other dry-cured meat products represent the effort of thousands of years to economize and preserve meat that could not be consumed fresh after slaughter [1, 2] for longer periods, and through its processing, increase its shelf-life of raw material of high nutritional [3], economic value with a great social and cultural relevance.

Among the dry-cured sausages, "Salchichón" represents one of the oldest meat products, since its elaboration has been described since Roman times, although it is also indicated in some texts that they have Greek origin. From a cultural point of view, these meat products are eminently Mediterranean that, regardless of the "seashore" where are produced and the consumer's religion (Christian, Hebraic, or Muslim), that are processed, their elaboration process is similar and only adapt the different raw materials to the "food rules" or precepts (Halal, Kosher, Friday of lent) that the three great religions have about them.

There is a great diversity of dry-cured sausages under the appellative of "*Salchichón*" or similar (*"Longaniza de Lorca,"* "*Longaniza de Aragón,*" "*Longaniza de Pascua,*" etc., *"fuet," "espetect,"* among others) (Figs. 1 and 2). Most of these "*Salchichón*" types have high acceptability but with low commercial distribution or scientific studies (physicochemical, microbiological, among others) about them [1].

They have some differences caused by the processor's recipes, the elaboration process (time, temperatures, dehydration conditions) with different raw meat types (*see* **Note 1**), and origins (the Mediterranean or Continentals), formulations (meat/fat ratio, formulation depends on the "*Salchichón*" type), condiments (salt, wine, garlic, among others), spices (pepper: black or white pepper, whole, grinded or both, garlic, among others), additives (with or without dairy ingredients, sugars and starches, curing agents, colorants, etc.), meat grinding size (2–10 mm), casing diameter (10 to 200 mm) and origin (natural or artificial), smoking (only in the northern regions of Spain) and drying (industrial, natural chambers, even caves), artisanal or industrial scales (Fig. 3), small (snack type) or length sized (1.5–2 m) (Figs. 4, and 5) [4, 5]. "Salchichón" types had great development and innovation thanks to the spices that came from "the New World," that spread throughout the world, especially in Europe. This sausage spreads in Spain and other countries in the 1960s, caused by the western country's economic development, the fusion of traditional sausage "making art" together with advances in man-made casing manufacturing

Fig. 1 Commercial presentation of different "Salchichón" types. (**a**) Artisanal "*Fuet*"; (**b**) Artisanal "*Longaniza imperial de Lorca*" and (**c**) Industrial "Salchichón de Toledo"

Fig. 2 Packaged and unpackaged Spanish commercial samples of "*Salchichón*" and "*Longaniza*". (**a**) "*Salchichón*" extra semi-circular shape (65 mm); (**b**) "*Longaniza*" extra (33 mm); (**c**) "*Salchichón*" extra round shape (65 mm)

on-going. According to Suursa & Barbut [6], the sausages were stuffed into attractive and functional casings.

All "*Salchichón*" types can be eaten in all processing stages (*see* **Note 2**). These dry-cured sausages are self-stable meat product when rich intermediate moisture values. When this value is not reached, heat treatment is suggested for its consumption.

Therefore, considering the abovementioned, the main objective of this chapter is to make a detailed description of the different processing conditions (formulations, raw materials, ingredients, times, temperatures, etc.) of the Spanish "*Salchichón*."

Fig. 3 "*Longaniza seca*" elaborated with different pork breeds. (**a**) "White breeds" (commercial meat); (**b**) "*Chato Murciano*" breed; and (**c**) "*Porco Celta*" breed

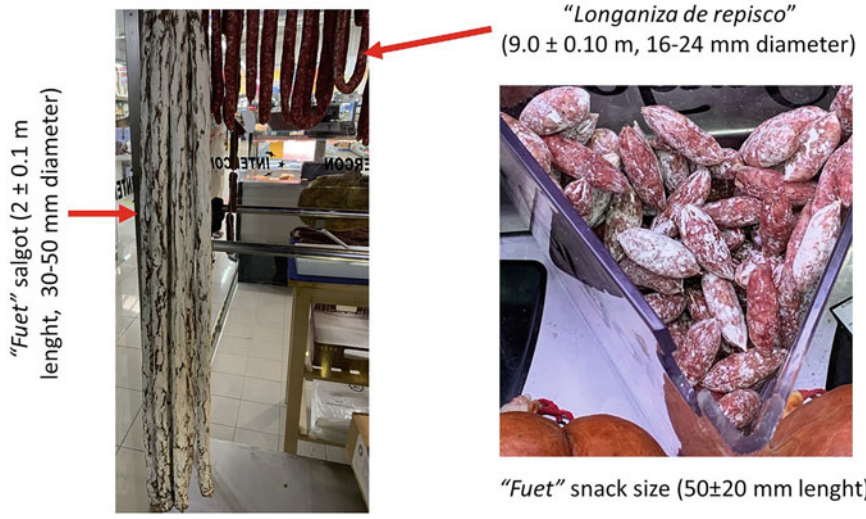

Fig. 4 Length, diameter, and size of different "*Salchichón*" types ("*Fuet*" and "*Longaniza de repisco*") commercially available in the Spanish market

Fig. 5 Different types of commercial "Salchichón" type snacks in the Spanish market. (**a**) Fuet cocktail size; (**b**) fuet stick size; (**c**) chicken Longaniza sticks size; (**d**) Longaniza sticks size

2 Materials

To avoid possible fraud to the consumer, *Salchichón* is regulated by the Spanish Laws. For this reason, this dry-cured sausage, as well as meat product it must comply with the provisions of 1.1 of Annex I of Regulation 853/2004 of the European Parliament and of the Council of April 29, 2004. In 2014, Spanish legislation protects "*Salchichón.*" Thus, the Royal Decree 474/2014, [7], approves the meat products quality standard. This document, according to their elaboration process and treatment applied, classify meat products, the composition, and quality characteristics, labeling, safety standards (to control elaboration process, critical control points during processing, industrial auto-control rules, and traceability, are established. In Table 1 the legal requirements for the different commercial "*Salchichón*" types can be seen [7].

As was mentioned above, "*Salchichón*" can be described as a dry-cured sausage that is made with minced lean a fatty tissues, added with salt (marine or rock), to which curing salts (nitrites and/or nitrates, ascorbates, erythorbates) are added with other ingredients (*see* **Note 3**), starter cultures [3, 8, 9] among others. In Iberian "*Salchichón,*" some producers even used small amounts of paprika to improve the flavor and taste) and that after a process of mixing and resting, it is stuffed into natural or artificial casings (cellulose, collagen, small and large intestine from pork, beef, veal, sheep, foal) that undergo a fermentation process (using autochthonous microbiota or starter cultures and depending on the "*Salchichón*" specialities it can be applied a smoking process) and drying-maturation [10, 11]. However, the elaboration process, as well as the main steps, are mentioned, as will be discussed in the following sections of this chapter.

Table 1
Commercial categories, composition, and legal requirements for the different "*Salchichón*" types commercialized in the Spanish market [7]

Salchichón type	Commercial category	Fat (g/100 g D.M.)	Carbohydrates (g glucose/100 g D.M.)	Protein (g/100 g D.M.)	Collagen/protein ratio (%)	Added protein (g/100 g)
Commercial	Premium (extra)	≤57	≤9	≤30	≤16	≤1
Salami	Premium (extra)	≤68	≤9	≤22	≤25	≤1
Salchichón de Málaga	Premium (extra)	≤50	≤5	≤37	≤14	≤1
Iberian *Salchichón*	Premium (extra)	≤65	≤5	≤22	≤25	≤1
Salchichón		≤70	≤10	≤22	≤30	≤3

D.M. Dry matter

3 Methods

Among sensory properties, in "*Salchichón,*" one of the most valued-added characteristics that consumers appreciated it's the long shelf-life (auto-stable at room temperature). This is caused by different barriers or hurdles [12] for the spoilage microbial growth and favors beneficial microbiota. Also, ultrastructural modifications caused by the salt effect upon myofibrillar proteins (actin–myosin complex) and acidic gelification of those proteins by the effect of lactic acid, generated by the microbiota metabolism (mainly by the Lactic Acid Bacteria-LAB), curing agents such as nitrate, nitrite, and sodium ascorbate. Nitrites contribute with the antioxidant and antimicrobial activity in the sausages, among cured color formation and avoid the warmed-over-flavor in this type of sausages: Microbiota metabolism among lactic acid formation also contributes to flavor and taste formation. The combination of these factors provokes hurdles that also reduce the redox potential, and generates an intermediate moisture food (water activity ≤0.90).

The dry-cured sausages can be described as processed meat products that are made with minced lean a fatty tissues, added with salt (marine or rock), to which curing salts (nitrites and/or nitrates, ascorbates, erythorbates) are added with other ingredients (carbohydrates: lactose, glucose, saccharose, potato starch, cooked rice, dietary fibers; unsaturated fatty acids [8, 13] lemon juice, wine, vinegar, nuts: almonds, walnuts, pistachios, etc.), additives

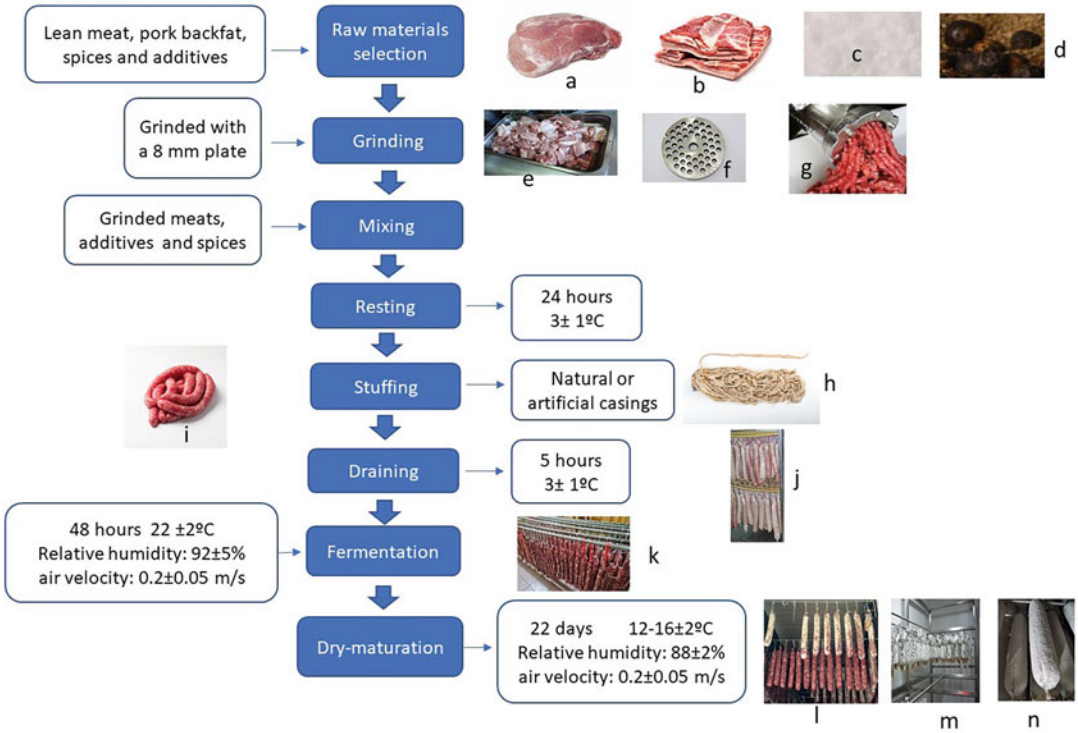

Fig. 6 Conventional commercial "*Salchichón*" processing flow chart. (**a**) Pork lean meat; (**b**) Pork backfat; (**c**) Salt; (**d**) Ground and whole black pepper; (**e**) Trimmed lean meat; (**f**) Grinder 8 mm plate; (**g**) Ground meat; (**h**) Natural pork casings; (**i**) Stuffed "*Salchichón*" meat batter; (**j**) Drained "*Salchichón*" fresh sausages; (**k**) "*Salchichón*" during fermentation stage in controlled conditions chamber; (**l**) "*Salchichón*" during the first week on the dry-maturation stage; (**m**) "*Salchichón*" during the second week on the dry-maturation stage; (**n**) Finished "*Salchichón*" at the end of the dry-maturation stage

(phosphates) and spices (black and white pepper, anise, cinnamon, garlic, onion, oregano, among others) and that after a process of mixing and resting, it is pressed into natural or artificial casings that undergo a fermentation process (employing autochthonous microbiota or starter cultures and depending on the dry-cured sausages specialties it can be applied a smoking process) and drying-maturation [10]. In Fig. 6 the flow chart of the "*Salchichón*" elaboration process can be observed.

There is not only one formulation for each *Salchichón*" type, all of them are elaborated considering the producer's traditional knowledge or the innovation developed (fats, carbohydrates, additives reduction, new ingredients addition, among others) [5], to satisfy the consumer's special requirements applied to this well-known dry-cured sausage.

The "*Salchichón*" processing stages can be summarized as:

1. Raw material: "*Salchichón,*" as a meat product, is prepared totally or partially with authorized meat (pork, beef, poultry,

game, among others) mentioned in point 1.1 of Annex I of Regulation 853/2004 of the European Parliament and of the Council of April 29, 2004, and is prepared according to establish in the European Community Food Regulations Laws.

2. Mincing-Mixing: All lean and fatty cuts are ground with different plates holes (2–10 mm) according to each sausage specifications, ingredients are incorporated and make de "Salchichón meat batter." In, both stages meat proteins, fats, salt, and other ingredients start all. At this stage, important changes take place (*see* **Note 4**). At this point, the "meat batter" is formed.
3. Stuffing: The meat batter is introduced, by pressure, in a natural or artificial casing, that gives the special shape and length (Figs. 1, 2, 3, 4, 5).
4. Resting: is a short-term stage (12–24 h), in this stage allows that the formulation water excess can be eliminated through the casing pores.
5. Fermentation: In this stage, temperature favored, the microbiota growth ("wild microbiota" or that the starter culture is intentionally incorporated). Microbiota metabolizes "natural" or added sugars and produces lactic acid, which reduces "*Salchichón*" pH. Changes in pH produce several changes in the meat batter (*see* **Note 5**) take place. From an industrial point of view, this stage can be made in two ways: cold and warm fermentation. Thus, "cold" fermentation (fermentation temperatures are between 16 and 18 °C) and "warm" fermentation (fermentation temperatures between 19 and 28 °C). The fermentation time will depend on the "Salchichón" diameter (1–2 days in cold fermentations to 7 days in "warm fermentations") and sensory characteristics of the sausages. In both fermentation types, the relative humidity in the fermentation chamber is high (90–95%), to avoid that the surface dehydrates and separation between meat batter and casing takes place. This aspect must be avoided during the changes from sol to gel in the stuffed sausage meat batter ("fresh Salchichón").
6. Smoking: This treatment is applied in few "*Salchichón*" types, mainly in rural areas from the north of Spain (*see* **Note 6**).
7. Dry-maturation is the longest stage of the elaboration process. In this stage, chemical, physical, physicochemical, microbiological, and sensorial changes take place. From the industrial point of view "*Salchichón*" must lose, at least 30% of their original weight ("merma"). Also, water activity (Aw) is a good indicator that the product is finished (Aw $\leq$0.90, Intermediate Moisture Food) and is self-stable at room temperature (Fig. 2). This stage is characterized by a slow and gradual reduction in chamber humidity (90–80%), pH increase caused by the microbiota evolution, the dynamic enzymatic activity

Table 2
Agreements between the Spanish Health Agencies and the Meat Industry for the reduction of salt, fat, and sugars content in Salchichon (Premium quality) until 2020

Ingredient	Reduced amount in meat products (%)	Average concentration (g/100 g) 2016	Average concentration (g/100 g) 2020
Salt (NaCl)	16	3.9	3.5[a]
Total fat	5	41.0	38.95
Total sugars	10	4.0	3.6

[a]To ensure *Salchichón* microbiological safety, only a reduction of 10% can be applied [14]

(to produce aromatic compounds) and most notorious physical change (sausage hardening).

The consumer's information, according to legal requirements for labeling of the Spanish "*Salchichón*" commercial types and another dry-cured specialty associated with this sausage, ingredients, additives and energy value (kJ and kcal) found in the Spanish market is described in [5].

In 2019, the Spanish meat industries and the Spanish Health authorities (Ministry of Health, Consumption and Social Welfare) have reached an agreement (Table 2) about how to reduce the health restrictors (salt content, sugars, saturated fats, and additives) in the meat products. As result of this agreement, meat processors have incorporated some practices to make meat products healthier [14].

4 Notes

1. Traditionally, "Salchichón-types" is made with pork meats. There are different pork breeds (normally, "White," "Celta," "Chato Murciano," and "Iberian breeds") that are used in these dry-cured sausages. Also, other meat types (goat, sheep, foal or beef meats, and games) can be used as raw material.
2. All "Salchichón-types," can be eaten during mixing-resting stage, at the end of the fermentation stage and in all dry-curing stage.
3. "Salchichón-types" can be formulated with no-meat ingredients such as: (carbohydrates: lactose, glucose, saccharose, potato starch, cooked rice, maltodextrins, quinoa flour, dietary fibers (pea, soy, orange, lemon, apple, datepalm, tiger nut) [8]; lemon juice, white wine, vinegar, nuts: date palm, roasted almonds, walnuts, pistachios, pine seed, chia, and sunflowers seeds, etc.), additives (phosphates), and spices (black and white pepper, anise, cinnamon, garlic, onion, oregano.

4. During this stage, the biochemical, chemical physicochemical, microbiological, physical, and sensorial changes take place. Meat color pigments are formed and solubilization of actomyosin complex occurs.
5. Biochemical (enzyme activities), chemical (protein and fat hydrolysis among others), physical (color, texture) and physicochemical (water holding capacity, oil holding capacity, water activity, etc.) changes take place. Microbiota metabolism also generates other chemicals, physical, physicochemical, and sensory changes that characterize this type of meat product.
6. In the drying-smoking chamber, the smoke must impinge on the sausage indirectly. Woods used should not be damp or green, they should not come from resinous wood (avoid the use of pine wood or similar).

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