CHANGES IN CHEMICAL COMPONENTS DURING RIPENING OF SPANISH SAUCISSON

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Summary

The changes in colour, fatty and protein fractions (proteolysis and protein insolubility) during curing process were studied.

The saucisson batches used in this study were manufactured in a local factory according to industrial process. The saucisson was analysed throughout the curing process: minced mix, fermented, 2nd and 4th week of drying (finished product). Water activity (aw), pH, moisture, chloride content, total fat extracted, total protein, total and soluble sugar, protein fractions, non-protein nitrogen, free aminoacids, free fatty acids composition and parameters related to fat stability (Iodine, acidity and carbonyl compounds index and peroxide value) were determined. In relation to colour characteristics, total pigments and nitrosopigments, nitrate and nitrite levels were evaluated. CIELAB coordinates (L*, a*, b*, C*, H*) and nitrosation index were also studied.

The main changes in the characteristics of Spanish saucisson take place during the fermentation phase. Significant variations were found in the following cases: pH values, development of nitrosation phenomena, denaturalization of protein, lipolysis, and formation of volatile compounds. The moisture content of sausage decreased by 30% during the process. The pH decreased from 5.85 to 4.87 at the 2nd week of drying, and increased slightly until the end of ripening, when it was 4.91. Significant differences were found to compare center and periphery values. The extractability of the sarcoplasmic and myofibrilar nitrogen fractions decrease during the curing process, while the amount of soluble nitrogen in 0.1N NaOH increased. The curing of dry saucisson causes proteolysis and protein insolubilization, leading to a selective loss of protein solubility. The ratios of saturated to unsaturated fatty acids of the C16 and C18 chains increased during ripening time. In addition to colour, saucisson samples showed decreasing a* and C* values. The colour of the center presents a redder hue (>H*), is lighter (>L*) and more intense (>C*) than the periphery.

Introduction

Saucisson is a raw cured product which plays an important role in economic terms owing to the high demand for it in Spain. It is a medium-humidity sausage which is characterized by its good conservation at ambient temperature.

Fermentation is a crucial part of the sausage curing process in which the microbial flora develops which largely give the final product its characteristics (Mottram & Edwards, 1983; Beriain et al., 1993). A series of physical, chemical and biochemical transformations occur during the curing process, which depend on the raw material and process conditions (Roncalés et al., 1989) and will be reflected in the organoleptic properties of the final product (flavour, colour, and texture). The bibliography on this kind of curing of Spanish saucisson is scarce, and only refers to aspects of the curing process (León-Crespo & Millán, 1977, 1978; León-Crespo et al., 1978; Garriga et al., 1998a,b; Astiasarán et al., 1990; Melgar et al., 1990).

This study follows up changes to the protein and lipid fractions and to the colour of an industrially-produced saucisson throughout its curing process.

Materials and methods

Materials: for the purpose of this study we used 16 industrially-produced saucisson batches from a local factory. The ingredients used were the following: lean pork (60%), pork back fat (20%), common salt (20 g/kg), sugar (45 g/kg), nitrate (0.1 g/kg), nitrite (0.2 g/kg) polyphosphates (sodium pyrophosphate and potassium metaphosphate) (0.2 g/kg), sodium ascorbate (0.3 g/kg) and black pepper (4 g/kg). Frozen pieces of pork and beef are then mixed with the salts and spices in the cutter. Frozen pork fat is added after being minced in a 3-mm diameter mincer. The mixture is vacuum minced, stuffed in 60 mm diameter sausage cellulose casing and fermented for 3 days (25ºC, 90%RH) followed by 4 weeks drying (15-18ºC, 75-80%RH).

The saucisson was analysed throughout the curing process; minced mix, fermented, 2nd and 4th weeks drying (final product). The parameters of each sample were determined in three replicates.

Analytical methods: Water activity (aw) using an Aqualab CX2 instrument. pH (ISO R 2917-1974) with the Orion Research potenciometer for solid samples. Moisture (ISO 1442-1973), Chloride content (AOAC, 1984). Total fat using a Shoxlet method (ISO 1443-1973). Fat extraction (Bligh & Dyer, 1959). Total and soluble sugar (Fehling method). Protein fractions: sarcoplasmic protein Nitrogen (N), myofibrilar protein N, non protein N, soluble N in 0.1N NaOH and total N, were separated according to Helander´s method (1957) modified by Bello et al. (1974) and then determined using a kjeldahl method, ISO R-937. Total free aminoacids, Rosen method (1957) with tyrosine as standard. Parameters related to fat stability: Iodine value (ISO 3961-1979), acidity value (ISO, 1740-1980), carbonyl compounds index (Henick et al., 1954) and peroxide value (ISO 3960-1977). Free fatty acids (FFA) composition: FFA in the lipid fraction were separated by thin layer chromatography (TLC), dissolved in n-hexane, filtered and methylated (ISO 5509-1978) for identification by gas chromatography (GC). Methyl esters were analyzed using a Hewlett-Packard chromatograph

(HP-5890) with a HP-FFAP (cross-linked) column under the following conditions: a) carrier gas: helium at 1ml/min. b) oven temperature: 180ºC-210ºC at 3ºC/min, 210ºC for 5min, 210ºC-225ºC at 5ºC/min, 9min at 225ºC. c)injector temperature: 230ºC. d) detector temperature: 240ºC. Methyl ester standards of fatty acid (Matreya Inc.) were used.

Related to colour characteristics: total pigments (Hornsey, 1956) and nitrosopigments (Hornsey, 1956 modified by Gorospe et al., 1986), nitrate and nitrite levels (Volff et al., 1974 and Nicholas & Nason, 1957 respectively) and CIELAB coordinates (L*, a*, b*, C*and H*) and nitrosation index (Giddey, 1966) using a Minolta C2002 spectrophotometer.

Statical Analysis: Analysis of variance and multiple comparison test of Tuckey at 0.05% of level of significance were applied to the data to see if significant differences existed between the different brands of saucisson.

Results and discussion

During the four weeks drying period the sausage loses up to 30% of its aqueous content (table 1). Its aw decreases throughout the process, from the minced mix (0.95) until the final product (0.89). As in most previous research reports (Baumgartner et al., 1980; Rödel & Klettner, 1980; Barranco et al., 1985; Lois et al., 1987) the largest decrease in pH is within the first few days of fermentation, the center being less acidic than the periphery.

The curing process of saucisson seems to be more intense in the myofibrilar fraction than in the sarcoplasmic fraction (Table 2). Sarcoplasmic solubility decreases during the first week of curing, parallel to protein denaturalization. Myofibrilar solubility, however, is significantly reduced during drying. In contrast to other authors (Klement et al.,, 1974; Astiasarán et al., 1990) no correlation was found between the variation in soluble protein and the pH. The proteolysis index increases from fermentation in parallel to the total aminoacid content until the second week of drying. Significant differences were not detected in weeks 3 and 4. Dierick et al. (1974) found a significant increase throughout the entire curing process.

The changes to the parameters related to fat stability reflect the presence of lipolitic and oxidative phenomena throughout the curing process (Table 3). The fermentation phase is the critical stage in the formation of carbonyl compounds. The saturated/unsaturated free fatty acids ratio increases as the process goes on due to the loss of unsaturated free fatty acids, mainly linoleic and linolenic, as a result of their greater susceptibility to oxidation. Our results agree with the data presented by Mottram & Edwards (1983) and Flores et al. (1985).

Regarding the colour study (table 4), fermentation is the stage where the greatest variations appear in colour parameters (a*, b*, C*, H*, nitrosation index. nitrates and nitrites). The nitrites decrease to trace levels during fermentation when they react with meat pigments and form nitrosomyoglobin, this is reflected in an increase in the conversion index (nitrosopigments/total pigments * 100) and a reduction in the nitrosation index. The a* and C* values decrease throughout the entire process. Hue (H*) decreases during fermentation and

then increases in the second week of drying, later becoming stable. During drying the center gives higher H* readings, lower redness (a*) and Crome (C*) than the periphery. In the final product the colour of the center is lighter (>L*), has stronger redness (>a*), is brighter (>C*) and has a stronger red hue (H*) than the periphery.

Conclusion

The major changes in the characteristics of Spanish saucisson take place during fermentation, and these are mainly reflected in the reduction of protein solubility, unsaturated free fatty acids and a* and C* values, as opposed to an increase in proteolysis and lipolysis phenomena, reflected in the concentration of total free aminoacids and carbonyl compound content.

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