# MICROBIOLOGICAL AND PHYSICO-CHEMICAL ASPECTS IN THE FERMENTED CURED PIG SHOULDER. II) DEPTH

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## Introduction

On account of the fact that the fermented meat products are characterized for their not undertaking baking in its processing the presence of obstacles detaining the development of the pathogenic bacteria becomes important. Physico-chemical parameters such as the pH, $a_w$, concentration of chlorides and nitrites and the like can operate as obstacles [9].

## Objectives

The accompanying of the evolution of physico-chemical parameters (pH, $a_w$, $NO_2$, moisture, sodium chloride) along with some microorganisms (Mesophilic, *Micrococcacea, Staphylococcus xylosus*, and Lactic acid bacteria), during the processing and storage of fermented cured pig shoulder.

## Material And Methods

**Processing.** The experiment had been set up at pilot scale being constituted of ten (10) pieces of pig shoulder unprovided of bones, skin and external layer of fat and presenting in average 1,6 kg weigth, 20 cm width, 25 cm length and 6 cm thickness. The pieces were submitted to the brine injection at the ratio of 20% volume/weigth, which presented in its constitution 25% of sodium chloride, 1,25% of nitrite and nitrate salts, 1,12% of sodium eritorbato of sodium, and pure culture of *Staphylococcus xylosus* added fifteen minutes before the injection. After injection, the shoulder were taken to the tambler in which they remained for 1 hour at 5°C temperature and 600 psi vacuum, this time divided in 30 minutes of beating and stopped 30 minutes. Finished the tambleamento, the shoulders were taken to the maturation camera where they remained for 30 days under controlled temperature and relative humidity. Removed from the camera, they were packed in coextruded - nylon polished five layers plastic bags of 100μ thickness, vacuum closed and stored for 120 days at 10°C temperature.

**Sampling procedures**. Samples for the microbiological and physico-chemical analyses had been collected during the processing (points 1 to 6) and during 120 days of storage (points 7 to 10). The points of analyses and temperature variations inside the maturation camera during the processing, as well as the storage temperature were the following: 1) raw material for 5°C; 2) after brine injection at 5°C; 3)after 2 days inside the maturation camera at 4°C; 4)after 10 days of camera at 4°C; 5) after 20 days of camera ranging from 6° and 7°C; 6) after 30 days of camera at 9°C; the points 7, 8, 9 and 10 correspond respectively to 30, 60, 90 and 120 storage days at 10°C (±2).

**Microbiological analyses.** It has been determined in samples originated from the inner parts of the shoulders, according to 10 points chosen [11]. Variation of bacterial populations during processing and storage time were monitored by means of total aerobic mesophilic counts, total lactic acid bacteria, total aerobic *Micrococcaceae*, and *Staphylococcus xylosus.*

**Physico-chemical analyses.** Moisture, ashes and pH were determined following the procedures described by AOAC[1]. Sodium chloride content was determined by the method mentioned in BRASIL [2]. Water activity ($a_W$) has been determined using Aqua-lab equipment, model CX – 2, operating at 30ºC (± 0,1). Nitrite content has been determined according to methodology described by IAL [8].

**Statistical analysis.** The results were analyzed statistically following the procedures suggested by CAMPOS [3].

## Results and discussions

The statistical results of moisture, sodium chloride, nitrites, $a_w$, and pH values are presented in Table 01. It has been shown a reduction in moisture ($p < 0.05$), $a_w$ ($p > 0.05$) and nitrite ($p < 0.05$) content after the ageing period. The less water available for the bacteria development combined with the amount of sodium chloride in the final product ensure its microbiological stability. The minimum concentration required for that the sodium chloride exercises its inhibitory action, as bacteriostatic in the cured ham is of 4,5%, [4]. At the points 5, 6, 7, 8, 9 and 10 such inhibitory action would take place. Following the classification presented in the work of SABATAKOU et al. [10] the shoulder could be stored at room temperature considering that the values of found for $a_w$ were smaller than 0,91.

Mountainous cured ham produced through the fast method (90 and 110 days), presented counting of flora aerobic mesophilic in depth $\log_{10}$ 4,41 UFC/g [5, 6]. The shoulder considered as final product (point 6) presented $\log_{10}$ 7,44 UFC/g, that larger value found in the shoulder would be due to the injection with the starter, since it is not used brine injection in the cured ham. The results of the microbiological analyses performed in the pig shoulder can be visualized in the Figure 01.

CORNEJO et al. [7], found in the internal part of ready cured ham counting of the family *Micrococcaceae* 103 UFC/g, sodium chloride concentration ranging from 7% to 8%, and moisture between 55 and 60%. In the fermented cured shoulder (point 6) the counting was of 106 UFC/g, 7,37% of sodium chloride and 69,5% of moisture. The counting and the moisture value were superior to those found in the cured ham, thought the sodium chloride content was similar.

## Conclusions

Based on the results achieved in this study, it can be concluded that the hurdles evaluated indicated some bacteriostatic action although *Staphylococcus xylosus* was able to develop in concentration of sodium chloride as high as 7,54%.

The fermented cured shoulder presented in the final product and during the storage period nitrite contents within the Brazilian legislation.

The fermented and cured pig shoulder can be stored at room temperature.

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Table 01. Physico-chemical parameters in the inner part (depth) of the pig shoulder cured and fermented during the processing and storage.

| Physico-Chemical | Raw Material | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Moisture | 75,54ab (±0,08) | 74,18bc (±1,97) | 77,31a (±0,84) | 73,39bc (±0,10) | 71,57cd (±0,11) | 69,50d (±0,36) | 59,78e (±0,96) | 52,12g (±0,73) | 56,38f (±1,15) | 57,11f (±1,29) |
| NaCl | 0,14f (±0,00) | 2,38e (±0,15) | 4,45cd (±0,09) | 3,90d (±0,04) | 4,63c (±0,12) | 7,37a (±0,24) | 5,97b (±0,16) | 7,54a (±0,51) | 5,02c (±0,21) | 5,72b (± 0,28) |
| Nitrites | Nd* | 110,67b (±2,96) | 180,73a (±7,53) | 57,74d (±0,37) | 66,58c (±2,88) | 7,39ef (0,67) | 13,43ef (±1,80) | 14,98e (±1,14) | 6,56f (±0,62) | 6,31f (± 0,56) |
| $a_w$ | 0,982 | 0,968 | 0,956 | 0,943 | 0,930 | 0,904 | 0,894 | 0,862 | 0,867 | 0,888 |
| pH | 6,40 | 6,31 | 6,72 | 5,90 | 6,37 | 5,84 | 6,40 | 6,47 | 5,71 | 6,51 |

Nd: non determined; $a_w$ determined at 30oC. The results moisture, NaCl expressed in percentage (%), nitrites in mg/kg and with the pattern deviation in brackets. a, b, c, d, e, ..., are analyzed in the horizontal and different lower-case letters present relevant difference by the test of Tukey p<5%.

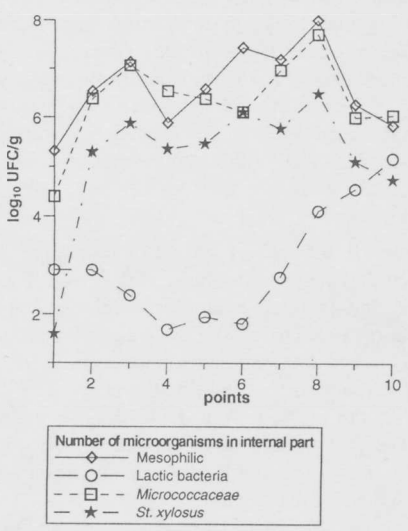


Figure 01. Evolution of bacteria counts during the processing and storage in the internal part of the fermented cured shoulder ($log_{10}$ UFC/g).