

## TEMPERATURE INFLUENCE ON COLOUR PROPERTIES IN DRY-CURED HAM.

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### SUMMARY

The influence of pH and temperature upon colour properties, during the salting stage of the dry-cured ham process was studied. The hams were salted for 11 days. The parameters under study were : moisture, residual nitrite level, CIEL\*a\*b\* and reflectance ratios (R560/R500, R650/R570 and R630/R580). The temperatures under study did not affect colour properties, as the same form, the studied pH did not show influence on either colour properties. The colour properties of the Semimembranosus muscle were particularly affected by the salt in its external zone, whereas Semitendinosus and Biceps femoris parameter colours were not affected.

### INTRODUCTION

The dry-cured ham is a deep-rooted product in Spain. The spaniards are its highest producers and consumers in the world. Dry-cured ham consumption in Europe was in 1992 (kg/person/year) as follow: Spain 5.0, Italy 2.2, France 2.0, Belgium 1.5 and Portugal 0.4 (Pascual Fernández, 1993). Its process can vary, with small details, in accordance to the traditions of each production zone, but it always has the same fundamental phases.

In the last few years new technologies were incorporated to the dry-cured ham process in order to improve the traditional handcraft method and to avoid the weather conditions. These new technologies were incorporated with a few previously carried out scientific studies.

In the dry-cured ham process there are three principal stages : 1-Salting: The hams are totally covered with salt and put in a cold storage room (1-3,3°C). 2-Postsalting: during this stage the salt equalization takes place. The salted hams, are kept at a low temperature (aprox. 3,3°C) for approximately 30 days. 3-Dry-maturation: in this stage proteolysis and lipolysis take place. These reactions develop the desirable sensorial characteristics, by which the dry-cured ham is so appreciated.

The salting stage is the shortest stage in process time (8-11 days) and it has a great influence on the quality of the final product. During this stage the salt uptake takes place, but there is not an equal salt concentration in all ham muscles. There are few papers that study the influence of salt upon colour properties (Forcen Vicente et. al., 1993).

The aim of this work was to study the influence of pH and the process temperatures (2,3-3,2°C) upon colour properties during the salting stage.

### MATERIALS AND METHODS

This work was made with 12 green hams, each one weighing 10Kg which were provided by a C.E.E. authorized slaughter house. The hams were selected according to their pH and were then clasified into two batches: normal pH (5,6-6,0) and high pH (>6,0). The surface of the hams was immediately dusted with salt curing agents, and then, the hams were put in a cold storage room ( $T^{\circ} < 3,3^{\circ}\text{C}$ ) for one day. The hams were salted by a traditional method (totally covered with salt) for 11 days. Each pH batch was divided in two batches and exposed at different temperatures: 2,2 and 3,5°C. At the end of the salting stage the salt excess was brushed off. For this study were analysed obtained 3 muscles: Semimembranosus (SM), Semitendinosus (ST) and Biceps femoris (Bf). Each muscle was divided in 3 sections (outer, middle, inner) in accordance with salt diffusion (2 cm. of depth by section).

The physicochemical parameters under study were: Moisture and Residual nitrite level, both parameters were measured by international standards ISO 1442 and ISO/DIS 2918 respectively. The physical parameters analysed were: Reflectance ratios: R560/R500 (IN), R650/R570 (ID) and R630/R580 (ITP) and

CIEL\*a\*b\* 1976 notations (D65, 10°). Both parameters were measured by a Minolta CM1000 spectrophotometer.

The results were analysed by a statistical program (BMDP ver. rel. 9.0), and was made an ANOVA by 2V, along with a description of multiple factor groups by 9D.

## RESULTS AND DISCUSSION

The tables 1 and 2 show the results for the different physicochemical parameters under study.

Significant statistical differences between the hams moisture were not found ( $P < 0,01$ ). Semimembranosus outer zone was the only one that showed significant statistical differences for this parameter ( $P < 0,05$ ). Moisture was not affected by pH and salting temperature, probably due to the fact that the hams were covered with a salt saturated layer which could control moisture losses. Significant statistical differences in residual nitrite levels, were found ( $P < 0,01$ ) among the three muscles studied. Also, a concentration gradient among them was found, which agree well with the Sayas et al. (1989) results. Moreover, this concentration gradient was found among the three zones of Semimembranosus muscle but not in the other muscles under study. The tables 3 and 4 show the results of colour parameters and reflectance ratios. For L\* (lightness) it was found that ST and Bf showed similar values in all the zones under study, the same as Kauffman et al. (1991) reported for fresh meat. In SM muscle a decrease was observed in its values for outer and middle zone. This reduction could be caused by salt concentration. For a\* (red-green), the hams showed significant statistical differences between them. The only muscle that showed significant statistical differences ( $P < 0,05$ ) was SM. These differences can be due to salt concentration or the different fiber types (red and white). (Hunt et al. 1993). For b\* (yellow-blue), all hams and muscles ( $P < 0,01$ ) and every SM zone ( $P < 0,05$ ) showed significant statistical differences.

Only SM muscle ( $P < 0,01$ ) and its zones ( $P < 0,05$ ) showed significant statistical differences for Hue ( $h^\circ$ ). Figure 1 are represents colour tone for each zone and muscle under study. The reflectance ratios studied, only showed significant statistical differences between muscles ( $P < 0,01$ ) and even in SM zones ( $P < 0,05$ ). ID showed that all muscles and zones have an excellent cured colour, all results agree well with Forcen et al (1993) for the same phase.

## CONCLUSIONS

The salting stage temperatures under study did not affect colour properties. At the end of the salting stage the pH studied did not show any influence on colour properties. The salt diffusion only affects in colour properties the external and medium zones in semimembranosus muscle. Semitendinosus and Biceps femoris muscles maintain fresh muscle colour properties, during all salting stage.

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