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SALTING OF SPANISH HAM: INFLUENCE OF MEAT ZONE AND TIME ON SALT PENETRATION

F. León Crespo, F. Céspedes Sánchez, H. Galán Soldevilla, A. Martín Serrano, M.C. Torres Muñoz, G. Pérez Alcántara and M.A. Ortega Mariscal

Planta Piloto de Tecnología de Alimentos. Departamento de Bromatología y Tecnología de Alimentos. Universidad de Córdoba. Campus de Rabanales. 14071 Córdoba.Spain

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INTRODUCTION

In Spanish dry cured ham processing the amount of salt is highly important to determine the final quality characteristics as salt influences the acceptability of ham by itself and also influences most of the aging processes taking place in this product (Leistner, 1987). As the total amount of salt included in ham depends on the salt penetration during salting, this step is one of the most significant processing variables to be controlled to be able to obtain a consistent quality in hams .

Penetration of salt into meat has been object of several studies and Palmia and Bolla (1992) established the possibility of using this effective diffusion coefficient as a method to establish the time of salting in ham, and calculated a value of 0,225 x 10^{-9} m^2/s that these authors evaluated in different commercial hams. From their results, it was possible to appreciate that the observed values in hams containing a higher amount of salt were quite approximate to the theoretical ones. However, in hams absorbing lower amounts of salt presented salt concentrations in the deep of muscle under the expected values. Although an explanation is not provided for this observation, as the amount of salt depend on the time of ham permanence in the salting step), and it is possible to find variations in the effective coefficient of diffusion during the salting step-

By the other way, ham is composed of many different muscles, being possible to think in obtaining different values for the effective diffusion coefficient depending of the zone of the ham. The values reported for the effective diffusion coefficient in meats has been established to depend of type of muscle (Fox, 1980).

OBJECTIVES

The objective of this study has been to evaluate the adequacy of using one effective diffusion coefficient to evaluate salt penetration during salting of Spanish ham in different zones and at different periods of the salting process.

MATERIAL AND METHODS

Twelve pieces of ham, that had been previously frozen stored, as usual in the meat industry, were used for this study, being salted by burying them in salt piles. Six pieces were extracted from the piles after 5 days of salting and the another six after 8 days. From each ham 4 cylinders of meat of 2 cm of diameter, to a total length of 10 cm, were taken. The four cylinders were taken from different regions of the ham as presented in Figure 1. Each cylinder was divided in samples of 1 cm length that were analyzed for moisture and salt as described by Ockerman (1985).

The values of the effective diffusion coefficients (D) at each depth of the each cylinder and the ones for the total amount of salt penetrating at each time in each cylinder were calculated using the equations proposed by Crank (1975). The total amount of salt (M) penetrating in each cylinder was calculated as $M=:\sum c_i$; being c_i : amount of salt in each sample of 1 cm depth . The experimental results were submitted to statistical analysis using the *Estatistica for windows* program.

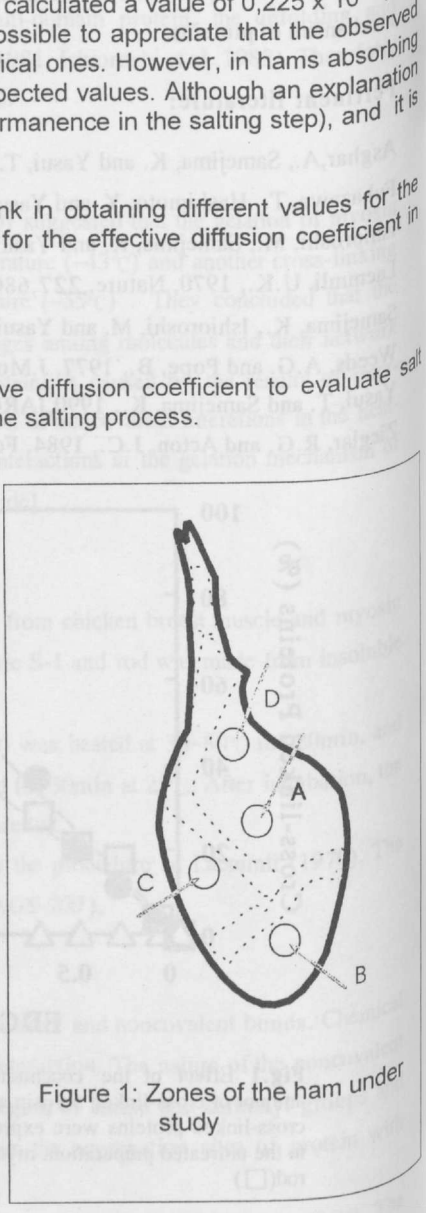

Figure 1: Zones of the ham under study

RESULTS AND DISCUSSION

Figure2 includes the salt concentration at different depth in the four studied zones of the ham after 5 days of salting (approximately half of the time of salting) and Figure 3 the results obtained after 8 days of salting (the usual final of salting in this type of product. In each of the figures there is a line presenting the theoretical salt concentration using the effective diffusion coefficient of 0.225 x 10^{-9} m^2/s as proposed by Palmia and Bolla (1992)

It is possible to see in both figures (2 and 3) that the actual salt concentration found in the depth of ham agree quite well with the proposed coefficient in zone A after 5 days of salting and zone D after 8 days of salting. In the rest of the graphics it is clearly apparent the existence of deviations from the expected salt concentration.

The magnitude of these deviations can be appreciated in Table 1. In fact, there were significant differences among the calculated values for the effective diffusion coefficient for the four studied zones and the two points in time selected. It is possible to see that the effective diffusion coefficient presented very low values in zones C and D at 5 days of salting . In general it was possible to appreciate a general increase in the D value from the 5th to the 8th day of salting in all the studied zones. This increase seems to indicate that there is a change in the conditions of salt penetration in the late period of salting that favors this process. This fact can have a significant interest to be able to obtain the right amount of salt in the final product.

Table 1. Values of the effective diffusion coefficient (D in $m^2/s \times 10^{-9}$) in the four studied zones from the total amount of salt penetrating in muscle during salting.

Zone	Salting for 5 days	Salting for 8 days
A	$0.226^{a\,A}$	$0.296^{a\,A}$
B	$0.340^{a\,B}$	$0.572^{b\,A}$
C	$0.050^{a\,C}$	$0.130^{c\,A}$
D	$0.080^{a\,C}$	$0.222^{a\,A}$

CONCLUSIONS

The results obtained in the study show that salting of ham is a complex process very difficult to control as salt diffusion present significant differences among different zones of the piece and at different times of the salting process.

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Figure 2: Salt concentration (kg/m3) in the depth of ham in the four studied zones at 5 days of salting

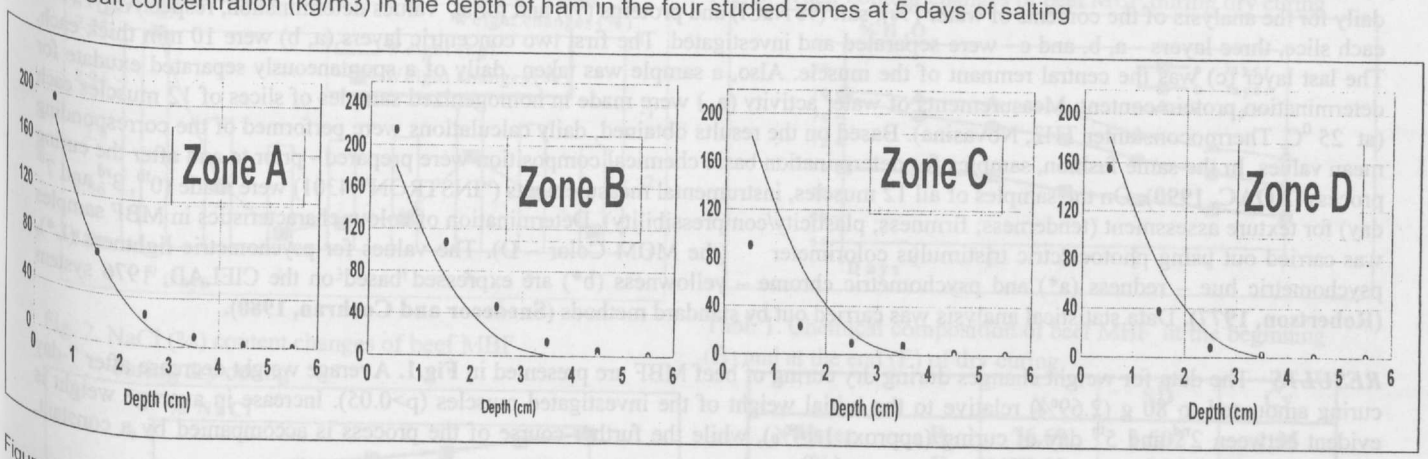

Figure 3: Salt concentration (kg/m3) in the depth of ham in the four studied zones at 8 days of salting