OLOUR AND COLOUR STABILITY OF DRY-CURED HAM

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UMMARY

Packaged and unpackaged Spanish dry-cured ham slices were evaluated for colour stability at different lux intensities. The slices were ced in an illuminated display cabinet at 5°C under continuous illumination (700, 1800, 2500 lux). The physical parameters under study re CIE L*a*b*, C*, h*, S*, ΔE, RSI (pigment discolouration R570/R650), NI (pigment nitrosation R560/R500) in **Semimembranosus**, **mitendinosus** and **Biceps femoris** muscles. The unpackaged slices show discolouration but show no brownish, this slices present a or red colour. The packaged slices do not show any changes in colour.

NTRODUCTION

The Spanish processed meat industry traditionally made dry-cured products, to all dry-cured products the dry-cured ham is the most portant of them. Now the dry-cured products of white pork can be exported to CEE countries; this made Spanish industry to study fferent forms to sell dry-cured ham, because in Spain the traditionally selling form of dry-cured ham is by piece or cutted in the permarket. At this moment the most important form to sell Spanish dry-cured ham for exportation is in slices. Hereby the importance of lour stability of the packaged slices, because in the mind of the average consumer about to purchase meat products, colour becomes nonymous with meat quality. Only little information is available on colour stability in dry-cured hams.

The aim of this work was the study of physical parameters evolution in packaged and unpackaged Spanish Dry-Cured Ham slices ring a week, at different lux intensities (700, 1800, 2500 lux).

ATERIALS AND METHODS

The present study was carried out with 5 deboned female hams (Large White x Belgium White). All the hams were selected for the panish Inspection like IB (approximately 76 kg). The zone under study was delimited between the central part of the femur bone and the rpendicular zone at that bone. The muscles under study were **Semimembranosus** (SM), **Semitendinosus** (ST), and **Biceps femoris** (BF). The hams were taken at 9th months after the beginning of the process, and the samples obtained (0.5 cm thick) were analyzed for lour evaluation at 0, 1, 2, 3, 4, 5, 6, and 7 days after the hams were cut for consumers sale, one part of the samples were packaged in nikoron AC vacuum package bags with an oxygen permeability of 40-60 mL m^{-2} day atm O_2 (20% polyamide and 80% polyethylene) and aled in a Tecnotrip vacuum sealer. The other part of slices were unpackaged. Both samples were placed in an illuminated display cabinet 5°C under continuous illumination with a Osram L 36 w/76 nature de lux (700-2500). The physical parameters under study were CIE *a*b* (observer 10°, D-65 illuminant). L* (lightness), a* (redness), b* (yellowness) C* (Chroma), h* (hue), S* (saturation), ΔE lour differences), RSI (pigment discolouration R570/R650), NI (pigment nitrosation R560/R500). The colour study was made with a inolta CM1000R spectrophotometer. The RSI and NI values were measured by %reflectance.

ESULTS and DISCUSSIONS

Two way Anova was used to analyze the obtained data. This statistical analysis showed that no statistically significant differences ere found between all hams, but statistically significant differences were found for muscles, treatment and parameter under study. L* in BF nd SM showed a similar behavior in days and lux intensities, but not in treatments (packed and unpackaged samples). In ST L* showed ifferences between treatment and lux intensities. The changes in a* values are caused by the chemical transformation of myoglobin forms (**Myo** myoglobin), (**Omyo** oximyoglobin), (**Metmyo** metmyoglobin), (**NOmyo** nitrosomyoglobin) as its is being interconverted. The esults for a* values in BF, ST, SM can be observed in Table 1, 2 and 3 respectly. The results showed statistically significant differences etween day and treatments for all muscles under study. The a* values decreased during the light exposition in unpackaged slices, this ehavior can be observed in figures 1, 2 and 3 for each muscle under study. One of the causes for discolouration could be the action of NaCl (SAKATA, et al, 1989)". For b* statistically significant differences were found between ST and BF muscles for days but for SM no

Table 1. Evolution of a* for **Biceps femoris** muscle in vacuum packaged and unpackaged slices of dry-cured ham at different lux intensities.

time	VACUUM PACKAGED			UNPACKAGED		
(days)	700[a]	1800[a]	2500[a]	700[a]	1800[a]	2500[a]
0	13.06	13.06	13.06	13.06	13.06	13.06
1	13.40	11.78	15.20	9.56	8.97	9.23
2	12.21	11.81	13.74	8.11	7.89	8.13
3	12.49	13.72	13.97	7.15	6.87	6.89
4	11.98	13.02	13.68	6.66	6.25	6.35
5	11.30	14.41	14.04	5.85	5.56	5.48
6	12.52	14.03	13.45	5.45	5.24	5.00
7	10.25	13.49	14.07	5.08	4.80	4.50

[a] Lux intensities.

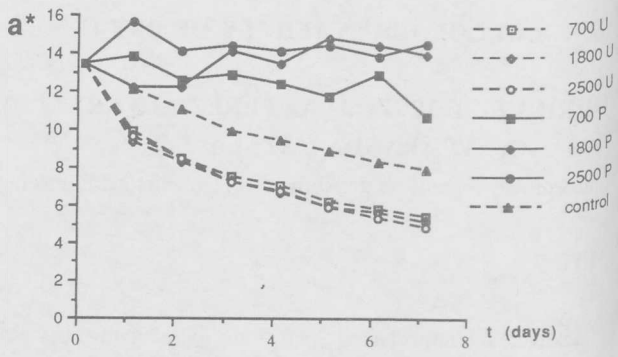


Fig. 1 Evolution of a* in dry-cured ham slices packaged (P) , unpackaged (U) and control slices at different lux intensities for Biceps femoris

Table 2. Evolution of a* for **Semitendinosus** muscle in vacuum packaged and unpackaged slices of dry-cured ham at different lux intensities.

0	13.42	13.42	13.42	13.42	13.42	13.42
1	11.94	12.07	14.02	9.25	8.78	8.26
2	12.05	11.33	12.39	7.09	6.59	6.30
3	11.98	13.39	12.74	5.56	5.35	4.67
4	11.98	11.17	13.07	4.52	3.84	3.77
5	11.00	13.23	12.42	3.98	3.47	3.19
6	10.88	12.22	12.78	3.18	3.13	2.80
7	10.42	13.35	12.52	3.17	2.71	2.55

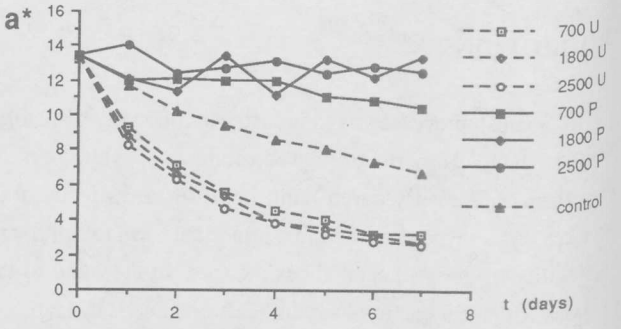


Fig. 2 .- Evolution of a* in dry-cured ham slices packaged (P) , unpackaged (U) and control slices at different lux intensities for Semitendinosus

Table 3. Evolution of a* for **Semimembranosus** muscle in vacuum packaged and unpackaged slices of dry-cured ham at different lux intensities

time	VACUUM PACKAGED			UNPACKAGED		
(days)	700[a]	1800[a]	2500[a]	700[a]	1800[a]	2500[a]
0	12.74	12.74	12.74	12.74	12.74	12.74
1	14.35	11.52	13.95	10.62	9.69	9.55
2	11.85	12.07	12.56	8.78	7.99	7.29
3	11.77	14.59	13.98	7.27	6.87	5.81
4	12.40	11.04	11.62	6.55	5.97	6.15
5	11.59	12.64	12.25	5.76	5.63	4.34
6	11.39	11.90	12.94	4.79	5.36	4.35
7	10.55	15.13	13.17	4.57	4.96	4.07

[a] Lux intensities.

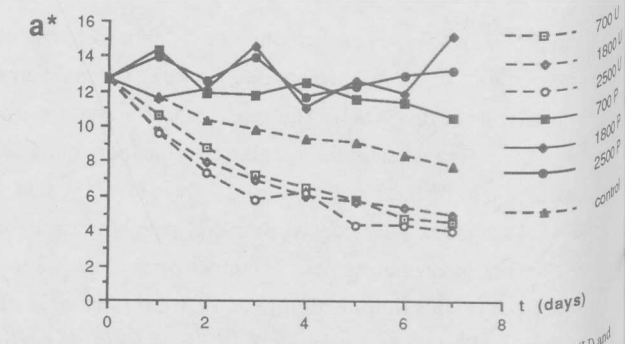


Fig. 3 Evolution of a* in dry-cured ham slices packaged (P), unpackaged (U) and control slices at different lux intensities for Semimembranosus

statistically significant differences were found. For the different lux intensities no statistical differences were found for each muscle under study. The NI values showed statistically significant differences between treatments for each muscle, in respect to lux intensities in BF and SM muscles no statistically significant differences were found, this index showed that in the first day after the beginning of illumination takes place a retrogradation of NOmyo "(GIDDEY 1966)", no changes were found during the next days. The RSI values showed that no statistically significant differences were found between muscles, but presented differences between days and treatment, the unpackaged slices increased in RSI value. This results, which contradicts the normal pattern of colour stability. This apparently contradictory pattern of the decrease in Metmyo concentration at light and air exposition has been reported in several works "(RENERRE, et al, 1986)", "(O'KEEFE et al, 1982)", "(FOX, et al, 1968)","(SMULDERS, et al, 1989)". Only little information is available on RSI in Spanish dry-cured hams "(GOROSPE, ET AL 1989)", "(CAMPO, et al 1991)". The decrease of Metmyo concentration during light exposition can be explained by several factors that incise in dry-cured ham. Dry-cured ham presents enzymatic activity during all the process (proteolytic and lipolytic activity "(CORDOBA, 1990)") because in this product does not takes place heat treatment that makes enzymes denaturalize. The muscle show an aerobic enzymatic activity (ARA), "(O'KEEFE, et al 1982)", another factor in dry-cured ham is the reductant conditions, reductant aminoacid (cysteine), pH "(TARLADGIS, 1962)", "(NIETO, 1988)", residual nitrite, in this reducing conditions the oxygen presents low solubility in

uscles, the NaCl and the dehydration during the exposition of the slices at air decreased the oxygen solubility in cured meats "(O'KEEFE, et 1982)" reducing oxygen disposability to transform Myo in Metmyo. The muscles showed a clear difference between them, SM was the st stable to light and oxygen action, the evolution of Δ E can be observed in figure 4. This phenomena can be explained by the act that SM one of the most stable muscle to discolouration "(O'KEEFE, et al 1982)","(RENERRE, et al 1986)", and presents a different NaCl ncentration because during the salting stage this muscle is in contact with the salt, the evolution of RSI can be observed in figure 5. C* is erally considered as useful parameter to describe colour changes in more descriptive terms decreases with the exposition time, this was re notorious in the outer muscles, the evolution of C* can be observed in figure 6. Either for h* and S* statistically significant differences ist between treatments and days, the evolution of h* can be observed in figure 7. Is very important to consider that a panel finds no ferences to in the visual colour of package slices from the beginning to the end of the experiences.

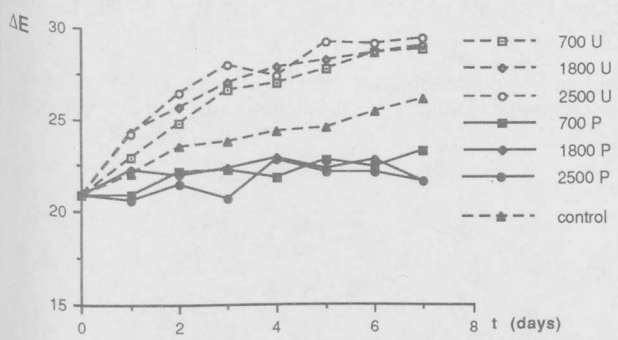


Fig. 4 Evolution of ΔE in dry-cured ham slices packaged (P),unpackaged (U) and control slices at different lux intensities for Semimembranosus

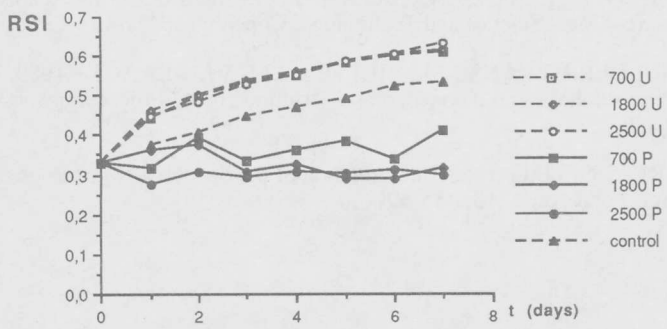
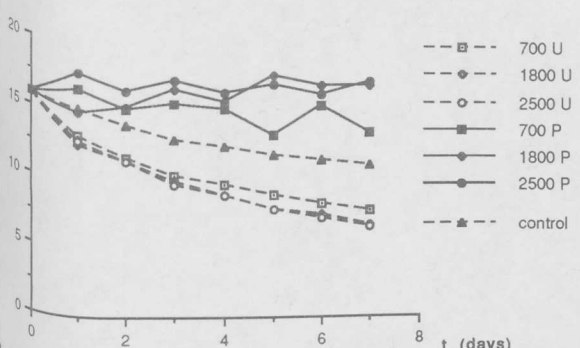


Fig. 5 Evolution of RSI in dry-cured ham slices packaged (P), unpackaged (U) and control slices at different lux intensities for Biceps femoris



. 6 Evolution of C* in dry-cured ham slices packaged (P), unpackaged (U) and control slices at different lux intensities for Biceps femoris

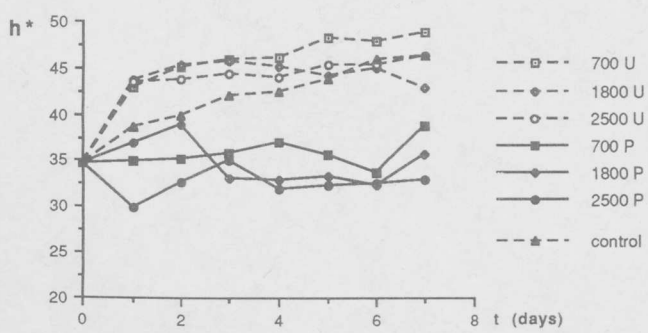


Fig. 7 Evolution of h* in dry-cured ham slices packaged (P), unpackaged (U) and control slices at different lux intensities for Biceps femoris

ONCLUSIONS

None of the unpackaged samples present brownish colour, only less intense colour that packaged slices. No differences exist between e different lux intensities for packaged and unpackaged slices. In Spanish dry-cured ham the **Semimembranosus** muscle shows the best havior to colour stability. During the first day of light exposition in unpackaged slices takes place a nitrosomyoglobin retrogradation. The e of vacuum packaged bags of 40 mL m^{-2} day atm O_2 is good to retain the colour characteristic in Spanish dry-cured ham .

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