"LOMO EMBUCHADO": COLOUR EVOLUTION DURING THE SALTING-SEASONING STAGE

Sánchez-Rodríguez, E.; Pérez-Alvarez, J.A.; Gago-Gago, M.A.; Fernández-López, J.; Ruíz-Peluffo, M.C.; Pagán-Moreno, M.J.; Aranda-Catalá, V. Departamento de Tecnología de Alimentos. Universidad Politécnica de Valencia Camino de Vera 14. 46022 Valencia SPAIN

KEYWORDS: Lomo embuchado, salting-seasoning stage, colour, CIELAB, hue, chroma.

BACKGROUND

Dry-cured meat products are an important part of the Spanish diet, and have a long tradition in Spain. Within the group of dry-cured meat products, "lomo embuchado" has a higher economic value. The "lomo embuchado" elaboration process has two principal stages: salting-seasoning and dry-maturation (Sánchez et al., 1994). The salting-seasoning stage is the first stage in the elaboration process which, in spite of its short duration, has a great influence on final product quality. During this stage, salt, curing agents, a mixture of spices (paprika, garlic, black pepper, oregano, etc.), water and/or wine must be added.

OBJETIVE

The aim of this work was to study the colour properties during the salting-seasoning stage of the "lomo embuchado" elaboration process.

METHODS

This work was undertaken using 16 green loins, obtained from 6 month old pigs [Large White x Landrace (female) and White Belgian (male)]. The green loins were selected according to two criteria: weight (1800 ± 200g) and pH (5,70 ± 0,10). The salting-seasoning stage was undertaken in a pilot plant in accordance with the industrial process. Green loins were treated with salt and curing agents and later, a paste consisting of smoked Vera paprika, fresh garlic and water was made. Then it was homogeneously rubbed over the loin surface. The study was carried out on loin slices (considered as cylinders) of 2 ± 0,5 cm of length and 6 ± 1 cm of diameter. Each one was divided in three zones with 2 cm of depth depending on salt diffusion: zone 3 being that covered by connective tissue which hinders salt penetration, zone 2 the middle one and zone 1 which is in direct contact with salt. The technological process conditions during this study were: temperature: 3 ± 1°C, relative humidity: 90 ± 5% and time: 3 days. Sampling took place at 0, 24, 48, 54, 72 and 84 hours. CIELAB space colour: Colour coordinates [Lightness (L*), Redness (a*) and Yellowness (b*)], colour attributes [Chroma (C*) and Hue (H*)], a*/b* ratio and colour differences (ΔE*) were determined. Colour parameters were measured by a Minolta CM1000 (Minolta Camera Co, Osaka, Japan) spectrophotometer (light source D65 and standard observer 10°). American Meat Science Association Guidelines for colour measurements were followed. (Hunt et al., 1991). Each parameter was tested in triplicate. Conventional statistical methods were used to calculate means and standard deviations (statistical program BMDP 9.0 software). Statistical analysis (ANOVA) was applied to the data to determine statistically significant differences ($P<0.01$ and $P<0.05$) between each factor, taking zone and time as factors and the zones 1, 2 and 3, and the different hours as levels under study. Also a linear regression analysis (1R y 2R) was made.

RESULTS AND DISCUSSION

Lightness (L*)

ANOVA results for this parameter show that significant differences between zones ($P> 0,05$) were not found but they were over time ($P <0,01$). L* increased during the process. This could be due to the pH decrease and lactid acid increased found in this stage (Sánchez-Rodríguez & Pérez-Alvarez unpublish data). This increase on L* could be due to the effect that the increased lactic acid causes on meat proteins, which produces a water holding capacity decrease and, therefore, a water exudation and an L* increase. This effect could predominate over the salt effect and could be the cause of L* increase in "lomo embuchado". This lesser salt effect (decrease L*) upon L* in "lomo embuchado" could be due, firstly to the shorter time contact with the salt and to temperature, which hinders salt diffusion (Sayas and Pérez-Alvarez, 1989), or secondly to lower salt concentration used in the process (in the other meat products with anatomic integrity, salt saturate concentrations are used). A regression analysis was carried out for the time factor which is shown in the following equation $L^* = 44,14 + 0,29T - 3,40\times10^{-3}T^2$ $r=0,91$; ($P <0,05$); r= correlation coefficient, P= probability, T= hours.

Redness (a*)

ANOVA results for this parameter show that significant differences between zones ($P> 0,05$) were not found but they were over time ($P <0,05$). When the Tuckey test was made, significant differences were only found between 0 hours and 24 hours.

Yellowness (b*)

ANOVA results for this parameter show that significant differences between zones (P> 0,05) were not found but they were over time (P <0,01). b* increases during the first 24 hours, and then it decreases progressively. Johanson et al. (1991) reported that in fresh meat, the b* coordinate must be related to the myoglobin (Mb) and oxymyoglobin (OMb). The handling of the meat during its preparation could cause an increase in OMb. This could be responsible for the b* increase observed during the first 24 hours. During the salting-seasoning stage in the "lomo embuchado" elaboration process, the nitrites added to green loin could be reacting with the Mb forming nitric oxide myoglobin (NOMb), thus the present Mb and/or OMb decrease and with it the b* value.

Chroma (C*)

ANOVA results for this parameter show that significant differences between zones (P> 0,05) were not found but they were over time (P <0,01). C* increases during the first hours of the process, so the colour of the product increases its saturation, in relation to green loin. A regression analysis made for the time factor is represented in the following equation $C^* = 9,20 + 0,14T - 1,54x10^{-3}T^2$ r=0,89; (P <0,05).

Hue (H*)

ANOVA results for this parameter show that there are significant differences for the time factor (P< 0,01), but not for the zone factor (P> 0,05). A H* decrease also can be observed during the process. This behaviour has also been observed in other dry-cured meat products ("salchichón", "chorizo", "longaniza de pascua", dry-cured ham) (Pérez-Alvarez, 1996). Hue dependes on which Mb form is predominantly present at the surface (Johansson et al., 1991). A regression analysis made for the time factor is shown in the following equation $H^* = 69,21 + 0,38T + 2,42x10^{-3}T^2$ r=0,97; (P <0,01).

a*/b* ratio

ANOVA results for this parameter show that significant differences between zones (P> 0,05) were not found but they were between the time (P <0,01). a*/b* ratio increases during the process. Similar behaviour has been reported for other dry-cured meat products (Pérez-Alvarez, 1996). The increase in this ratio could indicate that there are changes in the meat products' red colour; these changes are mainly due to the loss of b* coordinate in the product, so the OMb (principal component of yellow colour in the product) is diminishing. Moreover, as a* coordinate it does not evolve in time after the first 24 hours and has no influence on this ratio increase. A regression analysis made of the time factor is represented in the following equation $a^*/b^* = 0,32 + 1,08x10^{-2}T - 7,24x10^{-5}T^2$ r=0,98; (P <0,01).

Colour differences (ΔE*)

ANOVA results for this parameter show that significant differences between zones (P> 0,05) were not found but they were over time (P <0,05). It can be observed that during this stage, the ΔE* are "very evident" (3-6) to "big" (6-12). During the first 24 hours the ΔE* values are big and after it goin decreases in respect to green loin standard. This behaviour has been observed in other dry-cured meat products (Pérez-Alvarez, 1996). A regression analysis of the time factor is represented in the following equation:
$\Delta E^* = 0,40 + 0,32T - 3,32x10^{-3}T^2$ r=0,95; (P <0,01).

CONCLUSIONS

Lightness and a*/b* increased during the salting-seasoning stage. Redness, yellowness and Chroma increased only during the first 24 h, the a* did not change during process time and b* and C* decreased. Hue decreased throughout this stage.

REFERENCES

HUNT, M.C., ACTON, J.C., BENEDICT, R.C., CALKINS, C.R. COMFORTH, D.P., JEREMIAH, L.E., OLSON, D.P., SALM, C.P., SAVELL, J.W. and SHIVAS, S.D. 1991. Guidelines for Meat color evaluation. Proc. 44th Ann. Recip. Meat Conf., Manhattan.

JOHANSSON, G., TORNBERG, E. and LUNDSTRÖM, K. 1991. Meat colour in loin and ham muscles of normal meat quality from Hampshire, Swedish Landrace and Yorkshire pigs. Proc.37th Int. Congr. of Meat Sci. and Technol. Vol. 1, pp. 394. Kulmbach, Germany.

PEREZ-ALVAREZ, J.A. 1996. Contribución al estudio objetivo del color en productos cárnicos crudos-curados. Ph.D. Thesis. Universidad Politécnica de Valencia.

SANCHEZ, M.E.; GAGO-GAGO, M.A.; ARANDA-CATALA, V (1994). Evolución de los parámetros de color durante el proceso de elaboración del lomo embuchado. In. Anales de Investigación del Master en Ciencia e Ingeniería de Alimentos. P. Fito, J.Serra, E. Hernández, D. Vidal (Eds). SPUPV Vol IV.: 703

SAYAS, M.E. and PEREZ-ALVAREZ, J.A. 1989. Aportación al proceso de elaboración del jamón curado: Cambios fisicoquímicos y estructurales durante el periodo de postsalado. M. Sc. Thesis. Universidad Politécnica de Valencia.