PAPRIKA EFFECTS ON LIGHTNESS (L*) IN A "CHORIZO" MODEL SYSTEM DURING THE MIXING-RESTING STAGE.

García-Marcos, M.L.; Rosmini[1], M.R.; Pérez-Alvarez, J.A.; Fernández-López, J.; Pagán-Moreno, M.J.; Aranda-Catalá, V.

Departamento de Tecnología de Alimentos-Universidad Politécnica de Valencia. Camino de Vera, 14 (46022)Valencia-Spain.
[1]Departamento de Salud Pública Veterinaria-Facultad de Agronomía y Veterinaria - Universidad Nacional del Litoral (Argentina).

KEYWORDS: "chorizo" - mincing - paprika - water - lightness (CIELAB) - lean meat - mixing resting stage.

BACKGROUND

The colour of foodstuffs in general, and meat products in particular, is a determining factor in their selection and acceptance by the consumer (MacDougall, 1982). Meat colour, from a physical point of view, is considered as a surface phenomenon of an opaque solid, where light falling upon it may undergo processes of absorption, reflection or scattering but, where generally there is little transmission (Hunt *et al.*, 1991).

The International Commission of Illumination (Commission International de l'Eclairage - CIE) has defined the most important and most widely used system today for colour description, which is based on the use of observers and sources of standard illumination (Giese, 1995).

The most popular Spanish fermented sausage is "chorizo", which is the second dry-cured product in terms of economic importance. Paprika is the most important spice in "chorizo" manufacture, and this spice gives it its special appeareance (Pagán- Moreno *et al.*, 1992).

The technological processes applied to foodstuffs, in particular size reduction (comminution) and mixing techniques, as well as adding additives and spices, affect colour properties (Mabon, 1993; Giese, 1995). The depth of light penetration and reflection are pH dependent. Thus, the low pH causes more light scattering and the high pH less (Kropf *et al.*, 1984).

During the manufacture of "chorizo", the raw materials are comminuted and then mixed with additives and spices to make up a filling, which is generally left to rest for 12 h, after which it is stuffed, fermented and matured. In studies carried out upon colour changes during the "chorizo" making process, variations have been observed in the lightness of the meat filling during that rest period, but the way in which those changes develop during that period has yet to be established (Pérez-Álvarez, 1996).

OBJECTIVES

The aim of this work was to study the evolution of lightness in the minced lean pork as a result of the effect of paprika and curing agents used during the rest period, prior to the stuffing stage.

METHODS

A model system to a standard formula of "chorizo" was prepared with lean meat, with added curing agents and paprika (5 % water, 2.5 % paprika, 2.306 % NaCl, 0.010 % $NaNO_3$, 0.05 % Na-ascorbate). Lean meat from three de-boned pig shoulders was used. Each shoulder was processed separately, cut into cubes (approximately 10 x 10 cm) and then minced using a plate with a 20 mm hole. The minced meat obtained from each of the shoulders was divided into five 400 g portions. One of the portions was used as a control (minced lean meat without additives) and the four remaining ones had either water or additives or paprika added to them. To add the additives and paprika of each treatment, they were first dissolved in 5% water and the filling was then mixed to ensure correct distribution. From each of the five portions three replications were made. The determinations were made: before mincing (pre-treatment samples, time -1), immediately after mincing and adding the additives (time 0) and over 12 h at intervals of 1 h between each measurement. The time lapse between the lightness determinations on the whole lean meat (time -1) and those made on the minced meat, with or without additives (time 0) was minimal (approximately 5-6 min) and only that needed to carry out the mincing and mixing operations. Lightness determinations were made using CIELAB colour space (illuminant D65 and 10° observer). American Meat Science Association Guidelines for colour measurements were followed (Hunt *et al.*, 1991).

To analyse the effect of differents treatments on L*, a 3-way ANOVA with all interactions was undertaken, considering the shoulder, time and treatment factors. The program 8V was used of the BMDP (version 9.0) statistical software. To discover where there were significant differences among the levels of the main factors or their interactions, contrasts between means were made (Gómez & Gómez, 1976).

RESULTS AND DISCUSSION

The ANOVA results shown that significant differences ($P < 0.01$) existed when the shoulder factor was considered. This means that the shoulders were different in their lightness. It may also be seen that the L* did not present any significant differences ($P > 0.05$) for the main time factor. Regarding the main treatment factor (T), the ANOVA results shown that there were significant differences ($P < 0.01$), which indicates that L* was modified by at least one of the treatments applied.

When the contrasts were made (Tukey test), significant differences ($P < 0.01$) were found between the following treatments: minced lean meat (control)/paprika, water/paprika, salt+sodium nitrite+sodium ascorbate/salt+sodium nitrite+sodium ascorbate+paprika.

Figure n° 1 shows at time -1, the mean L* for the whole lean meat and at time 0, the mean L* for the same lean meat after mincing (representation of value -1 is only graphic). Taking the L* value at time -1 into account, it can be seen how lightness increases on mincing the lean meat. Moreover, that increase was greater when the lean meat was minced and 5% water was added. On the contrary, when the lean meat was minced and paprika was added in addition to the 5% water, a decrease in the lightness was observed. The mincing and water effect on L* has been previously described by García-Marcos *et al.* (1996). When the contrasts (Tukey test) were carried out, only the differences between the minced meat with paprika, water with paprika and salt+nitrite+ascorbate with salt+nitrite+ascorbate+paprika treatments were significant ($P < 0.01$). This behaviour indicates that adding paprika reduces L*. The paprika probably hydrated retaining 5% of the added water and not allowing it to remain free on the meat's surface to increase lightness.

Figure n° 2 shows the evolution of lightness differences (ΔL) over time for the following treatments: water in relation to the minced lean meat (control) and the paprika treatment, using paprika powder, water and minced lean meat (control) as references. In this figure it can be seen how adding water makes the minced meat lighter ($\Delta L+$), while adding paprika darkens it ($\Delta L-$).

CONCLUSIONS

Mincing produces an increase in the lean meat's lightness at the moment of carrying out the treatment, which does not evolve for the following 12 hours. Adding 5% water to the minced meat does not result in any significant changes to its lightness, but increases lightness in relation to whole lean meat. Adding paprika darkens the minced meat, an effect which takes place at the moment of its being added and which does not evolve over time.

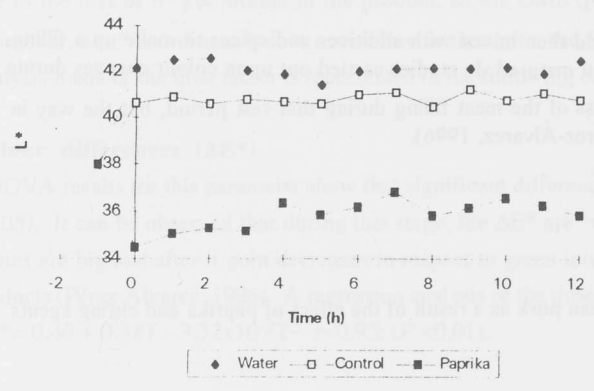

Fig. n° 1: Lightness (L*) evolution for minced lean meat (control) and water, and paprika treatments.

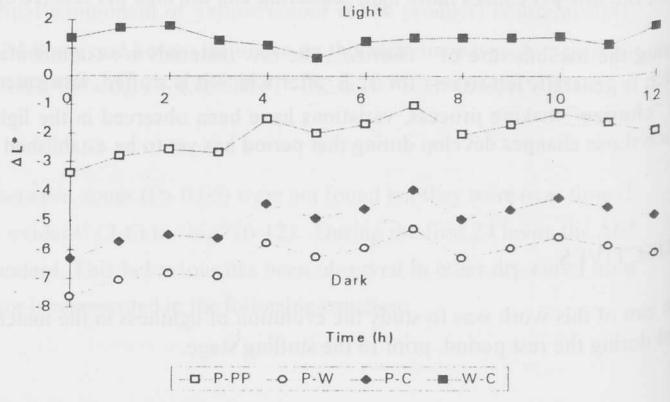

Fig. n° 2: Lightness differens (L*) for paprika treatments using paprika power (P-PP), water (P-W) and minced lean meat (control) (P-C) as references and water treatment using minced lean meat (W-C) as reference.

REFERENCES

Giese, J. (1995) *Food Technology*, **49**(2), 54-63.

García-Marcos, M.L. (1996) M.Sc. Thesis. Universidad Politécnica de Valencia (Spain).

Gómez, K. & Gómez, A. (1976) Statistical procedures for agricultural research. Los Baños (Laguna-Phiilipines), The Internat. Rice Research Inst.

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. & Shivas, S.D. (1991) American Meat Science Association, Guidelines for meat color evaluation. Chicago, National Live Stock and Meat Board.

Kropf, D.; Olson, D. & West, R. (1984) In *Proc. 37th Annual Rec. Meat Conf.*, p. 24-32. Lubbock (Texas). AMSA & Nat. Live Stock Meat Board.

Mabon, T.J. (1993) *Cereal Foods World*, **38**(1), 21-25.

McDougall, D.B.(1982) *Food Chemistry*, **9**, 75-88.

Pagán-Moreno, M.J.; Pérez-Álvarez, J.A.; Sayas, M.E.; Gago-Gago, M.A.; Rodriguez-López, A.; Ballester, A. & Aranda-Catalá, V. (1992) In *38th ICoMST*, Clermont-Ferrand, France. Vol. 3, p. 563-566.

Pérez-Álvarez, J.A. (1996) PhD Thesis, Universidad Politécnica de Valencia (Spain).