COLOUR CHARACTERIZATION OF A FRESH SAUSAGE MODEL SYSTEM

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BACKGROUND

The "longaniza" is a typical fresh sausage from the south-east of Spain. However, the "longaniza" is less known because is it a regional sausage. The "longaniza" is stuffed in 38-45 mm diameter pork casings. The physical changes that take place during processing have not been adequately studied and very few papers study colour evolution in this type of meat product.

OBJECTIVE

The aim of this work was to sudy the evolution of the colour parameters (CIEL*a*b*) due to the processing of fresh pork sausages.

METHODS

Materials

The sausages were prepared using pork lean meat (68,6%), bacon (27%) and additives: salt (3%), sodium caseinate (H- 4512) (0,5%), phosphate (0,30%), spices: nutmeg (0,06%), cinnamon (0,3%) and white pepper (0,3%); the raw materials were ground and mixed. All selected materials, were minced in a screw mincer (Castellvall PTI/106) which included a plate (Olotinox) with 10 mm diameter holes and were mixed with the additives, in 5% water, for 5 minutes, in an arm kneading machine (CATO, Sabadell, Spain). The mixing was stuffed in pork nature casing, of 40 mm diameter, with a weight of 100 g in each piece.

Physical analysis

Physical determinations (CIEL*a*b* parameters: Ligtness-L*-, redness-a*-, yellowness-b*-, chroma-C*- and hue-H*-) were measured using a Minolta CR-300 colorimeter (Minolta Camera Co., Osaka, Japan). In all samples a low reflectance glass CR-A571829-752 M (Minolta Camera Co., Osaka, Japan) between the samples and the colorimeter was interposed. In the sausage, two cross cuts were made and each piece were divided into three parts, about 10-11 cm size, the measurements were made on the cut surfaces.

Statistical analysis

Statistical analysis, One Way ANOVA, (9 levels : 0 for lean; 1 for fat bacon; 2 for lean bacon; 3 for ground lean; 4 for ground bacon; 5 for ground lean and bacon; 6 for ground lean and bacon and water; 7 for the mixture and salt; 8 for the mixture, salt, spices and phosphate and 9 the same as 8 after the resting stage), were applied. Tukey test (Gomez and Gomez, 1976) was applied, in order to know where significant differences could be found between the levels of factor. All statistical analysis were made using STAGRAPHICS Statistical software, Windows 2.0, (Statistal, Graphis Corp., Rockville, U.S.A.).

RESULTS AND DISCUSSION

Table 1.- Mean values of color co-ordinates, lightness (L*), redness (a*) and yellowness (b), chrome (C*) and hue (H*) during the elaboration process of "longaniza fresca".

MATERIAL/STAGE		LIGHTNESS (L*)	REDNESS (a*)	YELLOWNESS (b*)	CHROMA (C*)	HUE (H*)
BACON	LEAN	39,85a	6,76bcd	5,51a	8,85b	39,22a
	FAT	70,97e	-0,5a	5,48a	5,54a	95,47f
	GROUND	52,28cd	6,77bcd	9,78c	11,58cd	54,79bcde
LEAN MEAT	WHOLE	40,98a	6,81bcd	7,16ab	10,13bc	46,16ab
	GROUND	49,01bc	7,85de	9,78c	12,59d	51,20bcd
LEAN+BACON+WATER		55,7d	6,18bcd	10,85c	12,56d	560,45de
LEAN+BACON+WATER+SALT		52,86d	6,27bcd	10,66c	12,41cd	60,01de
+SPICES+PHOSPHATE		52,28cd	5,07b	10,51c	11,68cd	64,20e
AFTER RESTING STAGE		53,72d	5,46bc	9,73c	11,26cd	61,43e

[a-f] For each variable, means within the same column with different superscripts differ significantly ($P<0.05$)

Grinding effect over lean meat and bacon

Lightness (L*): Grinding process increased lightness. This process has been seen to modify lightness values in other studies of lean meat. Palombo *et al.*, (1989) found that the increases in L* in meat batters were due to changes in the state of the myoglobin (Mb). A similar pattern for

the effect of grinding has been described for different types of lean meat (chicken and beef) (Pérez-Alvarez *et al.*, 1998), although the same authors describe how in fatty meats (pork backfat, dewlap and bacon) and in viscera (heart and lung) L* behaves in the contrary way with grinding (L* decreasing). Perlo (1997) pointed out too that grinding reduces the lightness in pork liver. Lightness depends on various factors (among them pH and WHC), however, this process led to the highest L* values It was suggested that the modifications in the meat structure caused by mincing (which leads to a greater amount of water being available on the surface) are responsible for this increase. The incorporation air by the grinding action should also be taken into account since this increases L*, a greater dispersion of light is being caused by the air bubbles trapped in the meat batter (Palombo *et al.*, 1989).

Redness (a*): The ANOVA showed identified significant differences ($P<0.01$) for the mincing process in this coordinate. The Tukey test showed that there were only significant differences ($P<0.05$) between fat bacon, ground bacon and ground lean meat, but not between lean bacon, ground bacon and whole lean meat (table 1). It has been suggested that this coordinate is related to the Mb content (Johansson *et al.*, 1991), and this was confirmed by Pérez-Alvarez *et al.* (1998) and by Fernández-López (1998) who also pointed out that a* values fall with increasing levels of metmyoglobin (MMb). The mincing process could be favour the development of oxidative phenomena which would, in turn, be partly responsible for the change of Mb into MMb. The study of Fernández-López (1998) mentions how the incorporation of water in lean pork meat reduces the a* values since it has a "dilutant" effect, but this effect was not observed in this work.

Yellowness (b*): The ANOVA showed significant differences ($P<0.01$) for the grinding process in this coordinate. As in redness, Tukey`s test showed differences between the lean and fat bacon and the ground bacon (table 1), as well as lean meat and ground lean meat. The grinding process increases the values of this coordinate. In a study of the colour parameters in different raw meat materials, Pérez-Alvarez *et al.* (1998) reported that the Mb concentration is not an important factor for this coordinate. Johansson *et al.* (1991) reported that the yellowness in fresh meat is related to the oxymyoglobin content (OMb). Fernández-López (1998) reported that both, oxidation and Mb oxygenation, affects the b* values, by increasing them. The grinding process destroys muscle structure, liberating Mb, and this process *per se*, could be facilitated air incorporation and the consequent OMb formation, which would contribute to the increase of b* values.

Chroma (C*): The ANOVA carried out found differences ($P<0.01$) for this parameter. Grinding affects the saturation of the meat batters (also in bacon and lean meat). Chroma, as b*, depends on Mb concentration (Johansson *et al.*, 1991), although Pérez-Alvarez (1996) also mention that it might be related with the state of the Mb, and diminished as the proportion of MMb increase. In our study, C* values increased by mincing process, it could be due to Mb liberation from the meat.

Hue (H*): ANOVA showed differences ($P<0.01$) and Tukey`s test showed that the differences were found significant ($P<0.05$) between ground samples and ungrounded meat samples. The grinding process itself increased the values of H*. The hue depends on Mb concentration (Pérez-Alvarez, 1996) and on its state (Johansson *et al.*, 1991) so that, if Mb concentration is considered as constant, the Hue values, after grinding, would be more related to Mb state.

There are not significant differences for all colour parameters, under study, for the remaining stage of fresh pork "longaniza" elaboration process (mixing and water addition, salt effect, spices and phosphate effect and resting effect).

CONCLUSIONS

On this fresh pork sausage model system colour co-ordinates are stabilised with the raw meat materials and the other ingredients or stages did not affect colour parameters.

REFERENCES

CASSENS, R.G.; DEMEYER, D.; EIKELENBOOM, G. HONIKEL, K.O.; JOHANSSAN, G:; NIELSEN, T.; RENERRE, M.; RICHAARDSON, I.; SAKATA, R. (1995): "Recommendation of reference method for assessment of meat color". Proceedings of 41th International Congress of Meat Science and Techonoloy. San Antonio (Texas). C86, p. 410-411.

FERNÁNDEZ-LÓPEZ, J. (1998). Estudio del color por métodos objetivos en sistemas modelo de pastas de embutidos crudo-curados. PhD thesis, Universidad de Murcia, Spain.

GOMEZ, K.A. AND GOMEZ, A.A. (1976): "Statistical Procedures for Agricultural Research". The International Rice Research Institute. Laguna.

JOHANSSON, G.; TORNBERG, E. & LUNDSTRÖM, K. (1991). Meat colour in loin and ham muscles of normal meat quality from Hampshire, Swedish Landrace and Yorlshire pigs. Proc. of 37th International Congress of Meat Science and Technology. Kulmbach, Germany, pp. 394-397.

PALOMBO, R.; VAN ROON, P.S.; WIJNGAARDS, G. & PRINS, A. (1989). Kinetic analysis of changes in lightness attribute of color during the processing of comminuted meat product. Proc of 35th International Congress of Meat Science and Technology. Copenhage, Danmark, pp. 624-631.

PÉREZ-ALVAREZ, J.A. (1996). Contribución al estudio objetivo del color en productos cárnicos crudo-curados. PhD thesis. Universidad Politécnica de Valencia, Spain.

PÉREZ-ALVAREZ, J.A., FERNÁNDEZ-LÓPEZ, J., SAYAS-BARBERÁ, M.E., & CARTAGENA-GRACIÁ, R. (1998). Caracterización de los parámetros de color de diferentes materias primas usadas en la industria cárnica. Eurocarne 63. 115-122.

PERLO, F. (1997). Caracterización física y fisicoquímica de pastas finas: paté. PhD thesis. Universidad Politécnica de Valencia, Spain.