

PHYSICAL AND PHYSICO-CHEMICAL CHARACTERIZATION OF "LONGANIZA IMPERIAL DE LORCA"

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BACKGROUND

The "Salchicha Imperial" is a typical dry-cured sausage from Murcia (south-east of Spain). This regional sausage is stuffed in 38-45 mm diameter pork casings and 30-32 cm in size. This sausage has been included in a quality denomination as "quality product of Murcia". The process can be divided into two main stages as same as other dry-cured sausages: fermentation and ripening. The physical, chemical and biochemical changes that take place during processing have not been adequately studied and very few papers study colour evolution in this type of meat product.

OBJETIVES

The aim of this work was to study the evolution of the colour (CIELAB colour space) and physico-chemical (pH, lactic acid concentration, moisture content, water-holding capacity) properties in the elaboration process of "longaniza imperial de Lorca".

METHODS

Materials

Twelve "Longaniza imperial" were elaborated in according to custom in Murcia, its composition was as followed: pork lean meat (67%), bacon (26,43%); additives: KNO_3 (0,02%), NaNO_2 (0,01%), salt (2,16%), lactose (1,88%), dextrine (0,15%), dextrose (0,94%), sodium caseinate (0,5%), phosphates (0,28%); spices: nutmeg (0,06%), cinnamon (0,28), white pepper (0,29%). All selected materials, were minced in a screw mincer which included a plate with 6 mm diameter holes and were mixed with the additives, in 5% water, for 5 minutes. After the mixing had been in repose for 12 hours and it was stuffed in calf nature casing, of 40 mm diameter, with a weight of 250 g in each piece. Later, the sausages were undergone a the fermentation stage for 14 hours at $23 \pm 1^\circ\text{C}$ and a relative humidity of $90 \pm 5\%$. Finally, the pieces were undergone at the dry-madurate stage at $13 \pm 2^\circ\text{C}$ and a relative humidity of $75 \pm 5\%$. For this study samples of lean and bacon mixture with additives at 12 hours (0 day), in fermentation stage (1 day) and during 6, 13 y 19 days of the dry-maduration stage were taken. In each collected sample, three "Imperiales" were taken at random and were analysed by triplicate.

Physical analysis

The CIELAB color space was determined with a Minolta CM-100 colorimeter (Minolta Camera Co., Osaka, Japan), with D65 and 10° according to Cassens *et al.*, (1995). Two cross cuts were made in the sausage and each piece were divided into three parts, about 10-11 cm in size, the measurements were made on the cut surfaces.

Physicochemical analysis

pH determinations were taken using a Crison 2001pHmeter and a Crison CAT n° 52-32 electrode (Crison Instruments, S.A., Alella, Barcelona). The moisture content was determined according to ISO method R (1975) and the results were expressed as water (g)/100 g sample. The lactic acid determinations were made according to AOAC (1984) and the results were expressed as %. The water holding capacity were determined according to Guerrero and Artega (1990) and the result were expressed as % (mL solution NaCl 0,6M/100 g sample).

Statistical analysis

Statistical analysis (ANOVA) of one factor (levels 0, 1, 6, 13 and 19 days), and the Tukey's test were applied All statistical analysis were made using STAGRAPHS 5.0 statistical, software.

RESULTS AND DISCUSSION

The mean values of physicochemical and physical parameters obtained during the elaboration process of "longaniza imperial de Lorca" are shown in tables 1.

pH and lactic acid. ANOVA results of pH parameter and lactic acid percent pointed out significant differences for time factor ($P < 0.01$ and $P < 0.05$, respectively). Tukey test for pH showed no significant differences ($P > 0.05$) between days 13 and 19 and differences were found between these and 0, 1 and 6 days. However, Tukey test for lactic acid pointed out significant differences ($P < 0.05$) between all studied days. The pH decrease during 1 day, was principally caused by the fermentation produced the activity of lactic-acid bacteria, this decrease of pH may help the partial gelification of miofibrillar proteins and the coagulated of the paste, this would allow the union of the sausage (Roncales, 1994). During the dry stage, the pH decrease under the isoelectric point (IP) of myofibrillar proteins. After day 6, it is showed an increase of pH values, this would be related, in sausages stuffed in natural casing, to the development of flavour and the colonization of the casing by mould (Roncales, 1994).

Moisture. The result of ANOVA concerning the moisture content indicated significant differences for time factor. The Tukey test showed significant differences ($P < 0.05$) between all studied days (table 1). The table 1 shows that content moisture decreases gradually (concentration gradients between the moisture of the dry-room and the sausages cause the water diffusion). The dehydration of sausage contributed with the decrease of water activity and hardening of the pieces.

Water-holding capacity (WHC). The ANOVA results for this parameter pointed out significant differences ($P < 0.01$) for the time factor. The Tukey test indicated that there were not significant differences between days 1 and 6, but significant differences were found between these and the rest of the days. During the fermentation and in the first days of dry-maturation stage, the lactic acid increases and pH tends to isoelectric point. At the IP, less space is available for the retention of water in the tighter protein network and a part of the water becomes free to move out. This makes easy the lost of moisture and consistent of the product. After day 6 the WHC increases, this would be caused by factors such as the increase of pH (Swatland, 1995). The final values of the WHC in the "imperial" was lower than initial values, this could be caused by the changes of in the structure and charges of the proteins, and therefore the binding of water (van Laack and Solomon, 1994).

Lightness (L*). The ANOVA results showed significant differences for the time factor ($P < 0.01$). The Tukey test did not point out present significant differences between days 0, 6 and 19 and between days 11 and 13 ($P > 0.05$), but differences were found between these two groups ($P < 0.05$) (table 1). The lighthness is related to the moisture and the WHC (Kauffman *et al.*, 1991; Fernandez-López,



1998). A decrease is showed in WHC and L* values, for the first 24 hours, this could be due to strong changes in the interfilament spaces may not have a strong instantaneous correlation with WHC (Swatland, 1995; van Laak and Solomon 1994). The decrease in L* values could be due to the diffusion towards surface of the incorporated water and its following evaporation. After fermentation stage the lightness values increased due to the production of lactic acid which caused a reduction of pH towards IP. After 6 day the L* decreased due to the loose of the moisture.

Redness (a*). Significant differences were founded for the time factor (P<0.01). The Tukey test did not show differences (P>0.05) between days 1, 6, 13 and 19, the differences were found between this group of days and 0 day (P<0.05) (table 1). The a* co-ordinate has been related with the myoglobin state and salt concentration, in model systems of dry-cured sausages (Fernandez-López, 1998). The table 1 shows an increase of the a* values for the first 24 hours, but they did not develop during the dry-maturation stage. This behaviour has been observed in "salchichón" (Rosmini, 1997). The increase of a* values could be related to the developments of the nitrosomyoglobin, during fermentation stage (Pérez-Alvarez, 1996).

Yellowness (b*). There were significant differences due to the time factor (P<0.01) according to ANOVA. The Tukey test did not present significant statistical differences (P>0.05), between days 6, 13 and 19, but significant differences were found between these and days 0 and 1 (P<0.05) (1). Recents studies have shown that b* co-ordenate do not depend on the myoglobin concentration, but it depends on its state (Pérez-Alvarez *et al.*, 1998). The b* values decreased during the first 6 days (table 1). This behaviour has also been observed in the majority of dry-cured meat products (Pérez-Alvarez, 1996; Rosmini, 1997).

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Table 1.- Mean values of physicochemical (pH, moisture, water-holding capacity (WHC), lactic acid) parameters and of color co-ordinates, (lightness (L*), redness (a*) and yellowness (b)), during the elaboration process of "longaniza imperial de Lorca".

Time (days)	pH	Moisture (%)	WHC (%)	Lactic acid (%)	L*	a*	b*
0	6,03 a	66,52 a	53,66 a	0,39 a	51,73 a	7,37 a	8,81 a
1	5,41 b	63,17 b	14,66 b	0,55 b	46,85 a	11,71 b	7,44 b
6	4,79 c	56,19 c	15,66 b	0,66 c	49,17 b	12,06 b	5,49 c
13	5,14 d	49,41 d	24,88 c	0,88 d	48,57 b	11,63 b	5,91 c
19	5,21 d	45,48 e	39,15 d	1,03 e	47,07 b	10,56 b	5,01 c

a-e For each variable, means with the same column with different superscripts differ significantly (P<0.05)