

Effect of prolonged freezer storage on physical-chemical and sensory quality of *Serratus ventralis* muscle ("presa") from Iberian pig.

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Abstract-*Serratus ventralis* muscle ("presa") from Iberian pigs were stored under freezing conditions for 365 and 547 days. Instrumental color, texture and sensory analysis were carried out in order to evaluate the effect of storage at -18°C on these parameters. *Serratus ventralis* ("presa") of Iberian pig can be stored for 547 days under freezing temperatures (-18°C) since color is only affected in a limited way and texture is not negatively influenced by storage.

Keywords- "presa", freezing, quality

I. INTRODUCTION

The *Serratus ventralis* muscle ("presa") is highly appreciated by consumers in Spain. In the latest years the demand of raw meat from Iberian pig has experienced a marked increase, so that industries of this sector have recently started exportation of frozen meat abroad. Large quantities of raw meat are stored under freezing conditions for long periods and subsequently sold as chilled products following thawing [1], however this is not the common practice in Iberian meat sector.

The effect of freezing on foods is well documented [2]. A prolonged storage of meat under freezing conditions can affect some of the physical-chemical and sensory characteristics such as meat color, aroma and texture [3,4]. In this sense, as far as we are concerned, no specific studies have been developed in such a peculiar meat piece as "presa" from Iberian pig. Thus, the objective of the present work was to investigate the effect of long time freezing storage on quality attributes of "presa" samples from Iberian pig, in order to improve exportation possibilities.

II. MATERIAL AND METHOD

Serratus ventralis muscles were obtained from a local industry, Montesano, S.A., frozen in an air blast freezer (-40°C) and subsequently placed at -18°C for a 365 days and 547 days. Non-frozen samples were also taken (day 0) for analysis. After storage, frozen samples were subsequently thawed under refrigeration (5±1°C for 48 hours). Samples were cut into steaks 1cm thick and the following determinations were carried out (n=8):

- Instrumental colour (L*,a*, b* Chroma and Hue angle) [5] from slices from *Serratus ventralis* muscle was measured using a portable colorimeter (Minolta CR-400) (Minolta Camera Co., Osaka, Japan) and following recommendations from AMSA) [5].
- Slices of *Serratus ventralis* muscle were cooked in bags during 45 minutes in a water bath at 75°C. Shear force was measured using the Warner-Bratzler method as described by [6]. Texture profile analysis (TPA) was also performed by using a Universal TA-XT plus texture analyser (Stable Micro Systems, UK). Samples were cut into cubes (1 x 1 x 1 cm³), parallel to the longitudinal orientation of muscle fibers. Samples were axially compressed twice using a 20 mm diameter cylinder probe. Once the probe triggered on the surface, it then proceeded to penetrate to a depth of 30% and 70% of the thickness of the sample to evaluate, measuring the force value as the hardness (N) of the sample. Force-distance deformation curves were recorded at a crosshead speed of 5 mm/s.
- Sensory characteristics of *Serratus ventralis* muscles were assessed by a semi-trained panel of 8 members using a quantitative-descriptive analysis method (QDA) for different attributes (tenderness, juiciness, fibrousness, "pig"aroma, rancidity). Descriptor selection was carried out on the basis of the acquired experience of our research group and the training sessions carried out for the experiment. The panelists

answered using an unstructured 10cm line, ranging from the lowest intensity of each trait (left side) to the highest (right side).

-Statistical analysis; the results were expressed as mean \pm standard error of the mean for the batches under study (n= 8 for each batch and day). The obtained data were analyzed by using one-way analysis of variance (ANOVA) using SPSS V.15.0 (SPSS Institute Inc., Cary, NC) in order to evaluate the effect of time of storage under freezing conditions of *Serratus ventralis* muscles. In cases where the effect of the independent variable was significant, the means were compared using the Tukey test ($P < 0.05$).

III. RESULTS AND DISCUSSION

Table 1 shows color parameters of raw "presa" (Day 0) and stored for 365 and 547 days under freezing conditions. L^* , a^* , b^* and Chroma were not statistically affected by freezing and time of storage ($P > 0.05$). Only hue angle was affected, this parameter showing an increase after 547 days with respect to the initial values ($p < 0.05$), and thus indicating a decrease in red color intensity of "presa" with time of storage.

Table 1.- Instrumental color evolution (L^* , a^* , b^* Croma y hue angle) (mean \pm standard error) in cut surface of fresh *Serratus ventralis* muscle (day 0) and thawed after storage under freezing conditions during 365 and 547 days at -18°C .

Time (days)	L^*	a^*	b^*	Chroma	Hue
0	32.93 (0.76) [*]	13.55 (0.38)	3.66 (0.24)	14.04 (0.43)	15.04 ¹² (0.59)
365	31.88 (0.82)	13.14 (0.57)	3.40 (0.30)	13.58 (0.63)	14.40 ² (0.62)
547	33.76 (0.82)	13.70 (0.51)	4.21 (0.21)	14.34 (0.54)	17.07 ¹ (0.52)
P*	ns	ns	ns	ns	*

*Standard error of the mean; *Significance levels: ns= >0.05 ; *= $p < 0.05$; **= $p < 0.01$; ***= $p < 0.001$. 1,2,3: Different superscripts mean significant differences among times of storages $p < 0.05$, Tukey test.

The decrease in red tone of "presa" can be related to a decrease in metmyoglobin reductase activity or to an increase in lipid oxidative reactions over time, as was observed by [7] and [8].

Table 2 shows results from Warner-Bratzler and TPA analysis. Shear force was significantly affected by freezing ($P < 0.001$), this parameter decreasing after 365 days and again increasing at the end of storage, however not reaching the initial values. The decrease in shear force values could be ascribed to the disruption of muscle fibers as a consequence of ice crystals or enzymatic activity as was pointed out by [9]. The same evolution was observed for the rest of texture parameters ($p < 0.05$).

Table 2.- Texture parameter evolution (Warner-Bratzler and TPA) (mean \pm standard error), in fresh *Serratus*

		Time (Days)				
		0	365	547	SEM [*]	P*
WB ¹	Shear force	55.13a	41.89b	53.06a	2.06	***
	Cohesiveness	0.64 ¹	0.57 ²	0.67 ¹	0.01	***
	Gomosity	4.90 ¹	1.02 ³	3.37 ²	0.60	***
	Elasticity	0.98	0.98	0.97	0.00	ns
	Resilience	0.38 ¹	0.25 ²	0.35 ¹	0.02	***
TPA ² 30%	Chewiness	4.83 ¹	1.00 ³	3.29 ²	0.60	***
	Cohesiveness	0.64 ¹	0.29 ²	0.37 ²	0.02	***
	Gomosity	5.48 ¹²	3.70 ²	11.32 ¹	1.44	**
	Elasticity	0.99 ¹	0.86 ¹²	0.77 ²	0.03	*
	Resilience	0.40 ¹	0.19 ²	0.21 ²	0.02	***
TPA ² 70%	Chewiness	5.41 ¹²	3.19 ²	9.23 ¹	1.29	**

ventralis muscle (day 0) and thawed after storage under freezing conditions during 365 and 547 days at -18°C .

* Pooled standard error of the mean; *Significance levels: ns= >0.05 ; *= $p < 0.05$; **= $p < 0.01$; ***= $p < 0.001$. 1,2,3: Different superscripts mean significant differences among times of storages $p < 0.05$, Tukey test.

Sensory quality (table 3) was not affected by storage at -18°C , with the exception of fibrousness, which significantly decreased ($p < 0.05$) during storage. Tenderness shows an increasing trend after 365 days, values decreasing again after 547 days ($P > 0.05$), which is in agreement with the explained evolution for shear force.

Table 3.- Evolution of sensory traits (mean \pm standard error) of *Serratus ventralis* muscle (day 0) and thawed after storage under freezing conditions during 365 and 547 days at -18°C .

Time (days)	Tenderness	Juiciness	Fibrous-ness	"pig" aroma	Rancidity
0	5.49 (0.70)	5.90 (0.66)	6.29 ¹ (0.46)	4.58 (0.68)	0.69 (0.29)
365	5.87 (0.24)	5.98 (0.32)	6.14 ¹ (0.37)	4.35 (0.30)	1.86 (0.50)
547	5.19 (0.36)	6.73 (0.36)	4.62 ² (0.36)	3.35 (0.37)	0.87 (0.29)
P*	ns	ns	*	ns	ns

*Standard error of the mean; *Significance levels: ns=>0.05; *= $p<0.05$; **= $p<0.01$; ***= $p<0.001$. 1,2,3: Different superscripts mean significant differences among times of storages $p<0.05$, Tukey test.

IV. CONCLUSIONS

Serratus ventralis ("presa") of Iberian pig can be stored for 547 days under freezing temperatures (-18°C) since color is only affected in a limited way and texture parameters are not negatively influenced by storage.

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