

SENSORY EVALUATION OF SPANISH HAM WITH DIFFERENT SALTING PERIODS

LEON CRESPO, H.GALAN SOLDEVILLA, N.CIUDAD GONZALEZ, A.PERALTA FERNANDEZ, B.BALDERAS ZUBELDIA, MARQUEZ PRIETO and A.MOLINA ALCALA

Estación Piloto de Tecnología de Alimentos. F.Veterinaria. UNIV.CORDOBA.14005 CORDOBA. Spain.

SUMMARY

Four lots of Spanish Ham all processed in the same traditional way except with different length of the salting period (3, 5, 7 and 9 days) has been submitted to sensory evaluation, using the Quantitative Descriptive Analysis (QDA). This method included the evaluation of six analytical attributes (color, marbling, odor, flavor, juiciness and saltiness) as well as general acceptability, using a standard uniform 10 points scale for all of them. From each ham three different regions were studied. The analysis of variance shows statistically significant differences among regions on color, odor and marbling. Differences are also shown among hams in saltiness; hams with reduced period of salting received higher sensory scores for saltiness. The analysis of correlation shows significant relationships among studied sensory attributes and these with general acceptability. The discriminant analysis of data shows that the most important factor influencing general acceptability of these samples is flavor and the least one is saltiness.

INTRODUCTION

There is actually an increasing interest in sensory evaluation techniques as they are a valuable tool to establish the potential acceptability of food products by consumers. Really, among the principles under sensory evaluation are almost the same acting in the marketplace. Different sensory techniques, the descriptive ones using trained panelists that evaluate interesting sensory attributes on the analyzed product are very useful. One of the most interesting of these techniques is the Quantitative Descriptive Analysis (QDA), developed especially to evaluate flavor profiles (Caul, 1957) and adapted for texture in food products (Szczeniak et al., 1963). The QDA method allows to construct multiscale graphic models, known as "profiles", easy to understand for consumers (Stone et al., 1974). These profiles can be obtained from almost any product.

The evaluated properties in QDA usually follow a logical sequence of sensory appreciation (appearance, texture and flavor); these properties are established in accordance to scales adapted to the product analyzed (Szczeniak and Hall, 1975). The QDA technique offers high reproducibility (Amerine et al., 1965) and versatility (Bourne et al., 1975).

The QDA technique has been applied by our working group in Spanish Ham to establish its commercial rating (Leon Crespo et al., 1983) and to discriminate the sensory properties of different regions within the same ham (Leon Crespo et al., 1984).

This study uses the QDA method to evaluate the sensory properties of ham processed in the traditional way, changing the period of salting. There is a increased concern in reducing salt content in meat products (Best, 1989) but this chemical compound influences many processes taking place during aging, so reducing salt content may present some problems (Wirth, 1981). The aim of the present work has been to establish the influence of reducing salting period on sensory properties of Spanish Ham using the QDA technique.

MATERIAL AND METHODS

Four lots of three hams each were salted in the traditional Spanish way, buried in salt piles, for different periods of time. The times studied included 9 and 7 days of salting (usual time used in commercial factories) and 5 and 3 days (reduced period of salting). Once salted, hams were washed with tap water and hung in a cold room at 0 - 5°C for 3 months to allow salt to distribute in the inside of the product by diffusion (León Crespo, 1990) and then aged in the traditional way until ready for consumption (9 months).

From each ham, samples were taken from three different regions (see Figure 1) and evaluated for six sensory attributes (color, marbling, odor, flavor, juiciness and saltiness) and for general acceptance using an uniform 10 points scale. A trained panel of 9 people evaluated the samples in different working sessions.

Data obtained were analyzed by the ANOVA program (SAS).

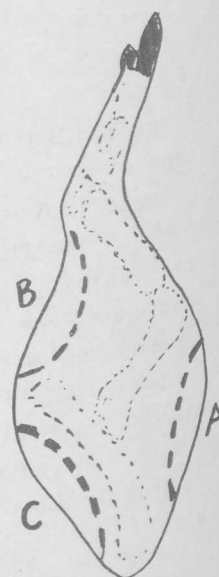


Figure 1.- Experimental sampling procedure.

RESULTS AND DISCUSSION

Table 1 includes the data for color. The analysis of variance shows that there are highly significant differences among regions ($F = 34.64^{***}$), but not among hams ($F = 1.68$ NS). Samples from region A were rated darker than samples from regions B and C, with no differences in color in these last two regions. These results relate to myoglobin content as well as to the extent of drying in different regions of ham (León Crespo et al., 1984).

Table 2.- Mean data for odor in the studied samples using QDA.

Days of salting	Region			X
	A	B	C	
3	6.8	6.6	5.8	6.3
5	6.1	5.8	5.2	5.7
7	5.6	5.6	5.2	5.5
9	5.8	6.0	3.9	5.3
X	6.0	6.0	5.1	

Table 1.- Mean data for color in the studied samples using QDA.

Days of salting	Region			X
	A	B	C	
3	7.9	5.6	6.6	6.6
5	8.2	5.6	6.0	6.0
7	6.6	6.3	5.3	6.3
9	7.8	5.3	5.2	
X	7.6	5.7	6.0	

Table 2 shows the means obtained in odor evaluation. The analysis of variance of these data shows no significant differences among hams ($F = 2.65$ NS) and significant differences among regions ($F = 5.23^{**}$). Region C was rated lower in odor than regions A and B. Odor of ham depends on the presence of volatile compounds and the present results seem to indicate that salting period at the experimental levels studied did not affect the volatiles development in ham during aging.

Table 3.- Mean data for marbling in the studied samples using QDA.

Days of salting	Region			— X
	A	B	C	
3				
5	3.5	4.9	6.4	5.0
7	4.0	5.4	4.6	4.7
9	3.3	5.3	6.1	4.9
	3.9	4.9	5.9	4.8
X				
	3.9	5.1	5.7	

Marbling scores are presented in table 3. The analysis of variance shows that there was not a significant effect of salting time ($F = 0.24$ NS) but there were highly significant differences in marbling rating among regions ($F = 17.74$ ***). Marbling was rated higher in regions B and C, and lower in region A.

Table 4.- Mean data for flavor in the studied samples using QDA.

Days of salting	Region			— X
	A	B	C	
3	6.6	6.3	6.3	6.4
5	5.7	6.7	6.0	6.1
7	6.6	6.6	5.7	6.3
9	6.4	6.6	5.3	6.2
X				
	6.3	6.5	5.9	

Table 4 includes data of flavor scores. The analysis of variance of these data shows that there were no significant differences in flavor due to salting time ($F = 1.66$ NS) nor regions ($F = 1.14$ NS).

Table 5.- Mean data for juiciness in the studied samples using QDA.

Days of salting	Region			— X
	A	B	C	
3	6.6	6.4	6.6	6.5
5	5.8	6.6	5.4	5.9
7	6.4	6.8	6.4	6.5
9	5.8	6.4	6.6	6.2
X				
	6.1	6.5	6.2	

Table 5 data are included in Table 5. The analysis of variance of these data shows that there were no differences in juiciness of ham due to salting period ($F = 1.66$ NS) or regions ($F = 1.14$ NS).

The data scores for saltiness are included in table 6. The analysis of variance shows that there were no differences among the studied regions ($F = 0.85$ NS) but there were differences related to the salting period ($F = 8.52$ ***). Means separation by the Tukey test allows to discriminate among two groups, one including samples of ham salted for 3 and 5 days and another one including samples from ham salted for 7 and 9 days. Hams salted for a longer period of time were rated lower in saltiness.

Table 6.- Mean data for saltiness in the studied samples using QDA.

Days of salting	Region			— X
	A	B	C	
3				
5	6.3	5.8	6.0	6.0
7	5.3	5.4	6.2	5.7
9	4.9	5.1	4.9	5.0
	4.4	4.7	5.0	4.7
X				
	5.2	5.3	5.6	

The mean general acceptance rates of the samples of ham included in this study are presented in table 7. The analysis of variance of these data shows no significant differences among salting period ($F = 0.83$ NS) nor ham regions ($F = 2.00$ NS).

Table 7.- Mean data for general acceptability in the studied samples using QDA.

Days of salting	Region			X
	A	B	C	
3	6.5	6.3	6.4	6.4
5	6.0	6.3	5.6	6.0
7	6.2	6.4	5.8	6.1
9	6.2	6.2	5.0	5.9
X	6.2	6.3	5.7	

In table 8 it is possible to see that there is a significant relationship among color, odor and acceptance. Odor scores are also highly related to flavor, juiciness and general acceptance. Flavor is highly related to juiciness and general acceptance. Saltiness is related to juiciness.

Table 8.- Correlation coefficients (Spearman tests) among sensory attributes.

	odor	flavor	saltiness	marbling	juiciness	acceptance
color	.245*	.234*	.019	-.165	-.068	.257**
odor		.476***	-.011	.150	.297**	.506***
flavor			-.016	.146	.562***	.860***
saltiness				-.097	.001	-.033
marbling					.267**	.194*
juiciness						.597***

related to any other evaluated attribute. It seems that the degree of marbling is related to juiciness and global acceptance. Also juiciness is highly related to general acceptance.

The discriminant multivariate analysis of data included in Table 9 allows to evaluate the ponderal influence of each attribute on the general acceptance. It is possible to see that flavor is the attribute rated higher, followed by juiciness and odor. It seems that the degree of saltiness had a low influence on general acceptance in the studied samples.

TABLE 9.- Discriminant multivariate analysis (SAS) of attributes influencing general acceptance on Spanish Ham.

Variable	R	F	Prob
Color	0.2020	3.471	0.0023
Marbling	0.1685	2.779	0.0112
Odor	0.2955	5.751	0.0001
Flavor	0.7398	38.998	0.0001
Juiciness	0.3955	8.974	0.0014
Saltiness	0.1013	1.545	

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