

DESCRIPTIVE SENSORY PROPERTIES OF *CECINA DE LEÓN*

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ABSTRACT

Cecina de León is the Protected Geographical Indication of a dry-cured beef produced in Northwest Spain. A Quantitative Descriptive Analysis (QDA)[®] of three types of *Cecina de León* pieces (thick flank or *babilla*, silverside or *contra*, and topside or *tapa*) was performed by a trained 10-member sensory panel using an intensity non-structured 10-cm length scale. Average sensory scores varied between 3.14±1.54 (beef flavour) and 6.95±1.26 (brightness of lean). *Contra* pieces showed lower percentage of unacceptable scores (9.57%) than *babilla* (10.24%) or *tapa* (13.09%). Frequency of unacceptable values was lower for appearance (4.09%) than for flavour (15.32%) or texture (8.79%) attributes.

Keywords: *cecina*, dry-cured meat, quantitative descriptive analysis

1. INTRODUCTION

Cecina de León is a high value intermediate moisture meat (approximately 50% humidity) produced exclusively in the province of León (Northwest Spain) from hind leg pieces (*babilla* or thick flank, *cadera* or rump, *contra* or silverside, and *tapa* or topside) of beef cattle, with a minimum age of 5 years old and weight of 400 kg. This food product has the quality label, Protected Geographical Indication (PGI; OJEC, 1996).

Cecina de León is manufactured following a processing scheme based on the preparation of pieces and profiling (excision from the carcass and rubbing in order to eliminate any remaining blood, and shaping of the pieces for adjusting); salting (with common salt at 3-5°C for 0.3-0.6 days per kg weight); washing (with lukewarm water in order to eliminate any remaining salt); settling or post-salting (for 30-45 days in a cold room to allow for a homogeneous distribution of salt within the meat mass); smoking (optional, with oak or holm-oak wood, between 12 and 16 days), and drying (in natural drying kilns with adjustable windows to control the temperature and humidity using the traditional system of "opening and closing windows", or in industrial drying installations). The whole process takes a minimum of seven months after salting.

The production of *Cecina de León* has increased over the last few years from 1,500 manufactured pieces in 1994 to more than 100,000 pieces in 2012. *Cecina* from *babilla*, *contra* and *tapa* make up more than 95% of the production (Supervisory Council of Protected Geographical Indication *Cecina de León*, private communication). The Supervisory Council of PGI *Cecina de León* has to control the sensory quality of the *cecina* pieces in order to detect the presence of defects in the product as well as to certify its typicality in such a way that it can be differentiated in comparison with non-labeled products.

Most reports on *Cecina de León* refer to physicochemical and microbiological characteristic (GARCÍA *et al.* 1998; MENÉNDEZ *et al.*, 2015; MOLINERO *et al.*, 2008). The hedonic and descriptive sensory properties have been scarcely studied (RUBIO *et al.*, 2007; MOLINERO *et al.*, 2008). To the best of our knowledge, the influence of the type of piece used for manufacture on the descriptive sensory attributes of *Cecina de León* has yet to be reported. This study was designed to describe the sensory properties of *Cecina de León*; to investigate whether the type of meat used for manufacturing has a significant influence on sensory attributes of this foodstuff, and to determine the frequency of intensity scores outside specifications for each attribute and type of meat piece tested.

2. MATERIALS AND METHODS

2.1. Samples

Eleven *Cecina de León* pieces (three *babilla*, five *contra* and three *tapa* pieces) were randomly obtained from normal production in different processing plants in the Province of León (Northwest Spain). *Babilla* or thick flank is made up of *vastus lateralis*, *vastus intermedius*, *vastus medialis* and *rectus femoris* muscles, *contra* or silverside is composed by *semitendinosus* and *gluteobiceps* muscles, and *tapa* or topside contains the *quadratus femoris*, *semimembranosus*, *adductor*, *gracilis*, *pectineus* and *sartorius* muscles and a fragment of *obturatorius externus* muscle.

2.2. Sensory evaluation

A trained 10-member sensory panel (eight males and two females, ranging in age from 23 to 47 years, with experience in sensory evaluations) was used to evaluate attributes of each

sample. The trained assessors were selected and trained for two years according to International Organization for Standardization regulations (ISO 6658:2005, ISO 8586:2012, ISO 11132:2012).

A Quantitative Descriptive Analysis (QDA; ISO 13299:2016) was used to describe *cecina* pieces, which were evaluated in a tasting room equipped with white fluorescent lighting (ISO 8589:2007). Scores were given for appearance (cherry colour, brightness of lean, marbling and fat colour), flavour (odour characteristic, flavour characteristic, persistence of flavour, taste characteristic, saltiness, beef flavour and smokiness) and texture (tenderness, juiciness and fibrousness) attributes on a non-structured 10-cm length scale with anchor points one cm from each end, where 0 means absence (white for fat colour attribute) and 10 means great intensity (yellow for fat colour attribute). Scores were the distances (cm) from the left extreme. The panelists were also asked to indicate the heterogeneity of the colour (Table 1). *Cecina* pieces showing different intensities were used to define the scale for the descriptors (reference standards).

Table 1. Description of the sensory attributes considered in this work.

Attribute	Definition
Cherry colour	Visual assessment relating to the hue and the lightness (intensity) of the typical red colour of <i>cecina</i>
Brightness of lean	Brightness intensity (attribute of a glossy surface showing bright reflection) of the lean surface
Marbling	Level of visible intramuscular fat
Fat colour	Colour intensity of subcutaneous fat
Odour characteristic	Assessment relating to the odour before eating the sample, associated with the ripening and smoking process
Flavour characteristic	Assessment relating to the olfactory/gustatory sensation caused by salt, ripening and smoking process
Persistence of flavour	The time during the olfactory/gustatory sensation is perceptible after the bolus has been swallowed or ejected
Taste characteristic	Assessment relating to the taste associated with the salt, ripening and smoking process
Saltiness	Basic taste sensation elicited by NaCl
Beef flavour	Flavour after cooking/heating of beef
Smokiness	Assessment relating to the olfactory/gustatory perception caused by the smoking of these products with smoke obtained from wood burning
Tenderness	Softness and ease of chewing before swallowing
Juiciness	Perception of the amount of water released by the product during the first chews
Fibrousness	Perception of the amount of muscle fibers detected during chewing
Heterogeneity of the colour	Assessment of the uniform distribution of colour on the slice

A portion of each piece of *cecina* was presented to the panelists at room temperature ($21\pm 1^\circ\text{C}$) for evaluation of visual attributes and odour characteristic, and slices of approximately 2 mm thick were presented for evaluation of the remaining sensorial attributes. Samples were randomly labeled with three digit codes and panelists were asked to evaluate each sample in randomized order. Mineral water at room temperature was used to cleanse the palate between successive samples.

The testing of the eleven *cecina* pieces was carried out in four sessions (four sets of two or three samples, randomly chosen) at daily intervals. Each sample was evaluated by all panelists in the same session. A replication for each *cecina* piece was carried out in a different session; each session lasting approximately 2 hours. The performance of panel

and panelists was confirmed by their reliability, reproducibility and discrimination in sensory descriptive tests (ROSSI, 2001; RODRÍGUEZ-LÁZARO *et al.*, 2002b, c).

Sensory specifications (represented by the range of intensities tolerated for each attribute) were established by correlating descriptive data with scores from consumer hedonic evaluation (nine-point hedonic scale). Intensities of attributes in the QDA were considered acceptable when they were associated with scores ≥ 5 in the hedonic evaluation. Attributes of positive evaluation (the better the intensity, the better the quality): cherry colour, brightness of lean, marbling, odour characteristic, flavour characteristic, persistence of flavour, taste characteristic, tenderness and juiciness, were deemed as unacceptable if a score lower than 5 was given by the panelist, according to the 10-cm scale. The beef flavour (attribute of negative evaluation) was considered unacceptable when scores were higher than 5. For the remaining attributes (fat colour, saltiness, smokiness and fibrousness), scores lower than 3 and higher than 8 were considered as unacceptable values (RODRÍGUEZ-LÁZARO *et al.*, 2002d).

Statistical analysis. Mean and standard deviations for all *cecina* samples data were calculated. Sensory panel evaluation averages were analyzed by an analysis of variance (ANOVA). Mean separation was carried out using the Duncan's multiple range test. Pearson's correlation coefficients were calculated. The Statistica® 8.0 (Statsoft Ltd., Tulsa, OK, USA) software package was used.

3. RESULTS AND DISCUSSION

Analysis of variance of the four factors (replication, attribute, type of meat piece and panelist) showed statistical differences ($P < 0.001$) between scores from different attributes. Replication, panelist, type of meat piece or their interactions did not influence ($P > 0.05$) descriptive scores.

The score values obtained by the attributes tested (the mean data of replications were considered) are given in Table 2.

Values differed markedly between samples, as indicated by the standard deviations (STD) calculated on all groups of samples, which were much greater than the STD obtained from replicate analysis (data not shown). The absence of significant differences between *babilla*, *contra* and *tapa* pieces are probably due to the relatively high standard deviations found, which are mainly due to the heterogeneity of the samples. According to REYES-CANO *et al.* (1994), there are differences between animals (age, breed, sex) that may have an influence on the sensory properties of *cecina* pieces.

Even though significant differences were not found between types of piece, *contra* pieces showed the best behaviour because they scored higher ($P > 0.05$) than *babilla* and *tapa* pieces in five (55.6%) of the nine attributes of positive evaluation (cherry colour, odour characteristic, flavour characteristic, persistence of flavour and taste characteristic), and lower ($P > 0.05$) in beef flavour (attribute of negative evaluation). Moreover, *contra* pieces showed the lowest mean percentage of unacceptable scores: 9.57%, as opposed to 10.24% and 13.09% for *babilla* and *tapa* pieces, respectively (Fig. 1). The only *cecina* without any unacceptable (outside specifications) score was a *contra* piece.

No substantial differences were found for average scores between *babilla* and *tapa*. However, *tapa* pieces showed a higher percentage of unacceptable scores, and heterogeneity in colour was detected in 10% of tests. This attribute is an important and desirable sensory property of dry-cured meats when they are sliced (ARNAU *et al.*, 1998).

Table 2. Average values for the sensory properties of three different types of *Cecina de León* pieces.

Attribute	Sensory modality for the attributes	Meat piece			Average
		<i>Babilla</i>	<i>Contra</i>	<i>Tapa</i>	
Cherry colour		6.70±1.56a	6.94±1.35a	6.87±1.33ab	6.85±1.39ab
Brightness of lean	Appearance attributes	7.00±1.39a	6.96±1.19a	6.90±1.27b	6.95±1.26ab
Marbling		6.63±1.88a	6.64±1.59ab	6.90±1.24ab	6.71±1.58abc
Fat colour		5.47±1.09bc	5.49±1.14cd	5.49±1.02cd	5.48±1.09d
Odour characteristic		6.57±1.59ad	6.66±1.36ab	6.57±1.72ab	6.61±1.51bc
Flavour characteristic		6.07±1.66bd	6.24±1.49ac	5.97±1.79ace	6.12±1.61ef
Persistence of flavour		6.00±1.55bd	6.34±1.57ab	5.87±1.81ace	6.12±1.63ef
Taste characteristic	Flavour attributes	6.07±1.64bce	6.10±1.70bc	5.67±1.88ace	5.97±1.73e
Saltiness		3.68±0.83f	3.70±0.95ef	3.48±1.15f	3.63±0.97g
Beef flavour		3.30±1.64f	3.04±1.54e	3.13±1.48f	3.14±1.54h
Smokiness		4.04±0.85f	4.04±1.01f	3.76±1.11f	3.96±1.00g
Tenderness		6.26±1.48ad	6.30±1.50ab	6.50±1.41abc	6.34±1.46ce
Juiciness	Texture attributes	6.63±1.27ade	6.36±1.53ab	6.37±1.45be	6.44±1.44cf
Fibrousness		5.04±1.25c	4.83±1.26d	5.01±1.24d	4.94±1.24i
Grouping attributes ¹					
Appearance attributes		6.45±1.60a	6.51±1.45a	6.54±1.35a	6.50±1.46a
Flavour attributes		5.10±1.90b	5.16±1.97b	4.92±2.04b	5.08±1.97b
Texture attributes		5.98±1.49c	5.83±1.59c	5.96±1.51c	5.91±1.54c

¹, mean score for the attributes in each modality.

A 10-cm non-structured scale was used by trained assessors.

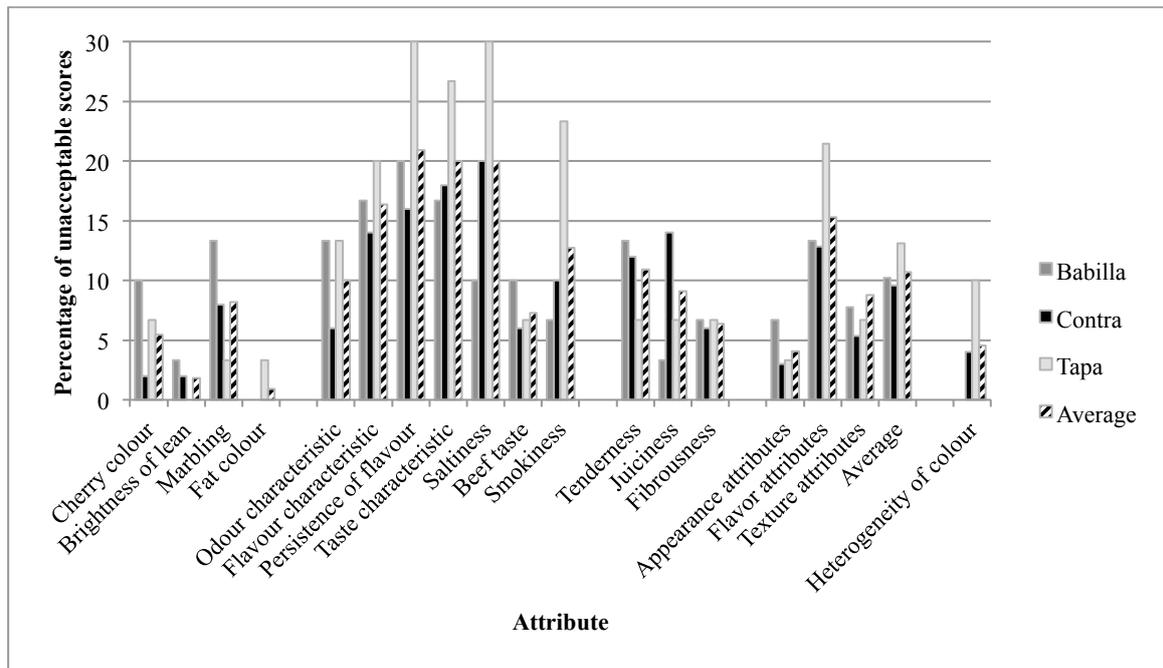
Average values within a column (for single attributes or for grouping attributes) that are not followed by the same letter are significantly different ($P<0.05$). No significant differences were found between means in the same row.

Data are the means of 60, 100, 60 and 220 determinations for the first (3 *cecina* pieces x 10 panelists x 2 replications), second (5 *cecina* pieces x 10 panelists x 2 replications), third (3 *cecina* pieces x 10 panelists x 2 replications) and fourth columns, respectively.

The lower number of unacceptable scores was obtained by a *contra* piece (0%) and the higher by a *tapa* piece, which showed a total of 24 of 140 (14 attributes x 10 panelists) unacceptable values (17.14%). It must be noted that scores considered as unacceptable were close to the intensity range tolerated for each attribute.

Average scores of appearance attributes were significantly ($P<0.05$) higher than those of flavour and texture (Table 2). Moreover, unacceptable values were substantially lower for appearance (4.09%) than for flavour (15.32%) and texture (8.79%) attributes. MARTÍN *et al.* (1999) also observed the best scores for appearance attributes in *Cecina de Maestrazgo* pieces.

Significant ($P<0.001$) Pearson's correlations were found between marbling and odour characteristic (0.542), flavour characteristic (0.431), persistence of flavour (0.407) and taste characteristic (0.399). These results coincide with findings of DE ANDA-SERRANO *et al.* (1999) in ham samples, and may be explained by taking into account the fact that fat compounds are important components of flavour in meat products. According to KAUFFMAN (1993), marbling is required to adequately provide flavour attributes. The high correlation coefficients detected between smokiness and characteristic flavour and taste attributes ($P<0.001$; $r>0.7$) also agrees with previous findings in smoked meat products (SINK and HSU, 1979).



For cherry colour, brightness of lean, marbling, odour characteristic, flavour characteristic, persistence of flavour, taste characteristic, tenderness and juiciness, a value was considered as unacceptable when a score lower than 5 was given by the panelists, according to the 10-cm scale. The beef flavour was considered unacceptable for scores higher than 5. For fat colour, saltiness, smokiness and fibrousness, scores lower than 3 and higher than 8 were considered as unacceptable values.

Figure 1. Percentage of unacceptable scores for each attribute tested in three different types of *Cecina de León* pieces.

The negative correlation coefficient found between saltiness and brightness ($P < 0.01$; $r = -0.270$) and tenderness ($P < 0.05$; $r = -0.197$) may be explained by considering the influence of salt on proteolysis activity (GUERRERO *et al.*, 1996). Lower salt levels are related to a higher proteolytic activity and consequently with a higher tenderness and brightness. It should be noted that the normal salt concentration in *Cecina de León* (5.6%) is generally lower than that of ham (RODRÍGUEZ-LÁZARO *et al.*, 2002a).

Finally, a significant ($P < 0.001$) correlation was found between fibrousness and flavour, persistence of flavour and taste attributes ($r = 0.428$ to 0.467). These results are similar to previous findings by BUSCAILHON *et al.* (1994) in dry-cured ham. According to these authors, higher fibrousness induces longer chewing time, which allows for better extraction and stronger perception of some compounds responsible for taste and flavour.

To summarize, sensory properties of *Cecina de León* are not significantly influenced by the type of meat piece used for manufacturing, which is a positive aspect for producers. However, *contra* pieces showed the best behaviour, with the lowest percentage of outside specifications (unacceptable) scores. Flavour attributes showed the highest, and appearance attributes the lowest, percentage of unacceptable scores for all *cecina* pieces examined. On average, one tenth of the scores for each piece were outside (although close to) the range of intensities tolerated.

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