Contents lists available at ScienceDirect

Meat Science

A novel approach to assess temporal sensory perception of muscle foods: Application of a time–intensity technique to diverse Iberian meat products

Laura Lorido, Mario Estévez, Sonia Ventanas *

Animal Production and Food Science Department, Faculty of Veterinary Sciences, Avd/Universidad s.n., Cáceres, Spain

A B S T R A C T

Although dynamic sensory techniques such as time–intensity (TI) have been applied to certain meat products, existing knowledge regarding the temporal sensory perception of muscle foods is still limited. The objective of the present study was to apply TI to the flavour and texture perception of three different Iberian meat products: liver pâté, dry-cured sausages ("salchichon") and dry-cured loin. Moreover, the advantages of using dynamic versus static sensory techniques were explored by subjecting the same products to a quantitative descriptive analysis (QDA). TI was a suitable technique to assess the impact of composition and structure of the three meat products on flavour and texture perception from a dynamic perspective. TI parameters extracted from the TI-curves and related to temporal perception enabled the detection of clear differences in sensory temporal perception between the meat products and provided additional insight on sensory perception compared to the conventional static sensory technique (QDA).

© 2013 Elsevier Ltd. All rights reserved.

1. Introduction

Sensory perception is a dynamic phenomenon that changes during the process of food consumption (Cliff & Heymann, 1993). Dynamic sensory methods provide information about variations in perception intensity of flavour and texture attributes over time. While traditional static sensory methods provide information about the intensity of the sensory perception of an attribute at a particular moment, these dynamic techniques are closer to the real sensory perception during food consumption (Dijksterhuis & Piggott, 2001). Among the dynamic sensory techniques, the time–intensity method (TI) allows assessing variations in perception intensity of a particular attribute over time using a sensory panel trained for this purpose (Cliff & Heymann, 1993). The result is a sequence of very intuitive graphical representations (TI curves). The TI curves show increases and decreases of the intensity of sensory perception over time (Dijksterhuis & Piggott, 2001). Several parameters can be extrapolated from these curves (maximum intensity, time to achieve the maximum intensity etc.) which enable the objective evaluation of the temporary changes as well as the comparison between TI-curves obtained for different products, panellists, sessions etc.

TI has been applied to the dynamics of flavour and texture perception in a variety of food products such as dairy products (King, Lawler, & Adams, 2000; Silva-Cadena & André-Bolini, 2011; Tuorila, Sommardahl, & Hyvönen, 1995), chewy gums (McGowan & Lee, 2006; Ovejero-López, Bro, & Bredie, 2005), salad dressings (Guinard, Wee, McSunas, & Fritter, 2002) and cheeses (Pionnier et al., 2004). Although this methodology has been applied to meat products such as pork patties (Reinbach, Toft, & Møller, 2009) and sausages (Ventanas, Puolanne, & Tuorila, 2010), existing knowledge regarding the temporal sensory perception of muscle foods is still limited (Fuentes, Ventanas, Morcuende, & Ventanas, 2013). Meat products derived from Iberian pigs are high-quality products with distinctive sensory properties (Ventanas, Ventanas, Ruiz, & Estévez, 2005). The sensory quality of meat products derived from Iberian pigs has been widely studied (Andrés, Cava, Ventanas, Thovar, & Ruiz, 2004; Carrapiso, Bonilla, & García, 2003, Ruiz, Ventanas, Cava, Timon, & García, 1998; Ventanas, Ventanas, & Ruiz, 2006). However, the methodology used in these studies (mainly Quantitative Descriptive Analysis—QDA) is based on the assessment of the perception of the different quality attributes as a "static" phenomenon. Therefore, the use of dynamic sensory techniques such as TI would represent a breakthrough in the field of sensory evaluation of meat products and particularly of those derived from Iberian pigs.

The aim of the present study was to apply a dynamic sensory evaluation technique (TI) to the flavour and texture of three different meat products derived from Iberian pigs, namely, liver pâté, dry-cured sausages and dry-cured loins.

* Corresponding author. Tel.: +34 927257100.
  E-mail address: sanvenca@unex.es (S. Ventanas).

Table 1
Attributes and definition sorted by the meat products (pâté-P, dry-cured sausage-DCS and dry-cured loin-DCL).

Attributes	Product	Definition
Appearance		
Colour intensity	P, DCS, DCL	Brownness of pâté (pale brown to dark brown) and redness of lean of dry-cured products (pale pink to dark red)
Colour homogeneity	P, DCS, DCL	Colour uniformity (very low to very high)
Brightness	P, DCS, DCL	Intensity of brightness on the meat product surface (dull to very bright)
Fat colour	DCS	Yellowness of fat (white to yellow)
Fat/lean proportion	DCS	Attribute which shows the relation of fat and lean content on the dry-cured sausages slice (very low to very high).
Marbling	DCL	Level of visible intramuscular fat (very lean to intense marbled)
Marbling size	DCL	Size of the fat veins (very small to very big)
No oral texture		
Cohesiviness	P, DCS	Degree of adhesion between the different ingredients. Evaluate by spreading the pâté over a toast using a knife (very low to very high) or by shaking gently a dry-cured sausage slice (very low to very high).
Spreadability	P	Ability of a soft product to be spreaded and adhered over a solid surface. Evaluate by spreading the product over a toast using a knife (very low to very high).
Hardness	DCS	Effort required for deforming a dry-cured sausage slice between the fingers (not hard to very hard).
Odour		
Overall	P, DCS, DCL	Level of overall odour before sample consumption (very low to very high)
Liver	P	Intensity of the typical odour provided by the presence of the liver before sample consumption (very low to very high)
Pepper note	P	Odour associated with black pepper (very low to very high)
Meat	P	Intensity of the typical odour from cooked meat before sample consumption (very low to very high)
Rancid	P	Odour associated with aroma compounds derived from fat oxidation reactions (very low to very high).
Acetic	DCS	Characteristic odour of acetic acid (very low to very high)
Spicy	DCS, DCL	Odour associated with aromatic spices added to dry-cured sausage (nutmeg, cumin, black pepper, etc.) and to dry-cured loin (paprika, oregano, garlic, etc.) (very low to very high).
Cured	DCL	Intensity of the typical odour from cured meat products before sample consumption (very low to very high)
Oral texture		
Hardness	DCS, DCL	Effort required to bite through sample and to convert it to a swallowable state (very tender to very firm).
Juiciness	DCS, DCL	Impression of lubricated food during chewing (not to very juicy)
Fibrousness	DCS, DCL	Extent to which fibres are perceived during chewing (not to very fibrous).
Chewiness	DCS, DCL	Number of chews or time of chewing required to masticate the product until reaching a state ready for swallowing (very low to very high).
Flavour		
Overall	P, DCS, DCL	Level of overall flavour (flavourless to very intense flavour)
Saltiness	P, DCS, DCL	Level of salt taste (not to very salty)
Umami	P	Level of umami taste (very low to very high)
Liver-like	P	Level of liver-like taste (very low to very high)
Spicy	P, DCS, DCL	Flavour associated with black pepper in pâté, with aromatic spices added to dry-cured sausage (nutmeg, cumin, black pepper, etc.) and to dry cured loin (paprika, oregano, garlic, etc.) (very low to very high).
Sourness	DCS	Level of source taste (not to very sour)
Cured	DCL	Intensity of the typical flavour from cured meat products (very low to very high)
Rancid	DCL	Intensity of the rancid flavour (very low to very high)
After-taste	DCL	Intensity and duration of the overall flavour perception after the sample was swallowed (very low to very high).

2. Material and methods

2.1. Samples

Three different Iberian meat products (n = 6) were randomly selected from a local supermarket (pâté of liver) and from a local industry "Dehesa Serrana" (dry-cured sausages "salchichón" and dry-cured loins) as representative of cooked, minced dry-cured and whole dry-cured products. Iberian meat products were developed according to their quality standard (BOE, 1980, 1981, 2007). Spices were added to all these products in the manufacturing process (black pepper in pâté; nutmeg, cumin, black pepper, etc. in salchichón; and paprika, oregano, garlic, etc. in dry-cured loin).

2.2. Physico-chemical analysis

Each sample was analysed for chemical composition in triplicate. Moisture content was determined by drying the sample at 102 °C for 24 h (AOAC, 2000). Total protein content was analysed using the Kjeldahl method (AOAC, 2000). Fat content was determined according to Folch, Lees, and Sloane Stanley (1957) and chloride content using the Volhard method (AOAC, 2000).

2.3. Sensory evaluation

2.3.1. Assessors

Eleven panellists (six males and five females, aged: 26–54 years) with previous experience in sensory evaluation, participated in the study (training and evaluation sessions). All were staff at the University of Extremadura.

2.3.2. Panel training

Prior to TI evaluation, a descriptive sensory profile of the meat products was carried out according to international standards (ISO 4121:1987). Moreover, the development of a conventional sensory profile of the products can be considered as part of the TI training (Peyvieux & Dijksterhuis, 2001). This training enables verification as to whether the selected attributes are applicable or not to the product under investigation and allows panellists to get familiar with the attributes and samples subsequently used in the TI study. To generate the attributes that better described the meat products, a list of potential descriptors was given to the panel based on the scientific literature (Briz-Escribano & García-Faure, 2000; Ruiz Pérez-Cacho, Galán-Soldevilla, León Crespo, & Molina Recio, 2005; Sancho, Bota, & de Castro, 1999; Ventanas et al., 2006). First, the panellists individually generated a set of terms that better described the samples. After that, the panellists