Effect of serving temperature on temporal sensory perception of sliced dry-cured ham.

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Abstract- **Effect of serving temperature (7ºC, 16ºC and 20ºC) on temporal sensory perception (texture and flavour attributes) of sliced and vacuum-packaged dry-cured ham was investigated using time-intensity (TI) technique. Sensory evaluations were performed with panellist (N=11) trained for this purpose. FIZZ software was used to compute the average TI-curves and the following TI parameters were extracted: maximum intensity of the curve (Imax), end time (Tend) and the total area under the curve (Area). Juiciness was more intense (higher Imax) at 16ºC and 20ºC than at 7ºC, although this difference was not significant. However, serving temperature had a significant effect on temporal perception of fibrousness since the total Area values were lower in samples served at 7ºC compared to those served at 16ºC and 20ºC. Regarding the perception of flavour attributes, an increase of serving temperature from 7ºC to 16ºC or 20ºC significantly increased the perceived overall flavour (Imax and Area) of samples. The increase of serving temperature caused an increase on overall flavour persistence (Tend), although this difference was not significant. Temporal results of rancid flavour shows that this attribute was more persistent (higher Tend) in samples served at 20ºC compared to the samples served at lower temperatures. The present study revealed the feasibility of applying the TI technique to evaluate the changes in temporal perception of flavour and texture of sliced dry-cured ham caused by modifications of serving temperature.**

Keywords- **time-intensity, dry-cured ham, serving temperature**.

I. INTRODUCTION

Meat flavour is considered to be one of the most important factors affecting purchasing habits and preferences of meat consumers [1]. Dry-cured Iberian ham is a meat product of Spain, with a first-rate consumer acceptance. This high consumer acceptability is mainly sustained on its unique and very appreciated sensory features, which are the consequence of both the characteristics of the raw material and the prolonged traditional processing method that requires between 1 and 2 years of ripening [2]. Lipid oxidation and Maillard-type reactions are the main routes for the generation of the volatile components of meat products [3, 4].

Physicochemical properties of aroma compounds and their interactions with other food components affect flavour release and perception [5].

Serving temperature is an important factor affecting both acceptability and intensity of odour and flavour attributes [6]. The effect of serving temperature on flavour perception depends on the food and the sensory attribute evaluated. Ryynänen et al. [7] reported an increase in both the odour and flavour intensities with serving temperature in different meals components, including meat patties. Temperature effects on texture perception can be mediated by physico/chemical changes in the product, or by differences at the level of the mucosa. In addition to sensory phenomena, these effects may also be perceptual [8]. Product temperature could influence the viscosity of the product and the ratio of solid and melted fat and thereby influence the quality and the thickness of the oral coating formed [8].

Flavour and texture perception are dynamic processes since continuous changes in their intensities are perceived during eating as a result of mixing with saliva and the breakdown of the food matrix through chewing. The time–intensity (TI) method allows monitoring the intensity over time and thus provides more real and valid information compared to static techniques [9].

The aim of the present study was to investigate the effect of serving temperature on the dynamic perception of flavour and texture in sliced and vacuum- packaged Iberian dry-cured ham using TI method. Three different serving temperatures (7ºC, 16ºC and 20ºC) were considered in order to study the effect of different serving temperature on sensory traits.

II. MATERIAL AND METHODS

Dry-cured hams (7.5 kg average) were obtained from free-range reared Iberian pigs fed on grass and commercial concentrates during the fattening period (60 days prior to slaughter) and slaughtered at 160 kg live weight and 12 months of age. Green hams were processed according to previous methods described Estévez et al. [10]. Once the ripening process was finished the hams were deboned and sliced (1 mm thickness) and vacuum-packaged (HF100 in the upper film with 34.0 cm3/m2 permeability to O_2 at 23 ºC and 85% HR; HF200 in the lower film with 18.0 cm^3/m^2 permeability to O_2 at 23 ºC and 85% HR) (Mobepack company, Salamanca, Spain). Afterwards, the packages were refrigerated (5ºC) for one month until sensory evaluation.

Sensory profile was performed by eleven panellists (six males and five females, range age 26– 54 years) with previous experience in sensory evaluation participated in the study (training and evaluation sessions). All of them were staff of the University of Extremadura.

Prior to TI, descriptive sensory analysis of the same samples was also carried out as training sessions. The protocol of samples evaluation was fixed after panel discussion and was established as follows: panellists should keep the sample in their mouths, chew for 10 seconds and then swallow. After swallowing panellists should continue the evaluation until they did not perceive anything. Panellists were required to move the cursor along the scale non-structured according to the intensity of their perception. Attributes were scored on a 10 cm non-structured horizontal scale anchored with ‘‘not at all” and ‘‘very strong” for overall and rancid attributes and with ‘‘less” and ‘‘more” for juiciness and fribousness. Between samples, panellists were required to follow the rinsing protocol. The final rinsing protocol between samples was tap water and a piece of unsalted crakers. Data were collected using the FIZZ software (Sensory Analysis and Computer Test Management) (Biosystemes, France, 2002).

Previously, samples and glass plates were conditioned at different serving temperature (7ºC, 16ºC and 20ºC) for at least 30 minutes and subsequently served on glass plates with a glass of water and a piece of unsalted crakers. To follow the rinsing protocol between samples. The samples were conditioned at different serving temperature in heat cabinet. Evaluations took place in individual booths under white fluorescence light. In each session, three dry-cured ham samples at two serving temperature were presented to the assessors, with the serving order of the samples randomised according to the Williams Latin Square design.

Data analysis;

Data from individual TI curves of juiciness, fibrousness, overall flavour and rancid flavour were analysed and average TI- curves were computed for each attribute over 11 assessors and four replications using FIZZ software. Three TI parameters were extracted from TI curves: maximum intensity (Imax), total duration of perception (Tend) and total area under the curve (Area). Two-way ANOVA (repeated measures) (GLM procedure) was carried out for each TI parameter. In this model, serving temperature (7ºC, 16ºC and 20ºC) and replications (session 1, 2, 3 and 4) were included as within-subject factors.

III. RESULTS

Results from TI evaluations are shown as average TI-curves for each attribute (Figure 1).

The perceived intensity of juiciness increased with serving temperature, confirmed by the higher values for Imax and Area (Fig.1a) obtained in samples served at 20ºC and 16ºC compare to samples served at 7ºC. Although these differences were not significant. Juiciness perception was significantly more persistent (higher Tend) in samples served at lower temperature, particularly at 16ºC.

The serving temperature had a significant effect on temporal perception of fibrousness (Fig.1b) since the total Area values were significantly ($p<0.01$) lower in samples served at 7ºC compared to those served at 16ºC and 20ºC. The temperature did not cause a significant effect on maximum intensity, but this parameter was influenced in the same direction than Total area under the curve. Regarding the total duration of perception, although the serving temperature had not a significant effect on this parameter (Tend), it was longer at 7ºC than samples served at higher temperature.

Regarding overall flavour (Fig.1c) an increase of serving temperature from 7ºC to 16ºC or 20ºC significantly ($p<0.01$) increased the perceived intensity of overall flavour (Imax and total Area) of samples. The increase of serving temperature caused also an increase on overall flavour persistence (Tend), although this difference was not significant ($p>0.05$).

Temporal results obtained from rancid flavour shows that this attribute was more persistent (higher Tend) in samples served at 20ºC compared to the samples served at lower temperatures, although this difference was not significant ($p>0.05$). The total Area increased with serving temperate, the samples served at 20ºC showed the highest total Area ($p>0.05$).

IV. DISCUSSION

Serving temperature is one of the most important conditions affecting consumer's responses to foods [11]. If the serving temperature is not appropriate, consumers may reject the food [12]. In the present study reported 16ºC or 20ºC seemed to be more appropriate serving temperature compared to refrigeration temperature. Higher intensities for most texture and flavour attributes were collected in samples served at higher temperatures. Increasing the serving temperature from 7ºC to 16ºC or 20ºC of rancid flavour did not result in increased rancid perception. In general, the juiciness and overall flavour in samples conditioned (16ºC or 20ºC) turned out to be more intensity and persistence. According to Ruiz et al. [2] the juiciness and flavour intensity are the most important features in determining dry-cured Iberian ham acceptability, the juicier and the more intense the flavour of the ham, the better the ham quality.

These results are in agreement with several previous studies. According to Engelen et al. [8] reported a great influence of product temperatures on the perception of sensory attributes in semi-solids food. Ventanas et al. [6] observed a flavour intensities increased with serving temperature in flavoured model systems.

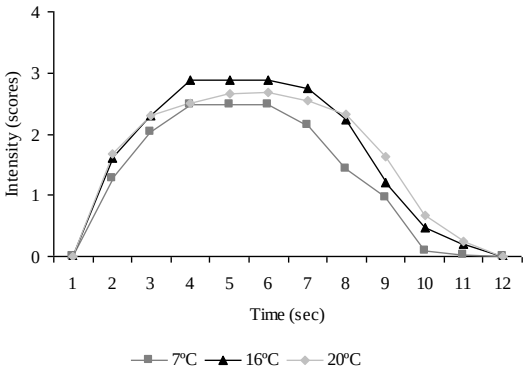

Figure1a. Average TI-curve for the attribute juiciness.

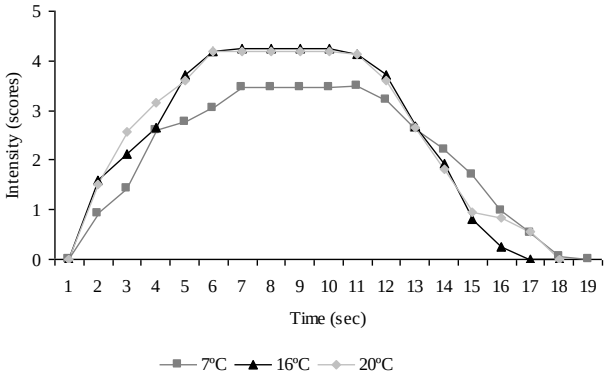

Figure1b. Average TI-curve for the attribute fibrousness.

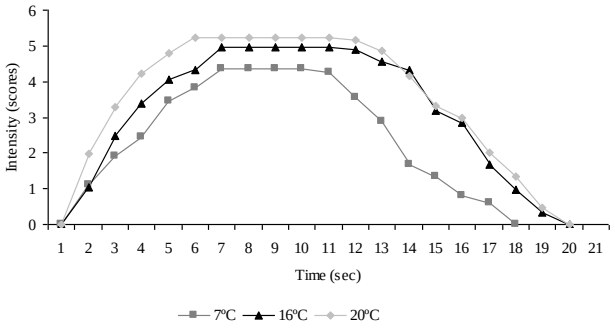

Figure1c. Average TI-curve for the attribute overall flavour.

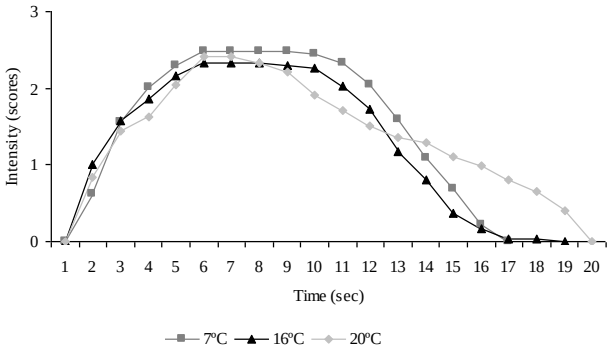

Figure1d. Average TI-curve for the attribute rancid flavour.

V. CONCLUSIONS

The present study revealed the feasibility of applying the TI technique to evaluate the changes in temporal perception of flavour and texture of sliced dry-cured ham caused by modifications of serving temperature. Increased serving temperature (from 7ºC to 16ºC and 20ªC) contributed to increased texture and flavour intensities, with except, intensity of rancid flavour. Therefore, the serving temperature in dry-cured ham should be carefully considered prior to consumption.

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