

Effect of high pressure treatment on microbial and sensory quality of sliced dry-cured Iberian Ham

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Abstract— The aim of this study was to evaluate the effect of applying high pressure on microbiological and sensory characteristics of sliced dry-cured Iberian ham at 0, 90 and 180 days of storage at + 4 °C. The trial consisted of three experimental treatments based on the application or not of high pressure (600 MPa) for 6 or 9 min. Attributes tasted were as follows: colour, appearance of fat, marbling, brightness, odor intensity, stale, unpleasant taste, juiciness and hardness. *Listeria monocytogenes* was inoculated in the samples and its growth evaluated. High pressure processing at 600 MPa for 6 and 9 min inhibited the growth of *L. monocytogenes* in sliced dry-cured Iberian ham at any of the chilled storage times evaluated. No changes were found after high pressure treatment and during chilled storage in the sensory parameters evaluated. On the basis of the results, it is concluded that the high pressure treatment at 600 MPa for 6 or 9 min is an efficient method for preserving the microbial safety of sliced dry-cured Iberian ham without detrimental effect on its sensory characteristics.

Keywords— vacuum packaging, high pressure processing, dry-cured Iberian ham.

I. INTRODUCTION

Dry-cured Iberian ham is a meat product with high sensory quality [1]. This kind of product is a ready-to-eat food (RTE), usually sold sliced and vacuum packed. Sliced dry-cured Iberian ham has a low water activity (A_w) and high NaCl content so it is a product with a long shelf-life at refrigeration temperature (more than 3 months). However, slicing and packaging operations constituting a permanent risk of contamination because products can be recontaminated [2]. Moreover, prolonged shelf-life at refrigeration temperatures may contribute to the survival and growth of *Listeria monocytogenes*, a pathogen capable of exponential growth at

refrigeration temperatures [3] [4] [5]. In this regard, high-pressure processing (HPP) is an attractive preservation technology for eliminating pathogenic and spoilage microorganisms of meat products improving safety and extending the shelf-life [6] [7] [8]. The application of HPP has been studied in several meat products and different effects of pressure, temperature and holding time have been determined depending on the type of product [6] [9] [10] [11] [12]. However, the effect of HPP treatment could induce undesirable changes on sensory properties of the meat products, modifying texture, colour, external appearance and increasing lipid oxidative reaction and therefore affecting the aroma and taste. As result HPP can decline the acceptability, especially in some rich protein foods treated at pressures higher than 400 MPa [10]. Hence it is necessary to establish optimum processing conditions to ensure the microbiological safety of the product, especially if shelf-life is extended, minimizing the negative effects of pressure on sensory quality. The aim of this study was to evaluate the effect of high pressure treatment (600MPa) and two holding times (6 min and 9 min) on microbial and sensory quality of vacuum-packed sliced dry-cured Iberian ham.

II. MATERIALS AND METHODS

A. Slicing, inoculation and packaging

A total of 72 dry-cured Iberian ham samples were sliced. *L. monocytogenes* was inoculated in 45 of the samples at 10^2 ufc/ml/cm² in order to study its survival to HPP. The remaining 27 samples were used to evaluate the sensory parameters. Slices were placed between two films and vacuum-packed into 240x120 mm individual packs of 75 g. Packaged sliced dry-cured Iberian ham were stored for 24 h at 4°C before

the HPP treatment. Three independent batches were prepared: a control treatment (samples non-pressurised) and two experimental treatments (samples subjected to HPP at 600 MPa for 6 and 9 min).

B. High-pressure treatment

The HPP was done in an industrial HPP equipment capable of operating up to 600 MPa. Pressurization was performed at 600 MPa for 6 min (treatment A) and for 9 min (treatment B). The pressure level (600 MPa) and time (6 and 9 min) were set by an automatically controlled device.

C. Storage of the samples

After high-pressure treatment, the samples were stored at 4 °C for up to 180 days together with the nontreated control samples. At selected times: time 0, after HPP, and during chilled storage (90 and 180 days), microbiological and sensory analyses were carried out. Five and three samples per treatment and storage time were used for microbiological and sensory evaluation, respectively.

D. Microbiological analyses

The presence/absence of *L. monocytogenes* was investigated by preenrichment of 25 g of sample in *Listeria* enrichment broth (UVMI, Oxoid, Basingstoke, Hampshire, England) at 37 °C for 24 h followed by selective isolation in Palcam and Oxford agar at 37 °C for 24 h.

E. Sensory analyses

HPP (A and B) and control samples were checked for the following attributes: colour, appearance of fat, marbling, brightness, odor intensity, stale, unpleasant taste, juiciness and hardness. Samples were assessed by a trained panel of 8 members. The panel sessions were held at mid-morning. Slices (1.5 mm thick) of the dry-cured Iberian ham were served on plates to panellists. A profile of 9 sensory attributes of dry-cured Iberian ham was assessed. Attributes were rated

on a structured scale of 1–10 (1, very low, to 10, very high). All sessions were done at 22 °C in a sensory panel room equipped with white fluorescent lighting (Philips TLD 86, 5600 K, 800 lux). The sample order was randomised within sessions.

F. Statistical analysis

The effects of treatment and time of storage were analyzed using the Analysis of Variance procedure of SPSS, version 19.0. Tukey's test was used to compare the mean values of the treatments and storage time. Mean values and standard errors of the means (SEM) were reported.

III. RESULTS and DISCUSSION

A. Microbial analysis

All the vacuum-packed sliced dry-cured Iberian ham samples tested, control and HPP, showed absence of *L. monocytogenes* in 25 g at any of the storage periods evaluated (90 and 180 days). Other studies conducted on dry cured products also indicated consistent decreases in the microbial populations after high pressure treatment, with the population remaining quite stable for the rest of the shelf-life [11].

B. Effect of high pressure and holding time on sensory quality

Although modifications in colour and lipid oxidation in sliced dry-cured ham by pressure treatment have been previously reported [13] [14] [15], no differences have been found in the present experiment after high pressure treatment and during chilled storage.

The effect of high pressure and holding time on sensory quality values of vacuum-packed sliced dry-cured Iberian ham during refrigerated storage is shown in Figures 1, 2 and 3. In general, no differences in colour, appearance of fat, marbling, brightness, odor intensity, stale, unpleasant taste, juiciness and hardness were found between pressurized and non-

pressurized samples or when different HPP times were applied in dry-cured Iberian ham after pressurization.

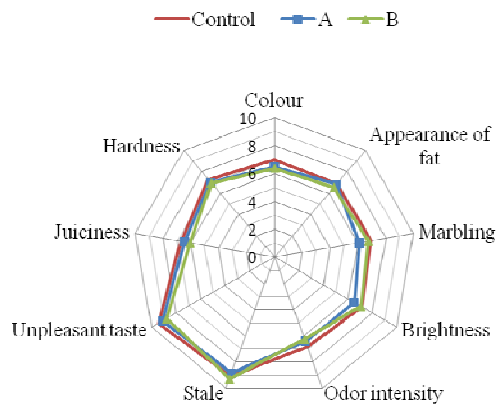


Fig. 1 shows values for the non-pressurized and pressurized dry-cured Iberian ham samples measured after vacuum and chilled storage for 0 days at 4° C. The effect of pressure treatment on parameters evaluated was not statistically significant. Average values are shown.

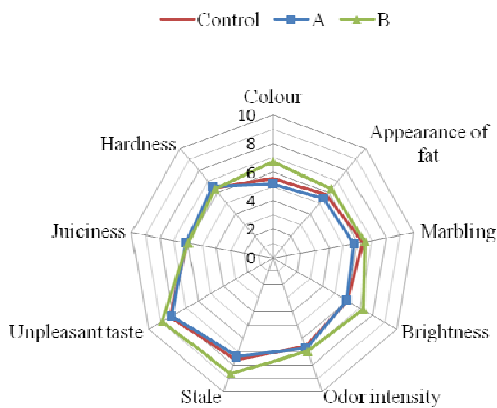


Fig. 2 shows values for the non-pressurized and pressurized dry-cured Iberian ham samples measured after vacuum and chilled storage for 90 days at 4° C. The effect of pressure treatment on parameters evaluated was not statistically significant. Average values are shown.

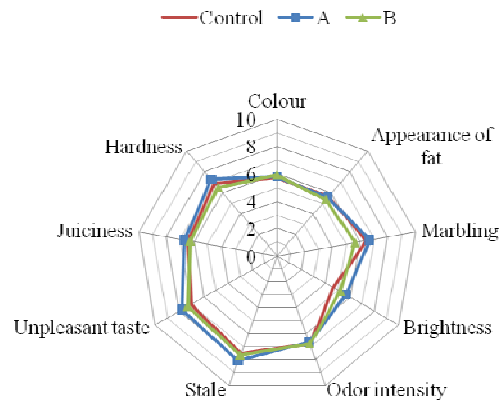


Fig. 3 shows values for the non-pressurized and pressurized dry-cured Iberian ham samples measured after vacuum and chilled storage for 180 days at 4° C. The effect of pressure treatment on parameters evaluated was not statistically significant. Average values are shown.

IV. CONCLUSIONS

The lack of differences in stored products treated with HPP with respect to non-treated products shows that the application of HPP at 600 MPa for 6 or 9 min might not compromise sensory quality of dry-cured Iberian ham.

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