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Effect of high pressure preservation on the quality of dry cured beef "Cecina de Leon"

Begoña Rubio [a,*], Beatriz Martínez [a], M[a] Dolores García-Cachán [a], Jordi Rovira [b], Isabel Jaime [b]

[a] *Estación Tecnológica de la Carne. Instituto Tecnológico Agrario de Castilla y León. C/ Filiberto Villalobos s/n. 37770 Guijuelo (Salamanca). Spain*
[b] *Departamento de Biotecnología y Ciencia de los Alimentos. Universidad de Burgos. Plaza Misael Bañuelos s/n. 09001 Burgos. Spain*

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Abstract

Microbiological, physicochemical and sensory quality of "Cecina de León" vacuum packed was evaluated after high pressure treatment (500 MPa, 5 min) and further chilling storage at 6 °C for up to 210 days. The objective was to determine if high pressure processing is a valid preservation method to reduce the growth of spoliage microorganisms without modification of its quality properties along of the chilling storage time for this Spanish beef dried meat product. Since, this product is usually presented to the consumer in vacuum packed slices and cuts, these two retail sale systems were studied. High pressure processing at 500 MPa for 5 min avoided the growth of enterobacteria, enterococci and pseudomonads and delayed the growth of lactic acid bacteria, *Micrococcaceae* and yeasts and moulds. Besides, no change was found after pressure treatment and during refrigerated storage, in physicochemical and sensory parameters. It could be concluded, on the basis of the results, that the high pressure treatment was an efficient method for preserving the safety of "Cecina de León" without decreasing their sensory properties.

Keywords: Vacuum packaging; High pressure processing; Shelf-life; Dry cured beef; Cecina de León

Industrial relevance: High pressure processing is finding increasing use in the food industry because of its relative advantages versus other food processing methods in eliciting minimal changes in the flavour and nutritional qualities of the final product and in extending the shelf life. The study aimed the evaluation of microbiological, physicochemical and sensory characteristics at vacuum packed slices and cuts of "Cecina de León" during subsequent extended chilled storage. High pressure processing was a valid preservation method to reduce the growth of spoilage microorganisms without any changes on "Cecina de León" quality properties along wide chilled storage.

1. Introduction

"Cecina de León" is a salted, smoked and dried, beef meat product manufactured traditionally in the region of León (north-western Spain). It is an intermediate moisture meat product, and the preparation method is similar to that used in dry cured ham manufacture. The final product has a typical red colour, smoked flavour and a slight genuine salty taste. Two different retail sale systems are mostly used: vacuum packaged "cecina" slices or "cecina" cuts.

Normally, at the end of drying, internal flora of this product is present at low levels (10^3 cfu/g) in the overall "Cecina de León" (García, Zumalacárregui, & Díez, 1995). According to Rubio, Martínez, González-Fernández, García-Cachán, Rovira and Jaime (2006), cross-contamination during cutting or slicing and packaging leads to an increase of the concentration of total viable microorganisms. This fact reduces to 90 days the shelf life of vacuum packed "Cecina de León" slices. As heat treatment is not suitable for this product after packaging, an alternative process to minimise the microbiological counts is necessary.

In this sense, high hydrostatic pressure processing (HPP) is a very promising preservation technology of sliced meat cured products (Hugas, Garriga, & Monfort, 2002), which can be

* Corresponding author. Estación Tecnológica de la Carne. Instituto Tecnológico Agrario de Castilla y León. C/ Filiberto Villalobos s/n. 37770 Guijuelo (Salamanca). Spain. Fax: +34 923580353.
E-mail address: rubherbe@itacyl.es (B. Rubio).

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applied to the product after slicing and vacuum packaging. HPP at low or moderate temperature causes destruction of microbial vegetative cells without remarkable changes in odour, taste and nutrient content. Furthermore, the use of HPP will ensure the safety of meat cured products and extends the life of these products without decreasing organoleptic properties.

However, the effectiveness of the treatment or the resistance of the microorganisms is extremely variable and it depends on (1) the process parameters (achieved pressure, treatment temperature and exposure time); (2) the strain (gram-positive microorganisms are more resistant to HPP than gram-negative species as well as spores), cell morphology (bacilli are more sensitive to pressure than cocci) and the stage of growth of the microorganisms (bacteria from the early log phase of growth are more barosensitive than cells from stationary, dormant or death phase); and (3) the meat matrix to be treated (Hoover, Metrick, Papineau, Farkas, & Knorr, 1989; Hugas et al., 2002; Saccani, Parolari, Tanzi, & Barbuti, 2004). In this way, it is important to experiment with real matrices because results obtained in buffers or synthetic media cannot be always extrapolated and applied to real situations (Garriga, Grébol, Aymerich, Monfort, & Hugas, 2004). Food composition can often have protective effect during pressurisation, and it is important to evaluate microbial resistance to pressure in foods. As for dry cured meat products, few studies have been carried out in order to study the effectiveness of the high pressure processing and to evaluate the microbial safety and the quality of these pressurised products throughout chilled storage (Andrés-Nieto, Møller, Adamsen, Ruiz, & Skibsted, 2004; Cava, González, Ladero, & Carrasco, 2005; Garriga et al., 2004; Saccani et al., 2004).

In this study, HPP (500 MPa during 5 min) was assayed in dry cured beef "Cecina de León". The objective was to compare the microbiological, physicochemical and sensorial evolution between the HPP and untreated samples during a long chilled storage time (210 days) and thus to determine if HPP processing is a valid preservation method to reduce the growth of spoilage microorganisms without any changes on "Cecina de León" quality properties along wide chilled storage.

2. Materials and methods

2.1. Preparation of samples

The study was carried out on "Cecina de León" cuts and on "Cecina de León" slices.

2.1.1. "Cecina de León" cuts

The study was carried out on 4 pieces of "Cecina de Leon" manufactured according to the specifications of Protected Geographical Indication "Cecina de León" (Boletín Oficial de Castilla y León, 1994). The anatomical cut used was the knuckle, comprising mainly of *Quadriceps femoris*. Pieces of approximately 7 kg and 10–11 months of ripening were divided into portions (4–5 cm thick and about 500 g weight). A portion of each piece was used for initial analysis (day 0) and results corresponding to day 0 for all parameters were the average value of data from the 4 portions analysed.

2.1.2. "Cecina de León" slices

Two pieces of "Cecina de Leon" with the same characteristics above mentioned were sliced (1.5 mm thick) and 100 g of them were placed in polystyrene trays. Two trays from each piece were used for initial analysis and results corresponding to this sampling time for all parameters were the average value of four data.

2.1.3. Packaging

The cuts and trays of slice of "Cecina de León" were individually packaged in plastic bags (polyamide/polyethylene with an oxygen transmission rate of 30–40 cm^3/m^2/24 h/bar at 23 °C and 50% RH and a water vapour transmission rate of 2.5 g/m^2/24 h at 23 °C and 50% RH, supplied by WK Thomas España S.L., Rubí, Spain) which were subjected to vacuum and sealed using either a packer (EVT-7-TD Tecnotrip, Barcelona, Spain). After vacuum packaging, one group of samples of both cuts and slices remained untreated and the rest were high pressure treated. Then, all packs were stored at 6 °C for up to 210 days.

2.1.4. High pressure treatment

The pressurisation took place in an industrial hydrostatic pressurisation unit (Wave 6000/135. NC Hyperbaric, Burgos, Spain). The pressure level was 500 MPa, the treatment time of 5 min and the initial temperature, 18 °C. The time needed to achieve the treatment pressure was approximately 4 min and decompression was instantaneous.

2.1.5. Storage of the samples

After HPP, the pressurised samples (HP) were stored at 6 °C for up to 210 days together with the untreated control samples (CO). At selected times: after high pressure processing (1 day) and during chilled storage (15, 30, 60, 90, 150 and 210 days), microbiological, physicochemical and sensory analyses were carried out. Two packs of each treatment were opened for subsequent analysis after the determined days of storage.

2.2. Microbial analyses

Ten grams of each sample were taken aseptically and homogenised with 90 ml of tryptone water (Scharlau, Spain) for 2 min in a sterile plastic bag in a PK 400 Masticator (IUL, S.A., Barcelona, Spain). Serial decimal dilutions were made in sterile tryptone water and duplicate 1 ml or 0.1 ml samples of appropriate dilutions were poured or spread onto total count and selective agar plates.

The samples were analysed for: *mesophilic aerobic bacteria* determined on 3 M Petrifilm Aerobic Count Plate (Bioser, Spain), incubated at 30 °C for 48 h; *psychrotrophic bacteria* on Plate Count Agar (Scharlau, Spain), incubated at 7 °C for 10 days; *anaerobic bacteria* on Schaedler Agar (Scharlau, Spain), overlayed with 5 ml of the same medium and incubated at 37 °C for 48 h; *enterobacteria* on 3 M Petrifilm Enterobacteriaceae Count Plate (Bioser, Spain), incubated at 37 °C for 24 h; *enterococci* on Slanetz Bartley Agar (Scharlau, Spain), incubated at 37 °C for 48 h; *pseudomonads* on Pseudomonads