

PRICKLY PEAR ENCAPSULATED EXTRACT AS ANTIOXIDANT IN BEEF PATTIES

Raquel Lucas-González¹, Laura Moraga-Babiano², Roberto Bermúdez², Mirian Pateiro², Jose Angel Perez-Alvarez¹, Rubén Domínguez-Valencia², José M. Lorenzo^{2,3*}

¹ Institute for Agri-Food and Agri-Environmental Research and Innovation, Miguel Hernández University (CIAGRO-UMH), Ctra. Beniel km 3.2, 03312 Orihuela, Alicante, Spain

² Centro Tecnológico de la Carne de Galicia, Avda. Galicia nº 4, Parque Tecnológico de Galicia, Ourense, San Cibrao das Viñas, 32900, Spain

³ Área de Tecnoloxía dos Alimentos, Facultade de Ciencias, Universidade de Vigo, 32004 Ourense, Spain

*Corresponding author email: jmlorenzo@ceteca.net

I. INTRODUCTION

In the meat industry, additives are essential due to the high-water activity of meat, its grinding process and raw presentation, which facilitates microbial growth and accelerates oxidation reactions. The prickly pear (*Opuntia ficus-indica*) is the fruit of the prickly pear, which is rich in betalains, a water-soluble nitrogenous pigment, which includes red violet betacyanins and orange yellow betaxanthins [1]. In addition to their colouring capacity, betalains show antioxidant activity [2]. Therefore, obtaining powder extracts rich in betalains derived from the skin of the prickly pear can promote its valorization and the inclusion of natural additives in the meat industry. The present work aimed to evaluate the antioxidant ability of prickly pear encapsulated extract in beef **patties** after 9 days of cold storage.

II. MATERIALS AND METHODS

Ultrasonicator UP400St a 180 W and 24kHz accoupled with S24d22D probe was employed to extract betalains from the prickly pear (*Opuntia ficus-indica*) peel with the following extraction conditions: time: 6 minutes; extractant: EtOH (40%, pH 3.5), solid to solvent ratio 1:35; amplitude 100%. After evaporating EtOH, the betalain-rich extract was dehydrated using a spray-dryer (Mini SprayDryer B-290; Büchi) with maltodextrin as a vehicle (11.5 g/100 mL extract). Four batches of 2 kg each, whose common ingredients were beef, water, and salt, were made. The batches were negative control [N-CON.] (without additives), positive control [P-CON.] (with the addition of sodium erythorbate at 0.5 g/kg), and two formulations with the addition of 2.5 and 5.0 g/kg of Prickly pear encapsulated extract (PPEE) [PP-2.5] and [PP-5.0]. **The chemical composition and the oxidations in raw beef patties stored at 4°C. were evaluated.** The chemical composition was achieved following the corresponding AOAC method. The lipid oxidation was evaluated with the thiobarbituric acid reactive substances (TBARS) assay. Protein oxidation was determined following DNPH method. Significant differences were determined by means of one-way ANOVA and two-way ANOVA (day and treatment).

III. RESULTS AND DISCUSSION

The inclusion of synthetic additive, sodium erythorbate, and prickly pear encapsulated extract in the beef **patties** formulations did not modify beef **patties** chemical composition and physicochemical properties as can be expected (Table 1) due to the low amount of both substances added to the beef **patties**. The rancidity threshold perceptible by consumers is set between 1.5 – 2.0 mg malonaldehyde (MDA)/kg. [3] As can be seen in Figure 1A, the N-CON **patties** on day 9 presented rancidity values perceptible by consumers (1.75 mg MDA/kg). On the other hand, both **patties** added with PPEE did not reach values greater than 1.37 mg MDA/kg on day 9. Furthermore, both tested concentrations were effective to slow down significantly lipid oxidation ($p < 0.05$). Concerning to protein oxidation, PP-5.0 showed lower protein oxidation values than the rest of the batches analyzed at day 9. However not significant differences were detected among the four studied batches.

Table 1. Chemical composition and physicochemical properties of beef patties at day 0.

	N-CON	P-CON	PP-2.5	PP-5.0
Moisture	73.25 ± 0.38	73.79 ± 0.29	72.97 ± 0.67	73.21 ± 0.55
Fat	6.36 ± 0.53	5.85 ± 0.47	6.48 ± 0.58	6.58 ± 0.62
Protein	18.29 ± 1.06	18.34 ± 0.82	18.19 ± 0.14	17.89 ± 0.36
Ash	1.85 ± 0.09 ^{ab}	1.80 ± 0.02 ^a	1.97 ± 0.04 ^a	1.94 ± 0.02 ^b

Different letters in the same row indicate significant differences among formula. Statistically significant differences were considered when $p < 0.05$ after Tukey's post hot test.

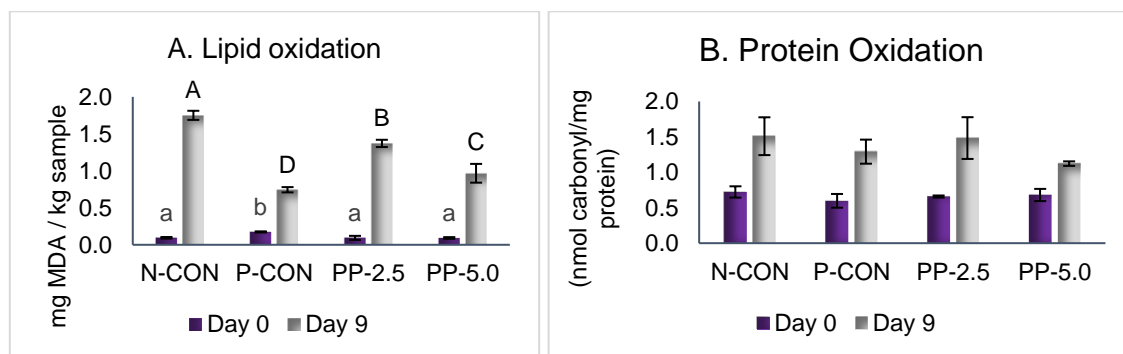


Figure 1. A. Lipid oxidation and B. protein oxidation of four studied batches of beef patties on days 0 and 9 of cold storage. Different letters indicate significant differences among treatments. Statistically significant differences were considered when $p < 0.05$ after Tukey's post hot test.

IV. CONCLUSION

Prickly pear encapsulated extract presented potential to be a natural antioxidant for meat industry, especially for mitigate lipid oxidation. Between the two concentrations studied, the highest concentration (5 mg/kg) was more effective in reducing lipid oxidation. During the 9 days of storage, the beef patties are preserved without presenting a perceptible level of rancidity. However, protein oxidation didn't show significant changes during storage.

ACKNOWLEDGEMENTS

This study was supported by the Spanish Ministry of Science and Innovation project (PID2021-123628OB-C41-Agri-food co-products as a source of bioactive compounds for the development of functional meat products), which is funded by MCIN/AEI/10.13039/501100011033/ and FEDER, UE. The work of Laura Moraga Babiano was supported in part by MCIN/AEI/10.13039/501100011033 and in part by the FSE+ under the grant PRE2022-105858. Raquel Lucas-González would like to thank the Spanish Ministerio de Universidades for her 'Margarita Salas Requalification' postdoctoral fellowship (funded by the European Union–Next Generation EU).

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