Combined effect of pomegranate extract and high pressure on the evolution of instrumental color of Iberian dry-cured sausages during refrigerated storage

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Introduction: Consumers are increasingly demanding meat products without chemical preservatives. Natural sources of antioxidants from plant origin have been evaluated in different meat products, such as grapes (Bañón et al., 2007), broccoli (Banerjee et al., 2012), or green tea (Bañón et al., 2007). Pomegranate extracts have been used as an antioxidant agent due to their known potent antioxidant and antimicrobial properties (Kandylis & Kokkinomagoulos, 2020). In addition, the use of high hydrostatic pressure (HHP) processing for preserving meat products and extending their shelf life has recently increased (Bolumar et al., 2021).

The objective was to evaluate two ingoing amounts of nitrite (0, 150 mg/kg) and pomegranate peel extract (PPE) (1% and 2%) in sausages together with HHP processing on instrumental color changes during refrigerated storage.

Materials and methods: Four different batches of dry-cured sausages were manufactured:

1). 0ppm NaNO2 + 0% PPE (Con-ve); 2). 150 ppm NaNO2 + 0% PPE (Con+ve); 3). 0 ppm NaNO2 + 1% (v/w) PPE (1%PPE) and 4). 0 ppm NaNO2 + 2% (v/w) PPE (2%PPE).

After drying, samples were randomly allotted in two groups: CONTROL and HHP. HHP samples were pressurized at 600 MPa, 8 min, 16 °C in an NC Hyperbaric Wave 6000/55 (NC Hyperbaric, Burgos, Spain). All samples were stored at 4°C in the dark and sampled at days 0, 30, 60, and 120 of storage.

Instrumental color parameters and reflectance spectrum were analyzed according to AMSA, (2012) with a Minolta CM-600d spectrophotometer (Minolta Camera Co., Osaka, Japan).

Data were analyzed by a two-way ANOVA with interaction using SPSS software, v. 22.0 (SPSS, 2013). When ANOVA was significant ($p<0.05$) means were compared using Tukey's test.

Results: The HHP treatment did not affect CIE L* and a*-values at any time of storage. At days 30, 60, and 120, the CIE b*-values were significantly higher in untreated samples than in pressurized ones. In the same way, hue angle values were lower ($p<0.05$) in HHP treated samples than in untreated samples immediately after pressurization and at 30 days of storage.

Ingoing amounts of nitrite and PPE addition significantly affected instrumental color coordinates. The CIE L*-value was higher ($p<0.05$) in Con-ve, than in Con+ve sausages during storage. Samples from sausages with PPE did not show differences in CIE L* in comparison with Con-ve samples. During storage, lightness decreased in all groups, although it was only significant in Con-ve samples.

The addition of PPE significantly reduced the CIE a*-values in stored sausages compared to those without PPE added. Surprisingly, ingoing amounts of 0 and 150 mg/kg nitrite added did not affect CIE a*-values. The time of storage did not affect CIE a*-values.

The addition of PPE significantly increased the CIE b*-values compared to samples without added PPE. The increase in CIE b* was greater the higher the level of PPE addition in the sausages. No changes in CIE b* occurred during storage.

The addition of PPE increased ($p<0.05$) the values of the hue angle when compared with sausages without PPE added. Hue angle values were higher ($p<0.05$) in 2% PPE samples than in 1% PPE added ones. The hue angle did not show changes during storage.

Samples with 150 mg/kg sodium nitrite showed a higher ($p<0.05$) cured index than samples formulated with 0 mg/kg. The addition of PPE did not affect the cured index.

Conclusions: The removal of nitrite causes changes in the CIE L*-value of the products that make them paler and decreases the cured index value during storage. Both of these factors could affect the acceptability of the product. Notwithstanding other desirable effects of PPE incorporation, the addition of PPE significantly alters the color of sausages during refrigerated storage.

Additional Comments: The aim was to evaluate the combined effect of the addition of a natural antioxidant extract produced from pomegranate peel and high hydrostatic pressure processing on the instrumental color during refrigerated storage in a dry-cured sausage (30 mm dia/28 day drying) with added nitrite. Sausages formulated with 150 mg/kg nitrite was used as a positive control to which compare the removal of nitrite (0 mg/kg, negative control) and the incorporation of PPE at two levels in uncured sausages. All products were treated at 600 MPa 8 min. The study comprised 192 samples.

The CIE a* values were higher in 150 mg/kg batch (control positive) than in the other groups, but the differences with 0 mg/kg (control negative) were not statistically significant on all days of sampling. This lack of differences is attributable to the high fat content and the small diameter of the sausages that could affect the color measurement with the spectrocolorimeter (8 mm dia measuring port). However, the use of reflectance ratio 650 nm/570 nm (cured index) showed a clear effect of the use of nitrite with significant higher values in cured sausages than in uncured ones (control negative -0 mg/kg-, 1% -0 % mg/kg + 1% PPE- and 2% -0 % mg/kg + 2% PPE- experimental groups).

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