Effect of the application of pulsed electric field on the free amino acid profile of porcine liver

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Introduction: Pulsed electric field (PEF) is a novel non-thermal process of food preservation that involves the application of high-intensity electrical pulses for short duration times. It is employed for microbial inactivation due to it produces a minimal detrimental influence on the food attributes, maintaining their original properties such as flavor, texture, color, nutritional value, etc. (Gómez et al., 2019). It also has the potential to improve meat tenderization and juiciness. It should be noted that the efficiency of the PEF depends on the PEF conditions as well as meat properties (Alahakoon et al., 2016). PEF treatment can induce irreversible structural changes in cell membranes resulting in the electroporation breakdown of cellular tissue (Bhat et al., 2019), where myofibril fragmentation and protein denaturation take place (Baldi et al., 2021). Thus, the aim of this study was to assess the effect of PEF on the free amino acid profile (FAA) of porcine liver.

Materials and methods: Raw porcine livers were supplied by a local market. They were mixed with cold distilled water in a proportion 1:1 (w/w) using a cutter. Then, the homogenized were divided in two batches (3000 V and 9000 V) and submitted to pulsed electric fields (Epulsus – PM1-10, Energy Pulse Systems) with the following conditions: pulse number: 100, pulse width: 20 µs, frequency: 10 hz, GAP: 5 cm, sample height: 2 cm, voltage: 3000 or 9000 V. The extraction of FAA was performed according to the method described by Lorenzo et al. (2015). The separation and subsequent determination of analytes was achieved using a HPLC (Waters Alliance 2695). The identification and quantification were carried out fluorescence detector with excitation and emission wavelengths of 250 and 395 nm. Data were expressed as mg/100 g pork liver. A total of 15 samples (3 porcine livers x 5 replicates) were employed to evaluate the statistically significant differences in the FAA content. They were calculated by one-way analysis of variance (ANOVA) with a 95% confidence interval ($p < 0.05$) followed by Duncan's multiple range test to differentiate the significance of mean values.

Results: Effectively, the treatment with electric fields entailed a higher concentration of all the FAA determined except taurine, arginine and cysteine, where no significant differences were observed. Consequently, the total amount of FAA was markedly greater, with no differences between the voltages studied (970.560 and 970.787 mg/100 g, for 3000 V and 9000 V, respectively), in comparison to control (639.633 mg/100 g). Therefore, it is enough to use less energy to achieve the expected results. The pore formation as a consequence of PEF treatment leads the protein degradation in smaller peptides and amino acids (Sánchez-Vega et al., 2020)

Conclusions: The application of PEF to porcine liver produces the protein cleavages leading larger amount of FAA. These findings are interesting since the previous pretreatment of the livers could facilitate the extraction of other compounds of interest such as biopeptides.

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