

# Changes in biogenic amines profile of skin-packed beef treated by high pressure processing

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**Objectives:** The aim of the study was to evaluate the changes in biogenic amines (BAs) profile of skin-packed beef treated by high pressure processing (HPP; 300, 400 and 500 MPa/5 min/5°C) during 56 days of cold storage (4-6°C). Vacuum skin packing is an effective method to extend the shelf life of meat, but it can be assumed that in combination with HPP treatment it is possible to improve the quality of meat.

**Materials and Methods:** The study material was culinary beef (beef round) obtained directly from the meat processing plant in three experimental series. Meat was cut into 150 g slices and placed on rigid PET trays (187'137'36 mm). The packages were closed with the Multifresh™ top film with a vacuum skin effect, using a tray-sealer packaging machine. The samples were pressurized at 300, 400 and 500 MPa for 5 minutes at 5°C in the U5000/120 high pressure processor using water as pressure-transmitting medium. The control group consisted of skin-packed meat samples that were not exposed to high pressure (Control). At weekly intervals, starting from the first day after packaging and HPP applying, the contents of nine BAs (spermine - SPM, spermidine - SPD, cadaverine - CAD, putrescine - PUT, tyramine - TYM, histamine - HIS, tryptamine - TRM, agmatine - AGM and 2-phenethylamine - PEA) in beef were determined according to Świder et al. (2020) with minor modifications. Biogenic amine index (BAI) was calculated according to Triki et al. (2018), and meat characterized by BAI >50 mg/kg was classified as spoiled meat. Moreover, the microbiological quality (total plate count - TPC, lactic acid bacteria - LAB, Enterobacteriaceae, psychrotrophic bacteria, *Pseudo-monas* spp., *Brochothrix thermosphacta* and yeast and moulds - YAM) was evaluated. The One-Way ANOVA analysis of variance was used to determine the influence of storage time or HPP treatment on the beef quality. The detailed testing was conducted using Tukey's HSD test (significance level  $\alpha=0.05$ ). The relationships between the microbiological counts and biogenic amines contents were determined using the Pearson's (linear) correlation.

**Results and Discussion:** It was found that regardless of beef treatment, the number of all microbial groups tested increased with the storage time (except for *B. thermosphacta*). The application of HPP improved the microbiological quality of beef, and the increase in pressure resulted in a more effective slowdown of the growth rate of microorganisms. Significant ( $P\leq 0.05$ ) differences were found between Control and especially HPP500 beef for such microbial groups as TPC, LAB, psychrotrophic bacteria and *B. thermosphacta*. In terms of quantity, the dominant BAs in skin-packed beef were: CAD, TYM and PUT, the level of which increased with storage time. The use of HPP significantly ( $P\leq 0.05$ ) inhibited the formation of CAD, PUT and TYM in beef, and the content these BAs was the lower, the applied pressure was higher. This is with agreement of other results according to which inhibition of biogenic amines formation depends on the level of pressure applied (Naila et al. 2010). The observed differences in the levels of CAD, PUT and TYM can most likely be attributed to the inhibitory effect of HPP on the growth of bacteria, mainly Enterobacteriaceae, LAB and psychrotrophic bacteria. Significant ( $P\leq 0.05$ ) correlation coefficients were obtained between CAD and BAI and the majority of microbiological quality indicators regardless of treatment. In the case of HPP400 and HPP500, high (0.67- 0.90) and significant ( $P\leq 0.05$ ) correlation coefficients were also obtained between PUT and the majority of microbiological quality indicators.

**Conclusions:** The obtained results contribute to expanding the knowledge on the impact of the relatively new method of packaging, which is vacuum skin packaging, and the non-thermal preservation method, which is high pressure processing, on the shelf life and consumer safety of culinary beef. It was found that HPP inhibits the growth of many groups of microorganisms and slows down the processes of formation of biogenic amines in skin-packed beef. Therefore skin packaging can be combined with HPP treatment to extend the shelf life of culinary beef. The BAI value and the level of CAD, PUT and TYM would be the most useful indicators of deterioration of skin-packed beef subjected to HPP in range from 300 to 500 MPa.

## References:

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