P-05-03

Effect of high-pressure processing on volatile compound profile of dry-cured ham (#226)

Cristina Pérez -Santaescolástica, Paulo Eduardo S. Munekata, Paula Borrajo, Laura Cutillas-Barreiro, Ruben Dominguez, Daniel Franco, Jose Manuel Lorenzo

Centro Tecnologico de la Carne de Galicia, Ourense, Spain

Introduction

High-pressure techniques (HP) are used in food manufacture since, among others, it is considered a good method for sterilizing, bringing an extended shelf-life of products (Pérez-Santaescolástica *et al*., 2019a). At first instance, the most important attributes affecting consumer's purchase preference are related to odour and taste, but after consumption, texture has a high influence in the quality perception. On one hand, the aroma is originated by chemical and enzymatic reactions during the processing of dry-cured ham (Bermúdez *et al*., 2015), and on the other hand, techniques like HP could induce texture changes (Duraton *et al*., 2012). Keeping in mind the importance of food sensorial characteristics for its commercializing, and the profound value of dry-cured products around the world, the impact of HP treatment has been studied and it is needed to examine the best temperature to applicate this useful technology which leads the least impact on final quality. For that, our purpose was to evaluate the impact of HP treatments assisted at 12 °C on the volatile profile of dry-cured hams with high proteolysis index in order to make possible its application for other potential purposes obtaining technologic advantages in its production.

Methods

Twenty-five raw hams were elaborated following the procedure described by Santaescolástica *et al*. (2018) to obtain proteolysis levels above 32%. All dry-cured hams were sliced and from each one unit, two plastic bags were vacuum-packed: one of them was treated at 600 MPa during 6 min at 12 °C (HP-12) and the other one was preserved untreated as a control (CO) batch. The HP treatment was applied using an NC Hyperbaric WAVE 6000/120 equipment (NC Hyperbaric, Burgos, Spain), and volatile compounds analyze was carried out using solid-phase microextraction (SPME) and the quantification was performed using GC-MS technique following the chromatographic conditions described by Domínguez *et al*. (2014). The effect of treatment on volatile compounds profile was examined using a one-way ANOVA with IBM SPSS Statistics 23.0 program software package. The values are shown in terms of mean values and standard error of the mean (SEM).

Results

A total of 149 compounds were identified and classified based on their origin in 8 chemical families and 2 sub-families: hydrocarbons (which are divided in aliphatic hydrocarbons and aromatic and cyclic hydrocarbons), aldehydes, ketones, esters and ethers, alcohols, carboxylic acids, nitrogenous compounds and sulphur compounds. The total values per family and sub-family are shown in Table 1. The major family of volatile compounds in CO samples was hydrocarbons (around 21400 AU x 10^3 /g dry-cured ham) followed by aldehydes (around 20500 AU x 10^3 /g dry-cured ham) and alcohols (around 6500 AU x 10^3 /g dry-cured ham). In contrast HP-12 samples showed the highest value in aldehyde (around 13400 AU x 10^3 /g dry-cured ham), followed by hydrocarbons (around 11500 AU x 10^3 /g dry-cured ham), alcohols (around 5700 AU x 10^3 /g dry-cured ham) and, ketones and ester and ethers with similar values (around 2300 AU x 10^3 /g dry-cured ham). Although both batches expressed the lowest values in nitrogenous compounds (around 650 and 460 AU x 10^3 /g dry-cured ham for CO and HP-12 respectively).

The analysis of volatile compounds showed great differences between treatments. Hydrocarbons, aldehydes, nitrogenous compounds and sulphur compounds were significantly reduced ($P<0.001$) after HP treatment, while ketones were slightly increased. It is well known that aldehydes are one of the families which most influences have in odour. For that, it is expected losses of typical odours of dry-cured products, so the sensorial properties could be changed. This fact is not necessarily negative since hexanal, which is the main aldehyde in dry-cured hams and it is associated with the rancid odour (Aparicio *et al*., 1998). Its levels decreased (from around 14000 AU x 10^3 /g dry-cured ham in CO to around 6000 AU x 10^3 /g dry-cured ham in HP-12) after HP treatment. This outcome agrees with data reported by Pérez-Santaescolástica et al. (2019b) who observed a decrease of hexanal after HP treatment. On the other hand, sulphur compound reduction was expected according to the traditional use of HP as a sterilizing technique. The reason for that is probably due to the origin of the main sulphur compound, called dimethyl disulphide, which is related to the microbial activity (Martin *et al*., 2006) and its content after HP application was reduced by 87%.

Conclusion

HP treatment produces changes on volatile compounds profile of dry-cured ham. An important reduction of total volatile compounds after HP treatment was observed which could affect the sensorial properties of dry-cured ham.

Acknowledgements

This work was supported by project RTA 2013-00030-CO3-03 from INIA (Spain). Acknowledgements to INIA for granting Cristina Pérez Santaescolástica and Paula Borrajo with a PhD scholarships (grant numbers CPD2015-0212 and CPD2016-0030, respectively). Paulo E. S. Munekata ac-

Notes

knowledges postdoctoral fellowship support from Ministry of Economy and Competitiveness (MINECO, Spain) "Juan de la Cierva" program (FJCI-2016-29486)

References

Aparicio, R., & Morales, M. T. (1998). Characterization of olive ripeness by green aroma compounds of virgin olive oil. *Journal of Agricultural and Food Chemistry*, *46*(3), 1116-1122.

Bermúdez, R., Franco, D., Carballo, J., & Lorenzo, J. M. (2015). Influence of type of muscle on volatile compounds throughout the manufacture of Celta dry-cured ham. *Food Science and Technology International, 21(8)*, 581–592.

Domínguez, R., Gómez, M., Fonseca, S., & Lorenzo, J. M. (2014). Effect of different cooking methods on lipid oxidation and formation of volatile compounds in foal meat. *Meat Science, 97*, 223-230.

Duranton, F., Simonin, H., Chéret, R., Guillou, S., & de Lamballerie, M. (2012). Effect of high pressure and salt on pork meat quality and microstructure. *Journal of Food Science*, *77*(8), E188-E194.

Martín, A., Córdoba, J. J., Aranda, E., Córdoba, M. G., & Asensio, M. A. (2006). Contribution of a selected fungal population to the volatile compounds on dry-cured ham. *International Journal of Food Microbiology*, *110*(1), 8-18.

Pérez-Santaescolástica, C., Carballo, J., Fulladosa, E., Garcia-Perez, J. V., Benedito, J., & Lorenzo, J. M. (2018). Effect of proteolysis index level on instrumental adhesiveness, free amino acids content and volatile compounds profile of dry-cured ham. *Food Research International*, *107*, 559-566.

Pérez-Santaescolástica, C., Carballo, J., Fulladosa, E., Munekata, P. E. S., Campagnol, P. B., Gómez, B., & Lorenzo, J. M. (2019b). Influence of high-pressure processing at different temperatures on free amino acid and volatile compound profiles of dry-cured ham. *Food Research International, 116,* 49-56.

Pérez-Santaescolástica, C., Fraeye, I., Barba, F. J., Gómez, B., Tomasevic, I., Romero, A., ... & Lorenzo, J. M. (2019a). Application of non-invasive technologies in dry-cured ham: An overview. *Trends in Food Science & Technology, 86,* 360-374.

References

Table 1. Effect of HP treatment applied at 12 °C on volatile compounds content (expressed as Area Units (AU) x 10^3 /g dry cured ham)

Compound	Treatment		SEM	Sig.
	CO	HP-12		
Aliphatic hydrocarbons	20422,72	10977,72	931,559	***
Aromatic and cyclic hydrocarbons	985,58	508,18	39,245	***
Hydrocarbons	21408,30	11485,90	960,923	***
Aldehyde	20540,50	13431,08	773,820	***
Ketone	1903,78	2425,78	68,272	***
Ester and ether	2211,67	2202,88	62,162	ns
Alcohol	6490,14	5754,41	189,236	ns
Carboxylic acid	1619,81	1442,75	123,240	ns
Nitrogenous compounds	666,41	463,68	24,123	***
Sulphur compounds	1987,34	513,15	138,767	***
Total Compounds	**56827,96**	**37719,63**	**1703,195**	***

Sig.: significance: *** (P<0.001), ns (not significant); SEM: Standard error of the mean.
Treatments: CO = control (without treatment); HP-12 (High pressure treatment at 12 °C)

Table 1

Notes