

Aroma profile of dry fermented sausages as affected by the addition of nitrogen and sulfur precursors

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Introduction and Objectives: “Savoury” aroma is the most characteristic odour note in dry meat products (Flores et al., 2021). The main contributors to the savory and roasted fragrances are sulfur and nitrogen volatiles which are present in relatively low concentrations. Several amino acids like proline and ornithine can produce nitrogen odor molecules in fermented sausages (Perea-Sanz et al., 2019) while thiamine is known to be a critical precursor of meaty odor in heat degradation processes (Cerny, 2007). The aim of the study was to determine the effect of the addition into the pork meat batter of nitrogen and sulfur precursors (proline, ornithine and thiamine) on the scent of dry fermented sausages.

Materials and Methods: 1. Dry sausage manufacture: Four formulations were prepared adding the precursors into the meat batter: proline (P, 1.2 g/kg), ornithine (O, 1.2 g/kg) and thiamine (T, 0.24 g/kg), and a control (C) without precursors (Li et al., 2022b). All sausages were fermented and dried in climatic chambers using a slow ripening procedure at 10°C and 75-90% relative humidity (RH). At the end of process (62 d), samples from each formulation were taken and wrapped in aluminum foil, vacuum-packed, and stored at -80 °C for volatile and aroma analysis. Additionally, entire vacuum-packed sausages were kept at 4 °C for sensory analysis. The experiment was done in triplicate. 2. Volatile compounds analysis: Sausage samples were analyzed by SPME extraction using a Car/PDMS fiber and following GC-MS conditions (Li et al., 2022b). Volatiles were analyzed in SCAN mode, identified by mass spectra and linear retention indices and quantified by using total ion (TIC) or extracted ion (EIC) current on an arbitrary scale. 3. Olfactometry analysis (GCO): The aroma eluted from the GCO was evaluated by four trained panelists that performed a total of 14 assessments (Li et al., 2022b) and results were indicated as the number of times a descriptor was detected (Detection Frequency values, DF). 4. Sensory analysis: Sensory differences among sausages were evaluated using Free Choice Profile (FCP) (Li et al., 2022b) and employing 20 consumers (15 women and 5 men, 21 to 55 years old). The aroma of the sausage slice was evaluated by each panelist with his/her own list of terms using a 10-cm unstructured scale ranging from “not perceived” to “intense”. 5. Statistical analysis: Principal components analysis (PCA) was plotted to evaluate the relationships among formulations and aroma compounds (XLSTAT 2018). Sensory data was analyzed by a Generalized Procrustes Analysis (GPA).

Results and Discussion: Sausages at the end of process, 62 d with a 45 % weight loss, were used for the study. Eighty five volatile molecules were identified and quantified; although, the GCO analysis revealed 29 aroma notes in the dry fermented sausages. The most important compounds for the aroma were those with high DF values >10. Among them, several roasted (meaty) and toasted odors were detected but not identified. The PCA analysis based on the identified volatile aroma compounds distinguished P-sausages from the other formulations based on the presence of aldehyde compounds. C, T and O sausages were characterized by esters, acids, and terpenes aroma compounds. The sensory analysis revealed differences in aroma among sausages. It confirmed the similarities in aroma between O and C-sausages, characterized by the “fatty” note, while T and P-sausages were distinguished by the terms “cured”, “savory” and “spicy”. The results from sensory analysis could be related to the GCO. The compound hexanal may explain the “peppery” odour in the P-sausages. The “fatty” odour in C and O-sausages may be explained by compounds butanoic and 3-methyl butanoic acids, which contribute to cheesy odour notes, and also by other lactic compounds like 2,3-butanedione, 3-hydroxy-2-butanone and propanoic acid. However, no specific aroma compounds from the PCA can explain the “cured” and “savory” odours reported by panelists in T-sausages. The reason is the absence in the PCA of the five compounds producing “toasted” and “meaty” odours as they were not identified. These compounds may explain the differences in T-sausages perceived by the panelists. Further studies are needed to elucidate the contribution of these compounds to the sausage aroma.

Conclusions: The differences in the sensory properties (aroma) of the sausages supplemented with aroma precursors (proline, ornithine and thiamine) can be partially understood through PCA analysis of the volatile aroma compounds identified by GCO. The contribution of unknown meaty and roasted scents to the aroma of dry sausages requires careful examination using advanced analytical techniques.

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