

HS-SPME-GC-MS metabolomics approaches to investigate the volatile profiles of virgin olive oils and table olives from Greece

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Metabolomics is applied to address modern challenges related to food quality and safety. In this context, the development of multi-purpose analytical methods is of utmost importance to ensure authenticity and highlight the quality characteristics of the food products produced. The volatile profile provides important information on the quality characteristics of the product. In this study, two separate methods based on gas chromatography coupled mass spectrometry (GC-MS) technique were developed for the analysis of volatile organic compounds in extra virgin olive oils and table olives, respectively. The volatile organic compounds were extracted by the solid phase microextraction technique (HS-SPME). The first method was applied for the analysis of branded extra virgin olive oil samples (n = 117) of Crete harvested in two consecutive years (2018-19, 2019-20) and allowed the identification of a large number of metabolites (>90). The statistical analysis allowed the identification of compounds/markers with relevance to the geographical origin of Cretan olive oils. In addition, differences were observed between samples from different years of harvesting of the fruit. Finally, a correlation between the volatile compounds and the results of the organoleptic evaluation of the samples was carried out.

The second method was developed and optimised for the investigation of the aroma profile of table olives during fermentation. Microbiological and physicochemical analyses were also performed to assess the quality of olives. With the optimised conditions, table olives of Chalkidiki were analysed to investigate the changes of volatile organic compounds during fermentation. In total, 127 VOCs were putatively identified and semi-quantified derived from different chemical classes. The volatile profile of table olives changed significantly during fermentation, with an increase in the number of detected aromatic compounds and the development of new compounds, shaping the final taste. The method proved robust for the investigation of the volatile profile of table olives providing easy, automated, efficient, and economic sample preparation and analysis along with information-rich GC-MS data.

Overall, both methods, with the combined use of chemometric models and statistical analysis, are important tools for authenticity studies and highlighting the quality characteristics of the products.

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