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Development of a non-targeted LC-qToF-MS-based approach to verify the geographical origin of olive oils

Ina Willenberg, Alessandra Parma, Anja Bonte, Bertrand Matthäus

Max Rubner-Institut, Federal Research Institute of Nutrition and Food, Department of Safety and Quality of Cereals, Detmold

Regulation (EU) No 29/2012 on the marketing standards for olive oil provides requirements for the labelling of olive oils. Amongst others, it is regulated that the indication of the geographical origin has to be included to the labelling of virgin olive oils. As the geographical origin of virgin olive oils can be a purchase argument for consumers, an incorrect labelling of the geographical origin has to be regarded as a fraud to the consumer. However, up to now there are no standardized analytical methods which enable the verification of the origin of olive oils.

Therefore, the aim of this study was to develop a non-targeted LC-qToF-MS approach for the profiling of the polar extract of olive oils in order to analyze a set of virgin olive oils with different geographical origins. Finally, these data were used for setting up a statistical model for the differentiation between oils from different origins.

Preparation of the polar extract of the oils was obtained by liquid/liquid extraction with methanol/water (80/20 (v/v)). It could be shown that a 2-fold extraction process was sufficient, ultrasonic treatment did not further increase the extraction efficiency, and evaporation of the solvent at 30°C did not result in a significant loss of phenolic compounds. Liquid chromatography separation was performed on a C18 column and detection was carried out in broadband collision induced dissociation (bbCID) mode after negative ion spray ionization. Subsequently, the established protocol was used for the analysis of 95 olive oils from Spain, Italy, Greece and Portugal. The data analysis workflow for the resulting data set comprised different steps of data processing like peak detection, bucket table generation and reduction of features. Finally, linear discriminant analysis was applied in order to build a statistical model for the classification of olive oils according to the geographical origin. The correctness of prediction for the training set (n=75) was found to be between 67 % (Portugal) and 88% (Italy). However, prediction of the test set (n=20) was even better and resulted in 100% correct classification for all four countries. These results show that analysis of the polar fraction of olive oils might be a helpful tool for geographical authentication analysis.