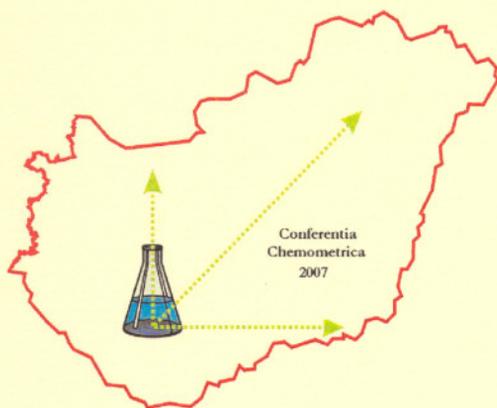


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**Multivariate analysis of NMR profiles of extra-virgin olive oils
for the authentication of PDO olive oil**

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Food authenticity and food traceability are of great concern to the consumer, food processor, retailer and regulatory bodies. For instance, one authenticity issue of emerging importance is geographical origin, with some selected products permitted to be marketed using a Protected Designation of Origin (PDO), Protected Geographical Indication (PGI) or Traditional Specialty Guaranteed (TSG) label on the basis of their area of production [Regulation (EEC) No 2081/92]. Extra-virgin olive oil is one of these high value protected agricultural products. However, given the financial benefits associated with such labels, it is very likely that economic fraud occurs (e.g. labeling a non-PDO product as a PDO one, adulteration with olive oils that do not fulfill the PDO requirements). Therefore, validated methods to guarantee the authenticity and traceability of PDO and PGI olive oils are necessary to protect both the consumer and the producer from illicit practices in this sector. This problem of authentication of olive oils with respect to their geographical origin has been studied using various analytical approaches such as NMR (¹H, ¹³C, ³¹P), NIR spectroscopy, IRMS, LC-MS and GC-MS. However, most of these have considered only a limited number of samples and geographical areas. NMR fingerprinting methods seem particularly promising in this context. NMR can be used to generate reference fingerprints for these products, providing the means to compare profiles of suspected counterfeit products with these reference data, and thus detect fraud. These concerns have been addressed to the Food and Quality Priority of the EU Framework VI research program, and so the TRACE project was born; (<http://www.trace.eu.org>), due to the necessity to provide a 'traceability infrastructure', that can trace and confirm the origin of a particular foodstuff. Regarding olive oil, TRACE strives to create a cost-effective system that can identify where olive oils are produced, focusing on those labelled "as of designated origin". For this project, MAST at the Joint Research Centre is developing and assessing NMR fingerprinting tools applied to olive oils. In this context, ¹H-NMR profiles of olive oils obtained by a high throughput NMR approach are analyzed by several supervised pattern recognition techniques in order to distinguish the olive oils of a certain PDO, e.g. "*Riviera Ligure*" (Liguria, Italy), from the oils of other protected origins. LDA, PLS-DA, SIMCA, SVM, CART and CAIMAN are used in order to evaluate the best approach for the authenticity and traceability of PDO and PGI olive oils, taking the PDO "*Riviera Ligure*" as an example. For this purpose, a statistically significant number of authentic PDO and PGI extra-virgin olive oils from EU and non EU countries (716 samples) during two seasons, 2005 and 2006 were analyzed. By covering such an extensive range of geographical origins, from two harvests, the multivariate analysis of the resulting NMR profiles will provide a very strong tool for the authentication of protected origin olive oils. The contribution of these results will considerably strengthen our ability to protect both the consumer and the producer in the ongoing fight against fraud in the food sector.