BOOK OF ABSTRACTS

11th International Symposium on
RECENT ADVANCES IN FOOD ANALYSIS

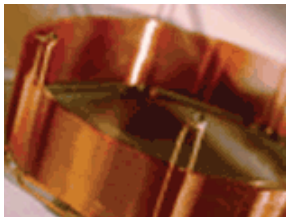
November 5–8, 2024

Prague, Czech Republic

Jana Pulkrabová, Monika Tomaniová, Stefan van Leeuwen, Michele Suman, Michel Nielen and Jana Hajšlová

Editors



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K24
ACCURATE QUANTITATIVE PROFILING OF FATTY ACIDS IN PLANT-BASED FOOD USING BY ONE-STEP MICROWAVE-ASSISTED EXTRACTION AND DERIVATIZATION FOLLOWED BY COMPREHENSIVE TWO-DIMENSIONAL GAS CHROMATOGRAPHY WITH PARALLEL DETECTION BY FLAME IONIZATION DETECTOR AND MASS SPECTROMETRY

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The quality assessment of dietary fats typically involves analyzing their fatty acid composition. In foods, fatty acids are primarily present as glycerol esters, in form of triglycerides. For high-resolution profiling using comprehensive two-dimensional gas chromatography (GC×GC), these fatty acids must be converted into their corresponding methyl ester form, known as fatty acid methyl esters (FAMEs). Additionally, an initial separation of the lipid fraction from matrix interferences, such as proteins and fibers present in food samples, is essential. This study aimed to profile fatty acids in foods (available on the market) from two different dietary regimes: omnivorous and vegan/vegetarian. The analytical procedure utilized a one-step microwave-assisted extraction and derivatization (MAED) developed and validated *vs.* the Official Method Ce 2b-11 by the American Oil Chemical Society (AOCS) [1,2]. The extracted FAMEs were then analyzed by GC×GC with reverse-inject differential-flow modulation and parallel detection by flame ionization detection (FID) and mass spectrometry (MS), to identify and quantify individual fatty acids. The GC×GC technique was chosen for its superior separation power compared to one-dimensional GC and the possibility to obtain structured retention patterns for homologs and isomers facilitating FAMEs identification even without available reference standards. By external calibration and FID predicted relative response factors, FAMEs were accurately quantified and their profiles adopted to evaluate several quality and nutritional indices. Of interest the ∑SFA, ∑MUFA, ∑PUFA, index of atherogenicity (IA) and thrombogenicity (IT), the hypocholesterolemic/hypercholesterolemic (HH) ratio, the health-promoting index (HPI), and the unsaturation index (UI) [2]. Moreover, for products with a short ingredient list, a consistency index corresponding to the percentage relative bias/error (Δ%) between the experimental FAMEs % in the product over the theoretical/expected one was calculated. Results on selected food samples exhibited deviations, with percentage values ranging from -80% to +140% compared to the declared or estimated values based on label information. Notably, processed products and plant-based alternatives to animal meat showed the most significant deviations. Nutritional indices supported a classification of products according to the fat quality while highlighting the importance for professionals in nutrition and dietetics to understand the actual impact of processing procedures on the fat quality and compositional consistency according to the ingredients list. The MAED procedure followed by GC×GC –MS/FID resulted highly flexible and informative supporting accurate definition of FAMEs profiles in complex food products with minimal sample manipulation and analyst exposure to harmful solvents and reagents.

[1] doi:10.1016/j.sampre.2022.100039.
[2] doi:10.1016/j.jchromb.2024.124074.

Keywords: fatty acid methyl esters, microwave-assisted extraction and derivatization, comprehensive two-dimensional gas chromatography, reversed fill/flush flow modulation