European Food Research and Technology
https://doi.org/10.1007/s00217-021-03863-2

ORIGINAL PAPER

Geographical origin discrimination of "Ntopia" olive oil cultivar from Ionian islands using volatile compounds analysis and computational statistics

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Received: 8 July 2021 / Revised: 2 September 2021 / Accepted: 4 September 2021

Abstract

The aim of the present study was to characterize the aroma profile of olive oil of the "Ntopia" (local) cultivar from the Ionian islands (Zakynthos, Kefalonia, Leukada, and Kerkyra) (Greece), and investigate whether specific volatile compounds could be considered as indicators of olive oil geographical origin, using computational statistics. In this context, 137 olive oil samples were subjected to headspace solid phase microextraction coupled to gas chromatography/mass spectrometry using the internal standard method. Computational statistics on the semi-quantitative data of olive oil samples, as rapid machine learning algorithms, showed that specific volatile compounds could be used as indicators of geographical origin of olive oil of the "Ntopia" cultivar, among the four main Ionian islands. Volatile compounds such as ethanol, pentanal, 2,4-dimethylheptane, 3,7-dimethyl-1,3,6-octatriene (E), 2,5-dimethylnonane, 1-hexanol, 6-methyl-5-hepten-2-one, octanal, dl-Limonene, acetic acid hexyl ester and dodecane could aid to the geographical origin discrimination of "Ntopia" olive oil cultivar when two (Zakynthos and Kefalonia) or four (Zakynthos, Kefalonia, Leukada and Kerkyra) Ionian islands are subjected to statistical analysis. The discrimination rate using the cross-validation method was 100% and 85.7%, respectively. These results were further evaluated using training and holdout partitions, during which a comparable classification rate was obtained.

Keywords Olive oil · "Ntopia" cv. · Characterization · Volatile compounds · Geographical origin · Computational statistics

Introduction

Olive oil comprises a long-term ingredient in the Mediterranean cuisine and diet, including ancient Greek and Roman cuisine [1]. Olive oil is a liquid source of fat obtained from olives (*Olea europaea*) and is produced by pressing the olives and extracting the respective oil. It is mainly consisted by oleic acid with smaller amounts of other fatty acids including linoleic acid and palmitic acid, phenols, tocopherols, sterols, phospholipids, waxes, squalene and other hydrocarbons [2].

According to the United States Department of Agriculture, the global olive oil production in the 2020/2021 harvesting season was ca. 3.03 million tons, which represents the fourth successive year of decline in terms of quantity [3]. Among the olive oil producing countries, Morocco, Tunisia, Turkey and Portugal had all a decrease in the production yield, whilst the olive oil production in Greece and Spain remained fairly stable. Spain accounts for almost half of the global olive oil production; other major olive oil producers are Italy, Greece, Tunisia, and Turkey [4].

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Published online: 20 September 2021