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Volatile profiles of Italian monocultivar EVOOs during 12 months of storage: different trends associated to polyphenols and fatty acids content

Eugenio Aprea,[1] *Emanuela Betta,*[1] *Claudio Cantini,*[2] *Flavia Gasperi* [1]

[1] Fondazione Edmund Mach, Food Quality and Nutrition Department, IASMA Research and Innovation Centre, Via E. Mach, 1, 38010 S. Michele all'Adige (TN, Italy); [2] Trees and Timber Institute-National Research Council of Italy (CNR-IVALSA) Via Aurelia 49, 58022 Follonica (Italy)

Summary: *In the present study we investigated the variation in volatile organic compounds of a large number of monocultivar extravirgin olive oils after 6 and 12 months of storage at 15 °C. The initial polyphenol profile or the composition in fatty acids of the EVOOs is partially responsible for the different evolution observed among the samples during storage.*

Keywords: *Monocultivar extravirgin olive oils, volatile organic compounds, polyphenols*

Introduction

Aroma is one of the most important and the first to be perceived attribute of high-quality extravirgin olive oil (EVOO). Volatile organic compounds (VOCs) derived from lipoxygenase (LOX) pathway are considered the most important and impacting for olive oil aroma. In a previous study we quantified such compounds in 130 monocultivar EVOOs from 67 genotypes belonging to a Tuscany germoplasm collection [1]. During the storage of EVOOs, the VOCs responsible for the pleasant flavour became less dominant and compounds responsible of negative sensory attributes may arise. The main chemical alteration of EVOO is due to oxidation that is influenced by storage conditions, such as temperature, light exposure, oxygen availability, and also by oil composition [2]. Even at optimal storage condition, auto-oxidation of fatty acids takes place further contributing to the modification of EVOO composition. For these reasons the aroma profile in EVOO is not stables but changes from the production until the consumption. The present study investigated the fate of VOCs in 60 monocultivar EVOOs after 6 and 12 months of storage and evaluated the possible influence on it of the initial polyphenol availability and the fatty acids compositions.

Experimental

Sixty monocultivar EVOOs were stored at 15 °C in the dark until 12 months. Details about olives and oil production can be found in [1]. VOCs were measured by SPME/GC-MS before storage (1) and after 6 (2) and 12 (3) months as reported in [1].

At T0, compositions in fatty acids and in polyphenols were determined as well using official methods [3].

Results

The different VOCs evolved differently during the storage. (E)-2-hexenal, the most abundant compound, initially present in the EVOOs, significantly decrease after 6 months while in the successive months an inversion in this trend was observed (Fig. 1, left). Similar behaviour was observed for (Z)-3-hexen-1-ol, (E)-2-hexen-1-ol and (Z)-3-hexenyl acetate. Differently, hexanal, the second most abundant compound initially present in the EVOOs, did not change significantly after 6 months while increased at 12 months of storage (Fig. 1, right). In order to investigate the possible influence on VOCs evolution of the initial composition in polyphenols and fatty acids, a PCA was computed using these composition data. Four classes were identified that correspond to the 4 quadrants defined by the first two plotted scores where the total polyphenols vary along the 1st component while oleic/linoleic vary along the 2nd component. Main features of the 4 classes are reported in table 1.

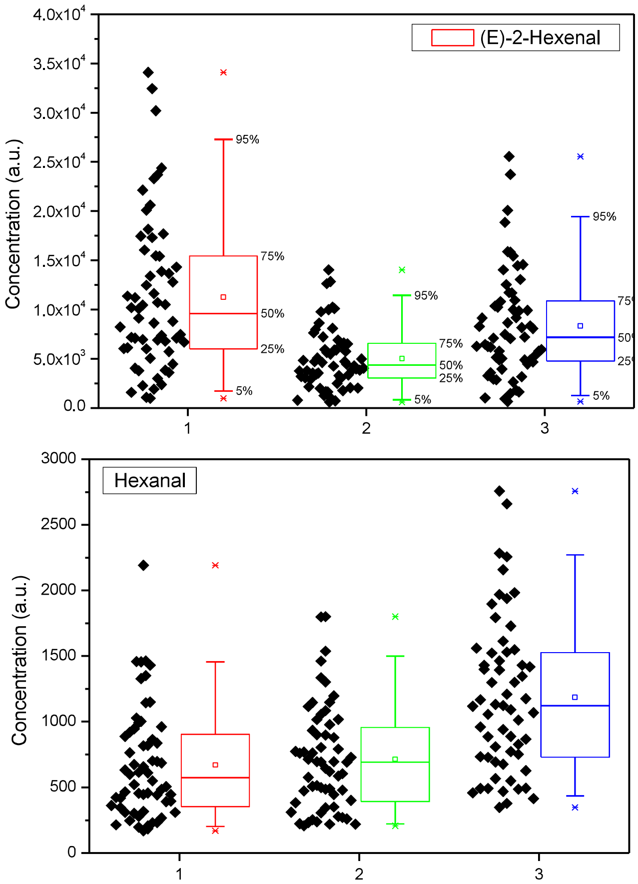

Fig. 1. *Boxplot of the concentrations of (E)-hexenal and hexanal at production time (1) and after 6 (2) and 12 (3) months of storage at 15°C in the dark.*

Table 1. *Class of EVOOs identified based on the PCA of chemical composition data*

Class	**Number of EVOO**	**Total Polyphenols**	**oleic/linoleic ratio**
1	17	High	High
2	16	Low	High
3	15	High	Low
4	12	Low	Low

The largest variations, significantly influenced by the initial EVOO composition, were observed after the first 6 months of storage. Several VOCs show different magnitude of variation according the identified class. In figure 2 is reported the example of (Z)-1,3-pentadiene that after 6 months of storage shows significant ($p<0.001$) higher depletion in group 1.

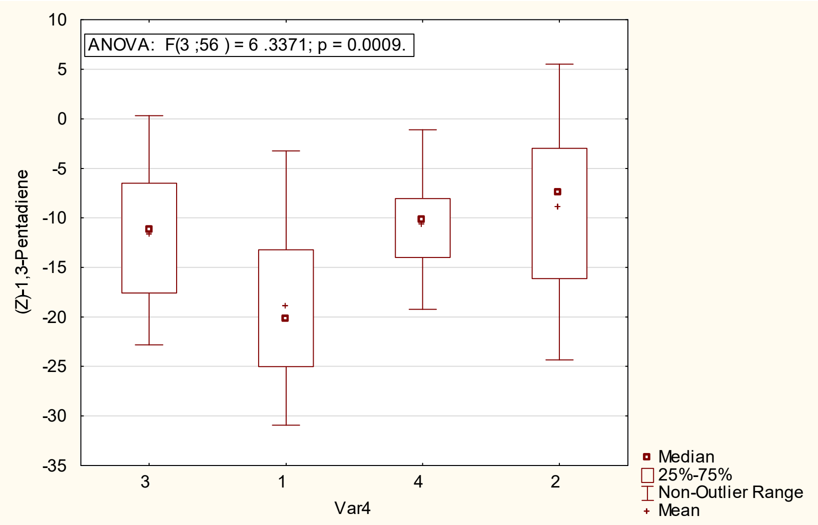

Fig. 2. *Boxplot of the variation in concentrations of (Z)-1,3-pentadiene after 6 months of storage within the four classes reported in Table 1.*

Conclusions

We investigated the VOCs in a large number of monocultivar EVOOs during storage, in controlled conditions, showing that their evolution may differ among the oils partly influenced by the initial composition of the samples itself.

References

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