High phenolic content in extra virgin olive oil influences the release (time-intensity) of aroma compounds in mouth

The popularity of extra virgin olive oil (EVOO) is linked both to its pleasant sensory notes and health properties. The sensory notes of EVOO are attributed to the presence of aroma compounds while bitterness and pungency are due to the quality-quantitative composition of olive phenolics (Fig. 1a). The latter are well-known to be responsible also for several healthy properties.

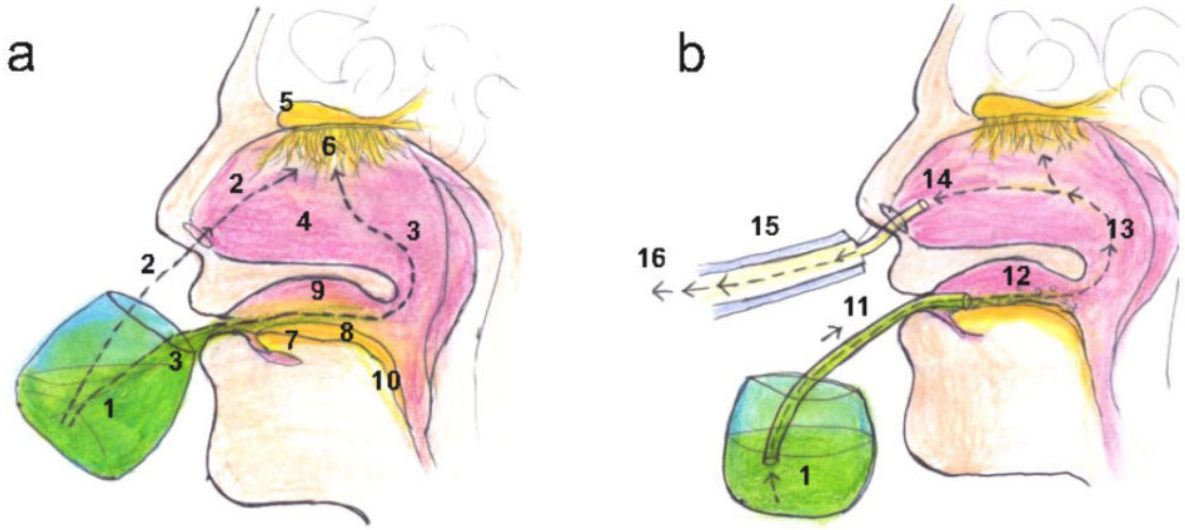

Fig. 1. Schematic picture of sensory perception of ‘odour’ and ‘aroma’ (a) and of the principle of APCI/MS analysis of the aroma release (time-intensity) in mouth (b). Legend: 1) extra virgin olive oil glass, 2) Odour (through orthonasal route), 3) Aroma (through retronasal route), 4) Nasal cavity, 5) Olfactory bulb, 6) Olfactory epithelium (sense of smell), 7) Tongue (sense of taste), 8) Taste buds (bitterness perception), 9) Oral cavity, 10) Trigeminal nerve (chemesthesis perception: pungency), 11) oil aspiration in mouth (without orthonasal route), 12) oil volatiles interaction with saliva in the oral cavity, 13) retronasal route (aroma after interaction with saliva), 14) aroma expulsion, 15) transfer line, 16) APCI/MS mass spectrometer with registration of time-intensity curves for extra virgin olive oil aroma compounds.

In this *in-vivo* study (Fig. 1b) two model oils were set-up with the addition of 8 volatile compounds of EVOO to a refined olive oil. One of them was enriched with 600 mg kg^{-1} of EVOO phenolic compounds. In the latter one the aroma release in mouth, similarly to other foods and drinks, resulted significantly affected by the presence of phenolic compounds: 1-penten-3-one, *trans* -2-hexenal and esters had a lower release in mouth in the presence of EVOO phenols. A possible explanation of these findings may be the interaction between EVOO phenolics/proline-rich proteins,

which could trap these aroma compounds and consequently decrease their release during *in-vivo* analysis. In contrast, linalool had an opposite behavior with a greater release in mouth and longer persistence in the breath than other volatile compounds.

The practical applications of these findings could be related, both to sensory analysis and industrial applications. From the sensory analysis point of view, it is known that the quality of an olive oil is defined both by several chemical indices and official sensory assessment (panel test). Therefore, the retention effect of phenolic compounds on some aroma compounds could influence the score given a panel test during an EVOO organoleptic assessment: *e.g.* slight “fusty-muddy” off-flavour (mainly related to some ester compounds) could be masked in phenolic-rich (very bitter-pungent) EVOOs because of a possible trapping effect by phenolic and saliva on esters. According to our findings, an under-estimation of “green fruity” can also occur in very “bitter-pungent” EVOOs which is mainly due to the lower release in mouth of *trans*-2-hexenal and 1-penten-3-one.

From the industrial point of view, new functional foods enriched in olive phenolic compounds (*i.e.* sauces, drinks, etc.) could be designed to reach a positive effect on human health and optimized favour time-intensity release to increase the consumer’s acceptability. In addition, the use of olive phenolic extracts in food may prevent oxidation and extend its shelf life.

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