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In-vitro and in-vivo flavour release from intact and fresh-cut apple in relation with textural and physicochemical parameters.

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Flavor is a multi-sensorial perception resulting from stimulating a combination of taste buds, olfactory bulbs and chemesthetic receptors within the oral and nasal cavity. Taste is a chemical perception using taste buds whereas for odour to be perceived, volatile organic compounds (VOC) need to stimulate the olfactory bulb either via the nostrils (orthonasal) or via the internal nares of the oral cavity (retronasal)[1]. This is however, influenced somewhat by food texture (structural, mechanical and surface properties of food detected through sight, sound and touch). The combination of texture and flavour are known key factors influencing consumer acceptability of apples however, this relationship is poorly understood[2, 3]. VOC release from six commercial apple cultivars (Fuji, Granny Smith, Golden Delicious, Jonagold, Morgen Dallago and Red Delicious) under static conditions (intact fruit or fresh cut samples) and during consumption of fresh cut samples (nose-space) was determined by Proton Transfer Reaction Quadrupole Mass Spectrometry (PTR-QUAD-MS). Physicochemical (pH, acidity and water content) and textural (firmness, fracturability, flesh elasticity and rupture) properties of the apples were also measured. Fuji and Granny Smith apples head space had the lowest total concentration of VOC (esters, aldehydes, alcohols and terpenes) whereas Red Delicious had the highest concentration. Cut fruit generally had a significantly higher overall VOC concentration than intact fruit with acetaldehyde being the most abundant VOC. Dynamic in-vivo nose space analysis enabled cultivars to be characterized based on mastication time, and the in-nose concentration and relative proportion of the four VOC measured (esters m/z 43, 61; acetaldehyde m/z 45; ethanol m/z 47). Softer varieties (Golden Delicious, Morgen Dallago) were consumed faster releasing more VOCs (particularly esters) and reached a maximum VOC intensity (t_{max}: 20.5s) faster. Firm varieties (Fuji, Granny Smith) had a longer consumption time, a higher t_{max}(27.7s) and a lower VOC concentration. Intermediate cultivars (Jonagold, Red Delicious) had a t_{max} of 21.5s and a higher VOC concentration compared to firmer varieties. The diffusion of VOC within the nasal cavity was dependent on particle breakdown during mastication i.e. faster for mealy apples; slower for firm apples. Texture was shown to play an integral role in apple flavour release. This finding suggests that in-vivo PTR-MS coupled with traditional physico-chemical measurements could be used to yield information on flavour release from a wide range of food matrixes and help in the development of strategies to enhance food flavour and quality. Limitations of this method include: reduced signal intensities recovered during in-vivo measurements induced by the different eating patterns of panellists and the inability to differentiate isobaric compounds which may mask potentially important findings. Preliminary nose-space results on apples using a Proton Transfer Reaction Time of Flight Mass Spectrometer, PTR-TOF-MS, allows some of these limitations to be overcome by enabling a full mass spectrum to be measured (greater chemical information) and greater temporal resolution, to confirm and quantify differences in chemical information with increased resolution and full mass spectrum readings. Thus increasing panellist's reproducibility and allowing differentiation of results based solely between cultivar variation.