

Title Flavour volatile production and regulation in apple fruit
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Abstract

Purpose of review: Consumption of fresh fruit is increasing as consumers become more aware of their nutritional value and role in disease prevention. Improving the flavour properties of fresh fruit reaching the consumer would add value, increase consumption and create new markets for these commodities. Many pre- and postharvest factors influence the flavour of fruit. Using apple fruit as an example, this review focuses on recent developments on fruit aroma research.

Recent findings: One of the important characteristics of apple fruit ripening is volatile aroma production. Both sensory studies and instrumental analysis confirm the importance of volatile production in apple fruit and its contribution to the eating quality. Postharvest storage and handling influence volatile development. Application of 1-methylcyclopropene and transgenic lines suppressing ethylene action and biosynthesis demonstrate the involvement of ethylene in volatile formation and provide useful research tools to elucidate the volatile production process during fruit ripening. Cloning of enzymes responsible for volatile production helps us understand the biochemical pathways and control mechanisms.

Limitations: Despite the exciting developments in flavour research, several challenges still remain. Volatile biosynthesis and its contribution to fruit eating quality are very complex traits that are influenced by many factors, such as genome, harvest maturity and postharvest handling and storage. An understanding of the fundamental mechanisms controlling changes in flavour quality is limited and most biochemical pathways determining this quality trait are still unknown.

Directions for future research: The sensory analysis of fruit flavour perception by consumers, combined with instrumental analysis should further define the contribution of individual volatile compounds to total flavour quality. This includes the role of volatile compounds in flavour perception by consumers, as well as its role in defining "ripeness", "eating quality" and "freshness" of apple fruit from a flavour perspective. As part of secondary metabolism, volatile production in apples is a complex process with tightly controlled systems involving substrates, enzymes and energy from many pathways. It is our hope that the biochemical pathways regulating the synthesis of volatile compounds in apple fruit will be

determined using integrated approaches, including biochemical, genomic, proteomic and microscopy tools, to determine fundamental metabolism and its localisation. Combining these efforts with direct measurement of sensory properties will lead us to new methods to optimise and retain fruit quality in the marketplace.