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Beyond Fragrance: Terpenes as Bioactive Molecules–From Standardization to Therapeutic Translation

Terpenes and terpenoids are major constituents of medicinal and aromatic plants and are responsible for much of the chemical diversity of essential oils. In addition to their sensory properties, many of these compounds have shown pharmacologically relevant effects. However, most available evidence is still based on experimental studies, and biological activity alone does not define the therapeutic value of a plant-derived preparation. Its botanical identity, chemical composition, reproducibility and safety also need to be considered. The composition of terpene-rich materials may vary according to plant part, chemotype, growing conditions, harvest stage, distillation and storage. These differences may affect both biological activity and safety. Thujone in sage oil, pulegone and menthofuran in Mentha oils, and estragole in certain aromatic plants are examples of constituents that require particular attention from a toxicological point of view. Quality may also change during storage. Tea tree oil, for example, undergoes oxidation, leading to changes in its terpene profile and the formation of oxidation products associated with increased sensitizing potential. Authenticity is another important issue, since commercial essential oils sold under the same botanical name may differ considerably in composition and may not always comply with established specifications. This presentation will use selected experimental and clinical examples, including chemotype-related variation in Salvia, Mentha and Origanum, oxidation of tea tree oil, commercial essential oil authentication, and clinical studies of 1,8-cineole, to discuss how quality and standardization influence the interpretation of pharmacological evidence. From a phytopharmaceutical perspective, botanical authentication, chromatographic profiling, control of marker and safety-related constituents, batch consistency, stability, toxicological evaluation and clinically meaningful evidence should be considered together when assessing the therapeutic potential of terpene-rich natural products.

Keywords: terpenes; essential oils; standardization; quality control; safety; therapeutic translation

Biography

Dr. Methiye Mancak is a pharmacist and Assistant Professor at the Faculty of Pharmacy, Istanbul University-Cerrahpaşa, Türkiye. Her academic work focuses on pharmacognosy, phytopharmacy, medicinal and aromatic plants, herbal medicines, standardization, quality control, and the safety of plant-derived products. Her research interests include the evidence-based evaluation of phytotherapeutic agents, herbal products, and natural bioactive compounds. She has been involved in undergraduate pharmacy education, teaching courses in botany, pharmacognosy, phytopharmacy, and standardization. Her academic approach combines traditional knowledge on medicinal plants with modern scientific methods for evaluating the quality, safety, and therapeutic relevance of herbal products.

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