Chapter 13
Shielding the Skin:
Terpenes and Skin Cancer

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ABSTRACT

Globally, melanoma is the leading cause of cancer-related deaths. Melanoma is a serious and possibly lethal form of skin cancer. Standard cancer therapies, such as radiation, chemotherapy, and surgical excision, have been used to treat malignant melanoma. Unfortunately, adverse side effects and treatment resistance sometimes render these medicines unsuccessful. Consequently, there is growing interest in developing more effective and safe substitute melanoma therapies. Terpenes are a large class of naturally occurring compounds generated from plants that have drawn interest as potential anticancer medications due to their ability to induce apoptosis in cancer cells and limit the growth of tumors. The present understanding of terpenes' anticancer properties was outlined in this review, with a particular emphasis on their potential as therapeutic agents for malignant melanoma. Thymoquinone, β-elemene, carvacrol, limonene, α-pinene, β-caryophyllene, taxol, betulinic acid, α-bisabolol, ursolic acid, linalool, lupeol, and artesunate are many examples of terpenes.

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INTRODUCTION

Terpenes, also known as isoprenoids, are a diverse group of chemical molecules found in a wide range of species, including fungi, plants, and certain animals (Christianson, 2017; Tholl, 2006). Their distinct carbon skeleton, which can be organized in a linear, branched, or cyclic pattern, is made up of many isoprene units. Terpenes have a major role in numerous physiological processes, including development and growth, reproduction, and defense against biotic and abiotic stress. They are also vital for the formation of secondary metabolites in plants, such as pigments and essential oils (Pichersky & Raguso, 2018). Terpenes, which are created by plants and other organisms via the mevalonate pathway, are commonly found in essential oils, resins, and other materials derived from plants (Gershenzon & Dudareva, 2007). Terpenes are the subject of biochemical and molecular research because of their numerous biological characteristics, which include their antiviral, anticancer, anti-inflammatory, and antibacterial qualities (Masyita et al., 2022). Terpenes can modify signaling pathways that are involved in numerous biological functions, including cell differentiation, proliferation, and death. Additionally, they can interact with specific biological targets including ion channels, receptors, and enzymes (Baser & Buchbauer, 2015).

One of the most remarkable biological activities of terpenes is its ability to reduce inflammation. Terpenes affect the immune system and reduce inflammation by inhibiting several enzymes and signaling pathways involved in the inflammatory response (Wink, 2015). Antioxidant qualities of certain terpenes protect cells against damage from free radicals and oxidative stress (Sharifi-Rad et al., 2017). Furthermore, it has been discovered that terpenes possess antibacterial properties against a range of bacteria, fungi, and viruses (Russo, 2011). Certain terpenes are thought to be able to harm bacteria's cell membranes, leading to their demise. The potential of terpenes to combat cancer has recently been thoroughly studied (Ross & Kasum, 2002). Numerous preclinical studies have demonstrated that terpenes have anticancer activity against a variety of cancer types, including melanoma (Bakkali et al., 2008). Terpenes have drawn particular attention for use as adjuvant therapy in the treatment of melanoma because they can make cancer cells less toxic and more responsive to chemotherapeutic medicines (Kamran et al., 2022). This study aimed to disseminate our expanding knowledge of the mechanisms via which some terpenes inhibit melanoma cell growth. Melanocytes, which are pigment-producing cells found in the basal layer of the epidermis, are the source of melanoma, a type of skin cancer (Arunasree, 2010). It is the most aggressive type of skin cancer, and if not found and treated in its early stages, it has a poor prognosis and a high potential for spreading (Woo et al., 2011). Although making up just 1% of all skin cancer cases, melanoma is the primary cause of skin cancer-related mortality (Lomas et al., 2012).