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Chapter 5

Integrative Cancer Therapeutics with Panax Ginseng: A Metabolomics Perspective on Ginsenosides in Cell Signaling and Tumor Suppression

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Abstract

Panax ginseng has been widely studied for its pharmacological properties, particularly in cancer therapeutics. Ginsenosides, the principal bioactive constituents, exhibit multi-targeted anti-cancer effects through the regulation of key signaling pathways, including PI3K/AKT/mTOR, MAPK/ERK, and NF-κB. These compounds induce apoptosis, inhibit angiogenesis, and modulate the tumor microenvironment, making them promising candidates for integrative cancer therapy. However, challenges such as poor bioavailability, rapid metabolism, and systemic clearance limit their clinical application. Recent advancements in nano-formulations, synthetic derivatives, and combination therapies have shown potential in overcoming these limitations. Moreover, metabolomics and precision oncology approaches may enhance the therapeutic efficacy of ginsenosides by tailoring treatments to individual patient profiles. This chapter explores the mechanistic insights, preclinical and clinical evidence, and future directions for harnessing ginsenosides in cancer prevention and therapy.