Using Bee Venom and Natural Nanoparticles as an Effective Treatment for PFOS and PFOA Induced Carcinogenesis

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Perfluorooctanesulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA), known as “forever chemicals,” are persistent environmental pollutants associated with many diseases, including cancer. Despite concern over their toxicity, particularly their carcinogenic potential, effective mitigation strategies remain limited. This research investigates the impact of PFOS and PFOA on normal (MCF10A) and cancerous (MCF7) breast cell lines, addressing their role in cancer development and broader toxic effects. Additionally, it explores the therapeutic potential of bee venom and natural nanoparticles in counteracting their harmful effects, offering a novel approach to mitigating PFAS-induced toxicity and carcinogenesis. Cells were exposed to PFOS and PFOA at 300 μM and 600 μM for 24 and 48 hours. MTT assays assessed viability, while light and electron microscopy analyzed morphological changes. To evaluate therapeutic potential, cells were treated with bee venom (15 μg/mL) and honey-derived nanoparticles (60 μg/mL). Apoptosis was measured via flow cytometry, and chemical interactions were analyzed using liquid chromatography. Results showed significant viability loss in MCF10A cells, with near-total death after 48 hours. MCF7 cells remained viable even at 600 μM, suggesting PFOS/PFOA may selectively promote malignant survival. Bee venom disrupted membranes, inducing apoptosis through reactive oxygen species. Nanoparticles improved normal cell viability (0.2 to 0.35) while reducing cancer cell survival (0.65 to 0.5), demonstrating protective and anticancer effects. In conclusion, bee venom and nanoparticles show promise as natural therapeutic agents against PFAS-induced toxicity, offering an innovative approach to mitigating their harmful effects and preventing associated diseases.

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