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ABSTRACT

Anticancer efficacies of α-Methylene-γ-valerolactone an active ingredient of *Bergenia ligulata* extracts against urinary bladder cancer cells

This study explores the anticancer potential of α-Methylene-γ-valerolactone, a major bioactive compound identified in *Bergenia ligulata* rhizome extracts, against urinary bladder cancer (UBC) cell lines. Extracts were prepared using solvents such as hexane, aqueous, acetone, and methanol. Among all, the methanol extract showed the highest cytotoxic activity. GC-MS analysis identified α-Methylene-γ-valerolactone and oleic acid as major phytoconstituents, however, oleic acid showed negligible cytotoxicity even at 1 mM concentration, after 24 and 48 hours of treatment in both cell lines. α-Methylene-γ-valerolactone significantly inhibited the proliferation of T24 and NBT-II UBC cells in a dose- and time-dependent manner, while exhibiting minimal toxicity against HEK-293 cells. It induced cell cycle arrest, increased reactive oxygen species (ROS) levels, disrupted mitochondrial membrane potential, and activated apoptosis via the caspase-dependent pathway. Additionally, the compound suppressed colony formation and inhibited cell migration, indicating long-term antiproliferative and anti-metastatic properties. Western blot analysis confirmed upregulation of Bax, caspase-8, caspase-9, and cleaved caspase-3, along with downregulation of Bcl-2. These findings demonstrate the promising therapeutic potential of α-Methylene-γ-valerolactone as a selective anticancer agent against urinary bladder cancer. This work contributes to the growing evidence supporting plant-derived compounds for cancer therapy and lays the foundation for further preclinical studies and combinatorial therapeutic strategies.

Keywords: *Bergenia ligulata*, Gas chromatography-mass spectrometry, α-Methylene-γ-valerolactone, T24, NBT-II, Urinary Bladder Cancer, anticancer activities, apoptosis.