The anti-cancer potential of ursolic acid: testing the pro-apoptotic properties of ursolic acid on breast cancer, ovarian cancer and human embryonic kidney cells

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Background: Cancer continues to defy medical science with no proper therapeutic approach to combating the cancer insight. Even though progress has been made with targeted therapies and small molecules, more needs to be done with regards to effectiveness and cost. Currently, drug development for anti-cancer medication is rather costly, hence alternatives like medicinal plants such as *Mimusops caffra,* which contain active components such as *ursolic acid (UA)* with established anti-cancer properties that induces apoptosis in cancer cells; making it a suitable compound to investigate as a potential anti-cancer drug active component.

Objective: To determine the cytotoxicity of UA on MDA MB-231 breast cancer cells, RMG-1 ovarian cancer cells and HEK-293 cells, the morphological changes that indicate cell death triggered by UA and to construct a molecular pathway of action that UA uses to induce cell death on cancer cells.

Method: The cytotoxicity of UA on MDA MB-231 cells, RMG-1 cells and HEK-293 cells was determined using an *AlamarBlue* assay following a 24hr treatment with UA and a 2hr treatment with the *AlamarBlue* dye. The morphological changes (following UA treatment) were determined for the RMG-1 and MDA MB-231 cell lines using light microscopy. The molecular mechanism of UA was determined using NCBI and KEGG Pathway Databases in the RMG-1 and MDA MB-231 cell

Results: The *AlamarBlue* assay showed that UA displayed significant *cytotoxicity* on the MDA MB-231 (with an IC50 of 8.7µM UA) and RMG-1 (with an IC50 of 30µM UA) cell lines while showing minimal cytotoxicity on the HEK-293 cell line. The morphological analysis of cells showed characteristics of apoptotic cell death, following the treatment of UA on the RMG-1 and MDA MB-231 cell lines, included reduced cell size and cell bodies as well as reduced nuclei size and a rounded appearance. The molecular pathway of the MDA MB-231 cell line was constructed based on UA interaction with FAS-L, the up-regulation of BAX and BAK and the down regulation of BCL-2. The molecular pathway for the RMG-1 cell line was constructed based on UA interaction with FAS-L, the cleavage of caspase 3,7 and PARP.

Conclusion: UA has shown significant anti-cancer activity in one cell line and is suitable to undergo further studies as a potential candidate for a cancer treatment.

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