

Oncol Rep. 2004 Mar;11(3):681-5

Anti-angiogenic efficacy of grape seed extract in endothelial cells.

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The present study is focused on the investigation of in vitro angiogenic potential of grape seed extract (GSE). Human umbilical vein endothelial cells (HUVEC) in culture were used to assess the effect of GSE on proliferation, survival, matrix metalloproteinases (MMPs) secretion and capillary tube formation. Our data show that GSE significantly inhibited cell growth ($< \text{ or } = 91\%$, $P < 0.001$) and cell viability ($< \text{ or } = 64\%$, $P < 0.005$) of HUVEC. Further studies by BrdU incorporation and annexin V staining showed that GSE strongly inhibits DNA synthesis ($< \text{ or } = 76\%$, $P < 0.001$) and induces apoptotic cell death ($< \text{ or } = 42.8\%$ versus control 2.6% , $P < 0.05$) in HUVEC, respectively. Similar GSE treatment decreased secreted levels of MMP-2 from HUVEC. GSE also inhibited capillary tube formation on Matrigel by endothelial cells in a dose-dependent manner. These findings suggest that GSE possesses an anti-angiogenic potential, which is associated with its antiproliferative, proapoptotic and inhibition of MMP-2 secretion in endothelial cells. Further studies are warranted to evaluate the in vivo anti-angiogenic efficacy of GSE for its possible usefulness in the inhibition of tumor angiogenesis.