Induction of Apoptosis in Cancer Cells by Bilberry (*Vaccinium myrtillus*) and the Anthocyanins

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Among ethanol extracts of 10 edible berries, bilberry extract was found to be the most effective at inhibiting the growth of HL60 human leukemia cells and HCT116 human colon carcinoma cells in vitro. Bilberry extract induced apoptotic cell bodies and nucleosomal DNA fragmentation in HL60 cells. The proportion of apoptotic cells induced by bilberry extract in HCT116 was much lower than that in HL60 cells, and DNA fragmentation was not induced in the former. Of the extracts tested, that from bilberry contained the largest amounts of phenolic compounds, including anthocyanins, and showed the greatest 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity. Pure delphinidin and malvidin, like the glycosides isolated from the bilberry extract, induced apoptosis in HL60 cells. These results indicate that the bilberry extract and the anthocyanins, bearing delphinidin or malvidin as the aglycon, inhibit the growth of HL60 cells through the induction of apoptosis. Only pure delphinidin and the glycoside isolated from the bilberry extract, but not malvidin and the glycoside, inhibited the growth of HCT116 cells.