CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

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Project Number

S1733

Project Title

Can It Bee? Investigating Cytotoxicity and Gene Regulation of Potential Anti-Cancer Agent Propolis

Abstract

Objectives/Goals

Propolis, a resinous substance produced by bees, has long been utilized as a popular folk remedy to its wide spectrum of purported pharmaceutical properties, including anti-cancer. To investigate propolis# anti-cancer effect, colon cancer cells and noncancerous fibroblasts were treated with two major constituents of propolis, quercetin and chrysin, to observe their effect on cell viability and gene expression.

Methods/Materials

HB-8059 mouse colon cancer cells were cultured with seven dosages of quercetin and chrysin for 24, 48, and 72 hours. A lactate dehydrogenase assay was conducted after the given time periods in order to count cell death. CLC-96 mouse fibroblasts were treated with the most effective dose from the results of the LDH assay to determine whether or not the drug was selective. After verifying the effect of the dosage, HB-8059 cells were serum-starved for 20 hours and treated with the effective dosage (120 microM) for 5 hours. RNA was isolated with TRIZOL, cDNA was generated using MMLV-RT, and RT-PCR was conducted with a qPCR machine to examine the effect of quercetin on several genes.

Results

The dose that significantly induced the most cell death was 120 µM quercetin, which resulted in a nearly two-fold increase in LDH activity relative to the untreated cancer cells. Quercetin-treated HB-8059 showed 1.8 times the cell death of the untreated cancer cells, while apoptosis among quercetin-treated fibroblasts was not significantly greater than that of untreated fibroblasts. Beyond 24 hours, the LDH levels did not significantly rise. FLT1 was downregulated with a 3.14 fold change ($p = 0.0019$). NOS2 was downregulated with a 2.35-fold change ($p = 0.0030$). JUN was downregulated with a 2.26-fold change ($p = 0.0004$). GADD45A was upregulated with a 2.72-fold change ($p = 0.0003$).

Conclusions/Discussion

Quercetin and chrysin can both play roles in the anticancer activities of propolis. Fewer fibroblasts were killed compared to cancer cells, suggesting that quercetin selectively kills cancer cells. Some oncogenes (FLT1 and JUN) were downregulated by quercetin, whereas a DNA repair and apoptotic gene (GADD45A) was upregulated. The downregulation of NOS2 may indicate the inhibition of pathways responsible for therapy resistance, which may allow quercetin to synergize with chemotherapy. All of these results indicate that quercetin may be a potential chemopreventive agent against cancer.

Summary Statement

To observe propolis' effect on cell viability and gene expression, colon cancer cells and non-cancerous fibroblasts were treated with propolis constituents quercetin and chrysin.

Help Received

Used lab equipment at Schmahl Science Workshop under supervision of Dr. Ali Haghighi, Dr. Joseph Bay taught me how to conduct RT-PCR