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## Evaluation of anti-oxidative, and anti-genotoxic potency of spirulina isolated human lymphocyte *in vitro* study

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**Background:** Spirulina is a commercial alga well known to contain various antioxidants, especially phycocyanin. Most of the previous reports on antioxidant activity of Spirulina were based on chemical rather than cell-based assays. The primary objective of this study was to assess the antioxidant activity of aqueous extract from Spirulina based on its protective effect against genotoxicity induced by doxirubcin (DOX) or valproic acid (VAP).

**Methods:** The antioxidant and genoprotective activity of Spirulina platensis (SP) water extract was assessed using both chemical and cell-based genotoxic assays. In the cell-based genotoxic assay Isolated human peripheral lymphocytes were treated with varying concentrations of SP (10.0, or 20.0 µM) alone or in combination with doxirubcin (DXR) (0.15 µg/mL) or valproic acid (VAP), Comet assays and apoptotic cell studies were performed to evaluate the effect of SP. Spectrophotometric assays were also used to assess the antioxidant activity of the extract.

**Results:** Spirulina (SP) extract did not cause cytotoxic effect on human lymphocytes within the range of concentrations tested (10 - 20 µM). The extract reduced significantly ($p<0.05$) apoptotic cell death and DNA damage due to DOX and VAP. Based on the antioxidants assay, the extract showed higher total antioxidant capacity in both water-soluble and lipid-soluble antioxidants

**Conclusions:** The results showed that aqueous extract of spirulina has a protective effect against apoptotic cell death and DNA damage induced by either DOX or VAP due to free radicals. The potential application of incorporating spirulina into food products and beverages to enhance their antioxidant capacity and cytoprotective is worth exploring.

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## *In silico* prediction of strong interaction between riboswitches and aminoglycosides candidates riboswitches as potential targets for antibiotics

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Riboswitches are cis acting riboregulaters usually located at 5' untranslated region of mRNAs. Discovery of the contribution of FMN, TPP and lysine riboswitches in antibiotic targeting was a milestone in the history of riboswitches. Some studies revealed the interaction between aminoglycosides and artificial riboswitches. In this study, the binding potential of different types of aminglycosides with various classes of riboswitches using molecular docking methods was elucidated. To achieve this goal, the affinity between each aminoglycoside and its target "16S rRNA A site" was studied. The affinity of riboswitches/natural ligands was used as the positive control and the interactions of riboswitches/ampicillin and 5S rRNA/aminoglycosides were employed as negative controls. Applying AutoDock vina, it was showed that the binding energy of each kind of riboswitches with different types of aminoglycosides is almost the same or sometimes more than the binding energy of the aminoglycoside with the corresponding binding cage of "16S rRNA A site" as aminoglycosides' target site. Accordingly, lysine, glycine and SAM-I riboswitches were recognized as the best RNA targets for all of the aminoglycosides with average binding energy of -10 kcal/mol whereas the mean binding energy of 16S rRNA A site/aminoglysides and riboswitches/ampicillin was -8 kcal/mol and -4 kcal/mol, respectively. In the next step, docking results were validated through rDock program. According to total scores, all of the studied riboswitches showed considerable affinity to paromomycin in the range of -16.83 – -55.16 for c-d-GMP-II and lysine riboswitches, respectively. Furthermore, it was indicated that hydrogen binding makes a key role in the binding energy between aminoglycosides and riboswitches. Moreover, simulation studies on riboswitch/aminoglycoside complex approved the strong interaction and stability of the docked structure in the solvent containing ions. In conclusion, computational findings support the hypothesis of possible role of riboswitches as aminoglycoside targets.

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