

Abstract:

Nutritional factors with antioxidant properties, such as those contained in edible algae or green plants, might be implicated in protection against cancer development. Chlorophyll and other tetrapyrrolic compounds, structurally related to heme and antioxidant bile pigment bilirubin, belong to important candidate molecules, which might be responsible for these effects. Based on our studies demonstrating antiproliferative effects of *S. platensis* edible alga extract on experimental model of human pancreatic adenocarcinoma we investigated in detail the effect of chlorophyll occurring abundantly in this alga. Since only scarce data exist on the antiproliferative effects of chlorophylls, the aim of our study was to assess these effects.

The study was performed on experimental models of human pancreatic and prostate cancer. The inhibitory effects of chlorophylls (chlorophyll *a*, chlorophyll *b*, chlorophyllin and pheophytin *a*) on cell proliferation and cell viability were investigated in *in vitro* studies. Chlorophylls reduced the mRNA expression as well as activity of hemeoxygenase in tested pancreatic cancer cells. Simultaneously, chlorophylls played an important role in redox environment of studied cancer cell lines including modulation of mitochondrial membrane potential, reactive oxygen species (ROS) production in mitochondria as well as in the whole cells, and change in proportion of reduced and oxidized glutathione. Anti-cancer effects of chlorophyll *a* were proved in *in vivo* experiments on pancreatic cancer cells xenotransplanted to nude mice.

In conclusion, the mechanisms of antiproliferative effects of chlorophyll are multiple, including the effects on the expression of key genes involved in antioxidant protection, as well as direct free radical scavenging affecting substantially the cell redox environment. This data confirm protective effect of plant food on incidence of cancer diseases observed in clinical and epidemiological studies.

Key words:

Cancer, chlorophyll *a*, chlorophyll *b*, chlorophyllin, edible algae, heme oxygenase, oxidative stress, pheophytin *a*, cell proliferation, reactive oxygen species, *Spirulina platensis*, tetrapyrrolic molecules.