

FTIR spectroscopic investigation of ionizing radiation-induced damage and possible protective effect of melatonin on rat brain crude membrane proteins and lipids

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Irradiation by ionizing radiation causes the production of free radicals due to water radiolysis, further causing molecular damage. As ionizing radiation is used in cancer treatment, it is an important issue to reduce its side effects, for which antioxidant supplementation is frequently used. Brain is especially susceptible to free radicals as it is rich in polyunsaturated fatty acids and consumes high amounts of oxygen. The study in concern is about the investigation of radiation-induced damage and the possible protective effect of an antioxidant hormone, melatonin, on rat brain crude membrane proteins and lipids by Fourier Transform Infrared Spectroscopy. For the experiments, melatonin was intraperitoneally injected to rats as a single clinical dose of 100 mg/kg [1, 2] and a single dose of 10 Gy was used as radiation

The results of the current study revealed that radiation induced a significant decrease in the lipid to protein ratio, a significant increase in the total protein amount and significant alterations in the protein structures. Neural network study and vector normalized-second derivative approach – both based on the amide I band – revealed changes in the secondary structure content of proteins. Significant decrease in α -helix structure and significant increase in β -sheet structure took place upon exposure to ionizing radiation. No restoring effect of melatonin was observed on radiation-induced damages in lipid and protein bands, although our group has previously reported that melatonin induces significant variations in lipid structure and function in model membranes [3] and lipid and protein composition in rat brain crude membrane treated with the same dose of melatonin [4]. Supporting these, successful differentiation of the groups with hierarchical cluster analysis also showed that melatonin has no restoring effect in the protein and lipid composition of the irradiated group.

References

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