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Synaptic membrane alterations and ROS production in aluminum-induced Alzheimer's disease rat model as probed by ATR-IR and EPR techniques

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In this work we have investigated the alterations in membrane physical properties and peroxidation mediated by AICl₃ in isolated synaptosomes of rat cortical brain tissue after 21, 42 and 65 days. The potential therapeutic role of *Lepidium sativum* (LS) as a natural anti-inflammatory, antioxidant and as acetylcholinesterase inhibitor in treating AD was also assessed in a curative group. We adopted ATR-IR spectroscopy, electron paramagnetic resonance (EPR) spin labeling and trapping (NADPH oxidase (NOX) activity), MRI, histopathological study, and animal behavior test. The ATR-IR and EPR spectroscopy results revealed that synaptosomal membrane lipids undergo free radical attacks mainly at early stage of AD (21D) and late 65D, due to Al toxicity. Al alters significantly the phospholipids membrane order, packing, membrane fluidity and polarity. These changes are time dependent. At late AD (42, 65D), the detected increase in synaptic membrane polarity renders the membrane hyperpolarized, that may obstacle the release of synaptic vesicles content into the synaptic cleft. Moreover, AD rats gave the lowest significant ($P \leq 0.05$) poking frequency compared to the control while curative group showed a great improvement with no significant changes between control and curative rats. MRI showed lateral ventricles dilation and brain atrophy only in the AD group. Gradual degenerative change was observed in AD cortical neurons with time; neurofibrillary tangles were appeared as magenta colored and looking like flames in the cytoplasm. In curative group, neurons looked more/or less similar to those of control. In conclusion, LS greatly restore membrane integrity and showed a promising curative effect.

Biography

Gehan Abdel-Raouf Ahmed has completed her PhD in Molecular Biophysics from Cairo University. She had initiated the Biophysics and Regenerative Medicine Research Group in Spectroscopy Department, Physics Division at National Research Centre, Egypt. She is working on Alzheimer's disease from November 2016. She established the Medical Biophysics Laboratory in King Fahd Medical Research Centre, King Abdulaziz University, Jeddah, Saudi Arabia during September 2008 - April 2015. She is a Principle Investigator and Co-Investigator in many projects dealing with early diagnosis and prognosis of cancer.

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