

Application of FTIR Spectroscopy to diabetes in rat animal model and the role of some antioxidants in the recovery of diabetes- induced damages

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Diabetes Mellitus (DM) is a metabolic disorder, which is characterized by abnormally high blood glucose levels due to decreased secretion or effectiveness in function of insulin. The lack or decreased levels of insulin in diabetic conditions especially alters carbohydrate and fatty acid metabolism, leading to important secondary complications such as kidney failure, liver dysfunction, cardiac disorders, etc.

Although the functional and pathological abnormalities seen in diabetes are both clinically and experimentally defined, the exact molecular mechanism and etiology of diabetes is not clear yet. We aimed to investigate the underlying molecular mechanisms of diabetes in different tissues, namely heart, liver, testis and skeletal muscle tissues. Regarding this aim, the effects of diabetes on these tissues and tissue membranes of Streptozotocin-induced (Type I) diabetic rat model were investigated using Fourier Transform Infrared (FTIR) and Attenuated Total Reflectance FTIR (ATR-FTIR) spectroscopy. Shifts in peak positions, changes in bandwidths, intensities, and band area values of the infrared bands were used to obtain valuable structural and functional information about the system of interest, which may have diagnostic value [1-4]. In addition, separation between the groups based on spectral differences were carried out using cluster analysis of the FTIR data.

A variety of significant alterations in spectral parameters was observed in diabetic tissues and membranes, indicating that significant changes in macromolecular composition, structure and function occurred in diabetic conditions. In addition, peroxidation of phospholipids in membrane structures were observed in diabetic tissues and membranes [3, 5-6]. Since lipid peroxidation eventually ends up with the changes in structural and functional properties of membrane, changes in membrane fluidity and lipid order of the system were detected in diabetic conditions [6]. Furthermore, the role of some antioxidants such as selenium, vitamin C and lipoic acid on the recovery of diabetes-induced damages were presented.

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