Diabetes-2013
OMICS Group Conferences
Accelerating Scientific Discovery
4th World Congress on
Diabetes & Metabolism
August 14-16, 2013 Holiday Inn Chicago-North Shore, USA

Ftir spectroscopy as a novel method in characterızatıon and dıagnosıs of type I diabetes in rat anımal model and the protectıve role of antıoxıdants

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Abstract

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. Although the functional and pathological abnormalities seen in diabetes are both clinically and experimentally defined, studies continue to understand the exact molecular mechanism of diabetes [1-10]. In recent years, Fourier Transform Infrared (FT-IR) spectroscopy together with chemometric methods, has had an increasingly important role to play in the field of pathology and diagnosis of disease states [11]. Pathological conditions induces changes in content, structure and function of biomolecules in biological systems and these changes can be rapidly and sensetively monitored by FTIR spectroscopy even at very early stage [3-6].

In this presentetaion characterization and diagnosis of Streptozotocin-induced (Type I) diabetic rat tissues (heart, liver, kidney, testis and skeletal muscle) and membranes isolated from some of these tissues (liver microsomal and kidney plasma membrane apical sides) by FTIR spectroscopy together with cluster anaysis methods will be discussed [1-10]. In addition, the role of some antioxidants (selenium, vitamin C and lipoic acid) on the recovery of diabetes-induced damages will be reported.

The results revealed significant alterations in spectral parameters of diabetic tissues and membranes, indicating significant changes in macromolecular concentration and composition, in lipid structure such as lipid order, the strength of hydrogen bonding around lipid head group and glycerol backbone, conformational changes in the proteins and nucleic acids and lipid dynamics. In addition, peroxidation of phospholipids in membrane structures were observed in diabetic tissues and membranes. Based on the spectral differences, cluster analysis of the FTIR data revealed succesfull differentiation of diabetic groups from the controls and clearly showed the recovery and the protective role of antioxidants from the diabetes-induced alterations. The results of these studies further revealed the power and sensitivity of FT-IR spectroscopy in rapid and automated diagnosis of diabetes.

Biography

Feride Severcan had her B.S degree in Physics from Ankara University, Turkey (1965), M.A in Physics) from RochesterUniversity, USA (1971), Ph.D in Physics from Hacettepe University, Turkey (1979), Post-Doctoral studies at Stanford University and Lecturer and Researcher at San Francisco State University, Research Associate at Perugia University. She had collaboration with UC-Santa Cruz, UC-Santa Barbara, North West Pacific Laboratory in USA, Bath, London and De Montford Universities in UK. Since 1992 she has been at Middle East Technical University, Turkey where she is Professor of Biophysics. In METU she also chaired the Department of Biological Sciences between 1994-1997.

She has published more than 100 peer reviewed scientific articles, 4 Books and 12 Book Chapters. Dr. Severcan's current research interest is the structural and functional characterization of disease states and therapeutic and protective role of drugs and antioxidants.