

Preliminary Study in diagnosis and early prediction of Preeclampsia by Using FTIR Spectroscopy Technique

Gehan A. Raouf^{1*}, Abdel-Rahman L. Al-Malki², Nesma Mansouri³, Rogaia M. Mahmoudi⁴

¹Medical Biophysics Lab., King Fahd Medical Research Centre; Biochemistry Dep., Faculty of Science, King Abdulaziz University, 21551 Jeddah –KSA B.O.Box:42805

^{2,4}Biochemistry Dept., Faculty of Science, King Abdulaziz University, Jeddah –KSA

³Obstet. Gyneo. Dept., Faculty of Medicine, King Abdulaziz University, Jeddah–KSA

*gehan_raouf@hotmail.com

Abstract: Background: Preeclampsia is a heterogeneous condition, potentially involving several separate pathophysiological pathways; currently no clinical screening test is useful for prediction of preeclampsia development. Fourier-transform infrared spectroscopy (FT-IR) holds great promise for clinical chemistry measurements. Methods: FT-IR spectra of serum samples from pregnant women -14 patients and 31 normotensive were obtained. Absorbance ratios, second derivative spectra, ANOVA test and personal correlation statistical analysis were tacking in comparison studies. The parameters studied were proteins and lipids. Results: Different absorbance ratios for specific bands were calculated and plotted versus the patient samples. These ratios yielded statistically significant increase/decrease among the groups under investigation. The results showed that among the normotensive control group three subjects later developed preeclampsia. The results obtained from the IR-measured (amide A/amide B) ratio of serum confirmed, with 92.9 % confidence level, the effectiveness of this technique for the diagnosis of preeclampsia. Normotensive pregnant women who developed preeclampsia were considered as subjects at high risk. Conclusion: This study suggests, for the first time that FT-IR spectroscopy can be successfully used as an accurate and rapid test, for diagnosis and early prediction of preeclampsia, starting from 20 week of gestation.

[Gehan A. Raouf, Abdel-Rahman L. Al-Malki, Nesma Mansouri, Rogaia M. Mahmoudi. T. **Preliminary Study in diagnosis and early prediction of Preeclampsia by Using FTIR Spectroscopy Technique.** Life Science Journal. 2011;8(2):453-464] (ISSN:1097-8135). <http://www.lifesciencesite.com>.

Key words: Fourier Transform Infrared Spectroscopy (FTIR); Oxidative Stress; Dyslipidemia; Preeclampsia; Serum
Abbreviations: Fourier transform infrared spectroscopy (FTIR);

1. Introduction:

Preeclampsia, which affects 3% to 10% of pregnancies ^[1], is a pregnancy-specific disorder characterized by hypertension, proteinuria and edema. The efforts to develop screening tests for potential use in clinical practice have yielded disappointing results ^[2]. Markers were generally chosen on the basis of specific pathophysiological abnormalities that have been reported in association with preeclampsia. Maternal concentrations of these biomarkers have been reported to be either increased or reduced early in gestation before the onset of preeclampsia. Given that preeclampsia is likely to be a heterogeneous condition, potentially involving several separate pathophysiological pathways, it is not surprising that simple clinical indicators are ineffective in identifying women who would benefit from pathway-specific treatment ^[3]. A variety of substances indicative of endothelial dysfunction are increased in the blood or urine of women with preeclampsia^[3,4-5]. Many of these substances are elevated weeks before (as well as during) clinically evident preeclampsia ^[6,7]. It has been suggested that preeclampsia is a disease of antioxidant inadequacy

appearing when the normal antioxidant balance is upset ^[8].

During the last decade, Fourier transform infrared (FTIR) spectroscopy has proven and accepted to be a powerful tool for the study of biological samples. The primary reason for this is that common biomolecules such as proteins, nucleic acids, and lipids, have characteristic functional groups having unique molecular vibrational modes (vibrational fingerprints) corresponding to specific infrared light frequencies ^[9,10]. The composition and structure of molecular functional groups can be determined by analyzing the position, width, and intensity of infrared light absorption^[12-16].

In this study we have tested FTIR spectroscopy as a potential specific accurate diagnostic tool for identifying normal pregnancy and preeclampsia. The second objective of this study was to define a new biophysical marker that is simple, valid and rapid, with potentially no limitation in clinical practice for early prediction of women – that are at high risk- who might later develop preeclampsia.

2. Materials and Methods