**INTRODUCTION**

Raman Spectroscopy (RS) is a non-destructive method of analysis, which is based on the inelastic light scattering of monochromatic light. The pattern of light scattering provides a structural fingerprint of the sample based on the vibrational response to the incoming light which is affected by components in the sample. Modern instrumentation with improved filters, computer algorithms and increased sensitivity allowed for important advancements in the clinical application of RS. Mira M-1 (Metrohm, CA, USA) is a hand-held and high-performance Raman spectrometer which uses Orbital Raster Scan (ORS) latest technology. We recently reported our attempts to identify fingerprints of placental hypoxia in fetal perfusates, obtained in *ex vivo* model. The aim of the present study was to apply this methodology in population of pregnant patients.

**MATERIALS AND METHODS**

The whole study was approved by TTUHSC as per IRB. Maternal blood samples were collected from 15 patients in the first and third trimester. The blood samples were centrifuged at 3500 rpm for 15 min. The serum was aliquoted and stored at -80°C. Raman spectrometer was used to analyze serum samples of first and third trimester. Raman spectra were collected using Mira Cal software (Metrohm, CA, USA). The data was quantified by Principal Component Analysis (PCA) and other statistical analysis in RStudio programming language. Feature vectors were collected at each time point from Raman spectra data, obtained from serum samples of all patients. Spectral characteristics of Raman spectra were analyzed using KnowItAll® spectroscopy software and databases (Biorad, PA, USA).

**RESULTS AND DISCUSSION**

The data, obtained with Raman spectrometer could be used as point-of-care test in prenatal diagnosis. Since changes, observed during gestation are associated with placental maturation, the RS analyses might represent a useful tool for rapid analyses of placental fingerprints in maternal circulation. The quest to identify detectable serum biomarkers of abnormal pregnancy or placental function has been ongoing focus in an attempt to improve maternal and fetal care. The first trimester of pregnancy is associated with the absence of the contact between maternal circulation and intervillous space of the placenta. The early onset of the blood flow in the intervillous space - prior to weeks 8 and 9 post conception due to defective trophoblastic invasion and plugging of the maternal spiral arteries is associated with abnormal pregnancy development. This early onset of placental dysfunction is associated with oxidative stress of developing placenta and detectable markers of such stress in maternal circulation. Maternal serum markers in early pregnancy have been extensively studied in association with the pregnancy complications. The maternal serum soluble vascular endothelial growth factor (VEGF) receptor 1 (sFlt1), soluble Endoglin and placental growth factor (PIGF) at 6-10 weeks of gestation were lower in the women with early pregnancy loss, compared to healthy pregnancy. In general, placental biomarkers herald the development of placental dysfunction and are present well before subsequent pregnancy complications become clinically apparent.

**ACKNOWLEDGEMENTS**

The authors wish to acknowledge the contribution of the Texas Tech University Health Sciences Center Clinical Research Institute for their assistance with this research. Specifically kind help of Cathy Lovett, Atilla Melkev, Jennifer Hines and Eva Mendosa is greatly appreciated. The samples are the part of the sample bank, created by Dr. D. Cazzaniga, thanks to the funds, provided by Laura Bush Institute of women’s health. This work was possible due to support of Dr. Gary Ventolini – Regional Dean of TTUHSC SOM at the Permian Basin. Great help from Melissa Waggoner and Elihu Arzate is kindly appreciated.