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Biomolecular Characteristics of Peritoneal Membrane Evaluated by Synchrotron Light Spectroscopy

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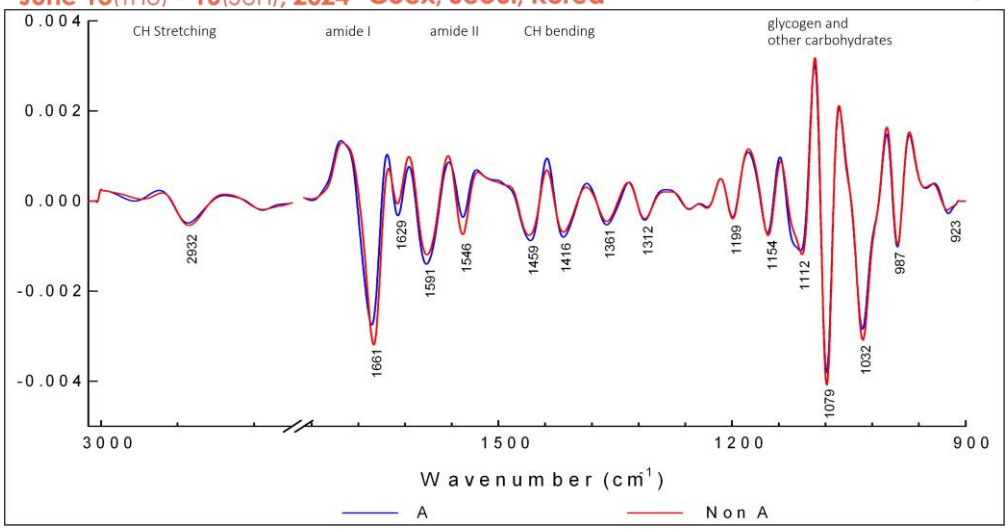
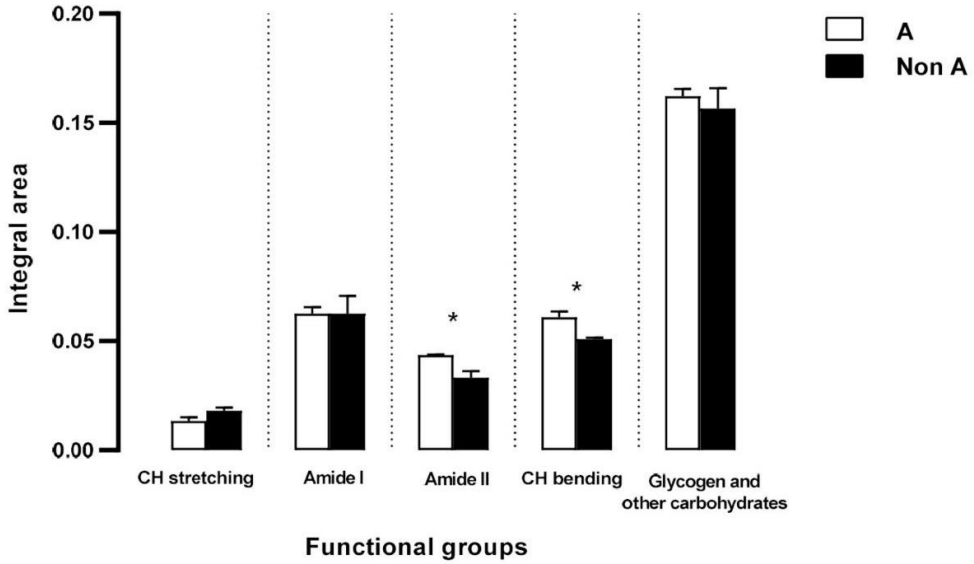
Objectives : Fourier transform infrared (FTIR) spectroscopy using a synchrotron source is a technique used in the molecular analysis of substances via the principle of infrared absorption by different tissues. This research aims to compare the differences between peritoneal membranes with different solute transporter properties in patients undergoing CAPD treatment. The data may prove to be beneficial in the selection of tailored made peritoneal dialysis fluid for indivdual patients.
Methods : Peritoneal drainage fluid was analyzed using FTIR spectroscopy. Average spectra results were analyzed using average second derivative spectra and statistical integration to compare the bio-molecular characteristics of peritoneal membrane with different solute transporter properties from standard PET.
Results : A total of 53 patients were included. Based on the D/P creatinine ratio of standard PET, the characteristics were identified as 8%, 42%, 46%, and 4% for high, high average, low average, and low solute transporter, respectively. The FTIR results displayed the average absorbance spectra for spheroids with different peritoneal membrane characteristics, comparing average versus non-average solute transporters. It depicted the area integral ratios for each biocomponent of the spheroid spectra. The content in the amide II and CH-bending regions significantly decreased in non-average solute transporters compared to the other ($p<0.05$). This indicates differing peptide sheet and lipid molecule characteristics between the two groups in the formation of bonds and hydrogen clusters.
Conclusions : The difference observed in the amide II and CH-bending regions between average and non-average solute transporters indicates distinct variations in the peptide sheet structure. Changes in the pH of PD fluid might impact alterations in the characteristics of solute transporters beyond typical adjustments like dwell time or glucose concentration, commonly practiced. However, expanding this investigation to a larger population may provide insights into avenues for altering the properties of PD membrane through modifications in the chemical composition or pH of the dialysate fluid.

pic1.png


0.004
0.002
0.000
-0.002
-0.004
CH Stretching
amide I
amide II
CH bending
glycogen and other carbohydrates
2932
1661
1629
1591
1546
1459
1416
1361
1312
1199
1154
1112
1079
1032
987
923
3000
1500
1200
900
Wavenumber (cm-1)
A
Non A

pic1.png


0.20
0.15
0.10
0.05
0.00
Integral area
A
Non A
*
*
CH stretching
Amide I
Amide II
CH bending
Glycogen and other carbohydrates
Functional groups