B91 A Large-Scale Study for the Differentiation of Individuals Based on Triacylglycerols (TG) in Latent Fingerprints

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Learning Overview: After attending this presentation, attendees will learn how Triacylglycerol (TG) species from latent fingerprints can be used to differentiate between individuals, specifically between people with and without diabetes.

Impact on the Forensic Science Community: This presentation will impact the forensic field by providing another potential way to utilize mass spectrometry imaging data for forensic analysis in cases where fingerprints have no match in any database. In the current study, the TG profile is used to gain insight into the health status of the suspect.

Introduction: Matrix assisted laser desorption/ionization (MALDI) mass spectrometry imaging (MSI) is being widely researched for use in the forensic field, particularly for the chemical analysis of latent fingerprints. MALDI-MSI is used to study the chemical composition of fingerprints and can provide a visual image in addition to the chemical information. The chemical composition of a fingerprints offers a means to obtain information about the suspect when no database match is available. For this technique to be useful, there must be chemical species that can differentiate individuals. In this work, the authors attempted to use TG species to distinguish between individuals that have diabetes and those that do not. TGs were chosen as a focus for this differentiation because diabetes is a known metabolic disorder and is therefore directly linked to TG levels.

Methods: Fingerprint samples were collected from various students, staff, and faculty from Iowa State University. The fingerprints were sprayed with a 10 mM solution of sodium acetate using a TM sprayer (HTX Technologies) and sputter coated for 10 seconds with a gold target. A MALDI-Linear Ion Trap-Orbitrap mass spectrometer was used to collect mass spectra from each of the fingerprints from *m/z* 500-1000, where TG species are found. Signal intensities were extracted from the spectra for each of the TGs and normalized to the most abundant TG in the fingerprint. Statistical analysis was done using the online software, MetaboAnalyst.

Preliminary Results: Thus far, fingerprints have been collected from 33 individuals of varying age, gender, and race. Nine of the 33 fingerprints collected have been from individuals diagnosed with type I or type II diabetes. Using the heatmap feature in MetaboAnalyst, initial patterns in the TG profiles were discovered. The authors began by focusing on only female participants to limit the number of variables in the statistical analysis. The heatmap displayed the TG profile of each female participant in the form of a matrix of colored cells, where the color indicates the value or signal intensity for each of the TG species. Two major clusters were visible in the data, one containing mostly healthy individuals and the other containing mostly participants with diabetes, with a few exceptions. Interestingly, the cluster containing most individuals without diabetes show more abundant TGs with higher levels of unsaturation, whereas the cluster containing mostly diabetic individuals have increased levels of saturated TGs. This finding is consistent with previous research that has shown the release of insulin may be inhibited by saturated long-chain fatty acids.

Conclusion: Preliminary results show promise for the possibility of distinguishing individuals by health status, particularly those with diabetes, from healthy individuals based on their TG profiles. Future work will include collecting fingerprints from more individuals to increase the statistical accuracy of the data. We also hope to incorporate a machine learning algorithm into data analysis to predict whether an individual has diabetes based on the TG profile in their fingerprint.

Individual Differentiation, Latent Fingerprints, Mass Spectrometry Imaging