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# MALDI-TOF MS Based Proteomic Fingerprinting of Total Serum Plasma for Somatic Pain Syndromes

Isaiah Pinkerton
*Rowan University*

Venkateswar Venkataraman
*Rowan University*

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Isaiah Pinkerton MS, Venkat Venkataraman PhD
Rowan-Virtua School of Osteopathic Medicine: Biology Department

## Abstract:

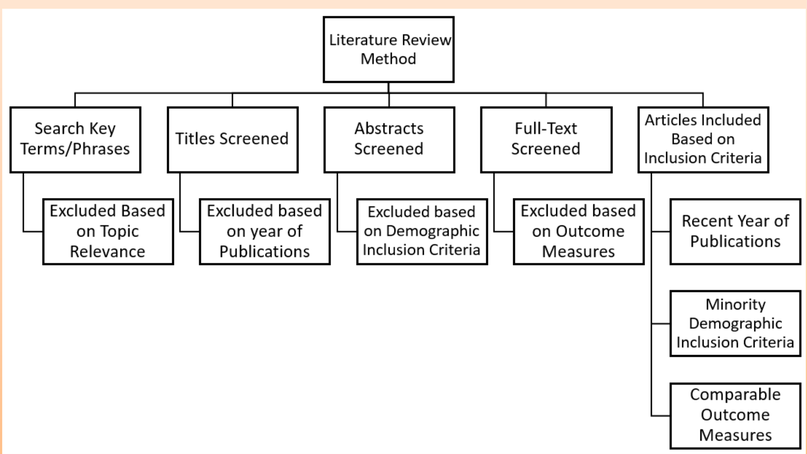
**Background:** There are racial and ethnic disparities regarding pain management within the United States, and that disproportionately affects women of color. There is also a fundamental lack of information regarding the biological mechanism by which pain sensitization and perception occurs, and how it could be affected by both neurologic and somatic pain syndromes.

**Methods:** Research was performed on principle electronic scientific databases including Google Scholar, PubMed, and Embase with search terms “MALDI-TOF”, “ESI-MS”, “Pain”, and “Biomarkers”, as well as other modifiers to narrow the literature search.

**Results:** Studies on comparison between MALDI-TOF and other traditional analysis platforms, including Electrospray Ionization (ESI-MS), proteomic characterization of biomarkers related to pain, classification of disease states based on global analysis of spectrograms, disparities between racial and ethnic groups regarding pain medication prescription, workflow pipelines regarding biomarker isolation and characterization, and potential biomarkers specific to somatic and neurologic pain symptoms (Cancer, Psychiatric Sensitization, Osteoarthritis, Fibromyalgia) and general inflammation have been presented and commented on.

**Conclusion:** This overview supports the view that MALDI-TOF has demonstrated high utility in detecting, selecting, and characterizing biomarkers relating to pain symptoms and pain-inducing conditions, compared to more traditional methods, with greater sequence coverage during proteomic analysis, specificity, and sensitivity. Additionally, the MALDI-TOF platform can be used both clinically and experimentally to describe the biomolecular basis of disease progression. This platform can be used clinically as an objective measure of pain and pain sensation to guide clinical treatment and reduce medical care inequality for marginalized groups and individuals.

## Methods:

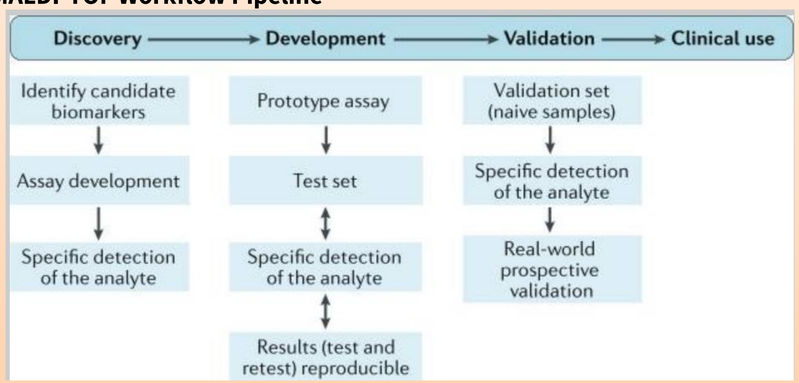



## Introduction:

The intent of this study is to evaluate the use of Matrix-Assisted Desorption Ionization, Time-of-Flight (MALDI-TOF) mass spectrometry as a method for detection and proteomic characterization regarding potential biomarkers that have been discovered and may be related to somatic pain symptoms. This review is critical because there is a multifaceted process for prescribing pain medications, most potent of which is synthetic opioids, that is in-part predicated on the relationship between prescribers and patients. This dynamic can contribute to an inherent bias in role of the physicians in a positive or negative way when prescribing medications. Furthermore, the nature of the relationship can already be influenced by the patient’s age, gender, pain syndrome, and race to such a degree that racially marginalized women of color are least likely to be prescribed pain medications, as a result[32]. When examined for racial bias, it was found that particularly for black populations there was an appreciable disparity in the prescription of pain medication, especially when there are no obvious or objective markers of pain symptoms e.g. migraines, headaches, neurologic pain syndromes[32]. Conventional and medically-based misconceptions held among white laypeople, medical students, and medical residents can feed into racially-charged stereotypes regarding biology can add to part of the reason that these disparities are observed, and this notion can also add to implicit biases among healthcare workers[33-36].

## Results:

**MALDI-TOF Workflow Pipeline**

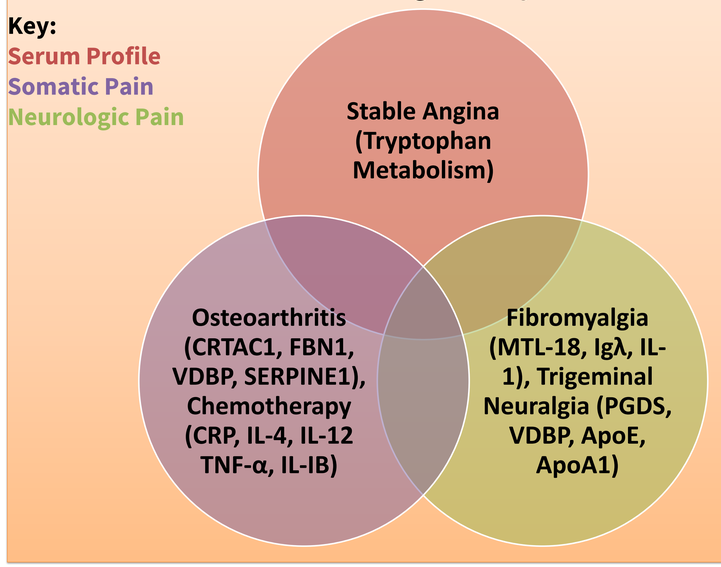



**Caption:** Davis and his colleagues to describe the workflow for discovering, characterizing, and validating the presence of specific biomarkers that are indicative of pain symptoms or are associated with pain syndromes, including neuropathic or somatic pain[6].

- MALDI-TOF comprehensively measure analytes at various concentrations, and abundance ratios with high sensitivity, specificity, accuracy & precision
- Protein sequencing data can be used from mass amounts of analyte to identify species for both intact mass and subunit analysis with variance
- MALDI-TOF has been used to isolate and identify candidates for both somatic and neurological pain syndromes
- MALDI-TOF can be combined with in-line HPLC for stratification of solutes,
- Efficacy is greater for large proteins, compared to electrospray ionization

## Results (Cont.):

**Biomarkers for Somatic and Neurologic Pain Syndromes**




## Conclusion:

MALDI-TOF mass spectrometry (MS) is a high throughput platform that can be used both experimentally and clinically to investigate potential biomarkers indicative of pain symptoms and pain syndromes. MALDI-TOF has also been demonstrated to detect several post-translational modifications that occur either *in vivo* as a part of normal proteomic expression, or *in vitro* as a part of the standard preparation during enzymatic digestion into smaller peptides for sequence analysis e.g. reduction and alkylation of cysteine residues. This platform has increased utility compared to the more widespread, conventional methods by way of the off-line acquisition of data at different points in time for increased repeatability and reliability during testing. In addition to discrete identification of proteins or peptide sequences, MALDI-TOF can be used to characterize entire spectra that can be used clinically to distinguish between ill and healthy patients.

There is a paradigm shift in diagnostic medicine that is beginning to rely less on physical findings and overt symptomatology, in exchange for a greater emphasis on monitoring biological markers, cellular metabolites and signaling molecules, and genetic aberrations. The long-term implications of adopting a platform that uses MALDI-TOF MS to detect biological metabolites indicative of pain symptoms, chronic pain syndromes, distinguish between neurologic and somatic pain pathologies, and pro-inflammatory states enables clinicians and researchers to better characterize disease states for the purposes of increasing diagnostic and prognostic confidence.

## Refernces:

**There are no conflicts of Interests**

**Acknowledge: Rowan-Virtua SOM**