The Mighty Metabolomics: Emerging Tool for Disease Diagnostics

Sir,

Current clinical laboratory diagnostic methods are capable of analysing only a little portion of the vast metabolome and do not take into account the variations that exist among populations and individuals. Clinicians are only able to give empirical treatments for diseases without much attention to individual patient needs or responses.

A metabolome consists of all the low molecular weight molecules (metabolites) produced in a cell, tissue, biofluids (whole blood, plasma, urine, CSF, *etc.*) or organism.[1] Metabolomics is the detailed analysis of these small molecules. The metabolomics profile changes according to physiological and disease conditions. There are two types of metabolomics methodologies: untargeted metabolomics deal with the complete analysis of a sample for all the known and unknown metabolites, whereas targeted metabolomics aims to measure only the previously well-identified metabolites present in physiological and diseased states.[2] Initially, metabolomics techniques were used for the diagnosis of only a small number of monogenic disorders in combination with genomic techniques to analyse phenotypes of genomic variants. However, with recent advances, metabolomics has been able to analyse a vast array of clinically significant biomarkers that are produced only in diseases. Most diseases result in the production of signature metabolites, depending upon the genotypic, and phenotypic variations within individuals, personal lifestyle, diet and comorbidity.

Metabolomics methods include the use of advanced analytical techniques like Nuclear Magnetic Resonance (NMR), Mass Spectrometry (MS); coupled with separation methods like Gas Chromatography (GC), Liquid Chromatography (LC) and Ultra Performance Liquid Chromatography (UPLC) to measure the metabolomics footprints of disease conditions. The metabolomics study of each disease will provide the medical community with better prognostic, diagnostic and surrogate biomarkers of various diseases, help in understanding the pathophysiology, sub-classification of patients based on their metabolomics patterns, treatment response prediction and in monitoring disease recurrence.

Recently, very powerful metabolomics analytical and informatics tools are being developed and new insights have been gained regarding cardiovascular disease, cancer, neuromuscular disorders, and diabetes.[3] One of the major contributions of metabolomics is towards the development of personalised medicine.

Currently, all the metabolomics tools and technologies are fairly expensive, not readily available and need specialized training; because of these limitations, metabolomics applications are limited to research laboratories. However, we believe that the existing narrow biochemical analyses used for disease diagnosis and disease monitoring will be eventually replaced by more comprehensive mighty metabolomics signature panels. The metabolomics horizon is broad and the future looks bright; with multiple applications in cancer research, drug efficacy, drug screening, monitoring and development of patient-specific treatment plans.

COMPETING INTEREST:
The author declared no competing interest.

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NA: Substantial contribution to the conception and data collection of the study, drafting, revision, and editing process of the manuscript.

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