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Towards a home companion diagnostic test for the early detection of Breast Cancer: The potential of the urine metabolome

Abstract:

Breast cancer is one of the deadliest cancers with 685,000 deaths and 2.26 million cases reported in 2020. Early detection is crucial for better treatment outcome. Mammography is the gold standard screening modality for breast cancer diagnosis but use of a cost-effective companion diagnostic with a high sensitivity and specificity is required to reduce the mortality rates; especially in group perceived to be low risk, e.g., younger women. This study aims to discover the novel biomarkers in liquid biopsies by direct infusion high resolution mass spectroscopy (DI-MS) to facilitate the development of low-cost and high throughput biomarker assay (or panel of biomarker profiles) that could be exploited such as ELISA. Metabolite profiling focused on urine samples from breast cancer (BC; n=9), benign breast disease (BBD; n=31), symptomatic control (SC; n=35) and age-matched healthy control (HC; n=24) groups, using DI-MS. Multivariate statistical analyses used the R-based Metaboanalyst platform. Data mining revealed 185 urinary metabolites that significantly ($p<0.05$) different across the sample groups. Heatmap depicted the expressions (up or down-regulated) of the urinary metabolites were consistent with the high frequency clinical breast tissue metabolic biomarkers related to breast cancer from previous published studies. Partial least squares discriminant analysis (PLS-DA) showed a clear separation between (1) groups (BC vs HC, BC vs BBD and BC vs SC. Based on pairwise analysis between BC and HC groups, the volcano plot revealed 150 metabolites were significantly up-regulated while 273 were down-regulated. Receiver operator curve (ROC) analysis identified m/z 430.19974, 369.17542 and 370.1783 with accuracies of 0.949, 0.921 and 0.926 respectively with the potential as the diagnostic biomarkers for breast cancer. In conclusion, the encouraging preliminary finding from this study illustrates that urinary metabolites can be a promising adjunct tool to the current breast screening programme which warrant further analysis with larger patients' cohorts.

Biography

Miss Aimi Zainurin is a doctoral student (PhD) in Department of Life Sciences, Aberystwyth University, UK, working on breast cancer project under research group of Prof. Mur, Clinical Hub Aberystwyth (https://www.clinicalhubaberystwyth.com/). She graduated with Biochemical-Biotechnology Engineering (Hons) and MSc Biotechnology Engineering in 2017 and 2019 respectively from International Islamic University Malaysia (IIUM). She worked as a scientist trainee in one of the top Asian biopharmaceutical companies and followed as a researcher at National Institute of Health (NIH) in Malaysia before decided to further her study. Her research interests in omics sciences focus on identifying the biomarkers and understanding the underlying relationship between the biomolecules, their molecular processes, and biological pathways to gain insights into disease mechanisms.