

Metabolomic Profiling of Severe Mental Disorders using Nuclear Magnetic Resonance (NMR) Spectroscopy and Chemometrics

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The metabolomics is the newest "omics" platform applied in chemical and biochemical studies of organisms, which enables the detection of specific metabolic changes caused by disease states or by pharmacological and/or therapeutic interventions. Although psychiatric illnesses such as schizophrenia and bipolar disorder have been associated with metabolic changes, metabolomics studies in these populations are still scarce. Our aim was to compare the metabolic profiles of individuals with psychiatric illnesses with healthy controls, and also to investigate the metabolic profile differences between the individuals with schizophrenia and bipolar disorder using Nuclear Magnetic Resonance (NMR), principally ¹H NMR, and chemometrics. The human plasma samples were analyzed applying ¹H NMR, T₂-edited NMR and 2D NMR (HSQC and HMBC) techniques. Principal component (PCA) and supervised partial least-squares discriminate (PLS-DA) analyses were used for the NMR data treatment. The subjects with psychiatric disorders (schizophrenia and bipolar disorder) have been compared with the healthy subjects (control group). Diagnosis has been performed through clinical interview using the Structured Clinical Interview Semi-DSM-IV (SCID). The analysis of the severity of symptoms were done by using the following instruments: Positive and Negative Syndrome Scale (PANSS), Hamilton Depression Rating Scale (Ham-D), and Young Mania Rating Scale (YMRS). We have identified the differences among metabolomic profiles of individuals affected by schizophrenia and the healthy controls in the 1.00-4.40 ppm ¹H NMR spectral region. The most interesting results were observed when the individuals with bipolar disorder and schizophrenia were analyzed together with healthy subjects as these samples could be classified into the following groups: (i) only bipolar; (ii) only schizophrenic, (iii) superposed group with individuals having these two major psychiatric disorders and (iv) healthy subjects. Some serum proteins, lipids (mono- and polyunsaturated), acetate, choline, L-glutamate, and myo-inositol among others, were pointed as key biomarkers for diagnosis of the two aforementioned psychiatric disorders.

Keywords: NMR-based metabolomics, bipolar disorder, schizophrenia.

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