Metabolic profiling of rat hair and biomarker discovery using ultra-performance liquid chromatography with electrospray ionization time-of-flight mass spectrometry

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The study of metabonomics is now quite common, and a liquid chromatography-mass spectrometry (LC-MS)-based metabonomic analysis has mainly been used for toxicology and screening new biomarkers. Up to now, the biological samples used in the studies of metabonomics are mainly restricted to plasma, urine, cerebrospinal fluid (CSF), or tissue, and no studies have reported the use of other biological samples, such as human and rat hairs. In the present study, an exhaustive analysis of metabolites in hair samples has been performed for the first time using ultra performance liquid chromatography with electrospray ionization time-of-flight mass spectrometry (UPLC-ESI-TOF-MS). The hair samples were collected from spontaneously hypertensive model rats (SHR/Izm), stroke-prone SHR (SHRSP/Izm) and Wistar Kyoto (WKY/Izm) rats, and were analyzed by UPLC-ESI-TOF-MS; a multivariate statistical analysis method, such as the principal component analysis (PCA), was then used for screening the biomarkers. From the samples derived from the group of SHRSP/Izm at weeks 10, 18, 26 and 34, we successfully detected a potential biomarker of stroke, which existed at much higher concentrations as compared with that in the other groups. However, a significant difference could not be found at weeks less than 7 before the rats were subjected to stroke and hypertension. In addition, the present method was applicable to screening not only the disease markers, but also the markers related to aging. The method utilizing hair samples is expected to be quite useful for screening biomarkers of many other diseases, and not limited to stroke and hypertension.