Human „lipidome atlas“ for adipose tissue

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Introduction: Human metabolic disorders including obesity are multifactorial and characterized by complex alterations in biomolecular and signalling networks challenging their early diagnosis, prognosis and selection of optimal pharmacological intervention strategies. Lipids represent a particularly promising markers as a majority of metabolic diseases are characterized by disbalance in lipid metabolism. Modern MS-based lipidomics provides the possibility to identify and quantify hundreds of individual lipids present in cells, tissues and biological fluids aiming to decipher the molecular mechanisms of lipids actions and biological roles. However, full understanding of lipid metabolism, signalling, and membrane properties in a particular tissue or cell type requires deep lipidomics profiling based on the combination of several analytical and computational strategies.

Methods: To monitor system-wide alterations of lipid metabolism we developed and optimized untargeted lipidomics platform based on LC-MS/MS separation of complex lipidomes, high-throughput accurate lipids identification and quantification. The platform was applied to study lipidome perturbation in human white adipose tissue (WAT) of obese insulin sensitive and resistant patients.

Results: Using state-of-the-art quantitative LC-MS/MS analysis we reconstructed the reference lipidome of human WAT (AdipoAtlas) covering over 1600 lipid species of which more than 700 were accurately quantified. Availability of quantitative data allowed to pinpoint obesity specific alterations in sphingo-, ether- and neutral lipids metabolism. Furthermore, AdipoAtlas can be used for genome-scale metabolic networks integration as well as to design robust, high-throughput analytical solutions adaptable to the clinical translation.

Conclusions: AdipoAtlas provides molecular inventory of human WAT lipids to support mechanistic understanding of pathophysiology of obesity and associated insulin resistance.

Reference: Lange M, Angelidou G, Ni Z, Criscuolo A, Schiller J, Blüher, Fedorova M. (2021) AdipoAtlas: a reference lipidome of human white adipose tissue. Cell Reports Medicine. 2(10): 100407.