METABOLOMICS AS A PRECISION MEDICINE TOOL FOR THE PREDICTION AND TREATMENT OF INSULIN-RELATED CHRONIC DISEASES

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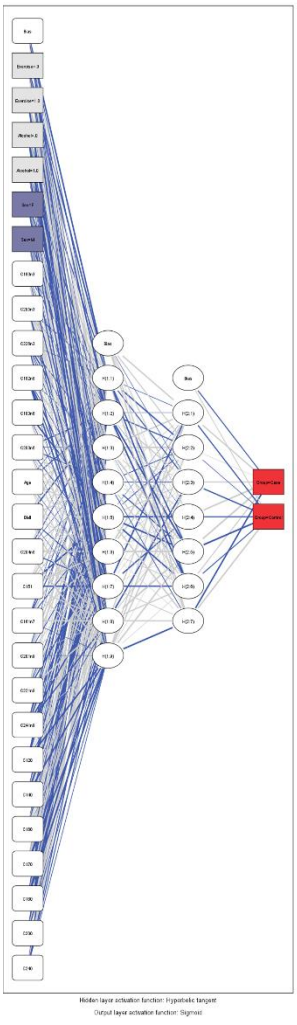
Introduction: Chronic diseases are responsible for 70% of global deaths and by 80% they are caused by modifiable risk factors including diet, smoking, alcohol and physical activity. The application of precision medicine to chronic and autoimmune diseases gains increasing attention recently. Among other precision medicine tools, metabolomics is the closest field to phenotype expression as it reflects the various interactions between the genome and the environment, which can indicate a normal or a pathogenic state. Insulin resistance (IR) and hyperinsulinemia are implicated in several chronic inflammatory states and studies show that IR metabolic biomarkers might have a high predictive value for chronic diseases. Aiming to identify an improved combination of biomarkers as a predictive factor for the presence of autoimmune diseases we have established the reference ranges of key metabolites in a healthy population and compared them to a group of patients with autoimmune diseases.



Material and Methods: A retrospective nested case-control study was conducted in 403 individuals with rheumatoid arthritis, thyroid disease, multiple sclerosis, vitiligo, psoriasis, inflammatory bowel disease, and other autoimmune diseases and a healthy group. A total of 28 variables including total fatty acids, measured by targeted metabolomic analysis GC-MS, and the modifiable risk factors of B.M.I., gender, age, exercise, and alcohol consumption were analyzed.

Results: Three predictive models were developed, namely (a) a logistic regression based on Principal Component Analysis (PCA), (b) a straightforward logistic regression model and (c) an Artificial Neural Network (ANN) model. The predictive accuracy of the logistic regression and ANN were very similar reaching up to 93% for those with ADs and 78.9% for the total population. The model identified among others, the saturated FAs lauric acid (C12:0), myristic acid (C14:0), stearic acid (C18:0), lignoceric acid (C24:0) and palmitic acid (C16:0) and the dihomo Gamma-linolenic acid (C18:3n6) polyunsaturated fatty acid as key biomarkers for ADs.

Discussion and Conclusions: These findings indicate that the metabolic profile of FAs is significantly changed in ADs and associated with presence of ADs. Dihomo-gamma-linolenic acid, stearic acid and palmitic have been associated with IR and its associated disorders possibly explaining their altered levels in ADs. Overall, metabolomic analysis of fatty acids can be a valuable tool for the identification of biomarkers for ADs and future treatment targets.