AN INTEGRATED $^1$H NMR, HPLC-(ESI/TOF) AND GC-MS BASED METABOLOMICS APPROACH TO THE STUDY OF ACUTE EXERCISE IN HUMAN SERUM METABOLOME

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INTRODUCTION & GOALS

It is well known that exercise affects substrate utilisation and insulin sensitivity, which in turn improve blood glucose and lipid levels in subjects with type 2 diabetes. However, these evidences are not so clearly stated in subjects with type 1 diabetes (DM1). In DM1 there are several hazards that make exercise difficult to manage: risks of hypoglycemia during or after exercise or of worsening metabolic control if insulin deficiency is present. Thus, a combined GC-MS, HPLC-MS (ESI/TOF) and NMR-based metabolomics approach was used to the assessment of the global metabolic rearrangement produced by the impact of acute short-term exercise in DM1 subjects.

RESULTS

Figure 1: Example of a total ion chromatogram and CPMG and NOESY spectra of the same control serum sample with their corresponding metabolite assignment

Figure 2: A multilevel two-component PCA model fitted either on 1D-CPMG spectra or on GC-MS m/zRT features showed two clearly separated clusters: corresponding to individuals prior and post acute exercise. Loadings plp holding exercise effect revealed a common metabolic pattern variation in DM1 and CTR groups showing increased levels of lactate (NMR, GC-MS) and alanine (NMR). Conversely only DM1 group revealed clear changes in glucose levels after acute exercise.

CONCLUSIONS

The increase in lactate and pyruvate levels might be indicative of an accumulation of such glycolysis metabolites in muscle cells after short-term intensive exercise. Serum alanine levels appeared to be increased since it is transported to the liver where it acts as a gluconeogenesis substrate. The increased levels of glycerol together with elevated levels of some fatty acids suggest mobilization of triglycerides with acute exercise.


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