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Metabolomics study of Dex induced mucsle atrophy with ADSC treatment based on UPLC-Orbitrap-MS

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Introduction

Aging, which ultimately leads to death, is accompanied by a variety of physical and mental conditions, including typical metabolic, inflammatory, cardiovascular, and neurodegenerative disorders. Sarcopenia, also known as muscle atrophy, which refer to age- induced is a progressive loss of skeletal muscle mass, quality and strength [1, 2]. Moreover, it also aggravates other chronic diseases resulted in increase of morbidity and mortality [3]. This study aims at examining the muscle atrophy improvement effect and the metabolic pathway of adipose-derived stem cell (ADSC) on dexamethasone (Dex) induced muscle atrophy rat serum based on UPLC-Orbitrap metabolomics analysis.

Fig1. Partial Least-Squares Discriminant Analysis

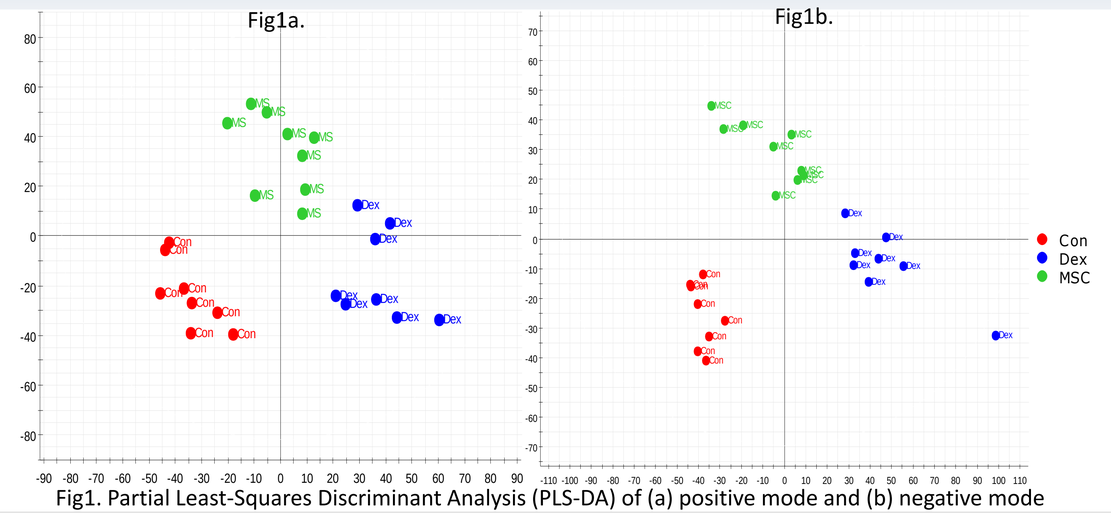


Fig1. Partial Least-Squares Discriminant Analysis (PLS-DA) of (a) positive mode and (b) negative mode

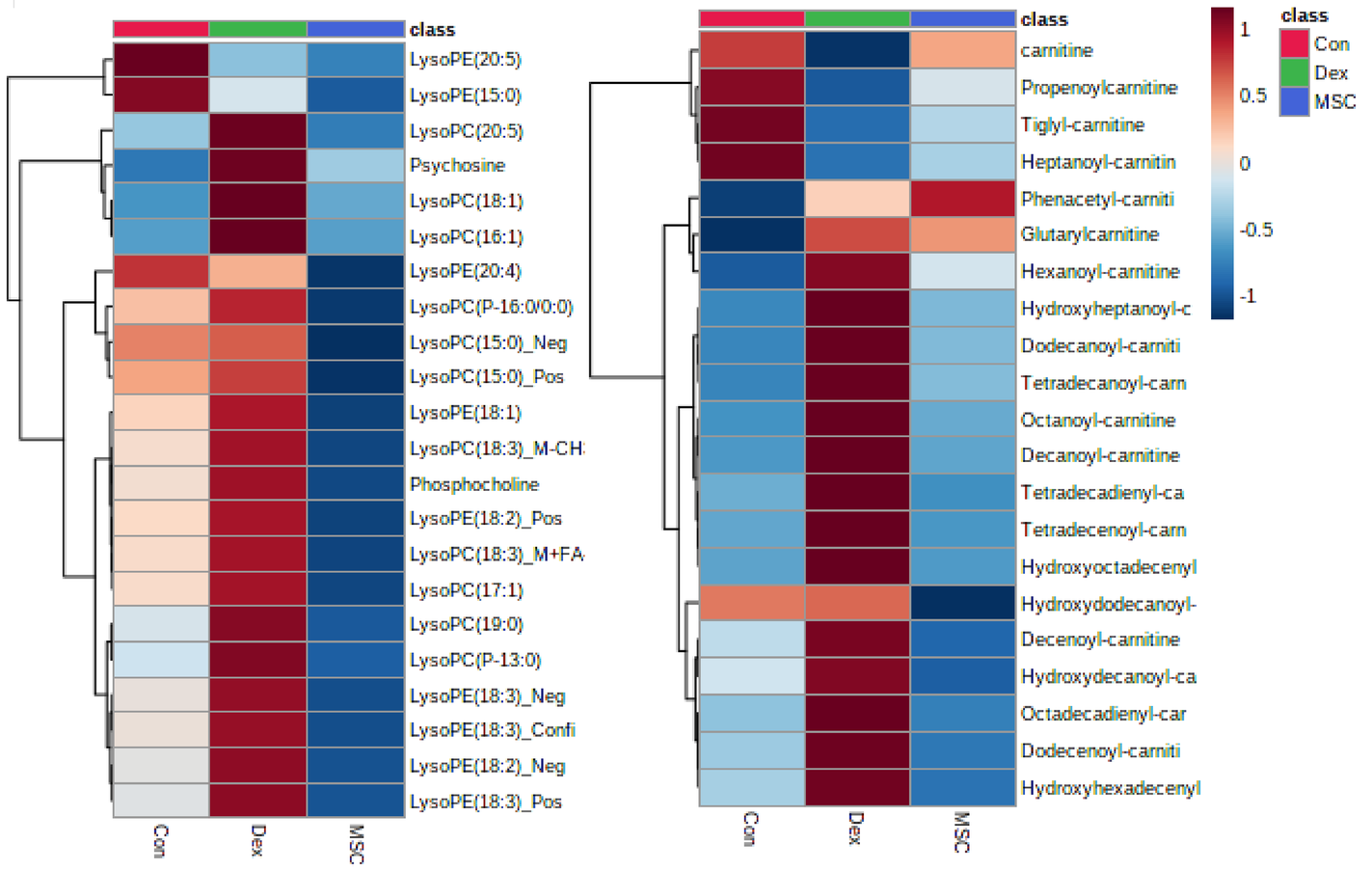
Method

- **Grouping**
  - Normal
  - Model (Dex)
  - Study Group (Dex+MSC)
- **Randomized sample preparation**
  - Deproteinmethanolation with
  - Supernatant drying by N_2
  - Redissolveing in 95% methane
- **MS data acquisition**
  - ACQUITY UPLC HSS T3 column
  - Thermo Orbitrap Fusion Lumos Tribrid Mass Spectrometry
- **Statistical Analysis**
  - Data extraction and preprocessing data by Progenesis QI V.2
  - Eliminating metabolite with with RSD>30% in QC
  - Normalization by QC
  - Multivariance analysis by Extended Statistical tool 2.0
  - Marker selection

RESULTS

As the Partial Least-Squares Discriminant Analysis (PLSDA) shown, there is a clear separation between three experiment group in both positive and negative mode. It means there is some features (VIP value >1.5)contribute the differences between groups and those features are selected for identification by using in-house and online database. Most of the identified feature are belong to the class of glycerophospholipid and carnitine. As the Heat map (Fig.2) shown, both class of compounds are highly increased in the model group but decreased in treatment group. Moreover, the content content in treatment is even lower than control group. However, not all the metabolite follow the trends. Carnitine with short carbon chain (Carbon number < 5) show an opposite trend compare with carnitine with longer carbon chain.

Fig2. Heatmaps



DISCUSSION

Both carnitine and glycerophospholipid are related to lipid metabolism. Moreover, carnitine are also related to energy metabolism. Lipid is a well known secondary energy source . Thus, the result of glycerophospholipid and carnitine show consistency. However, muscle atrophy can be improved by promoting energy metabolism. However, the relationship between lipid, energy metabolism and muscle atrophy are needed to be investigated.

Reference

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