Absence of gut microbiota affects lipid metabolism in the prefrontal cortex of mice

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Abstract

Objectives: Lipid metabolism is closely associated with many important biological functions. Here, we conducted this study to explore the effects of gut microbiota on the lipid metabolism in the prefrontal cortex of mice.

Methods: Germ-free (GF) mice, specific pathogen-free (SPF) and colonized GF (CGF) mice were used in this study. The open field test (OFT), forced swimming test (FST) and novelty suppressed feeding test (NSFT) were conducted to assess the changes in general behavioral activity. The liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS) was used to obtain the lipid metabolites. Both one-way analysis of variance (one-way ANOVA) and orthogonal partial least-squares discriminant analysis (OPLS-DA) were used to obtain the key differential lipid metabolites.

Results: The behavioral tests showed that compared to SPF mice, GF mice had more center distance, more center time, less immobility time and less latency to familiar food. Meanwhile, 142 key differential lipid metabolites between SPF mice and GF mice were identified. These lipid metabolites mainly belonged to glycerophospholipids, glycerolipids, sphingolipids, and saccharolipids. The gut microbiota colonization did not reverse these changed behavioral phenotypes, but could restore 25 key differential lipid metabolites.

Discussion: These results showed that the absence of gut microbiota could influence host behaviors and lipid metabolism. Our findings could provide original and valuable data for future studies to further investigate the microbiota-gut-brain axis.