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Abstract

Changes in Gut Microbiota and Serum Metabolites in Patients with Extreme Obesity †

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Abstract: Background and Objectives: In recent years, the crucial role of gut microbiota in the development and regulation of obesity and related metabolic conditions has been increasingly explored. This prospective cross-sectional study aimed to examine the differences in gut microbiota composition and energy metabolites between non-diabetic individuals with extreme obesity (EO) and healthy lean controls (HLC). Methods: A total of 19 non-diabetic participants with EO (average age ± SD: 35.4 ± 7.0 years, average BMI ± SD: 48.8 ± 6.7 kg.m^{-2}) and 23 HLC participants (average age ± SD: 31.7 ± 14.8 years, average BMI ± SD: 22.2 ± 1.7 kg.m^{-2}) were investigated. Fecal microbiota was analyzed and classified using specific primers targeting the V1–V3 region of 16S rDNA. Serum metabolites were characterized by nuclear magnetic resonance spectroscopy. Multivariate statistical analysis and Random Forest models were employed to identify predictors with the highest variable importance. Results: A significantly reduced microbial α-diversity; lower relative abundance of beneficial bacterium Akkermansia and SCFA-producing bacteria Eubacterium hallii, Butyrivibrio, Marvinbryantia, and Coprococcus; and increased abundance of pathogenic bacteria Bilophila and Fusobacterium were found in individuals with EO. Interestingly, energy metabolites (citrate and acetate), IR HOMA, and insulin were pinpointed as the most important predictors with exceptional ability to differentiate between EO and HLC participants by the Random Forest machine learning analysis. Conclusion: The findings suggest that changes in gut microbiota and serum acetate and citrate levels in patients with extreme obesity may serve as potential biomarkers for early progression to Type 2 diabetes. Consequently, weight loss interventions and non-invasive manipulation of gut microbiota composition in these patients could offer a novel strategy for managing obesity and related disorders.

Keywords: Gut Microbiota; extreme obesity Type 2 diabetes; energy metabolites

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