

Abstract

Diet-Specific Multi-Omics Markers Associated with Metabolic Health Benefits Can Be Determined in Vegan Population [†]

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Abstract: Background and objectives: Diet is one of the fundamental factors that not only determines metabolic health but also shapes the gut microbiome and serum metabolome (MIME). Plant-based diets are associated with potential health benefits, but their effect on MIME remain to be elucidated. We sought to determine whether diet-dependent markers explaining the observed health benefits of a vegan diet could be identified in the MIME of vegans from different geographic regions. Methods: Lean, healthy vegans ($n = 100$) and omnivores ($n = 73$) with comparable BMI from two geographical regions (Czech Republic, Northern Italy) participated in the cross-sectional study. Based on their clinical characteristics and serum markers, we investigated their glucose and lipid metabolism and used an integrated multi-omics approach (16S rRNA sequencing, metabolomics and lipidomics profiling) to identify country- and diet-specific MIME markers. Results: Czech and Italian vegans exhibited more favorable lipid profile parameters compared to omnivores characterized by decreased serum concentrations of sphingomyelins, ceramides, cholesterol esters, and lipid species containing saturated fatty acid. Using a machine learning approach, we were able to discriminate between vegans and omnivores based on separate omics datasets, regardless of country of origin. By combining all MIME features, we were able to identify a vegan diet-specific multi-omics signature that allows for the classification of vegans and omnivores with high accuracy. Most of the vegan-specific variables were associated with favorable indices of lipid and glucose metabolism, inflammation, or body weight. Discussion: Most of the MIME markers that are down-regulated in vegans are predominantly associated with adverse health outcomes, whereas those that are up-regulated are associated with a healthy phenotype and a low risk of non-communicable diseases. Our findings support the potential use of a healthy plant-based diet in the treatment of metabolic disorders.

Keywords: vegan diet; multi-omics; lipidomics; gut microbiota; NCDs



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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of the Third Faculty of Medicine of the Charles University, the Ethics Committee of University Hospital Kralovske Vinohrady (EK-VP/26/0/2017) and the Ethics Committee of Azienda Ospedaliera SS. Antonio e Biagio e Cesare Arrigo di Alessandria, Italy. ID: Colorectal miRNA_CEC2014 and subsequent amendments.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Sequencing data are available in the European Nucleotide Archive database under the accession number PRJEB43938. The publication of the dietary data as well as metabolomics data is not possible, as it was not covered by the participants' informed consent used for the study. However, pseudonymized data will be made available by the corresponding authors upon reasonable request.

Conflicts of Interest: The authors declare no conflict of interest.

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