

TITLE: EVALUATION OF CORRELATION AMONG PSYCHOLOGICAL STATE, HEART RATE VARIABILITY AND THE HUMAN GUT MICROBIOTA COMPOSITION.

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ABSTRACT:

Bidirectional communication between gut microbiota and brain is a source of many studies in recent years. Behavioral conditions such as depression, anxiety and stress have been implicated in alterations of the gut microbiota homeostasis and vice-versa. Preclinical studies indicate that components produced by the microbiota can communicate with the brain via immune system, circulatory system and also the vagus nerve. The vagus nerve connects the brain with the gut and it is the main via for the parasympathetic nervous system. Cardiac heart rate variability (HRV) is a measure of the vagal tonus used to understand the balance between the parasympathetic and sympathetic nervous. The aim of this study was to correlate the psychological state of 18 participants (mean age: 22.5 ± 1.91) and HRV parameters with the functional and compositional state of the gut microbiota. The study was conducted in stages: 1) acquisition of electrocardiographic signals in the resting state for 5 minutes and filling out of BDI-II (depression) and IDATE-T (anxiety) scales; 2) fecal metabolomics analysis using ¹H NMR 500 MHz spectroscopy and 3) analysis of relative abundance of Bacteroidetes, Firmicutes and Actinobacteria by RT-qPCR. Initially, groups were formed based on the median of each scale (BDI-II: 11.5 ± 9.6 and IDATE-T: 44.5 ± 11.7), in which those above the median are more likely to have depression or anxiety and those below are considered as healthy. Multivariate Partial Least Squares Discriminant Analysis (PLS-DA) and O-PLS-DA distinguished different metabolic profiles for depression x healthy (ACC: 0.72; R²: 0.99; Q²: 0.21), anxiety x healthy (ACC: 0.77; R²: 0.99; Q²: 0.17) and RMSSD high x RMSSD low (ACC: 0.66; R²: 0.99; Q²: 0.01). Furthermore, both multivariate and univariate ($p < 0.05$) showed increased aspartate and acetoacetic acid levels and a decrease of acetate in the group with a depressive pattern. Valerate, sarcosine and acetoacetic acid levels were found higher in the anxious group and participants with high RMSSD had a decrease of isovalerate, methionine, glutamate, acetoacetate and butyrate levels and an increase of propionate, valerate and acetate levels. Relative abundance of Firmicutes in the anxious ($p < 0.03$) and depressive ($p < 0.02$) were significantly higher than in the healthy ones. Our results demonstrated differences in composition and metabolic profile in participants with either high RMSSD or low RMSSD, anxiety and depression.

Keywords: Anxiety, Depression, Vagus nerve, Metabolome, Microbiota

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