Biomarkers in the blood serum of patients with unipolar depression and bipolar affective disorder: results of a study using Raman spectroscopy and machine learning

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Modern clinical psychiatry faces a significant challenge in accurately differentiating between bipolar affective disorder (BPAD) and unipolar depression (MDD). However, the analysis of biomarkers in biological fluids such as blood serum offers prospects for developing new diagnostic methods for these conditions. This study aimed to identify potential biomarkers in blood serum capable of distinguishing patients with MDD and BPAD, considering treatment stage and disease type.

Spectral data from blood serum were analyzed using machine learning methods, including support vector machines with a linear kernel, random forests, and gradient boosting. Serum samples were categorized into five groups: control group – healthy volunteers (n=39); BPAD 1 – bipolar affective disorder, pre-treatment (n=35); BPAD 2 – bipolar affective disorder, post-one month of therapy (n=35); MDD 1 – unipolar depression, pre-treatment (n=40); MDD 2 – unipolar depression, post-one month of therapy (n=40).

Comparative analysis of serum spectral data between groups was performed using machine learning techniques to assess the diagnostic informativeness of group separation. The obtained data indicated differences in the chemical composition of blood serum between patients and healthy volunteers. Patients with depression exhibited increased intensity of bands, potentially associated with elevated levels of cholesterol and lysozyme, as well as decreased relative band intensities, possibly linked to the presence of phenylalanine, carotenoids, glutamate, and lipids in the blood serum.

These findings provide insights into the distinct chemical composition of blood serum between patients and healthy volunteers. The study underscores the potential of Raman spectroscopy and machine learning methods for identifying biomarkers that could aid in the accurate diagnosis of mood disorders.

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