Development of an Alternative Approach for Ferritin Determination in Serum of COVID-19 Diagnosed Patients

The COVID-19 pandemic has demonstrated the critical significance of ferritin level monitoring in patient management and revealed the need for developing accessible diagnostic methods. Current methods for measuring ferritin (ELISA, CLIA, ECLIA) require expensive instrumentation, specialized laboratory settings, and highly qualified staff, which limits their accessibility for medical facilities with restricted budgets. Consequently, the demand for accessible diagnostic methods has increased.

The objective of this interdisciplinary research is to develop a relatively simple and cost-effective alternative approach for determining ferritin, an inflammatory process diagnostic marker protein, in blood serum for timely and accurate identification of patients at high risk of adverse disease progression, including COVID patients.

This study represents the first attempt to validate a novel method for ferritin determination using RGB Photonics' portable spectrophotometer (Qwave). The portable spectrophotometer (Qwave) employed in the study provides dynamic exposure control with 0.2-0.5 nanometer spectral resolution using a 3648-pixel linear CCD detector.

The study utilized blood serum samples from COVID-19 diagnosed patients and commercial ferritin derived from human liver (Sigma-Aldrich, F6754-1VL) with an initial concentration of 10 μg/mL. It is noteworthy that ferritin levels varied significantly among study participants: some exhibited low levels, while others demonstrated high concentrations as a result of cytokine storm.

Spectrophotometric analysis confirmed the maximum absorption peak of commercial ferritin in the 445-450 nm range, which aligns with literature data. The study results demonstrated that despite varying quantitative ferritin content in blood serum samples from patients of different severity, the qualitative characteristics of the curves correspond to the control (commercial ferritin) indicator. Of particular significance is that the spectral characteristics of all examined samples show high concordance with commercial ferritin in the 445-500 nm range, validating the method's reliability for both qualitative and quantitative analysis. Differences detected in patient samples were observed only in quantitative indicators, which fully corresponds to varying degrees of disease severity.