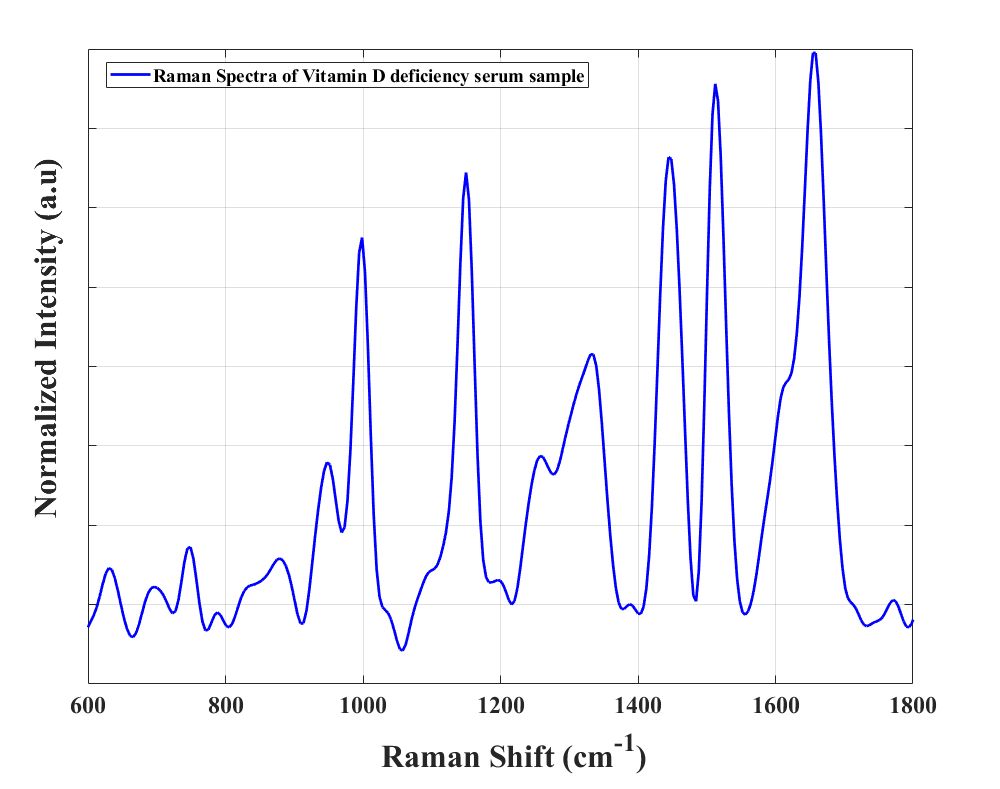
**Study of Human Blood Serum Through Raman Sensing and Computational Approach for Early Detection of Autoimmune Disorders**

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**Abstract:**

Vitamin D insufficiency has become a public health issue globally, regardless of region. Vitamin D insufficiency causes osteoporosis and is connected with metabolic syndrome, cardiovascular disease, obesity, diabetes, and autoimmune disorders. Early identification of vitamin D levels in the blood, followed by supplementation, can help avoid many chronic illnesses. In this study based on blood serum as a biomarker for vitamin D deficiency causing cardiovascular disease, we obtained the Raman spectra of six serum samples from Rheumatoid Arthritis (RA) affected patients, vitamin D deficiency patients, and healthy individuals. By Comparing each category's average Raman spectra, we observed that Vitamin D deficiency spectra are closely associated with RA affected samples in Amide I (1663 cm-1) and Amide III (1227 cm-1) regions. Also, the presence of phenylalanine peak at 1003 cm-1 shows a chance of autoimmune disorders. Raman scattering intensity is proportional to the energy of the incoming radiation. Raman activity is caused by polarisation changes in molecules. There may be a linear connection between intensity and concentration, making it possible to do in-situ Vitamin D investigations. Principal Component Analysis was performed to obtain the similarity between RA and VitD affected samples. We propose using the C = C stretch line in the region 1560-1670 cm-1 close to identify VitD characteristics. The applicability of Raman spectra to non-invasive optical Vitamin D sensors is examined. This spectroscopy based method will help in the long-term early detection of cardiovascular disease and autoimmune disorders.

**Figure 1:** Raman spectra of vitamin D deficient blood serum sample.