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Biological analysis of Fingernails of Healthy and Thyroid disordered subjects by FTIR-ATR spectroscopic technique

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Abstract : Fourier Transform Infrared - Attenuated Total Reflectance (FTIR-ATR) technique is a modern spectroscopic technique used for elemental analysis of biological samples. This technique is based on the principle of total internal reflection. In the present study, FTIR-ATR method is used to investigate the bio-molecules present in the fingernails. As the bio-molecules present in the finger nail can be changed by several pathological, physiological, and environmental factors, we analyze the human fingernails to evaluate the possibility of thyroid disorder. The FTIR-ATR spectrum of human nail has been recorded in the mid-infrared region of 4000-450 cm^{-1}. The FTIR-ATR spectral analysis revealed the differences in some major metabolic components viz., LDL, total cholesterol and triglycerides that clearly demarcated between control and thyroid disordered patient's nail. Measurements were recorded on 30 fingernails belonging to 10 hypothyroid, 10 hyperthyroid and 10 healthy subjects. Hypothyroid patients nail spectra show a remarkable increase from the control persons in LDL, total cholesterol, triglyceridess and glucose whereas nail spectra of hyperthyroid patients show an remarkable decrease in values of LDL, total cholesterol and triglycerides from the control ones. The difference in the values of the disorder are calculated using the internal ratio parameters viz LDL/ glucose R_1 (I_{1460}/I_{1083}), triglycerides/ glucose R_2 (I_{3060}/I_{930}) and total cholesterol/ glucose R_3 (I_{2933}/I_{930}). These parameters could be used as a basis for deriving a spectral method for analyzing thyroid disordered finger nail. It is shown that Fourier Transform Infrared - Attenuated Total Reflectance spectroscopy (FTIR-ATR) could be a possible technique for the analysis of nail and therefore identification of thyroid disorder problems.

Keywords: discriminant analysis; thyroid disorder; hypothyroidism; hyperthyroidism, fingernail.

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