A Smartphone-Based, Point-of-Care Iron Sensor Utilizing Colorimetric Techniques

Long, Mindy (School: Hamilton High School)

Iron deficiency, a leading cause of anemia, is one of the globe's top nutritional disorders according to the World Health Organization. Hemochromatosis, on the other hand, is a genetic disorder characterized by an excess of iron. This project seeks to develop a novel, mobile application-based sensor that can collect iron concentration via blood samples at home, since current methods cost around $150 and take at least 5-6 hours to return results. A sensor prototype was designed and tested. A mobile iOS application for users was programmed to take pictures of the sensor and reference areas and calculate iron concentration based on the difference of RGB values, which indicate iron absorbance, between the two regions. A reader device, consisting of a 3D-printed box with a window for phone placement, was developed to maintain constant illumination of the sensor. After the application was validated with the standard RGB value extraction software, a time-dependent calibration curve was established between RGB absorbance and iron concentration and tested with simulated blood samples to ensure performance. Results were obtained in less than 2 minutes. The app showed a 98% correlation with standard methods, proving the device accurate to be used in a non-professional setting. This timely and economically efficient sensor is estimated to cost significantly less than the standard iron blood test and can easily be modified to detect other biomarkers such as acetone and ammonia, which track metabolism, opening up the door to more personalized and accessible healthcare.

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