Non-invasive Blood Glucose Level Monitoring

Mitha, Hritik (School: Bryanston High School)

Purpose: To mitigate the drawbacks of the invasive glucometer test, a non-invasive device that could accurately measure glucose levels was sought after. Procedures: A near infrared-based prototype for measuring glucose concentrations was developed using a near infrared LED, photodiode, and micro-controller board and was tested under various conditions with a variety of glucose solutions. Following this, the mid-infrared range was examined using a Fourier Transform Infrared Spectrometer on glucose concentrations similar to those found in human tissue. The tests were completed to determine whether changes in light attenuation occurred due to changing the glucose concentration in water, milk, albumin, and soy-milk solutions. The mid-infrared spectra obtained were processed using normalization techniques and the Savitzky-Golay smoothing algorithm, thereafter correlation coefficients were generated for the infrared absorption with respect to glucose concentration. Results: A strong, linear correlation (>80%) was found for 3 of the 4 trials completed using the near-infrared prototype, with the circulated, artificial blood solution obtaining a correlation coefficient of above 96%. The mid-infrared tests yielded correlations of above 95% for the water and albumin solutions tested, with a maximum correlation of 99.81% obtained for the albumin tests. Conclusion: The results conclude that near infrared and mid-infrared light can be used to determine glucose levels by measuring light attenuation as justified by the high correlation coefficients obtained. Further work would include tests on human blood samples and tissues as well as actual clinical trials towards developing a clinically acceptable non-invasive glucose monitor.

Awards Won: