Sugar High!: Integrating Glucose and Ketone Testing to Improve Prevention of Diabetic Ketoacidosis

Bashir, Isra (School: Westdale Secondary School)

The detection of extremes in health is imperative to the preservation of human life. From the staple stethoscope in every medical institution, to as simple a scale in someone's bathroom, accurate and consistent testing in the health field ensures the prevention of complications by catching them before they can occur. The purpose of this investigation was to construct an integrated glucose and ketone test strip prototype that could simultaneously provide patients with an accurate reading of their current glucose and ketone concentrations, aiding in detection of the accumulation of ketone bodies after hyperglycemic events, preventing the unexpected onset of acute diabetic ketoacidosis. After determining the redox reactions with the appropriate enzymes, cofactor and mediator for both the blood glucose and ketone detection on separate active sites on the working electrode of the test strip, as well as a five-layer system for the structural design, the construction process was prepared in a thorough procedure that involved immobilizing and coating said enzymes in a mixing method on prepared carbon electrodes that were printed on a polycarbonate substrate. If functional, the prototype design of an integrated ketone and glucose system would positively impact the future of diabetic treatment by preventing the onset of DKA. This would not only revolutionize the lives of current diabetics in their management of the disease but allow for healthcare providers to better prepare and manage symptoms of DKA in the rising population of pre-diabetics, before any lasting damage can occur. This test strip would also resolve equity issues of choosing between needed testing equipment, providing diabetics and their loved ones with a more complete picture of their health.

Awards Won: