Transdermal Lactate Collection with Agarose Gels for Noninvasive and Painless Monitoring of Patients

Moshfeghi, Sina (School: Palos Verdes Peninsula High School)

Biomarkers are extremely important in medical diagnostics, as they can help monitor a patient's medical status. Heart disease and sepsis, for example, can be identified by a spike in the concentration of the lactate biomarker. Previous biomarker assimilation has been limited to invasive, painful, or expensive blood and sweat collection methods such as blood tests, iontophoresis, and microneedles. The objectives of this project were to noninvasively collect transdermal lactate and glucose with hydrogels and establish a correlation between transdermal lactate and blood lactate. Agarose gels were fabricated in an elliptical orientation. In vitro studies were conducted on porcine skin, later leading to on body testing in which hydrogels were placed on the fingers of volunteers. After each on body trial, diluted hydrogel samples were placed in a YSI machine to measure lactate and glucose concentrations. To evaluate trends in blood and transdermal lactate, trials involving both methods were taken before and after eating. The results show that transdermal lactate collection with hydrogels is an excellent alternative to invasive and painful methods. Glucose concentrations were below the limit of detection, therefore transdermal collection of glucose with hydrogels would require a more sensitive glucose sensor. Blood and sweat lactate concentrations increase just after eating, and transdermal samples showed similar trends. Transdermal biomarker collection with hydrogels is a noninvasive and painless method for monitoring a patient’s status. Due to the apparent correlation between blood and transdermal lactate, the lactate collected with hydrogels can be used to diagnose septic shock and heart disease early on after conducting successful clinical studies.

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