



**CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY**

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Project Title The Use of Lactic Acid Levels in Saliva as a Novel Biomarker for Sepsis	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Sepsis is a severe inflammatory immune-based response to an overwhelming infection, which can lead to shock, organ failure, and death. Each year, over one million people in the U.S. are diagnosed with sepsis, of whom nearly 35-50% die. Hence, rapid and reliable diagnosis is essential. Emergency departments use a standard measure of sepsis, based upon an elevated L-lactic acid level in blood. Saliva is more readily available and easier to obtain than blood samples, and is increasingly being studied as a new source of diagnostic information. This study aimed to evaluate whether analysis of lactic acid levels in saliva can substitute for that of lactic acid levels in blood.</p> <p>Methods/Materials We processed saliva samples from 25 ER patients (15 with sepsis and 10 with other non-sepsis conditions) using Cayman's L-Lactate Assay kit. We used the enzyme lactate dehydrogenase, which catalyzes the oxidation of lactate to pyruvate and also produces NADH, which then reacts with the fluorescent substrate to produce fluorescence which we measured using an optical plate reader. We used the equation provided in the kit to calculate L-Lactate levels from the fluorescence values we obtained. We plotted the concentration of L-Lactate in non-septic and septic patients and compared levels in saliva to levels in blood.</p> <p>Results We found increased serum and salivary lactic acid levels in all cases of sepsis compared to the control group. Differences in L-lactate levels measured in saliva or blood could differentiate between non-septic and septic populations. Notably, the increase in lactic acid levels was 3-fold higher in saliva as compared to serum in septic patients, suggesting saliva may serve as a better indicator of sepsis compared to blood.</p> <p>Conclusions/Discussion To our knowledge, this is the first study to compare lactic acid levels in serum and saliva in cases of sepsis. The 9-fold increase in salivary lactate in patients with sepsis compared to a 3-fold increase in serum lactate would make it easier for physicians to differentiate septic patients from non-septic patients. Moreover, as the process of obtaining saliva is relatively non-invasive, and less painful, and as saliva can be processed without much technical skill, it may become possible to test saliva in several settings outside a clinic such as in doctors' offices, nursing homes, and athletic facilities.</p>	
Summary Statement We found that lactic acid in saliva is a better measure to differentiate sepsis from non-sepsis instead of using blood.	
Help Received Dr. Feldman, ER Chairman at Good Samaritan Hospital, obtained patient saliva samples, which were processed in Dr. Podoly's lab at Stanford University. Dr. Podoly guided our experiments and data analysis. Mr. Spenner from Harker School helped us organize our application.	