

Title: SweatSense: A Sweat-Based Wearable Technology for Monitoring Glucose and Dehydration

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Introduction and Background: About 30% of Canadians live with diabetes or prediabetes.¹ It can be managed with exercise,² although exercise-induced hypoglycemia and hyperglycemia are real risks.³ My dad, a prediabetic, manages his health using DEXCOM G7, which is invasive⁴ and expensive.⁵

Innovation: SweatSense is a non-invasive, affordable wearable harnessing eccrine sweat to monitor glucose and other analytes, using colorimetric analyses performed with a smartphone camera.

Procedure: It will be developed in phases: 1) Development of Colorimetric Sensors; 2) Machine Learning (ML) for Enhanced Prediction of Biomarker Levels; 3) Integration into Wearable and Application with Real Samples. Phase 1: Three colorimetric sensors, detecting glucose, lactic acid, and sodium ions, will be developed on three substrate types: paper towel, 100% cotton, and 100% polyester. Using glucose oxidase (Gox), horseradish peroxidase (HRP), and 3,3',5,5'-Tetramethylbenzidine (TMB), shades of blue will be analyzed for glucose detection. Using Fe(III)-tris (1,10 phenanthroline), weak orange to intense red will be analyzed for lactic acid detection. Using potassium chromate and silver nitrate, red to yellow will be analyzed for sodium ion detection. For analytical performance evaluation, standard solutions of glucose, lactic acid, sodium ion, and pH will be tested on the substrates adapting methods from previous reports.^{6,7} Phase 2: ML will be used to enhance sensor accuracy. Photos of results from standard solutions will be entered into an ML training database representing sensors across varying glucose, lactic acid, sodium ions, and pH concentrations. Artificial sweat with known glucose, lactic acid, sodium ion concentrations will be used to validate the ML models. Phase 3: A wearable will be developed using the most promising substrate. Standard solutions will be used for ML training. Artificial sweat will be used for ML validation. Functionality will be tested with real sweat solutions from volunteers.

Conclusion: SweatSense will make glucose-monitoring during exercise comfortable and affordable.

References

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