GSSI ORIGINAL RESEARCH

SKIN-INTERFACED MICROFLUIDIC SYSTEM WITH PERSONALIZED SWEATING RATE AND SWEAT CHLORIDE ANALYTICS FOR SPORTS SCIENCE APPLICATIONS

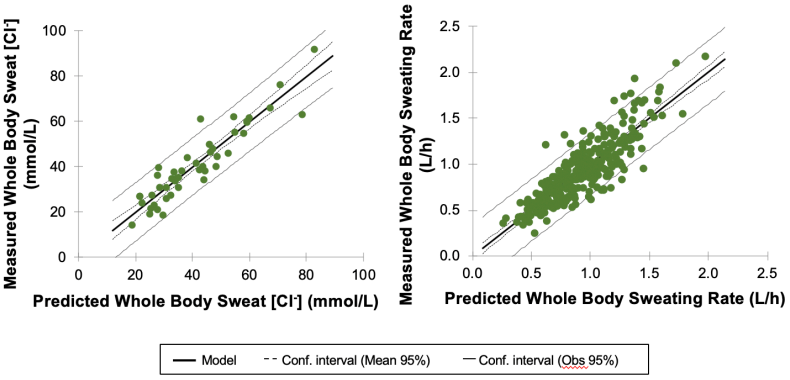
Lindsay B. Baker[1], Jeffrey B. Model[2,3], Kelly A. Barnes[1], Melissa L. Anderson[1], Stephen P. Lee[2,3], Khalil A. Lee[1], Shyretha D. Brown[1], Adam J. Reimel[1], Timothy J. Roberts[1], Ryan P. Nuccio[1], Justina L. Bonsignore[1], Corey T. Ungaro[1], James M. Carter[1], Weihua Li[2,3], Melissa S. Seib[2], Jonathan T. Reeder[2], Alexander J. Aranyosi[2,3], John A. Rogers[2,3], Roozbeh Ghaffari[2,3]

FOR MORE INFORMATION, SEE THE PAPER ON WHICH THIS INFOGRAPHIC IS BASED, FOUND IN THE FOLLOWING REFERENCE: Sci Adv (2020) 6(50):eabe3929

[1]Gatorade Sports Science Institute, PepsiCo R&D Life Sciences, USA. [2]Epicore Biosystems Inc, Cambridge MA, USA. [3]Northwestern University, Evanston IL, USA.

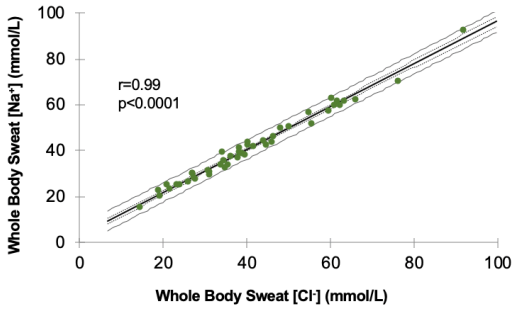
SYSTEMATIC STUDIES WERE CONDUCTED IN THE LAB AND FIELD WITH 312 ATHLETES TO COMPARE THE GX PATCH WITH STANDARD TECHNIQUES FOR SWEAT TESTING DURING EXERCISE UNDER VARYING ENVIRONMENTAL CONDITIONS (21–35°C, 25–82% RELATIVE HUMIDITY).

The regional sweating rate (SR) and sweat [Cl^-] results serve as input factors to algorithms implemented on a smartphone application that predicts whole-body SR and sweat [Cl^-] in athletes to inform personalized fluid-electrolyte intake recommendations.



Mean absolute error of the prediction models are **0.13 L/h (or 14%) for whole-body sweating rate and 5 mmol (or 13%) for whole-body sweat [Cl^-]**

The colorimetric technique measures chloride, but since most of sweat sodium is in the form of sodium chloride (table salt), **we can predict sweat sodium from chloride concentration**.



THIS WORK SIGNIFICANTLY IMPROVES UPON TIME-INTENSIVE AND LABORIOUS CONVENTIONAL SWEAT ANALYSIS METHODS AND DEMONSTRATES VALIDATION IN HUNDREDS OF ATHLETES, NOT ONLY IN A CONTROLLED SETTING BUT ALSO IN COMPETITIVE ATHLETES DURING LIVE ON-FIELD/COURT TRAINING FOR SEVERAL SPORTS (CYCLING, RUNNING, SOCCER, BASKETBALL, TENNIS, LACROSSE, AMERICAN FOOTBALL).

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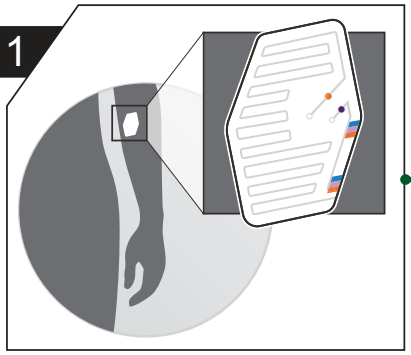
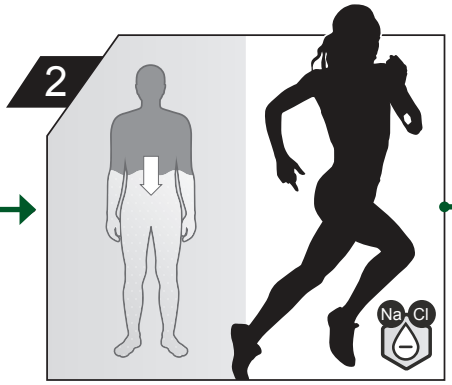
1



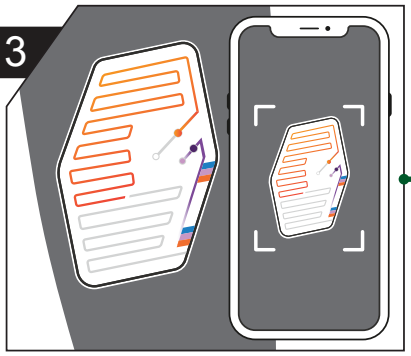
Apply Gx patch to left inner forearm before exercise

2



Athlete loses sweat and electrolytes during exercise

3

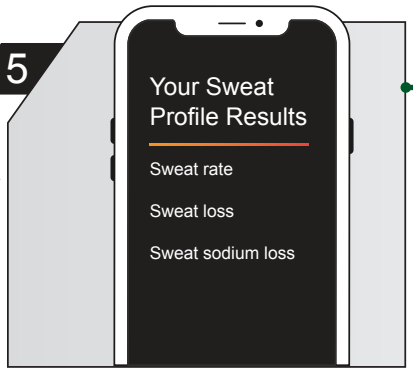


Gx patch image capture with a smartphone after exercise

4

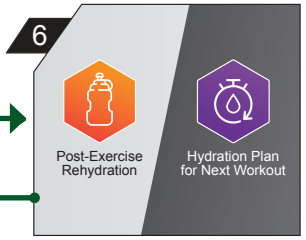
Image analysis and application of algorithms

5



The Gx app displays the athlete's sweat profile

6



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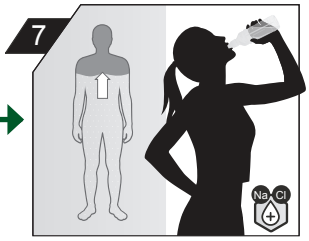

Personalized hydration recommendations for proper rehydration and fluid intake for future exercise sessions

GATORADE.COM/GXSWEATPATCH