

On-demand lactate monitoring towards assessing physiological responses in sedentary populations

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Supplementary information

Biosensor	Substrate	Electrochemical detection technique	Redox mediator	Limit of detection	Reference
Patch sensor with enzyme/Prussian blue polyester thread coated with conductive inks	Thread	Chronoamperometry	✓	3.6mM	[16]
MWCNT modified electrode immobilized with osmium- HRP complex and a bioactive bienzyme gel membrane	Polypropylene	Chronoamperometry	✓	3mM	[18]
Janus textile embedded with gold electrodes	Polyurethane	Differential pulse voltammetry	No	10mM	[21]
MIP imprinted lactate-based Ag nanowire coated carbon electrode	Polyurethane	Differential pulse voltammetry	✓	1.5mM	[19]
Textile biosensor with stretchable gold elastomer fiber electrode	Textile	Chronoamperometry	✓	0.137mM	[17]
CNT based enzyme - TTF mediator modified gold electrode	Flex substrate	Chronoamperometry	✓	1mM	[20]
Hybrid ZnO/gold electrode immobilized with enzyme	Polyamide	Electrochemical impedance spectroscopy	No	1mM	This work

Table S1. The biosensing performances various wearable electrochemical on-body sweat lactate biosensors reported in literature and their sensing techniques.

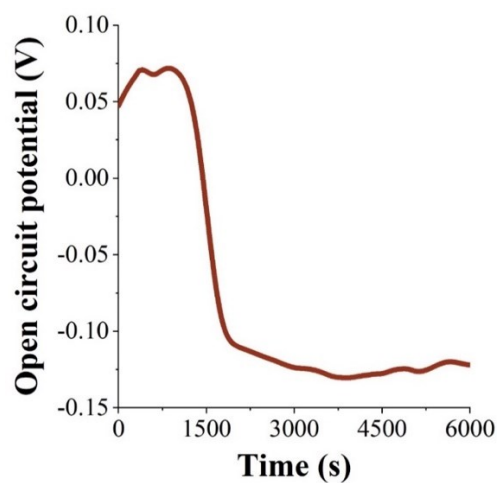


Figure S1a. Open circuit potential of the unfunctionalized Au/ZnO electrodes in PBS

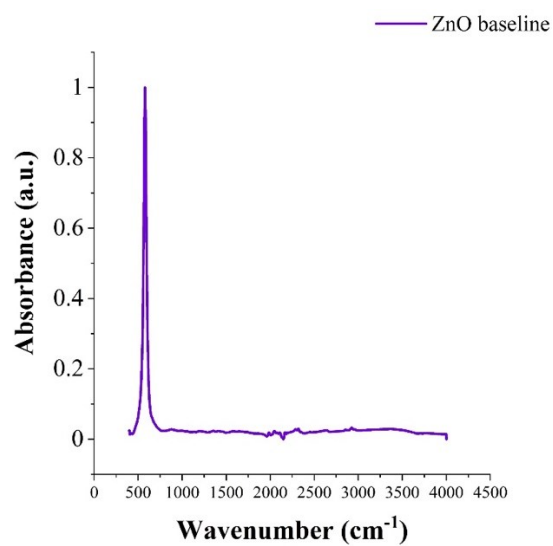


Figure S1b. FTIR peak of the nanotextured ZnO film

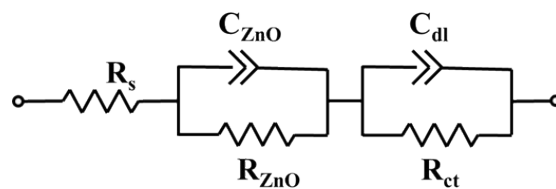


Figure S2. Randle's equivalent circuit modelled for the electrode- sweat interface

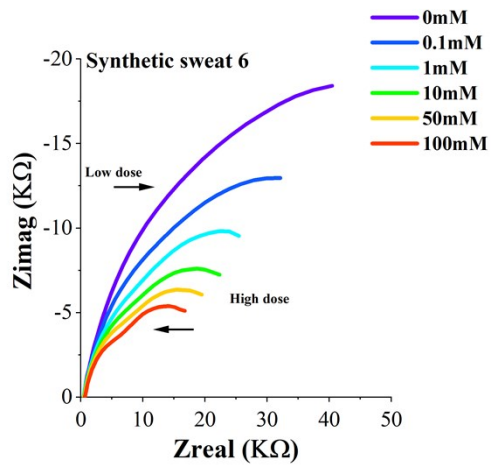


Figure S3a. Nyquist plot for lactate oxidase- lactate interaction for varying lactate dose concentrations in synthetic sweat pH 6

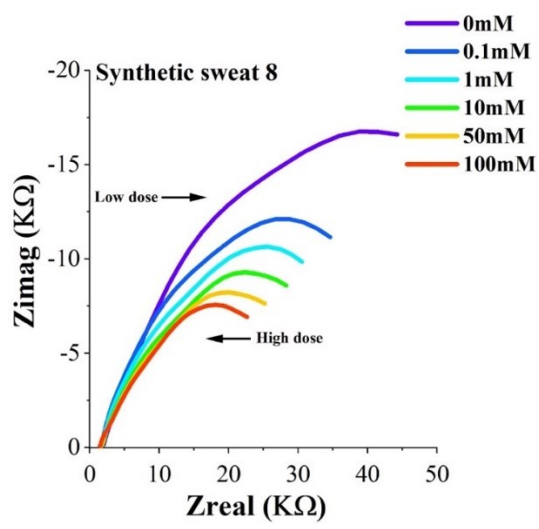


Figure S3b. Nyquist plot for lactate oxidase- lactate interaction for varying lactate dose concentrations in synthetic sweat pH 8

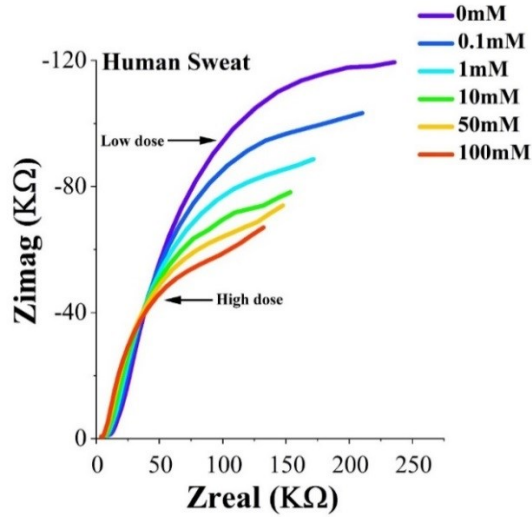


Figure S3c. Nyquist plot for lactate oxidase- lactate interaction for varying lactate dose concentrations in human sweat

Dose	Rct	Cdl	Rzno	Czno
0	40094	2.08E-06	2.08E-06	2.62E-06
0.1	27836	2.73E-06	2.73E-06	2.07E-06
1	20786	2.88E-06	2.88E-06	2.14E-06
10	16961	3.05E-06	3.05E-06	1.75E-06
50	14036	3.64E-06	3.64E-06	1.64E-06
100	11811	5.27E-06	5.27E-06	1.54E-06

Table ST1. Extracted circuit parameters modulated by the lactate oxidase- lactate interaction for varying lactate dose concentrations in synthetic sweat pH 6

Dose	Rct	Cdl	Rzno	Czno
0	38045	2.30E-06	18647	4.90E-06
0.1	22379	2.70E-06	1.05E+04	9.00E-06
1	24706	3.80E-06	13150	3.01E-06
10	19525	4.90E-06	6474	2.65E-06
50	17411	6.10E-06	3763	1.16E-05
100	15609	7.20E-06	1914	9.14E-06

Table ST2. Extracted circuit parameters modulated by the lactate oxidase- lactate interaction for varying lactate dose concentrations in synthetic sweat pH 8

Dose	Rct	Cdl	Rzno	Czno
0	38045	2.30E-06	18647	4.90E-06
0.1	22379	2.70E-06	1.05E+04	9.00E-06

1	24706	3.80E-06	16119	3.01E-06
10	19525	4.90E-06	4740	2.65E-06
50	17411	6.10E-06	3222	1.16E-05
100	15609	7.20E-06	2544	9.14E-06

Table ST3. Extracted circuit parameters modulated by the lactate oxidase- lactate interaction for varying lactate dose concentrations in human sweat

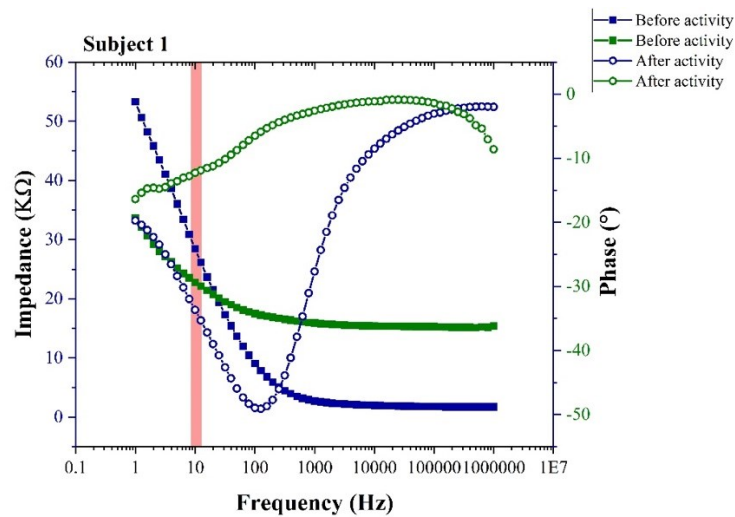


Figure S4a. Bode magnitude and phase plots extracted for subject 1 before and after activity

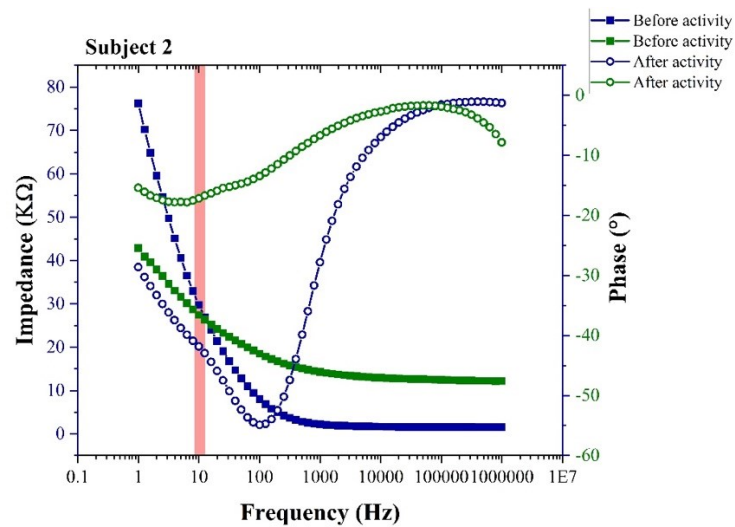


Figure S4b. Bode magnitude and phase plots extracted for subject 2 before and after activity

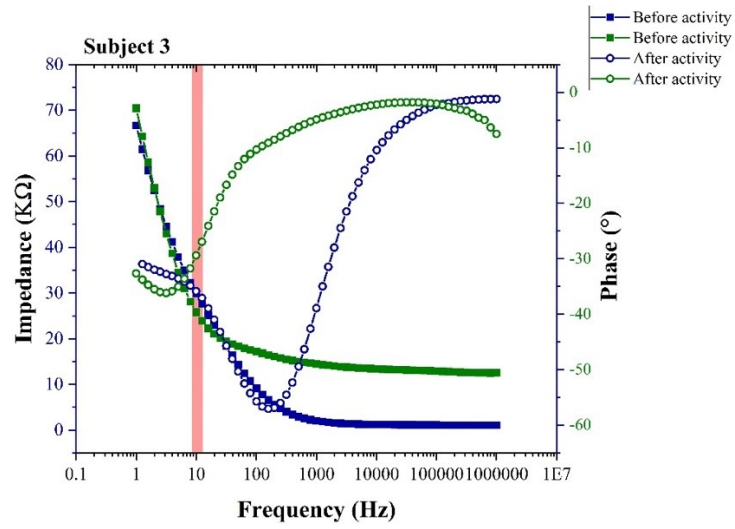


Figure S4c. Bode magnitude and phase plots extracted for subject 3 before and after activity