nature research

Corresponding author(s): Joseph Wang and Sheng Xu

Last updated by author(s): Jan 7, 2021

# Reporting Summary

Nature Research wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Research policies, see our Editorial Policies and the Editorial Policy Checklist.

## Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

| n/a | Confirmed | |
|---|---|---|
| ☐ | ☒ | The exact sample size (*n*) for each experimental group/condition, given as a discrete number and unit of measurement |
| ☐ | ☒ | A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly |
| ☒ | ☐ | The statistical test(s) used AND whether they are one- or two-sided<br>*Only common tests should be described solely by name; describe more complex techniques in the Methods section.* |
| ☐ | ☒ | A description of all covariates tested |
| ☐ | ☒ | A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons |
| ☐ | ☒ | A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals) |
| ☒ | ☐ | For null hypothesis testing, the test statistic (e.g. *F*, *t*, *r*) with confidence intervals, effect sizes, degrees of freedom and *P* value noted<br>*Give P values as exact values whenever suitable.* |
| ☒ | ☐ | For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings |
| ☒ | ☐ | For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes |
| ☒ | ☐ | Estimates of effect sizes (e.g. Cohen's *d*, Pearson's *r*), indicating how they were calculated |

*Our web collection on statistics for biologists contains articles on many of the points above.*

## Software and code

Policy information about availability of computer code

| | |
|---|---|
| Data collection | Acoustic blood pressure data were captured via an Olympus 507 7PR pulser-receiver, and processed via a custom developed program in LabView (National Instrument, TX). All electrochemical characterization and data acquisition were performed with an electrochemical workstation μAutolab III and CHI 1230A. A commercial glucometer (ACCU-CHEK, USA), blood lactate (NOVA biomedical, USA), breathalyzer (BACtrack 580 Pro) and an FDA-approved blood pressure cuff (LOVIA, USA) were used on the subject for obtaining blood glucose, blood lactate, alcohol level, blood pressure and heart rate validation data, respectively. |
| Data analysis | Nova 2.1 software provided by Metrohm and CHI 1230A software provided by CH instrument Inc. were used to analyse the acquired electrochemical data. A custom program developed on LabView to convert acoustic signals to a blood-pressure waveform was used to process the acoustic signal in real-time. The blood-pressure waveform data were analysed in Origin Pro 9. 0 to calculate the heart rate. |

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Research guidelines for submitting code & software for further information.

## Data

Policy information about availability of data

All manuscripts must include a data availability statement. This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A list of figures that have associated raw data
- A description of any restrictions on data availability

All the data generated and analysed during the study are included in the paper and its supplementary information.

# Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☒ Life sciences ☐ Behavioural & social sciences ☐ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see nature.com/documents/nr-reporting-summary-flat.pdf

# Life sciences study design

All studies must disclose on these points even when the disclosure is negative.

| | |
|---|---|
| Sample size | Five consenting subjects, including: one representative subject with a sedentary life style; one representative subject with an active life style; one representative subject caffeine-sensitive (not used to drinking coffee); and two subjects for the alcohol study. All 5 subjects were healthy, and no diabetes, alcoholic or hypertensive patients were recruited. |
| Data exclusions | No data were excluded. |
| Replication | Data acquisition was performed on the different subjects multiple times to verify the functioning of the device. |
| Randomization | The subjects were selected from within the research group, with different self-reported activity levels. |
| Blinding | No blinding measures were taken deliberately, and all data were processed together by multiple authors. |

# Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

## Materials & experimental systems

| n/a | Involved in the study |
|---|---|
| ☒ | ☐ Antibodies |
| ☒ | ☐ Eukaryotic cell lines |
| ☒ | ☐ Palaeontology and archaeology |
| ☒ | ☐ Animals and other organisms |
| ☐ | ☒ Human research participants |
| ☒ | ☐ Clinical data |
| ☒ | ☐ Dual use research of concern |

## Methods

| n/a | Involved in the study |
|---|---|
| ☒ | ☐ ChIP-seq |
| ☒ | ☐ Flow cytometry |
| ☒ | ☐ MRI-based neuroimaging |

## Human research participants

Policy information about studies involving human research participants

| | |
|---|---|
| Population characteristics | Healthy subjects, 20–40 years old. |
| Recruitment | Consenting subjects were recruited from within the research groups. |
| Ethics oversight | The institutional review board at the University of California San Diego. |

Note that full information on the approval of the study protocol must also be provided in the manuscript.