nature portfolio

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Reporting Summary

Nature Portfolio 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 Portfolio 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 *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 *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	All code for this project was written in Python, with reference to the Pandas library for parsing raw data from the FreeStyle Libre device. Apart from functions from this library, the code was written from scratch.
Data analysis	All code for this project was written in Python, with reference to the NumPy library for array manipulation . Apart from functions from this library, the code was written from scratch.

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 Portfolio 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 description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our policy

The continuous glucose monitor data that support the findings of this study are available from the corresponding

author upon reasonable request, with the appropriate IRB approval. This data will be anonymized, and the corresponding diabetes metrics (OGTT, HbA1c, diagnosis if applicable) will be included.

Human research participants

Policy information about studies involving human research participants and Sex and Gender in Research.

Reporting on sex and gender	Gender information was not collected for participants. Biological sex was separated for the analysis performed in the manuscript. Findings apply to both males and females.
Population characteristics	The initial study included 123 individuals (50 females, 73 males) between the ages of 18 and 60 with no prior diagnosis of T2D or prediabetes. At the end of the study, they were diagnosed by a physician as non-diabetic, prediabetic, and T2D (50 females - 29 non-diabetic, 17 prediabetic, 4 T2D & 73 males - 28 non-diabetic, 29 prediabetic, and 26 T2D). In the followup study, subjects were recruited in three cohorts: low-moderate risk (CANRISK = 0-32 points), high and very high risk but not diagnosed with T2D (CANRISK greater than 33 points), and previous diagnosis of T2D who are not treated with any medication. A total of 270 participants between the ages of 18 and 60 were included (111 females, 159 males). Physician diagnosis was not collected in the followup at the end of the study.
Recruitment	Participants were recruited in CRO affiliated hospitals in India. Because recruitment occurred within a healthcare setting, participants may have already had health concerns that brought them in to see their physician.
Ethics oversight	Saanvi Ethical Research LLP, Jasleen Hospitals Ethics Committee, Mavens Institutional Ethics Committee, Moraya Institutional Ethics Committee, and Ontario Tech University's research ethics board

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

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	The initial study described in this paper was determined by tripling the sample size in the pilot study described in "Homeostasis as a proportional–integral control system" by L. van Veen (2020). Sample size of the validation study was established based on budget constraints.
Data exclusions	Data was excluded if the continuous glucose monitor recorded data for less than 10 days. A large difference in the number of positive glucose excursions extracted from the continuous glucose monitor . This was determined in the preliminary stages of the data analysis.
Replication	A successful replication attempt is included in the manuscript on the followup study data (with no doctor's diagnosis). Furthermore, the representative distributions were recalculated by excluding randomly selected individuals with minimal changes in the outcome.
Randomization	Individuals were separated into the two experimental groups (calibration and validation data) based on which study they were recruited into. No randomization was performed to further split individuals. Covariates were controlled through recruitment.
Blinding	Investigators were not blinded for data collection/ analysis. Participant diagnosis and biological sex was necessary to know to create the representative distributions. In the validation set, no diagnosis was known, and HbA1c metrics were only used after analysis to assess accuracy. No intervention was performed on any participants.

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
☐	☒ Clinical data
☒	☐ Dual use research of concern

Methods

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

Clinical data

Policy information about clinical studies

All manuscripts should comply with the ICMJE guidelines for publication of clinical research and a completed CONSORT checklist must be included with all submissions.

Clinical trial registration	Initial study ClinicalTrials.gov Identifier: NCT04529239, followup study CTRI.nic.in Identifier: CTRI/2021/08/035957
Study protocol	https://clinicaltrials.gov/ct2/show/NCT04529239 and http://www.ctri.nic.in/Clinicaltrials/pmaindet2.php?trialid=53861
Data collection	Participants were recruited from 3 sites in India: Datta Meghe Medical College, Mavens Hospital, & Mittal Global Clinical Trial Services. The initial study ran from August 31, 2020 to March 1, 2022. For the followup study, recruitment is still in progress, but participant enrollment began on 30/08/2021.
Outcomes	Primary outcomes were pre-defined to assess individuals' glucose homeostasis response. This measure was assessed using a previously formulated mathematical model for homeostasis.