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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<u>Authors & Referees</u> and the<u>Editorial Policy Checklist</u>.

Statistics

For	all st	tatistical 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.	
X		A description of all covariates tested	
X		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 abou	it <u>availability of computer code</u>
Data collection	We used MTrackJ, a plugin of Fiji for dara collection. Fiji is an open-source platform for biological-image analysis (Nature methods 9(7): 676-682)
Data analysis	Data analysis were performed using Excel (Microsoft(R) Excel for Mac Ver. 16.16.18 (200112)

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/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

We have raw data sets for all figures and can provide for whenever requirement.

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

Life sciences study design

All studies must dis	sclose on these points even when the disclosure is negative.
Sample size	We determined sample size to be more than 250 mitochondria number for any experiments from more than three distinct samples.
Data exclusions	No data were excluded in this study.
Replication	We repeatedly performed experiments more than three times and used distinct samples to verify the repriduciblity of the results in this study.
Randomization	We randamly selected samples in this study for avoiding arbitrary interference.
Blinding	Studies were performed by blinding during data collection with more than two distinct reserchers.

Reporting for specific materials, systems and methods

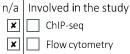
We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section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

Materials & experimental systems

Methods



🗶 🗌 Clinical data



MRI-based neuroimaging