

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 No software was used for data collection

Data analysis
Miinitab v19.0
R v 4.1.0
Microsoft Excel professional 2016

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](#)

This study comprised three parts. A retrospective analysis of data compiled into an international database, a systematic review and an animal study. With respect to the first two, this was a secondary analysis of data that are already published and available in the primary literature. We compiled these data into a database sponsored by the International Atomic Energy Agency (IAEA). The IAEA DLW database is publically accessible and free to access via submission of a data analysis request. Please see www.dlwdatabase.org for the appropriate forms to make a request. As with previous publications from the database the specific data published in the present study will be made available after publication to anyone requesting it, without the need to submit an analysis request for approval. Details of how to make such a request are available on the database website listed above. The data used for the systematic review are available on request to Dr Anura Kurpad, and the mouse data are available on request to dr Matthew Rodeheffer.

Human research participants

Policy information about [studies involving human research participants and Sex and Gender in Research](#).

Reporting on sex and gender

Data were analysed separately based on self reported sex of the participants. In total there were data available for 1672 males and 3127 females for total energy expenditure. For basal and activity energy expenditure we had available 632 measures for males and 800 for females. The option was available for declaration of non-binary gender and other gender types but these options were never selected by the persons submitting the data.

Population characteristics

Adult humans aged > 18 years old of both sexes, free of disease and living in Europe and North America.

Recruitment

Different studies employed different recruitment criteria. This recruitment information was not compiled when the study data were entered into the IAEA DLW database and hence it is not possible to share it. In general however the criteria were to recruit both sexes of adults aged >18 years old, free from obvious disease and not engaged in exceptional physical activity.

Ethics oversight

The component studies were each ethically approved at the component sites where the studies were performed.

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

This was a retrospective analysis of a convenience sample of data compiled across >100 component studies. The data were compiled into the IAEA DLW database. There was no pre-determined sample size because the data were collected before the idea to perform the analysis was formulated. This intention to perform the analysis was pre-registered on the IAEA DLW website.

Data exclusions

Data were excluded from children (aged <18 y), professional and amateur athletes and non-athletes engaged in exceptional physical activities (eg long distance running). Also individuals with identified chronic illness were excluded.

Replication

We found BMR declined over time in the component measures of individuals in the database. Since this was a unique database the finding could not be experimentally replicated. To replicate the finding we surveyed the literature via a registered systematic review (PROSPERO) to assess if the finding was replicated more generally in data pertaining to the USA and Europe dating back to the 1920s. This replication was successful.

Randomization

This was an observational study not an experiment. Accordingly there was no experimental allocation and hence no randomisation involved.

Blinding

There were no group allocations to be blinded against.

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

Animals and other research organisms

Policy information about [studies involving animals](#); [ARRIVE guidelines](#) recommended for reporting animal research, and [Sex and Gender in Research](#)

Laboratory animals	male C57BL/6 mice aged 6 weeks at the start and 10 weeks at the end of the dietary intervention. The housing temperature averaged 21.3 °C and the relative humidity was set at 50% but was not monitored.
Wild animals	No wild animals were used in the study
Reporting on sex	The measurements were only made on males. The aim of this part of the study was to demonstrate only proof of principle that diet differences can impact metabolism.
Field-collected samples	No field collected samples were used in the study
Ethics oversight	Yale University Institutional Animal Care and Use committee (IACUC)

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