

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 Avizo Lite 2020.3.1; Fiji image software v1.53f51 and EPMacroJ plugins; TPSDig2 v2.31

Data analysis Geomorph v4.0.0 for R v. 4.0.3; Statistica software 12 (Statsoft)

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 datasets generated and/or analysed in this article are available from the corresponding author upon reasonable request.

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](https://www.nature.com/documents/nr-reporting-summary-flat.pdf)

Ecological, evolutionary & environmental sciences study design

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

Study description	The article presents a morphological and comparative study of three hominin fossil remains from Chad, including one femoral shaft and two ulnae. The anatomical description of the specimen in a comparative framework is completed by 1) three geometric morphometrics analyses of the femoral shaft curvature and diaphyseal cross-sectional contours; 2) an analysis of the femoral cortical bone thickness, 2D and 3D; 3) an analysis of the cross-sectional geometric properties for the femur and the ulna; 4) an analysis of the femoral trabecular structure; 5) an assessment of the morphological features of the fossil bones in a functional context.
Research sample	The comparative sample comprises specimens of extant (including humans), and extinct hominoids providing a phylogenetically close and functionally diverse assemblage for the analysis of the Chadian material. Selected specimens are all adults, males and females, and only wild caught specimens were selected in osteological collections. Datasets from the literature were referenced in the text and supplementary files.
Sampling strategy	No sample-size calculation was performed. Sample size for extinct hominoids is directly dependent on the available fossil remains (nature and preservation). Relevant post-cranial specimens, when available, were included in our sample. Adult and wild caught specimens were randomly collected in order to approach the fossil sample size. On average, ten specimens represent each taxa, which is relevant for an extant comparative sample considering the nature of the study.
Data collection	Data were collected using microCT scan of the extant and extinct specimen bones, by F.G. and G.D.
Timing and spatial scale	Such information on our study design is not applicable, as some data were already available (microCT scans for some fossils and extant apes) while other have been collected during the 2017-2019 period (microCT scans and morphological observations), as later as 2020 for some specimens (eg Orrorin). As our study concerns osteological material from various institutions (not alive specimens), the temporality and the spatiality does not seem relevant (all apes are either from Africa or Asia from known geographic localities). Once the specimens were collected, all the dataset were collected in one time session per dataset over few weeks respectively.
Data exclusions	No data were excluded from the analyses.
Reproducibility	For landmarking and measurement data, authors (GD and FG) performed blinded sessions independently. All attempts to repeat the experiment were successful. For direct morphological observations, no need to verify the reproducibility as morphological evidences emerged from a consensus between the authors.
Randomization	Such information on our study design is not applicable, specimens belongs to defined taxa (eg a human femur belong to the group Homo sapiens). No need to control for interspecific covariates in the design of our analyses.
Blinding	Not relevant. As specialists, simple observations of the material is sufficient to allocate a specimen to a group.
Did the study involve field work?	☐ Yes ☒ No

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

Specimen provenance	Chad (Toros-Menalla), the Chadian paleontological material collected by the M.P.F.T. is regulated by formal agreement between the Université de N'Djamena, the Centre National de Recherche pour le Développement and the Université de Poitiers (last version of the agreement June 2019).
Specimen deposition	The Chadian postcranial material is curated and conserved by the CNRD (Centre National de Recherche pour le Développement; N'Djamena) in Chad. Access to the Chadian paleontological material collected by the M.P.F.T. is regulated by formal agreement between the Université de N'Djamena, the CNRD and the Université de Poitiers and is available for study upon approval from Chadian authorities. Access to the material for loan and/or study of the material, including original 3D microtomographic data, is available upon request to the CNRD, service de paléontologie, at nekoulnc@yahoo.fr.
Dating methods	Datation of fossils come from previous studies through biochronology and cosmogenic nucleides dating (10Be/9Be).
☒ Tick this box to confirm that the raw and calibrated dates are available in the paper or in Supplementary Information.	
Ethics oversight	No ethical approval or guidance was required. The Chadian paleontological material collected by the M.P.F.T. is regulated by a formal agreement between the Université de N'Djamena, the Centre National Recherche Développement and the Université de Poitiers

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