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Peer review history for:

Neves W, Valota L, Monteiro C. Dental metrics of *S. tchadensis*: A comparative analysis with apes and Plio-Pleistocene hominins. S Afr J Sci. 2024;120(7/8), Art. #16362. https://doi.org/10.17159/sajs.2024/16362

HOW TO CITE:
Dental metrics of *S. tchadensis*: A comparative analysis with apes and Plio-Pleistocene hominins [peer review history]. S Afr J Sci. 2024;120(7/8), Art. #16362.
https://doi.org/10.17159/sajs.2024/16362/peerreview

Reviewer B: Round 1
Date completed: 28 August 2023
Recommendation: Accept / Revisions required / Resubmit for review / **Decline**
Conflicts of interest: None

Does the manuscript fall within the scope of SAJS?
Yes/No
Is the manuscript written in a style suitable for a non-specialist and is it of wider interest than to specialists alone?
Yes/**No**
Does the manuscript contain sufficient novel and significant information to justify publication?
Yes/**No**
Do the Title and Abstract clearly and accurately reflect the content of the manuscript?
Yes/**No**
Is the research problem significant and concisely stated?
Yes/**No**
Are the methods described comprehensively?
Yes/No
Is the statistical treatment appropriate?
Yes/**No**/Not applicable/Not qualified to judge
Are the interpretations and conclusions justified by the research results?
Yes/Partly/**No**
Please rate the manuscript on overall contribution to the field
Excellent/Good/Average/Below average/**Poor**
Please rate the manuscript on language, grammar and tone
Excellent/Good/Average/**Below average**/Poor
Is the manuscript succinct and free of repetition and redundancies?
Yes/**No**
Are the results and discussion confined to relevance to the objective(s)?
Yes/**No**
The number of tables in the manuscript is
Too few/**Adequate**/Too many/Not applicable
The number of figures in the manuscript is
Too few/Adequate/Too many/Not applicable
Is the supplementary material relevant and separated appropriately from the main document?
Yes/No/**Not applicable**
Please rate the manuscript on overall quality
Excellent/Good/Average/Below average/**Poor**

Is appropriate and adequate reference made to other work in the field?
Yes/**No**
Is it stated that ethical approval was granted by an institutional ethics committee for studies involving human subjects and non-human vertebrates?
Yes/No/**Not applicable**
If accepted, would you recommend that the article receives priority publication?
Yes/**No**
Are you willing to review a revision of this manuscript?
Yes/**No**
Select a recommendation:
Accept / Revisions required / Resubmit for review / **Decline**
With regard to our policy on 'Publishing peer review reports', do you give us permission to publish your anonymised peer review report alongside the authors' response, as a supplementary file to the published article? Publication is voluntary and only with permission from both yourself and the author.
Yes/No

Comments to the Author:

The paper submitted to SAJS on the dental metrics of Sahelanthropus tchadensis is aimed at supporting the hypothesis that it is a bipedal hominin. The authors state that they employ multivariate statistics to compare the posterior dentition of S. tchadensis to those of Plio-Pleistocene hominids, yet the only measurements given are the mesio-distal length and bucco-lingual breadth (sometimes spelled buco-lingual) of the upper cheek teeth. Thus the word 'bivariate' would be more appropriate than 'multivariate'.

Apart from that, the approach employed ignores the dentition of African apes. The authors are recommended to include Gorilla and Pan in the analysis. As such the omission welcomes the conclusion that the Chadian species is a hominin, since the comparison is made only with hominins, thereby guaranteeing the desired conclusion. Detailed morphological comparisons with images of the teeth are essential for this kind of paper. Metrics on their own are seldom convincing.

Several papers published by various authors concerning the 'ape' status of Sahelanthopus have been omitted from consideration. A recently published paper (which the authors wouldn't have known about) reaches the conclusion that Sahelanthropus is not a hominin but a 'stem' hominid (note that the authors of the article (Sevim-Erol et al. 2023) include apes such as Sivapithecus and Pongo in the stem Hominidae).

There are also several uncited papers that have challenged the 7 Ma age of Sahelanthropus, which is far from being secure, despite the essays to bolster the 'faunal' dates using Beryllium isotope studies. According to the literature, faunas from the Toros Menalla outcrops range in age from ca 10 Ma to ca 4 Ma, with some sites yielding mixed faunas. The type site of Sahelanthropus in one such locality.

The authors mention that there are six to nine individuals now known of Sahelanthropus. A complete list of specimens would be useful for the paper, along with images of the specimens.

Figure 1 of the authors would be easier to understand if it were presented as a bivariate length/breadth diagrams of each tooth position, rather than as « morphospace defined by PC1xPC2 ». Given that the data in this paper are bivariate, the employment of principal component analyses seems excessive.

Author response to Reviewer B: Round 1

The authors state that they employ multivariate statistics to compare the posterior dentition of S. tchadensis to those of Plio-Pleistocene hominids, yet the only measurements given are the mesio-distal length and bucco-lingual breadth (sometimes spelled buco-lingual) of the upper cheek teeth. Thus the word 'bivariate' would be more appropriate than 'multivariate'.

AUTHORS: We disagree that the word "bivariate" would be more appropriate than "multivariate". Although only two measurements are provided for each dental piece, these two measurements were applied to five teeth (pre-molars and molars), totalizing, consequently, ten variables. Instead of approaching mesio-distal length and bucco-lingual breadth individually, by tooth, we approached them all together. In our opinion, this provided a much more synthetic view of the posterior dental size of each species treated in our study.

Apart from that, the approach employed ignores the dentition of African apes. The authors are recommended to include Gorilla and Pan in the analysis. As such the omission welcomes the conclusion that the Chadian species is a hominin, since the comparison is made only with hominins, thereby guaranteeing the desired conclusion. Detailed morphological comparisons with images of the teeth are essential for this kind of paper. Metrics on their own are seldom convincing.

AUTHORS: a.Dental metrics of *Pan troglodytes* were added to the analysis, as required. As can be seen in the morphospace defined by PC1 and PC2, the inclusion of an ape species does not change the position of *S. tchadensis* in the plot, reinforcing our original conclusion that this species is much more integrated to hominins than to apes.

b."Detailed morphological comparisons with images of the teeth are essential for this kind of paper". We completely disagree with the reviewer regarding this statement for several reasons: 1.In the title of the manuscript it is clearly stated that we will deal only with metric traits; 2.One of the reasons for our option is that detailed anatomical descriptions and comparisons of *S. tchadensis* dentition have already been carried out in previous papers by different authors, such as Brunet et al. (2002), Brunet et al. (2004), Beauvilain and Le Guellec (2004), Zollikofer et al. (2005) and Brunet et al. (2005); 3.We do not have access to the original fossils incorporated in the study. As explicitly shown in Table 1, where the sources of the measurements are listed, we worked based on secondary data, which is a legitimate practice in Paleoanthropology. 4.Last, but not least, even if we had access to the original fossils, the inclusion of detailed morphological comparisons in the manuscript would extrapolate the number of words permitted by the journal for a Research Letter.

c.We also partially disagree with the reviewer that "Metrics on their own are seldom convincing". We state clearly in our conclusions that the size of the dentition of S. tchadensis REINFORCES its proposed hominin status. Our study is just one additional evidence in this direction. Not the final word about it!

Several papers published by various authors concerning the 'ape' status of Sahelanthopus have been omitted from consideration. A recently published paper (which the authors wouldn't have known about) reaches the conclusion that Sahelanthropus is not a hominin but a 'stem' hominid (note that the authors of the article (Sevim-Erol et al. 2023) include apes such as Sivapithecus and Pongo in the stem Hominidae).

AUTHORS: We have added the recent contribution of Sevim-Erol et al. (2023) in our manuscript, and we thank the referee for calling our attention to this study.

There are also several uncited papers that have challenged the 7 Ma age of Sahelanthropus, which is far from being secure, despite the essays to bolster the 'faunal' dates using Beryllium isotope studies. According to the literature, faunas from the Toros Menalla outcrops range in age from ca 10 Ma to ca 4 Ma, with some sites yielding mixed faunas. The type site of Sahelanthropus in one such locality.

AUTHORS: "According to the literature faunas from the Torus Menalla outcrops range in age from ca10 Ma to ca4Ma, with some sites yielding mixed faunas". We were unable to find the pertinent literature supporting this statement of the reviewer. However, if he sends us the references, we will be glad to incorporate the subject in our manuscript. On the other hand, the dating of the site by Cosmogenic Beryllium is, in our opinion, a very reliable method to confirm the late Miocene date of S.tchadensis.

The authors mention that there are six to nine individuals now known of Sahelanthropus. A complete list of specimens would be useful for the paper, along with images of the specimens.

AUTHORS: We don´t think that adding details (including photos) of the six to nine specimens known for *S. tchadensis* in our manuscript would be of paramount importance, since we used data from only the two most complete individuals. These are listed in Table 1. Images are impossible for us, since we do not have access to or photos of these specimens. Besides that, adding new figures to the manuscript would extrapolate the space given by the journal for Research Letters.

Figure 1 of the authors would be easier to understand if it were presented as a bivariate length/breadth diagrams of each tooth position, rather than as « morphospace defined by PC1xPC2 ». Given that the data in this paper are bivariate, the employment of principal component analyses seems excessive.

AUTHORS: Already answered above in item 1. We really do not agree that the employment of principal component analysis seems excessive.

Reviewer F: Round 1
Date completed: 21 August 2023
Recommendation: Accept / Revisions required / Resubmit for review / Decline
Conflicts of interest: None

Does the manuscript fall within the scope of SAJS?
Yes/No
Is the manuscript written in a style suitable for a non-specialist and is it of wider interest than to specialists alone?
Yes/No
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Yes/No
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Yes/No
Are the methods described comprehensively?
Yes/No
Is the statistical treatment appropriate?
Yes/No/Not applicable/Not qualified to judge
Are the interpretations and conclusions justified by the research results?
Yes/Partly/No
Please rate the manuscript on overall contribution to the field
Excellent/**Good**/Average/Below average/Poor
Please rate the manuscript on language, grammar and tone
Excellent/Good/Average/Below average/Poor
Is the manuscript succinct and free of repetition and redundancies?
Yes/No
Are the results and discussion confined to relevance to the objective(s)?
Yes/No
The number of tables in the manuscript is
Too few/**Adequate**/Too many/Not applicable
The number of figures in the manuscript is
Too few/**Adequate**/Too many/Not applicable
Is the supplementary material relevant and separated appropriately from the main document?
Yes/No/**Not applicable**
Please rate the manuscript on overall quality
Excellent/Good/Average/Below average/Poor
Is appropriate and adequate reference made to other work in the field?
Yes/No
Is it stated that ethical approval was granted by an institutional ethics committee for studies involving human subjects and non-human vertebrates?
Yes/No/**Not applicable**
If accepted, would you recommend that the article receives priority publication?
Yes/No
Are you willing to review a revision of this manuscript?
Yes/No
Select a recommendation:
Accept / Revisions required / Resubmit for review / Decline
With regard to our policy on 'Publishing peer review reports', do you give us permission to publish your anonymised peer review report alongside the authors' response, as a supplementary file to the published article? Publication is voluntary and only with permission from both yourself and the author.

Yes/No

Comments to the Author:

This is a useful and well executed paper. Sahelanthropus teeth should be make more visible in the graph - red dots disapper ampong other dots. Maybe larger dots or asterisks ? Your finding that Sahelanthropus teeth are fairly small explains in a way its small cranial capacity. The entire organism of Sahelanthropus may have been smaller than other hominins. Hominins show the trend of incereasing body size in parallel with brain size that ends by the end of the Pleistocene. Sahelanthropus fits well into the extrapolation of these trends into 6-7 Ma ago. Reductioin of tooth size in hominins, especially during the Pleistoicene has been expained by the extraoral food processing (tools + cooking). Do you think this explanation can be valid for 6-7 Ma ?

Author response to Reviewer F: Round 1

This is a useful and well executed paper. Sahelanthropus teeth should be make more visible in the graph - red dots disapper ampong other dots. Maybe larger dots or asterisks ? Your finding that Sahelanthropus teeth are fairly small explains in a way its small cranial capacity. The entire organism of Sahelanthropus may have been smaller than other hominins. Hominins show the trend of incereasing body size in parallel with brain size that ends by the end of the Pleistocene. Sahelanthropus fits well into the extrapolation of these trends into 6-7 Ma ago. Reductioin of tooth size in hominins, especially during the Pleistoicene has been expained by the extraoral food processing (tools + cooking). Do you think this explanation can be valid for 6-7 Ma ?

AUTHORS: As to referee F, we made the teeth of S. tchadensis more visible in the graph, and by 6-7 Ma there was not any evidence of tools + cooking as he/she should know. In other words, this is not an issue.

Author response: Other additions

The evaluations of both reviewers are strikingly different. While reviewer F evaluated very positively our contribution to the subject, Reviewer B raised a series of deficiencies in our manuscript. Some of these deficiencies were tentatively corrected and incorporated in the new version of the manuscript. However, others were not incorporated in the new version, for two reasons: space limitations imposed by the journal itself, and simply because part of them is out of the scope of our contribution. We want to remind you that we submitted our manuscript as a Research Letter.

Reviewer I: Round 2
Date completed: 7 March 2024
Recommendation: Accept / Revisions required / **Resubmit for review** / Decline
Conflicts of interest: None

Does the manuscript fall within the scope of SAJS?

Yes/No

Is the manuscript written in a style suitable for a non-specialist and is it of wider interest than to specialists alone?

Yes/No

Does the manuscript contain sufficient novel and significant information to justify publication?

Yes/No

Do the Title and Abstract clearly and accurately reflect the content of the manuscript?

Yes/**No**

Is the research problem significant and concisely stated?

Yes/No

Are the methods described comprehensively?

Yes/**No**

Is the statistical treatment appropriate?

Yes/No/Not applicable/Not qualified to judge	

Are the interpretations and conclusions justified by the research results?

Yes/**Partly**/No

Please rate the manuscript on overall contribution to the field

Excellent/**Good**/Average/Below average/Poor

Please rate the manuscript on language, grammar and tone

Excellent/**Good**/Average/Below average/Poor

Is the manuscript succinct and free of repetition and redundancies?

Yes/No

Are the results and discussion confined to relevance to the objective(s)?

Yes/No

The number of tables in the manuscript is

Too few/**Adequate**/Too many/Not applicable

The number of figures in the manuscript is

Too few/**Adequate**/Too many/Not applicable

Is the supplementary material relevant and separated appropriately from the main document?

Yes/No/**Not applicable**

Please rate the manuscript on overall quality

Excellent/**Good**/Average/Below average/Poor

Is appropriate and adequate reference made to other work in the field?

Yes/No

Is it stated that ethical approval was granted by an institutional ethics committee for studies involving human subjects and non-human vertebrates?

Yes/No/**Not applicable**

If accepted, would you recommend that the article receives priority publication?

Yes/No

Are you willing to review a revision of this manuscript?

Yes/No

Select a recommendation:

Accept / Revisions required / **Resubmit for review** / Decline

With regard to our policy on 'Publishing peer review reports', do you give us permission to publish your anonymised peer review report alongside the authors' response, as a supplementary file to the published article? Publication is voluntary and only with permission from both yourself and the author.

Yes/No

Comments to the Author:

General comments

This interesting study aims to test the taxonomic status of the earliest potential hominin ever known, Sahelanthropus, by comparing published dental data from a wide sample of hominins (both fossil and extant) and chimpanzees. The interests of such an analysis are potentially numerous in the fields of palaeoanthropology and evolutionary sciences in general: one of the most promising perspective being a better understanding of the evolutionary steps that led to the emergence of the human clade. In this respect, most readers of SAJS who are interested in evolution and past diversity should be interested in this work. The main originality of the study consists in presenting for the first time a comparative dental analysis based on a comprehensive sample of hominins and chimpanzees using multivariate analyses.

However, the authors need to specify their hypotheses/evolutionary questions and how these hypotheses established from teeth morphology can be related to the debate on the hominin status of Sahelanthropus. Also, one of the interpretations mentioned at the end of the paper describes possible affinities between Sahelanthropus (teeth?) with Miocene apes. But if the authors wish to support this opinion, they need to demonstrate this using appropriate data. That's why I miss comparative data representing miocene taxa. Besides, dental remains ascribed to the other Miocene hominin (Orrorin) have been published (Senut et al., 2018) and should be included as well. Including such comparative data could be of importance and help make a more convincing case. Lastly, I also miss a representation of chimpanzee variation (including bonobos, that are surprisingly absent). As it stands, the PCA only figures average individuals for both chimpanzee species whereas I was expecting to have points for each 278 individuals, rather than two average point for male and females, which is not particularly informative/conclusive. This is crucial since the present study aims at providing a better representation of the morphological affinities of Sahelanthropus. Lastly, the discussion and general interpretations need a bit more justification how their resultats and the derived morphology in Sahelanthropus is in line with other cranial and poscranial traits.

To sum up, I think that the authors should make a choice here. Either the hypothesis of a “Miocene hominid affinities” is deemed acceptable in scientific terms (=for a hypothesis testing), then the authors should include such fossil comparative data in their analysis. On the opposite, they could chose to discard that hypothesis, their comparative approach as its stands can only support hominin affinities for Sahelanthropus anyway. Whatever their decision, the manuscript as it stands cannot be acceptable for publication and needs to be resubmitted.

All the above-mentioned remarks are detailed below and associated with additional comments.

<u>Keywords</u>
I recommend that the authors use more general terms such as “human evolution” and/or “teeth” rather than the access number of a cranium that only represents one of the dozen of teeth ascribed to Sahelanthropus.

<u>Abstract</u>
The abstract fails to mention the alternative hypothesis underlined by the authors at the end of their manuscript, namely, the hypothesis that Sahelanthropus share hominid-like affinitie**s** rather than hominins.

<u>Significance</u>
Line -19-20: the authors wrote “he” which is inappropriate here.

<u>Introduction</u>
Line 36: indeed the dates have been precised later in Lebatard et al., 2008, 2010 but these analyses led to new dates.

Line 45: Since the hypodigm is represented by a dozen of specimens including a small dozen of preserved postcanine teeth (with published usable metrics), I think the authors should mention accurately how many postcanine teeth metrics are available for study in comparison. In addition, I miss a comprehensive discussion focused on authors’ hypotheses and centered on postcanine teeth. In short, what hypotheses can be posited and how they can be related to the debate on the hominin status of Sahelanthropus. This is central in their introduction in my opinion.

Line: 57 I miss references here. the authors talk about the debate around the foramen magnum position but fail to mention the references that support one interpretation or the alternative hypothesis. They also should describe the orientation of the foramen, which has been described as a diagnostic trait as well.

Line 62: the authors mentioned that “the derived characters observed in this species are associated to primitive ape conditions, like the size and number of the teeth roots, and a small neurocranium". But is it true for all the traits mentioned above? References are still lacking here.

Lastly, the authors do not report on the unique combination of traits that have been initially put forth by Brunet’s team as it is usually the case in palaeoanthropology.

<u>Material and Methods</u>
Why do the authors did not include all well-preserved postcanine teeth? As an example, TM 266-01-447 is complete enough and dimensions have been published in Brunet et al., 2002.

Line 99 The authors should explain how they proceed precisely to manage the missing values in Sahelanthropus, they mentioned they used multiple regression but can they be more specific?

Overall, why chimpanzees are only represented by mean individuals rather than a scatter plot representing the 278 individuals, this is crucial here since PCA aims at exploring variation and potential affinities for chimpanzees and Sahelanthropus cannot be assessed as it stands.

<u>Results and Discussion</u>
The authors say "In terms of dental metrics, not much has been explored so far" but they wrote before Line 7 in the introduction that "much has been said about the dentition of S. tchadensis. These statements need to be explained, it does not make sense to me.

Line 128: the authors write "In this study we contribute to the understanding of this aspect of the paleobiology" but they do not discuss the paleobiology of Sahelanthropus, just their morphological affinities. This needs to be corrected.

Line 133: in the discussion the authors mention: "Our results indicate that the posterior dentition of the Chadian material fits the range of dental variation of our most remote ancestors, reinforcing but not necessarily proving, its hominin status". If the present study does not enable to provide new evidences susceptible to confirm or invalidate the hominin status of Sahelanthropus, one could consider the interest of such a study particularly moot.

Line 140 the authors argues that the derived teeth morphology of Sahelanthropus as demonstrated in their study is in line with other derived traits of the cranium and postcranium but they said in the introduction that's all these features are debated. They should explain why cranial and postcranial features seem to illustrated a derived condition contrary to what others said.

Author response to Reviewer I: Round 2

The authors should specify their hypothesis, and also the evolutionary questions in the Introduction

AUTHOR: Our work is an exploratory analysis and accordingly it does not depart from any specific hypothesis. In other words, we do not depart from any specific model. Although exploratory analysis is currently seen as a second class of inquiry in Science in general, we still think they can provide excellent information for future studies, mainly when a comprehensive data bank feeds the analyses.

Suggestion in the final paragraph of the text of a possible affinity of Sahelanthropus with Miocene apes. "But if the authors wish to support this opinion, they need to demonstrate it...."

AUTHOR: In no moment we explore the relationship between *Sahelanthropus* and Miocene apes. This is a proposal of Sevim Erol et al (2023), not ours, as it is stated in the final paragraph of the text.

To use the individual values for Chimpanzees, not only their means, and to include Bonobos and *O. tugenensis*.

AUTHOR: Unfortunately, the data obtained from the literature was provided in mean values, and the article does not inform the individual values, otherwise, we would have included so.
We also could not include bonobos because there is little data associated with the group available.
We included *O. tugenensis* in the study, but, since its specimens comprehend a few singular dental pieces assigned to different individuals, the species does not present at least 40% of the variables present. Taking this into account, the "individual" of *O. tugenensis* included in the analysis is a compilation of different individuals in one.

"The discussion and general interpretations need a bit more justification as to how their resultats and the derived morphology in *Sahelanthropus* is in line with other cranial and poscranial traits".

AUTHOR: The suggestion is incorporated in the introduction, and cites every derived traits associated to *S. tchadensis*. However, we had to be very short, because we are already approaching the word limits for a Reseach Letter, as emphasized by the editor.

Introduction

AUTHOR: The stratigraphic unit in where *S. tchadensis* specimens were found (TM) comprehend a dating of 6-7Ma, according to Lebatard et al., 2008 e 2010.
Also, the number of specimens used in the study is stated in Table 2, and the number of dental metrics in Table SM1.

Material and methods

AUTHOR: Our work is restrained to individuals with, at least, 40% of measurements present, i.e., at least three teeth. Considering this, we could not include specimens such as TM-266-01-447, since it represents just one tooth.

Author response: Other additions

The other suggestions were accepted and are modified in the main document.