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OPEN PEER REVIEW

Taekwondo-Based Core Stability Exercises Improve Functional Movement Screen Scores and Lumbar Sagittal Curvature in Individuals with Hyperlordosis: A Quasi-Experimental Study

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About this report

This open peer review (OPR) report shows the public comments made on this article during peer review, by the reviewers, the associate editor and the editor-in-chief, for every revision round, together with the authors' replies. Comments appear only with the consent of the people who wrote them. Reviewers who chose to sign their report are named; the others are shown as "Referee". Comments are edited for language only, and confidential remarks to the editors are not included.

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1 Original submission

4 comments · 6 May 2026 – 6 May 2026

Referee 1 Reviewer

MAJOR REVISION 6 May 2026

Dear Authors,

We have reviewed the manuscript, and the comments below provide the additional scientific reviewer points that have not already been raised in the editorial-screening assessment. The major comments address substantive methodological, reporting, and interpretability issues, whereas the minor comments address clarity, presentation, language, and reference currency.

The manuscript evaluates whether an 8-week taekwondo-based core stability exercise program improves lumbar lordosis angle and Functional Movement Screen scores in young men with lumbar hyperlordosis. The study uses a quasi-experimental pre-post design with an experimental group and a control group, measuring lumbar curvature with a Spinal Mouse device and movement patterns with the FMS. The topic is relevant to rehabilitation practice because it links sport-specific corrective exercise with functional movement and postural outcomes.

The manuscript has several strengths. The research question is clinically relevant to musculoskeletal rehabilitation, the intervention is described with progression across the 8-week program, and the selected outcomes are directly related to posture and functional movement. The manuscript also acknowledges important limitations, including lack of randomization, small sample size, convenience sampling, and restricted participant characteristics.

Major Comments:

1. Allocation process and risk of selection bias (TREND: assignment method, unit of assignment, and baseline comparability):

> *The manuscript states that participants were recruited by convenience sampling and divided into experimental and control groups, but it does not explain how participants were assigned to each group or whether allocation was based on preference, availability, investigator decision, or another procedure (source: Material and Methods, Study participants). This is central to a TREND-based nonrandomized intervention report because the validity of between-group comparisons depends on understanding the mechanism of allocation and the resulting risk of selection bias. Author to-do list:*
>
> ** Describe the exact procedure used to allocate participants to the experimental and control groups (source: Material and Methods, Study participants).*
> ** State whether allocation was performed before or after baseline assessment (source: Material and Methods, Procedure).*
> ** Explain whether any participant preference, investigator judgment, scheduling constraint, or institutional factor influenced group assignment (source: Material and Methods, Study participants).*
> ** Add a short discussion of how nonrandom allocation may have affected internal validity (source: Study limitations).*

2. Intervention fidelity, adherence, and control-condition monitoring (TREND: intervention details, exposure quantity, and implementation fidelity):

> *The intervention is described by exercise type, frequency, duration, and progression, but the manuscript does not report participant attendance, adherence, missed sessions, fidelity checks, adverse events, or whether the control group's usual activities were monitored during the 8-week period (source: Intervention; Procedure). Without these details, it is difficult to determine whether the observed effects reflect the intended taekwondo-based CSE exposure or uncontrolled*

differences in activity during follow-up.
Author to-do list:

** Report attendance and adherence for the experimental group, including missed sessions, if any (source: Intervention).*
** State whether the coach or researcher used a fidelity checklist or other method to ensure consistent exercise delivery (source: Intervention).*
** Report whether adverse events, pain, or exercise-related discomfort were monitored during the program (source: Intervention).*
** Clarify how the control group's usual daily activities were monitored or documented during the study period (source: Procedure).*

3. Outcome measurement blinding and measurement reproducibility (TREND: outcome assessment and bias reduction):

The manuscript provides procedural details for Spinal Mouse and FMS assessment, but it does not state whether the assessor was blinded to group allocation or test phase, whether the same assessor performed all pre-test and post-test measurements, or whether repeated measurements were averaged (source: Measurement, Assessment of hyperlordosis; Measurement, FMS assessment protocol). Because the outcomes involve examiner handling and observational scoring, assessor blinding and measurement reproducibility are important for reducing detection bias.
Author to-do list:

** State whether the outcome assessor was blinded to group allocation during post-test assessment (source: Measurement).*
** Clarify whether the same examiner assessed all participants at pre-test and post-test (source: Measurement).*
** Report whether each outcome was measured once or repeated and averaged (source: Measurement, Assessment of hyperlordosis).*
** Describe any training or calibration procedure used for FMS scoring consistency (source: Measurement, FMS assessment protocol).*

4. Statistical reporting requires fuller ANCOVA detail (TREND: statistical methods and adjusted estimates):

The manuscript states that ANCOVA was used and reports F values, partial eta squared, mean squares, and P values, but it does not specify the covariates included in each ANCOVA model, whether assumptions such as homogeneity of regression slopes were assessed, or whether adjusted post-intervention group means and confidence intervals were calculated (source: Statistical analysis; Table 3). This limits reproducibility and makes the magnitude and precision of the intervention effect difficult to interpret.
Author to-do list:

** Specify the covariate structure of each ANCOVA model, including whether baseline values were entered as covariates (source: Statistical analysis).*
** Report whether ANCOVA assumptions were tested and met, including homogeneity of regression slopes (source: Statistical analysis).*
** Provide adjusted post-test mean differences with 95% confidence intervals for each outcome (source: Table 3).*
** Clarify whether any correction for multiple outcome testing was considered, given the number of FMS components analyzed (source: Table 3).*

5. Interpretation of causality and clinical meaningfulness should be moderated (TREND: interpretation, limitations, and generalizability):

The results are statistically significant across all FMS components and lumbar lordosis angle, but the manuscript's causal wording should remain cautious because the study is nonrandomized, small, single-center, and limited to young

male participants (source: Results; Study limitations; Conclusion). In addition, the manuscript does not explain whether the observed changes, particularly in lordosis angle and FMS component scores, exceed clinically meaningful thresholds.
Author to-do list:

** Revise causal statements so they consistently reflect a quasi-experimental association rather than confirmed efficacy (source: Discussion; Conclusion).*
** Discuss whether the magnitude of lordosis angle change is clinically meaningful, not only statistically significant (source: Table 3; Results).*
** Discuss whether changes in individual FMS component scores represent meaningful functional improvement (source: Table 3; Results).*
** Limit generalization to populations similar to the study sample unless supported by additional evidence (source: Study participants; Study limitations).*

Minor Comments:

1. Tables and figures:

The manuscript contains 3 tables and 1 figure/image. Table 1, Table 2, and Table 3 are explicitly referred to in the main text, and Figure 1 is also explicitly cited in the intervention section (source: Intervention; Results; Tables 1-3; Figure 1). Please ensure that table titles, abbreviations, measurement units, and footnotes are formatted consistently; for example, Table 3 should define all abbreviations and clarify whether the displayed post-test values are raw or adjusted means (source: Table 3).

2. Early-stage editorial and language red flags:

Several sentences require language polishing for precision and readability. "The study population comprises male individuals" should be revised to "The study population comprised male individuals" because the methods describe completed work (source: Material and Methods, Study participants). "At first, for ethical considerations based on the Declaration of Helsinki, all stages of the study were informed to the subjects" should be revised to "Before participation, all study procedures were explained to the participants in accordance with the Declaration of Helsinki" because the current wording is unidiomatic (source: Material and Methods, Study participants). "At the end of the measurement, the examiner stopped the recording" could be revised to "After completing the measurement, the examiner stopped the recording" for smoother procedural wording (source: Measurement, Assessment of hyperlordosis). "It can be interpreted that a training regimen…" should be revised to "These findings suggest that a training regimen…" because the current phrasing is indirect and less academic (source: Discussion).

3. Terminology and abbreviation consistency:

The manuscript uses "core stability exercises," "CSE," "taekwondo-based CSE," and "NASM-based Core Stability Training Using Taekwondo Movements" in closely related contexts, but terminology should be kept uniform throughout the abstract, methods, intervention, discussion, and conclusion (source: Abstract; Intervention; Discussion). Please define each abbreviation at first use and use one preferred term consistently thereafter.

4. Reference currency:

Several references were published before 2010, including older biomechanical, measurement, and exercise-science sources such as references from 1966, 1995, 2003, 2005, 2006, 2007, and 2008 (source: References 3-5, 11-15, 29-31, 54). Please review these older citations and replace them with more recent, directly relevant sources where appropriate, while retaining genuinely seminal references only when their continued use is justified.

5. Reference and citation presentation:

> *The reference list mixes entries with complete DOI/PMID information and entries without identifier information, and several journal titles and citation details appear inconsistently formatted (source: References). Please standardize the reference style, ensure that each cited source follows the journal's required format, and add DOI or PMID information when available.*

6. Table 3 presentation clarity:

> *Table 3 includes F, ηp^2, mean square, and P values, but the layout makes it difficult to determine whether each statistic corresponds to the group effect after baseline adjustment or another model term (source: Table 3). Please revise the table header or footnote to identify the tested effect and the role of baseline adjustment clearly.*

Best regards,
Scientific Reviewer

Referee 2 Reviewer

MAJOR REVISION 6 May 2026

Dear Authors,

Thank you for submitting your manuscript to the journal. Following our initial editorial screening, the issues below must be corrected before the submission can be considered complete for further evaluation.

Please note that references are very important for publication, and all cited sources must include a DOI/PMID when one is supplied, be cited appropriately in the manuscript text, and be suitable for the journal.

2-1- Study period is not reported:

* What the author wrote: The manuscript reports the study setting and participant characteristics but does not report the recruitment period, intervention dates, or assessment period. (source: Material and Methods, Study participants; Procedure)
* Why correction is required: This must be corrected because the manuscript is not fully evaluable without a clear study timeline for recruitment, intervention delivery, and outcome assessment. (source: Material and Methods)
* To do: Provide the calendar period for recruitment, baseline assessment, intervention delivery, and post-test assessment. (source: Material and Methods)

2-2- Allocation procedure is insufficiently described:

* What the author wrote: The manuscript states that participants were selected using convenience sampling and divided into experimental and control groups but does not clarify the exact allocation procedure. (source: Study participants)
* Why correction is required: This must be corrected because the manuscript is not fully evaluable without knowing how group assignment occurred in a nonrandomized intervention study. (source: Study participants)
* To do: Clarify how participants were assigned to the experimental and control groups and whether allocation occurred before or after baseline assessment. (source: Study participants; Procedure)

2-3- Intervention adherence and fidelity are not reported:

* What the author wrote: The manuscript reports the taekwondo-based CSE program but does not report attendance, adherence, missed sessions, fidelity checks, or adverse-event monitoring. (source: Intervention; Table 1)
* Why correction is required: This must be corrected because the manuscript is not fully evaluable without information on whether participants received the intended intervention safely and consistently. (source:

Intervention)
* To do: Provide adherence, attendance, fidelity-monitoring, and adverse-event information for the intervention period. (source: Intervention)

2-4- Statistical model reporting is incomplete:

* What the author wrote: The manuscript states that ANCOVA was used and reports F, ηp^2, mean square, and P values but does not clarify model covariates, ANCOVA assumption testing, or adjusted mean differences with confidence intervals. (source: Statistical analysis; Table 3)
* Why correction is required: This must be corrected because the manuscript is not fully verifiable without enough statistical model detail to reproduce and interpret the adjusted comparisons. (source: Statistical analysis; Table 3)
* To do: Add the ANCOVA covariates, assumption checks, adjusted group differences, and 95% confidence intervals for each outcome. (source: Statistical analysis; Table 3)

2-5- Reference integrity requires correction and further internal review:

* What the author wrote: The manuscript contains 55 references, including 42 references with DOI/PMID and 13 references lacking DOI/PMID in the manuscript reference list; 17 references also require recency review because they were published in 2011 or earlier. (source: References)
* References with DOI/PMID: Ref 1 - Le Huec et al., Ref 2 - Roussouly et al., Ref 3 - Nachemson et al., Ref 4 - Prakash et al., Ref 5 - Adams et al., Ref 6 - Pesenti et al., Ref 7 - Sergeenko et al., Ref 8 - Czaprowski et al., Ref 9 - Sahrmann et al., Ref 10 - Shalamzari et al., Ref 11 - Willson et al., Ref 12 - Hodges et al., Ref 13 - Willson et al., Ref 14 - Akuthota et al., Ref 15 - Granata et al., Ref 16 - Zarnegar et al., Ref 17 - Abdellatif et al., Ref 18 - Saeidizadeh et al., Ref 20 - Hernandez-Martinez et al., Ref 21 - Ebrahimi et al., Ref 22 - Estevan et al., Ref 23 - Bridge et al., Ref 24 - Kraus et al., Ref 25 - Philp et al., Ref 26 - Ebrahimi et al., Ref 33 - Moran et al., Ref 35 - Anam et al., Ref 36 - Teyhen et al., Ref 37 - Bonazza et al., Ref 39 - Rahmanifar et al., Ref 40 - Yu et al., Ref 41 - Tsang et al., Ref 42 - Rodríguez et al., Ref 43 - Tsao et al., Ref 44 - Ebrahimi et al., Ref 46 - Ebrahimi et al., Ref 47 - Atalay et al., Ref 48 - Murray et al., Ref 49 - Uh et al., Ref 52 - Byun et al., Ref 53 - Lee et al., Ref 55 - Ebrahimi et al.
* References requiring further review:

* Ref 1 - Le Huec et al. — published in 2011 or earlier; replace with a newer study unless a strong justification exists for retaining it.
* Ref 2 - Roussouly et al. — published in 2011 or earlier; replace with a newer study unless a strong justification exists for retaining it.
* Ref 3 - Nachemson et al. — published in 2011 or earlier; replace with a newer study unless a strong justification exists for retaining it.
* Ref 4 - Prakash et al. — published in 2011 or earlier; replace with a newer study unless a strong justification exists for retaining it.
* Ref 5 - Adams et al. — published in 2011 or earlier; replace with a newer study unless a strong justification exists for retaining it.
* Ref 11 - Willson et al. — published in 2011 or earlier; replace with a newer study unless a strong justification exists for retaining it.
* Ref 12 - Hodges et al. — published in 2011 or earlier; replace with a newer study unless a strong justification exists for retaining it.
* Ref 13 - Willson et al. — published in 2011 or earlier; replace with a newer study unless a strong justification exists for retaining it.
* Ref 14 - Akuthota et al. — published in 2011 or earlier; replace with a newer study unless a strong justification exists for retaining it.
* Ref 15 - Granata et al. — published in 2011 or earlier; replace with a newer study unless a strong justification exists for retaining it.

* Ref 19 - Ebrahimi et al. — lacks a DOI/PMID in the manuscript reference list; please add a DOI or PMID if available or verify the citation manually.
* Ref 27 - Javadi et al. — lacks a DOI/PMID in the manuscript reference list; please add a DOI or PMID if available or verify the citation manually.
* Ref 28 - Rajabi et al. — lacks a DOI/PMID in the manuscript reference list; contains non-English/local-language citation information; published in 2011 or earlier; please add a DOI or PMID if available or verify the citation manually and justify retention or replace/remove it.
* Ref 29 - Seichert et al. — lacks a DOI/PMID in the manuscript reference list; published in 2011 or earlier; please add a DOI or PMID if available or verify the citation manually and justify retention or replace/remove it.
* Ref 30 - Ripani et al. — lacks a DOI/PMID in the manuscript reference list; published in 2011 or earlier; please add a DOI or PMID if available or verify the citation manually and justify retention or replace/remove it.
* Ref 31 - Ghorbani et al. — lacks a DOI/PMID in the manuscript reference list; published in 2011 or earlier; please add a DOI or PMID if available or verify the citation manually and justify retention or replace/remove it.
* Ref 32 - Cook et al. — lacks a DOI/PMID in the manuscript reference list; please add a DOI or PMID if available or verify the citation manually.
* Ref 34 - Cook et al. — lacks a DOI/PMID in the manuscript reference list; please add a DOI or PMID if available or verify the citation manually.
* Ref 38 - Chorba et al. — lacks a DOI/PMID in the manuscript reference list; published in 2011 or earlier; please add a DOI or PMID if available or verify the citation manually and justify retention or replace/remove it.
* Ref 43 - Tsao et al. — published in 2011 or earlier; replace with a newer study unless a strong justification exists for retaining it.
* Ref 45 - Elahi Amir Reza et al. — lacks a DOI/PMID in the manuscript reference list; please add a DOI or PMID if available or verify the citation manually.
* Ref 50 - Pourmatin et al. — lacks a DOI/PMID in the manuscript reference list; please add a DOI or PMID if available or verify the citation manually.
* Ref 51 - Tomenko et al. — lacks a DOI/PMID in the manuscript reference list; please add a DOI or PMID if available or verify the citation manually.
* Ref 54 - Myers et al. — lacks a DOI/PMID in the manuscript reference list; published in 2011 or earlier; please add a DOI or PMID if available or verify the citation manually and justify retention or replace/remove it.
* Why correction is required: This must be corrected because the manuscript is not fully verifiable without complete, current, properly formatted, and manually checked reference information. (source: References)
* To do: Correct the reference list by adding DOI/PMID where available, manually verifying references that lack identifiers, replacing or justifying older sources, and removing or revising any source that cannot be verified or justified. (source: References)

2-6- Self-citation proportion exceeds the screening threshold:

* What the author wrote: The manuscript contains 6 apparent self-citations among 55 references, approximately 10.9% of the reference list. (source: References 19, 21, 26, 44, 46, 55)
* Why correction is required: This must be corrected because the manuscript is not compliant with basic editorial requirements regarding balanced citation practice when self-citations exceed the screening threshold. (source: References)
* To do: Review the self-citations and retain only those that are directly necessary, replacing nonessential self-citations with independent sources where appropriate. (source: References)

Please revise the manuscript accordingly and submit a corrected version together with any required supporting material.

Kind regards,
Screening Reviewer

Associate Editor

MAJOR REVISION 6 May 2026

Dear Authors,

We have completed an Associate Editor assessment of your research article examining taekwondo-based core stability exercises for improving Functional Movement Screen scores and lumbar lordosis angle in young men with lumbar hyperlordosis. The manuscript addresses a relevant rehabilitation question and presents potentially useful intervention findings, but substantial revision is required before the work can be considered adequately reported and methodologically evaluable.

The strongest aspect of the manuscript is its clinically relevant focus on a functional, sport-based rehabilitation intervention for a musculoskeletal postural condition. The use of measurable outcomes related to lumbar curvature and movement quality gives the study practical relevance for rehabilitation and corrective exercise contexts.

The scientific review indicates that the manuscript requires clearer reporting of group allocation, intervention fidelity, adherence, outcome-assessment procedures, statistical modeling, and the clinical meaning of the observed changes. In addition, the editorial screening identified important submission-readiness concerns, especially incomplete reporting of the study timeline and reference-list issues. These concerns do not necessarily negate the potential value of the work, but they currently limit confidence in the manuscript's validity, reproducibility, and originality.

Title and abstract: 8/10
Introduction and rationale: 7/10
Methods rigor: 5/10
Results presentation: 6/10
Discussion and interpretation: 6/10
Reporting quality: 5/10
Language and structure: 7/10
Clinical relevance or scholarly value: 8/10
Overall quality: 6/10

Overall, the manuscript is promising and within the journal's rehabilitation scope, but it requires major revision before it can be reconsidered. The authors should revise the manuscript thoroughly to address the methodological and reporting gaps, correct the reference concerns, moderate causal claims, and improve the clarity and reproducibility of the intervention and statistical reporting.

Kind Regards,
Associate Editor

Editor-in-Chief

MAJOR REVISION 6 May 2026

Dear Authors,

Thank you for submitting your manuscript to the journal. After editorial and scientific assessment, the manuscript may be reconsidered only after major revision.

The topic is relevant to the journal, and the study has potential clinical value for rehabilitation and corrective exercise practice. However, the current version requires substantial revision before it can proceed further. The authors must address the methodological reporting gaps, clarify the study timeline and allocation procedure, improve reporting of intervention adherence and statistical analysis, revise the reference list, and moderate causal claims.

Please submit a thoroughly revised manuscript together with any required supporting material and a clear response explaining how each editorial and reviewer concern has been addressed. The revised submission will require further editorial evaluation before any final decision can be made.

Kind Regards,
Editor-in-Chief

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Revision 1

AUTHORS' RESPONSE TO REVIEWERS

Authors' reply to reviewers

The next pages contain the authors' point-by-point reply to the comments of this revision round, as submitted with the revised manuscript. It is published as the authors wrote it.

Dear reviewers and EIC;

Thank you for paying attention to our paper; we appreciate you a lot. We did our best to reply and revise each of them carefully.

Reviewer (1) Comments (highlighted in Yellow in the main text)

The manuscript states that participants were recruited by convenience sampling and divided into experimental and control groups, but it does not explain how participants were assigned to each group or whether allocation was based on preference, availability, investigator decision, or another procedure (source: Material and Methods, Study participants). This is central for a TREND-based nonrandomized intervention report because the validity of between-group comparisons depends on understanding the mechanism of allocation and the resulting risk of selection bias.

Answer: thank you very much. we have added whatever you mentioned in the text and highlighted in yellow. and also in the limitation section.

The intervention is described by exercise type, frequency, duration, and progression, but the manuscript does not report participant attendance, adherence, missed sessions, fidelity checks, adverse events, or whether the control group's usual activities were monitored during the 8-week period (source: Intervention; Procedure). Without these details, it is difficult to determine whether the observed effects reflect the intended taekwondo-based CSE exposure or uncontrolled differences in activity during follow-up.

Answer: Thanks. We have revised all of them in the text. In the procedure part and also in the intervention section.

The manuscript provides procedural details for Spinal Mouse and FMS assessment, but it does not state whether the assessor was blinded to group allocation or test phase, whether the same assessor performed all pre-test and post-test measurements, or whether repeated measurements were averaged (source: Measurement, Assessment of hyperlordosis; Measurement, FMS assessment protocol). Because the outcomes involve examiner handling and observational scoring, assessor blinding and measurement reproducibility are important for reducing detection bias.

Answer: Thanks. We have added whatever you mentioned in the measurement section in the hyperlordosis and also FMS part.

The manuscript states that ANCOVA was used and reports F values, partial eta squared, mean squares, and P values, but it does not specify the covariates included in each ANCOVA model, whether assumptions such as homogeneity of regression slopes were assessed, or whether adjusted post-intervention group means and confidence intervals were calculated (source:

Statistical analysis; Table 3). This limits reproducibility and makes the magnitude and precision of the intervention effect difficult to interpret.

Answer: Thanks. We have done all of them in statistical analysis part and also in the table 3, adding mean difference.

The results are statistically significant across all FMS components and lumbar lordosis angle, but the manuscript's causal wording should remain cautious because the study is nonrandomized, small, single-center, and limited to young male participants (source: Results; Study limitations; Conclusion). In addition, the manuscript does not explain whether the observed changes, particularly in lordosis angle and FMS component scores, exceed clinically meaningful thresholds.

Answer: we have made our paper smoother and avoid overstating and also add some sentences regarding the clinically meaningful thresholds for both FMS and Lordosis angle.

Table 3 includes F, ηp^2, mean square, and P values, but the layout makes it difficult to determine whether each statistic corresponds to the group effect after baseline adjustment or another model term (source: Table 3). Please revise the table header or footnote to identify the tested effect and the role of baseline adjustment clearly.

Answer: we have revised our table and its footnote.

The reference list mixes entries with complete DOI/PMID information and entries without identifier information, and several journal titles and citation details appear inconsistently formatted (source: References). Please standardize the reference style, ensure that each cited source follows the journal's required format, and add DOI or PMID information when available.

Answer: we have provided DOI/ PMID for each reference and made them revised.

Several sentences require language polishing for precision and readability

Answer: we have revised them and highlighted them carefully.

The manuscript contains 3 tables and 1 figure/image. Table 1, Table 2, and Table 3 are explicitly referred to in the main text, and Figure 1 is also explicitly cited in the intervention section (source: Intervention; Results; Tables 1-3; Figure 1). Please ensure that table titles, abbreviations, measurement units, and footnotes are formatted consistently; for example, Table 3 should define all abbreviations and clarify whether the displayed post-test values are raw or adjusted means (source: Table 3).

Answer: we have revised all of them, including the title of tables, footnotes, and figure.

Reviewer (2) Comments (highlighted in green)

The manuscript reports the study setting and participant characteristics but does not report the recruitment period, intervention dates, or assessment period. (source: Material and Methods, Study participants; Procedure)

Answer: we have provided the dates in the last paragraph of material and methods. Thanks.

The manuscript states that participants were selected using convenience sampling and divided into experimental and control groups but does not clarify the exact allocation procedure. (source: Study participants)

Answer: it was same as the first reviewer. We have completely explained it in the methods section.

The manuscript reports the taekwondo-based CSE program but does not report attendance, adherence, missed sessions, fidelity checks, or adverse-event monitoring. (source: Intervention; Table 1)

Answer: Thanks. We have now completely added some sentences regarding the fidelity and also attendance in the intervention section.

Add the ANCOVA covariates, assumption checks, adjusted group differences for each outcome. (source: Statistical analysis; Table 3)

Answer: thanks. We have provided all of the in the statical analysis and also result section.

Reference integrity requires correction and further internal review:

Answer: we have provided DOI/ PMID for each reference and made them revised

Associate Editor (1) Comments

ANSWER:

Thank you very much for your time and for helping to move our work forward quickly. We sincerely appreciate your effort in handling the review process and editorial handling of our manuscript. We would also like to inform you that we have carefully addressed all reviewers' comments in detail. In addition, all highlighted issues raised during the editorial screening have been fully revised and resolved. We greatly appreciate the constructive feedback provided, as it has significantly improved the clarity, rigor, and overall quality of the manuscript.

Thank you again for your consideration and support.

ADDITIONAL COMMENTS

Thanks for your suggestion.

We have provided all of the mentioned references in the revised manuscript.

2 Revision 1

5 comments · 16 May 2026 – 24 May 2026

Referee 2 Reviewer

MAJOR REVISION 16 May 2026

Dear Authors,

Thank you for submitting the revised manuscript and the reply-to-reviewers document.

After checking the revised files, we confirm that several reviewer concerns have been properly addressed. In particular, the manuscript now provides a clearer description of the group allocation procedure, including the non-random convenience allocation method and the timing of allocation after baseline assessment. The language-polishing requests have also been addressed in several sections, and Table 3 has been revised to clarify that the reported ANCOVA results refer to the adjusted between-group effect after baseline adjustment.

However, the revision is still incomplete. Please revise the manuscript and the response letter again using the required structure below.

Properly Addressed Items

* The allocation procedure and timing of group assignment have been clarified in the Methods and Procedure sections.
* The limitation related to non-random allocation and selection bias has been added to the Study limitations section.
* Several language and wording issues have been corrected.
* Table 3 now identifies the adjusted group effect and mentions baseline adjustment.
* The manuscript now includes improved reporting of attendance, adherence, fidelity monitoring, and control-group activity monitoring, although further clarification is still required as noted below.

To-Do List

1. Adverse-event monitoring
Please add a clear statement in the Intervention or Procedure section explaining whether adverse events, pain, or exercise-related discomfort were monitored during the 8-week program. Also state whether any adverse events occurred.

2. FMS scoring calibration and assessor blinding
Please clarify whether the FMS examiner received any training or calibration for scoring consistency. Also clarify whether the assessor was blinded only to group allocation or also to the test phase.

3. ANCOVA reporting and confidence intervals
Please revise Table 3 to include adjusted post-test mean differences with 95% confidence intervals for each outcome. Also clarify whether the displayed post-test values are raw means or adjusted means.

4. Study timeline
The statement that the study was completed within a single academic semester is not sufficient. Please provide the calendar period for recruitment, baseline assessment, intervention delivery, and post-test assessment.

5. Clinical and causal interpretation
Please further moderate causal wording throughout the manuscript, especially where the text states or implies that the intervention was definitively “effective” or “significantly affected” the outcomes. The interpretation should consistently reflect the non-randomized quasi-experimental design.

6. Reference integrity and older references
Please review all older references and references missing identifiers. Add a DOI or PMID where available, manually verify references that do not have identifiers, justify genuinely seminal older references, and replace or remove older sources that are not essential.

7. Self-citations
Please directly address the self-citation concern in the response letter. Retain only self-citations that are directly necessary and replace nonessential self-citations with independent sources where appropriate.

9. Response letter structure
Please revise the reply-to-reviewers file so that each reviewer comment is followed by a specific response explaining exactly what was changed and where it was changed in the manuscript. General responses such as “we revised it” or “we added whatever was mentioned” are not sufficient.

Please submit a revised manuscript and a revised point-by-point response letter addressing all items above. The revised response letter must clearly identify the manuscript section, table, figure, or reference-list entry where each change has been made.

Kind regards,

Screening Reviewer

Referee 3 Reviewer

ACCEPT 18 May 2026

The authors have addressed all the reviewers' comments. The article is acceptable for publication.

Referee 4 Reviewer

MINOR REVISION 18 May 2026

Thank you for submitting your manuscript. The study addresses an interesting topic, and the overall methodology is sound. However, one issue needs to be clarified before publication:

- In the Methods section, the authors describe measuring spinal curvature from C7 to S3 using the Spinal Mouse device. The title and the rest of the manuscript refer to "lumbar lordosis angle."

Standard measurement of isolated lumbar lordosis typically uses a range from T12/L1 to S1/S3. The C7–S3 range captures global spinal curvature (cervical, thoracic, and lumbar), not pure lumbar lordosis.

- Please clarify:

1) In the Methods, briefly explain why the C7–S3 range was chosen and how it relates to lumbar lordosis in this population.

2) Alternatively, consider revising the terminology throughout the manuscript (title, abstract, text) to reflect what was actually measured (e.g., "global spinal curvature from C7 to S3" or "thoracolumbar curvature").

No other major revisions are required. The rest of the manuscript is well written, and the limitations are appropriately discussed.

Associate Editor MAJOR REVISION 24 May 2026

Dear Authors
Based on the reviewers' and associate editor's comments, your article requires major revision.

Editor-in-Chief MAJOR REVISION 24 May 2026

Dear Authors
Based on the reviewers' and associate editor's comments, your article requires major revision. When revising your manuscript, please carefully consider all issues mentioned in the reviewers' comments: please outline every change made in response to their comments and submit the required files.

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Revision 2

AUTHORS' RESPONSE TO REVIEWERS

Authors' reply to reviewers

The next pages contain the authors' point-by-point reply to the comments of this revision round, as submitted with the revised manuscript. It is published as the authors wrote it.

Reviewer (3) Comments <----------
Thank you for submitting your manuscript. The study addresses an interesting topic, and the overall methodology is sound. However, one issue needs to be clarified before publication:

- In the Methods section, the authors describe measuring spinal curvature from C7 to S3 using the Spinal Mouse device. The title and the rest of the manuscript refer to "lumbar lordosis angle."

Standard measurement of isolated lumbar lordosis typically uses a range from T12/L1 to S1/S3. The C7–S3 range captures global spinal curvature (cervical, thoracic, and lumbar), not pure lumbar lordosis.

- Please clarify:

1) In the Methods, briefly explain why the C7–S3 range was chosen and how it relates to lumbar lordosis in this population.

2) Alternatively, consider revising the terminology throughout the manuscript (title, abstract, text) to reflect what was actually measured (e.g., "global spinal curvature from C7 to S3" or "thoracolumbar curvature").
Answer: ***Thanks. We agree that the C7–S3 scanning range used by the Spinal Mouse reflects global sagittal spinal alignment rather than an isolated radiographic lumbar lordosis measurement. Therefore, we have clarified the rationale for using the C7–S3 assessment range in the Methods section and explained that the lumbar curvature parameter generated by the Spinal Mouse software was used as the primary outcome. We also revised the terminology throughout the manuscript to improve methodological precision by referring to “lumbar sagittal curvature” where appropriate. Additionally, a limitation statement was added acknowledging that the assessment reflects functional sagittal spinal alignment rather than isolated vertebral lumbar lordosis measured radiographically.***

----------> END of Reviewer (3) Comments <----------

Reviewer (4) Comments <----------
Dear Authors,

Thank you for submitting the revised manuscript and the reply-to-reviewers document.

To-Do List

1. Adverse-event monitoring
Please add a clear statement in the Intervention or Procedure section explaining whether adverse events, pain, or exercise-related discomfort were monitored during the 8-week program. Also state whether any adverse events occurred.
Answer: ***Thank you. we added a detailed statement in the Intervention section clarifying that adverse events, pain, and exercise-related discomfort were monitored throughout the 8-week training period under supervision of the coach and researcher. We also clarified that no serious adverse events or exercise-related injuries occurred during the study.***

2. FMS scoring calibration and assessor blinding
Please clarify whether the FMS examiner received any training or calibration for scoring consistency. Also clarify whether the assessor was blinded only to group allocation or also to the test phase.
Answer: ***we clarified that the FMS examiner underwent standardized training and pilot calibration sessions before data collection to improve scoring consistency and adherence to official FMS scoring procedures. Additionally, we clarified the blinding procedure. The assessor was blinded to group allocation during post-test assessments; however, complete blinding to the assessment phase (pre-test vs. post-test) was not feasible due to the repeated-measures design. To minimize potential bias, the assessor did not have access to participants' previous scores during post-test evaluations.***

3. ANCOVA reporting and confidence intervals
Please revise Table 3 to include adjusted post-test mean differences with 95% confidence intervals for each outcome. Also clarify whether the displayed post-test values are raw means or adjusted means.
Answer: ***TNX. Table 3 was revised to include adjusted post-test mean differences with corresponding 95% confidence intervals for all outcome variables derived from the ANCOVA models. We also clarified in the table footnote that the presented pre-test and post-test values are raw descriptive means ± standard deviations, whereas the adjusted mean differences and inferential statistics were obtained from ANCOVA analyses controlling for baseline values.***

4. Study timeline
The statement that the study was completed within a single academic semester is not sufficient. Please provide the calendar period for recruitment, baseline assessment, intervention delivery, and post-test assessment.
Answer: ***Amended; the study timeline was clarified in the Methods section by specifying the calendar periods for participant recruitment, baseline assessments, intervention delivery, and post-test evaluations.***

5. Clinical and causal interpretationPlease further moderate causal wording throughout the manuscript, especially where the text states or implies that the intervention was definitively “effective” or “significantly affected” the outcomes. The interpretation should consistently reflect the non-randomized quasi-experimental design.6. Reference integrity and older referencesPlease review all older and identifier-missing references. Add DOI or PMID where available, manually verify references that do not have identifiers, justify genuinely seminal older references, and replace or remove older sources that are not essential.Answer: Thanks; we added PMID or DOI to all of them where existed. Also we have replaced older references. 7. Self-citationsPlease directly address the self-citation concern in the response letter. Retain only self-citations that are directly necessary and replace nonessential self-citations with independent sources where appropriate.Answer: We appreciate the reviewer’s concern regarding self-citations.

Kind regards,

Screening Reviewer
----------> END of Reviewer (4) Comments

3 Revision 2

4 comments · 26 May 2026 – 14 Jun 2026

Referee 3 Reviewer

MINOR REVISION 26 May 2026

Although the authors added a limitation regarding the use of a surface-based Spinal Mouse assessment across the C7–S3 region, the manuscript still inconsistently refers to the outcome as “lumbar lordosis angle” throughout the text. Since the applied method reflects global thoracolumbar/sagittal spinal curvature rather than isolated segmental lumbar lordosis, the terminology and interpretation remain overstated and should be revised consistently across the manuscript.

Referee 4 Reviewer

MAJOR REVISION 9 Jun 2026

Dear Authors,

I have reviewed your manuscript carefully. Two major methodological and conceptual issues need to be addressed before further consideration.
1 - Despite the explanation provided in your Methods section, it remains unclear whether, after scanning from C7 to S3 using the Spinal Mouse device, you extracted the data for calculating the lumbar lordosis angle based on a specific anatomical lumbar region (e.g., L1–S1, L1–S2, T12–S1) or whether the reported parameter instead reflects the curvature of the entire spine from C7 to S3.

Please clarify the following:

1A. If you did extract data from a defined lumbar region:
Please explicitly state which vertebral levels were used (e.g., L1–S1) and describe how the lordosis angle was calculated from the Spinal Mouse output (e.g., summation of segmental angles, automatic software parameter, etc.).

1B. If you did not extract data from a defined lumbar region and the parameter instead reflects the global C7–S3 spinal curvature:
Then the term "lumbar lordosis angle"—and any term that includes the word "lumbar", including "lumbar sagittal curvature"—is methodologically inaccurate. Your measurement does not isolate the lumbar region. In this case, we request that you:

Remove the term "lumbar lordosis angle" and any variant containing "lumbar" from all sections of your manuscript (title, abstract, Methods, Results including Table 3, Discussion, and Conclusions).

Replace it with an accurate descriptor that reflects what you actually measured, such as:

"Global sagittal spinal curvature (C7–S3)"

"Total sagittal spinal alignment (C7–S3)"

"C7–S3 sagittal curvature"

Revise your title accordingly. For example, if your current title includes "lumbar lordosis" or "hyperlordosis," you must either (a) justify that you specifically measured the lumbar region, or (b) reframe the title to reflect a global spinal curvature outcome.

Using terms such as "lumbar sagittal curvature" does not resolve the problem, because this term still implies that the lumbar region was isolated and measured separately. If your data reflect the entire C7–S3 curve, you

cannot claim to have measured any "lumbar" parameter.

2 – Failure to distinguish your study from a highly similar prior study (reference 19)
Reference [19] describes a study with a title and research design that appear strikingly similar to yours. Both studies investigate the effects of NASM-based corrective exercises on lumbar lordosis in individuals with hyperlordosis, using an 8-week quasi-experimental design.

Despite this clear similarity, you have not cited or discussed reference [19] in your introduction, nor have you explained how your study differs from it. This omission raises concerns about the novelty and necessity of your investigation.

Sincerely,
Reviewer

Associate Editor MAJOR REVISION 14 Jun 2026

According to the reviewers' comments, the article needs major revision.

Editor-in-Chief MAJOR REVISION 14 Jun 2026

Dear Authors
Based on the reviewers' and associate editor's comments, your article requires major revision. When revising your manuscript, please carefully consider all issues mentioned in the reviewers' comments: please outline every change made in response to their comments and submit the required files.

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Revision 3

AUTHORS' RESPONSE TO REVIEWERS

Authors' reply to reviewers

The next pages contain the authors' point-by-point reply to the comments of this revision round, as submitted with the revised manuscript. It is published as the authors wrote it.

Special thanks to the reviewers for their precious comments.

We did our best to answer your comments.

Thank you very much!

Reviewer: Although the authors added a limitation regarding the use of a surface-based Spinal Mouse assessment across the C7–S3 region, the manuscript still inconsistently refers to the outcome as “lumbar lordosis angle” throughout the text. Since the applied method reflects global thoracolumbar/sagittal spinal curvature rather than isolated segmental lumbar lordosis, the terminology and interpretation remain overstated and should be revised consistently across the manuscript.

ANSWER: We thank the reviewer for this important observation. In response, we have revised the terminology throughout the manuscript to better reflect the nature of the Spinal Mouse assessment. References to “lumbar lordosis angle” have been replaced where appropriate with terms such as “lumbar sagittal curvature,” “lumbar curvature parameter,” or “lumbar sagittal alignment characteristics.” In addition, we added clarifying statements in the Methods, Discussion, and Limitations sections emphasizing that the Spinal Mouse provides a surface-based estimate of spinal curvature derived from external landmarks and does not directly measure segmental vertebral lumbar lordosis. Consequently, the findings are now interpreted as changes in functional sagittal spinal alignment and lumbar curvature characteristics rather than definitive structural alterations in anatomical lumbar lordosis.

Reviewer: Please clarify the following:

1A. If you did extract data from a defined lumbar region:
Please explicitly state which vertebral levels were used (e.g., L1–S1) and describe how the lordosis angle was calculated from the Spinal Mouse output (e.g., summation of segmental angles, automatic software parameter, etc.).

1B. If you did not extract data from a defined lumbar region and the parameter instead reflects the global C7–S3 spinal curvature:
Then the term "lumbar lordosis angle" – and any term that includes the word "lumbar" , including "lumbar sagittal curvature" – is methodologically inaccurate.

Answer: We appreciate the reviewer's careful observation. We would like to clarify that although spinal scanning was performed across the C7–S3 segment in accordance with the standard operating procedure of the Spinal Mouse system, the variable analyzed in this study was not the global C7–S3 curvature. Rather, the primary outcome was the lumbar curvature parameter automatically generated by the Spinal Mouse software following regional segmentation of the scanned spinal profile. Therefore, the outcome reflects lumbar sagittal alignment characteristics derived from the lumbar region rather than total spinal curvature across the entire C7–S3 segment. To improve clarity, we have revised the Methods section to explicitly describe the measurement procedure and the nature of the extracted parameter. We have also modified the terminology throughout the manuscript, replacing "lumbar lordosis angle" where appropriate with "lumbar curvature parameter" or "lumbar sagittal alignment characteristics," and we now emphasize that the measurement represents a surface-derived estimate rather than a radiographic assessment of anatomical vertebral lordosis.

Reviewer: Failure to distinguish your study from a highly similar prior study (Reference 19).

Answer: We thank the reviewer for highlighting this important issue. We agree that the relationship between the present study and the previously published work by Ebrahimi et al. required clearer explanation. Accordingly, we have revised the Introduction to explicitly discuss this study and clarify the rationale for the present investigation. While both studies involve taekwondo-based core stability training in individuals with hyperlordosis, the primary purpose of the present study was not merely to replicate previous findings regarding spinal alignment. Rather, our study sought to extend the existing evidence by evaluating functional movement quality using the Functional Movement Screen (FMS) in addition to spinal alignment outcomes. Functional movement competency represents an important clinical and rehabilitation outcome that was not fully addressed in previous investigations and may provide additional insight into the mechanisms through which taekwondo-based core stability exercises influence movement performance. The Introduction and Discussion sections have been revised to better distinguish the contribution of the present study from previous work and to explicitly acknowledge the findings of Ebrahimi et al.

4 Revision 3

3 comments · 26 Jun 2026 – 13 Jul 2026

Referee 3 Reviewer

ACCEPT 26 Jun 2026

The article is acceptable for publication.

Associate Editor

ACCEPT 13 Jul 2026

Dear Chief Editor
Thanks to the authors for improving the quality of the article. Based on the reviewers' comments, the article is accepted for publication.

Editor-in-Chief

ACCEPT 13 Jul 2026

Dear Authors
We are pleased to share that your article has been accepted for publication in MEJRHS. We hope to receive other high-quality articles from your group.
Best wishes