ISSN: 2347-6567

International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)

IJAMSCR |Vol. 14 | Issue 4| Oct - Dec 2026

www.ijamscr.com

DOI : https://doi.org/10.61096/ijamscr.v14.iss4.2026.1854-1861

Effectiveness of Modified Pilates versus Core Stabilization Exercise on Pain, Quality of Life and Lumbopelvic Flexibility in Cricket Bowlers with Low Back Pain: A Comparative Study

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Published on: 21-10-2026
Published by: Futuristic Publications
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Abstract

Background: Low back pain is common among cricket bowlers because bowling repeatedly exposes the lumbar spine to rotation, extension, lateral flexion and high mechanical loading. Modified Pilates and core stabilization exercise are used to improve trunk control, muscular endurance and lumbopelvic function. However, comparative evidence in cricket bowlers with low back pain is limited.

Objective: To compare the effectiveness of Modified Pilates exercises and Core Stabilization exercises on pain, quality of life and lumbopelvic flexibility in cricket bowlers with low back pain.

Methods: A pre-test and post-test experimental comparative study was conducted in 40 male cricket bowlers aged 18·25 years. Participants were randomly allocated into Group A (Core Stabilization Exercise, n=20) and Group B (Modified Pilates Exercise, n=20). Both groups received supervised exercise three times per week for 6 weeks, 45·60 minutes per session. Pain intensity was assessed using the Visual Analogue Scale (VAS), disability/quality-of-life impact using the Oswestry Disability Index (ODI), and lumbopelvic flexibility using the Sit-and-Reach Test. Data were analyzed using paired and independent t-tests with a significance level of $p<0.05$.

Results: Both groups showed significant pre- to post-test improvement ($p<0.001$). Post-test VAS was 3.50 ± 0.512 in Group A and 2.25 ± 0.786 in Group B; ODI was 19.75 ± 3.07 and 14.15 ± 2.77, respectively; and Sit-and-Reach was 18.00 ± 2.07 cm and 23.00 ± 1.52 cm, respectively. Between-group differences favored Modified Pilates for all three outcomes (VAS: mean difference 1.25, 95% CI 0.825·1.675; ODI: 5.60, 95% CI 3.723·7.477; Sit-and-Reach: · 5.00, 95% CI · 6.166 to · 3.834).

Conclusion: Both interventions improved pain, disability/quality-of-life impact and lumbopelvic flexibility; however, Modified Pilates demonstrated greater post-test improvement than Core Stabilization exercise in this sample of cricket bowlers with low back pain.

Keywords: Modified Pilates; core stabilization; cricket bowlers; low back pain; pain; quality of life; lumbopelvic flexibility; VAS; ODI; Sit-and-Reach Test.

INTRODUCTION

Cricket bowling is a high-demand sporting activity involving coordinated movement of the trunk, pelvis and limbs. Fast bowling particularly combines lumbar flexion, extension, rotation and side flexion, exposing the lumbar spine to repeated mechanical stress. Bowling workload and abrupt increases in workload have also been associated with overuse injury risk in young bowlers.[1,2]

Low back pain is an important musculoskeletal problem in cricket bowlers. Repetitive lumbar hyperextension and rotation can increase stress on the pars interarticularis and other posterior spinal structures. Previous literature has described associations between bowling biomechanics, spinal loading, muscle asymmetry and lumbar stress injuries.[3·10]

Intrinsic factors such as reduced trunk flexibility, inadequate core endurance, altered lumbopelvic control and asymmetrical movement may further increase susceptibility to low back pain. In bowlers with symptoms, altered trunk and lumbopelvic movement patterns may contribute to repeated loading and reduced functional performance.[11,12]

Core Stabilization exercise is commonly used in low back pain rehabilitation. It emphasizes activation and endurance of deep stabilizing muscles, including the transversus abdominus and lumbar multifidus, with the goal of improving segmental control, trunk stability and force transfer.[13-16].

Modified Pilates is a controlled exercise approach emphasizing breathing, spinal alignment, core activation, mobility and coordinated movement. Pilates-based programs have been reported to reduce pain and disability and may improve lumbar mobility and functional outcomes in people with low back pain.[17–24]

The rationale for the present study is that cricket bowlers require efficient lumbopelvic control, flexibility and load transfer during the bowling action. Although both Core Stabilization and Pilates are used clinically, the available dissertation literature identified by the investigator provides limited direct comparison of these approaches in cricket bowlers with low back pain. Therefore, this study compared the effects of Modified Pilates and Core Stabilization exercise on pain, quality of life and lumbopelvic flexibility.

METHODOLOGY

Study design: Pre-test and post-test experimental comparative study.

Study duration: 6 months.

Sampling method: Purposive sampling was used for recruitment; participants were then randomly allocated to the two intervention groups.

Sample size: 40 male cricket bowlers, 20 in each group.

Study setting: Tiruppur Cricket School / cricket practice setting as described in the dissertation.

Age: 18–25 years.

Ethical Clearance: The study was approved by the institute ethics committee, IEC- RIPT/DT/21/4535.

INCLUSION CRITERIA

Male cricket bowlers aged 18–25 years; minimum 2 years of bowling experience; low back pain for more than 3 months; regular bowlers participating in at least 3 training sessions per week; and ability to understand and follow exercise instructions.

EXCLUSION CRITERIA

Recent spinal or lower-limb injury within 6 months; neurological or vestibular disorders; previous spinal surgery; structural spinal deformities; and acute injury occurring during the study period.

VARIABLES

Dependent variables: pain, quality of life/functional disability, and lumbopelvic flexibility.

Independent variable: exercise intervention (Core Stabilization or Modified Pilates).

INTERVENTION

Group A – Core Stabilization Exercise: 20 participants received supervised core stabilization training three times per week for 6 weeks, 45–60 minutes per session. The protocol included abdominal bracing,

bracing with heel slides, bracing with leg lift, bracing with bridge, bridging with leg lift, quadruped arm lift with bracing, quadruped leg lift with bracing, and quadruped alternate arm and leg. The exercises emphasized deep abdominal and lumbar stabilizer activation, segmental spinal control and trunk stability.

Group B – Modified Pilates Exercise: 20 participants received supervised Modified Pilates training three times per week for 6 weeks, 45–60 minutes per session, with approximately 30 seconds rest between exercises. The protocol included Modified Side Kick, Modified One-Leg Stretch, Modified Shoulder Bridge, The Hundred with Swiss-ball support, Swimming, Modified Swan Dive, Modified Roll Up and Modified One-Leg Circle. Exercises emphasized controlled breathing, core activation, spinal alignment, mobility and smooth movement progression.

OUTCOME MEASURES

Visual Analogue Scale (VAS): A 10-cm scale anchored by "No pain" and "Worst imaginable pain" was used to quantify current pain intensity. The distance from the no-pain end to the participant's mark was recorded in centimetres; higher scores indicated greater pain.[22]

Oswestry Disability Index (ODI): The ODI questionnaire contains 10 sections addressing functional domains affected by low back pain. Each section is scored from 0 to 5 and the total is expressed as a percentage; higher scores indicate greater disability. In this study it was used to capture the functional impact of low back pain and the associated quality-of-life burden.

Sit-and-Reach Test: Participants sat with the knees extended and feet positioned against the measuring surface, then reached forward as far as possible without jerking. The distance was recorded in centimetres, with higher values indicating better flexibility. The best of three trials was used for analysis.

STATISTICAL ANALYSIS

Data were tabulated and analyzed using SPSS version 24. The Shapiro–Wilk test was used to assess normality. The dissertation reported normally distributed dependent-variable data ($p>0.05$); therefore, parametric tests were used. Paired t-tests assessed pre- to post-test changes within groups and independent t-tests compared groups. Statistical significance was set at $p<0.05$ and 95% confidence intervals were used.

Additional effect estimates: Mean differences and 95% confidence intervals were calculated from the reported summary statistics and t-values. Between-group standardized mean differences are reported as pooled-standard-deviation Cohen's d. Within-group standardized change is reported as the paired-sample effect size ($|t|/\sqrt{n}$). Because the source tables provide rounded summary values rather than participant-level data, these derived confidence intervals and effect sizes should be regarded as approximate.

RESULTS

Forty male cricket bowlers completed the study allocation described in the dissertation, with 20 participants in each group. Baseline scores were not significantly different between groups for VAS, ODI or Sit-and-Reach ($p>0.05$), while post-test comparisons demonstrated statistically significant differences favoring Modified Pilates ($p=0.001$).

Table 1. Between-group comparison of pre- and post-test scores

Outcome	Group A pre	Group B pre	t	p	Group A post	Group B post	t	p
VAS	6.10 ± 0.852	6.25 ± 0.638	—	—	3.50 ± 0.512	2.25 ± 0.786	5.95	0.001
ODI	37.70 ± 3.52	35.60 ± 3.56	—	—	19.75 ± 3.07	14.15 ± 2.77	6.04	0.001
Sit-and-Reach (cm)	14.40 ± 1.18	14.00 ± 1.29	—	—	18.00 ± 2.07	23.00 ± 1.52	-8.68	0.001

The pre-test values showed no statistically significant between-group difference. Post-test values showed statistically significant differences between groups for all outcomes, with lower VAS and ODI values and a higher Sit-and-Reach value in Group B.

Table 2. Derived between-group effect estimates

Outcome	Between-group mean difference*	95% CI	Cohen's d	Interpretation
VAS	1.25	0.825 to 1.675	1.88	Favors Group B
ODI	5.60	3.723 to 7.477	1.92	Favors Group B
Sit-and-Reach (cm)	-5.00	-6.166 to -3.834	-2.75	Favors Group B

*Difference is Group A post-test minus Group B post-test. For VAS and ODI, positive differences indicate lower scores in Group B; for Sit-and-Reach, the negative difference reflects the higher score in Group B. Derived estimates are based on rounded published summary statistics and reported t-values.

Table 3. Within-group pre- to post-test changes

Outcome	Pre-test	Post-test	t	p	Mean change	95% CI	Effect size
VAS – Group A	6.10 ± 0.852	3.50 ± 0.512	11.13	0.001	-2.60	-3.089 to -2.111	2.49
VAS – Group B	6.25 ± 0.638	2.25 ± 0.786	20.84	0.001	-4.00	-4.402 to -3.598	4.66
ODI – Group A	37.70 ± 3.52	19.75 ± 3.07	27.93	0.001	-17.95	-19.295 to -16.605	6.25
ODI – Group B	35.60 ± 3.56	14.15 ± 2.77	-30.25	0.001	-21.45	-22.934 to -19.966	6.76
Sit-and-Reach – Group A	14.40 ± 1.18	18.00 ± 2.07	-10.11	0.001	3.60	2.855 to 4.345	2.26
Sit-and-Reach – Group B	14.00 ± 1.29	23.00 ± 1.52	-34.40	0.001	9.00	8.452 to 9.548	7.69

All within-group comparisons reported in the dissertation were statistically significant ($p<0.001$). The magnitude of improvement was larger in Group B for pain reduction, ODI reduction and Sit-and-Reach improvement.

Figure 1. Pre- and post-test VAS scores

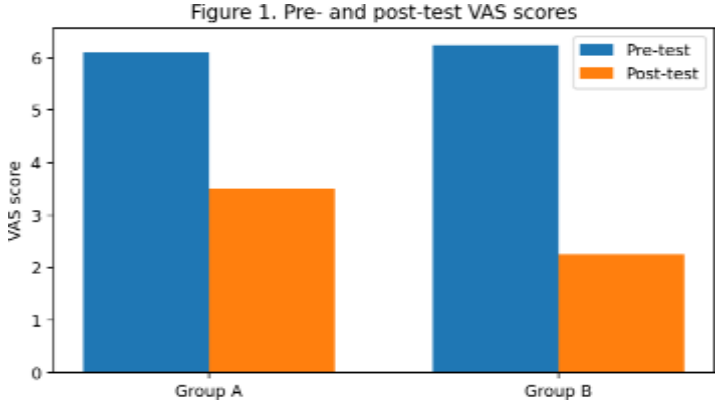


Figure 2. Pre- and post-test ODI scores

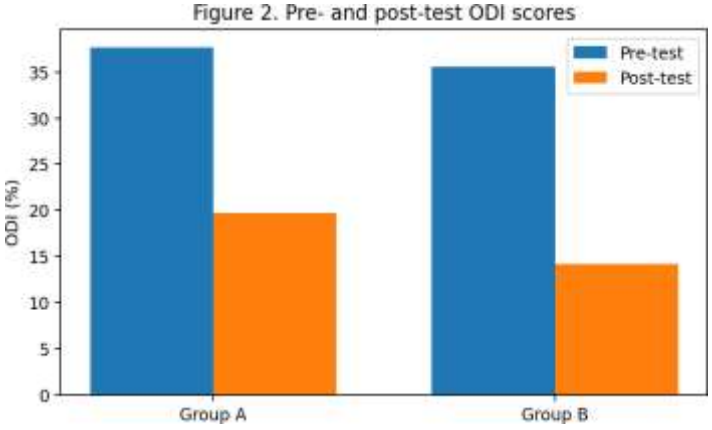
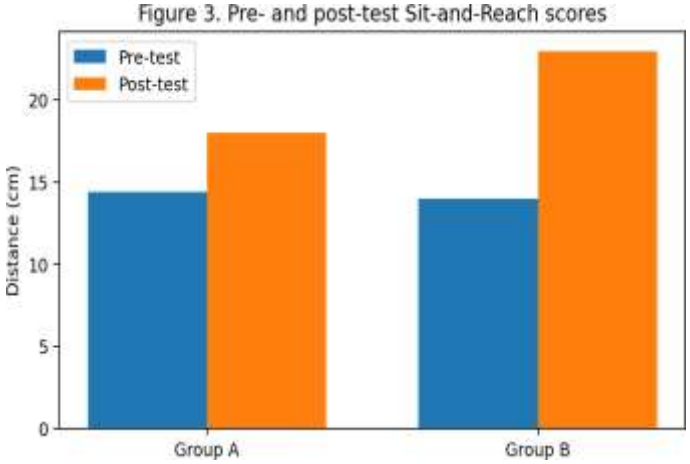


Figure 3. Pre- and post-test Sit-and-Reach scores



RESULTS – MANUSCRIPT INTERPRETATION

For VAS, Group A improved from 6.10 ± 0.852 to 3.50 ± 0.512, whereas Group B improved from 6.25 ± 0.638 to 2.25 ± 0.786. The post-test difference was statistically significant (t=5.95, df=38, p=0.001), with an approximate between-group Cohen's d of 1.88, indicating a large standardized difference.

For ODI, Group A improved from 37.70 ± 3.52 to 19.75 ± 3.07 and Group B improved from 35.60 ± 3.56 to 14.15 ± 2.77. The post-test difference was statistically significant (t=6.04, df=38, p=0.001), with an approximate Cohen's d of 1.92.

For Sit-and-Reach, Group A increased from 14.40 ± 1.18 cm to 18.00 ± 2.07 cm, while Group B increased from 14.00 ± 1.29 cm to 23.00 ± 1.52 cm. The post-test difference was statistically significant (t=□8.68, df=38, p=0.001), with an approximate absolute Cohen's d of 2.75.

DISCUSSION

The present comparative study demonstrated significant improvements in pain, disability/quality-of-life impact and lumbopelvic flexibility following both Core Stabilization and Modified Pilates exercise programs in cricket bowlers with low back pain. The findings are consistent with the biomechanical rationale that improved trunk control and lumbopelvic movement may reduce excessive spinal loading during sporting activity.[11–16]

Modified Pilates produced greater improvement than Core Stabilization across all three measured outcomes. The greater reduction in VAS score is consistent with evidence summarized in the dissertation indicating that Pilates can provide meaningful pain reduction in people with chronic nonspecific low back pain.[17,23,24] Controlled movement, breathing, deep muscle activation and neuromuscular coordination may contribute to improved movement confidence and reduced mechanical stress.

The ODI findings similarly favoured Modified Pilates. The reduction in ODI suggests a lower functional impact of low back pain after intervention. Pilates programs emphasize coordinated whole-body movement, postural control and functional mobility, which may help participants perform daily and sport-related activities with less pain and disability.[19,23,24]

The largest between-group difference was observed for the Sit-and-Reach Test. Modified Pilates incorporated movements involving spinal articulation, pelvic control, hip movement and controlled

flexibility. These components may explain the greater improvement in lumbopelvic flexibility observed in Group B compared with Group A.[17,18]

Core Stabilization nevertheless produced statistically significant improvements in all outcomes. This supports its established role in low back pain rehabilitation through activation and endurance training of deep stabilizers, improved motor control and enhanced lumbopelvic stability.[13–16] Thus, the present findings should not be interpreted as showing that Core Stabilization is ineffective; rather, Modified Pilates produced greater changes under the specific protocol and sample studied.

The results should be interpreted in the context of the study design and available data. The dissertation reports a purposive recruitment approach followed by random allocation, a sample of 40 male bowlers, and a 6-week intervention. The sample is therefore specific to young male cricket bowlers and may not represent female players, other age groups, recreational athletes or individuals with different causes of low back pain.

CONCLUSION

Both Core Stabilization and Modified Pilates exercises significantly improved pain, disability/quality-of-life impact and lumbopelvic flexibility in cricket bowlers with low back pain. Modified Pilates produced greater improvement in all three measured outcomes in the present sample. The null hypothesis was rejected and the alternative hypothesis was accepted. Modified Pilates may therefore be considered a useful exercise-based physiotherapy option for cricket bowlers with low back pain, particularly when the rehabilitation goal includes pain reduction, improved function and enhanced lumbopelvic flexibility.

LIMITATIONS

The study included only male cricket bowlers. Participants were restricted to the 18–25-year age group. The sample size was limited to 40 participants.Only pain, ODI and lumbopelvic flexibility were evaluated. The overall study duration was 6 months and the intervention period was 6 weeks.

RECOMMENDATIONS

Future studies should include larger samples, longer follow-up and broader age groups and both sexes. Additional outcomes such as agility, dynamic balance, endurance, reaction time, power and strength may provide a more complete assessment of athletic recovery. Future research should also use participant-level data and standardized intervention reporting to allow more precise estimation of confidence intervals and effect sizes.

ETHICAL CONSIDERATIONS

Written informed consent was obtained from participants. Participation was voluntary, participants were informed about the procedures and their right to withdraw, and confidentiality of research information was maintained, as described in the dissertation.

CONFLICT OF INTEREST

The dissertation does not report a conflict of interest.

AUTHOR CONTRIBUTIONS

Umapraveenkanth P: Study conception, participant recruitment, data collection, intervention delivery, statistical analysis and manuscript preparation.

Dr. B.J.A.C. Darrius MPT: Supervision, methodological guidance, interpretation and critical revision.

Dr. P. Bright Alwin Victor MPT., PhD: Academic and administrative guidance and final approval.

DATA AVAILABILITY

The underlying participant-level dataset was not included in the supplied dissertation manuscript. Any publication should provide an appropriate data-availability statement consistent with institutional requirements and participant consent.

ACKNOWLEDGEMENTS

The author acknowledges the Principal, Guide, faculty members and Department of Physiotherapy, Revathi Institute of Physiotherapy and Research, for their guidance and support, and thanks all participating cricket bowlers for their cooperation.

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